INE005-b

Open Source Software Solutions for Monitor Calibration and Quality Control

Education Exhibits

Location: IN Community, Learning Center

Participants

Nicholas Benjamin Bevins PhD (Presenter): Nothing to Disclose
Michael James Flynn PhD : Nothing to Disclose
Donald Peck PhD : Nothing to Disclose

TEACHING POINTS

1. Review the importance of monitor calibration for the presentation of medical images 2. Describe an open source software package for calibration and quality control of monitors 3. Explain how to manage monitor QC results using an enterprise database application

TABLE OF CONTENTS/OUTLINE

1. DICOM calibration of enterprise monitors (referring physician, technologists, home systems) 2. Standards and recommendations of regulatory and advisory organizations 3. pacsDisplay, an open source software package for calibration and QC of monitors a. Development history of the software b. Package contents and capabilities i. Display calibration for DICOM GSDF conformance ii. Quality control c. pacsdisplay.org for download 4. Deployment of an enterprise solution for display management a. Database for storage and centralization of results b. Routine compliance testing, verification 5. Future development and contributions

INE006-b

Natural User Interface for Advanced 3D Medical Image Processing

Education Exhibits

Location: IN Community, Learning Center

Participants

Michael Teistler PhD (Presenter): Nothing to Disclose
Oliver Johannes Bott PhD : Nothing to Disclose
Lars Christian Ebert PhD, MSc : Nothing to Disclose
Zak Al MD : Nothing to Disclose
Richard Spencer Breiman MD : Nothing to Disclose
James A. Brunberg MD : Nothing to Disclose

TEACHING POINTS

The viewer of this exhibit can 1. Experience a novel, gesture-controlled user interface approach, particularly for advanced 3D image viewing functions like on-the-fly oblique multiplanar reformations (MPR), maximum intensity projections (MIP) or volume rendering technique (VRT) 2. Assess benefits and drawbacks of a natural, 'deviceless' user interface as compared to conventional input devices (mouse, keyboard, touchpad, trackball)

TABLE OF CONTENTS/OUTLINE

A. Introduction: Desktop-based gesture-controlled user interface technology (Leap Motion) and its typical use B. Hands-On: B.1. Intuitively define oblique MPR images by hand movements ('Use your hand as ultrasound probe'). B.2. Change 3D view (rotate, move) B.3. Control other commonly used (2D) functions like zoom and pan, utilizing the user interface's multiple degrees of freedom C. Discussion: Benefits and drawbacks of the presented natural user interface as compared to conventional user interfaces (mouse, keyboard, touchpad, trackball)

INE007-b

Virtual Retinal Display: Use of a Novel Consumer Technology for Sonographic Visualization

Education Exhibits

Location: IN Community, Learning Center

Participants

Arjun Sharma MD (Presenter): Nothing to Disclose
Grant Martin BEng : Employee, Avegant Corporation
Franklin N. Tessler MD : Consultant, Koninklijke Philips NV Equipment support, Koninklijke Philips NV

TEACHING POINTS

Ultrasound technology has advanced remarkably over the past few decades with continual improvements in acquisition capabilities, including spatial/contrast resolution, frame rate, and color Doppler sensitivity. Despite this progress, a critical component of the imaging chain - the sonographic display - has changed little, apart from the transition from CRT to LCD. In recent years, head-mounted displays have become available for a variety of consumer applications. However, applications of wearable displays in medical imaging have not received much attention. In this interactive presentation, we demonstrate a novel use for the Avegant Glyph (Avegant, Ann Arbor, MI), a new head-mounted device that employs a micro-mirror array and optics to project high resolution images directly onto the user's retina at a high refresh rate. The Glyph may be connected directly to the scanner or to any workstation equipped to view stored static images or real-time clips, free of distracting reflections that affect conventional displays. We believe that this technology will prove beneficial in clinical or educational settings.

TABLE OF CONTENTS/OUTLINE

A. History of US displays
B. Limitations of current display methods
C. Technical background
D. Demonstration of use of Glyph head-mounted display for grayscale and color Doppler US images
E. Potential applications

INE008-b

DICOM Viewer on Wearable Devices: Do It Yourself or Work with Your Geek Friend?

Education Exhibits

Location: IN Community, Learning Center

Participants

Synho Do PhD (Presenter): Research Grant, Koninklijke Philips NV
Garry Choy MD, MS : Nothing to Disclose
Raul Nirmal Uppot MD : Nothing to Disclose
Sarabjeet Singh MD : Research Grant, Siemens AG Research Grant, Toshiba Corporation Research Grant, General Electric Company Research Grant, Koninklijke Philips NV
Mannudeep K. S. Kalra MD : Nothing to Disclose
Rajiv Gupta PhD, MD : Nothing to Disclose

TEACHING POINTS

1. Ever increasing data viewing (such as clinical indication, prior reports and images, lab tests, EMR, operative notes) at the time of exam interpretation can be daunting. 2. New wearable technologies can be helpful for healthcare professionals to tackle problems related to "data flooding" 3. These technologies can simplify the multi-tasking and potential multi-click access to various data sources. 4. Clinicians and engineers need to work together to improve and develop these technologies.

TABLE OF CONTENTS/OUTLINE

1. Introduce new visualization technology using wearable devices (Smart glasses and watches). 2. Outline data sources for interpreting and interventional radiologists and the problems related to access. 3. Discuss opportunities for applying wearable technologies to aid radiology workflow 4. Collaborative work (clinicians and engineers) : Step by step explanation of Smart Glass DICOM viewer development 5. Provide specific examples from our extensive work on use of wearable devices in radiology practice.

INE025-b

3D Printed Liver Models for Diagnostic and Surgical Assistance: How to Prepare Data, Print and Utilize?

Education Exhibits

Location: IN Community, Learning Center

Magna Cum Laude

Participants

Kensaku Mori PhD (Presenter): Nothing to Disclose
Yoshihiko Nakamura PhD : Nothing to Disclose
Yuichiro Hayashi PhD : Nothing to Disclose
Masahiro Oda PhD : Nothing to Disclose
Tsuyoshi Igami PhD, MD : Nothing to Disclose
Tomoaki Hirose MD : Nothing to Disclose

TEACHING POINTS

The major teaching points of this exhibit are

1. To understand how segmentation for 3D liver model printing is performed.
2. To understand how internal structures of liver are reconstructed in 3D printed liver models
3. To understand how 3D printed liver models are utilized for diagnostic and surgical assistance for liver surgery

TABLE OF CONTENTS/OUTLINE

This exhibits consists of three parts

Explanation of the process of 3D printed organ model creation and clinical use

- How to segment liver regions and internal vasculatures
- How to perform post-process of segmented regions for 3D printing
- How to fabricate of liver models
- How to utilize 3D printed liver modes for communication in diagnostic process
- How to utilize 3D printed liver models as reference object during surgery

Demonstration of 3D printed liver models and its utilization

- Liver region segmentation software for 3D printing
- Movie display of 3D printing and post-processing process
- On-side display of 3D printed liver modes
- Movie display of real clinical use

Summary

- Segmentation process is very important for fabricating 3D-printed liver model
- 3D printed liver models are very intuitive for understanding liver anatomy
- 3D printed liver models assist doctors to make diagnostic and surgical decision

INE034-b

Development of Educational Suite for Image Interpretation Based on Real-time ROC Method

Education Exhibits

Location: IN Community, Learning Center

Participants

Yuzuho Yamaguchi (Presenter): Nothing to Disclose
Yoshinao Sato MD : Nothing to Disclose
Masaki Matsusako MD, PhD : Nothing to Disclose
Kazuhiko Hosoya : Nothing to Disclose
Tsutomu Nihei : Nothing to Disclose
Takeshi Hara PhD : Nothing to Disclose
Daisuke Fukuoka PhD : Nothing to Disclose
Xiangrong Zhou PhD : Nothing to Disclose
Chisako Muramatsu PhD : Nothing to Disclose
Hiroshi Fujita PhD : Nothing to Disclose

TEACHING POINTS

Presenting a Real-time ROC (Receiver Operating Characteristic) curve will provide good motivations for readers during interpretation training. The purpose of this exhibit is to demonstrate our developed software suites based on ROC method for PC and tablets to create your own educational packages. Teaching points: 1) To understand the basic of ROC analysis. 2) To realize your teaching file for image interpretations. 3) To review the interesting cases for chest radiograms with bone-suppression and CT scans as demonstrations.

TABLE OF CONTENTS/OUTLINE

1) Basic of ROC analysis/Statistics, case selection, gold standard, test. 2) Real-time generation of ROC curves and AUC values/Software specific idea for the calculation. 3) How to create your own teaching files/Contents, required device and basic procedure to set up. 4) How to compare the results/AUC comparison, test, and discussion. 5) Demonstration of teaching file for chest X-ray cases/New idea for understanding chest radiograms by using bone-suppression images and CT./Interesting cases for nodule detections on chest radiograms. 6) Further application to ROC study/The suites can be applied to research purpose, not only for the educational use.

INE037-b

Data Analysis Using Machine Learning Tools: An Introduction for the Non-programmer

Education Exhibits

Location: IN Community, Learning Center

Selected for RadioGraphics

Participants

Rajiv Chekuri Raju BA (Presenter): Nothing to Disclose

TEACHING POINTS

The main goal of this exhibit is to introduce machine learning principles to those with no programming experience. Freely available software packages such as WEKA now make advanced machine learning techniques accessible to the non-programmer clinician. If clinicians learn the basic principles of machine learning, they may be able to identify problems that can be solved with machine leaning techniques. This can lead to more fruitful collaboration between clinicians and the machine learning experts.

After viewing this exhibit, the clinician should have a basic understanding of what machine learning is and what types of problems can be assessed with machine learning methods. The clinician should also be able to experiment with and explore machine learning using the WEKA software, as well as understand how to evaluate the effectiveness of a machine learning system.

TABLE OF CONTENTS/OUTLINE

What is Machine Learning? Why should I bother leaning about machine learning if I am not a physicist or engineer? Learning about machine leaning with Weka and a real mammography data set: Introduction to Weka Data visualization using Weka Machine learning experiments with Weka Evaluating performace: ten fold cross validation and area under the ROC curve Information gain evaluation: relative importance of data features Links

INE039-b

What Is the Most Suitable Requirements of the Comfortable Working of PACS os the Virtual Platform?

Education Exhibits

Location: IN Community, Learning Center

Participants

Naoki Mihara MD (Presenter): Nothing to Disclose
Zhi Xilong MD, PhD : Nothing to Disclose
Yuuichirou Yamamoto RT, PhD : Nothing to Disclose
Takashi Hayakawa : Nothing to Disclose
Hirohisa Iwasaki : Nothing to Disclose
Shirou Manabe : Nothing to Disclose
Toshihiro Takeda MD, PhD : Nothing to Disclose
Yasushi Matsumura MD, PhD : Nothing to Disclose

TEACHING POINTS

1. Characteristics of VDI (Virtual Desktop Infrastructure) enbironment 2. Esimates of various parameters to VDI at reading system 3. Discussisons of the optimal service specification and network design

TABLE OF CONTENTS/OUTLINE

Outline ; Nest generation PACS will have to meet various needs of many departments because there are many types of viewers in a hospital and they have the important role respectively and they have each storage for it. But it is not effient to save Images with diffferent methods simultaneously. So We think next generation PACS should have a vender neutral archiving storage and a common platform which several viewers can work simultaneously. We have assessed some requirements of PACS on VDI (Virtual Desktop Infrastructure) environment, and we will show the points for it as belows ; 1. Network traffic volume at reading image 2. Effectiveness of parameters (bandwidth, latency, packet loss ratio) 3. Compare the functions of several viewers Table of contents ; A. Background B. Estimate Points C. Hardware Concept D. System Configuration Concept E. Measument of traffic volume by flow capture F. Emulate the speed of network condition G. Comparing several DICOM Viewers

INE040-b

The State-of-the-Art and Recent Advances in Pulmonary Image Analysis Techniques

Education Exhibits

Location: IN Community, Learning Center

Certificate of Merit

Participants

Ziyue Xu PhD (Presenter): Nothing to Disclose
Ulas Bagci PhD, MSc : Nothing to Disclose
Awais Mansoor PhD : Nothing to Disclose
Brent Foster : Nothing to Disclose
Georgios Z. Papadakis MD : Nothing to Disclose
Jayaram K. Udupa PhD : Nothing to Disclose
Daniel Joseph Mollura MD : Nothing to Disclose

TEACHING POINTS

1) To present current state-of-the-art pulmonary image analysis techniques
2) To provide a general background of the challenges in pulmonary image analysis
3) To assess the accuracy and usability of multiple methods for different pulmonary applications
4) To discuss recent development in hybrid and longitudinal pulmonary image analysis techniques

TABLE OF CONTENTS/OUTLINE

1) Introduction 2) Background on pulmonary image analysis tasks, modalities, and techniques 3) Challenges of pulmonary image analysis a. Motion b. Noise c. Pathologies variability 4) Structures of interest a. Airways b. Vessels c. Lungs d. Pathologies 5) Analysis Methods a. Segmentation b. Registration c. Classification 6) Recent Advances in Pulmonary Image Analysis Techniques a. Hybrid imaging techniques b. Longitudinal studies

INE102

Natural Language Processing Technologies in Radiology Research

Education Exhibits

Location: IN Community, Learning Center

Selected for RadioGraphics

Participants

Tianrun Cai MD (Presenter): Nothing to Disclose
Kanako Kunishima Kumamaru MD, PhD : Nothing to Disclose
Sheng Yu : Nothing to Disclose
Amir Imanzadeh MD : Nothing to Disclose
Ruth M. Dunne MBBCh : Nothing to Disclose
Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation
Elizabeth George MD : Nothing to Disclose
Rani S. Sewatkar MBBS : Nothing to Disclose

TEACHING POINTS

1. Natural Language Processing (NLP) as a method for automatic data extraction has been applied to radiology research in a limited scope to date 2. The following current NLP technologies are used in radiology: pattern matching, machine learning, coupled with linguistic and statistical approaches. We will describe each with illustrative examples 3. Potential strategies to improve the versatility and accuracy of NLP technology are reviewed with the intent on achieving a wider implementation in radiology research

TABLE OF CONTENTS/OUTLINE

A. Applications of NLP to radiology reports in the biomedical imaging literature to date i. detection and classification of pulmonary embolism ii. identification of abdominal aortic aneurysm, appendicitis, pneumonia, lung nodules, and bone fracture iii. evaluation of cancer stage or tumor status iv. assessment of radiologists recommendations for additional imaging B. Algorithmic approach to current NLP technologies i. pattern matching ii. machine learning iii. linguistic approaches iv. statistical approaches C. New strategies for NLP include methods to obtain greatly needed clinical data from electronic medical records in order to supplement diagnostic radiology reports to enable more clinical outcomes focused research

INE103

The Use of the Geographical Information Systems (GIS) for Establishing Mammography Facilities

Education Exhibits

Location: IN Community, Learning Center

Participants

Faezeh Sodagari MD (Presenter): Nothing to Disclose
Pedram Golnari MD : Nothing to Disclose
Fatemeh Sodagari BS, MBA : Nothing to Disclose
Hamid R. Baradaran MD, PhD : Nothing to Disclose

TEACHING POINTS

The availability and ease of access to mammography facilities is one of the most important factors in the degree of the compliance of the target population with the current guidelines and standards. It has been shown that the distance to the mammography facility is correlated with the stage of the cancer at the diagnosis.
With the use of the Geographical Information Systems (GIS), we can integrate the data on geographical attributes, access routes, and available facilities with the demographic characterization of the local population and determine the best available location for establishment of a mammography center with the best access for the current or future number of women in the screening age. It can also be integrated with the available data on the prevalence of breast cancer in different neighborhoods. The use of GIS-based approaches can improve the efficacy and cost-effectiveness of establishment of future mammography screening centers.

TABLE OF CONTENTS/OUTLINE

• Introduction of the GIS and their use in healthcare especially in the field of radiology • Basic introduction to the available software and developing maps • Simple analyses using GIS • Demonstrating an analysis based on a hypothetical data for determining the best place for establishment of a mammography screening facility (both permanent and portable facilities)

INE104

Quality Improvement with Discrete Event Simulation (DES): A Primer for Radiologists

Education Exhibits

Location: IN Community, Learning Center

Magna Cum Laude
Selected for RadioGraphics

Participants

Michael Booker MD, MBA (Presenter): Nothing to Disclose
Ryan O'Connell : Nothing to Disclose
Bhushan Desai MBBS, MS : Nothing to Disclose
Vinay Anant Duddalwar MD, FRCR : Research Grant, General Electric Company

TEACHING POINTS

- To understand systems engineering and Discrete Event Simulation (DES)
- To know how DES can inform and answer common QI questions in radiology
- To learn how to introduce DES software into their own radiology practice

TABLE OF CONTENTS/OUTLINE

Systems engineering with discrete event simulation (DES) We will describe the utility of simulation to test complex radiology workflows and how DES is particularly useful in radiology to analyze a number of variables including resource scheduling, wait times, turnaround times, and equipment expenditures. Radiology examples of DES We will introduce a large-scale simulated imaging department and analyze specific systems questions that come up frequently in radiology decision-making. These include: • Wait times and resource capacity • Extending operational hours vs. purchasing additional equipment • Dedicating equipment to sequences vs. pooling resources • Scheduling in peak-demand situations • POC testing for contrast administration Quick-start guide to DES software We will walk through the basics of setting up a classic radiology workflow in a DES software package called Simul8 (Simul8 Corp.) that was chosen for its user-friendly graphic interface. This will allow the learner to begin analyzing their own radiology workflows with minimal formal training.

INE105

Contrast Reaction! The iPad Video Quiz Show

Education Exhibits

Location: IN Community, Learning Center

Participants

Huyen D. Tran MD : Nothing to Disclose
Susan L. Summerton MD (Presenter): Nothing to Disclose
John Thomas Debardeleben MD : Nothing to Disclose
Ryan Joseph Smith MD : Nothing to Disclose

TEACHING POINTS

Managing contrast reactions requires both didactic book-learning and practical experience. Practical experience is difficult and expensive to obtain, since high tech sim labs are seldom conveniently available. By repeatedly using the iPad Video Quiz Show, both didactic learning and 'hot seat' experience is gained, leading to increased retention of material and learner confidence. By viewing this exhibit, the learner will improve in confidence when faced with a contrast reaction, and will appreciate the advantages of using the iPad Video Quiz Show to learn to manage contrast reactions.

TABLE OF CONTENTS/OUTLINE

A contrast reaction scenario will be presented through a closed captioned reality video quiz filmed on dual iPads. Teaching points gleaned from the ACR Manual on Contrast Media (2013) include: • General approach to contrast reactions • Specific management with doses • Action checklist • Significant avoidable errors • Key learning points With the dual iPads, the student is immersed into the reaction. Presented with a blank iPad screen, the student must know what to do, or confront their ignorance; becoming motivated to learn and perform better next time. The teacher, with their own iPad screen including potentially correct and incorrect student responses, can guide the student while checkmarking that major educational guidelines are met.

INE106

Current State of Perceptive Learning in Radiology and the Potential Implications of Implementing Modern Perceptive Learning Techniques into Radiologic Education

Education Exhibits

Location: IN Community, Learning Center

Participants

Alaa Beydoun MD (Presenter): Nothing to Disclose
Jean Jeudy MD : Nothing to Disclose

TEACHING POINTS

To be able to differentiate between Perception and Analysis.
To understand what perceptive learning (PL) is.
To understand the history and current state of PL in radiology.
To appreciate the growth of PL research in modern cognitive neuroscience.
To consider the implications of improved PL applications in radiology education.

TABLE OF CONTENTS/OUTLINE

1) What is perception versus analysis? a) Definitions. b) Origins of PL. 2) PL in radiology. a) History. b) Visual tracking research. c) Search patterns. d) Brute strength experience-based approach of current PL in radiology. 3) Modern PL Research. a) Gabor Patches and Stimuli. b) Patterns and gating of learning. c) Effect on visual cortex and measurable improvements in vision. 4) Implications of PL applications in Radiology Education. a) Development of improved search patterns. b) Improved accuracy and speed of lesion detection. c) Better understanding of Perception from Radiologist perspective allows for even better teaching tools which overall leads to improved patient care.

INE107

Important Information at Your Fingertips: Creating and Distributing Mobile Apps within Your Department. A "How to" Guide Using Acute Contrast Reactions as an Example

Education Exhibits

Location: IN Community, Learning Center

Participants

Daniel Cornfeld MD (Presenter): Nothing to Disclose
Vladimir P. Neklesa MD : Nothing to Disclose

TEACHING POINTS

Explaining contrast administration policies and responding to acute contrast reactions are two of the most important responsibilities facing radiology trainees and staff. While attending to these tasks much time is spend looking up documents on-line or referring to index card sized cheat sheets. To save time and effort we created and distributed an iPhone app that places this frequently needed information at our fingertips. The app makes the following information immediately accessible: classification of allergic reactions, department specific policies regarding administering contrast in patients with prior allergic reactions, pre-medication regimens for adults and children, checklists for evaluating patients suspected of having acute contrast reactions, and treatment algorithms for different types of contrast reactions. There are two major teaching points to this exhibit. 1) Learn how department-wide apps can increase efficiency by placing important information literally in your staff's hands. 2) Provide step by step instructions for creating and disseminating iOS apps within your department.

TABLE OF CONTENTS/OUTLINE

A. Choosing Appropriate Content for an App B. Step by Step Guide for Building the App C. Step by Step Guide for Distribution within your Department D. Providing Updates as Policies Change

INE108

Mind-Mapping Software for the Radiologist: Novel Applications of an Emerging Electronic Resource

Education Exhibits

Location: IN Community, Learning Center

Participants

Sergey Kochkine MD (Presenter): Nothing to Disclose
Harprit Singh Bedi MD : Nothing to Disclose
Vera Mayercik MD : Nothing to Disclose
Elaine Shiang MD : Nothing to Disclose
Gene Michael Weinstein MD : Nothing to Disclose
Daniel Matheson Adams MD : Nothing to Disclose

TEACHING POINTS

Mind-mapping software, a computer program in which users build visual diagrams of knowledge and associations, represents a novel electronic tool with broad applications in a variety of educational curricula. As a highly interactive modality its emphasis on active learning improves recall and retention by drawing on visual associations. Its potential as a learning tool for radiologists is vast. Junior residents can pre-draw main branches and highlight gaps of knowledge, slowly filling them in through the course of their training. Senior residents can refine and consolidate their mind-maps, adding detail regularly and revisiting them for examination preparation. Interesting cases can be linked to these mind-maps throughout residency. Faculty can also take advantage of mind-maps for teaching, with integration into a variety of electronic resources and access to cloud storage being some of their primary benefits. We present an introduction to this software resource, review potential uses for a variety of levels of trainees, and discuss potential for implementation in teaching as well. Finally, a step by step approach to creating radiology mind-maps will be detailed.

TABLE OF CONTENTS/OUTLINE

Overview of mind-mapping software. How to build a mind-map. Applications for junior residents, senior residents, and teaching.

Integration with ebooks and iPad applications.

INE109

Teaching Radiology Using Instagram

Education Exhibits

Location: IN Community, Learning Center

Certificate of Merit

Participants

Saad Ranginwala MD (Presenter): Nothing to Disclose
Arnold Carlson Merrow MD : Author, Amirsys, Inc Editor, Amirsys, Inc Employee, Amirsys, Inc
Alex Towbin MD : Author, Amirsys Inc Shareholder, Merge Healthcare Incorporated Consultant, Guerbet SA

TEACHING POINTS

The purpose of this exhibit is to demonstrate how to use Instagram to create an educational resource for teaching radiology. The purpose of this exhibit is to: 1) Provide an overview of Instagram and how it is being used for education specifically in the context of medicine and radiology 2) Provide a step-by-step primer on how to set up an Instagram account 3) Describe how to post images and structure textual data so that it can act as an effective educational resource

TABLE OF CONTENTS/OUTLINE

I. Instagram in education A. How is it currently being used? B. How is it used in medicine? C. How is it used in radiology? II. How to create an Instagram account A. Creating an Instagram account B. Preparing content for Instagram 1. Proper formatting 2. Posting to Instagram 3. Manual vs. Scheduled content III. How to create an effective social media educational resource A. Establishing a curriculum B. Building a user base C. Increasing effectiveness of your social media education account 1. Regularly scheduled content 2. Effective social media promotion a) Hashtags b) Theme-based content c) Effective captions

INE110

The Death of Multiple Choice? Natural Language Processing as a New Testing Paradigm in Radiology

Education Exhibits

Location: IN Community, Learning Center

Selected for RadioGraphics

Participants

Andrew David Tannenbaum MD (Presenter): Nothing to Disclose
Jose Cayere : Nothing to Disclose
Kitt Shaffer MD, PhD : Nothing to Disclose

TEACHING POINTS

1. Understand the limitations and tradeoffs of current testing methods: multiple choice vs. oral boards vs. OSCE 2. Gain a basic understanding of the fundamental concepts associated with natural language processing 3. Learn about a new system that provides an extensible natural language processing framework and how it can be applied to radiological testing. 4. Understand how a natural language processing system-based examination may provide a superior testing environment for radiologists in comparison to the current methods. 5. Understand how the new system can be used for a variety of tasks including (but not limited to) formalized testing, self-assessment and content review.

TABLE OF CONTENTS/OUTLINE

A. Current state of radiology testing: from oral boards to multiple choice examinations B. Disadvantages of multiple choice testing. C. Advantages of simulated reporting environment for competency evaluation D. Overview of current NLP system, from inception to current status E. Current projects implementing NLP F. Future uses of the NLP system

INE111

The Radiological Diagnosis in the Light of Information Theory: A Perspective

Education Exhibits

Location: IN Community, Learning Center

Participants

Rossano Girometti MD (Presenter): Nothing to Disclose
Francesco Fabris PhD : Nothing to Disclose

TEACHING POINTS

1. Radiologists can be easily familiar with: a) the Information Theory (IT) by C. Shannon (1916-2001), which is widely used in engine search technology, telecommunication and biology; b) the definition of "information" and main measures of information provided by IT. 2. Radiological diagnosis can be formalized as a flux of information between the disease and the reader through the imaging procedure, in accordance with the Shannon's Binary Transmission Channel model. The flux of information is the "Mutual Information" (MI). 3. The Area Under the Curve (AUC)-ratio is an MI-based measure that can express the diagnostic performance of an imaging technique globally, using a single index that is independent from the probability of the disease.

TABLE OF CONTENTS/OUTLINE

1. Basic concepts of statistics and IT 2. Formalization of radiological diagnosis in terms of IT: - From the 2x2 table to MI - From MI to the AUC-ratio 3. How the AUC-ratio refines conventional measures of diagnostic accuracy: examples from radiological literature 4. Applicability and usefulness in clinical activity and/or research.

INE112

Using Social Media to Help Promote a Radiology Department

Education Exhibits

Location: IN Community, Learning Center

Participants

Saad Ranginwala MD (Presenter): Nothing to Disclose
Alex Towbin MD : Author, Amirsys Inc Shareholder, Merge Healthcare Incorporated Consultant, Guerbet SA

TEACHING POINTS

The purpose of this exhibit is to demonstrate the benefits of using social media for a radiology department. In this exhibit, we will: 1) Provide an overview of social media and describe how social media can help to promote a department 2) Describe several common social media platforms and explain how each can be used to uniquely target a different audience 3) Discuss how analytics can be used to track the impact of these services and a department's overall online presence

TABLE OF CONTENTS/OUTLINE

I. Social media as part of a departmental strategy A. Reasons why a department should consider social media B. Potential benefits of implementing a social media strategy benefits C. Potential risks of implementing a social media strategy II. Common social media platforms and potential uses of each platform for a Radiology Department A. Twitter B. Facebook C. Instagram D. YouTube E. Departmental blog III. Tracking the impact of your social media strategy A. Online analytic tools B. Social media specific data points C. Aggregate impact trackers

INE114

CT Guided Puncture Navigated by Gyroscope Equipped Smartphone

Education Exhibits

Location: IN Community, Learning Center

Cum Laude

Participants

Masaaki Hirata MD (Presenter): Nothing to Disclose
Hiroaki Tanaka MD : Nothing to Disclose
Naoki Fukuyama : Nothing to Disclose
Gen Koiwahara : Nothing to Disclose
Naoto Kawaguchi MD : Nothing to Disclose
Takaharu Tsuda MD, PhD : Nothing to Disclose
Teruhito Mochizuki MD : Nothing to Disclose

Background

CT-guided puncture is a well-established minimally-invasive technique applied to biopsy, drainage, percutaneous osteoplasty, etc. On this procedure, in case of nonuse of CT fluoroscope, physicians have to define the angle of puncture needle as planned on the reference images by eye measurement. This uncertain process can be the cause of inaccurate puncture with large angle error. To overcome this, we developed a smartphone application to support CT guided puncture.

Evaluation

Function of the application After definition of the appropriate puncture site and needle angle, planning puncture line is drawn on the reference image. Then the reference image is transferred to the smartphone as jpeg data. While holding smartphone at any angle, this application automatically rotate and keep the image horizontal by the function of gyroscope. All physicians have to do is just to advance the needle along the puncture line shown on the device. Puncture test In order to evaluate the accuracy of this application, experimental puncture test was carried out. Vertical, horizontal and curved plane was defined on the puncture target which was made from melamine sponge. On the scanned CT image of this target, puncture line of 30°, 50°and 70° was drawn. The reference image was transferred to the smartphone. Then, nine times of test puncture was performed using this application (i.e. 30°, 50°and 70°respectively for vertical, horizontal and curved plane). As a result, the maximum angle error was only 1° (average angle error was 0.6°).

Discussion

Most of smartphones have vibrating structure gyroscope inside in order to recognize the movement of the device itself. This application makes smartphone into a handy tool which present appropriate puncture angle in real time with high accuracy. Other advantages are as follows:
1. Recognition of anatomy around the puncture site from the image on the device without eye movement.
2. High availability of devices.
3. Easy preparation. (Just put the smartphone into sterilized nylon bag.)
4. Easy to complete procedure without assistant.

Conclusion

We developed an application to support CT guided puncture. This application makes smartphone into beneficial tool for accurate puncture.

INE115

Fundamentals and Applications of 3D Printing in Medicine

Education Exhibits

Location: IN Community, Learning Center

Participants

Amir Imanzadeh MD (Presenter): Nothing to Disclose
Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation
Dimitris Mitsouras PhD : Nothing to Disclose

Michael Lally Steigner MD : Speaker, Toshiba Corporation
Peter Constantine Liacouras PhD : Nothing to Disclose
Gerald Thomas Grant DMD, MS : Nothing to Disclose
Kanako Kunishima Kumamaru MD, PhD : Nothing to Disclose
Elizabeth George MD : Nothing to Disclose
Asha Sarma MD : Nothing to Disclose
Shanna Matalon MD : Nothing to Disclose
Tatiana Kelil MD : Nothing to Disclose
Catherine Phillips MD : Nothing to Disclose
Rani S. Sewatkar MBBS : Nothing to Disclose
Tianrun Cai MD : Nothing to Disclose
Meaghan Mackesy MD : Nothing to Disclose
Gregory Aaron Bonci MD : Nothing to Disclose
Sachin Shyamsunder Saboo FRCR, MD : Nothing to Disclose

TEACHING POINTS

1.Introduction of 3D printing methods 2.Discuss imaging pre-requisites and post-processing techniques for obtaining printable files (STL outputs) 3.Re-meshing techniques and preparing the STL files for printing 4.Overview of current clinical applications of 3D printing 5.Discuss potential utilizations and future directive

TABLE OF CONTENTS/OUTLINE

1.Techniques of 3D printing: Description of different technologies, printers , and materials used in 3D printing 2.Imaging pre-requisites: Discuss the imaging modalities, requirements, and protocols 3.Post-processing and segmentation: Software introduction and utilization 4.STL files: Rendering and Re-meshing 5.3D visualization vs. 3D printing 6.Overview of current medical Applications: a. Maxillofacial surgeries b. Reconstructive surgeries c. Implants d. Orthopedics surgeries e. Education 7.Future applications: Organ and soft tissue printing

INE116

Using the Leap Motion Controller and PACS Point to Allow for Hands-free Control of Standard DICOM Imaging Software

Education Exhibits

Location: IN Community, Learning Center

Participants

Peter Stoll : Nothing to Disclose
Jose Morey MD (Presenter): Nothing to Disclose

Background

Maintaining sterilization during surgical procedures is critical to maintain patient safety and to ensure optimal outcomes. When using imaging software, surgeons are forced to squander time and increase risk of infection to the patient by desterilizing and then resterilizing after operating the mouse and keyboard.

Evaluation

The Leap Motion Controller is a small device that contains three cameras that can measure hand and finger position down to the millimeter in its detection cone. The Leap Controller also can recognize several hand gestures which can be used as inputs for software designed to work in conjunction with the controller. PACS Point was designed to allow users to operate standard DICOM imaging software, and to provide full control over the cursor by moving their hand in the Leap's detection cone.

Discussion

By working with the Leap Motion Controller, PACS Point allows users all of the same controls as they would have with standard mouse and keyboard inputs, but without having to touch anything; thereby remaining sterile. PACS Point's controls currently allow for cursor movement by moving 1 finger in the x and y-plane of the Leap's detection cone while other mouse controls such as various types of clicks are controlled by simple gestures. Screen scrolling and zooming is controlled by 3 or 5 finger motion in the y-plane of the cone respectively. Additional controls are provided based on the imaging software being used in conjunction with PACS Point.

Conclusion

The ability to control imaging software in a hands-free manner will allow surgeons to save time by not having to resterilize after using a mouse or keyboard, and will likely improve on the rate of patient infections. The current state of PACS Point proves the feasibility of this type of control. Future studies will be done to measure the effect that PACS Point can have on these 2 factors. Because the Leap Motion Controller is such a new product there is room for development of PACS Point in the future. Further development will be geared towards making PACS Point compatible with additional exsisting imaging software as well as incorporating advances in the Leap Motion, itself, into increased usability for PACS Point.

INE117

Benefits and Challenges in Setting Up a State-of-the-Art Processing Lab for Quantitative and Qualitative Image Analysis and Clinical Integration

Education Exhibits

Location: IN Community, Learning Center

Participants

Frederick Schuster (Presenter): Nothing to Disclose
Khoschy Schawkat MD : Nothing to Disclose
Yanik Buetikofer : Nothing to Disclose
Michelle May : Nothing to Disclose
Hendrik Von Tengg-Kobligk MD : Research Grant, W. L. Gore & Associates, Inc
Daniel Ott MD : Nothing to Disclose

TEACHING POINTS

Modern image processing applications are becoming more and more complex and are demanded by clinicians in daily clinical routine. Clinical pathway for Radiology to stay up to date and provide a high standard of image analysis and interdisciplinary clinical presentation. Gain translational experience how to establish a dedicated processing core lab. This exhibit presents benefits and challenges in setting up such a clinical core lab.

TABLE OF CONTENTS/OUTLINE

Motivation for setting up an image processing lab Growing demands and possibilities Achieving a high level of quality Planning of necessary resources Facilities Hardware Personnel Financial aspects and possibilities within the Swiss health care system Establishing workflows in cooperation with our clinicians Creating awareness Meeting demands Feedback, communication Practical guidelines Workflows/SOP's Research and development Non-commercial software and hardware Implementation of new applications

INE118

Computer-aided Contouring: An Accurate and Reproducible Interactive Contouring Toolkit for Segmentation of Tumors and Organs

Education Exhibits

Location: IN Community, Learning Center

Selected for RadioGraphics

Participants

Wenli Cai PhD (Presenter): Nothing to Disclose
Yin Wu : Nothing to Disclose
Difei Lu : Nothing to Disclose
Xiuzi Ye PhD : Nothing to Disclose
Gordon J. Harris PhD : Medical Advisory Board, Fovia, Inc

TEACHING POINTS

Interactive contouring is a commonly-used tool for interactive segmentation and modification of contours of tumors and organs on medical images. The teaching points of this exhibit are: 1. Computer-aided contouring (CAC) provides an accurate, reproducible, and efficient toolkits for interactive contouring of tumors and organs. 2. CAC assisted with novel interactive hardware provides a quick tool for contour tracking and reviewing. 3. CAC reduces the inter- and intra-observers viabilities of interactive contouring.

TABLE OF CONTENTS/OUTLINE

1. Explain the emerging role of computer-aided contouring (CAC) for accurate and reproducible interactive segmentation of tumors and organs. 2. Technical explanation of CAC: illustrate the theory of optimal-path searching on 2D transversal images with minimal user-identified control points. 3. Experiments of CAC: demonstrate the improvement of accuracy, reproducibility, and efficiency of CAC in the segmentation of liver and liver tumors on CT images using interactive pen and digital drawing tablet. 4. Discussion of the effectiveness and limitations of CAC techniques in quantification of tumor and organs in clinical applications.

INE121

How to Find Physiologically-based and Prognostic Biomarkers for Prediction of Survival Risk from Baseline First-pass Perfusion CT and DCE-MRI Analysis in Advanced Hepatocellular Carcinoma Treated with Antiangiogenic Agents

Education Exhibits

Location: IN Community, Learning Center

Participants

Sang Ho Lee PhD (Presenter): Nothing to Disclose
Koichi Hayano MD : Nothing to Disclose
Dushyant V. Sahani MD : Research Grant, General Electric Company
Andrew X. Zhu MD, PhD : Nothing to Disclose
Hiroyuki Yoshida PhD : Patent holder, Hologic, Inc Patent holder, MEDIAN Technologies

TEACHING POINTS

To learn the essential biophysical foundation concepts and the computational approaches of pharmacokinetic (PK) models for the liver, and describe how to find effective prognostic biomarkers for survival risk prediction from baseline first-pass perfusion CT (PCT) and DCE-MRI analysis in advanced hepatocellular carcinoma (aHCC) treated with antiangiogenic agents.

TABLE OF CONTENTS/OUTLINE

Physiologic assumptions in five popular PK models: the Tofts-Kety (TK), extended TK, two-compartment exchange, adiabatic approximation to the tissue homogeneity, and distributed parameter models. Differences in imaging protocol, input function modeling, and PK parameter computation between first-pass PCT and DCE-MRI. Differences between standard and water exchange-modified PK models in DCE-MRI. Methods for finding optimal prognostic biomarkers in terms of the prediction of landmark survival and the association with overall survival: 1) Receiver operating characteristic analysis with cross-validation, 2) Kaplan-Meier analysis with cross-validated dichotomized values, and 3) Cox proportional hazard regression analysis with a single continuous parameter. Differences in prognostic biomarkers for survival risk prediction between different antiangiogenic agents (bevacizumab and sunitinib) and among different PK models in aHCC.

INE122

Lung Lobe Volumetry as a Reliable Biomarker: Methods for Automatic Extraction of Lobes from CT Scans, and Fissure Integrity Scoring

Education Exhibits

Location: IN Community, Learning Center

Participants

Awais Mansoor PhD (Presenter): Nothing to Disclose
Ulas Bagci PhD, MSc : Nothing to Disclose

Ziyue Xu PhD : Nothing to Disclose
Brent Foster : Nothing to Disclose
Georgios Z. Papadakis MD : Nothing to Disclose
Daniel Joseph Mollura MD : Nothing to Disclose

TEACHING POINTS

1. To highlight the clinical importance of lung lobe volume determination as an imaging biomarker. 2. To review the state of the art segmentation methods for lung lobe determination. 3. To identify challenges in lobe segmentation with the focus on evaluation of different lung diseases. 4. To discuss the future trends in lung lobe segmentation and explain how current engineering advancements in CT can play a valuable role in making the lung lobe volume information as strong biomarker in routine clinics.

TABLE OF CONTENTS/OUTLINE

1. Introduction a. Clinical importance of lung lobe segmentation b. Lung lobe information as a biomarker 2. The Challenges in Segmenting Lung Lobes a. Lacking anatomical information when pathology exists b. Image quality and resolution limitations c. Computational efficiency 3. State-of-the-Art Lung Lobe Segmentation Methods a. Expert manual delineation. b. Model-based methods. c. Feature-based methods. d. Neighborhood-assisted methods. e. Hybrid methods. 4. Concluding Remarks and Future Trends

INE123

Multi Material 3D Printing to Create Anatomic Models for Patient Education and Pre-surgical Planning

Education Exhibits

Location: IN Community, Learning Center

Certificate of Merit

Participants

Darryl Hwang PhD (Presenter): Nothing to Disclose
Benjamin Nguyen : Nothing to Disclose
Samantha McBirney : Nothing to Disclose
Bhushan Desai MBBS, MS : Nothing to Disclose
Vinay Anant Duddalwar MD, FRCR : Research Grant, General Electric Company

TEACHING POINTS

Creation of Standard Tessellation Language formatted 3D object files created by segmenting medical images using Synapse 3D (FujiFilm, Stamford, CT). Understand the differences between fusion deposition, stereolithography, selective laser sintering, and powder-based printing and how to choose the appropriate technology for the application. Examination of a mixed material 3D printed model. Personalized 3D cancer models can be very useful to patients' in understanding and receiving timely, complete and accurate information in order to effectively participate in their care and decision-making.

TABLE OF CONTENTS/OUTLINE

I. Use of Synapse 3D (FujiFilm, Stamford, CT) to generate Standard Tessellation Language formatted 3D object files. II. Overview 3D Printing Technologies o Fusion Deposition Modeling o Stereolithography - including new research from School of Engineering. o Selective Laser Sintering o Powder-based printing III. Examples of mixed material printing. IV. Discussion of clinical applications. o Patient education - better understanding of their disease to informed treatment choice o Surgical planning o Medical student education - use in human anatomy classes

INE124

Recent Topics of Image Processing for Improving Chest CT Images

Education Exhibits

Location: IN Community, Learning Center

Participants

Norihisa Nitta MD (Presenter): Nothing to Disclose
Haruo Mizutani : Nothing to Disclose
Kentarou Sakata : Nothing to Disclose
Masahiro Yanagawa MD, PhD : Nothing to Disclose
Sachiko Miura MD : Nothing to Disclose
Masashi Takahashi MD : Nothing to Disclose
Akinaga Sonoda MD, PhD : Nothing to Disclose
Hideji Otani MD : Nothing to Disclose
Yukihiro Nagatani MD : Nothing to Disclose
Noritoshi Ushio RT : Nothing to Disclose
Kiyoshi Murata MD : Nothing to Disclose

TEACHING POINTS

1.To introduce technology which reduces radiation exposure of iterative reconstruction (IR) CT equipment, by applying a successive approximation method. 2.To evaluate the technology of reducing radiation exposure by workstation manufacturers. 3.To consider future trends of reducing radiation exposure caused by CT.

TABLE OF CONTENTS/OUTLINE

1. Manufacturers' applications of successive approximation methods to IR

2. iGentle volume filters by TeraRecon, Inc.
Evaluation of physical properties of iGentle volume filters
Visual evaluation of iGentle volume filters

3. State-of-the-art imaging reconstruction methods
Veo by GE is a reconstruction method of successive approximation, including calculations of how X-rays spread and produce geometric reflection not only in the statistical noise model and anatomical model but also from the physical focus size and the cell size of the actual detector.
Philips has developed a state-of-the-art reconstruction method called Iterative Model Base Reconstruction (IMR).

4. Development of other image reconstruction methods

INE125

Utilizing Contextual Knowledge for Computer Aided Detection with Object-based Image Analysis

Education Exhibits

Location: IN Community, Learning Center

Participants

Michael Schwier (Presenter): Nothing to Disclose
Teodora Chitiboi : Nothing to Disclose
Andre Homeyer : Nothing to Disclose
Horst Karl Hahn PhD : Nothing to Disclose

TEACHING POINTS

1. Understand the difficulty of getting computers to automatically identify structures in (medical) images, while it seems rather easy for humans. 2. Understand the concept of object-based image analysis (OBIA) as a new image analysis approach. Most importantly understand the limitations of pixel-based approaches, which are most common in medical image analysis, and how OBIA extends the possibilities for image analysis. 3. Emphasize the importance of medical experts' contextual knowledge and how OBIA allows the utilization of this for developing better detection methods. 4. Insights into example solutions. Some published and evaluated. Some early experimental to demonstrate how in cooperation with clinicians first prototypes can be developed quickly.

TABLE OF CONTENTS/OUTLINE

1. Advantage of human vision - why is it so hard to teach computers to "see"? 2. Idea of object-based image analysis 3. Advantages of object-based over pixel-based image analysis 3a. Features matter - how objects exhibit a wealth of information and pixels don't 3b. Context matters - how context matters to identify a target object 3c. How to include (contextual) knowledge provided by medical experts 4. Example solutions 4a. Detection of liver lesions (CT) 4b. Vertebrae detection (CT) 4c. Spinal cord detection (MR) 4d. (possibly more depending on space)

INE126

Virtual Mono-energetic Image Reconstruction of Dual Energy CT Dataset – Review of Clinical Applications

Education Exhibits

Location: IN Community, Learning Center

Participants

Rahul Lohan MBBS (Presenter): Nothing to Disclose
Hui Seong Teh MBBS : Nothing to Disclose

TEACHING POINTS

1. Review the basis of mono-energetic image (MEI) reconstruction of dual energy CT images. 2. Illustrate the clinical applications of MEIs in day to day reporting

TABLE OF CONTENTS/OUTLINE

1. Introduction 2. Mono-energetic image (MEI) reconstruction - Physical principles - How to obtain them using available commercial software solutions 3. Examples of clinical applications of low kEV MEIs - A) Better visualization of hyper-vascular liver lesions - B) Pulmonary and coronary angiography - C) Peripheral angiography 4. Examples of clinical applications of high kEV MEIs - A) In imaging following spine surgery, hip replacements and internal fixation of extremities - B) Reduction of dental artefacts in head and neck imaging - C) Other miscellaneous applications 5. Conclusion

INE127

A New Approach for Semantic DICOM Interoperability

Education Exhibits

Location: IN Community, Learning Center

Participants

Arpad Bischof MD (Presenter): Employee, IMAGE Information Systems
Joerg Barkhausen MD : Nothing to Disclose

TEACHING POINTS

DICOM interoperability

How to solve interoperability issues

TABLE OF CONTENTS/OUTLINE

The goal of this project was to normalize DICOM data to allow completely vendor independent hanging protocols. We collected 1.67 Million datasets from over 800 imaging centers in multiple countries. We analyzed the collected data and created a summary of the real world listing the variability of vendors and manufacturers in coding information in DICOM. We used artificial intelligence and peer review by radiologists and radiographers to interpret all data. We performed a comprehensive literature research about terminologies in medical imaging and developed a complex rule set to convert data into a vendor neutral archive format. We chose the newest publications of the DICOM committee or the IHE as the target formats. The system was able to convert 91.8% of data into a vendor neutral format. This approach will help manage DICOM data from multiple vendors and sources in a single network more efficiently, e.g. for global hanging protocol management. The system cannot create

information which does not exist, e.g. completely missing information. System training for other geographical regions is pending. Further studies are required to assess the effects.

INE128

Implementing of a National RIS / PACS in Ireland

Education Exhibits

Location: IN Community, Learning Center

Participants

Yvonne Goff BSC, MSc (Presenter): Nothing to Disclose
Neil O'Hare : Nothing to Disclose
Keith Morrissey : Nothing to Disclose
Julie Bellew : Nothing to Disclose
Breda Matthews : Nothing to Disclose
Kate McKenna : Nothing to Disclose
Lisa Morrin : Nothing to Disclose
Damien Duffy : Nothing to Disclose
Sharon Flatley : Nothing to Disclose
Peter Smith : Nothing to Disclose

METHODS

Pre NIMIS implementation there were 52 hospitals existed in the Health Service of which only 15 had PACS. Except for some teleradiology systems for image transmission to the neurosurgical and spinal national centres, none of the existing PACS could communicate with each other. Today NIMIS is achieving 6,000, 000 Images and reports, with 35, 000 studies added weekly, using a central archive, a major achievement in the relatively short time period. The first site went live over 3 years ago, with 31 sites currently live on the system and one a month being added. While NIMIS is inherently a Radiology system, the original design and implementation has extended the boundaries of the solution into other imaging type services such as Cardiology, Vascular, Arthroscopy, Obstetrics, and Respiratory functions.The critical components of this enormous task to achieve fully national integrated RIS/PACS using a single archive will be discussed. In addition, the current issues with sharing of images and clinical reports across different hospitals without a national identifier, and the ability of NIMIS to adapt to the current healthcare reconfiguration will also be presented. NIMIS was introduced into fully operational departments in which work flow had to continue with minimal impact. Impediments to user acceptance will be discussed along with difficulties experienced transitioning to a paperless environment. The review will present the very many benefits accruing from the move to a single national system around patient care, service delivery, metrics and end-user support. The cost and process efficiencies of a single system support mechanism that have resulted will be presented along with the inherent risks and resultant mitigation strategies.

PURPOSE

In 2007 the Health Service Executive (HSE) in Ireland initiated the National Integrated Medical Imaging (NIMIS) Project. The initial aim of this project was to install a RIS / PACS solution into all publically funded hospitals in Ireland that currently did not have such systems (34 in total). This review sets out the current position with regard to the implementation of NIMIS throughout the Republic of Ireland, the impact this has had on improving patient care, and the lessons learned during the process.

RESULTS

The review gives insight to how NIMIS fits into the changing methods of service delivery to address increasing demand pressures on diagnostic imaging services, including insourcing and outsourcing radiology services and the capability of resource utilization monitoring. Increasingly, patients are moving between jurisdictions with service level agreements being discussed and agreed on the efficient provision of treatment for specialised areas. Inherent in the system specification and design is the use of the IHE XDS standard. The current NIMIS architecture is XDS enabled, allowing for cross border sharing of data.

CONCLUSION

The implementation of NIMIS is a very significant milestone in the development of a national electronic health record, as a national image archive for the Health System. The project has set new standards in aspects related to large system procurement and implementation. The system, while very successful, has highlighted other gaps in the IT infrastructure in Ireland such as the current lack of implemented national Order Comms, Results acknowledgement, or Criticial Findings solutions.

INE129

Incorporating Non Radiology Imaging Services within a National RIS/PACS Solution

Education Exhibits

Location: IN Community, Learning Center

Participants

Keith Morrissey (Presenter): Nothing to Disclose
Yvonne Goff BSC, MSc : Nothing to Disclose
Julie Bellew : Nothing to Disclose
Breda Matthews : Nothing to Disclose
Kate McKenna : Nothing to Disclose
Lisa Morrin : Nothing to Disclose
Damien Duffy : Nothing to Disclose
Peter Smith : Nothing to Disclose
Sharon Flatley : Nothing to Disclose

METHODS

NIMIS Implementation Team adopted a "Big Tent" approach with prospective sites where the system was offered to image producing areas if they agreed to adopt the basic NIMIS workflow and supply the necessary resources to facilitate successful implementation. The original design and implementation of the system has extended the boundaries of the solution into other imaging type services such as Cardiology, Vascular US, Obstetrics US, Arthroscopy, and Respiratory Function Laboratories

PURPOSE

In 2007 the Health Service Executive (HSE) in Ireland initiated the National Integrated Medical Imaging (NIMIS) Project. The initial aim of this project was to install a RIS / PACS solution into all publically funded hospitals that currently did not have such systems (34 in total). While NIMIS at its inception was inherently a Radiology system it was not designed to be exclusively so.

NIMIS as the acronym suggests was envisaged to be more of a holistic "Medical Imaging" archive rather than limited to a Radiology PACS/RIS. There was a desire to include the capture and storage of Resting ECG data within the system and to this effect an ECG module was procured to integrate with the core PACS/RIS. The system was designed to be XDS compliant and architecturally is XDS enabled

RESULTS

This review will focus on the particular requirements, benefits and challenges that were presented in the implementation of the NIMIS system in these non-radiology image producing areas. The process workflows in many of these areas were not as developed and standardised as within radiology depts. There was a significant learning curve involved for the national implementation team and vendor to gain the detailed understanding of the varied work processes followed in these areas necessary to support the system implementation in these areas. The particular benefits that have accrued to these non-radiology areas becoming part of the system will be presented in particular the resultant improvements in patient care delivery. There were also particular benefits delivered to the various stakeholders who utilise the services offered by these Depts. through their adoption of the NIMIS system. There were very specific lessons learned and functionality limitations encountered.

CONCLUSION

The project has delivered on a significant element of the original specification, namely the development of a generic image archive using the radiology solution as the catalyst for such. This has been proven in the utilisation of the archive to store many non-radiology image examinations. At the same time, these areas have had to adopt to a rigorous and structured workflows with interesting consequences a step taken by Radiology many years ago. The NIMIS solution, in just the same as for radiology exams, affords the opportunity to share such exams at a national level where clinically required.

INE131

Best Practices in Critical Test Results Management Systems

Education Exhibits

Location: IN Community, Learning Center

Selected for RadioGraphics

Participants

Paras Khandheria MD (Presenter): Nothing to Disclose
Brian David Gale MD : Board Member, SaferMD, LLC
Paul G. Nagy PhD : Nothing to Disclose

TEACHING POINTS

The purpose of this exhibit is to: (1) understand what constitutes a critical test results management system (CTRM) (2) identify important features a 'best in class' CTRM system should provide (3) understand how to effectively deploy CTRM in the learner's institution

TABLE OF CONTENTS/OUTLINE

1. Define what constitutes a critical finding in collaboration with clinical services.
- stratify by acuity
- define appropriate modes of communication
- define escalation tree(s) based on clinical setting if no initial response is found

2. Optimize communication process between radiologist and clinician.
- automate contacting of the referring provider
- maintain accurate personnel white pages
- automate tracking of results through the lifecycle of a critical result with timestamping
- provide extensibile application programming interface (API) to allow custom dashboarding
- offer clinician a convenient way to contact the interpreting radiologist if there are questions

3. Addend reports automatically with documentation of findings communication and readback receipt.

4. Implement fail-safe measure(s) to track abandoned important incidental findings.

INE180

National Library of Medicine (NLM) Literature Searches Demonstration

Education Exhibits

IN

Location: NA

TEACHING POINTS

NLM Literature Searching Consultation Area offers demonstrations of the free resources of the National Library of Medicine (NLM) (http://nlm.nih.gov/) and the Neuroimaging Informatics Tools and Resources Clearinghouse (NITRC) (http://www.nitrc.org/). Search PubMed/MEDLINE, the premier citation database, on individual workstations with one-on-one assistance from health sciences librarians. Improve your searching skills and discover tools to keep up with the latest publications. Tour related free NLM databases including those focusing on images and drugs. View demonstrations of the NIH-funded free NITRC website including the Image Repository (NITRC-IR) and the collaboration environment NITRC-R, a Resources Repository. This site collects, points to, and enables the comparing of neuroimaging tools and software and offers user provided ratings and reviews. In addition to tutorial brochures, materials for the in-person classes on PubMed and on online databases taught by NLM librarians will be available; as well as assistance in several languages.

INE181

IHE/RSNA Image Sharing Demonstration

Education Exhibits

IN

Location: NA

TEACHING POINTS

This demonstration will showcase developments in standards-based interoperability that enhance the quality, efficiency and safety of care in radiology. The demonstration will show enhanced radiology reporting and image sharing based on IHE profiles and the RSNA Image Share network, a pilot project funded by the National Institute of Biomedical Imaging and Bioengineering (NIBIB).

Location: South Building - Hall A, Booth 1336

Demonstration Hours: 10:00 AM - 2:00 PM daily, Sunday through Thursday

INE182

Computer Assisted Radiology and Surgery (CARS)

Education Exhibits

IN

Location: NA

INE183

The Society for Imaging Informatics in Medicine (SIIM)

Education Exhibits

IN

Location: NA

MSE002-b

Reshaping Individualized Medicine: 3D Printing Integration of Anatomic Models in Care of Complex Patients

Education Exhibits

Location: MS Community, Learning Center

Certificate of Merit

Participants

Jane Sexton Matsumoto MD (Presenter): Nothing to Disclose
Jonathan Michael Morris MD : Nothing to Disclose
Thomas Andrew Foley MD : Nothing to Disclose
Terri Jo Vrtiska MD : Nothing to Disclose
Eric E. Williamson MD : Research Grant, General Electric Company
Shuai Leng PhD : Nothing to Disclose
Kiaran Patrick McGee PhD : Nothing to Disclose
Linda Nesberg : Nothing to Disclose
Joel L. Kuhlmann : Nothing to Disclose

TEACHING POINTS

OVERVIEW: Highly detailed radiographic imaging sets are transformed into useful life-sized anatomic models (AMs) using additive manufacturing (3D printing). USE: AMs provide preoperative information and accurate perspective of critical anatomic relationships by segmentation of imaging data. COLLABORATION: Care is optimized when radiologists team with surgeons preoperatively to plan construction of AMs to illuminate anatomic points of interest.

TABLE OF CONTENTS/OUTLINE

1. Our Experience: 108 AMs
a. Clinical: MSK (41), Cardiovascular (20), Neuro (33), Abdominal (6)
b. Education (3)
c. Quality: Phantom Development (2)
d. Validation (3)

2. Mechanism
a. Segmentation process outlines and separates critical anatomy
i. Choose best data for segmentation and to display needed anatomy
i. Thinner section offers higher detail
ii. Phases of contrast enhancement
iii. Different phases or studies can be combined
b. Variables in printing process
i. Type and color of material
ii. Printing time varies

3. Consultation: In-depth discussion with surgeon to understand unique needs of individual patient and anatomic relationships important for surgical procedure. Radiologist tailors AM construction to these needs. Surgical colleagues report Improvement in safety, efficiency and outcome of complex surgical procedures.

MSE007-b

Mobile Computing Application Guidance for Quick Management of Contrast Reactions and Other Emergencies that May Occur During Imaging

Education Exhibits

Location: MS Community, Learning Center

Participants

Mohammed Ezuddin MD (Presenter): Nothing to Disclose
Gary H. Danton MD, PhD : Nothing to Disclose

TEACHING POINTS

THe purpose of this abstract is: Demonstrate use of electronic application on mobile computing devices is an efficient means for keeping track of quick information to manage contrast reactions. Application will be available for download. This is in use at our institution. Review evidence based summative guidelines for managing contrast reactions including but not limited to allergic reactions, bronchospasm, laryngeal edema, vasovagal reaction, angina, Seizures, and others in both pediatric populations and adults.

TABLE OF CONTENTS/OUTLINE

Medication and managemetn guidelines for: Premedication Urgent Premedication Nausea and Vomiting Urticaria and Hives Bronchospasm Laryngeal Edema Vasovagal Reaction Angina Anaphylaxis Hypertensive crisis Pulmonary Edema Seizures Diabetic Hypoglycemia Rigors Facial Edema Extravasation Review of Oxygen devices and their use

SSA11

Informatics (Education and Research)

Scientific Papers

RS IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 10:45 AM - 12:15 PM Location: S403A

Participants

Moderator
Safwan Halabi MD : Nothing to Disclose
Moderator
George Lee Shih MD, MS : Consultant, Image Safely, Inc Stockholder, Image Safely, Inc Consultant, Angular Health, Inc Stockholder, Angular Health, Inc

Sub-Events

SSA11-01 Standardized Software Object Models for Radiology Educational Content

Thomas W. Loehfelm MD, PhD (Presenter): Founder, Panorad , Jason Daehn Balkman MD : Nothing to Disclose

CONCLUSION

Standardized object models for radiology educational content analogous to the Digital Imaging and Communications in Medicine (DICOM) standard were developed, enabling cross-platform sharing of structured radiology educational content. This work may allow owners of radiology content to reach a broader audience and enable software developers to optimize presentation of cases for a variety of devices.

Background

User-generated teaching content comprises a significant portion of current online radiology education. Various case sharing platforms exist, such as the ACR Learning File®, AIRP Archive, Radiopaedia, and LearningRadiology, but no standardized case file data structure has been adopted. Such a standard would facilitate cross-platform sharing of online teaching files.

Evaluation

We evaluated current standards for sharing educational radiology content, focusing on the Sharable Content Object Reference Model (SCORM). Commercially available cloud computing products, including Google Cloud SQL, Cloud Store, and App Engine were identified as potential platforms to host content. Software models relevant to teaching files and individual cases were developed along with required database structure and server functions to enable the creation, storage, and retrieval of this content from the cloud. Web, Android, and iOS applications were developed to give end-users access to a growing library of standardized, structured, shared educational content.

Discussion

The widespread use of mobile devices and object-oriented software together create unprecedented opportunities for sharing radiology content online. Currently, the storage and structure of online radiology teaching files is not standardized, but rather is divided across numerous websites and software applications, each with their own content definitions. As the quality of online case content continues to increase, standardized definitions for case content should be developed to encourage efficient file sharing and presentation. In this work, the concept of a radiology case is defined using object-oriented software development principles as an object containing a title, discussion, diagnosis, various other data fields, as well as structured image content.

SSA11-02 Assessing the Validity of Contrast Induced Nephropathy Using the i2b2 Informatics Framework: A

Retrospective 3-year Electronic Medical Record Review

Cesar Augusto Lam MD (Presenter): Nothing to Disclose , Christina Eldredge MD, MS : Nothing to Disclose , Glenn Bushee : Nothing to Disclose , Rahul N. Sawlani MD : Nothing to Disclose , Bradley W. Taylor BS : Nothing to Disclose , Charles E. Kahn MD, MS : Shareholder, Hotlight Inc Officer, Hotlight Inc

PURPOSE

Whether contrast-induced nephropathy (CIN) is a real disorder or an artifact of prior studies is controversial. We sought to explore the effect of IV contrast on kidney function. We applied an i2b2 (Informatics for Integrating Biology and the Bedside) platform - an open-source, scalable framework to link biomedical research datasets to clinical record systems - to query a large, de-identified patient population to examine the validity of CIN.

METHOD AND MATERIALS

A 3-year retrospective review of a large academic medical center's electronic medical record system was performed using i2b2 software. CT exams (with or without IV contrast) with associated serum creatinine (SCr) results (within 24 hours before and within 72 hours after the exam) were obtained.

RESULTS

We reviewed 25,202 CT examinations of 18,384 patients. Of these, 17,718 exams (72.9%) and 12,673 patients (70.3%) received IV contrast. Both groups (contrast enhanced and Non contrast enhanced) demonstrated a statistically significant decrease in SCr with a P<0.0001 for both groups. For the non-contrast group, the SCr mean (Std) before exam 1.76(+/- 1.73) and after exam 1.57(+/- 1.56) for a mean (Std) difference of -0.19 (+/- 0.91) [CI -0.21,-0.17; P<0.0001]. For the contrast group, the SCr mean (Std) before exam 1.10 (+/- 1.30) and after 1.04 (+/- 1.24) revealed a mean (Std) difference of -0.06 (+/- 0.54); [CI -0.07, -0.05: P<0.0001]. The incidence of CIN (defined by a 25% or 0.5 mg/dL increase in SCr) in a subset of patients in the contrast group with a baseline (pre-exam) SCr >1.3 SCr (n=1941) was statistically significant (p<0.001) with an absolute risk of 3.5 (1.6-5.5%) and relative risk 1.28 (1.12-1.47).

CONCLUSION

The existence of contrast induced nephropathy is controversial. Our preliminary results indicate that the average creatinine value decreased after the CT exam in both contrast enhanced and non-contrast enhanced groups, although the incidence of CIN increased in patient's with an increased SCr at baseline. We are in the process of further stratifying additional data points (GFR, age, gender, and hospital setting [ER, inpatient, or outpatient]) to establish their significance.

CLINICAL RELEVANCE/APPLICATION

Several recent large scale retrospective articles have suggested that contrast induced nephropathy (CIN) may not exist when comparing contrast enhanced CT's to non-contrast CT control groups.

SSA11-03

Does Resident Report Modification Depend on Level of Attending? - Preliminary Analysis of Resident Report Modifications by Attending Radiologists as a Measure to Improve Resident Education and Quality Control

Supriya Gupta MBBS : Nothing to Disclose , Yulia Melenevsky MD (Presenter): Nothing to Disclose

PURPOSE

Learning to create accurate, concise, clinically relevant reports is a critically important part of radiology resident education. The resident reports are subsequently reviewed and modified by attending prior to signing. Feedback from this review is crucial to resident development and education. We wanted to assess differences between resident and attending reports at our institution and various factors which influence it.

METHOD AND MATERIALS

In this ongoing retrospective study, 145 resident and corresponding final attending reports from musculoskeletal radiology were collected. For resident reports, postgraduation training year and work setting (call vs regular workday) and for attending reports, experience of attending (<5 years - Junior, >5 years - Senior) were recorded. Report differences were analyzed broadly under three categories: grammatical or spelling mistake changes, misinterpretation of findings and missed findings. Chi square test was used to assess variance in degree of report changes in senior versus junior categories.

RESULTS

Of current data, 145 musculoskeletal radiographic reports were analyzed. Overall, only 6 reports had major grammatical changes or spelling mistakes. 18/145 (12.4%) contained missed finding (incidental or significant) while 29/145 (20%) had misinterpreted findings. 52 (35.8%) reports were read by senior staff radiologists and 93(64/13%) by junior staff. Among reports signed by Senior attendings, most final report changes were deemed either none (59.6%) or minor (28.8%) versus major (11.5%); whilst for reports read by Junior staff radiologists, distribution was none (50.5%), minor (22.5%) versus major (26.88%). The degree of changes between senior and junior attending reports were statistically significant (p<0.001).

CONCLUSION

Preliminary data showed significant difference between report modifications between junior and senior attendings for the same resident report. Junior attendings tend to modify reports more, compared to more experienced colleagues. This is intuitive since experience increases diagnostic confidence of radiologists and this is reflected in not only their dictation styles but also in their teaching styles.

CLINICAL RELEVANCE/APPLICATION

Analysis of residnt reports compared to final attending reports can provide valuable quality metrics for

augmenting resident feedback and education.It can aslo provide insight into practice behavior and teaching styles of attending radiologists.

SSA11-04

Search Pattern Training for Improving Pulmonary Nodule Identification on Chest Radiographs

William Auffermann MD, PhD (Presenter): Nothing to Disclose , Brent Little MD : Nothing to Disclose , Travis S. Henry MD : Spouse, Employee, F. Hoffmann-La Roche Ltd , Stefan Tigges MD : Stockholder, Microsoft Corporation Stockholder, General Electric Company , Srini Tridandapani PhD, MD : Nothing to Disclose

PURPOSE

Many chest radiograph interpretation errors occur because observer's eyes do not fixate on a relevant abnormality, which may be partially due to a lack of a search strategy. This project's goal is to determine if providing a standardized chest radiograph search pattern to medical trainees improves performance on a nodule identification task.

METHOD AND MATERIALS

Healthcare trainee participants included: medical and nurse practitioner students, and non-radiology residents and fellows. The image set included 50 chest radiographs; 25 normals and 25 with pulmonary nodules (one nodule per image, size range 10-20 mm). Subjects were divided into control and treatment groups, and were shown the 50 radiographs randomized into two case sets of equal size. Subjects were asked to mark nodules if present and give a rating of their diagnostic confidence using a 5 point scale. The control group received no training between case sets. The treatment group received chest radiograph search pattern training between the first and second case sets. Performance on nodule identification between control and treatment groups were compared using localization receiver operator characteristic (LROC) analysis and differences in the area under the LROC curve (D-AUC). P-values of less than 0.05 were considered statistically significant.

RESULTS

Control Group: There was no statistically significant difference in subject performance between case sets 1 and 2, D-AUC = 0.0521, p-value = 0.1910. Treatment group: There was a statistically significant improvement in subject performance between case sets 1 and 2, D-AUC = 0.1079, p-value = 0.0150.

CONCLUSION

Providing healthcare trainees with a chest radiograph search pattern improved performance on a nodule identification task.

CLINICAL RELEVANCE/APPLICATION

Search pattern training may be useful for healthcare trainees who will evaluate chest radiographs as part of their practice.

SSA11-05

Assessment of Web Based Interactive Learning of Basic Image Interpretation

Betty Anne Schwarz MSc, RN (Presenter): Nothing to Disclose , Mark E. Schweitzer MD : Consultant, MMI Munich Medical International GmbH Data Safety Monitoring Board, Histogenics Corporation , Rebecca Ann Peterson MD : Nothing to Disclose

PURPOSE

Following the Flexnor report in the early 1990's undergraduate medical school training underwent a revolution. These changes overwhelmingly affected clinical disciplines. Until recently formal medical school imaging training was extremely limited. As imaging is digital we felt it lended itself to web based teaching. Hence, we developed and systematically assessed the educational effects of a web-based series of modules to ameliorate this deficit.

METHOD AND MATERIALS

A web based teaching module was developed to be used by trainees from other services. These modules were based on what should be the critical mass of imaging that all non-imaging specialists should know. The curriculum consisted of 600 de-identified cases organized by body part, with text and user controlled animation. The 600 cases were felt to run the gamut of typical imaging that would be seen by the generalist. These cases were supplemented by 13 video power-point lectures including; Introduction to Head CT, An Approach to CT Head, Contrast Use, Basic Abdomen, Basics of Chest Imaging, Radiology of Spine Trauma, Easily Missed Musculoskeletal Injuries, Radiology of Extremity Fractures, Review of Chest Image Interpretation. Assessment of learning was done via a web based questionnaire. This questionnaire was based on the post test given as part of our University's radiology elective. Our assessment was given to third and fourth year medical students both pre and post web based educational intervention assessments. A fraction of later students also expressed their confidence in their answers.

RESULTS

The average on the pre-test was 40% whereas their post-test average was 71% ($P < 0.0001$ CI 23.26-38.45)

CONCLUSION

This web based systematic didactic and case based review of radiology demonstrably enhanced medical student

familiarity with our field.

CLINICAL RELEVANCE/APPLICATION

We implemented and evaluated the effectiveness of a web based program to significantly aid in teaching non imaging clinicians the basics of image interpretation.

SSA11-06

A Pocket-Size, Portable PACS and Open-Source Software Development Platform for Biomedical Researchers and Educational Institutions

Michael D. Torno DSc (Presenter): Nothing to Disclose , Eamon Johnson MS : Nothing to Disclose , Adam J Starkey : Contract, YellowDot Innovations, LLC , Paul J. Chang MD : Co-founder, Stentor/Koninklijke Philips Electronics NV Technical Advisory Board, Amirsys, Inc Research Contracts, Koninklijke Philips NV Medical Advisory Board, lifeIMAGE Inc Medical Advisory Board, Merge Healthcare Incorporated

CONCLUSION

A portable, cost-efficient radiology application development ecosystem was created for biomedical researchers. Furthermore, low cost hardware coupled with open-source software makes the device a viable solution as a radiology teaching aid and rapid software development platform.

Background

A pocket-size PC utilizing open-source software was created to fulfill the need for a low cost software developer tool and teaching aid for biomedical researchers and educational institutions. The system was designed for "plug-and-play" setup and rapid application creation and deployment. Additionally, the device functions as a teaching instrument demonstrating basic PACS function and software development. A unique user interface with standard or touch screen display integration was designed to facilitate ease of use for users with no programing background.

Evaluation

Hardware includes a credit card size, Linux OS based PC with internet connectivity. Open-source software was modified and compiled specifically for the device and is comprised of (1) a PACS suite;(2) DCMTK library;(3) programing libraries (JAVA,PERL,Python);(4) internet server/services (Apache,PHP,SQL);(5) indexing search engine with anonymized database that allows keyword queries. All data including OS and developer software reside on a removable SD card.

Discussion

SD card contents are stored as an 'image' file which allows for a rapid and efficient backup solution. This equates to no down-time in the event of hardware failure. Also, the image can be cloned on to a new card, creating a multitude of identical devices, and eliminating time needed to reinstall/recompile the OS and developer libraries. Incorporating DCMTK binaries used in conjunction with the most common programing languages and web services provides for a robust and versatile software development environment. Coupled with a locally running PACS and keyword queryable database, applications specific to a researcher's needs can be written. Additionally, radiology image based studies can be initiated by simply uploading DICOM images and associated radiology, pathology, or similar text data to the device. This data is then processed by the device and accessible via the device's web interface.

SSA11-07

Senior Medical Students' Awareness of Radiation Risks from Common Diagnostic Imaging Examinations

Elena Scali MD (Presenter): Nothing to Disclose , John R. Mayo MD : Speaker, Siemens AG , Savvas Nicolaou MD : Nothing to Disclose , Silvia D. Chang MD : Nothing to Disclose

PURPOSE

The radiology component of the undergraduate medical curriculum at our institution aims to provide medical students, as future practitioners, with broad-based knowledge about commonly performed imaging studies. The purpose of this study is to investigate senior medical students' awareness of radiation exposures from common diagnostic imaging studies as well as radiation risks.

METHOD AND MATERIALS

The study population consisted of medical students in their final year at our institution. An anonymous multiple-choice questionnaire was distributed. Questions were designed to assess knowledge of radiation from common diagnostic procedures and radiation-related risks.

RESULTS

48 eligible medical students responded. The majority of students felt that knowledge of the radiation dose of common imaging examinations is somewhat or very important (98%). However, only 6% of students routinely discussed radiation-related risks with patients when recommending imaging examinations. 85% of students recognized that CT is most responsible for medical radiation received by the population. While almost all recognized children as most sensitive to the effects of radiation, only 35% correctly identified gonads as the most radiation-sensitive tissue. 30% correctly identified the absolute dose (in milliSieverts) of a chest x-ray and relative dose compared to background radiation. The proportion of students able to correctly identify the relative dose of common imaging studies in chest x-ray equivalents varied from 26-65%; the remainder underestimated the dose received by the patient. Approximately half of the student correctly identified the risk of inducing a fatal cancer from an abdominal CT in an adult; the remainder underestimated this risk.

CONCLUSION

Medical students acknowledge the importance of radiation-related issues to patient care. While almost all students are familiar with radiation-free modalities, many students are not familiar with, and commonly underestimate, the relative doses and risks of medical radiation. This may expose patients to increasing imaging investigations and exposure to radiation hazards.

CLINICAL RELEVANCE/APPLICATION

Medical students commonly underestimate radiation-related doses and risks, and would do well to receive further instruction on the radiation-related hazards of commonly performed imaging studies.

SSA11-08

Educational Exhibit "Likes" at the 2013 RSNA Annual Meeting: A Detailed Analysis

Paul Michael Bunch MD (Presenter): Nothing to Disclose , Jeremy Robert Wortman MD : Nothing to Disclose , Katherine P. Andriole PhD : Nothing to Disclose

PURPOSE

The 2013 RSNA DPS offered educational exhibit (EE) viewers the opportunity to "like" an EE. We sought to evaluate any relationship between an EE's popularity and its chance of winning an award or being selected for Radiographics. We also evaluated any relationship between an EE's recognition and its subsequent popularity.

METHOD AND MATERIALS

The number of likes each EE received was captured from DPS on Tuesday evening prior to Wednesday's announcement of award selections, on Thursday evening prior to Friday's announcement of Radiographics invitations, and on Friday evening upon closure of the exhibit halls. Data analysis was performed by means of oneway ANOVA.

RESULTS

At the 2013 RSNA meeting, there were 1856 EEs, which received 4391 likes (Mean 2.37, Min 0 [n=527], Max 55 [n=1]). Awards were given to 423 EEs (22.8%), which received a total of 1490 likes (33.9%, Mean 3.52, Min 0 [n=59], Max 55 [n=1]). Radiographics invitations were given to 190 EEs (10.2%), which received a total of 752 likes (17.1%, Mean 3.96, Min 0 [n=32], Max 55 [n=1]). EEs receiving awards had significantly more likes prior to announcement of award selection (Mean 1.9 vs 1.3, SD 2.7 vs 2.1) and at the end of the meeting (Mean 3.5 vs 2.0, SD 4.6 vs 2.9) than non-awarded EEs [$p<0.001$ for both]. EEs receiving Radiographics invitations had significantly more likes prior to announcement of Radiographics invitations (Mean 2.4 vs 1.3, SD 3.5 vs 2.1) and at the end of the meeting (Mean 4.0 vs 2.2, SD 5.6 vs 3.0) than non-invited EEs [$p<0.001$ for both]. EEs receiving at least 15 likes prior to announcement of awards had a 44.4% chance of being recognized compared to a 22.7% chance. EEs receiving at least 15 likes prior to announcement of Radiographics invitations had a 33.3% chance of receiving an invitation compared to a 10.0% chance. Receiving an award on Wednesday had a statistically significant association with the number of likes (Mean 1.7 vs 0.7, SD 2.4 vs 1.2) an EE subsequently received [$p<0.001$].

CONCLUSION

The DPS "like" feature at the 2013 RSNA meeting, similar to social media impact, allowed for substantial audience feedback on EEs, with over 4000 distinct entries made. Receiving an award or a Radiographics invitation was associated with a subsequent increase in EE popularity.

CLINICAL RELEVANCE/APPLICATION

EE likes gauge radiologists' opinions of EEs and may predict awards and Radiographics invitations.

SSA11-09

Rapid-feedback Using a Web-based Module to Teach the Grading of Degeneration on an MRI of the Lumbar Spine

Alexander T. Ruutiainen MD (Presenter): Nothing to Disclose , Po-Hao Chen MD, MBA : Nothing to Disclose , Howard Lee Roth MD : Nothing to Disclose , Tessa S. Cook MD, PhD : Nothing to Disclose

PURPOSE

Grading the severity of lumbar degeneration on an MRI is an important task which carries treatment implications. Although published criteria exist for assigning such grades, the consistency of their use varies among radiology trainees and some practicing radiologists. We hypothesized that such cutoffs could be effectively taught by providing rapid feedback to a learner. To this end, we developed a free web-based module, named Centaur, to teach the grading of spine degeneration using rapid feedback.

METHOD AND MATERIALS

Seven musculoskeletal radiologists were asked to rate the size of disc bulges and the severity of spinal canal and neuroforaminal narrowing using a 7 point scale ranging from "normal" to "severe." The correct response for each case was determined by statistical consensus; for weighting Fleiss' kappa, responses were considered discordant if they differed from the consensus by more than one point. Next, a web-based module was created to present these cases to subjects: using the module, learners attempt to grade the established cases, and are provided with immediate feedback regarding their choices. The module automatically tracks performance to determine whether the accuracy of the responses improves with time.

RESULTS

Inter-observer concordance among practicing musculoskeletal radiologists was higher for assessing the size of disc bulges (Fleiss' weighted kappa = 0.78), than central canal narrowing (kappa = 0.59) or neuroforaminal narrowing (kappa = 0.54). Detailed results from the analysis of all respondents who consent to the collection of their performance data using our web based module will be presented. Specifically, we aim to show that providing rapid feedback is an effective tool for teaching this concept.

CONCLUSION

We demonstrate the use of a web-based module that delivers rapid feedback to teach the grading of degenerative changes on an MRI of the lumbar spine. We believe that these results add to the body of radiologic pedagogy and highlight the general feasibility of using such web modules to teach some concepts in diagnostic radiology.

CLINICAL RELEVANCE/APPLICATION

Learning to grade the severity of degeneration on a lumbar spine MRI is challenging but clinically important: we demonstrate the use of a web-based module that delivers rapid feedback to teach these criteria.

RCA11

Data Management and Analysis with Excel for Research and for Practicing Quality Improvement - A Hands-On Tutorial

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 11:00 AM - 12:30 PM Location: S401AB

Participants

Jaydev Kardam Dave PhD, MS (Presenter): Nothing to Disclose
Raja Gali MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe techniques for creating a spreadsheet to allow trouble-free data analysis. 2) Demonstrate key data management skills. 3) Describe tools for performing basic descriptive statistics. 4) Identify how to perform simple statistical tests and perform these tests with a sample dataset. 5) Understand how bad data (or bad data acquisition techniques) may corrupt subsequent data analyses. 6) Practice data plotting/representation techniques. 7) Identify differences between a spreadsheet and a database. 8) Identify statistical tasks that require more sophisticated software. Pre-requisites: Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed

ABSTRACT

A spreadsheet program is commonly employed to collect and organize data for practicing quality improvement, for research, and for other purposes. In this refresher course, we will demonstrate to a user, familiar with Microsoft Excel environment, how this spreadsheet program may be used for such purposes. The course will begin with describing efficient approach for data acquisition and highlight key data management skills; and with reviewing commons errors that may be avoided during data logging. Then we will provide a brief introduction on basic descriptive tests before proceeding with a hands-on tutorial using a sample dataset to calculate basic descriptive statistics, and to perform basic statistical tests like t-test, chi-square test, correlation analysis, etc. Effect of corrupted data on such analysis will also be demonstrated. The final hands-on component for this course will include data plotting and representation including the use of pivot tables. The course will conclude with a discussion on identifying differences between a spreadsheet and a database, limitations of a spreadsheet program and avenues where a dedicated statistical software program would be more beneficial. A list of some of these dedicated statistical software programs for analyses will also be provided. Pre-requisites: Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed

RCB11

Mobile Computing for Decision Support and Learning While You Work (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 11:00 AM - 12:30 PM Location: S401CD

Participants

Michael Patrick D'Alessandro MD (Presenter): Nothing to Disclose
Jeffrey R. Galvin MD (Presenter): Nothing to Disclose
James J. Choi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Learn to perform decision support on a mobile device at the point-of-care to answer questions that arise during clinical work and thus tie learning to practice and receive point-of care CME for it. 2) Learn to read Ebooks and educational apps on a mobile device. 3) Learn to stay up-to-date with radiology journals and society news on a mobile device. 4) Learn to manage a library of journal articles on a mobile device. 5) Learn to view podcasts and vodcasts on a mobile device. 6) Learn to maintain a learning portfolio / teaching file on a mobile device.

ABSTRACT

Acquiring and maintaining competency in the practice of radiology requires a program of continuous learning. This continuous learning would be most effectively performed during clinical work, when it has the greatest potential for modifying physicians' knowledge, attitudes, and behaviors as well as positively affecting patients' care, outcomes, and lives. The advent of mobile

computing, and the rich assortment of authoritative radiology resources it allows easy access to, now allows this dream to become reality. This course will be a hands-on, state-of-the-art review that will teach the radiologist how to use mobile computing to perform continuous learning while you work. The Apple iOS, Google Android and Microsoft Windows Phone platforms will be covered. Participants will be encouraged to bring their own mobile phone or tablet to the course and will be asked before the course to download into their mobile device several free apps that will be demonstrated, so they can follow along during the session. These free apps are listed on the course handout at http://www.radiologyebooks.com/rsna.html

URL's

http://www.radiologyebooks.com/rsna.html

RCC11

Fundamentals of 3D Printing

Refresher/Informatics

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 11:00 AM - 12:30 PM Location: S501ABC

Participants

Moderator
Vincent B. Ho MD, MBA : In-kind support, General Electric Company
Moderator
Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation

Sub-Events

RCC11A

Uses of 3D Printing in Radiology Practice: An Overview

Vincent B. Ho MD, MBA (Presenter): In-kind support, General Electric Company

LEARNING OBJECTIVES

1) To list potential opportunities for 3D printing in Radiology. 2) To describe requirements for a 3D printing service.

ABSTRACT

Radiology departments are uniquely positioned to perform 3D printing. In this presentation, a practical overview of this emerging technology and its opportunities will be discussed.

RCC11B

3D Printing Technologies

Peter Constantine Liacouras PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the basic principle of Additive Manufacturing (3D Printing) and how it differs from subtractive technology. 2) Understand the principles of the software needed to convert Medical Images into three-dimensional printed models and what factors contribute to the quality of each model. 3) Become familiar with the different types of Additive Manufacturing (3D Printing) technologies.

ABSTRACT

This presentation will provide a novice to Additive Manufacturing the general knowledge applicable to the medical field. The basic principles of Additive manufacturing (3D Printing) will be discussed along with the different technologies which encompass the field. The steps of converting radiographic images into three-dimensional printable files and the differences between the multitude of additive manufacturing techniques will be the primary focuses.

RCC11C

3D Printing Software

Timothy Mueller (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Access the results of new research and assess their potential applications to clinical practice. 2) Improve basic knowledge and skills relevant to clinical practice. 3) Practice new techniques. 4) Assess the potential of technological innovations and advances to enhance clinical practice and problem-solving. 5) Apply principles of critical thinking to ideas from experts and peers in the radiologic sciences.

ABSTRACT

1. Identify the application of basic anatomic, pathologic, and physiologic principles to specific disease processes, and diagnostic and therapeutic procedures. 2. Apply the physics of particular imaging and therapeutic modalities to improve quality and efficacy while minimizing patient risk. 3. Analyze imaging and therapeutic techniques and apply this knowledge to protocol development, patient management/safety, and cost. 4. Demonstrate understanding of the influence of socioeconomic issues on current and future practice patterns. 5. Compare

indications and contraindications of specific image-guided procedures.

RCC11D

Techniques for Current 3D Printing Applications

Gerald Thomas Grant DMD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Introduce the current use of 3D Printing in support of patient care, restoration, and rehabilitation. 2) Identify the requirements for use of 3d Printing technologies in support of patient care.

ABSTRACT

Additive Manufacturing technologies, commonly known as 3D printing, have proven to be ideal technologies to produce medical models, surgical guides, custom implants, as well as support for occupational health and prosthetics. This presentation will review the current of 3D Printing techniquesin the development and application in support of reconstruction and rehabilitation of Wounded Warriors.

URL's

http://www.wrnmmc.capmed.mil/ResearchEducation/3DMAC/SitePages/home.aspx

RCC11E

Implementing 3D Printing into a Clinical Practice

Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

1) To review sets of clinical images that will be amenable for 3D printing. 2) To establish within this group a set of clinical images that would be expected to be of clinical benefit with a 3D model "in hand".

ABSTRACT

Roughly 10 years ago, the "3D Lab" in diagnostic radiology was created to implement 3D visualization tools that, at the time, were highly innovative. At present, these software packages to view anatomy, pathology, and to perform advanced image post-processing are fundamental to the practice and success of radiology. In fact, much of the work of the 3D lab 10 years ago is now part of individual thin clients that are part of routine workflow as opposed to a separate "lab" for a radiology practice. The next generation 3D Lab will center around 3D printing. This is based on the increased utilization of 3D printing, and the growing need for these models. This need is largely, but not exclusively, for planning interventions. This lecture addresses the implementation of these devices to our practice and is intended as an adjunct to the 3D printing hands-on workshops.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

INS-SUA

Informatics Sunday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 12:30 PM - 1:00 PM Location: IN Community, Learning Center

Participants

Moderator
Kevin W. McEnery MD : Advisor, Koninklijke Philips NV

Sub-Events

INS132

Web-Based Interactive Generation of Structured Reports for Lumbar Spine MRI Improves Conformity with Consensus Reporting Guidelines (Station #1)

Patrick H Do MD (Presenter): Nothing to Disclose , Mingming Ma MD : Nothing to Disclose , Matthew Alexander MD : Nothing to Disclose , Benjamin Boun-Ming Chou MD : Nothing to Disclose , Young S. Kang MD : Nothing to Disclose , Rajul Parimal Pandit MD : Nothing to Disclose , Mahesh Ramu Patel MD : Stockholder, Novartis AG

CONCLUSION

Automated report generation improves accuracy and conformity with accepted guidelines, as well as improving radiologist efficiency.

Background

Classification of lumbar disc pathology identified on MRI and the nomenclature for radiology reporting have

historically been variable and difficult to interpret. Professional societies, including ASNR, developed a consensus scheme for nomenclature and classification. With contemporary technology, a role for electronically generated standardized reporting has emerged. We developed and evaluated a customized, web-based program for automated generation of reports using consensus nomenclature.

Evaluation

A web-based structured report generator tailored to lumbar MRI without requiring input of protected health information was created using software implemented on a Linux-based Apache webserver. The involves mySQL databases, AJAX scripting, and additional open source tools. After selection of relevant responses for each field at every spinal level, the program outputs text in a format appropriate for the imaging report that can be simply pasted into the electronic dictation system. A retrospective review was conducted to compare reports generated with and without use of the program. Conformity was evaluated, and resident and attending physician satisfaction with the program was evaluated with a survey. 50 reports each were evaluated with and without program implementation. Conformity with consensus nomenclature was found in 50% of reports without implementation and 96% with implementation. 10 residents and 4 attendings were surveyed. 12 of 14 (86%) users indicated the program increased efficiency and decreased ambiguity of reports compared to the previously utilized macro-based scheme. 2 of 14 (14%) had no preference between the two schemes. 9 of the surveyed residents (90%) indicated improved inter-attending concordance following program implementation.

Discussion

Appropriate use of consensus classification and nomenclature aids clinicians in managing disease and assessing response to treatment. The above-described program improves conformity in reporting and increases radiologist efficiency. This process found widespread acceptance by surveyed radiologists.

INS133

To Call or Not to Call? Referring Providers' Preferences on Communication of Non-Emergent Actionable Findings (Station #2)

Seetharam C. Chadalavada MD, MS (Presenter): Nothing to Disclose , Tessa S. Cook MD, PhD : Nothing to Disclose , Caroline Sloan : Nothing to Disclose , Darco Lalevic : Nothing to Disclose , Curtis P. Langlotz MD, PhD : Shareholder, Montage Healthcare Solutions, Inc Advisory Board, Reed Elsevier Advisory Board, Activate Networks, Inc Spouse, Consultant, Johnson & Johnson , Mitchell Dennis Schnall MD, PhD : Nothing to Disclose , Hanna Maryam Zafar MD : Nothing to Disclose

CONCLUSION

Our experience in developing a standardized lexicon for abdominal follow-up recommendations has been greatly shaped by the feedback of referring providers. Most referring providers prefer detailed follow-up recommendations when appropriate, but patients would also greatly benefit from an automated system to ensure follow-up occurs appropriately.

Background

Although free-text reports allow radiologists to customize reports, they introduce variability in the presence and content of follow-up recommendations, which may create confusion. Our objective was to understand referring provider preference for the communication of follow-up recommendations of non-emergent actionable findings on abdominal imaging using a standardized reporting lexicon.

Evaluation

We conducted a survey of all potential providers referring patients to abdominal imaging using an online survey software (Qualtrics). Among 433 referring providers 79 (18%) responded to the survey. 40 (51%) were female, 50 (63%) worked in a primarily outpatient/clinic based practice, and 61 (77%) providers had more than 5 years of clinical practice experience. Forty eight (65%) providers preferred recommendation for follow-up within the report, 2 (3%) selected never and 3 (4%) rarely. 63 (86%) providers desired both a modality and time interval for follow-up within the recommendations. Forty-two 42 (63%) providers indicated that the decision to not follow-up a recommendation is due to patient prognosis, while 26 (39%) stated it is based on patient preference. Twenty seven (37%) providers indicated they had no system in place for monitoring completion of follow-up and 9 (12%) indicated dedicated office personnel assigned to this task. Preferred means of communicating actionable findings were phone call (39, 53%), email (33, 45%), and electronic medical record message (27, 36%).

Discussion

Most providers desire recommendations for follow-up that include a specific modality and time interval. The decision to not pursue recommended follow-up is on clinical basis, often made based on patient prognosis. Most referring providers do not have an effective mechanism to ensure completion of follow-up recommendations.

INS134

Computed Tomography Turnaround Times in the Emergency Department: Radiologist Productivity and "Patient Ready Project" Will Make You Turn Around (Station #3)

Nicholas Vernace BS : Nothing to Disclose , Josiah W. Bancroft MD : Nothing to Disclose , Ronald Scott Shill MD : Nothing to Disclose , Ronald Drachenberg BS : Nothing to Disclose , Warren Wylie : Nothing to Disclose , Laura W. Bancroft MD (Presenter): Royalties, Wolters Kluwer nv

CONCLUSION

Radiology turnaround times can be markedly improved by assuming ownership and addressing inefficiencies in the various segments defining PAEC and ECRA.

Background

Radiology Department (RD) turnaround times (TAT) are continuously scrutinized by the entire medical team. At our institution, radiologist interpretation times were historically cited as the primary source of delayed treatment and discharge of Emergency Department (ED) patients. A change in radiologists and governance structure in 2008 prompted a systematic improvement in imaging TAT in the ED.

Evaluation

1st part of our study evaluated 'Patient Arrival to Exam Complete' (PEAC) time at baseline and after process implementation that improved system efficiencies. Patient Ready Project was initiated at 7 Hospital campuses in step-wise fashion 9/2010-3/2012. In first quarter (Q1) of 2008, baseline TAT from PAEC averaged 229 minutes for 26,335 ED CT scans. During Q1 of 2012, PAEC time dropped to 105 min. avg. One year after Patient Ready implementation, communication/logistics between the ED and RD significantly improved through series of checklists. Avg. PAEC was 110 min. in Q4 of 2013 despite 26% increase in CTs to 33,280. 2nd part of the study evaluated 'Exam Completion to Report Available' (ECRA) time at baseline and after intervention increasing radiologist productivity (reorganized PACS worklists, voice recognition templates, incentives, swing shifts matching radiologist and study volumes). ECRA in Q1 of 2008 averaged 74 min, steadily decreased from 2008 to 2013, and averaged 15 minutes in Q4 of 2013. However, improved Radiology TAT did not yield an equivalent decrease in time to discharge from the ED.

Discussion

Overall time from patient arrival to discharge from the ED proved to be partly, but not solely, dependent upon radiology department functionality. Individual components of system-wide and radiologist-dependent processes were dissected in order to understand deficiencies and extract maximal benefit. Through this two part endeavor, turnaround times of CT studies arriving at the PACS station decreased 52% over 5 years, and Radiologist time decreased by 80%. Interestingly, these improvements did not yield a direct correlation with time to discharge from the ED.

INS135

A Pocket-Size, Portable PACS and Open-Source Software Development Platform for Biomedical Researchers and Educational Institutions (Station #4)

Michael D. Torno DSc (Presenter): Nothing to Disclose , Eamon Johnson MS : Nothing to Disclose , Adam J Starkey : Contract, YellowDot Innovations, LLC , Paul J. Chang MD : Co-founder, Stentor/Koninklijke Philips Electronics NV Technical Advisory Board, Amirsys, Inc Research Contracts, Koninklijke Philips NV Medical Advisory Board, lifeIMAGE Inc Medical Advisory Board, Merge Healthcare Incorporated

CONCLUSION

A portable, cost-efficient radiology application development ecosystem was created for biomedical researchers. Furthermore, low cost hardware coupled with open-source software makes the device a viable solution as a radiology teaching aid and rapid software development platform.

Background

A pocket-size PC utilizing open-source software was created to fulfill the need for a low cost software developer tool and teaching aid for biomedical researchers and educational institutions. The system was designed for "plug-and-play" setup and rapid application creation and deployment. Additionally, the device functions as a teaching instrument demonstrating basic PACS function and software development. A unique user interface with standard or touch screen display integration was designed to facilitate ease of use for users with no programing background.

Evaluation

Hardware includes a credit card size, Linux OS based PC with internet connectivity. Open-source software was modified and compiled specifically for the device and is comprised of (1) a PACS suite;(2) DCMTK library;(3) programing libraries (JAVA,PERL,Python);(4) internet server/services (Apache,PHP,SQL);(5) indexing search engine with anonymized database that allows keyword queries. All data including OS and developer software reside on a removable SD card.

Discussion

SD card contents are stored as an 'image' file which allows for a rapid and efficient backup solution. This equates to no down-time in the event of hardware failure. Also, the image can be cloned on to a new card, creating a multitude of identical devices, and eliminating time needed to reinstall/recompile the OS and developer libraries. Incorporating DCMTK binaries used in conjunction with the most common programing languages and web services provides for a robust and versatile software development environment. Coupled with a locally running PACS and keyword queryable database, applications specific to a researcher's needs can be written. Additionally, radiology image based studies can be initiated by simply uploading DICOM images and associated radiology, pathology, or similar text data to the device. This data is then processed by the device and accessible via the device's web interface.

INE119

Computer-aided Diagnosis and You (the Radiologist) (Station #5)

Ranjit Singh Sandhu MD (Presenter): Nothing to Disclose , Brian Jin MD : Nothing to Disclose , Richard S. Ha MD : Nothing to Disclose , Ralph Thomas Wynn MD : Nothing to Disclose

TEACHING POINTS

CAD should not be seen as a 'black box.' Understanding how CAD analyses images and determines relevant outputs for the radiologist is fundamental for optimal diagnostic use as well as improving quality in radiology. Through participation in this exhibit, the audience will learn and demonstrate understanding of the goals, roles, applications and future directions of CAD.

TABLE OF CONTENTS/OUTLINE

Introduction to CAD and its potential role in solving issues faced by the field of radiology today. CAD goals (i.e. what are the characteristics of an optimal CAD system?). Overview of CAD image analysis. Image preprocessing along with a discussion about image standardization. Image segmentation. Candidate detection. Feature extraction, candidate analysis/classification. Introductions to vector space and machine learning. System output (i.e. what is CAD trying to tell you as the radiologist and why?). Discussion of first reader vs. second reader and the radiologist's relationship with CAD. Current and future applications. Current limitations. Throughout and at the end of the exhibit, interactive quiz questions will be presented to reinforce concepts and emphasize key points.

INE001-b

A Knowledge-based Representation of Clinical Trial Reports for Evidence-based Decision Support (custom application computer demonstration)

Maurine Tong (Presenter): Nothing to Disclose , William Hsu PhD : Nothing to Disclose , Rick K. Taira PhD : Nothing to Disclose

Background

Numerical information presented in figures, tables, and text within a clinical trial report is the evidence that guides clinical decision making and evidence-based medicine (EBM). However, hurdles exist when attempting to extract and apply this information. The published report has data scattered throughout the report and the context behind each piece of data is not automatically extracted. In addition, the clinical trial study describes specific experiments performed on a pre-defined patient population and comparisons between reports to determine subtle differences in trial design requires critical review by a domain expert. The goal of this research is to demonstrate a system with a context-driven representation to: 1) synthesize fragments of information found in clinical trial reports, 2) assess the strength and quality of a the study, 3) compare knowledge from similar trials. Previously, we have demonstrated a framework to organize numerical data within one clinical trial report. In this exhibit, we further develop this system to include the ability to retrieve and compare similar trials based on similar population characteristics, methods, interventions, or survival metrics.

Evaluation

We demonstrate the tool using clinical trial papers in the domain of non-small cell lung cancer (NSCLC). The usability and satisfaction of the system was evaluated using a 10-point Likert scale. The query outputs from the system were evaluated by domain experts for scientific significance.

Discussion

A structured representation was demonstrated with an interactive visualization. The visualization performed common queries, aided in interpretation and has implications for furthering scientific discovery.

CONCLUSION

In this exhibit, we have specified a representation for the purpose of synthesizing and integrating selected information from clinical trial reports in the domain of NSCLC. The tool transforms free-text reports to the target representation with functions allowing comparisons between trials. This research is relevant to radiology researchers involved in comparing and synthesizing clinical trial results and provides the basis for inductive reasoning using evidence from trial studies.

INE002-b

The Ultrasound Report of the Future (custom application computer demonstration)

David Joseph Vining MD (Presenter): Royalties, Bracco Group CEO, VisionSR Stockholder, VisionSR , Andreea Pitici : Employee, Eloquentix, Inc , Cristian Popovici : Employee, Eloquentix, Inc , Adrian Prisacariu : Employee, Eloquentix, Inc , David Bier : Nothing to Disclose , Radu Rosu : CEO, Eloquentix, Inc

Background

Ultrasound is practiced in a chaotic fashion with ultrasonographers attempting to record images in a logical pattern but frequently having to return to prior anatomy to record additional images. As a result, a radiologist to formulate a logical report from the random collection of images. We have developed a multimedia structured reporting system that tags each image with an anatomical location and radiological observation/diagnosis. The system allows a radiologist to designate key images for each anatomical site, and then drag-and-drop related images onto the key images to create supporting images of those findings. With this method, a multimedia structured report can be assembled from a random collection of images, a process that is well-suited for the practice of ultrasound.

Evaluation

We have developed a multimedia structured reporting system that functions in a client-server software arrangement. The client software runs in parallel with any third-party vendor's image display/analysis system to capture images, metrics and voice descriptions of each finding as identified by a radiologist. The images and voice data are transmitted to a server where metadata is extracted from the descriptions to indicate the anatomical location and radiological observation/diagnosis of each finding. The server software provides a means for a radiologist to drag-and-drop supporting images onto key images in order to organize a random collection of ultrasound images. The server software assembles the image findings into a multimedia structured report organized by anatomical categories. In addition, the server provides a means to link image findings from serial examinations to create graphical disease timelines showing the evolution of disease at each anatomical site.

Discussion

Ultrasound images are often recorded in random patterns. Our mutlimedia structured reporting system provides a means to organize random images while simultaneously creating structured report data which is essential for electronic health record initiatives.

CONCLUSION

We have developed a multimedia structured reporting process that is well-suited to the practice of diagnostic ultrasound.

INE003-b

Improving Peer Review Compliance: A Novel Solution for Anonymous Review on PACS (custom application computer demonstration)

Chun-Shan Yam PhD (Presenter): Nothing to Disclose , Bettina Siewert MD : Nothing to Disclose , Jonathan Yam : Nothing to Disclose , Jonathan B. Kruskal MD, PhD : Author, UpToDate, Inc , Seth Joshua Berkowitz : Nothing to Disclose

Background

Mandated by the ABR, Peer Review is becoming part of the daily routine for many radiologists in the United States; however, Peer Review is not yet 100% compliant in all radiology settings. One of most common issues hampering the Peer Review process in today's radiology workflow is the lack of anonymity for the reading radiologist who rendered the original report. Many radiologists have shared a common concern that Peer Review may damage interpersonal relationships with their colleagues. Based on a literature search on currently available Peer Review implementations in radiology institutions, none of these systems are anonymous - the name of the reading radiologist is exposed to the reviewers. The main reason for this drawback is because the process is attached to the existing RIS and PACS system for image viewing and it is very expensive to duplicate the entire PACS just for anonymous viewing. In this study, we propose a novel and simple solution for an anonymized Peer Review system.

Evaluation

We have developed a mechanism to bridge the PACS image database and the Peer Review system using a simple Java based web browser for displaying the DICOM images. To be HIPAA compliant, other associated materials such as reports and pathology results are also available for the reviewer with all PHI removed. An applet was developed using an open source software Java Development Kit for image viewing. The DICOM communication between the viewer and PACS is connected by another freeware MIR Central Test Node DICOM Software. Basic image manipulation tools such as scrolling, zooming and measuring are provided for the reviewers. This new software is available for RSNA readers upon request to the authors.

Discussion

We have developed novel software allowing for anonymized Peer Review in PACS/RIS Radiology settings.

CONCLUSION

Since both images and reports are completely anonymized, reviewers can focus on the Peer Review process more effectively instead of worrying about the potential risk of damaging the interpersonal and/or professional relationships with their colleagues. We believe this novel software will encourage more radiologists to participate into this required Peer Review process.

INE004-b

Imaging—Surgery Correlation Application (custom application computer demonstration)

Hong Yang : Nothing to Disclose , Laurie A. Perry RN : Nothing to Disclose , Rose Martin RT : Nothing to Disclose , Kathleen Helme Emery MD : Nothing to Disclose , Timothy OConnor MBA (Presenter): Nothing to Disclose , Alex Towbin MD : Author, Amirsys Inc Shareholder, Merge Healthcare Incorporated Consultant, Guerbet SA

Background

In order to improve diagnostic performance of musculoskeletal MRI we compare our diagnostic reports against actual surgical report findings. Historically, this involved a cumbersome paper-based process whereby both reports were printed, reviewed by a division chief, and any discrepancies annotated. The annotated reports were then sent to the radiologist for review. In order to simplify this process and begin to understand our overall performance, a web-based peer-review application was developed.

Evaluation

The report correlator system was created as a web-based, database application which allows an administrator to easily prepare cases to be scored by staff radiologists. With the administrator's guidance, the system automatically uploads and extracts the impression and findings from the MRI Radiology report for individual scoring. The corresponding surgical report is then copied into the application from the electronic medical record. Once the data is uploaded, it is available to radiologists for peer-review. Cases are scored in a blinded manner using the surgical report as the gold-standard. Radiologists cannot score their own cases or view the scored cases of their colleagues. The division chief and department chairperson can review scoring for all cases. Once a radiologist logs in, he or she is given a choice to perform a review of newly added cases or view the surgical correlation for cases in which they provided the initial interpretation.

Discussion

The system has been deployed for our musculoskeletal division as a pilot evaluation with a limited number of

radiologists. Based on pilot feedback, reporting tools will be added to allow individual radiologists to anonymously compare their performance to their peers. As this system expands, we anticipate that it will also be used as a tool for radiology-surgical pathology correlation.

CONCLUSION

Using an electronic, peer review system to correlate and score musculoskeletal MRI reports with surgical findings provides a necessary tool to evaluate diagnostic performance and provide educational feedback to our faculty.

INS-SUB

Informatics Sunday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Sun, Nov 30 1:00 PM - 1:30 PM Location: IN Community, Learning Center

Sub-Events

INS136

ROBO-CHIEF: A Simple Algorithm to Automatically and Fairly Distribute Call Shifts among a Large Resident Cohort at a Large Academic Institution with Complicated Scheduling Requirements (Station #1)

Thomas W. Loehfelm MD, PhD (Presenter): Founder, Panorad , Eleza Tema Golden MD : Nothing to Disclose , Robert John Hosker MD : Nothing to Disclose

CONCLUSION

A simple algorithm is able to fairly and rapidly distribute call shifts among a large cohort of residents, taking in to account complex scheduling requirements and even satisfying personal requests for call-free periods of time. Freeing chief residents from the burdensome task of scheduling preserves valuable time and energy that is better spent on more meaningful work and residency administration.

Background

Generating a resident schedule for an entire academic year is a daunting task, one that is compounded at a large academic institution. Chief residents strive to satisfy the personal requests of other residents for specific weekends free from call, the requirements of other components of the schedule that might block a resident from call eligibility, and the requirements of ACGME and other governing bodies which limit who can take call when.

Evaluation

We evaluated the scheduling requirements of our particular program, and developed an algorithm to automatically and fairly distribute call shifts among our large resident cohort. We divided our call responsibilities in to 11 categories, specified which classes were eligible for call, which varies throughout the academic year, inputted days when specific residents were blocked from call due to existing schedule constraints, and took in to account requests from each resident for specific call-free time periods.

Discussion

We developed an algorithm that systemically stepped through the 1000+ call shifts one-by-one, and at each step generated a list of residents eligible for that call shift. The algorithm calculated how many call shifts each eligible resident had already been assigned so far, and then chose randomly one of those eligible residents with the least number of already-assigned call shifts to work the current shift in question. This process was implemented in Microsoft Access, a program available in most versions of Microsoft Office, and required only 30 lines of code to implement. It was able to assign >99% of the required call shifts automatically and in approximately 60 seconds, leaving only a few shifts left for the chief residents to assign manually.

INS137

Novel Bone Suppression Imaging Technique in Small Lung Nodule Detection: Evaluation using Localized ROC Method (Station #2)

Tomohiro Miyoshi MD (Presenter): Research Grant, Konica Minolta Group , Junji Yoshida MD, PhD : Research Grant, Konica Minolta Group , Keiju Aokage MD, PhD : Research Grant, Konica Minolta Group , Tomoyuki Hishida MD, PhD : Research Grant, Konica Minolta Group , Tsuyoshi Kobayashi MS : Nothing to Disclose , Shinichi Tsubura MS : Nothing to Disclose , Shinsuke Katsuhara MS : Nothing to Disclose , Satoshi Kasai PhD : Nothing to Disclose , Yasuhiko Sasano : Nothing to Disclose , Kanji Nagai MD, PhD : Research Grant, Konica Minolta Group

CONCLUSION

LROC analysis demonstrated that BSI can improve the detection accuracy and localization of small lung nodules on chest radiographs not only for experts but also observers with limited experience.

Background

Bone suppression imaging (BSI) processes standard chest radiographs to improve the conspicuity of the lung field and the efficacy of small lung nodule detection. In this study, we evaluated the efficacy of a new BSI technique, using conventional ROC and localized ROC (LROC) analyses.

Evaluation

Standard and BSI chest radiographs of 80 patients, of which 40 with a nodular lesion (≤ 30 mm) and 40 without any nodules, were randomly interpreted by 20 observers, including 7 pulmonologists with more than 10-year experiences and 13 pulmonology residents. They recorded the changes in confidence levels regarding the presence or absence of a lung nodule and also the most likely location of the lesion, first without and then with BSI. ROC and LROC analyses were used to evaluate observer performance. The average area under the ROC curve (AUC) for all observers was significantly improved from 0.867 to 0.900 (p=0.004) with BSI. The average AUC for experienced pulmonologist and resident groups were also improved from 0.900 to 0.929 (p=0.035) and from 0.848 to 0.885 (p=0.031), respectively. In LROC analysis, the AUC was also significantly improved in each group. The AUC without BSI were generally greater among experienced pulmonologists compared to residents (0.80±0.03 and 0.72±0.09, respectively), whereas the AUC improvement was reversed (range: -0.03 to 0.18 for residents and -0.01 to 0.08 for experienced pulmonologists, respectively). Among the 13 residents, only one scored a worse AUC with BSI. BSI enabled more than 3 observers to localize nodules correctly in 5 of the 80 patients.

Discussion

BSI improved the accuracy of small nodule detection on chest radiographs regardless of observers' experience. LROC analysis showed that BSI improved nodule localization and tended to be more effective in observers with limited experience.

INS138

Tool Development for Sensitive Automatic Early Breast Cancer Detection in Mammograms through MATLAB as a Computing Environment: Supported by Grants from NCRR (P20RR016460) and NIGMS (P20 GM103429) at NIH (Station #3)

Shahrukh Babar : Nothing to Disclose , Thomas Hahn (Presenter): Nothing to Disclose , Rabail Zehra : Nothing to Disclose

CONCLUSION

Classification can be further ameliorated by considering even more features, training images, multifaceted diagnostics and temporal changes. More extensive unrestricted global real-time data, image and information exchange and more frequent collaborative meetings between radiologists, programmers and other stakeholders are very beneficial for maximally accelerating improvements in diagnosis given that even short delays inevitably cost the lives of many women unnecessarily.

Background

Adding artificial intelligence (AI) as a diagnostic aid could become very useful since it adds both objective and reproducible medical decision elements. It can alert physicians to clinically relevant abnormalities that are otherwise challenging to detect. Machine-learning algorithms, particularly the Support Vector Machine (SVM), have been widely applied for AI in Natural Language Processing, text mining, protein and gene expression pattern analysis and particularly image processing. SVM gradually improves, with each iteration, as it bases future classifications on past associations between image features and diagnoses. In particular, SVM has a great potential to accelerate the emerging trend for multifaceted diagnostics, i.e. basing final diagnoses on a combination of mammograms, ultrasound, MRI, Terra Hertz Imaging and past experience. However, the maximum possible correct classification rate of other similar AI-based diagnostic aids, currently available, is unnecessarily limited by considering only up to 2 features for classification, requiring more features and training images.

Evaluation

322 training and 25 test images from the MINI-MIAS database were used. The sensitivity is 83% and specificity 62%. This is a much better classification rate because - instead of only 2 - the following 6 features were used: correlation, center of gravity, optical density, low average distance, compactness and fractal dimensions.

Discussion

Since considering 4 additional features caused noticeable improvement, adding still more, such as duct angles, asymmetry, temporal changes, co-occurrences of encapsulated small multi-nodal tumors with diffuse regions and other clinically relevant features, can further improve classification.

INS139

Personalizing the Fleischner Criteria: Real Time Data Mining of a Large Clinical Trial Dataset (Station #4)

Jason Michael Hostetter MD (Presenter): Nothing to Disclose , James Jason Morrison MD : Nothing to Disclose , Jean Jeudy MD : Nothing to Disclose , Kenneth Chung-Yi Wang MD, PhD : Co-founder, DexNote, LLC , Eliot L. Siegel MD : Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson

Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

CONCLUSION

Pulmonary nodule cancer risk is correlated largely with nodule size in smokers and non-smokers as described by the Fleischner criteria, however risk varies widely within the size and density categories. Nodule risk predictions and surveillance strategies could be improved by incorporating multiple predictors into a tool to generate personalized matched NLST cohorts.

Background

The Fleischner Society guidelines are the standard for follow-up of pulmonary nodules. Availability of clinical and image data from large clinical trials such as the National Lung Screening Trial (NLST) makes it possible to utilize "big data" methodology to further personalize these recommendations. We used the NLST dataset and a custom web interface to stratify pulmonary nodules based on nodule and patient attributes and can provide a data driven reference for personalized nodule cancer risk by creating matched cohorts.

Evaluation

Real-time analysis of the NLST dataset was performed through a custom web-based interface. Evaluating the nodule data using Fleischner size criteria alone predicted risk of malignancy of 2.8% for nodules <= 4 mm to 7.0% for nodules > 8 mm. Further analysis within each size category using discriminators such as nodule location and patient smoking history (pack years) provided additional risk stratification. For example, in patients with 4-6 mm pulmonary nodules, the risk of malignancy ranged from 1.9% to 8.6%. In patients with 6-8 mm nodules, risk ranged from 4.7% to 8.9%. The NLST dataset includes additional demographic and nodule descriptive data, and incorporating these will likely lead to even greater risk discrimination.

Discussion

This work aims to evaluate and refine the Fleischner criteria using a large clinical dataset. The range of malignancy risk within Fleischner size categories suggests that size and nodule density are useful but incomplete predictors of nodule malignancy for a specific patient. Additional demographic and anatomic predictors of nodule malignancy have been identified in the literature. Leveraging matched NLST cohorts and incorporating additional cancer risk predictors could improve nodule follow-up recommendations.

INE100

A Predictive Diagnostic Imaging Calculator as a Clinical Decision Support Tool (Station #5)

Jose Morey MD (Presenter): Nothing to Disclose , Nora Marie Haney BS : Nothing to Disclose , Penny B. Cooper : Nothing to Disclose

Background

In preparation for a community hospital's transition into an Accountable Care Organization, a quality improvement group of radiologists was asked to monitor the hospital's imaging utilization. The group developed a predictive imaging calculator based on patient, physician, and department averages.

Evaluation

An analysis was conducted of all patients of radiologic modalities from 2009 through 2013. Success of linear regressions were determined to be statistically significant by P

Discussion

With this data, the group developed an imaging calculator with multiple advantages. One goal is to aid physicians with image utilization and diagnosis based on age, sex, comorbidity, and indices regarding primary diagnosis. If a physician goes beyond the hospital standard of what is typically ordered by a standard deviation, then an indication comes up with cheaper modality alternatives or advise that an alternative diagnosis should be considered to assist in patient management.

CONCLUSION

Predictive analytics based on patient demographics can help streamline patients for more efficient care, as well as create bundling payment models. Imaging information could be monitored within an individual institution or shared across institutions for more complex patient cases in need of imaging. Monitoring trends in imaging utilization is pivotal to enhance efficiency, decrease unnecessary imaging, reduce radiation and improve the quality of care. As the healthcare community transforms from a volume based to value based system, implementing a predictive calculator is a method radiology departments can use to improve care and demonstrate value to their ACO's.

INE043-b

Variability of Spleen Morphology and Volume Over Time Reveal Limitations of Index Estimates of Splenic Volume (hardcopy backboard)

James Shin MD (Presenter): Nothing to Disclose , Matthew A. Barish MD : Stockholder, Blackford Analysis Ltd , Jung Hwoon Edward Yoon MD : Nothing to Disclose

Background

Splenic size can be reliably evaluated through imaging. Quantitative methods have been proposed, including the Rezai method (0.36 x (L x W x H)+28) and prolate ellipse method (0.524 x (L x W x H)). This study examines the robustness of these methods, and evaluates the normal variation of splenic volume over time.

Evaluation

34 adults without known splenic pathology and 82 abdominal CT scans were included retrospectively. Image analysis was performed in Alice (Parexel Informatics; Waltham, MA). Manual tracings were performed to provide ground truth splenic volume. Volume estimations were calculated by human observers and automated VOI analysis. True volumes ranged from 73.46-704.9 mL (mean 297.27 ± 185.18 mL; 95% CI 232.65-361.88 mL). Intra-subject variance ranged from 0.001 to 0.367, for a maximum of 3 time-points. There was excellent concordance between observers (r=0.979, 95% CI -7.00-10.42 mm), and between computed and observed maximum axial length (r=0.984, 95% CI -8.64-2.74 mm; r=0.982, 95% CI -9.73-7.23 mm). There was intermediate concordance in computed and observed maximum orthogonal width (r=0.639, 95% CI -20.87-32.84 mm; r=0.691, 95% CI -23.07-29.49 mm). Overall, the Rezai method underestimated volume by 53.95 mL (r=0.892, 95% CI -169.94-62.04 mL), while the prolate ellipse method overestimated volume by 42.82 mL (r=0.879, 95% CI -141.74-227.38 mL).

Discussion

Potentially sizable changes in splenic volume may be subclinical or incidental. Estimations were more concordant with true volumes using the Rezai method. While correlation between both methods and true volume was not weak, occasionally changes in morphology significantly altered the maximum length and/or orthogonal width (observed and computed), resulting in falsely large calculated changes in splenic volume.

CONCLUSION

Quantitative index estimates of splenic volume are limited due to highly variable morphology between subjects and normal variation over time, which is further pronounced in the setting of pathology. Increasingly sophisticated and automated segmentation methodologies can obviate such estimates, making robust ground truth analysis of splenic volume change readily available.

INE044-b

Platform to Enable Shared Scientific Computing And Research Assets (PESSCARA) (hardcopy backboard)

Panagiotis Korfiatis PhD (Presenter): Nothing to Disclose , Timothy Kline MS, BS : Nothing to Disclose , Daniel J. Blezek PhD : Nothing to Disclose , Steve Gerhardt Langer PhD : Stockholder, Evidentia Health, Inc , Bradley J. Erickson MD, PhD : Stockholder, Evidentia Health, Inc

Background

Clinical studies can involve hundreds to thousands of subjects, with imaging data acquired over several time points, and at multiple institutions. Efficient execution of such studies demands a single platform that enables online collaboration and data management. The ability to develop data processing in this same environment is desireable. We created PESSCARA, a Platform to Enable Sharing of Scientific Computing Advances and Research Assets.

Evaluation

The execution of multi-site trials demands reliable data handling, including collection, processing, and reporting, with compliant audit trails of all steps. Prior to execution of such a study, the development of a processing pipeline is required. Validation of the pipeline requires access to data sets, and cohort selection is benefitted from flexible data and metadata tagging. PESSCARA offers a flexible data management schema incorporating data management features not available in existing solutions. Currently, PESSCARA has been tested in two different studies.

Discussion

PESSCARA consists of HUBzero a platform used to create web sites for scientific collaboration; a content management system (TACTIC) to store medical images and associated metadata; and a Python based computational environment. HUBzero allows people to upload content and "publish" software tools to group members. HUBzero handles datasets, analysis tools, and incorporates collaboration capabilities. TACTIC has a highly configurable workflow, exposing a unified interface that can store, manage, and retrieve imaging studies. TACTIC plus Dcm4chee and Clinical Trials Processor is a research PACS that assures deidentification, study storage, and management of data and metadata with full auditing capabilities. Python serves as a computational environment since it enables rapid algorithm prototyping. The components of PESSCARA are open source and can be offered as a cloud solution.

CONCLUSION

PESSCARA aims to provide the community with an environment suitable to deal with the requirements of medical image analysis adapted to the spirit of open and reproducible research.

INE045-b

How Many Work Relative Value Units (wRVUs) Does a Radiologist Produce Per Hour? (hardcopy backboard)

Arif S. Kidwai MD (Presenter): Owner, Profound Radiology, LLC

Background

Most radiology practices do not quantify daily imaging workload volume (demand) and hourly radiologist productivity (supply) to assess the appropriate staffing levels. Similar to a manufacturing production process, radiology departments can be quantified as a process flow diagram of inputs, buffers, processes, and outputs transforming imaging studies into radiology reports as the final product. In calculating the optimal number of radiologists to staff the process, one must know the radiologist productivity as measured by "flow rate" or "throughput rate" similar to a manufacturing machine.

Evaluation

Eight radiologists at a single, hospital-based practice were analyzed retrospectively for an eight-month period

for individual flow rates measured by work relative value units (wRVU) per hour during weekend rotations. Key features of the weekend rotation include: (1) single radiologist responsible for reading all imaging studies performed during previous night and during daytime shift (2) limited interruptions relative to weekday rotations (3) higher imaging workload relative to one radiologist compared to weekday rotations.

Discussion

The key metric to calculate radiologist productivity was radiologists flow rate as measured in [(wRVU)/(hour)]. Work RVUs units normalized variations in interpretation times among modalities and exam procedures. The analyzed practice typically had 100 wRVUs for interpretation per weekend shift. Radiologists in this practice had sustained reading rates between 6-12 wRVUs/hour and maximum rates between 8-18 wRVUs/hour. Individual radiologists varied in sustained flow rates, maximum flow rates, and number of reading hours.

CONCLUSION

As radiology practices begin to address inefficient production processes, which are unsustainable with increasing economic pressures, radiologists' hourly productivity metrics will become standard elements to make staffing decisions. In the near future, radiology practices will start to advertise their productivity rate expectations (demand) to potential candidates who are aware of their individual productivity rates (supply) to facilitate sustainable employment arrangements where supply meets demand.

INE046-b

Automated Technique for Characterization of Metastatic Spine Disease (hardcopy backboard)

Curtis Caldwell PhD (Presenter): Research Consultant, Bayer AG Research collaboration, Claron Technology Inc , Cari Marisa Whyne : Nothing to Disclose , Hamid Ebrahimi BS : Nothing to Disclose , Trinette Wright BEng : Nothing to Disclose , Gregory M. Szilagyi BS : Nothing to Disclose , Sameer Zaheer MSc : Employee, Claron Technology Inc , Ingmar Bitter PhD : Employee, Claron Technology Inc

Background

CT imaging is an essential tool for assessment of patients with metastatic disease of the spine. There is no widely accepted, easy to use method of quantifying spinal lesions or of assessing changes in spine lesions over time or in response to treatment. In a collaboration with Claron Technologies Inc, we have been working on developing means of automated assessment of the volume of blastic and lytic sub-regions in vertebrae.Pre- and post-therapy CT scans of 28 patients with metastatic spine disease were used. Pre- and post-therapy images were automatically aligned. Spine
segmentation was automated, with the software locating the vertebrae and pedicles for the cervical, thoracic and lumbar regions of the spine using an atlas based registration. Landmarks are placed by the software adjacent to each vertebra allowing identification of the edges of the vertebra. These landmarks can be manipulated if needed to change where the program has defined the edges. The cortical shell of each vertebral body was automatically stripped and trabecular bone volumes of interest (VOIs) defined. Histogram analysis was used to segment volumes that could represent lytic or blastic tissues. Volumes of lytic or blastic tissue were compared with the volumes defined by a radiologist.

Evaluation

196 blastic regions and 194 lytic regions were available for comparison. Complete analysis for a single patient (all vertebral bodies) took on average 3 minutes. In 6 patients, no modification of the landmarks was necessary. In 14, minor corrections were needed, while in 8 patients major modification was required. In no case did landmark modification take more than a minute to complete. For both the lytic and blastic regions, the volume defined by the expert observer and those defined by the automated technique were stongly correlated, as was the measure of change in these volumes over time.

Discussion

Lytic and blastic sub-volumes were quantitatively characterised using an automated technique. Strong correlation with volumes defined by an expert observer were found.

CONCLUSION

An automated, histogram-based method for characterizing spinal metastases shows potential for rapid and simple to use quantitative CT assessment.

INE047-b

Temporal Subtraction Images Derived by Large Deformation Diffeomorphic Metric Mapping Facilitate Identification of Bone Metastases in Follow-up CT (hardcopy backboard)

Ryo Sakamoto MD,PhD (Presenter): Nothing to Disclose , Masahiro Yakami MD, PhD : Nothing to Disclose , Koji Fujimoto MD, PhD : Nothing to Disclose , Susumu Mori PhD : Research Consultant, AnatomyWorks LLC CEO, AnatomyWorks LLC , Michael I. Miller PhD : Consultant, Anatomyworks LLC , Kaori Togashi MD, PhD : Research Grant, Bayer AG Research Grant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd Research Grant, FUJIFILM Holdings Corporation Research Grant, Nihon Medi-Physics Co, Ltd Research Grant, Shimadzu Corporation Research Grant, Toshiba Corporation Research Grant, Covidien AG , Keita Nakagomi MSc : Employee, Canon Inc , Gakuto Aoyama : Employee, Canon Inc , Can Ceritoglu : Nothing to Disclose , Takeshi Kubo MD : Nothing to Disclose , Yutaka Emoto MD, PhD : Nothing to Disclose , Hiroyuki Sekiguchi : Nothing to Disclose , Koji Sakai : Nothing to Disclose , Masami Kawagishi : Employee, Canon Inc , Yoshio Iizuka : Employee, Canon Inc , Hiroyuki Yamamoto : Employee, Canon Inc

Background

To improve observer performance in detecting bone metastases in serial follow-up CT, we developed a temporal subtraction technique based on a non-rigid image registration algorithm called Large Deformation Diffeomorphic

Metric Mapping (LDDMM).

Evaluation

With approval of the institutional review board, 60 cancer patients (prostate, 14; breast, 16; lung, 20; liver, 10) were recruited from our clinical database. All patients underwent torso CT scan at least twice between 2007 and 2013. For each patient, an image pair of two time points (previous and current) was used for the observer study. Bone metastases were consensually confirmed in 30 patients in current CT by referring all available clinical information and imaging data. The previous and current CT images were non-linearly registered by LDDMM, and the subtraction image was produced by subtracting previous image from current one. Three board-certified radiologists independently interpreted CT image pairs to identify emerged bone metastases without and with the temporal subtraction images, and marked their locations with confidence level for the diagnosis. The sensitivity and false positive rate for each condition were analysed to evaluate observer performance. Reading time was also recorded, and all observers were asked to rate the usefulness of subtraction image in a five point scale.

Discussion

The bone skeletons of two time point CT were almost perfectly co-registered except the ventral extremity of ribs and scapulas. The subtraction image clearly visualized all bone metastases as temporal changes. The average sensitivity for detecting bone metastases was improved from 57.4 to 66.2% with temporal subtraction images when 50% confidence level was considered as a threshold, and the false positive rate was slightly increased from 0.17 to 0.21 lesions per case. The reading time was reduced for all readers from 500.0 to 336.1 second in average per case. All the observers recognize the advantage of the subtraction image, and the average usefulness rate was 4.6.

CONCLUSION

Temporal subtraction image obtained by LDDMM improved the accuracy and efficiency for detecting bone metastases in reading follow-up CT.

INE048-b

An Interactive Sectional Anatomy Learning System Based on Chinese Visible Human Dataset (hardcopy backboard)

Jingxian Sun BEng, MSc (Presenter): Nothing to Disclose , Qiang Meng : Nothing to Disclose , Jing Qin : Nothing to Disclose , Pheng Ann Heng PhD : Nothing to Disclose

Background

Visible human images have unique value for medical education and research because they has higher resolution than CT, MR or Ultrasound images, and can exhibit richer anatomical details. However, these images are usually obtained along a constant direction and hence users cannot explore anatomical structures at arbitrary positions and angles, which is quite important for surgical path planning. Moreover, the original images lack of labels. To solve these two problems, we build an interactive learning system to display and label an anatomical image obtained from arbitrary positions and angles in real time. In the system, users use a tracker to locate a position on a 3D printed plastic human model, and the corresponding sectional image as well as its label information are calculated and displayed. In order to achieve real-time performance, we use GPU to accelerate the visualization and labeling processes.

Evaluation

We invited two groups of volunteers from medical school to evaluate the interactivity and usability of our system. One group uses a system with keyboard and mouse as input devices while the other group uses our system. Both groups are asked to find the locations of specified tissues. The results showed the second group completed the task averagely three times faster than the first group. Moreover, we found our system is easy to use that users can skillfully operate it with a few instructions.

Discussion

Displaying labels in real time is an important feature of our system. However, because the anatomical structures in the images are complicated, it is extremely difficult to identify and segment all tissues in the images. As a pre-processing step, we manually segmented and labeled about 1000 tissues in the original images. We will segment more organs and tissues to provide users a more complete learning environment.

CONCLUSION

We developed an easy-to-use anatomy learning system with a 3D printed human body and a 6DoF tracker. Slice images and labels are real-time calculated and displayed as users move the tracker on the plastic model at arbitrary positions and angles. This system can be used in the human anatomy education and research as well as other applications such as surgical planning.

INE049-b

A Fully GPU-accelerated Platform for Medical Image Processing and Visualization (hardcopy backboard)

Fei Yang : Nothing to Disclose , Jie Tian PhD (Presenter): Nothing to Disclose

Background

Most of the existing medical image processing systems still uses CPU dominated memory and computation model. This becomes a big limitation as parallel heterogeneous systems becoming mature and demonstrating significantly better performance. We have designed and implemented a fully GPU-accelerated software platform for medical image processing and visualization. Based on the new platform, several segmentation, registration and rendering algorithms have been implemented and tested in image based diagnosis and surgical planning. A runtime GPU code generation mechanism is applied to equip GPU programming with the same level of flexibility as CPU programming.

Evaluation

We have partners from 3 different hospitals using medical images for different purposes. We built different applications according to their requirements using both open-source platforms VTK/ITK and our new platform, implementing basically the same function sets. According to the feedback, overall, our new platform out-performs the open-source toolkits by 52% in speed.

Discussion

Although both the open-source society and commercial parties have been trying hard to develop platforms for medical image processing, the computation capability of most recent hardware cannot be fully utilized due to the difficulty of incorporating the new programming interfaces with the existing platform architectures. We have discovered the key to this problem, and we have successfully developed a new platform with both high-performance and high-flexibility. Several segmentation, registration and visualization algorithms have been implemented, including level-set, and push-relabel based graph-cut for segmentation, registration optimizers for both collinear and basic deformable transforms such as B-SPLINE, as well as an OpenCL and GLSL based ray-casting engine capable of rendering multiple volumetric and geometric entities simultaneously in the same scene.

CONCLUSION

We designed and implemented a fully GPU-accelerated software platform for medical image processing and visualization. Better performance has been achieved in comparison with existing open-source platforms during multiple case studies.

INE050-b

Automatic Data Driven Labeling of Lumbar Spine Structures in MRI (hardcopy backboard)

Ismail Ben Ayed (Presenter): Research, General Electric Company , Seyed-Parsa Hojjat PhD : Nothing to Disclose , Kumaradevan Punithakumar PhD : Nothing to Disclose , Gregory J. Garvin MD : Nothing to Disclose

Background

Precise detection and identification of spine structures (e.g., the vertebrae and discs) facilitate the diagnosis of various spine disorders. For instance, in MRI, spine labeling provides anatomical benchmarks that ease dramatically the evaluation and reporting of frequent disc deformities, e.g., protrusion. In addition to their usefulness in spine diagnosis, such benchmarks yield a patient-specific coordinate system that can be very useful in (i) mapping radiologic reports to the corresponding image segments, (ii) building semantic inspection tools, (iii) guiding image registration, and (iv) providing priors for segmentation, image retrieval, as well as shape and population analysis.

Evaluation

We propose an efficient (nearly real-time) two-stage spine MRI labeling algorithm, which is applicable to different types of MRI data and acquisition protocols. The first stage aims at roughly detecting vertebra candidates with a novel segmentation technique. The second stage removes false positives and identifies all vertebrae and discs by imposing anatomical constraints. We performed quantitative evaluations over 90 mid-sagittal MRI images of the lumbar spine acquired from 45 subjects. We used both T1- and T2-weighted images for each subject. 990 structures were automatically detected and labeled, and compared to ground-truth annotations by an expert. On the T2-weighted data, we obtained an accuracy of 91:6% for the vertebrae and 89:2% for the discs. On the T1-weighted data, we obtained an accuracy of 90:7% for the vertebrae and 88:1% for the discs.

Discussion

Most of the existing algorithms require intensive and time consuming training from a large and manually-labeled data set, with the results often being dependent on the choice of (i) the training set and (ii) the modality and/or acquisition protocol. Our algorithm removes training requirements and, therefore, promises to handle the substantial variations encountered in realistic clinical contexts.

CONCLUSION

The proposed algorithm removes the need for training, while being applicable to different types of MRI data and acquisition protocols. Our comprehensive evaluations over T1- and T2-weighted images demonstrated the flexibility of the algorithm.

INE051-b

The Use of Rapid 3D Model Printing to Illustrate Complex Aortic Root Anatomy (hardcopy backboard)

Phillip Kim (Presenter): Nothing to Disclose , Jayne Kang : Nothing to Disclose , Harshna Vinodbhai Vadvala MD : Nothing to Disclose , Brian Burns Ghoshhajra MD : Nothing to Disclose

Background

3D printing is a relatively new technology with expansive benefits in medicine; especially in cardiovascular

imaging. The ability to hold and touch an analog 3D representation of a patient's heart, particularly with complex congenital heart disease, could aid in education, diagnosis, and even treatment planning.

Evaluation

DICOM images of two patients, one with normal coronary artery origins with dilated sinuses of Valsalva (SOV) and one with anomalous left anterior descending (LAD) artery arising from the right SOV, were retrieved. Unrelated data, such as pulmonary arteries, veins, left and right atriums and ventricles, and descending aorta were manually removed using a 3D workstation (Osirix 3.6.1, Geneva, Switzerland). Stereolithography (STL) files were generated with the workstation. Edited images were sliced using Skeinforge 50 with pypy plugin (Python, CWI, Amsterdam, Netherlands), at a layer thickness of 0.2 millimeters and converted to gcode, the format accepted by a commercial 3D printer (MakerBot Replicator 2X, Makerbot, Brooklyn, NY).

Discussion

Two hollow life-size aortic root models were printed. Both models required 12 hours to print, each weighing less than one pound. Results faithfully represented the true root anatomy, with the dilated SOV model's short axis diameter of the sinotubular junction (3.4 x 3.7cm) very close to the measurements made on DICOM images (3.5 x 3.6cm). The anomalous LAD model clearly depicts the anomaly.

CONCLUSION

Accurate 3D printing of a life-size aortic root is feasible in a 12-hour cycle using commercially available printers and software. The educational and clinical benefits of 3D printed models warrant further exploration.

RC153

Advances in Radiology Decision Support

Refresher/Informatics

IN **IN**

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 2:00 PM - 3:30 PM Location: S404AB

Participants

Charles E. Kahn MD, MS (Presenter): Shareholder, Hotlight Inc Officer, Hotlight Inc
Elizabeth S. Burnside MD, MPH (Presenter): Stockholder, Cellectar Biosciences, Inc Stockholder, NeuWave Medical Inc
Sandy Napel PhD (Presenter): Medical Advisory Board, Fovia, Inc Consultant, Carestream Health, Inc Scientific Advisor, EchoPixel, Inc

LEARNING OBJECTIVES

1) Define decision support systems and their role in radiology. 2) Describe widely used decision support technologies. 3) Explore how radiology decision support systems can improve patient care outcomes.

ABSTRACT

Decision support systems use knowledge -- ranging from books, to web sites, to real-time artificial intelligence systems -- to help physicians improve their decision making. This Refresher Course will review a number of systems that can help radiologists' decision making. We will describe tools for information retrieval and image retrieval, and systems that use rules or probabilities to help identify the most likely diagnosis. We will discuss how evolving technologies provide new ways to integrate advanced decision support into routine clinical practice, and how decision support systems can improve outcomes in patient care.

RC154

Getting It Right: Informatics Tools for Imaging 3.0

Refresher/Informatics

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 2:00 PM - 3:30 PM Location: N229

Participants

Moderator
J. Raymond Geis MD : Nothing to Disclose

Sub-Events

RC154A **Right Order: Ordering Clinical Decision Support**

Keith J. Dreyer MD,PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Be informed of the new federal legislation requiring the use of Clinical Decision Support (CDS) for the ordering of medical imaging required by CMS in 2017. 2) Understand the challenges of implementing CDS in the hospital and imaging center environments. 3) Learn the value of embedding CDS into the EHR and CPOE

ordering process. 4) Learn methods to use CDS to manage the utilization of medical image appropriateness. 5) Become familiar with methods to implement CDS in an ACO environment.

RC154B

Right Interpretation: Radiologist Clinical Decision Support

Tarik K. Alkasab MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the motivations for integrating clinical decision support (CDS) into the clinical practice of radiologists. 2) Understand how CDS modules can be defined for use in radiologist reporting. 3) Understand what it looks like for a CDS system to be integrated with radiologist reporting. 4) Understand the challenges associated with deploying CDS for radiologists.

URL's

https://dl.dropboxusercontent.com/u/140978/AlkasabRSNA2014RadCDS.pptx

RC154C

Right Information: Business Intelligence Tools

Woojin Kim MD (Presenter): Co-founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Board of Directors, Montage Healthcare Solutions, Inc Advisory Board, Zebra Diagnostics Ltd

LEARNING OBJECTIVES

1) Understand the role of business intelligence (BI) tools in providing value-based care. 2) Understand how BI can provide effective monitoring of various components of the imaging value chain, including imaging appropriateness, modality operations, image interpretation and reporting, and report communication. 3) Learn how data mining can improve report quality by ensuring proper documentation and reducing errors. 4) Learn how one should implement a BI system and learn about potential problems to consider.

ABSTRACT

The goals of improving population health at a lower cost and higher quality are placing increased emphasis on value-based care over volume-based approach. Imaging 3.0™ is ACR's call to action for radiologists to take a leadership role in shaping America's future healthcare system through 5 key pillars, which are imaging appropriateness, quality, safety, efficiency and satisfaction. With the aims of delivering better value to patients, Imaging 3.0 has outlined what it calls "imaging value chain" where each link of this chain represents a discrete number of unique value opportunity activities. The imaging value chain includes following components: imaging appropriateness and patient scheduling, imaging protocols, modality operations, image interpretation and reporting, and report communication and referring physician interaction. In the center of the imaging value chain, inter-connected with every link, lie data mining and business intelligence (BI). Timely analysis and appropriate modification using data mining and BI tools are critical to the effective monitoring of all components of the imaging value chain. As a result, it is a critical component of your Imaging 3.0 informatics toolkit. Effective use of BI will allow access to right information at the right time for right decision. This presentation will discuss the basics of BI and its benefits. Specifically, attendees will learn how data mining and BI can monitor adherence to imaging appropriateness guidelines, modality capacity, patient throughput, radiation dose exposure, report standardization and quality including detection of errors and compliance with various reporting requirements including documentation of proper report communication. In addition, attendees will learn how one should implement a BI system, what are some potential problems to consider, and various tips for getting BI right.

RC154D

Right Workflow: Workflow Engines and Lexicon

Bradley J. Erickson MD, PhD (Presenter): Stockholder, Evidentia Health, Inc

LEARNING OBJECTIVES

1) Become familiar with the RSNA Clinical Trials Processor Software, including how to configure it to accomplish the common tasks, including, deidentification for internal research or education, deidentification and forwarding to an external site for multi-site trials. 2) Learn how to optimize configurations and pipelines for variants of the above major categories of tasks.

ABSTRACT

CTP is a powerful software tool that is useful for supporting education and research. CTP has a pipeline approach to handling data. It can receive DICOM images using DICOM transports, but can also get DICOM images from a directory/filesystem. It can then modify the header elements according to rules defined by the user. It can replace Protected Health Information (PHI) in one of several ways, to help assure HIPAA compliance. PHI can be located in many parts of a DICOM object, and the many variants, and ways that CTP can address those will be described. CTP can also do basic processing on any other DICOM tag, if required. At the end of the pipeline, CTP can then send the images using DICOM, store them into a filesystem, or transmit them to another CTP instance using HTTP. Example configurations and the advantages of each will be described.

RCA12

National Library of Medicine: Free Online Databases: Images and More (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 2:00 PM - 3:30 PM Location: S401AB

Participants

Holly Ann Burt MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify freely available online image databases and data archives and know their contents and value. 2) Identify freely available online case studies and educational materials. 3) Become familiar with online drug, contrast agents, and other substance databases. 4) Understand basic searching skills across a variety of databases.

ABSTRACT

The National Library of Medicine (NLM) is only one of many agencies which support freely available online databases and data archives. In this hands-on workshop, explore the rich variety of online resources for radiographic images and data, imaging tools, drugs and contrast agents, and education (e.g. case studies). Databases covered include PubMed/MEDLINE, the National Cancer Institute's Cancer Imaging Archive, MedlinePlus.gov and RadiologyInfo for patients and families, plus search engines and portals offering a radiology option. Learn which databases may be the best starting point for your research.

URL's

http://nnlm.gov/training/resources/onlinedatabases.pdf

Handout:Holly Ann Burt

http://media.rsna.org/media/abstract/2014/13013418/onlinedatabasesRSNA2014.pdf

RCB12

Optimizing PowerPoint Slides (Hands-on)

Refresher/Informatics

IN ED IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 2:00 PM - 3:30 PM Location: S401CD

Participants

William J. Weadock MD (Presenter): Owner, Weadock Software, LLC
Sarah C. Abate BS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the components of an optimal slide presentation. 2) Learn about common errors made in slide preparation and how they can be avoided. 3) Learn about how to improve the quality of a presentation by using optimal different slide backgrounds, font size and color, and image sizes. 4) Learn tips to ensure a smooth presentation.

ABSTRACT

Electronic presentations are very common in radiology practice. This hands-on demonstration and questions and answer session will show attendees how to optimize their presentations. The focus will be on the use of slide templates, color selection (font and background), font and image size, and animations. Additional review of image and video display and management will be covered. Demonstrations will include tips to decrease time creating and modifying presentations. Bring your questions!

RCC12

The Use of Business Analytics for Improving Radiology Operations, Quality, and Clinical Performance (In Association with the Society for Imaging Informatics in Medicine)

Refresher/Informatics

SQ LM IN SQ LM IN ARLM

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 2:00 PM - 3:30 PM Location: S501ABC

Participants

Moderator
Katherine P. Andriole PhD : Nothing to Disclose

LEARNING OBJECTIVES

1) Understand what is meant by business analytics in the context of a radiology practice. 2) Be able to describe the basic steps involved in implementing a business analytics tool. 3) Learn how business analytics tools can be used for quality assurance in radiology, for maintenance of certification (MOC), and for practice quality improvement. 4) Be introduced to the capabilities of current and potential future business analytics technologies.

ABSTRACT

This course will provide an overview of the use of business analytics (BA) in radiology. How a practice manages information is becoming a differentiator in the competitive radiology market. Leveraging informatics tools such as business analytics can help a practice transform its service delivery to improve performance, productivity and quality. An introduction to the basic steps involved in implementing business analytics will be given, followed by example uses of BA tools for quality assurance, maintenance of certification (MOC) and pracitce quality improvement . The power of current business analytics technologies will be described, along with a look at potential future capabilities of business analytics tools.

Sub-Events

RCC12A

Introduction to Business Analytics Demonstrating Use of an Open-Source Tool for Application to Radiology

Katherine P. Andriole PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Gain an overview of business analytics tools and understand how they might be used in radiology. 2) Be able to describe the general steps involved in business analytics, including extract, transform, load (ETL) and key performance indicators (KPI). 3) See a demonstration implementation of an open-source business analytics tool using a radiology use case.

ABSTRACT

This session will provide a general overview of business analytics concepts and how they can be used in radiology. A walk through of the basic steps involved in implementation including identifying, collecting, transforming, and dynamically presenting key performance indicators (KPI) will be demonstrated. The extract, transform, load (ETL) steps will be shown using an example use case, and multiple database sources taken from a radiology practice.

RCC12B

Operational and Predictive Analytics in Radiology

Paul G. Nagy PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the importance of informatics tools for ABR MOC PQI and ACGME SBP quality efforts. 2) Identify the role of informatics in capturing, extracting, analyzing, and communication quality projects. 3) Illustrate graphical dashboarding examples to support quality efforts.

RCC12C

Capabilities of Current and Future Business Analytics Technologies

Tessa S. Cook MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To gain familiarity with currently available business technologies and their relevance to radiology practice. 2) To consider how existing business technologies can support quality assurance in radiology. 3) To learn about business analytics features that may be available/desirable in the future to augment and support both the practice of radiology.

RCA13

National Library of Medicine: Find Articles You Need: Searching PubMed/MEDLINE Efficiently (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 4:00 PM - 5:30 PM Location: S401AB

Participants

Holly Ann Burt MLIS (Presenter): Nothing to Disclose
Tony Nguyen MLIS (Presenter): Nothing to Disclose
Patricia Devine MLS (Presenter): Nothing to Disclose
Jamie T. Dwyer MLS (Presenter): Nothing to Disclose
Stephanie Friree MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how PubMed constructs a query and how to develop and refine effective search strategies in radiology. 2) Use PubMed tools including Clinical Queries, Related Articles, Single Citation Matcher and Loansome Doc. 3) Build focused searches using the Medical Subject Headings (MeSH) vocabulary for radiology and limit searches to radiology-oriented journals. 4) Understand how to save and download citations.

ABSTRACT

This hands-on workshop covers key searching techniques, changes to PubMed, and how to develop effective search strategies for PubMed and MEDLINE. Topics covered include: why keywords don't always give the results you expect, how to limit to specific journals, quick searches to find evidence-based citations, how to access full-text articles, and downloading citations to reference manger programs. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov). MEDLINE is a subset of PubMed which includes links to sites providing full text articles and to other related databases and resources.

URL's

http://nnlm.gov/training/resources/pubmed8.pdf

Handout:Holly Ann Burt

http://media.rsna.org/media/abstract/2014/13013403/pubmedRSNA2014.pdf

RCC13

IHE Workflow Efficiency from Acquisition to the Report

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Sun, Nov 30 4:00 PM - 5:30 PM Location: S501ABC

Participants

Moderator
Bradley J. Erickson MD, PhD : Stockholder, Evidentia Health, Inc
Bradley J. Erickson MD, PhD (Presenter): Stockholder, Evidentia Health, Inc
Curtis P. Langlotz MD, PhD (Presenter): Shareholder, Montage Healthcare Solutions, Inc Advisory Board, Reed Elsevier Advisory Board, Activate Networks, Inc Spouse, Consultant, Johnson & Johnson
Christopher Lindop (Presenter): Employee, General Electric Company
Harry Solomon (Presenter): Employee, General Electric Company

LEARNING OBJECTIVES

1) Understand how report templates can improve productivity. 2) Examine how IHE profiles facilitate system interoperability. 3) Learn about the features of the new IHE profile for management of radiology report templates. 4) Review proposed new features for radiology reporting systems.

ABSTRACT

The purpose of this session is to demonstrate how existing and planned IHE profiles can help improve the workflow in a medical imaging department, and help those responsible for its operation, monitor what is happening. Prior IHE profiles focused heavily on traditional RIS and PACS. Newer projects are focused on exchange of images and reports between medical facilities. We will also describe future possible profiles for utilizing RadLex to improve radiologist efficiency. We will also describe workflow terminology in RadLex and describe how that can help manage and improve departmental workflow.

RC253

Clinical Applications of 3D Printing

Refresher/Informatics

IN ED NR CA

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 8:30 AM - 10:00 AM Location: N229

Participants

Moderator
Shi-Joon Yoo MD : Owner, 3D HOPE Medical

Sub-Events

RC253A **Overview of 3D Imaging Acquisitions**

Karin Evelyn Dill MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the concept of three-dimensional image acquisition. 2) Comprehend the importance of high quality three-dimensional image acquisition as it applies to three-dimensional printing.

RC253B **From 3D Visualization to 3D Printing**

Michael Lally Steigner MD (Presenter): Speaker, Toshiba Corporation

LEARNING OBJECTIVES

1) Review the evolution of 3D image post-processing. 2) Demonstrate the current state-of the-art of 3D post-processing. 3) Demonstrate the relationship between current 3D image post-processing and 3D printing.

RC253C

3D Printing as a Radiology Educational Tool

Amir Imanzadeh MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Demonstrate the utility of 3D printing in pediatric cardiac imaging and surgery. 2) Demonstrate the surgical anatomy of complex forms of double outlet right ventricle, congenitally corrected transposition and criss-cross or twisted heart shown in 3D print models. 3) Observe the models of the example cases in your hands.

ABSTRACT

Precise understanding of the complex morphology of the heart with congenital heart disease is crucial in surgical decision and undertaking the procedure. Most surgeons rely on the anatomy shown in echocardiograms, CT or MRI. Recent advances in computer graphic technology allows virtual demonstration of 3D anatomy in the computer screen. However, the virtual anatomy still requires surgeon's mental reconstruction and ability to discriminate between the real and the false. 3D printing ultimately provides the surgeons with the physical replicas of the heart that allows easier and accurate understanding of the anatomy, opportunity to practice the procedure and to prepare the tailor-made implants or patches in advance, and, therefore, improves the accuracy of the surgery, shortens the procedure time, and improved the surgical outcome. This presentation will show how 3D print models facilitate understanding of complex congenital heart diseases such as aytpical forms of double outlet right ventricle, congenitally corrected transposition and criss-croos or twisted heart.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

RC253D

Role of 3D Printing in Congenital Heart Disease Surgery

Shi-Joon Yoo MD (Presenter): Owner, 3D HOPE Medical

LEARNING OBJECTIVES

1) Understand 3D printing process for heart models. 2) Know how 3D printing helps pediatric cardiac surgery. with case examples. 3) Know the future directions of 3D printing for cardiac surgery

ABSTRACT

Using rapid prototyping or 3D printing, physical replicas of the hearts can be provided to surgeons before their surgical decision and procedure. The replicas fill the gap between the imagination from the medical images and the reality. By having the replicas in hands, the surgeons can make optimum surgical decision and simulate the intended procedures on the replica prior to the procedure. This allows precise surgical procedures with reduced procedure and anasthesia time. In canses in the grey zone for biventricular versus univentricular repair, the replicas are of tremendous help in a binary decision. The presentation will include a few clincal cases where 3D printing played a crucial role in surgical decision making.

RC253E

3D Surgical Planning Using Printed Models: The Surgeon's Perspective (Spine and Skull)

Donald J. Annino MD, DMD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To describe the value of 3D visualization from the surgeon's perspective. 2) To show the role of 3D printing in current and future surgical planning. 3) To review important components of 3D models for face transplantation.

RC253F

The Impact 3D-Printing in the Imaging Environment

Frederik Lars Giesel MD, MBA (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) History of 3D-Printing. 2) Imaging modalities and post-processing procedures to provide data surrogates for 3D-printing. 3) Concept of 3D-printing for improved clinical services. 4) Limitations and perspectives of 3D-printing in the imaging environment.

ABSTRACT

This presentation outlines the impact of 3D-printing in the imaging environment. Applications in the medical field are reviewed and growing clinical applications are discussed. Starting with an overview of current 3D-printing technologies including fused deposition modelling (FDM), selective laser sintering (SLS), and

stereolithography (SLA) common techniques for generating 3D object models based on medical imaging are illustrated. Typically, imaging source data from different modalities are post-processed using dedicated algorithms and software in order to generate triangle mesh surface data. These surface data are usually exported to STL-files that are commonly understood by current 3D printing machines. 3D-printed objects are most often made from plastic, such as ABS, PA, or PLA, but metal or other material is even possible. Finally the presentation will demonstrate how 3D-printed objects are valuable for treatment planning, treatment procedures in several clinical subspecialties, intra-operative surgical navigation, or for prosthesis production. However, medical applications of 3D-printing are still in a very early phase but the growing awareness in the medical and non-medical field nowadays support the promising utilization and development in the very near future.

RCA21

Data Management and Analysis with Excel for Research and for Practicing Quality Improvement – A Hands-On Tutorial

Refresher/Informatics

RS IN RS IN RS IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 8:30 AM - 10:00 AM Location: S401AB

Participants

Jaydev Kardam Dave PhD, MS (Presenter): Nothing to Disclose
Raja Gali MS (Presenter): Nothing to Disclose

http://www.cornellphysicians.com/kjuluru/publications.html

LEARNING OBJECTIVES

1) Describe techniques for creating a spreadsheet to allow trouble-free data analysis. 2) Demonstrate key data management skills. 3) Describe tools for performing basic descriptive statistics. 4) Identify how to perform simple statistical tests and perform these tests with a sample dataset. 5) Understand how bad data (or bad data acquisition techniques) may corrupt subsequent data analyses. 6) Practice data plotting/representation techniques. 7) Identify differences between a spreadsheet and a database. 8) Identify statistical tasks that require more sophisticated software. Pre-requisites: Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed

ABSTRACT

A spreadsheet program is commonly employed to collect and organize data for practicing quality improvement, for research, and for other purposes. In this refresher course, we will demonstrate to a user, familiar with Microsoft Excel environment, how this spreadsheet program may be used for such purposes. The course will begin with describing efficient approach for data acquisition and highlight key data management skills; and with reviewing commons errors that may be avoided during data logging. Then we will provide a brief introduction on basic descriptive tests before proceeding with a hands-on tutorial using a sample dataset to calculate basic descriptive statistics, and to perform basic statistical tests like t-test, chi-square test, correlation analysis, etc. Effect of corrupted data on such analysis will also be demonstrated. The final hands-on component for this course will include data plotting and representation including the use of pivot tables. The course will conclude with a discussion on identifying differences between a spreadsheet and a database, limitations of a spreadsheet program and avenues where a dedicated statistical software program would be more beneficial. A list of some of these dedicated statistical software programs for analyses will also be provided. Pre-requisites: Familiarity with Microsoft Windows and Microsoft Excel environment will be assumed

RCB21

Creating, Storing, and Sharing Teaching Files Using RSNA's MIRC® (Hands-on)

Refresher/Informatics

IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 8:30 AM - 10:00 AM Location: S401CD

Participants

Daniel Peter Link MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how easy it is to install the new and improved RSNA teaching file software with the one-click installer. 2) Learn how to create, organize, and share teaching files, create conference documents and save interesting cases for yourself, your group or your department.

RCC21

Leveraging Your Data: Informatics Approaches and Solutions to Improve Imaging Care Delivery

Refresher/Informatics

SQ IN SQ IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 8:30 AM - 10:00 AM Location: S501ABC

Participants

Moderator
Arun Krishnaraj MD, MPH : Nothing to Disclose

LEARNING OBJECTIVES

1) Identify unmet needs of current and future practices with regards to emerging and existing informatics tools. 2) Apply existing and emerging informatics applications to improve report generation. 3) Demonstrate an understanding of how best to achieve consistency of radiologists' recommendations.

ABSTRACT

Existing and emerging informatics applications have the potential to markedly improve the quality of imaging care delivery. Much of the inefficiency and inconsistency of report generation could be potentially solved with the appropriate informatics application. In this session, the learner will gain an apprecation of the unmet needs of current and future pracitces and discover how novel applications developed at various institutions across the country are seeking to plug these voids and improve imaging care delivery.

Sub-Events

RCC21A — The Unmet Needs of Current and Future Practices

Michael Ethan Zalis MD (Presenter): Co-founder, QPID Health Inc Chief Medical Officer, QPID Health Inc Stockholder, QPID Health Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC21B — Augmenting Image Interpretation through the Use of Advanced Health Record Technology

Arun Krishnaraj MD, MPH (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the current state of Electronic Health Record (EHR) technology and adoption in the United States. 2) Identify areas where EHR integration into the daily workflow of Radiologists is lacking. 3) Demonstrate an understanding of the importance of incorporating data contained in the EHR to generate high quality reports. 4) Understand the consequences of under utilizing data contained in the EHR.

ABSTRACT

Advanced heath information technologies, specifically EHR systems, are undergoing rapid dissemination and widespread adoption spurred by initiatives in the American Recovery and Reinvestment Act of 2009. When properly integrated into clinical workflow, an EHR can improve both the quality and efficiency of care delivery. Radiology has long been at the forefront with respect to information technology (IT), however the integration of EHR data into radiolgists' workflow is lacking which affects the efficiency, safety, and costs of Imaging. Emerging advanced heatlh record technologies which incorporate natural language processing and semantic search allow the radiologists to retrieve and incorporate relevant clinical data when generating reports thereby improving both efficiency and quality. In this session, the learner will explore how one such health intelligence platform, known as QPID (Queriable Patient Inference Dossier), allows for the creation of search queries tailored to the workflow of an abdominal radiologist.

RCC21C — Bone Age and Skeletal Atlas Decision Support Tools with Patient Context Integrated into Clinical Workflow

Cree Michael Gaskin MD (Presenter): Author with royalties, Oxford University Press Author with royalties, Thieme Medical Publishers, Inc

LEARNING OBJECTIVES

1) Review concepts for contemporary decision support tools for diagnostic radiologists. 2) Discuss bone age and skeletal atlas decision support tools integrated into clinical diagnostic workflow via context sharing.

ABSTRACT

There are numerous references available to radiologists to aid image interpretation or provide guidance on management of imaging findings. Given the vast amounts of information we are expected to know and the speed with which we are expected to perform our clinical work, it is helpful to quick and easy access to relevant resources at our point-of-care (e.g., during image interpretation and reporting). Such resources should be available in electronic format on our diagnostic workstations and, when relevant, be integrated with our clinical applications. Our Radiology Information System (RIS), PACS, and/or Electronic Health Record (EHR) can share study and patient context information with decision support tools to facilitate our diagnostic workflow. Examples to be shared include modern remakes of classic printed atlases in pediatric skeletal imaging, updated to contemporary electronic tools integrated with PACS and EHR applications to expedite workflow and reduce error.

RCC21D

Advanced Decision Support Tools for the Radiologists

Giles W. Boland MD (Presenter): Principal, Radiology Consulting Group Royalties, Reed Elsevier

LEARNING OBJECTIVES

View learning objectives under main course title.

VSIN21

Radiology Informatics Series: Mobile Computing Devices

Series Courses

IN

AMA PRA Category 1 Credits ™: 3.25

ARRT Category A+ Credits: 3.50

Mon, Dec 1 8:30 AM - 12:00 PM Location: E352

Participants

Moderator
David S. Hirschorn MD : Nothing to Disclose
Moderator
Asim F. Choudhri MD : Nothing to Disclose
Moderator
George Lee Shih MD, MS : Consultant, Image Safely, Inc Stockholder, Image Safely, Inc Consultant, Angular Health, Inc Stockholder, Angular Health, Inc

Sub-Events

VSIN21-01

Introduction

David S. Hirschorn MD (Presenter): Nothing to Disclose

VSIN21-02

Multi-Touch Control Device for PACS Workstation Implemented on a Consumer Tablet

Gabriel Howles-Banerji MD, PhD (Presenter): Nothing to Disclose , Daniel Holstein : Nothing to Disclose

CONCLUSION

A radiology-specific multi-touch controller for PACS workstations has been implemented on a consumer tablet.

Background

The traditional computer mouse is the primary tool for operating a PACS workstation, but its use can be cumbersome and is associated with ergonomic hazards. Meanwhile, dramatic advances in trackpad and touchscreen technology have revolutionized the way humans interact with computers, particularly smartphones and tablets. We sought to explore whether contemporary "touch" technologies could be used to operate a PACS workstation. More specifically, we sought to develop a peripheral device with radiology-specific touch controls which might make navigating imaging studies more efficient and less fatiguing.

Evaluation

An application was written for the Apple iPad tablet that displays a collection of touch controls used for operating the PACS workstation. The tablet communicates wirelessly with the PACS workstation and is used as a peripheral device, like a mouse or keyboard. A client application on the workstation executes the commands from the tablet. The device can be used with any vendor's workstation. The displayed controls allow the radiologist to directly execute common PACS functions. For example, the Window/Level control works by touching the control and then dragging the finger horizontally and vertically to control the displayed window and level, respectively. Harnessing the "multi-touch" capability of the tablet, some controls respond to multiple fingers. For example, the rate at which the Scroll control moves between slices in a CT scan is dependent on the number of fingers used -- one finger for precise scrolling, four fingers for fast scrolling. The collection of the controls can be customized for each type of study. For example, a Cine Loop control is provided for ultrasound studies but not plain films.

Discussion

This work demonstrates that a touch control interface can be used for navigating imaging studies on an existing commercial PACS workstation. Having developed a prototype with a suite of radiology-specific controls, the next step is to test the device in routine use to determine what advantages it may offer in the daily work of radiologists.

VSIN21-03

Diagnostic Imaging in Live Streaming using High Tech Mobile Devices: Is Real Time Diagnosis, While Being on the Move, Possible?

Vasileios Moustakas MD (Presenter): Nothing to Disclose , Demosthenes D. Cokkinos MD : Nothing to Disclose , Eleni Antypa : Nothing to Disclose , Panagiotis Tserotas MD : Nothing to Disclose , Alkmini

Skoura MD : Nothing to Disclose , Ploutarhos A Piperopoulos MD, PhD : Nothing to Disclose

CONCLUSION

Real time remote diagnosis of complete US examinations performed elsewhere using a wireless setting and a tablet is feasible and useful.

Background

Mobile devices are already part of daily routine radiological practice. We built a remote real time wireless review system using ultrasound (US). In this modality visualisation of a complete examination in real time, instead of static images, is important to establish the best possible diagnosis.

Evaluation

The live streaming wireless system is composed of 3 components: a hardware video compression system that also sends video clips in 1080p Full HD; a WiFi router capable of connecting to HDSPA+ / LTE(4G) mobile networks and a tablet with an Octa Core CPU featuring a 10.1", super-clear LCD 2560 x 1600 WQXGA display. 37 patients were scanned by a Consultant Radiologist for various indications. 42 complete US examinations of the abdomen (18 examinations), carotids (10), leg arteries (5), leg veins (6) and thyroid (3) were reviewed remotely in real time by another Consultant Radiologist in another area, with no contact to the examining doctor. The two doctors' independent double blinded reports were compared using standardised reporting systems to assess imaging quality of the tablet in comparison to the US machine image. In 538/545 (98.72%) results (organ measurements, echogenicity of normal findings and lesions, degree of blood perfusion, suggested diagnosis) complete interobserver agreement was observed. The few (7/545=1.28%) contradicting results were limited to different evaluations of liver/kidney echogenicity and thyroid nodule perfusion, data which also often present discrepancies between different examiners on the same monitor.

Discussion

In most of the evaluated parameters, good interobserver agreement showed that the real time wireless streaming did not affect image quality and therefore did not alter diagnosis. Therefore, this technique can be used in cases where a second (usually more experienced) look on whole US examinations is needed, instead of specific static images as is the usual practice.

VSIN21-04 The Perks and Pitfalls of Implementing an iPad Program at a Large Radiology Residency Program

Evan Johnson MD (Presenter): Nothing to Disclose , Jason Sherwin : Nothing to Disclose , Theodora A. Bakker MS : Nothing to Disclose , Cecilia Luz Mercado MD : Nothing to Disclose

PURPOSE

Tablet computing is now ubiquitous in society and is seeing widespread implementation in education. Radiology, as a technology and knowledge based specialty, is suited to the introduction of tablet computing and residency is an ideal place for implementation as this is when the maximal amount of knowledge is required to be absorbed. Tablets increase the portability and interactivity of residency education.

METHOD AND MATERIALS

Apple iPad Airs are to be introduced to 40 diagnostic radiology residents at a major academic medical center in mid-April 2014. Early surveys have been performed recording resident's interest and study habits prior to widespread implementation. Issues addressed include whether there is interest in increasing the interactivity of conferences and whether or not there would be interest in implementing the iPads clinically. Similar surveys and metrics will be obtained following implementation of the iPad. Issues that arose during implementation including management, funding, software, and utilization will be discussed.

RESULTS

Early results have been promising with 81% of residents finding a positive impact with increased interactivity in noon conference (utilizing a previous audience response system). Though 59% of respondents did have a previously purchased tablet computer, 100% felt that a program provided unit would provide a benefit to their education.

CONCLUSION

Tablet computing is rapidly becoming a commonplace item in residency education. The task of implementing a tablet computer on a large scale and with the appropriate software is not an easy one. The authors hope to provide insight into their experiences and give a roadmap for residency programs hoping to implement a similar program.

CLINICAL RELEVANCE/APPLICATION

Implementation of an Apple iPad in a radiology residency can be a daunting task but one that can reap great educational rewards.

VSIN21-05 Platforms and Security

George Lee Shih MD, MS (Presenter): Consultant, Image Safely, Inc Stockholder, Image Safely, Inc Consultant, Angular Health, Inc Stockholder, Angular Health, Inc

LEARNING OBJECTIVES

1) Mobile platforms: (a) Provide understanding of key features and advantages of mobile platforms including platform owner, app developers, and end-users (b) Discuss mobile healthcare trends and evolution involving Apple iOS and Google Android, with focus on healthcare-specific concerns. 2) Mobile Security: Provide basic understanding of different security concerns i.

ABSTRACT

Mobile healthcare devices of all shapes and sizes are now ubiquitous in clinical setting. Radiologists and other providers are leveraging mobile solutions in their clinical workflow. The major mobile platforms provide distinct advantages for both app developers and end users (ie, clinicians and patients) in the healthcare setting. The two main platforms for tablet mobile devices are Apple iOS and the Google Android. Mobile devices will need to have the same or enhanced security compared with traditional computers because of increased portability and the Bring Your Own Device (BYOD) phenomenon where clinicians are increasingly using their personal devices for work. Managing enterprise mobile security on a wide range of work and personal mobile devices will remain challenging although can be alleviated by using Mobile Device Manager software which can deploy updates and enforce security policies. Shared mobile devices for patients in the clinical setting may also present similar challenges.

VSIN21-06

Apps, Bandwidth, and Integration

Asim F. Choudhri MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To have an understanding of available applications available for mobile medical imaging, including native clients, web clients, and virtual desktop/terminal server approaches. 2) To have an understanding of bandwidth concerns in mobile medical imaging, including device data handling, network speeds, and possible bandwidth cost issues. 3) To have an understanding of possible clinical implementations of mobile medical imaging within radiology departments and in health care networks overall.

ABSTRACT

Applications: There are several vastly different approaches to mobile viewing of medical images. Native clients are programs written using a software development kit for a given platform. These clients can retrieve data from remote servers and view locally stored image data. Web clients are web-based programs which are often (but not always) platform independent. They will typically access remotely stored data which may be stored in a local cache but is usually not permanently stored on the mobile device. Virtual desktop/terminal server software allows a mobile device to access a remote computer or server. The remote server handles all higher level processing and data storage, minimizing the processing requirements of the mobile device but possibly straining bandwidth limitations. Examples of several applications using each of these approaches will be presented, with a discussion of pros and cons for each method as it pertains to an individual user and as it pertains to widespread implementation within a healthcare network. Bandwidth: Viewing medical images may require transfer of datasets that are tens or hundreds of megabytes in size. This provides a special challenge for mobile devices which typically receive data via wireless communication. If using a cellular network, network bandwidth can be a limiting factor (as can data transfer costs). File compression can reduce the size of files, however requires data processing power and may involve compromises in image quality. Once data is on a device, image processing may overwhelm its processing capabilities compared with dedicated PACS workstations. We will discuss both network and device bandwidth concerns as it relates to mobile medical imaging, and possible solutions for overcoming obstacles. Integration into a healthcare system: Mobile review of medical imaging is a tool which has potential to significantly change health care delivery, but the specifics for implementation are unclear. After a device platform has been selected, security protocols established, and bandwidth concerns solved, each institution will need to determine what role this technology will play. Possibilities include radiology residents (or even faculty) consulting with subspecialty faculty, surgeons and interventionalists triaging patients for procedures and for procedure planning, however these approaches are simply extensions of existing practices. New frontiers in consultation will be discussed, including an example involving mobile imaging review in a multidisciplinary stroke team. Guidance will also be provided regarding training and establishing institutional "standard operating procedures" documents. The current state of medical-legal concerns and risk management strategies will also be discussed.

VSIN21-07

A Collaborative Approach to Implementing a Tablet-Computing Program at an Academic Radiology Residency

Evan Johnson MD (Presenter): Nothing to Disclose , Jason Sherwin : Nothing to Disclose , Theodora A. Bakker MS : Nothing to Disclose , Cecilia Luz Mercado MD : Nothing to Disclose

CONCLUSION

An interdisciplinary team was a key component in implementation of a tablet-computing program within our residency. Utilization of such a team will ease the transition to a tablet-computing program and ensure that all of the appropriate hardware and software factors are considered and to more fully integrate the program into the infrastructure of an academic medical center.

Background

Tablet-computing is seeing widespread implementation in medical education. Radiology residency, as a technology and knowledge based specialty, is well suited to the introduction of tablet-computing. Several programs have sought the introduction of tablet-computing but none have described the interdisciplinary

approach that is needed to incorporate the entire spectrum of clinical information needs of the resident within the tablet program.

Evaluation

Introducing a tablet-computing program on a large scale that incorporates the specific needs of a radiology residency can be a complex undertaking. This includes access to imaging tools (PACS and teaching file), education tools (electronic books and journals as well as online study tools, etc.), clinical applications (EHR), response ware, and productivity tools (centralized calendaring, note taking, etc). It also requires conceptualizing hardware needs such as the tablet device and wireless access. The program must adapt to the evolving needs of residents as they progress through the program. Assessment of the program will involve ongoing evaluations of the participants as well as a cost-benefit analysis of ongoing support.

Discussion

An interdisciplinary approach was formed to implement a tablet-computing program at an academic radiology residency program consisting of 40 residents. Radiology information technology, library informatics, radiology administration, and resident input were part of the program's implementation. Utilizing this approach allowed us to expedite the introduction of and find the best tools for our tablet-computing program. This partnership also expanded to include a longitudinal assessment plan for the impact and efficacy of the program in the aims of improving resident knowledge and ease of access to critical tools and information.

VSIN21-08 First-person Simulation of Interventional Procedures Using Google Glass™ as Both a Recording and Display Device

Adnaan Moin MD (Presenter): Nothing to Disclose , Alaa Beydoun MD : Nothing to Disclose , Eliot L. Siegel MD : Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

CONCLUSION

Application of wearable technology should continue to expand in healthcare in both the educational and clinical realms. Radiology must be at the forefront of such technology given our strengths in both innovation and imaging. While a teaching video series may represent the most basic application of such technology, dynamic use such as procedural assistance and PACS integration as well as further optimization with appropriate shielding of wearable devices should continue to be explored.

Background

With the increasing popularity and functionality of wearable technology such as Google Glass™, focused investigation has only begun into the utility of such devices in the field of healthcare. While currently there exists a dearth of literature on clinical applications of wearable technology, at the most basic level, interactive educational models can be developed utilizing this unique first-person perspective as a supplement to other traditional teaching methods. Within radiology in particular, education of interventional procedures and periprocedural patient management can be enhanced through the perspective of experienced radiologists.

Evaluation

Multiple interventional radiology procedures were recorded from a first-person perspective through Google Glass™ on simulation models. The wearable device was primarily used to document what an operator may observe both at the level of their hands as well as their eyes during the course of a procedure. These recordings were then compiled to create a library of simulation videos of a diverse range of procedures. Additionally, the device was used as a display for procedural guidance.

Discussion

The functionality of wearable technology provides a unique opportunity within the academic model, as residents and fellows are able to experience a procedure from a first-person perspective without combatting with physical and visual limitations in an interventional suite or procedure room. While this video series may be introductory in the potential use of wearable devices in radiology, it provides further insight on the vast educational and clinical applications of the technology throughout healthcare, such as using wearable media as a primary display.

VSIN21-09 Adoption of a Mobile Clinical Decision Support Tool for Radiologists

Roy Kwak MD (Presenter): Founder, Medocratic LLC CEO, Medocratic LLC , Steve Do : Nothing to Disclose

CONCLUSION

The creation and rapid adoption of RadsBest, proves the need for Radiology decision support. Aggregate user data can provide insights into the utilization of management guidelines by practicing Radiologists.

Background

As part of the focus on quality within Radiology, Radiologists have been encouraged to create more actionable reports with consistent management recommendations based on published guidelines and consensus statements. There are hurdles to incorporating these guidelines. A mobile decision support tool was recently

developed for Radiologists called RadsBest. It allows Radiologists to navigate many of these guidelines and recommendations very easily. We evaluate the early adoption of this technology and how users are utilizing the application in clinical practice.

Evaluation

Within the app, users choose a specific tool applicable to the clinical scenario. Then they tap through a few questions. The recommendations are output on the next screen and can be used verbatim, or modified, based on the users expertise. All content is based on major publications relevant to the management of radiologic findings. The app collects generic aggregated information about how users are utilizing the application. On average, there has been approximately 104 new user accounts created per month since the app was initially released. The app is opened 2.71 (+/-0.52) per month by each active user. The distribution of activity is skewed toward a smaller subset of users. The five most frequently utilized tools were (decreasing order) guidelines for thyroid nodules, asymptomatic ovarian cysts, solitary pulmonary nodules, incidental adrenal mass, and asymptomatic liver mass.

Discussion

Early adoption rates supports the existence of demand for tools such as this. Although there is a high level of early engagement, the majority of users are not considered 'active users'. Amongst 'active users' there appears to be a subset of 'power users' who use the application frequently. The relative popularity of the individual tools may provide insight into the the prevalence of the imaging finding, characteristics of the guideline, and/or the effectiveness of the app for that guideline.

VSIN21-10

Displays and Quality Assurance

David S. Hirschorn MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss ranges of spatial and contrast resolution for medical imaging. 2) Explore options for calibration and quality assurance. 3) Understand the impact of ambient light and viewing distance and angle on medical image display.

ABSTRACT

Mobile devices have significantly smaller displays than desktop or even laptop computers to make them lighter and more easily transported. They are also designed for shorter viewing distances which require smaller pixels. The smaller total display size tends to reduce the number of pixels, while the smaller pixel size tends to increase the number of pixels. On balance, these displays typically have considerably fewer pixels than their stationary counterparts. Nonetheless, even desktop displays typically have less resolution than the original image size of a radiograph which is typically about 5 megapixel (MP) for a chest radiograph. And both types of displays have more resolution than a single CT image, which is 0.25 MP. Since these devices do allow zooming and panning, they may be suitable for image interpretation under controlled circumstances.

The main purpose of the DICOM Part 14 Grayscale Display Function is to ensure that contrast is preserved across the range of shades of gray from black to white, particularly at the edges where uncalibrated displays tend to fall off. With desktop displays this can be measured with a photometer, either external or built-in, and graphics adapter adjustments can be made to make the display conformant. Mobile devices typically do not offer this degree of adjustability. This requires a different approach to DICOM curve conformance, and a reasonable alternative is to present the user with a visual challenge to identify low contrast targets placed randomly on the display. If the user can find them and tap on them, then the display may be considered compliant, and if not, then the display should not be relied upon.

RCA22

Correlating Imaging with Human Genomics (Hands-on)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 10:30 AM - 12:00 PM Location: S401AB

Participants

Daniel L. Rubin MD, MS (Presenter): Nothing to Disclose
Sandy Napel PhD (Presenter): Medical Advisory Board, Fovia, Inc Consultant, Carestream Health, Inc Scientific Advisor, EchoPixel, Inc
Olivier Gevaert PhD (Presenter): Nothing to Disclose
Debra Willrett (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the methods for and the potential value of correlating radiological images with genomic data for research and clinical care. 2) Learn how to access genomic and imaging data from The Cancer Genome Atlas (TCGA) and The Cancer Imaging Archive (TCIA) databases, respectively. 3) Learn about methods and tools for annotating regions within images with semantic and computational features. 4) Learn about methods and tools for analyzing molecular data, generating molecular features and associating them with imaging features.

ABSTRACT

Radiogenomics is an emerging field that integrates medical images and genomic data for the purposes of improved clinical decision making and advancing discovery of critical disease processes. In cancer, both imaging and genomic data are becoming publicly available through The Cancer Imaging Archive (TCIA) and The Cancer Genome Atlas (TCGA) databases, respectively. The TCIA/TCGA provide examples of matched molecular and image data for five cancer types, namely breast, lung, brain, prostate and kidney. The data in TCGA includes various omics data such as gene expression, microRNA expression, DNA methylation and mutation data. The community is beginning to extract image features from the MRI, CT and/or PET images in TCIA, including tumor volume, shape, margin sharpness, voxel-value histogram statistics, image textures, and specialized features developed for particular acquisition modes. They are also annotating the images with semantic descriptors using controlled terminologies to record the visual characteristics of the diseases. The availability of these linked imaging-genomic data provides exciting new opportunities to recognize imaging phenotypes that emerge from molecular characteristics of disease and that can potentially serve as biomarkers of disease and its response to treatment. They also provide an opportunity to discover key molecular processes associated with distinct image features, within one cancer type and across different cancer types. This workshop will describe datasets and tools that enable research at the intersection of imaging and genomics, and that point to opportunities to develop future applications that leverage this knowledge for diagnostic decision support and treatment planning.

Active Handout

http://media.rsna.org/media/abstract/2014/14001877/RCA22 sec.pdf

RCB22

Creating and Delivering Online and Mobile Education Content: From Online Courses to Interactive iBooks (Hands-on)

Refresher/Informatics

IN ED IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 10:30 AM - 12:00 PM Location: S401CD

Participants

Moderator
George Lee Shih MD, MS : Consultant, Image Safely, Inc Stockholder, Image Safely, Inc Consultant, Angular Health, Inc Stockholder, Angular Health, Inc

LEARNING OBJECTIVES

1) Assess the potential of online and mobile e-learning innovations to augment your residents', medical students', and staff's educational curricula. 2) Acquire the domain knowledge to use already available content (eg, PowerPoint presentations) to both create video content and deploy e-learning courses on modern web-based and mobile platforms. 3) Acquire the domain knowledge to create an interactive Apple iBook (electronic books) with text, images, video, and interactive questions.

ABSTRACT

1. From OpenCourseWare to the Khan Academy, and now to Coursera, e-learning has been dramatically improved over the last decade, changing education from the normal classroom into learning done at convenience, and also allows for more creative and engaging content during the typical lecture. Stanford Med published positive initial findings in utilizing video-based lectures in an interactive class setting. Leveraging this new way of learning, requires knowledge about the types of technology and platforms for these courses. 2. The workflow required to host an e-learning course can be summarized in 3 steps: (a) creating the educational content, (b) hosting the materials, and (c) making the materials available to the intended audience. E-content today typically consists of lecture slides along with video recordings captured by technology like TechSmith Camtasia (non-free) and Apple Quicktime (free). Once the materials are created and edited, one must choose a suitable hosting platform realistic to the skills and goals of the instructor with options that include coursesites.com, iTunes U, and YouTube / Google Hangouts. Students can then be invited to view the material or the content can be made available to the public. 3. Creating and publishing e-books is a great way to share your teaching material as an engaging interactive tool. Publishing in e-book format solves many logistical problems of conventional publishing and the e-book format has interactive features that paper books can't match. We will review the process of creating your own e-book from assembling material to layout design to submitting for e-publication. Specifically Apple iBooks Author software will be used to demonstrate converting an existing Powerpoint presentation or journal publication into an e-book. In addition, the course will go over how to publish with or without DRM (copy-protection) and ways to obtain an ISBN for publishing for sale. Online resources will also be reviewed.

Sub-Events

RCB22A **Screencasting Basics on the Desktop and on the iPad**

Ian Ross Drexler MD, MBA (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCB22B **Massive Open Online Course (MOOC) Creation and Hosting**

Kurt T. Teichman BSC, MENG (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout

http://media.rsna.org/media/abstract/2014/14002173/RCB22B sec.pdf

RCB22C **Interactive iBooks to Supplement your Online Course**

Richard S. Ha MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC22

Monitoring Radiation Exposure: Standards, Tools and IHE REM

Refresher/Informatics

SQ IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 10:30 AM - 12:00 PM Location: S501ABC

Participants

Moderator
Kevin O'Donnell : Employee, Toshiba Corporation
Kevin O'Donnell (Presenter): Employee, Toshiba Corporation
Michael F. McNitt-Gray PhD (Presenter): Institutional research agreement, Siemens AG Research support, Siemens AG
Tessa S. Cook MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Learn about key radiation exposure metrics, such as CTDI, and how to interpret them. 2) Learn about radiation exposure monitoring methods and tools including 2a) Capturing dose information with the DICOM Radiation Dose SR (RDSR) standard. 2b) Managing RDSR objects with the IHE Radiation Exposure Monitoring (REM) Profile. 2c) Integrating 'CT dose screens' from legacy systems into RDSR. 2d) Pre-scan dose pop-ups on the CT console defined by the MITA Dose Check standard and AAPM guidance on their use. 3) Learn how to specify the above features when purchasing and integrating Radiology Systems. 9) Learn about components of a dose management program such as protocol optimization. 4) Participation in the ACR Dose Registry, and reporting requirements such as California SB-1237.

SSC07

ISP: Informatics (Enterprise Integration)

Scientific Papers

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 10:30 AM - 12:00 PM Location: S402AB

Participants

Moderator
Rasu B. K. Shrestha MD, MBA : Advisory Board, General Electric Company Medical Advisory Board, Nuance Communications, Inc Editorial Medical Advisory Board, Anderson Publishing, Ltd Advisory Board, KLAS Enterprises LLC Advisory Board, Peer60
Moderator
Jesse Chusid MD : Nothing to Disclose
Moderator
Arnon Makori MD : Medical Advisory Board, Carestream Health, Inc

Sub-Events

SSC07-01 **Informatics Keynote Speaker: Enterprise Integration—Enterprise Imaging Nuggets**

Rasu B. K. Shrestha MD, MBA (Presenter): Advisory Board, General Electric Company Medical Advisory Board, Nuance Communications, Inc Editorial Medical Advisory Board, Anderson Publishing, Ltd Advisory Board, KLAS Enterprises LLC Advisory Board, Peer60

SSC07-02 **Automated Email Delivery of Clinical and Laboratory Follow-up Data to the Radiologist from the Dictated Report: Preliminary Results of a New IT Algorithm**

Anna Ellermeier MD (Presenter): Nothing to Disclose , Jonathan S. Movson MBChB : Nothing to Disclose , Elaine Binns : Nothing to Disclose , Bradford Thomas March MD : Nothing to Disclose , Grayson L. Baird MS : Nothing to Disclose , William W. Mayo-Smith MD : Author with royalties, Reed Elsevier Author with royalties, Cambridge University Press

CONCLUSION

Using a macro within our voice dictation system, we were able to seamlessly and automatically e-mail high-yield clinical and laboratory follow-up to radiologists for their diagnostic reports and image-guided procedures.

Background

Correlating radiographic findings with subsequent clinical and laboratory data is important to maintain and

improve diagnostic skill. However, given the large volume of interpreted examinations, obtaining this data is tedious. We used a speech recognition macro and interface engine algorithm to automate this process. Unique characters inserted into radiology reports generated follow-up requests: "automatic request" for image-guided procedures or "intentional request" placed by the interpreting radiologist. Automatic query of the EMR for cytology, pathology, endoscopy and operative reports provided results delivered to dictating radiologists via HIPAA-compliant e-mail. The purpose of this study was to determine the type and utility of the delivered information.

Evaluation

The internally-developed algorithm has been in place for 22 months, generating 10,000 e-mails. We audited a 1-month data sample (February 2013) to assess for utility of provided data, as determined by e-mail concordance with the original dictation. There were 268 unique reports (170 automatic; 98 intentional), of which 92% (246/268) received concordant e-mail follow-up. Automatic requests were 96% useful (164/170) and intentional requests were 79% useful (77/98). As some accession numbers generated multiple e-mails, 418 total messages were received. Useful data was contained in 90% (378) of these, with concordance by category as follows: pathology 94% (160/171), cytology 91% (127/140), operative report 88% (73/83) and endoscopy 75% (18/24).

Discussion

The high-yield of our clinical follow-up algorithm demonstrates a useful new tool to easily correlate laboratory and clinical outcomes with original radiographic findings. These HIPAA-compliant e-mails may be forwarded to referring physicians, further promoting efficient communication for improved patient care.

SSC07-03

Patient Directed Internet-based Medical Image Exchange: Consumer Experience from an Initial Multicenter Implementation

Giampaola Greco MPH (Presenter): Nothing to Disclose , Anand S. Patel MD : Stockholder, ChemoFilter, Inc Officer, ChemoFilter, Inc , Sara Lewis MD : Nothing to Disclose , Wei Shi MS : Nothing to Disclose , Mary Torosyan : Nothing to Disclose , Alan J. Moskowitz MD : Nothing to Disclose , Bradley J. Erickson MD, PhD : Stockholder, Evidentia Health, Inc , Atheeth Hiremath BS : Nothing to Disclose , Wyatt Michael Tellis PhD : Officer, EyePACS, LLC , Eliot L. Siegel MD : Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation , David S. Mendelson MD : Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Corporation

CONCLUSION

We confirmed previous assumptions that patients highly value direct access to their medical exams and showed that the implementation of this internet-based, interoperable, image-sharing solution meets patient and provider expectations regarding ease of access, timeliness and privacy.

Background

Fragmentation of health information among physicians, institutions or practices and inefficient exchange of test results decrease quality of care and contribute to high cost. The aim of this study is to evaluates patient's and provider's satisfaction with the use of an internet-based, interoperable image-exchange system, that gives patients ownership of their imaging exams and control over their access.

Evaluation

Patients undergoing any radiological exams in 4 academic centers were eligible to receive online Personal Health Records (PHRs). Participants were provided a brief survey, to assess patient's and physician's experience with the exchange of images. Patients were instructed to complete and to return the survey after their visit with their referring physician. Survey responses were rated on a 5 point scale and comparisons were performed using logistic regression.

Discussion

2,216 patients, mean age 49.8 (±19.9) were enrolled between July 2012 and July 2013. The median number of exams uploaded per patient was 6. The most common types of exams were x-rays (34%), CT (26%) and MRI (18%). 502 (23%) patients returned their survey. Of these, 448 identified the method used at the visit to share images (Internet, CDs, both Internet and CDs, other) and 165 included a section filled by their physician. Nearly all patients liked having direct access to images and 78% viewed their medical images independently. Satisfaction with the privacy and security of the method by which radiologic exams were shared was similar between PHR users and CDs users (91% vs. 92%, respectively). More PHR users than CD users were satisfied with ease of access (89% vs. 79%, $p<0.0001$). Most physicians reported a favorable experience with the PHRs with no differences compared to other methods.

SSC07-04

Patient Healthcare Provider Discovery System (PHPDS) for Connecting Emergency Departments with Healthcare Provider of the Patient in Real Time

Nihar Sunilkumar Parikh BEng (Presenter): Nothing to Disclose

CONCLUSION

The discovery system will equip emergency departments to connect with patient healthcare providers and take timely collaborative decision for improving patient outcome.

Background

Providing access to historical data in real-time is a key challenge faced across clinical facilities. There is a pressing need for a system which can connect Emergency Departments with relevant clinical systems where historical data is available in real time. This paper proposes a system to support Emergency Department in addressing this challenge.

Evaluation

PHPDS is a zero footprint web application which searches for a patient on registered EHR/PHR systems and displays hospital provider details where data is available by the steps below: • Emergency department (ED) searches for patient using patient demographics data, biometric data, body marks, driving license number, etc. • The PHPDS queries proposed emergency service on EHR/PHR system • The EHR/PHR system returns healthcare provider name, address, emergency contact details, local patient ID along with patient photograph which can be used for uniquely identifying the patient • ED then contacts relevant healthcare provider, discusses the patient's condition and takes an informed clinical decision • Connecting parties can also make use of existing image sharing solutions

Discussion

PHPDS is designed to give access to users from registered ED. The emergency service can be integrated with XDS infrastructure of the hospital facility: • Emergency service queries PDQ server to get the matching records along with patient photograph • The Imaging Document Source details are fetched from Document Registry • Source Institution details are obtained from a table which maps Source ID and Institution details PDQ will need to be enhanced to support search on biometric data and to send patient photograph for matching records. HPD profile can be used to get the healthcare provider details. The messaging model of the emergency web service can be designed using FHIR solutions. ED can also use PHPDS when the team is in transit. PHPDS can also be used as a search tool for locating non-registered XCA community of the patient in case of emergency cases in XCPD workflow.

SSC07-05

The Evolution of Global Health Radiology Informatics; Are We Equipped to Communicate to Colleagues? A Review of the Completeness of the Radiology Informatics Alphabet Soup

Judy Wawira Gichoya MBChB, MSc (Presenter): Nothing to Disclose

CONCLUSION

RSNA initiatives should expand to support global radiology informatics through modeling and mapping appropriate concepts for use in radiology systems. From our experience, use of value groups and coded concept sets can be explored to comprehensively represent minimum reporting for radiology tests.

Background

Developing countries are rapidly adopting Electronic Medical Records (EMR) systems to improve patient care. There is an increased emphasis to collect structured data types to improve reporting and clinical decision support. Radiology systems in developing countries are characterized by continued use of analogue systems, manual development of films, and paper based prose form reporting and inadequate radiologists for reporting. Despite these challenges, basic radiology modalities are relied upon in managing trauma cases, obstetric care, and to support diagnosis for primary and chronic care diseases like HIV and Tuberculosis. To improve quality of radiology reports and clinical communication, RSNA provides a reference guide for structured reports

Evaluation

CIEL-MVP dictionary is a reference terminology provided for use in OpenMRS® , an open source medical records system used in over 42 countries, and selected for national deployment in Kenya, Rwanda and Nigeria. It has concepts in various local languages that are mapped to SNOMED CT and ICD10. We mapped the structured template reports available at http://www.radreport.org/ to this dictionary, and analyzed mapped concepts for completeness.

Discussion

A total of 119 (< 1%) concepts are classified as 'Radiology/Imaging Procedure'. None of the templates have 100% complete mapping of terminologies. Existing concepts are created for setting up order systems but are insufficient for clinical reporting since all are mapped as normal and abnormal. Laterality and possible views are separated into separate concepts e.g. Left and right extremity ultrasound, CXR AP view, Lateral view - and this creates fragmentation and increased complexity of data collection. No reporting templates for barium and obstetric studies are provided for reporting by RSNA.At present, use of the dictionary is inadequate to provide complete radiology reports.

SSC07-06

Interactive Multidisciplinary Patient Lifetime Graph for Facilitating Rapid Review of Past Medical Events

David Joseph Vining MD (Presenter): Royalties, Bracco Group CEO, VisionSR Stockholder, VisionSR , Andreea Pitici : Employee, Eloquentix, Inc , Cristian Popovici : Employee, Eloquentix, Inc , Adrian Prisacariu : Employee, Eloquentix, Inc , David Bier : Nothing to Disclose , Berhan Pirimoglu MD : Nothing to Disclose , Radu Rosu : CEO, Eloquentix, Inc

CONCLUSION

We have developed a multimedia structured reporting system that creates a patient lifetime graph which can enhance the practice of diagnostic radiology.

Background

Radiology is often practiced independent of information available from other medical specialties; however, the actions of other medical disciplines can have a profound impact upon the imaging studies that radiologists interpret. Despite the availability of electronic health records and PACS, there is often a disconnect between radiology reports, images, and clinical information. To facilitate the rapid review of a patient's entire medical history in an interactive format, we have developed a multimedia structured reporting system that can be applied to all medical specialties to generate a patient lifetime graph that depicts the occurences of medical events against a background of disease response criteria

Evaluation

We have developed a multimedia structured reporting system that is applicable to not only diagnostic radiology but other medical specialities including pathology, gastroenterology, oncology, radiation therapy, and surgery. The system works by capturing key images from any diagnostic or therapeutic process, tagging each image with metadata using an ontology, and assembling a multimedia structured report. The system can link image findings from serial exams derived from any medical discipline in unique graphical disease timelines. Finally, the sytem produces a patient lifetime graph which shows major medical events against a background of disease response criteria (e.g., Response Evaluation Criteria in Solid Tumors, RECIST).

Discussion

Review of prior imaging exams, clinical information, and disease response criteria during a radiologist's analysis of new imaging exams can be a tedious and time-consuming process. We have developed a multimedia structured reporting system and patient lifetime graph concept that enables the rapid review of past medical events against a background of disease response criteria. We believe that this technology will improve the efficiency and accuracy of radiology reporting, and hence improve a radiologist's value in the healthcare enterprise.

SSC07-07

PRICETag -- A Real-time Application for Radiology Examination Costs during Image Examination Protocol and Interpretation

Mindy Licurse MD (Presenter): Nothing to Disclose , William W. Boonn MD : Founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Shareholder, Nuance Communications, Inc Shareholder, Merge Healthcare Incorporated , Scott Raymond Steingall ARRT : Nothing to Disclose

CONCLUSION

There is poor cost awareness amongst radiologists at every level. While the effect on clinical utility and cost savings has yet to be measured, a solid understanding of radiology costs is essential if radiologists are to play a vital role in value based care.

Background

The long-standing lack of cost awareness amongst physicians is cited as one of the contributors to the high cost of U.S. healthcare. Studies have shown substantial cost savings in specialties such as surgery due to cost-awareness interventions. Despite surging attention on overutilization of radiology exams, radiologists themselves have poor knowledge of exam costs. With the rise of Meaningful Use and shifts towards quality driven and quantity controlled patient care, clinical coordination becomes paramount. Increasing cost awareness amongst radiologists allows for an integrated and informed decision-making process between radiologists, referring physicians, and patients. Implementation of a tool displaying a range of costs for each exam interpreted by a radiologist allows for knowledge building towards this goal.

Evaluation

A pre-intervention survey evaluated cost perceptions amongst radiologists of differing experience and modalities. After the survey, an application built into an institutional clinical web portal was activated. Upon opening an exam, the application displays the average Medicare hospital reimbursement for the specific exam and average professional reimbursement. After a period of two months, a post-intervention survey was distributed to the same population evaluating the effect of the tool on cost awareness.

Discussion

While knowing the cost of an exam may not seem beneficial to a radiologist, it does in fact play a vital role for patient care. Radiologist cost awareness may allow for improved multidisciplinary decision making with referring clinicians and become a standard part of consultation regarding the cost-benefit ratio of tests both financially and clinically. With the evolution of shared knowledge, both radiologists and referring physicians are more likely to meet health care legislation along with possible cost-saving due to increased price transparency.

SSC07-08

Current Trend of Academic Radiology Image Archival System in Imaging Departments of a Developing Country

Amit T. Kharat PhD, DMRD (Presenter): Nothing to Disclose , Dhaval Kanu Thakkar MBBS, MD : Nothing to Disclose , Amol Takalkar MBBS : Nothing to Disclose , Amarjit Singh MD, DMRD : Nothing to Disclose , vilas kulkarni : Nothing to Disclose , Kuldip Parthibhai Chaudhary MBBS, MD : Nothing to Disclose , Mansi N Jantre MBBS,MD : Nothing to Disclose

CONCLUSION

LHDA on workstation and PACS of academic images is efficient and fastest. It is a favored option amongst radiologists as compared to CB system. CB system is systematic and safe, but limited by network speed, requires local storage of data prior to upload to CB PACS. Radiologists therefore prefer local storage on the

hard disc drive to save time. A robust ARIA and storage system can be a boon to radiologists to archive interesting cases directly from PACS.CB system can also alleviate space requirements, provide automatic backup in case of damage to the original source and provide access to teaching file cases virtually to anyone with an appropriate internet connection.

Background

Study the least time consuming method of academic radiology image archival (ARIA).Utility of cloud based (CB) academic radiology image archival versus local hard disc archival (LHDA) and Picture Archiving and Communication System (PACS) storage.

Evaluation

143 resident and consultant radiologists of the same country belonging to multiple institutions were questioned regarding procedures used for ARIA. A questionnaire was prepared and answers were sought. Of those, 100 (69.93%) radiologists responded completely to the survey. Study was conducted over 4 months starting October 2013 to January 2014.

Discussion

All images stored by radiologists followed HIPAA guidelines. Out of 100 radiologists, majority (95 %) used LHDA while 5 % used CB image archival system. Of the 95% using LHDA, 65 % stored files and data on the local hard drive while 35% used the PACS for image archival. 60% radiologists were aware of CB technology for ARIA, while 40 % were unaware. The 60 % radiologists who were aware but not using CB system gave following reasons: time consuming procedure to categorize, upload images (1 minute for LHDA versus 3 minutes for CB PACS), unreliable internet access; lack of technical expertise/support, lack of financial support by institution, and few other declined to answer. 84% radiologist's acknowledged the fact that CB data was more secure, systematic as compared to LHDA on workstation. PACS based academic image archival was thought as adequate by 69% while 31 % radiologists suggested need for refinements and upgrade.

INS-MOA

Informatics Monday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Mon, Dec 1 12:15 PM - 12:45 PM Location: IN Community, Learning Center

Participants

Moderator
Alexander T. Ruutiainen MD : Nothing to Disclose

Sub-Events

INS140

Software Tool for Fully-automated Image Quality Control in Computed Tomography (Station #1)

Celia Juan-Cruz : Nothing to Disclose , Roberto Sanz-Requena PhD : Nothing to Disclose , Javier Saiz-Rodriguez : Nothing to Disclose , Luis Marti-Bonmati MD, PhD (Presenter): Nothing to Disclose

CONCLUSION

The presented tool allows to automatically quantify quality image parameters, easily enabling the longitudinal assessment of quality in CT devices without human interaction.

Background

Good practice in CT acquisitions need to accurately calculate the image quality. The aim of this study is to develop an automatic method for CT image quality analysis. Images were acquired using a Philips phantom and a cone-beam CT imaging system O-ARM (Medtronic Inc., USA), configured for the head protocol in the three 3D modes: Standard, HD and Enhanced. The software for the evaluation of several quality parameters (noise, uniformity, and spatial resolution) was developed using MATLAB (The Mathworks Inc., USA). All ROIs and parameters were extracted and calculated automatically. Noise was calculated as the standard deviation of the CT value of water and uniformity by the difference among the CT values of the centre of the image and 4 peripheral ROIs. Spatial resolution was determined by the Modulation Transfer Function (MTF) at the 10%, obtained by the Edge Spread Function method.

Evaluation

The validation of the software was done by systematically varying the kVp and mA acquisition parameters for the three modes. For the noise and uniformity the same slice at the water section of the phantom was selected. Image noise decreased as both kVp and mA increased. Regarding uniformity, most images appeared to be more uniform at the lower part of the phantom. For the MTF, the same slice including a Teflon bar was chosen, as this material has a high CT value. A total of 15 automatic points were chosen, all along the edge of the Teflon bar. The MTF was obtained at every point, with a mean value of approximately 1 cy/mm.

Discussion

Noise values changed as expected across the study, decreasing when mA and kVp increased. Spatial resolution was almost constant as it was not influenced by these parameters. The values were below the theoretical reachable one calculated by the Nyquist frequency (1.2 cy/mm). It was impossible to determine the spatial

resolution for kVp values under 60 due to the higher noise.

INS141

Improving Radiology Resident Feedback and Efficiency with the Radiology Toolbox (Station #2)

Michael Francavilla MD (Presenter): Nothing to Disclose , Cuong Nguyen DO : Nothing to Disclose , Kevin Liaw MD : Nothing to Disclose

CONCLUSION

Incorporating the Radiology Toolbox into daily practice has improved overall workflow, report quality, and resident education.

Background

At our institution, radiology residents begin taking independent overnight call as second years. They dictate full reports on up to 100 to 200 exams during an overnight and 24-hour shift, respectively. Routine tasks performed while dictating a case include looking up floor phone extensions, clinical data review, and accessing educational websites such as StatDx can consume a considerable amount of time. Feedback on studies that are not reviewed with an attending has traditionally been provided in an ad-hoc manner, generally via email, with suboptimal results. In an attempt to improve clinical care as well as resident education, in-house software was developed to facilitate attending-to-resident feedback and improve dictation efficiency and workflow. The software also includes a searchable teaching file.

Evaluation

A few months after introducing the Radiology Toolbox to residents and attendings, a survey was crafted using SurveyMonkey and distributed to all staff regarding its utility and the usage frequency of each function. Data were also collected using a built-in usage tracking function.

Discussion

The Radiology Toolbox is a multi-function tool that interacts with our dictation software and our Picture Archiving and Communication System. It automates a number of tasks to expedite dictation, including: dictating the most recent comparison studies; looking up floor phone numbers; opening the patient's chart in the Electronic Medical Record (EMR); and automatic log-in to educational reference sites. The software also has an integrated searchable teaching file. Its most heavily utilized feature has been the attending to resident feedback function, accomplished with a single button click. Finally, it allows residents to compare the preliminary and final reports, utilizing highlighting and strikethroughs. This function helps residents learn from past mistakes to improve dictation quality. An increased amount of feedback was provided to residents. Functions that were utilized most by attendings and residents include the comparison feature and feedback button.

INS142

Low Tube Voltage (100 kVp) Setting in Enhanced Chest CT: Improved Vessel Enhancement and Simultaneous Decreased Radiation Dose and Iodine Dose (Station #3)

Zhipeng Gao BEng (Presenter): Nothing to Disclose , Xiaoyi Ren : Nothing to Disclose , Xiaonan Cui : Nothing to Disclose , Donghua Meng : Nothing to Disclose , Jun Wang : Nothing to Disclose , Zhao Xiang Ye : Nothing to Disclose

CONCLUSION

We can obviously find that the use of the 100 kVp protocol for chest CT substantially improved vascular enhancement with 20% reduction in the radiation dose, even though IOCM (270 mgI/mL) was 10% less iodine than LOCM (300 mgI/mL),

Background

Over the last decade, the use of CT has increased dramatically in clinical examination. There has been growing interest in decreasing the radiation dose during chest CT examinations, since CT examination has the potential risks of radiation-induced carcinogenesis. At the same time, CIN is closely related to hospital acquired acute renal failure.

Evaluation

Vascular enhancement was significantly higher in 100 kVp protocol (group C: 204.9±32.4HUand group D:188.7±26.0HU) than 120 kVp protocol (group A: 172.1±24.4HU and group B:155.4±21.7HU). In addition, ED was lower in 100 kVp protocol (group C: 3.9±0.6 mSv and group D: 3.8±0.74 mSv) than 120 kVp protocol (group A: 4.8±1.3 mSv and group B: 5.0±1.2 mSv). The subjective degree of image quality and CNR was not significantly different among the four groups.

Discussion

In this study, ED was 20% lower in 100 kVp protocol than 120 kVp. The ED of Group D (100 kVp and 270 mgI/mL setting) was 3.8±0.74 mSv which was approximately the natural ambient radiation exposure.The application of lower tube voltage in CT increases the photoelectric effect, leading to a higher mean attenuation value of iodine. Vascular enhancement was significantly higher in 100 kVp (group C: 204.9±32.4HU and group D:188.7±26.0HU) than 120 kVp (group A: 172.1±24.4HU and group B:155.4±21.7HU). The vascular enhancement of group D(100 kVp with IOCM setting) was 188.7±26.0HU, just approximated the general setting group A (120 kVp with LOCM setting). We used a weight-based adjustment of a combined modulation type of automatic exposure control technique to increased the tube current-time product (reference mAs) in the 100 kVp protocol to compensate for the increased image noise .In the objective and subjective image analyses of

the image study, the image noise of the 100 kVp protocol was not significantly different from that of the 120 kVp protocol. In addition, The subjective degree of image quality and CNR was not significantly different among the four groups.

INS143

Operationalizing a Hospital High Reliability Strategy to a Radiology Informatics Initiative (Station #4)

Joseph Mack MS, BA (Presenter): Nothing to Disclose , Steven P. Braff MD : Nothing to Disclose , Kristen K. DeStigter MD : Research Grant, Koninklijke Philips NV Consultant, Koninklijke Philips NV Medical Advisory Board, McKesson Corporation

CONCLUSION

The hospital high reliability strategy provided Radiology and the imaging informatics team the opportunity to bring forward a set of IT projects that were consistent with hospital strategic objectives. The clinical vision provided by Radiology, the support of the hospital to provide the capital investment for new software and the collaboraton between IT and Radiology clinical teams that brought the projects to fruition is an excellent example of organizational focus.

Background

The Institute of Medicine (IOM) has stressed the urgency of transforming hospitals into places where each patient receives the best quality care every time, setting a goal for hospitals to become Highly Reliable Organizations. Radiology and IT operationalize this strategy into an initiative of 4 IT projects: Integration of a Clinical Decision Support System with the EHR Installation of a Radiation Dose Management system Integrate the Electronic Health Record Data on a PACS workstation Install a Critical Test Result Management for documented closed loop communication

Evaluation

The integration of the EHR with the PACS systems has provided the Radiologist with patient episodic data that match the presented study. The critical test results management system implementation did not reach the goal we had envisioned. We identified workflows and physician on call processes that required improvement. The clinical decision support system provide baselines data on imaging study ordering patterns by ordering physicians. The dose monitoring system improves quality consistency and embeds CT dose metrics in reports.

Discussion

The integration of the EHR and PACS system has streamlined Radiologist access to the clinical chart. The critical test results management system implementation resulted in the development of an imaging study follow-up process for repeat studies. The clinical decision support system baseline established the ordering physician scorecard and creates a feedback loop that match individual ordering practices against evidence based data. The dose monitoring system provides statistical opportunities to measure radiation dosage per (study and device) and document organ specific exposure.

INE113

3D Printing - A Primer for Radiologists (Station #5)

Stephen Thomas MD (Presenter): Nothing to Disclose

TEACHING POINTS

Educate the user on the current techniques of 3D printing, the additive manufacturing process, printer hardware and printing materials. Provide a step-by-step guide for image data acquisition, printable object rendering, post-processing to create a polygonal mesh structure and object fabrication.

TABLE OF CONTENTS/OUTLINE

A) Introduction to types of additive fabrication process B) 3D printer technology and printing materials [Fused Deposition Modeling, Selective Laser Sintering/Granular materials binding, Laminated Object Manufacturing, Photo-polymerization, Stereolithography, Electron Beam Melting] C) Medical uses for 3D fabrication and future directions D) CT, MR and US image data acquisition E) Editing and rendering the printable object F) Creating and editing the polygonal mesh 3D printable model G) Printing the model H) Finishing the model

INE009-b

RadQA: Automated Quality Control of Radiological Interpretations in Prostate Cancer (custom application computer demonstration)

Simon Han (Presenter): Nothing to Disclose , William Hsu PhD : Nothing to Disclose , Corey W. Arnold : Nothing to Disclose , Daniel Jason Aaron Margolis MD : Research Grant, Siemens AG , Alex Anh-Tuan Bui MS, PhD : Nothing to Disclose , Dieter Roland Enzmann MD : Nothing to Disclose

Background

Prostate imaging is increasingly being used to detect, stage, and manage individuals with prostate cancer given its ability to characterize lesions in a non-invasive and objective way. However, the sensitivity and specificity of these imaging exams are not well studied. We present a software tool that automatically assesses the concordance between radiology and pathology report findings from clinical text documents. The system was previously demonstrated to work in breast imaging (BIRADS), and we have adapted the tool to work for prostate exams at our institution. While recommended radiological reporting guidelines exist for prostate (PIRADS), this metric is relatively recent and not widely adopted. As such, we extract relevant elements from retrospective imaging reports to determine the radiological interpretations and compare the results to pathology findings in order to generate summarizing visualizations to assess the utility of imaging in diagnosing prostate cancer.

Evaluation

The Radiology Quality Assurance (RadQA) software was implemented for prostate imaging cases at a large medical institution. 114 patients who have undergone targeted prostate biopsies or radical prostatectomies with resulting pathology results have been processed by the tool.

Discussion

The system automatically generates statistics (e.g., number of biopsied patients, concordance to pathology reports) in the dashboard. Users can specify filters such as time period, modality, and quality. Since prostate imaging reports are semi-structured, a challenge is to extract relevant elements from these reports and correctly match lesions from one report to another.

CONCLUSION

Our software tool can assist in departmental efforts to improve the quality and value of information from radiology interpretations by objectively assessing its accuracy in comparison with downstream results. Currently, we determine the radiological interpretation by mining text reports, but as structured reporting and scoring systems (e.g., PIRADS) become used more widely, we will improve the ability to make meaningful comparisons. In addition to prostate, we are exploring extending the framework to other domains such as lung cancer.

INE010-b

Magnetic Resonance Imaging Protocol Application (custom application computer demonstration)

Hong Yang : Nothing to Disclose , Julie Young : Nothing to Disclose , Laurie A. Perry RN : Nothing to Disclose , Timothy OConnor MBA (Presenter): Nothing to Disclose , Alex Towbin MD : Author, Amirsys Inc Shareholder, Merge Healthcare Incorporated Consultant, Guerbet SA

Background

As a complex Radiology department at a large tertiary care hospital with multiple outpatient centers, we were faced with the problem of maintaining standard MRI protocols on ten machines at four locations across three vendors. Historically, the imaging protocols were documented using a word-processing application. They were then distributed either via a shared network drive or through paper-based copies maintained in binders. Changes to the protocols were difficult and time consuming. To address these issues, we designed and implemented an easy-to-use, web-based MRI protocol database application.

Evaluation

A database-driven, web-based application was created which allows clinical managers to store MRI protocol information in a database. Multiple protocols can be stored and organized based on the physical scanner, radiology specialty, and the specific body part(s). For each protocol, individual sequence steps can be defined and annotated along with pre-scan and post-scan steps to be followed by the technologist. Each step in the protocol can be annotated with images in order to further convey relevant information. In addition, the system also allows for associated documents (PDF, MS Word, etc.) and hyperlinks to be stored as part of the protocol and referenced directly from the protocol web pages. Protocol information is displayed via a standard web browser in a tabular, easy to understand and follow format.

Discussion

More than 100 MRI protocols are currently stored in the system with more being added as the system continues to be rolled out. The use of web technology has allowed us to provide a single, easy to use portal for access to all of the protocol information. We believe that consistent presentation of the sequence step instructions and notes aids in consistency in the use of the protocols throughout the department.

CONCLUSION

Using a database-driven, web application to store and manage complex MRI protocols provides easier access to critical information for imaging technologists and allows divisional leaders to quickly make changes that are instantly accessible to all technologists.

INE011-b

Desktop Reporting Assistant Tools using QR Code and OCR on the Fly in the Reading Room: Feasibility of all-in-one Cam Mouse and Web-based QR Code Templates (custom application computer demonstration)

Norio Nakata MD (Presenter): Nothing to Disclose , Tomoyuki Ohta : Nothing to Disclose , Yukio Miyamoto MD : Nothing to Disclose , Kunihiko Fukuda MD : Nothing to Disclose

Background

Nowadays, almost science journals are online and e-Books are becoming more popular. However, old journals and textbooks still remain on paper in the department of radiology. Contents of e-Books are stored in the tablet. And those smart devices are sometimes difficult to connect directly with HIS/RIS. If radiologists want to cite the important descriptions from those references for radiological reporting, they have to copy those descriptions manually by typing or dictation. So those jobs are tedious and time-consuming. Optical character recognition (OCR) and QR codes enable connecting the offline world to the online environment. Webcam is available to manage OCR and QR code. But conventional enterprise workstations for radiology reporting do not include the web cam as standard equipment.

Evaluation

We have developed reporting assistant tools using open source OCR and QR code libraries using the cam mouse. The cam mouse is a commercial available all-in-one wired mouse, which combines a 1200DPI mouse with a 2.0M pixel camera. Those OCR and QR code tools are developed using HTML5 and JavaScript. Using OCR and QR code scanner with the cam mouse, it is easy to attach the cited text to the reports and to read the QR codes including the URL and document data. We have also developed unique web-based management system of QR code templates for radiology reports including RSNA Radiology Reporting Templates. This QR code templates are put in our original website. Radiologists do not input their original templates into their each reporting system of multiple institutes. Radiologists can create and revise their own variable templates using real-time QR code generator and OCR tool with their tablet terminals and use them in any hospitals.

Discussion

BYOD brings new security challenges for secured IT. OCR or QR code is one of those technologies. We will discuss the pros and cons of each solution. We will also compare these technologies with other wireless data transfer methods such as Bluetooth, transfer data using ultrasound, and other new technologies.

CONCLUSION

OCR and QR code tools for reporting using the cam mouse are feasible approach to paper-based data transfer between reporting workstation and BYOD.

INE012-b

Single-Handed Gesture Control for Image Manipulation Using Leap Motion and Open Source Software: Initial User Experience (custom application computer demonstration)

Derick Hsieh (Presenter): Nothing to Disclose , Philippe Kruchten : Nothing to Disclose , Darra Thomas Murphy MD, FRCPC : Nothing to Disclose

Background

With gesture-based control systems becoming an alternative interface to traditional computing systems, new interactive methods can be implemented in a medical environment. Gesture-based interactions allow no-touch control of a system that removes the need of the re-sterilization process. This may reduce procedure time and allow the physician to focus on the primary task at hand. We propose a simple method where the primary user can perform most common tasks such as scroll, zoom, pan and window width/level (ww/wl) adjustments with just one hand using a Leap Motion sensor and an open source DICOM viewer, Weasis.

Evaluation

Special algorithms were derived to eliminate obstacles such as lighting conditions, noise, and interference from other equipment. We asked 12 clinicians (9 radiologists and 3 orthopedic surgeons) to participate. All clinicians stated they routinely reviewed patient imaging during a procedure. Following a brief introduction and demonstration taking less than 5 minutes, the clinicians were asked to perform certain tasks on multiple CT and MRI imaging datasets in a non-clinical test environment. Most clinicians had no prior experience with interactive gesture sensors (10/12). All clinicians rated the experience as satisfactory or very satisfactory and provided very positive feedback with regards to image zoom, scroll, pan and fine tuning ww/wl as well as ww/wl presets. All 12 clinicians stated a preference of single-handed over two-handed gesture control.

Discussion

Gesture based technology for manipulation of medical images in a sterile environment is a promising tool. We have developed an open source plugin to allow the user the ability to use one hand to finely manipulate medical imaging data. We endeavored to make the system easy to use by developing a method where no calibration is needed. This is simple to implement as it can easily be integrated into existing systems, requires no calibration and is very low cost.

CONCLUSION

We have demonstrated a very positive user experience by harnessing this powerful technology. Further research is required to evaluate the impact this may have on procedure times and user experience in the operating room or interventional radiology suite.

INE013-b

Universal Decision Support Application and Semi-automated differential Diagnosis Generation System for Liver CT and MR Imaging (custom application computer demonstration)

Toshimasa James Clark MD (Presenter): Nothing to Disclose , Suresh Maximin MD : Nothing to Disclose , Sooah Kim MD : Nothing to Disclose , Carolyn Lee Wang MD : Nothing to Disclose , Mariam Moshiri MD : Consultant, Reed Elsevier Author, Reed Elsevier , Puneet Bhargava MD : Editor, Reed Elsevier , Tao Li MD, PhD : Nothing to Disclose

Background

Algorithm-based characterization of hepatic lesions is well defined by the LI-RADS criteria for a small subset of studies. LI-RADS is not applicable to patients without underlying liver disease or on MR performed with hepatobiliary contrast agents. We therefore created a web-based application to categorize hepatic observations

along with semi-automated report generation of the differential diagnosis in descending order of probability. It will apply to livers with or without underlying disease, imaged with multiphase CT or MR, with any contrast agent.

Evaluation

We developed an algorithm encompassing all hepatic observation signal intensities and attenuations on all phases where applicable, building upon prior extant work. We then developed a free Javascript web application implementing both our algorithm and differential diagnosis generator. The decision tree is based on current literature, can be updated as consensus evolves, and will include a comprehensive set of benign and malignant hepatic entities. It will also allow input of other relevant data, e.g. prior studies or history of malignancy.

Discussion

There exists literature supporting definitive characterization of various hepatic entities based on imaging characteristics on multiphase studies, yet we are unaware of any decision support applications that can be used in imaging of both non-cirrhotic and cirrhotic livers. This application's evidence-based algorithm can be used for decision support, structured report generation, and as a learning tool.

CONCLUSION

We have developed a free web application that can be used to characterize lesions and auto-generate a differential diagnosis for CT or MR of both non-cirrhotic and cirrhotic livers, regardless of contrast agent choice. Given the increasing complexity of hepatic imaging, our goal is to provide decision support that will be useful as a learning tool as well as help radiologists become more consistent, efficient and accurate in the interpretation and reporting of hepatic lesions.

INE014-b

Computer Aided Detection (CADe) of Retained Surgical Items (RSI) in X-ray Images (XR) (custom application computer demonstration)

Gady agam PhD (Presenter): Shareholder, RaPID Medical Technologies, LLC , Vicko Vicko Gluncic : Founder, RaPID Medical Technologies, LLC CEO, RaPID Medical Technologies, LLC , Serge Kobsa MD, PhD : Nothing to Disclose , Shirley Richard MBA : Clinical Advisor, RaPID Medical Technologies, LLC , Mario Moric : Officer, RaPID Medical Technologies , Sameer A. Ansari MD, PhD : Shareholder, RaPID Medical Technologies, LLC

Background

RSI are commonly surgical sponges/needles inadvertently left in a patient's body (0.02-1% incidence). They are a priority OR patient safety concern, classified as sentinel events by the Joint Commission. Measures to prevent RSI include effective OR communication, mandatory counts of surgical instruments/sponges, methodical wound examination, and XR. Miscounts occur in <12.5% of surgeries, requiring XR of the surgical field. Since 80-90% of RSI occur with "correct surgical counts" hospitals may mandate XR at the end of all complex surgeries. Although XR based protocols are crucial for RSI detection, they are limited by the sensitivity and experience of the human eye, lack of formal training for RSI detection, and a time intensive process for complete analysis. These limitations motivated us to develop CADe software for the ray-tec XR detectable sponge.

Evaluation

Developed CADe software involves three steps: enhancement, detection, and recognition. Enhancement reduces noise and improves contrast to assist detection. Identification detects candidate regions and classifies them using a supervised learning technique based on extracted 112 dimensional feature vectors. Detected regions are clustered to form candidates using a spatial clustering algorithm. The object detection stage uses an additional classifier that is trained in a supervised manner.

Discussion

The test collection included a total of 790 images where 277 have one or more ray-tec sponges. We manually labeled the images by marking the area of each sponge and automatically marked negative candidate locations. Overall we had 561 positive locations and 25,638 negative locations.10 fold cross validation was performed and receiver operating characteristic curve generated. Using the optimal point on the curve we obtained 509 true positives, 25,611 true negatives, 27 false positives, and 52 false negatives. CADe beta prototype testing resulted in 99% specificity, 90% sensitivity, and 0.92 F-measure.

CONCLUSION

Our data demonstrate the feasibility of the CADe for the ray-tec sponge in XRs based on supervised learning methods. Developed CADe software has a potential to improve OR time utilization, RSI detection rate, and overall patient safety.

INE015-b

ISO27001-Implementing Secured DICOM Replication and Data Restore for Multiple Archiving Servers (custom application computer demonstration)

Suranarong Kamtasila MEng (Presenter): Nothing to Disclose , Krongrat Kangwanklai BS, MS : Nothing to Disclose

Background

Based on research; ISO27001-Implementing Medical Imaging Archiving using Big Data Architecture, having two set of onsite archiving data on HDFS enable the onsite copying and unlimited storage space. We have

encountered a problem of having another set of data storage offsite. A result of using HDFS synchronization was not satisfactory. Our solution is to develop a multisource file-transfer or swarming file-transfer replication system. Its aim is to improve the overall performance, and accuracy of data backup to the offsite storage.

Evaluation

Performance of transferring data over DICOM protocol was not good. Using other protocols e.g., FTP or rsync, might lead to inability to know if the data transfer was successful. This research focuses on an adaption of the principle of multisource file-transfer. If there are changes at the Study level, a source server will modify the structure of source directory by combining all into one file, compress and divide into smaller pieces and encrypt each piece. The cryptography technique is used to ensure data integrity and confidentiality when data is sent across to a destination server in the form of multisource-single receiver. In this structure, if there is more than one copy of data, it is possible to divide and send multiple pieces of data simultaneously.

Discussion

ISO27001 standard required to have business continuity management process implemented to minimize the impact on the organization and recover from loss of data. Also, it is required to ensure authenticity and protecting message integrity. In the research, backup servers are online 24x7 to enable the resource availability. The Map Reduce Framework allows compression to happen quickly and concurrently. These implementations allow us to have reliable and efficient data transfer and be able to monitor data replication activities at all times.

CONCLUSION

The onsite and multi-site copying with concurrent data validation in application, database and file system will enable us to counteract interruptions to business activities and to protect critical business processes from the effects of major failures of information systems and to ensure the timely resumption. This will fulfill ISO27001 requirements-BCP.

INE016-b

Moving Towards Big Data Analytics in Radiation Therapy: Dynamic Decision Support through Data Mining (custom application computer demonstration)

Ruchi Deshpande MS (Presenter): Nothing to Disclose , John J. Demarco PhD : Nothing to Disclose , Brent Julius Liu PhD : Nothing to Disclose

Background

We have developed a decision support system for Radiation Therapy that utilizes a comprehensive DICOM RT specific database of retrospective treatment planning data to perform data mining. These data mining results may corroborate a clinician's radiation therapy treatment plan, thus increasing confidence or they may highlight potential ways to improve the treatment plan by lowering dose to sensitive organs surrounding the tumor. Since the success of such systems depends heavily on the size and composition of the training database, we have also developed an infrastructure to facilitate data collection for cloud-based research collaborations.

Evaluation

The infrastructure and decision support algorithm have both been tested and evaluated with 51 sets of retrospective treatment planning data of head and neck cancer patients. An expert has tested and validated the integrity of our client-side JavaScript DICOM parser and anonymizer. An expert has also verified HIPAA compliance of our data collection mechanism.

Discussion

An efficient data collection mechanism is essential to ensure a constantly growing and self-updating big data repository for good system performance. DICOM compatibility ensures vendor neutrality, and a HIPAA-compliant data sharing protocol encourages research participation. This provides the potential for a large-scale cancer registry containing vital anatomical, dosimetric and treatment planning information, which is harnessed by a data mining decision support algorithm in a cloud-based environment. The cloud-based infrastructure promotes big data analytics in the field of Radiation Oncology, by paving the way for building data warehouses, dealing with HIPAA regulations and providing a platform for testing data mining algorithms.

CONCLUSION

We will present an infrastructure for facilitating large-scale collection of radiation therapy treatment planning data, and demonstrate the benefits of a data mining decision support algorithm that utilizes this infrastructure. The various components of the system, including a client-side DICOM parser, a HIPAA-compliant data sharing protocol, a cloud-based data mining and analytics engine, and a DICOM specific database will be presented.

RCA23

Slicer: 3D Interactive Visualization of DICOM Images for Radiology Applications (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 12:30 PM - 2:00 PM Location: S401AB

Participants

Sonia Marie-Aurore Pujol PhD (Presenter): Nothing to Disclose

Ron Kikinis MD (Presenter): Nothing to Disclose
Kitt Shaffer MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Facilitate interpretation of DICOM images through the use of computer-assisted 3D visualization. 2) Increase the understanding of the correlation of the three dimensional relationships of the segments of the liver and lung with the surrounding vascular anatomy. 3) Introduce cutting-edge open-source computer graphics applications for Radiology.

ABSTRACT

Three-dimensional visualization of anatomy is emerging as a vital component of clinical imaging through the combined development of technological breakthroughs in Radiology hardware and increasingly sophisticated software tools for medical image analysis. For the past 10 years, the National Alliance for Medical Image Computing (NA-MIC), one of the seven National Centers for Biomedical Computing part of the NIH Roadmap for medical research, has converted some of the major scientific advances made by the biomedical imaging community into open-source software tools, contributing to increase the deployment of cutting-edge visualization techniques on a national and international scale.As part of the NA-MIC toolkit, the 3D Slicer open-source software has been developed as a technology delivery platform for clinical researchers. 3D Slicer has evolved into a multi-institution effort to share the latest advances in image analysis with the scientific and clinical community. This course is an introduction to the basics of viewing and interacting in 3D with DICOM volumes and anatomical models using 3D Slicer. The course is divided into three sections: the first part introduces the concepts of 3D visualization through an hands-on training session using an MR DICOM dataset of the brain and 3D reconstructed models of cerebral structures; the second section presents 3D models of the segments of the liver reconstructed from three clinical cases; and the third section guides the user through the exploration of the bronchopulmonary segments of the lung reconstructed from DICOM images. Interactions with 3D anatomical models are fostered by a series of radiological tasks for participants to complete for each clinical case. Detailed answers to the tasks are provided during the workshop as the instructors guide the audience through the 3D visualization settings to enhance the understanding of the complexity of the anatomical structures involved.

URL's

http://www.na-mic.org/Wiki/index.php/RSNA_3D_Visualization_Course

active handout

http://media.rsna.org/media/abstract/2014/11033051/RCA23 sec.pdf

RCB23

3D Printing (Hands-on)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 12:30 PM - 2:00 PM Location: S401CD

Participants

Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation
Peter Constantine Liacouras PhD (Presenter): Nothing to Disclose
Timothy Mueller (Presenter): Nothing to Disclose
Amir Imanzadeh MD (Presenter): Nothing to Disclose
Dimitris Mitsouras PhD (Presenter): Nothing to Disclose
Nicole Wake MS (Presenter): Nothing to Disclose
Andreas Giannopoulos MD (Presenter): Nothing to Disclose
Tatiana Kelil MD (Presenter): Nothing to Disclose
Catherine Phillips MD (Presenter): Nothing to Disclose
Beth A Ripley MD, PhD (Presenter): Nothing to Disclose
Asha Sarma MD (Presenter): Nothing to Disclose
Hansol Kim MD (Presenter): Nothing to Disclose
Tianrun Cai MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To familiarize radiologist with the general indications for 3D printing in biomedical imaging. 2) To learn the basic principles of an STL file. 3) To obtain "hands-on" experience in creating a STL file from radiology DICOM images. 4) To learn an approach to STL file manipulation to achieve a 3D printed model.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

Active Handout

http://media.rsna.org/media/abstract/2014/14003455/RCB23sec.pdf

RCC23

Next Generation Infrastructure for Medical Imaging (In Association with the Society for Imaging Informatics in Medicine)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 12:30 PM - 2:00 PM Location: S501ABC

Participants

Moderator
Paul J. Chang MD : Co-founder, Stentor/Koninklijke Philips Electronics NV Technical Advisory Board, Amirsys, Inc Research Contracts, Koninklijke Philips NV Medical Advisory Board, lifeIMAGE Inc Medical Advisory Board, Merge Healthcare Incorporated

LEARNING OBJECTIVES

1) The participant will be introduced to the importance of information system integration and interoperability to support modern imaging informatics workflow. 2) Examples of practical integration strategies that have been used successfully (e.g. web viewer EHR integration, single sign-on, RIS vs PACS driven workflow) will be discussed. 3) Advanced integration strategies, including using vendor APIs, state aggregation, SOA, and IHE, will be presented.

ABSTRACT

Modern imaging informatics workflow requires consumption, choreography, and orchestration of content from multiple disparate information systems that do not natively "talk to each other." Without optimal integration and interoperability amongst these systems, humans are required to serve as "integrating agents:" this frequently results in inefficiency and error. This session will provide an introduction to the importance of system integration and will provide a practical introduction to commonly used integration strategies. In addition, more advanced integration approaches, including leveraging vendor APIs (application programming interfaces), IHE, and SOA (service oriented architecture) will be discussed.

Sub-Events

RCC23A

Interoperability and Integration—from HL7, DICOM, IHE, to SOA

Paul J. Chang MD (Presenter): Co-founder, Stentor/Koninklijke Philips Electronics NV Technical Advisory Board, Amirsys, Inc Research Contracts, Koninklijke Philips NV Medical Advisory Board, lifeIMAGE Inc Medical Advisory Board, Merge Healthcare Incorporated

LEARNING OBJECTIVES

1) The participant will be introduced to the importance of information system integration and interoperability to support modern radiology workflow. 2) Examples of practical integration strategies that have been used successfully (e.g. web viewer EHR integration, single sign-on, RIS vs PACS driven workflow) will be discussed. 3) Advanced integration strategies, including using vendor APIs, state aggregation, SOA, and IHE, will be presented.

ABSTRACT

Modern radiology workflow requires consumption, choreography, and orchestration of content from multiple disparate information systems that do not natively "talk to each other." Without optimal integration and interoperability amongst these systems, humans are required to serve as "integrating agents:" this frequently results in inefficiency and error. This session will provide an introduction to the importance of system integration and will provide a practical introduction to commonly used integration strategies. In addition, more advanced integration approaches, including leveraging vendor APIs (application programming interfaces), IHE, and SOA (service oriented architecture) will be discussed.

RCC23B

Image Sharing—A Fond Farewell to CDs

David S. Mendelson MD (Presenter): Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Corporation

LEARNING OBJECTIVES

1) Understand the importance of Image Sharing / Exchange with regard to the quality of care a radiologist delivers as well as to efforts to control costs. 2) Understand the benefits and pitfalls of CDs and the transition to internet based sharing. 3) Understand the different internet (Cloud) based solutions that are available and what distinguishes them. 4) Learn that the cloud can be employed not only for archival but for a variety of radiology services. 5) Learn about the IHE XDS-I and related profiles and their role in internet based image exchange. 6) Understand what solutions a radiologist might implement at this time. 7) Understand how image exchange fits into the broader efforts directed at healthcare information exchange and interoperability through EHRs.

ABSTRACT

The safe and secure exchange of heatlhcare information is of paramount importance in delivering the highest quality of care to our patients. The realm of Health Information Exchange while nascent is undergoing explosive growth. The exchange of radiologic exams and reports must be tightly integrated into this porcess. Radiological images have historically presented some unique challenges. This session will build upon the prior and focus on existing solutons for image exchange and discuss how it is expected to evolve over the next few years.

RCC23C

Vendor Neutral Archives vs Archive Neutral Vendors: Towards the Next Generation Archive

Richard L Kennedy MSc (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the differences between vendor neutral archives, archive neutral vendors, and cloud archives. 2) Identify key strategic advantages and disadvantages of these three respective models of archival. 3) Observe some potential obstacles to implementation of these three respective models of archival.

INS-MOB

Informatics Monday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Mon, Dec 1 12:45 PM - 1:15 PM Location: IN Community, Learning Center

Sub-Events

INS144

Open Source Substitution of a Full Featured Programmable Editor in Place of Commercial Voice Recognition Editor Why We Did It, How It Was Done, and How to Do It (Station #1)

Mitchell Phillip Laks MD, PhD (Presenter): Owner, Meromorphic Enterprises Corporation

CONCLUSION

We have found that the ability to utilize an advanced programmable editor which enables configuration and shortcuts utilizing complex add on software developed for those editors (we mention YASnippet and Abrev mode for Emacs) greatly enhances the radiologists productivity.

Background

Our medical center has been utilizing Nuance, a commercial voice recognition (VR) radiology reporting product. Its strength is that it enables different report templates for different exam types. Unfortunately, its greatest weakness is the heavy reliance upon voice recognition. Many advanced editors exist which are fully programmable and enable many text typing based efficiencies. In advanced editors, typing macros are much more efficent, flexible and configurable than voice macros and picklists. VR should best be viewed as a crutch for transitioning a generation of radiologists to a more error free, robust, natural and efficient text based reporting system. The next generation of radiologists will consist of fluent text messagers, and the software should leverage that strength.

Evaluation

We have written open source software to enable the radiologist to seamlessly extract a draft report or template (with the relevant patient and exam study demographics from the Nuance software and insert it into a powerful programmable editor system, and then after the radiologist completes their streamlined editing to seamlessly return the report to Nuance for signature. We have programmed this for both the Emacs and VI open source editors. Emacs and VI are amongst the earliest and most highly evolved text editors with programmable backbones, and with many useful extensions created for them, and there are thousands of programmers and others who swear by them and use them daily for all their editing needs. Microsoft Word could be set up for it as well.

Discussion

The sofware is written in a combination of Lisp and Perl and Autohotkey. The software is open source and available at github. It is utilized at our medical center. The use scenario is largely complex CT and MR reports where radiologists prefer to utilize a fast efficient editor, although it is also sometimes used for complex plain film reports..

INS145

Creation of Custom Cranial Implant for Wounded Warriors Using Digital Technology and Additive Manufacturing (3D Printing) (Station #2)

Peter Constantine Liacouras PhD (Presenter): Nothing to Disclose , Gerald Thomas Grant DMD, MS : Nothing to Disclose , Vincent B. Ho MD, MBA : In-kind support, General Electric Company

CONCLUSION

These benefits have led to better surgical outcomes of our Wounded Warriors

Background

Additive Manufacturing (3D Printing), three-dimensional reconstructions, and digital design software have aided in the evolution of custom cranial implants. Traditionally, large cranial implants were fabricated by a moulage impression of a patient's cranium to acquire a stone model with a best estimate of the missing skull section, a wax sculpture and stone mold of the proposed implant, and heat processing of Polymethylmethacrylate (PMMA). Smaller defects would be addressed by hand sculpting material or bending metal mesh in the operating room. Both methods resulted in modification of the implants and long operating times.

Evaluation

3D Reconstructions and Additive Manufacturing have allowed for high spatial resolution CT and MRI scans to be manufactured into physical models. In addition, digital design software can aid in the creation of a template to be molded and manufactured from Polymethyl methacrylate (PMMA), or aid in the creation of a custom implant to be manufactured directly on a 3D Printer from metals such as titanium.

Discussion

These custom manufactured implants have many direct and indirect clinical advantages including: an enhanced pre-surgical plan/understanding, more precise borders and contours for optimized implant fit, shorter surgical times, shorter manufacturing times, and improved patient education.

INS146

Detection of Metastatic Lesion with Triple Fusion of MR, PET, and CT Images based on Bone-edge Specific Maximum Overlapping (BESMO): A Retrospective Study of Patients with Metastasis Clinical Application of Triple Fusion of MR, PET, and CT Images Base (Station #3)

Young Han Lee MD (Presenter): Nothing to Disclose , Dosik Hwang : Nothing to Disclose , Jaemoon Yang : Nothing to Disclose , Dan Heo : Nothing to Disclose , Bonjune Kim : Nothing to Disclose , Jin-Suck Suh MD : Nothing to Disclose

CONCLUSION

The proposed triple fusion method using CT, PET, and MR can improve the delineation of the cortical bone and soft tissue. This triple fusion method might be utilized in pre-procedure planning such as CT-guided procedure.

Background

To evaluate the usefulness of triple fusion of MR, PET, and CT images based on Bone-edge specific maximum overlapping (BESMO) for CT-guided biopsy of MR- or PET-detected lesions.

Evaluation

The protocol of this retrospective review was approved by the institutional review board. The MR, PET, and CT images were retrieved from PACS server. The fusion images were retrospectively reconstructed using dedicated software written in Matlab (Mathworks). After acquiring DICOM images from PACS server, bone mask from CT and bone mask from MR were obtained to co-registration of the images. The bone contours from the CT and MR images were used as picking points to fuse the images. Co-registration scheme of Bone-edge specific maximum overlapping (BESMO) algorithm was verified to be geometrically practical. In order to determine the detection rates, 12 metastatic lesions from 5 patients were evaluated. All MR, PET, and CT images and various fusion images were retrospectively evaluated in terms of visualization of metastatic lesions.

Discussion

Triple image fusion software was implemented at real-time workstation based on automatic co-registration. The MR, PET, and CT images can be fused across modalities of MR/PET, MR/CT, PET/CT, and MR/CT/PET by applying transparent layer. Each modality can be seen as a layer, and the visualization weighting factors can be controlled in terms of transparency. We evaluated the metastatic lesions on various fusion images and each modality images presenting metastasis, and these images showed no significant difference for each modality in statistics. Additionally, triple fusion images could visualize bone cortical lesion as well as soft tissue lesions.

INS147

How to Leverage Electronic Medical Record to Administer a Lung Cancer Screening Program (Station #4)

Michael Hanley MD (Presenter): Nothing to Disclose , Genevieve G. Easley BS : Nothing to Disclose , Cree Michael Gaskin MD : Author with royalties, Oxford University Press Author with royalties, Thieme Medical Publishers, Inc , Arun Krishnaraj MD, MPH : Nothing to Disclose , Juliana Marcela Bueno MD : Co-author, Oxford University Press , Juan Miguel Olazagasti MD : Nothing to Disclose

CONCLUSION

As Lung Cancer Screening with annual low dose CT becomes more common, the challenge will rest with ensuring studies are performed and interpreted at the highest standards and that patients are not lost to follow-up. Using your existing EMR can provide the structure and support needed to separate your facility from just being able to offer a low dose Chest CT to offering a Comprehensive Lung Cancer Screening Program.

Background

Most Health Systems in the United States now offer a low dose CT scan for lung cancer screening and many are in the process of developing screening programs. While many Health Systems have the technology to conduct the low dose CT, most lack the infrastructure to offer a comprehensive screening program. We anticipate the future of Lung Cancer Screening Programs to parallel the current practice of screening mammography for breast cancer. With anticipated regulation and/or guidelines we have set out to use our existing Electronic Medical Record (EMR) to assist in the management of patients eligible and those subsequently enrolled in Lung Cancer Screening.

Evaluation

In order to facilitate our Lung Cancer Screening Program we were able to make minor modifications in our existing EMR and tasked it with the following: Identify - Identify patients within our EMR who are eligible and notify the patient's PCP. Record - Record CT scan results and follow-up recommendations. Follow-up - Remind both the PCP and the patient of their yearly screening CT. Identify patients who are not adhering to recommendations and allow our coordinator to initiate contact. Quality Assurance - Ability to audit CT reports to ensure recommendation are consistent with national guidelines and that individual readers are falling within expected guidelines.

Discussion

The use of our existing EMR to administer our Lung Cancer Screening Program had many benefits when compared to a stand-alone program. By expanding existing pathways for PCP notification we were able to get immediate support. We received feedback from PCPs and were able to modify workflow in a way that improved

patient care and did not put excess burden on the health system.

INE130

How to Demonstrate As Low as Reasonably Achievable (ALARA) by Generating Institutional Dose Reference Levels (Local Dose Reference Levels) for Computed Tomography Using Automated Dose Tracking Software (Station #5)

Bruce G. Gray MD : Nothing to Disclose , Marie Kate MacGregor MPH (Presenter): Consultant, Bayer AG , Timothy Richard Dowdell MD : Nothing to Disclose

TEACHING POINTS

This presentation will demonstrate the methods for auditing computed tomography (CT) radiation dose for a patient population through the development of institutional dose reference levels that can be used for quality control. We will demonstrate how to use these dose reference levels in prospective monitoring of radiation by protocol, equipment and operator.

TABLE OF CONTENTS/OUTLINE

1. How can we demonstrate "As Low As Reasonably Achievable" in our institutions? Why is this important? 2. How have Dose Reference Levels (DRLs) been used in quality control and quality improvement for computed tomography? 3. What is the evidence that DRLs can affect optimum dose levels for CT? 4. How are LDRLs generated using an historical database of patient examination data?How is image quality taken into consideration in establishing LDRLs by protocol? 5. What are the best methods for sorting CT examination data by protocol/equipment for making DRL comparisons? 6. How is statistical significance determined for new LDRLs and how are new LDRLs used for prospective monitoring of radiation dose? 7. Adapting LDRLs for specific patient demographics: pediatrics, young adults, women 8. How can the CT radiation dose distributions by protocol be used to begin dose optimization?

RCA24

National Library of Medicine: Save Searches, Get Updates: The Free PubMed My NCBI Tool (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 2:30 PM - 4:00 PM Location: S401AB

Participants

Holly Ann Burt MLIS (Presenter): Nothing to Disclose
Patricia Devine MLS (Presenter): Nothing to Disclose
Jamie T. Dwyer MLS (Presenter): Nothing to Disclose
Stephanie Friree MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Use My NCBI to personalize PubMed. 2) Understand how to save search strategies and create email alerts. 3) Use filters to link to library full-text articles and to focus PubMed searches. 4) Understand how to save collections of citations including a personal bibliography.

ABSTRACT

In this hands-on workshop session, explore the free My NCBI tool in PubMed. Discover how to save search strategies, create email alerts to keep up with the latest publications, create instant links to library full-text resources, and build permanent online bibliographies. Topics covered include creating a free My NCBI account, adding search and library filters to PubMed, using My Bibliography to create an online list of personal publications, and the link between the NIH Manuscript Submission System and PubMed. Important notes on PubMed searching will also be included. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov); MEDLINE is a subset of PubMed.

URL's

http://nnlm.gov/training/resources/myncbi8.pdf

Handout:Holly Ann Burt

http://media.rsna.org/media/abstract/2014/14003438/myncbiRSNA2014.pdf

RCB24

Using RSNA Clinical Trial Processing (CTP) Software for Deidentification, Clinical Trials and Research Applications (Hands-on)

Refresher/Informatics

RS IN RS IN RS IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 2:30 PM - 4:00 PM Location: S401CD

Participants

John Perry (Presenter): Nothing to Disclose
Justin Kirby (Presenter): Stockholder, Myriad Genetics, Inc
Bradley J. Erickson MD, PhD (Presenter): Stockholder, Evidentia Health, Inc

LEARNING OBJECTIVES

1) Learn how to install, configure, and use the RSNA's CTP software for clinical trials and research dataset processing. 2) Learn about the the unique challenges of DICOM image de-identification and how to utilize CTP to implement the Attribute Confidentiality Profile (DICOM PS 3.15: Appendix E) to properly de-identify DICOM images. 3) Learn how to customize CTP to process and transfer imaging studies according to the requirements of common research study scenarios.

ABSTRACT

Clincial Trial Processor (CTP) is a highly configurable and extensible stand-alone program that provides many features necessary for managing imaging as part of a clinical trial or research study. In this course participants will be provided with an overview of CTP's functionality, and then perform hands-on image processing of sample data based on common reserach and clinical trial scenarios. Addtionally, participants will receive an overview of the unique challenges associated with de-identifying DICOM images and learn about using CTP to implement the DICOM standard's guidance for how best to ensure removal of PHI without compromising the utility of the data for research.

URL's

http://rsna.org/ctp.aspx
https://wiki.cancerimagingarchive.net/display/Public/De-identification+Knowledge+Base

RCC24

IHE Clinical Solutions for Interoperability - Imaging and Beyond: IHE and HIE does the Order Matter?

Refresher/Informatics

IN **IN**

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 2:30 PM - 4:00 PM Location: S501ABC

Participants

Moderator
David S. Mendelson MD : Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Corporation
David S. Mendelson MD (Presenter): Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Corporation
Albert Edwards (Presenter): Nothing to Disclose
Jean Chalaoui MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the organization of IHE and the IHE profiles. 2) Understand the importance of interoperability in healthcare. 3) Learn about the various IHE profiles that address interoperability, including XDS. 4) Learn about how XDS-I and related profiles address interoperability for imaging. 5) Learn about real world implementations regarding interoperability and how IHE profiles have been employed to solve interoperability issues including: a. The RSNA Image Share b. Cleveland Clinic enterprise-wide multi-specialty imaging integration and implementation c. Canada Health Infoway: emphasis on the Province of Quebec Project d. Kaiser Permanente. 6) Understand the challenges in attaining safe, secure and transparent interoperability.

ABSTRACT

This course will focuson HIT inteoperability and its importance in providing for the optimal care of patients. The session will start with a review of standards and the role of IHE. The discussion will then move to real world implementations at the Cleveland Clinic and in Canada where the Canada Health Infoway project is underway.

SSE13

Informatics (Workflow and Displays)

Scientific Papers

IN

AMA PRA Category 1 Credits ™: 1.00

ARRT Category A+ Credit: 1.00

Mon, Dec 1 3:00 PM - 4:00 PM Location: S402AB

Participants

Moderator
Jesse Chusid MD : Nothing to Disclose
Moderator
Arnon Makori MD : Medical Advisory Board, Carestream Health, Inc
Moderator
George Lee Shih MD, MS : Consultant, Image Safely, Inc Stockholder, Image Safely, Inc Consultant, Angular Health, Inc Stockholder, Angular Health, Inc

Sub-Events

SSE13-01 Reducing RECIST (Response Evaluation Criteria in Solid Tumors) Index Lesion Selection Variability through Radiology-driven Candidate Selection

Merlijn Sevenster PhD : Employee, Koninklijke Philips NV , Paul J. Chang MD (Presenter): Co-founder, Stentor/Koninklijke Philips Electronics NV Technical Advisory Board, Amirsys, Inc Research Contracts, Koninklijke Philips NV Medical Advisory Board, lifeIMAGE Inc Medical Advisory Board, Merge Healthcare Incorporated , Jeffrey Bozeman BA : Nothing to Disclose , Andrea Cowhy BS : Nothing to Disclose , Piotr Roman Obara MD : Nothing to Disclose , Joost Peters : Employee, Koninklijke Philips NV , Manish Sharma MD : Nothing to Disclose , Will Trost BA : Nothing to Disclose , Lauren Wall MS : Nothing to Disclose , Charles William Westin MD : Nothing to Disclose

PURPOSE

RECIST guidelines objectivize treatment response assessment in oncology trial patients by standardizing comparison of index lesions. Clinical research associates (CRAs) typically select index lesions that are described in a narrative radiology report. We describe a Lesion Dashboard (LD) tool that presents index candidates that were identified by the radiologist as selectable items leveraging an electronic based workflow orchestration. The LD tool presents these index lesions in a longitudinal view on patient disease progression. We measure agreement in index lesion selection comparing the traditional manual and LD workflows.

METHOD AND MATERIALS

RECIST worksheets of 9 trial patients were obtained under IRB 13-0397. Images and reports of each worksheet's first two cycles were obtained and deidentified. Part 1: Mimicking the traditional workflow, 4 CRAs reviewed the 2 deidentified radiology reports for each patient, selected index lesions out of the candidates described, and transcribed these into a blank RECIST worksheet Part 2: Radiologists measured and annotated all candidates discussed in the reports on the images. Annotation data was persisted in AIM-consistent format and electronically sent to LD. 3 oncologists and 3 CRAs subsequently selected and marked candidates as index lesions in LD and completed RECIST response assessment consistent with anticipated use of LD. F-measure statistic was used to quantify agreement between selections.

RESULTS

Part 1: Agreement between CRAs for selecting index lesions was 75%. Part 2: LD contained 42 candidates. Participants selected 94% of LD candidates as index lesions (oncologists: 92%; CRAs: 97%). 22% of CRA selected index lesions in part 1 were not candidate lesions in LD. Agreement was 98% for CRAs, 94% for oncologists, 96% for all participants.

CONCLUSION

Substantial variability exists in index lesion selection by end users in the traditional workflow, which is nearly eliminated by utilizing LD as users generally comply with the radiologist's index lesion suggestions. By consuming computer-interpretable data generated upstream, LD leverages the radiologist's expertise in the oncology workflow.

CLINICAL RELEVANCE/APPLICATION

Oncology index lesion selection variability using traditional methods is significant. Electronic based workflow orchestration can reduce variability and better leverage the radiologist's expertise and relevance in oncologic patient management.

SSE13-02 iPad Accuracy in the Diagnosis of Thoracolumbar Spine Fractures on Conventional Radiographs

Maria T. Tzalonikou MD (Presenter): Nothing to Disclose , John Spigos BS : Nothing to Disclose , Socratis Gavriilidis MD : Nothing to Disclose , Georgios Velonakis MD : Nothing to Disclose , Irene Vraka MD : Nothing to Disclose , Eric C. Bourekas MD : Nothing to Disclose , John Andreou MD : Nothing to Disclose , Spyros D. Yarmenitis MD : Nothing to Disclose , Dimitrios G. Spigos MD : Nothing to Disclose

PURPOSE

To evaluate the usefulness of tablets in the diagnosis of thoracolumbar spine fractures in a general hospital's emergency department

METHOD AND MATERIALS

Sixty-one consecutive thoracolumbar trauma cases were evaluated retrospectively. Radiographs and the corresponding diagnostic reports were retrieved from the PACS-RIS database. They included 36 cases with fractures, both acute and chronic, and 25 cases without a fracture. The images were anonymized and distributed after randomization to two attending radiologists and to two radiology residents. They used diagnostic monitors and a non-retina display iPad2 device. DICOM images were transferred to the iPad in a compressed 1263x1536 matrix.

RESULTS

On the diagnostic monitors, the attendings made 104 correct and 18 incorrect diagnoses, while the residents made 99 correct and 23 incorrect diagnoses. On the iPad, the attendings made 103 correct and 19 incorrect diagnoses, while the residents made 107 correct and 15 incorrect diagnoses. In the detection of fractures, the iPad had a sensitivity 87.50%, specificity 84.00%, positive predictive value 88.73%, negative predictive value 82.35% and accuracy 86.07%. As a group, the attendings and residents made 203 correct and 41 incorrect diagnoses on the monitors and 210 correct and 34 incorrect diagnoses on the iPad. The accuracy of interpretation of attending radiologists was the same on both devices while the residents performed better on the iPad

CONCLUSION

Based on this study, tablets are as accurate in the diagnosis of thoracolumbar spinal fractures on conventional radiographs. Although the diagnostic monitors are the primary diagnostic devices in radiology departments, tablets will play an important role in the emergency department and for teleradiology purposes

CLINICAL RELEVANCE/APPLICATION

Spinal fracture radiographs can be diagnosed on iPad as accurately as on diagnostic monitors

SSE13-03

Organ-specific Windowing: Providing CT Images with an "MRI Look" for Faster Interpretation of CT Studies

Reuven Shreiber MD (Presenter): Employee, Algotec Limited , Guy Engelhard PhD : Employee, Algotec Limited , Tiferet A. Gazit MSc : Employee, Algotec Limited , Roni Shreter MD : Nothing to Disclose , Doron Fischer BSc, MD : Nothing to Disclose , Luda Goralnik : Nothing to Disclose

PURPOSE

Imaging data sets such as CT, MRI and PET are characterized by a highly dynamic range of pixel values, which must be reduced for the purpose of display. Regular windowing processes cover only a fraction of the dynamic range, which renders it necessary to use several different sets of windowing procedures for the reading of a single study. In chest CT images, for example, the user has to use three separate sets of windowing levels: bone, mediastinum and lung windows in the same reading. Several filters have been used in the past in an attempt to locally enhance the contrast while incorporating all of the required windowing operations into a single set. These methods are based on High Dynamic Range (HDR) imaging but are not clinically employed because the output has been too different from the images to which radiologists are used. A new method is suggested whereby segmentation of the main organs in a CT scan is performed, and several windows are assigned to a single image according to the various organs being shown on screen. For example, if a lung and bone segmentation is generated, the application assigns a lung window to the lung , a bone window to the bone and a body window to the rest (see figure).

METHOD AND MATERIALS

Several examples of CT studies, including dual energy ones, were tested by 4 experienced radiologists. After segmentation of the main organs in the study the windowing procedure was applied using different window settings for each of the organs. This yielded an MRI appearance to the read images. The results were viewed by the radiologists.

RESULTS

When viewing abdomen, lung and bone windows on a unified view, an 'MRI-like appearance' was observed and accepted by all radiologists as a satisfactorily familiar view.

CONCLUSION

While in HDR and other filter-type methods used in the past in an attempt to apply the same filtering to the entire image the resulting image did not present characteristics radiologists expected to see, the proposed method yields images possessing characteristics with which radiologists are familiar. This results from the fact that the windowing settings applied to the various organs in the image are standard windowing levels and widths using the familiar linear mappings in each region.

CLINICAL RELEVANCE/APPLICATION

The proposed organ-specific windowing is expected to provide a faster viewing of CT and MRI studies with minimal need for manual windowing operations.

SSE13-04

Are Medical Displays Calibrated to GSDF or sRGB Sufficient for High Quality Visualization of Color Medical Images?

Tom Kimpe PhD (Presenter): Employee, Barco nv , Albert Xthona : Employee, Barco nv

CONCLUSION

This paper has shown that calibrating medical color displays to DICOM GSDF or sRGB does not offer sufficiently stable nor perceptally linear color behavior. CSDF, a recently proposed extension to DICOM GSDF offers a better reproducible color behavior with improved perceptual linearity. The differences between the three calibration targets result into visible differences for several types of medical images.

Background

Use of color images has increased significantly the last few years. Sometimes color is only used for annotations but in other cases color is clinically relevant eg. for fused multimodality images or quantitative imaging.

There is no standard yet for color calibration and QA on medical displays. The de facto situation today is that color displays are calibrated to DICOM GSDF (which only standardizes greyscale behavior and leaves color unstabilized). Sometimes also (consumer level) sRGB displays are used for visualization of color medical images.

Evaluation

This paper evaluates whether DICOM GSDF and sRGB offer sufficient stability and quality for visualization of color medical images. Recently a color extension to DICOM GSDF has been proposed: CSDF. Color performance of CSDF will also be evaluated and compared with GSDF and sRGB. As a first step the current situation will be explained by clearly describing what the color behavior is of medical displays calibrated to DICOM GSDF or sRGB and how CSDF differs. Secondly, metrics for color stability, as well as perceptual linearity of color will be reported. Finally the impact of the calibration algorithm (GSDF vs sRGB vs CSDF) will be visually shown and quantified for different types of medical images.

Discussion

Measurement data of a large sample of medical color displays shows that significant color instabilities remain with DICOM GSDF or sRGB. Variability in color behavior even between display systems of the same type can easily be tens of percents. CSDF offers much more stable color behavior as proven by improved metrics for perceptual linearity. Visual differences between the three calibration targets are large and easily perceivable on medical images.

SSE13-05

Reader Efficiency Using a Dedicated Workstation for Rapid Observer Performance Studies in Low-dose CT

David R. Holmes PhD (Presenter): Nothing to Disclose , Rickey Carter PhD : Nothing to Disclose , Cynthia H. McCollough PhD : Research Grant, Siemens AG , Maria Shiung : Nothing to Disclose , Lifeng Yu PhD : Nothing to Disclose , Kurt Ernest Augustine MS : Nothing to Disclose , Joel Garland Fletcher MD : Grant, Siemens AG , Norbert Gilles Joseph Campeau MD : Nothing to Disclose , Amy Louise Kotsenas MD : Nothing to Disclose , Sudhakar Kundapur Venkatesh MD, FRCR : Nothing to Disclose , Naoki Takahashi MD : Nothing to Disclose , David Maitland Hough MD : Nothing to Disclose , Anne-Marie Gisele Sykes MD : Nothing to Disclose , Phillip Edwards : Nothing to Disclose , Vance Lehman MD : Nothing to Disclose

PURPOSE

Observer performance studies in low dose CT are hampered primarily by the expense and time required for radiologist evaluation. We sought to determine if a workstation designed to facilitate reader studies in low dose CT would result in reader times of less than 5 minutes for common diagnostic tasks in CT.

METHOD AND MATERIALS

We constructed an open source workstation that permits automatic anonymization and randomization of CT datasets; customizable reader surveys for organ location, diagnosis, and image quality; tools for circumscription of pathological findings; viewing and correlation of axial and non-axial images; local image database for efficient retrieval; and server-based results database for statistical export. For each of 3 diagnostic tasks (abdominal CT for liver metastasis, head CT for acute neurologic deficit, chest CT for nodule detection), 3 subspecialized radiologists examined CT images of varying dose levels and reconstruction methods as part of an ongoing study. Readers were required to circumscribe all pathologic findings, give presumptive diagnoses and levels of confidence, and complete a brief image quality survey for each case. Reader times were automatically recorded for each case, with mean reader times and interquartile ranges (IQR) reported for each diagnostic task.

RESULTS

Three subspecialized radiologists interpreting abdominal, head and chest CT each interpreted a mean of 339, 354, and 234 cases, respectively. Mean reading times for abdominal and neurological radiologists was 2.80 ± 0.82 and 3.05 ± 0.63 minutes, respectively (abdominal IQR: 1.37 - 3.08; head IQR: 1.92 - 2.48). Mean reading times for chest radiologists was 4.48 ± 1.81 minutes (IQR: 2.5 - 5.5), with 2/3 radiologists having mean interpretation times between 5 and 6 minutes. For each diagnostic task, reading times varied significantly between pairs of readers ($p < 0.004$).

CONCLUSION

A workstation that minimizes radiologist effort can drastically reduce reader times to 5 minutes or less for common diagnostic tasks in low dose CT, and facilitate performance of multi-reader, multi-case studies. Interpretation times can still vary markedly depending on diagnostic task and individual readers.

CLINICAL RELEVANCE/APPLICATION

Dedicated workstations designed for low dose CT studies can reduce interpretation times to approximately 5 minutes or less and facilitate rapid completion and substantial cost savings for observer performance studies.

SSE13-06

Improved Reporting Efficiency and Accuracy from Field Pre-Population in Templated Reports

Maximilian Cho MD (Presenter): Nothing to Disclose , Mark Daniel Kovacs MD : Nothing to Disclose , Michael A. Trambert MD : Medical Advisor, DR Systems, Inc

PURPOSE

With integration of the RIS, PACS, and reporting systems, patient identifiers and exam information can automatically map into exam reports. This automation should result in fewer errors, increased speed, and less fatigue for the radiologist. Many sites do not offer this level of integration and automation. This study assesses the potential benefits of report automation to radiologist workflow and efficiency.

METHOD AND MATERIALS

13 staff radiologists and 9 radiology residents completed an anonymous 12 question 5 point survey. Respondents were asked if automatic pre-population of exam description, comparison exam data, indications, CT dose, technique, and copy to physician data saved time, decreased fatigue, and increased accuracy. Respondents were asked if the "copy findings" function in which findings from a previous exam are copied into the current report, saved time. 9 radiologists were asked to dictate these fields for 8 mock exams (2

ultrasound, 2 plain x-ray, 2 CT, and 2 MR) to simulate an environment where RIS, PACS and reporting are not tightly integrated. Subjects were timed and reporting errors monitored. These results were then used to calculate projected time savings and error rates on a mix of 100 studies -40 XR, 20 US, 20 CT, 20 MR- an estimate of daily workload for a radiologist.

RESULTS

95% surveyed (21 of 22) responded that report automation saved time. 91% responded that report automation improved accuracy of dictations. 82% responded that report automation decreased their fatigue. 83% of copy finding function users reported time savings.
Average time to dictate these pre-populated fields was 51 seconds per study. Average error rate per report was 0.85, with an average of 0.27 errors remaining uncorrected upon report completion.
Average time per day saved per radiologist from report automation was 75 minutes. Average corrected errors was 60 per day. Average uncorrected/missed errors was 26 per day.

CONCLUSION

Report automation using pre-populated fields was measured to save 75 minutes per day per radiologist, improve accuracy by avoiding 86 errors per day, and found to decrease fatigue for the radiologist. This automation results from tight integration of RIS, PACS, and reporting systems.

CLINICAL RELEVANCE/APPLICATION

Report automation, in which exam report fields are automatically populated/mapped into the report, results in significantly improved radiologist efficiency and accuracy with decreased fatigue.

RCB25

Hands-on Introduction to Social Media (Hands-on)

Refresher/Informatics

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credit: 0

Mon, Dec 1 4:30 PM - 6:00 PM Location: S401CD

Participants

C. Matthew Hawkins MD (Presenter): Nothing to Disclose
Safwan Halabi MD (Presenter): Nothing to Disclose
Garry Choy MD, MS (Presenter): Nothing to Disclose
Neil U. Lall MD (Presenter): Nothing to Disclose
Tirath Yogesh Patel MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the professional relevance of social media for radiologists. 2) Understand the differences between Facebook pages and personal accounts. 3) Better grasp how hospitals and groups can use Facebook to connect with patients. 4) Setup and use a Twitter account. 5) Understand the purpose of hashtags, lists, and DMs. 6) Get acquainted with other radiologists and radiology organizations on Twitter. 7) Evaluate enterprise solutions for managing multiple social media accounts for larger groups and organizations. 8) Understand how to safely /securely communicate via social media while maintaining HIPAA requirements.

Active Handout

http://media.rsna.org/media/abstract/2014/11035017/RCB25 sec.pdf

RCC25

Precision Medicine through Image Phenotyping

Refresher/Informatics

IN BQ VA CH CA IN BQ VA CH CA

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 4:30 PM - 6:00 PM Location: S501ABC

Participants

Moderator
Ella A. Kazerooni MD : Nothing to Disclose

LEARNING OBJECTIVES

1) To learn what the term precision medicine means. 2) To understand how informatics intersects with clinical radiology to enable precision medicine in practice. 3) To learn through concrete examples how informatics based radiology precision medicine impacts health

ABSTRACT

Biomarkers have been emrabced by both the scientific and regulatory communities as surrogates end points for clinical trials, paving the way for their widespread use in medicine. The field of imaging biomarkers has exploded, and the their integration into clinical practice relies heaving on and intersects with the field of bioinformatics.. Once specific biomakers are show to have value, easily integrating them into the digital environment of the radiologist and communcating them to the health care providers and or directly to patients effeiciently and seamlessly is important for their value and impact on health to be realized. Culturally, it is taking radiologists from the era of description and largely qualitative reporting, into a quantitative future state, and leveraging informatics to extract information from imaging alone ot together with data available in the electronic medical record is essential for future sucess in this new world. To get there, understanding the impact of this approach as a value of our services, and standardization of imaging technques along the lines of what the RSNA QIBA initiative is designing, are essential, so that imaging biomarkers are robust, accurate and reprodicbile. Embraching this approach enables and facilitates new appracohes, relationships of imaging and IT researchers, vendors and consumers, to fully realize the possiblities. This course will discuss and describe the overall constructs, and use tangible exams of using this in practice today and for the future.

Sub-Events

RCC25A

Imaging Biomarkers Meet Informatics: The Personalized Medicine Construct

Ella A. Kazerooni MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

View abstract under main course title.

RCC25B

Lung Nodules: Combining Population and Patient Specific Data to Inform Personalized Decision Making

Eliot L. Siegel MD (Presenter): Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

LEARNING OBJECTIVES

1) Describe how data from a clinical trial can be repurposed as a decision support tool. 2) List some of the potential techniques that can be utilized to predict likelihood of a malignant nodule from the NLST database. 3) Explain how the Fleischner Guidelines can be personalized utilizing data from NLST and PLCO. 4) Detail the implications for lung screening trials of having access to NLST and PLCO data. 5) Demonstrate how a healthcare enterprise can create their own local reference database using information from their own patient population.

ABSTRACT

The era of personalized/precision medicine offers the potential to utilize patient and lesion specific data to personalize screening and diagnostic work-up, diagnosis, and treatment selection to a particular patient to optimize effectiveness. Although recently, the emphasis has been on utilization of genomic data in personalized medicine, there is a 'gold mine' of useful data in previously conducted clinical trials as well as patient medical electronic records that has, until now, gone largely untapped. The purpose of this presentation is to describe how the screening, diagnosis, and treatment of lung nodules can be personalized utilizing data from the NLST and PLCO clinical trials and how the Fleischner Guidelines and screening criteria for lung cancer can be modified according to the characteristics of an individual patient and individual nodule. The presentation will also include ways in which a facility can collect local data on their own patients to supplement these reference databases with experience from their own patient population.

RCC25C

Managing Cardiovascular Care through Image Phenotyping Combined with Patient Level Data

John Jeffrey Carr MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI21

Special Interest Session: Radiology and Pathology Diagnostics: Is It Time to Integrate?

Special Courses

LM IN V

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 4:30 PM - 6:00 PM Location: E351

Participants

Moderator
Mitchell Dennis Schnall MD, PhD : Nothing to Disclose
Moderator
Michael D. Feldman MD, PhD : Nothing to Disclose

LEARNING OBJECTIVES

1) Learn about the potential value that would come from better integration of pathology and radiology. 2) Learn about near term opportunities for improving workflow and performance through coordination of Radiology and Pathology. 3) Learn about the future of molecular diagnostics integrating imaigng and tissue assays.

Sub-Events

SPSI21A

Goals and Associated Value Proposition Related to Radiology and Pathology Integration

Mitchell Dennis Schnall MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI21B

Near Term Opportunities for Radiology and Pathology Integration

Michael D. Feldman MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

There are several challenges to meaningfully integrating clinical radiologic and pathologic information. These include issues of sampling and geographic registration, and practical matters of developing a shared workflow and integrated information systems as well as a common culture. These challenges invite research opportunities to investigate the most effective ways to extract diagnostic information from both molecular markers and imaging data, and to optimize evidence-based utilization of diagnostic tools for best patient outcomes. If done well, integrated and intelligent radiology/pathology information systems and processes may catalyze the realization of precision medicine.

SPSI21C

Integrating Molecular Diagnostics and Molecular Imaging

Martin Gilbert Pomper MD, PhD (Presenter): Grant, Eisai Co, Ltd Grant, Eli Lilly and Company Founder, Cancer Targeting Systems, Inc Board of Directors, Cancer Targeting Systems, Inc Founder, Theraly Pharmaceuticals Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI21D

Panel Discussion

Mitchell Dennis Schnall MD, PhD (Presenter): Nothing to Disclose , Michael D. Feldman MD, PhD (Presenter): Nothing to Disclose , Martin Gilbert Pomper MD, PhD (Presenter): Grant, Eisai Co, Ltd Grant, Eli Lilly and Company Founder, Cancer Targeting Systems, Inc Board of Directors, Cancer Targeting Systems, Inc Founder, Theraly Pharmaceuticals Inc , Carolyn C. Meltzer MD (Presenter): Board of Directors, ACR Image Metrix , Curtis P. Langlotz MD, PhD (Presenter): Shareholder, Montage Healthcare Solutions, Inc Advisory Board, Reed Elsevier Advisory Board, Activate Networks, Inc Spouse, Consultant, Johnson & Johnson , Jeffrey C. Weinreb MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

SPSI23

Special Interest Session: Image Wisely

Special Courses

SQ IN V

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 4:30 PM - 6:00 PM Location: S505A

Sub-Events

SPSI23A

Image Wisely Overview

Richard L. Morin PhD (Presenter): Nothing to Disclose , William W. Mayo-Smith MD (Presenter): Author with royalties, Reed Elsevier Author with royalties, Cambridge University Press

SPSI23B

Fluoroscopy Campaign Launch, Team Performance

James R. Duncan MD, PhD (Presenter): Consultant, Novita Therapeutics, LLC Consultant, Proteon Therapeutics, Inc

LEARNING OBJECTIVES

1) List team members for fluoroscopic procedures and their typical responsibilities. 2) Describe the role of shared mental models in teamwork. 3) Write in order the common stages of team development. 4) Produce examples of how teamwork improves radiation safety during fluoroscopic procedures.

SPSI23C

Checklists, Task-specific and Patient Specific Factors

Steven Y. Huang MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Promote a checklist for fluoroscopic radiation safety designed to decrease radiation dose to the patient and radiology staff while preserving image quality. 2) Explain how task-specific and patient-specific factors can affect radiation dose and image quality during a fluoroscopic procedure. 3) Be familiar with the various techniques in which dose reduction can be successfully applied.

ABSTRACT

Radiation dose during a fluoroscopic procedure is dependent on many factors. While some factors are fixed (e.g. body habitus), others can be manipulated to minimize radiation dose to the patient and radiology staff. This presentation focuses on optimizing radiation use by adhering to basic radiation safety principles and tailoring fluoroscopic procedures to task- and patient-specific factors.

SPSI23D

Technical Principles for Interventional Procedures

James R. Duncan MD, PhD (Presenter): Consultant, Novita Therapeutics, LLC Consultant, Proteon Therapeutics, Inc

SPSI23E

High/Substantial Dose Patient Management

Stephen Balter PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand key aspects of radiobiology and technology that influence tissue reactions. 2) Understand guidelines for radiation management before, during, and after a procedure. 3) Understand the applicability of QA/QI processes to high-dose interventional procedures.

ABSTRACT

Fluoroscopically guided interventional procedures offer patients both clinical and economic benefits. Radiation-induced tissue reactions continue to be an uncommon side-effect of these procedures. Radiogenic tissue reactions should never come as a surprise to either the operator or the patient. A tissue reaction cannot always be avoided, but its magnitude can usually be minimized. Minimizing the likelihood and severity of reactions such as skin injuries requires appropriate action before, during, and after each procedure. This presentation reviews key elements of radiobiology, technology, operational guidelines, and administrative tools for interventional radiation management.

SPSI24

Special Interest Session: Clinical Decision Support for Imaging: Update on Current State and New Federal Regulations

Special Courses

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Mon, Dec 1 4:30 PM - 6:00 PM Location: N228

Participants

Moderator
Ronald L. Arenson MD : Nothing to Disclose
Keith David Hentel MD, MS (Presenter): Nothing to Disclose
Bibb Allen MD (Presenter): Nothing to Disclose
Ramin Khorasani MD (Presenter): Consultant, Medicalis Corp

LEARNING OBJECTIVES

1) Describe the context (e.g., concerns about inappropriate use of imaging, quality and waste-pre-auth programs, and federal regulations including meaningful use, and promoting evidence based practice) urgency, and future federal requirements for the use of decision support for improving appropriateness of diagnostic imaging. 2) Define decision support, describe attributes of effective decision support and discuss current understanding of impact of CDS on use of imaging. 3) Describe ACR's approach and direction regarding CDS. 4) Describe current gaps, opportunities and future directions in imaging CDS with focus on pending regulations (e.g., quality and sources of evidence, optimal integration into the EHR).

RC321

Medical Physics 2.0: Information Management and Display

Refresher/Informatics

IN **PH**

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 8:30 AM - 10:00 AM Location: S403B

Sub-Events

RC321A

Information Management and Display Perspective

Ehsan Samei PhD (Presenter): Research Grant, Siemens AG Research Grant, General Electric Company Research Grant, Carestream Health, Inc

LEARNING OBJECTIVES

1) To gain an appreciation for interaction between medical physics and information technology in modern medicine
2) To understand how physics can add value to patient care in the area of information and image management and technology.

RC321B

Information Management and Display 1.0

Donald Peck PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the different areas of imaging informatics.
2) Understand the methodology for developing informatics standards and their current status
3) Understand the components of various informatics systems
a. Enhanced DICOM objects
b. Vender neutral archives for enterprise image storage
c. Web distribution protocols
d. Dose monitoring
e. Reporting systems
f. Structured reports

ABSTRACT

Imaging informatics is part of every radiology practice today. Imaging informatics covers everything from the ordering of a study, through the data acquisition and processing, display and archiving, reporting of findings and the billing for the services performed. The standardization of the processes used to manage the information and methodologies to integrate these standards is being developed and advanced continuously. These developments are done in an open forum and imaging organizations and professionals all have a part in the process. In this presentation the flow of information and the integration of the standards used in the processes will be reviewed. The role of radiologists and physicists in the process will be discussed. Current methods for validation of informatics systems function will also be discussed.

RC321C

Information Management and Display 2.0

Michael James Flynn PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the display performance evaluation methods used for monitor QA.
2) Understand current guidelines for display systems that are used for medical imaging.
3) Learn about emerging requirements for handheld display, and color display.

RC353

3D Printing: A Powerful Tool for Applied Imaging Science

Refresher/Informatics

IN IR VA NR IN IR VA NR IN IR VA NR

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 8:30 AM - 10:00 AM Location: N226

Participants

Moderator
Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

1) To review current applications for 3D printing in biomedical imaging science. 2) To discuss clinical problems in radiology for which imaging science with 3D printing can potentially improve patient care.

ABSTRACT

In broad terms, 3D printing can be used for to enhance clinical care and to enable investigation that would otherwise not be possible. This talk focuses on those research applications. For example, 3D models of individual phantoms will enable studies in CT that may be limited by radiation concerns, the delivery of large volumes of contrast, or both. In addition, research can be used to simulate individual organ systems. Finally, complicated pathophysiology may be amenable to 3D models and thus 3D technologies can expand current research in multiple applications.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

Sub-Events

RC353A

Validation of Coronary Contrast Gradients Using 3D Coronary Phantoms

Dimitris Mitsouras PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

3D printed models are poised to expand current investigations toward accurate functional CT and MR imaging that will likely open new horizons for diagnostic tool development that is not otherwise feasible due to patient considerations such as radiation burden, scan time, and monetary cost. 3D printing can produce hollow structures (e.g. vessels and airways) that, with appropriate selection of the printing technology (particularly with respect to the so-called "support" material) can replicate human physiology, including at the moment vascular compliance. Vascular phantoms have been successfully created from rotational digital subtraction angiography, CR, and MRI data sets. Early attempts begun with negative molds, namely 3D printing of a solid lumen to be used as mold around which to cure a silicon "vessel" wall. At present, the "vessel" wall can be printed with high accuracy (

RC353B

Blood Flow in the Thoracic Aorta Elucidated with 3D Models

Michael Markl PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

Flow sensitive MRI offers the ability to assess anatomy as well as flow characteristics in healthy and pathological blood vessels and is therefore an attractive tool for the diagnosis of vascular diseases. However, in-vivo studies do not allow the prediction of hemodynamic changes due to vascular modifications. Realistic vascular in-vitro 3D phantoms in combination with MRI flow measurements allow to model different vascular deformations and evaluate their effect on blood flow dynamics. This presentation will provide a review of the methods for the in-vitro simulation of aortic 3D blood flow with realistic boundary conditions and review previously reported application for the simulation of common aortic pathologies and their impact on aortic hemodynamics.

RC353C

3D Printing in Interventional Radiology and Vascular Surgeries

Matthew D Tam FRCR (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe potential workstream flows from CTA to a 3D printed model of the aorta. 2) Discuss the potential role of solid and hollow models of the vasculature to aid procedure planning, procedure execution and patient outcomes. 3) Gain an insight into future developments of the 3D printing industry.

ABSTRACT

3D printing has a major role to play in healthcare - procedure planning and execution, implant and device design, as well as facilitating better patient communication strategies and patient outcomes. Anatomically accurate patient-specific models of the vasculature can be constructed using 3D printing technologies. CT angiograms and DICOMS can be processed and the data converted into computer-aided design files using a range of different techniques and software. CAD files can then be 3d printed. In the setting of endovascular aneurysm repair, solid models of the lumen can be created and may be used to better understand complex anatomy. Hollow models can be created which can facilitate procedure execution through patient-specific rehearsal. 3D printing technologies will have further impact upon vascular and interventional radiology as both software, hardware and material science improves.

RC353D

3D Printing in Otolaryngology

Glenn E. Green MD (Presenter): Nothing to Disclose , Maryam Ghadimi Mahani MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC353E

3D Printing of Viable Tissues

Roger R. Markwald PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the development of the use of 3D applications in support of surgical reconstruction. 2) Describe the use of 3D Medical Applications in the support of Wounded Warrior Care.

ABSTRACT

Digital design and manufacturing technologies have been leveraged by the military in support of Wounded Warrior care since before the year 2000. A dedicated service for medical modeling was developed at the WRNMMC to provide 3D planning and manufacturing in the support of the DOD and wounded warrior care, expanding services to surgical simulations, development of surgical guides and custom implants, as well as support of research, occupational health and prosthetics world- wide. The purpose of this presentation is to present a review of the development of the use of digital design, digital manufacturing, and the establishment of 3D Medical Applications Center in support of Wounded Warrior Care.

URL's

http://www.wrnmmc.capmed.mil/ResearchEducation/3DMAC/SitePages/home.aspx

RC353F

Future Applications in 3D Printing

Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation

LEARNING OBJECTIVES

1) To review the current innovative literature in 3D printing related to radiology. 2) To hypothesize and discuss future applications in 3D printing for radiology.

ABSTRACT

One of the main applications of 3D visualization is to enhance diagnoses for which the anatomy in question is complex. Additionally, the planning for a specific intervention often requires a volumetric assessment. 3D printing in radiology is rapidly growing as a means to realize real 3D objects in 2D surfaces. The promise of this technology in the near future has spawned several new hypotheses that may define future applications. The purpose of this lecture is to review the literature and discuss novel ways that printed models can enhance radiology diagnoses and investigations.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

RC354

Health IT Incentive Programs: Experience from Radiology Practices in Hospitals and Health Systems

Refresher/Informatics

SQ IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 8:30 AM - 10:00 AM Location: S102C

Participants

Moderator
Ramin Khorasani MD : Consultant, Medicalis Corp
Ramin Khorasani MD (Presenter): Consultant, Medicalis Corp
Curtis P. Langlotz MD, PhD (Presenter): Shareholder, Montage Healthcare Solutions, Inc Advisory Board, Reed Elsevier Advisory Board, Activate Networks, Inc Spouse, Consultant, Johnson & Johnson
Keith David Hentel MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the meaningful use program. 2) Learn how hospitals and health systems have achieved meaningful use for their radiologists. 3) Decide how your practice should respond to the program.

RCA31

Slicer: Quantitative Medical Imaging for Clinical Research and Practice (Hands-on)

Refresher/Informatics

BQ IN BQ IN BQ IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 8:30 AM - 10:00 AM Location: S401AB

Participants

Sonia Marie-Aurore Pujol PhD (Presenter): Nothing to Disclose
Katarzyna J. Macura MD, PhD (Presenter): Nothing to Disclose
Ron Kikinis MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Enhance interpretation of DICOM images through the use of 3D visualization. 2) Gain hands-on experience with quantitative imaging tools developed in clinical research. 3) Present current directions of quantitative imaging biomarkers in clinical trials.

ABSTRACT

Quantitative imaging has the potential to bring valuable information for the assessment of treatment response. Technological breakthroughs in medical imaging hardware and the emergence of increasingly sophisticated image processing algorithms permit the estimation of quantitative parameters with increasing sensitivity and specificity. For the past 10 years, the National Alliance for Medical Image Computing (NA-MIC), one of the seven National Centers for Biomedical Computing funded by the National Institutes of Health, has converted some of the major scientific advances made by the biomedical imaging community into open-source software tools. As part of the NA-MIC toolkit, the 3D Slicer open-source software has been developed as a technology delivery platform for clinical researchers. The course provides an introduction to quantitative medical imaging data analysis and includes a series of hands-on sessions using 3D Slicer. Cases from multiple imaging modalities and from multiple organ systems will be highlighted to illustrate the depth and breath of this field. The hands-on sessions will give participants a practical experience of the latest quantitative image analysis tools developed in clinical research. Course url: http://www.na-mic.org/Wiki/index.php/RSNA_2014

URL's

http://www.na-mic.org/Wiki/index.php/RSNA_Quantitative_Imaging_Course

RCB31

Creating Radiology eBooks for the iPad (Hands-on)

Refresher/Informatics

IN ED IN ED IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 8:30 AM - 10:00 AM Location: S401CD

Participants

Henry J. Baskin MD (Presenter): Nothing to Disclose
Justin Cramer MD (Presenter): Nothing to Disclose
Justin LaPlante MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Become familiar with Apple's free ebook authoring tool, iBooks Author. 2) Create a sample radiology ebook during the course. 3) Learn how to freely share your ebook with others.

ABSTRACT

The iPad is rapidly becoming the de facto learning tool used by radiology residents and fellows. iBooks Author, a free authoring tool from Apple, enables the creation of ebooks with a near-limitless number of high-resolution images, movies, and other interactive elements. Unfortunately, most radiologists lack the expertise to leverage the advantages of this application. This hands-on workshop will cover the basics of iBooks Author. During the course, attendees will create their own interactive radiology ebook and learn how to freely share it with anyone who has an iPad. iBooks author is only available for Mac OS and bringing your own Mac is required for the hands-on portion of the course. Attendees are encouraged to download iBooks Author prior to attending; the link is provided below. Attendees are also encouraged to come with an idea for their own iBook, ideally with a text file and folder of images they would like to turn into an ebook during the course. Sample text and images will be provided for those who do not bring their own material.

URL's

https://itunes.apple.com/us/app/ibooks-author/id490152466?mt=12

http://bit.ly/ibookrsna

RCC31

RadLex®: Overview of a New Lexicon for Radiology

Refresher/Informatics

SQ IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 8:30 AM - 10:00 AM Location: S501ABC

Sub-Events

RCC31A

Overview of RadLex®

Daniel L. Rubin MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the rationale for developing a new lexicon for medical imaging. 2) See how an imaging lexicon can be used for education, research, and clinical reporting. 3) Understand the key technical decision that were necessary to create a complete and organized vocabulary for medical imaging. 4) Learn about the formats in which RadLex is distributed and the tools that are available for maintaining and using terminology systems. 5) Discover how you can take advantage of RadLex in the development of radiology applications.

ABSTRACT

The purpose of the RadLex lexicon is to provide a uniform framework for indexing and retrieval of a variety of radiology information sources, including teaching files, research data, and radiology reports. The RadLex lexicon is unifying and supplementing radiology terms from other medical lexicons, such as the ACR Index from the American College of Radiology, the Unified Medical Language System (UMLS) from the National Library of Medicine, SNOMED-CT from the College of American Pathology, and the DICOM Content Mapping Resource. This session will explain the motivations for the creation of the RadLex imaging lexicon and describe new applications being created that leverage its rich knowledge resources, such as structured reporting, radiology information retrieval, image annotation, decision support, and computerized order entry. RadLex technical experts will describe the formats in which RadLex is distributed, and will demonstrate some of the tools available to incorporate RadLex into the development of useful software applications. An update on the recently developed RadLex "playbook" will be provided, with an overview of RadLex methods to describe radiology orderables and procedure steps.

RCC31B

"RadLex Inside": Information Retrieval, Radiology Reporting, and Beyond

Charles E. Kahn MD, MS (Presenter): Shareholder, Hotlight Inc Officer, Hotlight Inc

LEARNING OBJECTIVES

1) Learn how the RadLex lexicon enables applications in radiology research, education, and clinical practice. 2) Describe how RadLex enables information retrieval. 3) Define the role of RadLex in RSNA's structured reporting initiative. 4) Discover new applications of RadLex in radiology education and decision support.

RCC31C

ACR Usage of RadLex® Playbook for CT Dose Registry

Richard L. Morin PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the challenge related to procedure code matching across institutions. 2) Describe the RadLex Playbook. 3) Explain how the RadLex Playbook can be used to harmonize data across institutions.

RCA32

Tapping into Big Data in Images: Annotation and Image Markup, Tools, and Applications (Hands-on)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 10:30 AM - 12:00 PM Location: S401AB

Participants

Daniel L. Rubin MD, MS (Presenter): Nothing to Disclose
Adam Eugene Flanders MD (Presenter): Nothing to Disclose
Elizabeth S. Burnside MD, MPH (Presenter): Stockholder, Cellectar Biosciences, Inc Stockholder, NeuWave Medical Inc
Raghunandan Vikram MBBS, FRCR (Presenter): Nothing to Disclose
Ross Warren Filice MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the new Big Data paradigm of radiology and emerging scientific areas in breast, brain and renal imaging that are leveraging this to drive new radiological insights. 2) Understand the Annotation and Image Markup (AIM) standard for image metadata and tools that use it to enable radiologists to make their observations explicit and machine-accessible. 3) Learn how AIM can support radiology clinical workflow, help referring physicians, be used outside the clinical environment, support research objectives, support regulatory objectives, improve regulatory science, facilitate new biomarker development and validation, help with meta-analyses across disparate trial data.

ABSTRACT

AIM brings tremendous benefits to clinical radiology by standardizing annotation documentation, allowing more specific and customizable searching of annotations, enabling objective and computable analysis of measurements, and allowing clinicians to more easily consume measurement data. But, AIM also has many important use cases outside of the clinical setting. Clinical trials, many of which include imaging and measurement data, are the foundation of medical product approval and regulation. Regulators must be able to easily review increasingly large amounts of data to make an educated decision regarding a new medical product. By submitting imaging measurement data in a standard format, such as AIM, regulators could more easily review this data. Additionally, as meta-analysis of data across multiple trials becomes more and more useful - both in the regulatory as well as the research settings - documenting measurements in standard formats better facilitates these analyses. Finally, standardizing measurement data and aggregating multiple datasets could better allow for new imaging biomarker discovery and validation that might lead to better response criteria for use both clinically and in the approval of new medical products.

Active Handout

http://media.rsna.org/media/abstract/2014/14001871/RCA32 sec.pdf

RCB32

Overview of RSNA's Teaching File Software (MIRC®)

Refresher/Informatics

IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 10:30 AM - 12:00 PM Location: S401CD

Participants

William J. Weadock MD (Presenter): Owner, Weadock Software, LLC
Stacy Dorothy O'Connor MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Learn the features of the RSNA's MIRC software for teaching files. 2) Learn how to download and install the software. 3) Learn to use the RSNA MIRC Wiki to obtain documentation on the software.

RCC32

Workflow Tools to Optimize Departmental Operations

Refresher/Informatics

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 10:30 AM - 12:00 PM Location: S501ABC

Participants

Moderator
Bradley J. Erickson MD, PhD : Stockholder, Evidentia Health, Inc

Sub-Events

RCC32A **Managing Your Department with Workflow Engines**

Bradley J. Erickson MD, PhD (Presenter): Stockholder, Evidentia Health, Inc

LEARNING OBJECTIVES

1) Become familiar with workflow engine technology. 2) Understand how workflow engines can be used within a radiology department. 3) Understand strengths and weaknesses of workflow engines compared to alternative methods like databases.

ABSTRACT

Workflow engines are a commonly used technology in many process-oriented industries like manufacturing and logistics. However, they have seen limited application in radiology or medicine. There are a few reasons why that might be, but the increasing pressures to increase clinical efficiency and expectations of adherence to evidence-based medicine principles may drive adoption of workflow engines. There are some important enabling technologies that may encourage increased use of workflow engines in healthcare, and radiology specifically. These include the SWIM workflow lexicon. The increased use and expectations for departmental dashboards will also reduce the barriers to implementing workflow engines. Some commercial entities are now building workflow technology into their systems. It is important to adopt technologies for workflow that are reliable and scalable as healthcare systems grow increasingly complex. Some examples of where workflow engines can support enterprise as well as departmental work will be examined.

RCC32B

Measuring Your Department with the SWIM Lexicon

Marc D. Kohli MD (Presenter): Research Grant, Koninklijke Philips NV Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Describe existing heterogeneity of workflow terminology. 2) Explain benefits arising use of a standard nomeclature for workflow steps. 3) Provide details regarding how the SWIM lexicon could be applied in the learner's environment.

ABSTRACT

In current practice, standard workflow steps such as the arrival of a patient to the imaging department, and completion of the exam are tracked in a very heterogenous manner with imprecise terminology. In order to better understand and compare workflow across radiology departments, a common language must be devised and deployed. The SIIM Workflow Initiave In Medicine (SWIM) lexicon aims to address this challenge. We will illustrate how the SWIM lexicon can be used to measure and compare workflow in a radiology department.

RCC32C

Monitoring Your Department with Dashboards

Christopher D. Meenan (Presenter): Stockholder, Analytical Informatics, Inc

LEARNING OBJECTIVES

1) Understand why dashboards can be important. 2) Become familiar with dashboarding tools. 3) Understand organizational dynamics and driving change with data. 4) Learn methods to sustain quality improvements with.

ABSTRACT

Leveraging dashboards to measure and improve operational quality can be an effective way for clinical departments to navigate change. However, understanding which tools to use . Technology alone is often not enough, and Department's may invest without realizing benefits.There are significant challenges including understanding and selecting key metrics, data quality issues, and driving organizational change.

SSG07

Informatics (3D, Quantitative and Advanced Visualization)

Scientific Papers

IN CT

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 10:30 AM - 12:00 PM Location: S402AB

Participants

Moderator
David S. Hirschorn MD : Nothing to Disclose
Moderator
Asim F. Choudhri MD : Nothing to Disclose
Moderator
Safwan Halabi MD : Nothing to Disclose

Sub-Events

SSG07-01

Classification of Renal Masses Using CT Texture Analysis: Generation of A Predictive Model on the Basis of Quantitative Spatial Frequency Measurements and Random Forest Modeling

Siva P. Raman MD (Presenter): Nothing to Disclose , Yifei Chen BS : Nothing to Disclose , James L. Schroeder MD,PhD : Nothing to Disclose , Peng Huang : Nothing to Disclose , Elliot K. Fishman MD :

Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

PURPOSE

CT texture analysis (CTTA) allows the quantification of lesion heterogeneity based on the distribution of pixel intensities within a region of interest. This study investigates the ability of CTTA to distinguish between several different common renal masses, and seeks to develop a 'random forest' predictive model allowing the differentiation of these lesion types.

METHOD AND MATERIALS

Following IRB approval, CTTA software (TexRAD Ltd.) was used to retrospectively analyze 20 clear cell renal cell carcinomas, 20 papillary RCCs, 20 oncocytomas, and 20 Bosniak I renal cysts. Regions of interest were drawn around each mass on multiple slices, and each lesion was analyzed using arterial, venous, and delayed phase images on renal mass protocol CT scans performed with uniform technique. Analysis was performed on both unfiltered images and spatial band-pass filtered images to quantitatively assess heterogeneity. Random forest method was used to construct a predictive model to classify lesions, and separate models were constructed using either one phase in isolation or all three contrast phases in conjunction. The model was then externally validated on a separate set of 19 cases that were not used in the generation of the original random forest model.

RESULTS

The random forest model was able to successfully distinguish the four lesion types, and when utilizing all 3 contrast phases in conjunction, the model correctly categorized oncocytomas in 89% of cases (sensitivity 89%, specificity 99%), clear cell RCCs in 91% of cases (sensitivity 91%, specificity 97%), cysts in 100% of cases (sensitivity 100%, specificity 100%), and papillary RCCs in 100% of cases (sensitivity 100%, specificity 98%). Models utilizing a single contrast phase (arterial, venous, or delayed) in isolation were less accurate, with the model based only on the arterial phase images performing the best. When tested on a separate/validation set of 19 cases, the model was correctly able to categorize all 19 cases.

CONCLUSION

CTTA, in conjunction with random forest modeling, demonstrates great promise as a tool for correctly characterizing lesion types, and was able to classify four common types of renal masses with a high degree of accuracy.

CLINICAL RELEVANCE/APPLICATION

CT texture analysis allowed accurate characterization of a small subset of common renal masses, suggesting its promise as a quantitative imaging tool that may augment our ability to predict lesion histology.

SSG07-02

A Four-dimensional Segmentation Algorithm for Accurate Reproduction of 3D-printed Coronary Arteries from Clinical Coronary CT Angiography

Dimitris Mitsouras PhD (Presenter): Nothing to Disclose , Kurt Schultz RT : Employee, Toshiba Corporation , Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation , Gerald Thomas Grant DMD, MS : Nothing to Disclose

PURPOSE

To reproduce accurate patient-specific coronary tree phantoms from clinical CTA and use them for in vitro CTA experiments to elucidate the intraluminal kinetics of iodinated contrast agent giving rise to the Transluminal Attenuation Gradient (TAG).

METHOD AND MATERIALS

A "four-dimensional" segmentation algorithm was developed taking advantage of cardiac motion in the CTA cardiac phase window. The algorithm iteratively combines commercial segmentations (Vitrea 6.2) of the coronary tree in individual phases to a single segmentation. This is accomplished by iteratively solving for motion between cardiac phases using least squares optimization and refining the "corresponding point" problem at each iteration. The corresponding points of individual segmentations are then combined into a single segmentation of the lumen plus its motion in-between cardiac phases. The algorithm was applied to 3 phases (70,75,80% of R-R) of a coronary CTA and the resulting endoluminal surface, extended with Luer connectors, was directly output in STL file format and printed on a Viper 2SI stereolithography machine (courtesy, Gerald T. Grant and Shayne Kondor, 3D Medical Applications Center, Walter Reed National Military Medical Center). The printed phantom was attached to a dual injector (Bracco Diagnostics) with one syringe loaded with saline and the other a mixture of 10:90% contrast:saline and scanned at 0.5sec intervals using a volume CTA protocol on 320-detector row CT (Toshiba) from a starting state of saline and during an injection protocol of 10s@0.1ml/s of mixture, followed by 6s@0.5ml/s of mixture, and finally 6s@1ml/s saline.

RESULTS

CTA of the printed phantom during contrast passage resulted in contrast opacification curves along the length of the coronary (Figure) of similar TAG magnitude as seen in vivo, between -26 HU/cm (upslope) to 9.5 HU/cm (downslope). Turbulence in the fluid jet due to an incidental luminal stenosis was readily detected and quantified by the CT Hounsfield units during contrast arrival.

CONCLUSION

The effect of blood flow on CTA contrast enhancement is sufficiently large to be detected by current CT technology and gives rise to the TAG observed in vivo

CLINICAL RELEVANCE/APPLICATION

High-fidelity 3D-printed coronary artery phantoms reproduced from clinical CTA will enable understanding the principles underlying TAG measurements and how they may be properly used to detect functionally significant coronary artery disease.

SSG07-03

Application of 3D Printing in Face Transplantation

Amir Imanzadeh MD (Presenter): Nothing to Disclose , Maximilian Kueckelhaus MD : Nothing to Disclose , Kanako Kunishima Kumamaru MD, PhD : Nothing to Disclose , Nicole Wake MS : Nothing to Disclose , Bohdan Pomahac MD : Nothing to Disclose , Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation , Dimitris Mitsouras PhD : Nothing to Disclose , Elizabeth George MD : Nothing to Disclose , Gerald Thomas Grant DMD, MS : Nothing to Disclose , Peter Constantine Liacouras PhD : Nothing to Disclose , Edward J. Caterson MD, PhD : Nothing to Disclose

CONCLUSION

Based on this data, 3D printing is now a mandatory step in surgical planning for face transplantation and it is very likely to be implemented in the other VCA and complex surgeries in the near future.

Background

The role of 3D printing in surgical planning has been assessed in some studies; however, to date there is only sparse data to assess clinical impact. Vascular CTA is performed for surgical planning before face transplantation, a large scale Vascularized Composite Allotransplantation (VCA). The purpose of this study is to assess the clinical impact of 3D printing in face transplantation.

Evaluation

This study was approved by the institutional human research committee. Four face transplantation patients from a single, large, urban teaching hospital prospectively underwent pre-procedure 320 x 0.5 mm detector row CT (Aquilion One , CITY, Japan) with 3D visualization (Vitrea, Vital Images, Minnetonka, MN, USA). For 3D printing, DICOM images were segmented and processed using customized software (Mimics, Materialise, Leuven, Belgium) and the STL files were created. The models were printed subsequently (SLA 7000 ,3D Systems, Rock Hill, SC) from the STL outputs. The clinical impact of the 3D models was assessed by consensus between one senior surgeon and one senior radiologist.

Discussion

3D printed models provide superior pre-operative data for face transplantation surgical planning when compared to 2D visualization. Complex anatomy and bony defects from either injury, prior surgeries, or both was better appreciated with 3D models. It was felt that the total procedure time was reduced with the prospective use of 3D models.

SSG07-04

Semi-Automated Quantification of Donor Kidney Volume Applied to a Predictive Model for Outcomes in Renal Transplantation

Jessica Ashley Rotman MD (Presenter): Nothing to Disclose , Paul Masi : Nothing to Disclose , Robert Spandorfer : Nothing to Disclose , Carl Ceraolo : Nothing to Disclose , Ashley Giambrone PhD : Nothing to Disclose , David Serur MD : Nothing to Disclose , Choli Hartono MD : Nothing to Disclose , Krishna Juluru MD : Nothing to Disclose

PURPOSE

Graft mass has been shown to be positively correlated with outcomes in kidney transplants. We investigate the use of semi-automated, CT-based quantification of graft volume as a non-invasive, pre-operative predictor of 12 and 24 month graft function.

METHOD AND MATERIALS

In this retrospective study, all transplants over a 3 year period in which donors obtained CT scans for routine pre-operative evaluation were included, and transplants in which recipient outcomes data were unavailable were subsequently excluded. Using a commercially-available reconstruction tool, donated kidney cortical and whole parenchymal volumes (DKV) were measured independently by two observers. Transplant characteristics recorded by chart review included donor/recipient demographics, recipient weight (RW), transplant immunological matching, history of acute rejection, delayed graft function, and/or viral infections, and recipient creatinine values at multiple time points. Intra-class correlation (ICC) of measurements by the two observers was calculated. DKV/RW ratios were correlated with graft function over 24 months and utilized in logistic regression models to calculate odds of developing diminished renal function.

RESULTS

150 transplants met inclusion/exclusion criteria. Cortical and total parenchymal measurements demonstrated high reproducibility between the two observers (ICC = 0.93-0.94). Unadjusted correlations existed between eGFR and DKV/RW ratio at 12 (R=0.82) and 24 months (R=0.78). After adjusting for transplantation parameters, recipients in the highest DKV/RW ratio tertile had persistently higher mean eGFR at all timepoints over 24 months than recipients in lower tertiles. Recipients in the highest tertile had a significantly reduced risk of developing diminished renal function as compared to recipients in the lowest tertiles at 12 and 24 months post transplant (adjusted OR = 0.15 and 0.10, respectively).

CONCLUSION

DKV/RW ratio is a non-invasive, readily-obtained, reproducible parameter that is a predictor of 12 and 24 month renal transplant outcomes.

CLINICAL RELEVANCE/APPLICATION

Transplant outcomes can be improved by incorporating DKV/RW ratio into the renal donor/recipient selection process.

SSG07-05

CT Texture Analysis of Histologically Proven Benign and Malignant Lung Lesions

Roberto Lo Gullo MD (Presenter): Nothing to Disclose , Mannudeep K. S. Kalra MD : Nothing to Disclose , Atul Padole MD : Nothing to Disclose , Alexi Otrakji MD : Nothing to Disclose , Jo-Anne O. Shepard MD : Consultant, Agfa-Gevaert Group , Subba Rao Digumarthy MD : Nothing to Disclose , Sarabjeet Singh MD : Research Grant, Siemens AG Research Grant, Toshiba Corporation Research Grant, General Electric Company Research Grant, Koninklijke Philips NV , Ranish Deedar Ali Khawaja MD : Nothing to Disclose

PURPOSE

To assess differences in CT texture of histologically proven benign and primary malignant lung lesions.

METHOD AND MATERIALS

Our ongoing IRB approved study included 62 patients (28M; 34F; mean age 64 years; range27-88) who underwent CT guided biopsy and had definitive diagnosis on pathology [22 benign (9 tumor and tumor-like and 13 acute infections), 40 malignant (17 well differentiated and 23 poorly differentiated primary lung adenocarcinomas)], over a period of three years. All mediastinal, chest wall, pleural lesions and pulmonary metastases were excluded. CT texture analysis of all biopsied lesions was performed on the pre-biopsy non-contrast CT images using a commercially available software (TexRAD limited, UK). For each patient, regions of interest were drawn on a single image with largest lesion dimensions. Areas of cavitation containing air were excluded. The features analyzed included mean HU values, percent positive pixels (PPP), mean value of positive pixels (MPP), standard deviation (SD), normalized SD, skewness, kurtosis, and entropy. Data were analyzed using two tailed unpaired non parametric T-test with Welch correction

RESULTS

There were significant differences between CT texture of well- and poorly-differentiated primary lung cancers (p

CONCLUSION

CT texture analysis can separate well diffentiated and poorly differentiated primary lung adenocarcinomas. There is a significant difference in SD between tumor/tumor-like lesions and infections among the benign lesions.

CLINICAL RELEVANCE/APPLICATION

CT texture analysis can help characterize malignant and benign lung lesions and can separate well differentiated from poorly differentiated cancers, which may help in selecting treatment options.

SSG07-06

Accuracy and Reproducibility of Automated, Standardized Transluminal Attenuation Gradient (TAG) Measurements in Coronary Computed Tomography Angiography (CCTA)

Yiannis M. Chatzizisis MD : Nothing to Disclose , Elizabeth George MD : Nothing to Disclose , Tianrun Cai MD : Nothing to Disclose , Richard Thomas Mather PhD : Employee, Toshiba Corporation , Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation , Dimitris Mitsouras PhD (Presenter): Nothing to Disclose , Urvi Pravin Fulwadhva MD : Nothing to Disclose , Kanako Kunishima Kumamaru MD, PhD : Nothing to Disclose , Kurt Schultz RT : Employee, Toshiba Corporation , Yasuko Fujisawa MS : Employee, Toshiba Corporation , Michael Lally Steigner MD : Speaker, Toshiba Corporation , Ron Blankstein MD : Nothing to Disclose , Carlos Rassi : Nothing to Disclose

PURPOSE

TAG from 320-detector row CTA offers incremental value for the prediction of functionally significant coronary artery disease (CAD). However, TAG measurements are labor-intensive. We thoroughly assessed TAG accuracy and reproducibility using new automated software compared to a manual method previously validated against invasive fractional flow reserve (FFR).

METHOD AND MATERIALS

540 TAG measurements were performed in 20 patients that underwent clinically indicated CCTA on a 320-row detector CT (Toshiba AquilionONE). Two readers measured TAG manually by placing 1mm2 luminal ROIs in cross-sections orthogonal to the vessel centerline every 5 mm; two independent readers used an automated software (Cardiac Analysis Package, Toshiba). Accuracy of automated vs manual TAG and inter- and intra-observer reproducibility of both methods were assessed via linear regression and Bland-Altman analyses. Subanalyses were performed with respect to factors that can affect accuracy or reproducibility, namely a) presence/severity of CAD by CCTA or invasive angiography and SPECT (n=14 patients), b) plaque composition (calcified vs noncalcified), c) CT reconstruction method (iterative vs FBP), and d) physiologic parameters (BMI, left vs right coronaries).

RESULTS

Correlation of automated and manual measurement was excellent (y=1.0x+2.0, r=0.92, p<0.001), with low mean difference (1 HU/cm) and narrower inter- and intra-observer limits of agreement for automated vs manual (25% and 36% average reduction, respectively, Figure). The median TAG in vessels with angiography/SPECT-confirmed obstructive CAD was -23.8 (IQR: -26.6, -19.3), similar to that previously reported for vessels with FFR ≤0.8 (median -21, IQR: -27, -16). Presence and severity of CAD, plaque composition, reconstruction method, and physiologic factors did not significantly affect accuracy or reproducibility. Analysis time was reduced by 68% per patient (13.9±3.3 min automated vs 39.8±8.7 min manual TAG).

CONCLUSION

Automated assessment of TAG is fast, accurate, and enhances reproducibility.

CLINICAL RELEVANCE/APPLICATION

Automated TAG measurement alleviates labor-intensive calculations and can thus enable studies over larger populations to establish its clinical significance for detecting hemodynamically significant CAD.

SSG07-07

Incremental Value of Minimum Intensity Projection Images on Hepatobiliary Phase Imaging for Detection of Hepatic Lesions

Sheela Agarwal MD, MS (Presenter): Nothing to Disclose , Duangkamon Prapruttam MD : Nothing to Disclose , Sandeep Subhash Hedgire MD : Nothing to Disclose , Jennifer W. Uyeda MD : Nothing to Disclose , Cinthia Cruz MD : Nothing to Disclose , Mukesh Gobind Harisinghani MD : Nothing to Disclose

CONCLUSION

Creation of MinIPs marginally improved detection of hepatic lesions irrespective of reader experience level. Given increasing utilization of surgical resection for colorectal metastases, this small improvement in detection may be clinically significant. There was no significant difference in the interpretation time for standard versus MinIPs. Qualitatively, readers found MinIPs to be particularly useful in detection of lesions less than 10mm.

Background

MIP reconstruction algorithms have proven to increase detection of lung nodules on MDCT, due to increasing number of slices in conventional imaging and large amount of "anatomic noise" in the lung. Analogously, MinIPs may lead to improved sensitivity for detection of liver lesions on hepatobiliary phase (HBP) imaging. Accurate detection of all hepatic lesions is particularly relevant in the setting of colorectal cancer, where multi-lesion resections are being performed with increasing frequency given survival benefits.

Evaluation

Patients were screened using inclusion criteria of biopsoy proven colon cancer, gadoxetate MRI, and at least 1 lesion less than 10mm in maximal diameter. MinIPs were created on axial HBP (20 min) images, with slice thickness of 10mm and reconstruction increment of 2.5mm, using AGFA PACS post-processing software. HBP and MinIP images were independently evaluated by 3 readers with varied experience, in random order. Interpretation time was recorded for each sequence. An expert reader who reviewed all available sequences and pertinent clinical details served as the reference standard. The Wilcoxon matched-pairs signed rank test and confidence intervals for differences between methods were used to compare the sensitivities of the two methods.

Discussion

All 24 exams, with a total of 243 liver lesions (range: 4-29 lesions), were considered of diagnostic quality and included in the study. Avg lesion size was 9.5mm, and 70% of lesions were less than 10mm. On standard HBP, 3 readers missed an average of 1.24 lesions per exam, with an overall detection rate of 88%. On MinIPs, the 3 readers missed an average of 0.79 lesions per exam with an overall detection rate of 92%. Average read time was 2:45 min for HBP and 2:57 min for MinIPs.

SSG07-08

A Novel Technique for Organ Segmentation Utilizing Dynamic Contrast Enhanced Multiphase Datasets

Elizabeth Weidman MD (Presenter): Nothing to Disclose , Sadaf Jalili MS, RRA : Nothing to Disclose , Pascal Spincemaille PhD : Nothing to Disclose , Krishna Juluru MD : Nothing to Disclose , Jonathan Paul Dyke PhD : Nothing to Disclose

PURPOSE

Tissue enhancement curves may offer a unique organ-signature. We test the accuracy of an automated algorithm that utilizes contrast enhancement curves from dynamic MRI datasets for the purpose of liver segmentation and volume determination.

METHOD AND MATERIALS

Abdominal DCE MRIs obtained from a previously-concluded IRB approved study were retrospectively included. Scans were obtained following injection of Gd-EOB-DTPA at 0.025 mmol/kg at a rate of 1cc/s followed by saline flush. Utilizing a spiral 3D technique, images of the entire abdomen were obtained in 15 phases within the first 90 seconds, following by a single phase every minute up to 20 minutes. All phases were registered using a commercially-available software tool. The custom tool being assessed in this study (created in IDL) allowed a user to identify an organ of interest by placement of an ROI. All voxels in the entire multi-phase MRI dataset demonstrating high correlation (Pearson's R2) with the time-intensity curve of the voxels in the ROI were determined to belong to the same organ and therefore included in segmentation. Volumes of the liver calculated by this automated technique were compared to volumes generated by manual tracing performed by an

experienced 3D technologist.

RESULTS

23 DCE MRI exams were included in the analysis. Average liver volumes obtained manually and by the automated technique were 2053 ± 454 mL and 1703 ± 405 mL, respectively ($p<0.0001$), and were highly correlated ($R2 = 0.76$). Areas of discrepancy between automated technique and manual segmentation were most frequent at the periphery of the liver due to signal intensity loss secondary to respiratory motion and receiver coil placement.

CONCLUSION

Liver volumes obtained by the automated and manual techniques were highly correlated. Unlike manual measurements, automated measurements excluded intra-hepatic vascular structures, likely explaining the systematic reduction in automated volumes as compared to manual, and in fact likely providing a more accurate estimate of liver *parenchymal* volume. Tissue time-intensity curves do offer a unique organ-signature that may be utilized for liver and other organ segmentation.

CLINICAL RELEVANCE/APPLICATION

Information in DCE MRI datasets can be utilized for automated organ segmentation and may provide an accurate, reproducible and fast method for obtaining organ volumes in surgical planning, transplant evaluation, and monitoring drug treatment response.

SSG07-09

Semi-automated 3D Segmentation of Livers Using User-defined Landmarks in CT Images

Wenli Cai PhD (Presenter): Nothing to Disclose , Difei Lu : Nothing to Disclose , Yin Wu : Nothing to Disclose , Gordon J. Harris PhD : Medical Advisory Board, Fovia, Inc

PURPOSE

Segmentation of diseased liver remains a challenging task in clinical applications due to the high inter-patient variability of liver shapes, sizes and pathologies caused by cancers or other liver diseases. The purpose of this study was to develop a semi-automated scheme for segmentation of diseased livers with cancers using as little as five user-identified landmarks.

METHOD AND MATERIALS

Based on the 3D iterative mesh transformation constrained by 2D optimal contour searching on transversal image planes, we developed a semi-automated scheme for multi-resolution segmentation of diseased livers with cancers on CT image, called iterative mesh transformation. The initial liver mesh is defined using five liver anatomical landmarks identified by users and a set of points from the chest wall detected automatically. Liver mesh is then deformed in a progressive manner by iterations between 3D mesh transformation based on the deformation transfer model and 2D contour optimization using the dynamic-programming algorithm. Forty (40) IV-contrast enhanced hepatic MDCT cases with biopsy-confirmed liver cancers or metastases were used for evaluation of our proposed semi-automated liver segmentation scheme. The MDCT imaging parameters settings were: 2.5-5 mm collimation, 1.25-2.5 mm reconstruction interval, 175 mA tube current, and 120 kVp tube voltage.

RESULTS

In reference to the liver segmentation by manual-contouring of two radiologists, the volumetric size of these 40 cancerous livers ranged from 1079.2 CC to 4652.3 CC, in which the tumor volume percentages ranged from 1.77% to 53.54%. We quantify the accuracy of the proposed liver segmentation scheme by using five metrics: (1) VOE: volumetric overlap error (%), (2) RVD: relative absolute volume difference (%), (3) ASD: average symmetric surface distance (unit: mm) (4) SSD: root-mean-square of symmetric surface distance (unit: mm), and (5) MSD: maximum symmetric surface distance (unit: mm). The performance of the proposed scheme was VOE=5.88, RVD=2.57%, ASD=0.51 mm, SSD=1.05 mm, and MSD=7.12 mm.

CONCLUSION

Our semi-automated liver segmentation scheme can achieve accurate and reliable segmentation results with significant reduction of interaction time and efforts when dealing with the diseased liver cases.

CLINICAL RELEVANCE/APPLICATION

Our semi-automated 3D liver segmentation scheme can provide an accurate and efficient liver volumetric measurement for diseased livers.

INS-TUA

Informatics Tuesday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Tue, Dec 2 12:15 PM - 12:45 PM Location: IN Community, Learning Center

Participants

Moderator
Rasu B. K. Shrestha MD, MBA : Advisory Board, General Electric Company Medical Advisory Board, Nuance Communications, Inc Editorial Medical Advisory Board, Anderson Publishing, Ltd Advisory Board, KLAS Enterprises LLC Advisory Board, Peer60

Sub-Events

INS148

A Software Tool to Quantify Hemodynamic Parameters from Digital Subtraction Angiography (Station #1)

Patricia Del Castillo Hernandez : Nothing to Disclose , Roberto Sanz-Requena PhD : Nothing to Disclose , Ignacio Bosch-Roig : Nothing to Disclose , Fernando Aparici-Robles MD : Nothing to Disclose , Luis Marti-Bonmati MD, PhD (Presenter): Nothing to Disclose

CONCLUSION

Registered post-processing imaging software for quantitative parametric DSA analysis is now available, providing objective and reliable information of the cerebral hemodynamic situation before and after endovascular treatment.

Background

Cerebrovascular disease is the most common cause of disability in adults, being carotid stenosis responsible of 25% of strokes. Endovascular treatment has emerged as an alternative to medical and surgical treatment of carotid stenosis. After stenosis resolution, digital subtraction angiography (DSA) allows to observe changes in different hemodynamic parameters, such as cerebral blood flow (CBF), blood volume (CBV) and mean transit time (MTT). Treatment evaluation may objectively quantify changes in these parameters at the pixel level. To do that properly, there is a need to correct patient motion artifacts. The aim of this study is to introduce a software tool to accurately assess the motion-corrected absolute values and relative variations after endovascular treatment of CBF, CBV and MTT.

Evaluation

A rigid registration of DSA images was performed before image processing to achieve an accurate assessment of the interventional procedure. Intra- and inter-series displacements were corrected, so that pre- and post-series could be compared pixel-by-pixel. The arterial input function was selected with a ROI at the carotid artery. Tissue respone was also evaluated on a ROI-basis. To quantify the CBF, CBV and MTT, the contrast agent concentration-time curves were extracted for each pixel. Subsequently, registered parametric maps were generated to compare the pre- and post-intervention situation. Fig.1 shows the evolution of the injected contrast media concentration and the values of the perfusion parameters. Stenting generated faster contrast circulation and increased whole brain CBF and CBV. In average, MTT decreased by 10% while CBF increased up to 40%.

Discussion

Currently, assessment of hemodynamic changes in angiographic studies is done qualitatively. Although DSA provides projection images, it is possible to calculate tissue CBF, CBV and MTT values, allowing objective treatment evaluation.

INS149

Learning from the Mistakes of Others: Utilizing Peer Review Data for Education via a PACS-based Teaching System (Station #2)

Richard Joseph Thomas Gorniak MD : Speaker, Koninklijke Philips NV , Adam Eugene Flanders MD : Nothing to Disclose , Christopher Geordie Roth MD (Presenter): Author, Reed Elsevier , Paras Lakhani MD : Nothing to Disclose , Vijay Madan Rao MD : Nothing to Disclose

CONCLUSION

This system increases the educational value of peer review data captured during the normal course of clinical operations, potentially reducing future errors.

Background

Peer review is commonplace in radiology practices and is necessary to meet regulatory requirements. While there are differing methodologies for collecting and presenting peer review, typical systems include data gathering, validation, benchmarking and individual feedback. Beyond individual feedback, peer review data is sometimes used more broadly for education such as in "missed case" conferences or teaching files. While these educational methods have utility, they do not emulate the actual image interpretation process.

Evaluation

Using a PACS-integrated tool, our institution's peer review database was queried for discrepancies occurring in the last 2 years and the discrepant cases were reviewed for educational value. The entire DICOM file set of 45 selected cases and reports were extracted from PACS and anonymized. The anonymized DICOM files were then stored on a nonclinical PACS server. Using the PACS javascript API, a user interface was made to list cases, display images and history, show the report and recorded discrepancy, and record user self-assessment.

Discussion

Peer review data offers a rich source of educational material highlighting real world mistakes of attending radiologists. While feedback to the individual who committed the error is valuable, this project increases the educational value of peer review by allowing multiple trainees and attendings to learn from an error. By reviewing the mistakes of others, radiologists may be able to avoid making similar future mistakes. Unlike a typical teaching file or conference, this system more closely simulates normal practice where the radiologist has the entire image set to evaluate instead of a few key images, mimicking the condition of the original reader. There is likely a greater potential for retention by actively reviewing the error as an unknown in a familiar reading-room workflow, rather than viewing cases passively in a conference. This system accomplishes this, while keeping both the radiologist who erred and the radiologist who flagged the error anonymous.

INS150

Comparison between iPad3 and Conventional Workstation for Assessment of Breast Composition and Abnormal Cases (BIRADS 0) in Screening Mammography (Station #3)

Chin-Hsiang Feng BS (Presenter): Nothing to Disclose , Samir Abboud MD : Nothing to Disclose , Jessica Ann Galandak MD : Nothing to Disclose , Lyn Wan Ho MD : Nothing to Disclose , Scott Rotenberg MD : Nothing to Disclose , Eliot L. Siegel MD : Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation , Cristina Irene Caterina Campassi MD : Nothing to Disclose

CONCLUSION

The iPad has similar performance to a conventional workstation for classifying breast composition across trained breast imagers. Initial data suggests the iPad may have similar performance for identifying positive screenings. Further studies are needed to analyze the iPad's lesion detection for features such as masses, calcifications, and asymmetries in order to clarify the iPad's utility in mammography.

Background

Recent studies have evaluated mobile displays for conventional radiography tasks such as tuberculosis screening. This study investigated the use of the iPad3 display for ultra high resolution tasks such as mammography.

Evaluation

We compared the iPad3 3.1 megapixel display using the MobileMIM app with an AGFA IMPAX workstation with 5MP monitors for the evaluation of two parameters: breast composition and positive screening mammograms. Positive screening mammograms were defined as abnormal cases (BIRADS 0). Negative screening mammograms were defined as negative (BIRADS 1) or benign (BIRADS 2) cases. We selected 60 digital screening mammograms with a biopsy diagnosis or a minimum of 2 years of follow-up to represent all 4 groups of breast composition. The dataset was enhanced, increasing the positive cases to 25 %. Of these cases, 32 were interpreted with and 28 without a prior screening mammogram. The dataset was anonymized and read in randomized order first on the iPad and then on the workstation with a 2 week interval between sessions. Four radiologists, 3 attendings with varying expertise in breast imaging and 1 fellow in training, interpreted the cases blinded to outcome. Breast composition, lesion type and location, and assessment category were recorded for each case according to BIRADS standards. For each reader, the interpretation on the workstation served as the gold standard, and the performance of the two displays was evaluated by kappa statistics.

Discussion

For breast composition, the iPad and 5MP comparison yielded a substantial kappa value ranging from 0.63 to 0.78 in all readers. For the positive screening assessment, the iPad and 5MP comparison yielded a fair kappa value of 0.39 for the fellow and a moderate to substantial kappa value of 0.56 to 0.72 for the attendings.

INS151

Semi-automated Small Bowel Segmentation with Automated Centerlining on Thin-slice CT (Station #4)

Ryan Michael Kohlbrenner MD (Presenter): Nothing to Disclose , Aliya Qayyum MBBS : Spouse, Employee, Imorgon Medical , David E. Avrin MD, PhD : Stockholder, Reed Elsevier

PURPOSE

The small bowel is time-consuming to track and evaluate on CT and is challenging to automatically segment. The purpose was to determine the feasibility of small bowel tracking by developing a computerized algorithm that segments the small bowel lumen and generates its centerline as a reference for creation of reformatted images in cross section to the lumen.

METHOD AND MATERIALS

A computerized scheme was developed using the Insight Segmentation and Registration Toolkit. Three CT scans with well-distended small bowel were included in the study, including one CT enterography and two CT scans with small bowel obstruction. Beginning at a user-defined start point within the bowel lumen, a region-growing segmentation algorithm was used to accumulate neighboring intraluminal voxels of air or fluid attenuation until a user-defined endpoint within the lumen was reached. The distance between the two points was arbitrary, assuming loops of bowel between the points remained least partially distended. A secondary segmentation of

the extraluminal abdominal contents was used to further refine the binary results by subtraction. The Euclidean distance transform of the binary segmentation volume was then generated (characterized by high values near the luminal center, low values at the periphery, and zero values for extraluminal voxels). Employing the transform as a cost function, where high values correspond to low cost, the minimal cost path between the two seed points was determined. The approximate centerline was superimposed on the original CT volume, and a series of images were generated perpendicular to the centerline.

RESULTS

Transluminal images perpendicular to the centerline were successfully generated for all cases in the test series, using maximally spaced user-defined seed points within the distended small bowel lumina. The line connecting the seed points remained within the small bowel lumen for each case.

CONCLUSION

Small bowel luminal segmentation can be performed in cases of partially or fully distended small bowel. Automated centerlining of the segmentation result facilitates generation of transluminal images, which would improve evaluation of small bowel pathology.

CLINICAL RELEVANCE/APPLICATION

Generating an enteric centerline and perpendicular images would improve localization and evaluation of small bowel pathology such as enteritis in Crohn disease, small bowel tumors, and the transition point in small bowel obstruction.

INS152

Faster Report Turnaround-times versus Report Quality! Two Opposing Objectives? (Station #5)

Achim Escher (Presenter): Nothing to Disclose , Tobias Heye MD : Nothing to Disclose , Elmar M. Merkle MD : Advisor, Siemens AG Advisor, Bayer AG Speakers Bureau, Bayer AG Reserach Support, Bayer AG Reserach Support, Bracco Group Reserach Support, Guerbet SA

CONCLUSION

Despite a substantial reduction in report TAT in 2013 there was no evidence of a negative impact on the structural report quality. This may be explained by the assumption that TAT improvement is a matter of optimizing time efficiency and TAT awareness rather than shortening the time available for reporting.

Background

Radiology reports from a time period before reduction in TAT (06-12/2012) were compared to reports from a time period with significant reduction in TAT (06-12/2013). Plain text data from 1'812 radiology reports containing the keywords "pulmonary embolism" (PE) and "cerebral ischemia" (CI) were retrieved from the radiology information system. An advanced language processing approach was used to analyze the following objective criteria for report quality: word count and its variability, the number of addendums to reports and the adherence to common reporting structures (history, procedure, comparison, findings, impression). It was also assessed if the impression addressed the clinical question which initiated the procedure.

Evaluation

No significant difference in mean word count (CI: 108.3 to 127.7 words; PE: 125.4 to 125.4 words) and variability (standard deviation; CI: 48.0 to 58.7; PE: 65.4 to 64.2) was found. The number of addendums slightly increased but remained on a very low level in absolute numbers (CI: 0.8% to 1.5%; PE: 0.6% to 1.6%). The adherence to common reporting structures showed a slight improvement in some categories (e.g. reference to comparison studies, case history). 98.0% of reports addressed PE as clinical question in 2012, which changed to 97.8% in 2013 (CI: 73.0% to 66.1% respectively). The percentage of reports addressing PE in the line in the impression decreased from 69.3% to 65.0% (CI: 28.6% to 27.6% respectively).

Discussion

The approach of analyzing structural report quality can be used to detect changes in the report quality. In this work we could show that improving report TAT does not negatively impact report quality. Although this approach does not measure the clinical accuracy of reports, it offers objective measures of the care that goes into reporting.

INE017-b

Automatic Partitioning Torso CT Images based on Anatomical Definition and its Performance Evaluation by using a Large Dataset (custom application computer demonstration)

Xiangrong Zhou PhD (Presenter): Nothing to Disclose , Syoichi Morita : Nothing to Disclose , Takeshi Hara PhD : Nothing to Disclose , Ryujiro Yokoyama : Nothing to Disclose , Huayue Chen : Nothing to Disclose , Masayuki Kanematsu MD : Nothing to Disclose , Hiroshi Fujita PhD : Nothing to Disclose

Background

Understanding anatomical structures on CT images is an essential step of computer-based medical image analysis. Partitioning whole body region on a CT scan into a number of special organ or tissue units based on anatomical definition is the way to realize this tough task. Here, an organ unit is generally presented by a rotated bounding box that tightly covers a special organ region with a little background as small as possible. In

this work, we demonstrate a computer system that can automatically and quickly partitioning a 3D volumetric CT scan into a number of organ or tissue boxes based on anatomical definition.

Evaluation

A dataset consisting of more than 4,000 volumetric CT scans was used for performance evaluation. These CT images were generated from 4 kinds of CT scanners by using different scan protocols for clinical diagnosis. The spatial resolution of the CT images varied from 0.62 mm to 5 mm. Eighteen major organs and tissues including heart, liver, gallbladder, spleen, pancreas, stomach, bladder, left-lung, right-lung, left-kidney, right-kidney, left-femur-head, right-femur-head, left-psoas-major-muscle, right-psoas-major- muscle, uterus and rectum, abdominal rectus muscle, and inferior vena cava (IVC) with ventral aorta were selected as partitioning targets. In this study, the bounding box was considered to be correct if most (two thirds of the volume) of the detected 3D box and the manually inputted box overlapped with each other.

Discussion

Our evaluation showed that the success rates for most targets were in the range of 95 % to 100 %, besides of stomach (94 %), spleen (90 %), pancreas (82 %) and gallbladder (84 %). Typical computing time for partationing a torso CT scan using a general-purpose computer equipped with an Intel Core2Duo 2.23-GHz CPU was 2 minutes or less.

CONCLUSION

We developed a computer system that can be used to partition a CT scan into more than 18 kinds of major organ or tissue units automatically. The efficiency and accuracy were validated using a large dataset including more than 4,000 real clinical CT scans.

INE018-b

Planning Software of Minimally Invasive Needle Trajectory for Lung Biopsy in 3D Volumetric Chest CT: Considering Quantitative Pulmonary Vessels Invasiveness and Distance from Virtual Walls (custom application computer demonstration)

Minho Lee PhD : Nothing to Disclose , Namkug Kim PhD (Presenter): Stockholder, Coreline Soft, Inc , Joon Beom Seo MD, PhD : Nothing to Disclose , Sang Min Lee MD : Nothing to Disclose

Background

Recently, image based biopsy has been popular, because CT fluoroscopy or C-arm fluoroscopy imaging modality is becoming accurate and fast, by which the trajectory of biopsy needle can be guided and planned. Therefore, we proposed the automatic biopsy planning method to find minimally invasive insertion trajectory of biopsy needle in the pre-operation stage of volumetric chest CT.

Evaluation

Volumetric CT scans of twenty lung biopsy patients were performed. At first, semi-automatic multi-organ segmentation including rib-bone, airway, pulmonary vessels, heart, skin, and soft tissue were performed with in-house software. Then, distance maps from critical organs including lung boundary, peripheral of rib-bone, airway, pulmonary vessels, and heart and set 2mm as a safety margin from possible needle trajectory were generated. In addition, shortest and near vertical trajectory from skin to target lesion picked by the physician were evaluated. Finally, the minimally invasive insertion trajectory which collide the fewest number of pulmonary vessels less than 2mm in the 3D cone with 30° around the trajectory was evaluated. This trajectory was compared with manually determined trajectory by a physician. The trajectories of 2, 2, and 12 cases in the shortest trajectories, near vertical trajectories, manually determined trajectory by a physician, respectively were within 2mm of critical organs. The pulmonary vessel invasiveness less than 2mm were 0.25±0.57mm, 0.03±0.13mm, and 6.35±4.55mm (mean ± SD) in the shortest trajectories, near vertical trajectories, manually determined trajectory by a physician (all p-values < 0.001, paired t-test).

Discussion

This insertion trajectory planning which depends on the experience of a physician could be determination by the quantitative degree of invasiveness, such as blood vessels invasiveness and distance from virtual walls.

CONCLUSION

This method could be used for planning minimally invasive biopsy trajectory based on the quantitative degree of invasiveness, such as blood vessels invasiveness and distance from virtual walls.

INE019-b

Development of Fine-scale Size based Emphysema Cluster Segmentation and Analysis Platform using Length Scale and Unsupervised Clustering (custom application computer demonstration)

Minho Lee PhD : Nothing to Disclose , Taekjin Jang (Presenter): Nothing to Disclose , Namkug Kim PhD : Stockholder, Coreline Soft, Inc , Sang Min Lee MD : Nothing to Disclose , Joon Beom Seo MD, PhD : Nothing to Disclose , Sang Young Oh MD : Nothing to Disclose

Background

In patients with chronic obstructive pulmonary disease (COPD), robust size based emphysema analysis is of importance, because size of emphysema cluster would be a surrogate imaging biomarker of etiology and progress of COPD, resulting in the morphological change of the emphysema. In this study, we developed a quantitative analysis on fine-scale size based emphysema in volumetric CT.

Evaluation

Volumetric CT scans of sixty patients with COPD were performed by a more than 16 MDCT scanner (Siemens Sensation 16 and 64) within 0.75mm collimation. Using thresholding by -950 HU, emphysema index (EI) of low attenuation area (LAA) mask within lung except airway was evaluated. Based on these LAA masks, a length

scale analysis to estimate each emphysema cluster's size was performed as follows. At first, Gaussian low pass filter from 30mm to 1mm kernel size with 1mm interval was performed iteratively. No changed voxel in the filtered volume was selected and dilated by the size of the kernel, regarded as the specific size emphysema cluster. In this way, emphysema clusters with specific size range was differentiated and evaluated. The power law D of area and number of size based emphysema cluster (slope of log-log plot) were evaluated and compared with pulmonary function test (PFT). All PFT parameters including DLco, FEV1, and FEV1/FVC were significantly correlated with D (r-values, -0.73, 0.54, 0.69, respectively) and EI (r-values, -0.84, -0.60, -0.68, respectively). In addition, D independently contributed regression for FEV1, FEV1/FVC (adjust R sq.: EI only, 0.70, 0.45; EI and D, 0.71, 0.51, respectively). In addition, size based emphysema clusters was visualized.

Discussion

Size based emphysema cluster segmentation and analysis evaluated the Ds of area, number, density histogram, extent, and distribution of size based emphysema cluster, which would be an independent factors for predictor of PFT parameters.

CONCLUSION

In conclusion, we developed the size based emphysema cluster segmentation and analysis platform, which would be useful for estimation of PFT parameters.

INE020-b

Automated Segmentation Method for Lung Tumor Attached to Neighbor Structures in Chest CT Images (custom application computer demonstration)

Julip Jung MS (Presenter): Nothing to Disclose , Helen Hong PhD : Nothing to Disclose , Jin Mo Goo MD, PhD : Research Grant, Guerbet SA

Background

Lung tumor segmentation on chest CT images is essential and important to measure tumor size and volume for cancer diagnosis, treatment planning and therapy response assessment. One of the most challenging tasks is the separation of lung tumor from neighbor structures such as chest wall or mediastinum. Because lung tumor is often attached to chest wall or mediastinum and its intensity is similar to its neighbor structures. Thus, we propose a novel segmentation method of lung tumor on chest CT images using asymmetric multi-phase deformable model with peripheral region probability map.

Evaluation

Our method has been applied to ten patients with lung tumor. Each CT image had a matrix size of 512 x 512 pixels with in-plain resolutions ranging from 0.52 to 0.73 mm. The slice thickness ranged from 2.5 to 3.0 mm and the number of images per scan ranged from 103 to 158. First, optimal volume circumscribing lung tumor is decided by dragging inside the tumor and initial tumor region was extracted by applying thresholding with threshold value of -400HU to the optimal volume. Second, to estimate the possibility of neighbor structures to be separated from lung tumor, peripheral region probability map is generated. In peripheral region probability map, tumor region is suppressed by localizing lung tumor using Hough ellipse transform and neighbor structure region is highlighted by counting the number of voxels with intensity higher than 0HU. Finally, the initial tumor region is refined by asymmetric multi-phase deformable model with peripheral region probability map. For evaluation of our segmentation method, automatic segmentation results are visually assessed in axial plane and Dice similarity coefficient is measured between automatic and manually segmented tumor regions.

Discussion

Our peripheral region probability map can estimate the possibilities of region to be separated from lung tumor. Our asymmetric multi-phase deformable model with peripheral region probability map can separate lung tumor from attached chest wall and mediastinum without lung segmentation.

CONCLUSION

Our segmentation method can be used in lung tumor measurements for cancer diagnosis, treatment planning and therapy response assessment.

INE021-b

Adding DICOM Segmentation Capability to the National Cancer Informatics Program (NCIP) Annotation and Image Markup (AIM) Enabled Imaging Workstation for Imaging Research (custom application computer demonstration)

Pattanasak Mongkolwat PhD (Presenter): Nothing to Disclose , Vladimir Kleper : Nothing to Disclose , Skip Talbot BS : Nothing to Disclose , Norman Young MSc : President, ClearCanvas Incorporated CEO, ClearCanvas Incorporated , David A. Clunie MBBS : Owner, PixelMed Publishing LLC

Background

For quantitative research and clinical practice, manually authored and automatically generated Regions of Interest (ROIs) may be encoded either as contours or arrays of voxels. The Free Open Source Software AIM-enabled ClearCanvas Workstation creates and displays AIM annotations as DICOM SR or XML.

Only contours are stored in AIM annotations. The DICOM Segmentation (SEG) object encodes ROIs as arrays of voxels, and SEG objects may be referenced from AIM annotations (via UIDs). Created SEGs can be consumed by SEG enabled workstations.

Evaluation

SEG capabilities used are sufficient to encode manually created ROIs of unconnected regions on single or successive slices, to make 3D tumor measurements. A shared label is used to identify user-drawn polygonal ROIs to be converted to SEGs. Users select anatomy, category and type properties from an extensive DICOM coded value set, which may be modified via configuration files. A configurable color for each user is recorded.

Conformance to the DICOM Segmentation Storage SOP Class was verified mechanically. Creation and display of SEG objects on enhanced multi-frame and series of legacy single frame images is supported and was tested on CT and MR.

The workstation loads and superimposes SEGs on referenced images or frames. Binary and thresholded fractional probability or occupancy segments, multiple segments and multiple slices per segment, and sub-regions coplanar with images are supported. Opacity of rendered segments can be adjusted. Correct superimposition and spatial location of sub-regions was verified with synthetic test objects.

Computed volume, mean and standard deviation are shown. Statistics of predictable size on imported synthetic test SEG objects were successfully compared with known values.

Discussion

AIM and SEG offer a complete persistence mechanism for 3D ROIs for tumors, serialized as DICOM and compatible with PACS archives. Broader adoption of DICOM SEG in PACS viewers and research tools (3DSlicer, ePad) will also allow interoperable visualization.

CONCLUSION

The workstation allows annotation of imaging features found on images. The new segmentation capabilities make AIM a more powerful tool for clinical and research use.

INE022-b

Big Data in Multiple Sclerosis Analysis: Data Mining and Analysis using a Web-based Longitudinal Study Viewer in an Imaging Informatics-based eFolder System (custom application computer demonstration)

Kevin Chikai Ma MS (Presenter): Nothing to Disclose , Ximing Wang MS : Nothing to Disclose , Mark S. Shiroishi MD : Nothing to Disclose , Alexander Lerner MD : Nothing to Disclose , Lilyana Amezcua MD : Consultant, Biogen Idec Inc Consultant, Bayer AG Consultant, Teva Pharmaceutical Industries Ltd Consultant, Merck KGaA Consultant, Pfizer Inc Advisory Board, Biogen Idec Inc Advisory Board, Bayer AG Advisory Board, Teva Pharmaceutical Industries Ltd Advisory Board, Pfizer Inc Advisory Board, Merck KGaA Speaker, Biogen Idec Inc Speaker, Bayer AG Speaker, Teva Pharmaceutical Industries Ltd Speaker, Merck KGaA Speaker, Pfizer Inc , Brent Julius Liu PhD : Nothing to Disclose

Background

Previously, we have demonstrated a multiple sclerosis eFolder that integrates clinical, imaging, and white matter lesion quantitative data. We have developed a web-based user interface and database to store and view patient data. This year, we aim to fully demonstrate its capability of handling big data analysis and data mining for MS patient treatment and tracking. While data storing and data viewing has been demonstrated before, we will introduce data mining based on patients' clinical, ethnicity, social and environmental information, and lesion characteristics. Big data analysis results are used to predict MS disease trends and patterns in Hispanic and Caucasian populations. The discovery of disease patterns among the two ethnicities will lead to personalized patient care and treatment planning.

Evaluation

Data from 72 matching Hispanic and Caucasian patients are collected. Quantitative lesion analysis, including lesion volumes, number of lesions, lesion locations, and brain parenchyma ratio, are performed by the CAD program and neuroradiologists. Relationships between disease/lesion progression, treatment types and length of treatments, social and environmental factors, and lesion volumes, sizes, and locations are observed in the two ethnicity groups in the database. The GUI is modified to display patient's longitudinal image comparisons and lesion tracking across multiple studies to show disease progression with lesion changes, clinical result changes, and symptom progressions.

Discussion

The integrated longitudinal study viewer is successfully demonstrated. Patient profiles have been stored and displayed in the eFolder system. Data analysis has been performed, and different lesion characteristics with ethnic differences of the patients are shown in our pilot study.

CONCLUSION

We have demonstrated how an imaging informatics-based system can handle big data analysis using our MS eFolder, and the system provides data mining, longitudinal disease tracking, monitoring of disease progressions for personalized patient care, and displaying of comprehensive patient profile on a web-based user interface. Results are used to predict MS disease patterns in two different ethnicities from our pilot study.

INE023-b

Does the Background Removal Tool used on Nature Pictures Work Well for Organ Segmentations on 3D CT Images? (custom application computer demonstration)

Xiangrong Zhou PhD : Nothing to Disclose , Takaaki Ito : Nothing to Disclose , Takeshi Hara PhD :

Nothing to Disclose , Ryujiro Yokoyama : Nothing to Disclose , Huayue Chen : Nothing to Disclose , Masayuki Kanematsu MD : Nothing to Disclose , Hiroshi Fujita PhD (Presenter): Nothing to Disclose

Background

Background removal is a useful tool that is implemented in Microsoft Office 2010, and can be used to efficiently separate the target (foreground) from the background on a 2D picture. The algorithm of this tool is called "Grabcut" that accomplishes a fast and automatic background removal after marquee selection by indicating a 2D box region. The question whether such kind of background removal techniques work well for organ segmentations on clinical CT image is what we want to answer here.

Evaluation

A dataset consisting of more than 100 volumetric torso CT scans was used for testing. These CT images were generated from 3 kinds of CT scanners from GE, Toshiba, and Philips by using different scan protocols for clinical diagnosis. The spatial resolution of the CT images was varied from 0.62 mm to 2 mm. Nine major organs and tissues including heart, liver, spleen, left-kidney, right-kidney, bladder, gallbladder, left-psoas-major-muscle, and right-psoas-major- muscle were selected as segmentation targets. The Grabcut algorithm was expanded to 3D by our group to adapt to CT images. The Jaccard similarity coefficient (JSC) between the segmentation result and doctors's manual sketch was used as the accuracy measure.

Discussion

Our evaluation showed that the average JSC values for these targets were in the range of 60 % to 70 %, and can be improved to 90 % by combining with an probabilistic atlas approach. Typical computing time for organ segmentation on a torso CT scan using a general-purpose computer equipped with an Intel Core2Duo 2.23-GHz CPU was less than 1 minute.

CONCLUSION

Background removal technique is helpful for the organ segmentations on CT images, but it was not as powerful as it is used on nature pictures and need to be improved.

INE024-b

Development of Patient Specific Anatomy based 17-segment Modeling (AHA) on Bull's Eye Map: Application for differentiation between Normal Control and Severe Aortic Stenosis (custom application computer demonstration)

Joonho Jung MS (Presenter): Nothing to Disclose , Namkug Kim PhD : Stockholder, Coreline Soft, Inc , Dong Hyun Yang MD : Nothing to Disclose , Young-Hak Kim : Nothing to Disclose

Background

Aortic stenosis is a narrowing of the aortic valve which can cause symptoms and may lead to heart failure. For differentiation between normal control and severe aortic stenosis(AS), we developed cardiac CT quantitative analysis software with patient specific anatomy based

Evaluation

An electrocardiogram-gated cardiac CT images was segmented semi-automatically to make patient specific myocardial 17-segment model (AHA) using seeded region growing method. Two experts manually determined anterior and posterior interventricular groove as a boundary between 1st and 2nd segments and as the other boundary between 3rd and 4th segments respectively to correct the model. Each segment is automatically identified as follows. The outer angle of two boundaries was divided to differentiate 1st, 4th, 5th and 6th segments with basal plane while the inner angle divided 2nd and 3rd segments. Similarly, segments of mid plane are differentiated. The area of the 17 segments was quantitatively assessed on the bull's eye map using the morphological boundaries. For this procedure, an in-house program was developed on the windows7 x64 environment. CT data (normal control: 35, AS: 144) were evaluated for bull's eye map analysis. Segment area distributions of AS patients and normal control were significantly different (t-test, all p-values < 0.011) which would be equivalent to maximum thickness of each segment in 3D (t-test, all p-values < 0.02 except 5th segment). In addition, quantitative parameters including mean density, maximum thickness and volume of each segment were structured-reported in this platform.

Discussion

This patient specific anatomy based 17-segment model could be used for differentiate between AS and normal control. Especially, this model could be equivalent to 3D segment analysis and would be superior to conventional 17-segment model, because it represents patient specific segment anatomy information simultaneously on the bull's eye map with visualization of morphological boundaries.

CONCLUSION

We developed the quantitative cardiac analysis platform with 17-segment considering anatomic variation. These quantification parameters could be used for differentiate AS and normal control using cardiac CT scans.

RCA33

National Library of Medicine: Find Articles You Need: Searching PubMed/MEDLINE Efficiently (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 12:30 PM - 2:00 PM Location: S401AB

Participants

Holly Ann Burt MLIS (Presenter): Nothing to Disclose
Tony Nguyen MLIS (Presenter): Nothing to Disclose
Patricia Devine MLS (Presenter): Nothing to Disclose
Jamie T. Dwyer MLS (Presenter): Nothing to Disclose
Stephanie Friree MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how PubMed constructs a query and how to develop and refine effective search strategies in radiology. 2) Use PubMed tools including Clinical Queries, Related Articles, Single Citation Matcher and Loansome Doc. 3) Build focused searches using the Medical Subject Headings (MeSH) vocabulary for radiology and limit searches to radiology-oriented journals. 4) Understand how to save and download citations.

ABSTRACT

This hands-on workshop covers key searching techniques, changes to PubMed, and how to develop effective search strategies for PubMed and MEDLINE. Topics covered include: why keywords don't always give the results you expect, how to limit to specific journals, quick searches to find evidence-based citations, how to access full-text articles, and downloading citations to reference manger programs. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov). MEDLINE is a subset of PubMed which includes links to sites providing full text articles and to other related databases and resources.

URL's

http://nnlm.gov/training/resources/pubmed8.pdf

Handout:Holly Ann Burt

http://media.rsna.org/media/abstract/2014/14003436/pubmedRSNA2014.pdf

RCB33

3D Printing (Hands-on)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 12:30 PM - 2:00 PM Location: S401CD

Participants

Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation
Peter Constantine Liacouras PhD (Presenter): Nothing to Disclose
Timothy Mueller (Presenter): Nothing to Disclose
Amir Imanzadeh MD (Presenter): Nothing to Disclose
Dimitris Mitsouras PhD (Presenter): Nothing to Disclose
Nicole Wake MS (Presenter): Nothing to Disclose
Andreas Giannopoulos MD (Presenter): Nothing to Disclose
Tatiana Kelil MD (Presenter): Nothing to Disclose
Catherine Phillips MD (Presenter): Nothing to Disclose
Beth A Ripley MD, PhD (Presenter): Nothing to Disclose
Asha Sarma MD (Presenter): Nothing to Disclose
Hansol Kim MD (Presenter): Nothing to Disclose
Tianrun Cai MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To familiarize radiologist with the general indications for 3D printing in biomedical imaging. 2) To learn the basic principles of an STL file. 3) To obtain "hands-on" experience in creating a STL file from radiology DICOM images. 4) To learn an approach to STL file manipulation to achieve a 3D printed model.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

Active Handout

http://media.rsna.org/media/abstract/2014/14003456/RCB33sec.pdf

RCC33

The RSNA Reporting Initiative: Developing a Library of Best-Practices Radiology Report Templates

Refresher/Informatics

SQ IN SQ IN SQ IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 12:30 PM - 2:00 PM Location: S501ABC

LEARNING OBJECTIVES

1) Understand the meaning and purpose of structured reporting and standard terminology. 2) Review the progress on RSNA's library of best-practices radiology report templates. 3) Discuss directions for further development of the report template library. 4) Learn how radiologists can use these reporting templates to improve their practice.

ABSTRACT

This session will review the RSNA-sponsored initiative to improve radiology reporting practices. The RSNA has created a library of over 200 exemplary report templates that contain reusable structured data based on RadLex® and other standard terminologies. These report templates represent best-practices that can be adopted by radiologists and adapted based on local practice patterns. The template library, available on the RSNA web site, serves as a resource for radiologists who wish to improve their practice by standardizing the format, content, and structure of their reports. Over the last 2 years, the RSNA has collaborated with IHE and DICOM to develop standards for radiology report templates that will provide new reporting capabilities. This session will provide an overview of structured reporting, review the progress of the RSNA-sponsored initiative, and describe how radiologists can take advantage of this effort to improve their clinical practice.

URL's

http://www.rsna.org/Reporting_Initiative.aspx

Sub-Events

RCC33A

The RSNA Reporting Initiative: Background and Status

Curtis P. Langlotz MD, PhD (Presenter): Shareholder, Montage Healthcare Solutions, Inc Advisory Board, Reed Elsevier Advisory Board, Activate Networks, Inc Spouse, Consultant, Johnson & Johnson

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC33B

RSNA's Reporting Initiative: Accomplishments and New Directions

Charles E. Kahn MD, MS (Presenter): Shareholder, Hotlight Inc Officer, Hotlight Inc

LEARNING OBJECTIVES

1) Describe the RSNA Report Template Library and how radiologists can access its reporting templates. 2) Understand current efforts to integrate the RSNA's reporting templates into clinical practice. 3) Define a vision for reporting that will advance the specialty of radiology as a leader in data-driven healthcare delivery.

URL's

http://www.radreport.org/tour/

RCC33C

Using Templates from radreport.org: Benefits, Critiques and Solutions

Marta Elise Heilbrun MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

INS-TUB

Informatics Tuesday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Tue, Dec 2 12:45 PM - 1:15 PM Location: IN Community, Learning Center

Sub-Events

INS153

Planning Complex Surgical Cutting Guides for Le Forte-Based, Maxillofacial Transplantation (Station #1)

Gerald Thomas Grant DMD, MS (Presenter): Nothing to Disclose , Peter Constantine Liacouras PhD : Nothing to Disclose , Ryan J. Murphy MS : Nothing to Disclose , Chad R Gordon DO : Nothing to Disclose , Mehran Armand PhD : Nothing to Disclose

CONCLUSION

Proper alignment of the donor and recipient bony anatomy could potentially decrease future complications and provide a screening tool if multiple donors are available. In efforts to achieve proper alignment, custom surgical guides can be designed and manufactured allowing surgeons to identify and transect precisely on

predetermined planes. In addition, earlier identification and surgical cuts will decrease surgical times.

Background

Craniomaxillofacial allotransplantation is currently a new and challenging procedure. Presently, more than twenty patients have received full or partial face transplants. Recently, one of the most current focuses of this procedure is the refinement of the methods and surgical technique used. Creating an optimal hybrid occlusion and facial proportions is difficult and benefits greatly from pre-surgical planning. Using radiographic tools, Digital Software, and Additive Manufacturing (3D Printing) many of the complex steps in these surgeries can be planned in advance.

Evaluation

CT scans of two deidentified cadaver heads were converted with segmentation software to gernerate volume data used for preoperative planning and visualization. One fo the scans was designated as a recipient with a maxillofacial defect. Surgical planes are developed and located on the recipient scann. The intact donor volume is then registerd to the recipient scan maintaining the cut planes for the best fit of donor to recipient.

Discussion

Registering the donor scan to the recipient provides the opportunity to evaluate the best fit of donor to recipient. In a situation where there may be multiple donors available, this technique could provide another screening of the donors as one may be a better fit than another. Since the cutting planes slice through both the donor and recipient, by adjusting the plane cuts to accomodate the cutting blades, the guides provide the best opportunity for exacting fit of the two boney sections.

INS154

Prostate MRI Structured Reports Co-connectible to Pathology Synoptic Report Structure Promote Improved Cancer Therapeutic Pathway Decision-making (Station #2)

Katherine Marie Gallagher MD : Nothing to Disclose , Marie Kim MD : Nothing to Disclose , Ashali Jain : Nothing to Disclose , David Dawson Bartlett Bates MD : Nothing to Disclose , Naznin Daginawala MD : Nothing to Disclose , Karen Buch MD : Nothing to Disclose , Alessandra Sax : Nothing to Disclose , C. Carl Jaffe MD : Nothing to Disclose , B. Nicolas Bloch MD (Presenter): Nothing to Disclose

CONCLUSION

Radiology and pathology reports that share format and semantic elements can facilitate efforts to audit consistency of healthcare pathway choices in prostate cancer patients and may influence decisions in post-operative care.

Background

Prostate MRI cancer staging is increasingly used in pre-surgical or radiotherapy planning. However, current radiology reporting practices (e.g. RadLex®) have yet to be aligned with the existing Synoptic pathology reporting framework currently implemented by the College of American Pathologists (CAP). The degree of semantic consistency between radiology and pathology reports can affect data search and efforts to audit the consistency of healthcare pathway choices in prostate cancer patients. Additionally, consistency between radiology and pathology reports can influence decisions in post-operative care, specifically with regards to radiotherapy.

Evaluation

A new prostate MRI structured reporting template was constructed. Several radiologic-reportable elements were identified that shared common relevance in radiology and pathology. These were successfully recast in the new radiology report structure to match the pathology Synoptic report format. Each element proffered a choice of responses contained between [ ] delimiters such as [Y/N or Not identified]. These data field headers included: Prostate Size [in cm]; Index Lesion [ ]; Extraprostatic Extension [ ]; Neurovascular Bundle Invasion and Laterality [ ]; Seminal Vesicle Invasion and Laterality [ ]; Staging (TNM). Conventional items, such as clinical request indications, patient demographics, and scan parameters, were also included in the template. A paragraph of free-text findings was allowed along with a summary impression.

Discussion

Coordinated radiology and pathology reports organize information into a clear, consistent, and more accessible format. This framework facilitates data search and enables auditing of healthcare therapeutic pathway choices to optimize clinical outcomes for prostate cancer patients. Furthermore, coordinated radiology and pathology reports promote improved clinical decision-making with regards to post-operative radiotherapy.

INS155

End-Loop Feedback Notifying Ticketing System (ELFNTS): Applying Automated Free-form Report Timeline Queries for Follow-up Examination Planning, Scheduling, and Physician Notification (Station #3)

Jaron Chong MD (Presenter): Nothing to Disclose

CONCLUSION

We believe this design pattern of a closed-loop feedback notification ticket system offers a general-purpose architecture for the development of a variety of valuable quality-assurance projects. Automated messaging allows for a 'push' instead of a 'pull' delivery model and the flexible notifications system permits both human and machine messaging to be performed yielding significant benefits beyond hard-coded dashboard implementations.

Background

Report timeline search has the potential to query for sequences of clinical or radiological events. However, translating these queries into routine follow-up examinations and clinician verified notification requires a complete end-to-end ticket and messaging architecture. This project describes the practical implementation of a query and notification system to allow a free-form report search engine to implement examination follow-up planning, scheduling, and physician notifications.

Evaluation

Recurring scheduled nested SPHINX EXTENDED2 queries are utilized to execute report timeline queries on a real-time search index. Using report text, study meta-information, and timeline query result matches, open tickets are generated, continuously re-evaluated, and closed. Upon satisfying of query report criteria, ticket maturity, or chronic persistence of an open-loop, a notification is dispatched to machine and/or human recipients including the RIS, radiologists, referring physician/physician teams, or patients.

Discussion

Using this general-purpose framework, we have been able to address commonly missed/near-miss clinical scenarios that lie below routine clinical practice thresholds and have been able to institute closed-loop quality assurance across a diverse variety of scenarios. We describe application examples involving (1) verification of scheduling of IVC filter retrieval, and (2) pulmonary nodule / incidental lesion follow-up, and (3) preliminary report discrepancy notification. Additionally, we describe multi-tiered notifications methods involving e-mail, SMS/FAX gateways, XMPP instant messaging gateways, and POTS Interactive Voice Response software (Asterisk) to allow for reliable verified message delivery in a heterogeneous operating environment.

INS156

Automatic Classification of Regional Patterns of Diffuse Interstitial Lung Disease with 3D Features from the Volumetric Chest CT Images (Station #4)

Yongjun Chang : Nothing to Disclose , Jangpyo Bae MS (Presenter): Nothing to Disclose , Namkug Kim PhD : Stockholder, Coreline Soft, Inc , Jung Won Moon : Nothing to Disclose , Ho Yun Lee MD : Nothing to Disclose , Joon Beom Seo MD, PhD : Nothing to Disclose

PURPOSE

To develop a computer-aided diagnosis (CAD) system to investigate the possible usefulness of 2D and 3D features by measuring the accuracy of regional pattern classification of diffuse interstitial lung disease (DILD) from volumetric chest Dual Energy CT (DECT) images.

METHOD AND MATERIALS

Twenty eight patients with suspected DILD were enrolled from February 2010 to August 2011. All patients underwent surgical biopsy within 3 days from DECT scanning (Somatom Definition Flash) with the dual-energy technique. Preprocessing including noise filtering and threshold-based segmentation of lung and airway using a rib detection and inverse level set algorithm were performed to extract lung with threshold of -130 HU at virtual non-contrast (VNC) images. For training with features, circular regions of interest (ROI) with 10-pixel diameter including normal, ground-glass opacity (GGO), reticular opacity, and consolidation patterns were picked by the two chest radiologists with consensus. For testing, a hundred 2D images randomly selected were manually divided into the four classes in the similar way. For training with 2D and 3D features, 10x10 reticular and 10x10x10 cubic regions were selected respectively. The characteristics of each ROI were represented by thirteen textural features and eleven shape features in 2D and 3D features were extracted. Support vector machine (SVM) classifier were used. Twenty repetitions with five-fold cross-validation were performed to evaluate overall accuracy of these classifiers.

RESULTS

The overall accuracy is 90.47 ± 4.62% for the whole lung classification with the combination of 2D and 3D features, which is significantly enhanced by 8.69% compared with that of 2D features only (paired t-test, $p<0.05$).

CONCLUSION

We proposed an automatic classification method based on SVM with 2D and 3D image features for DILD in DECT imaging. The experiments using twenty five-fold cross-validations result in 90.47% in mean accuracy, which demonstrates the effectiveness of the proposed CAD system for classifying DILD in DECT images.

CLINICAL RELEVANCE/APPLICATION

This method is useful in computer aided differentiation and quantification of regional disease patterns of diffuse infiltrative lung disease in DECT images, which could be helpful for lessening radiologists' workload by the initial diagnosis of the possible DILD.

INS157

3D Printing of Individual Immobilization Devices based on Radiological Imaging to Improve Daily Clinical Procedures in Radiation Therapy (Station #5)

Roland Unterhinninghofen PhD (Presenter): Nothing to Disclose , Jacob Kuypers : Nothing to Disclose , Moritz Wade : Nothing to Disclose , Alan Preuss : Nothing to Disclose , Florian Sterzing MD : Nothing to Disclose , Frederik Lars Giesel MD, MBA : Nothing to Disclose , Juergen Debus MD, PhD : Nothing to Disclose , Ruediger Dillmann PhD : Nothing to Disclose

CONCLUSION

By integrating modern radiological imaging and rapid manufacturing techniques with a dedicated algorithmic data processing we propose a completely new approach that is straightforward and significantly improves patient comfort. In the near future it may replace the last manual segment in the radiotherapy workflow by an almost fully automated production line.

Background

In radiation therapy patients need to be accurately immobilized in order to hit the tumor target exactly and to prevent damage to healthy tissue. For repeated sessions patient position must be reproducible. Usually immobilization devices are made manually using cast (ScotchCast) or thermoplastic material, which is costly and time-consuming. Especially with the head to be immobilized this causes significant discomfort to the patient.

We developed a new approach to produce individual immobilization devices for the head based on tomographic image data and 3D printing technologies: using in-house developed software, MRI or CT images are processed to generate a surface mesh model of the fixation mask. Subsequently apertures for eyes, nose, mouth, and ears are cut into the mask model. Also, an interface for fixation to the intervention table is added. Finally the mask model is materialized using a Dimension SST1200es 3D printer (Stratasys, Eden Prairie, MN, USA).

Evaluation

The concept has been implemented in a prototypical fashion and has proven to be feasible. In a qualitative study with healthy volunteers (N=10) the masks fitted well on the volunteers' faces leaving marginal space for moving. However, with some masks, specific areas of the faces such as eyebrows, nose, or chin experienced uncomfortable stress. A quantitative evaluation of the fixation accuracy is ongoing.

Discussion

The main advantage of our solution is that the mask is produced in a completely contact-free way using radiological image data already acquired for planning. It hence improves patient comfort and reduces psychological stress considerably.

Also, our approach has the potential to outsource the production of the masks from the clinics, thereby reducing costs and releasing human resources that were needed for conventional mask production.

RCA34

Rapid Application Development with XIP™ - the eXtensible Imaging Platform (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 2:30 PM - 4:00 PM Location: S401AB

Participants

Lawrence R. Tarbox PhD (Presenter): Nothing to Disclose
Fred William Prior PhD (Presenter): Research collaboration, Electrical Geodesics, Inc

LEARNING OBJECTIVES

1) Learn the basic architecture of an XIP™ Application and how it interacts with the XIP Host™ and with the GUI system. 2) Become familiar with the capabilities available in the XIP Libraries™. 3) Describe how to use the XIP Builder™ and GUI engine to create XIP Applications from modules in the XIP Libraries. 4) Understand the concepts of DICOM Application Hosting and its impact.

ABSTRACT

The eXtensible Imaging Platform (XIP™) is an open source framework supporting rapid development of imaging and visualization applications. In this 'hands on' tutorial participants will dissect a fully functional XIP™ application to see firsthand how developers utilize XIP's visual 'drag-and-drop' programming tool (the XIP Builder™) and associated libraries (the XIP Libraries™) in creating applications. In addition to functions from the popular ITK and VTK libraries, the XIP Libraries include modules tailored for medical imaging, many of which are hardware accelerated via GPU programming (e.g., OpenGL® GLSL or OpenCL or CUDA C). Applications created with XIP can either run standalone, or as DICOM Hosted Applications. Through the DICOM Application Hosting interfaces (DICOM WG-23), a Hosting System, such as the XIP Host™, relieves the application developer from the need to re-implement infrastructure common to all applications (e.g. DICOM network connectivity, database, etc.). We will demonstrate how users execute Hosted Applications, such as those created with the XIP Libraries, via the XIP Host.

URL's

http://www.OpenXIP.org

RCB34

Making the Most of Google Docs: Collaborative Word Processors, Spreadsheets, and Calendars (Hands-on)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 2:30 PM - 4:00 PM Location: S401CD

Participants

Moderator
Marc D. Kohli MD : Research Grant, Koninklijke Philips NV Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Describe the benefits and drawbacks of using google documents for collaborative editing. 2) Explain issues related to storing protected health information in google documents. 3) Demonstrate the ability to use google documents for collaboration on document and spreadsheet creation.

ABSTRACT

Note: Attendees should have or create a google account prior to coming to the session. In today's busy environment, we need tools to work smarter, not harder. Google documents provides a platform for collaboration that can be used across and within institutions to produce documents and work up data with less hastle. However, with increased sharing, secuirty concerns need to be addressed. At the end of the session, learners should be able to demonstrate creating, sharing, and editing a document as a group.

Sub-Events

RCB34A

Word Processor

Marc D. Kohli MD (Presenter): Research Grant, Koninklijke Philips NV Research Grant, Siemens AG

LEARNING OBJECTIVES

View learning objectives under main course title.

RCB34B

Spreadsheet

Ross Warren Filice MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCB34C

Calendar

Aaron P. Kamer MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC34

Using IHE Profiles to Plan for Medical Imaging

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 2:30 PM - 4:00 PM Location: S501ABC

Participants

Moderator
David S. Mendelson MD : Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Corporation
Kinson Ho (Presenter): Employee, Agfa-Gevaert Group
David A. Clunie MBBS (Presenter): Owner, PixelMed Publishing LLC
Christopher Lindop (Presenter): Employee, General Electric Company

LEARNING OBJECTIVES

1) Value of IHE with content and vendor neutral integration. 2) How content neutral clinical information is managed with a Vendor Neutral Archive (VNA). 3) Planning for a Vendor Neutral Archive (VNA) or expand upon an existing VNA system to support both imaging and non-imaging content and systems. 4) The benefit of using IHE Imaging profiles for cross-enterprise and cross-community image sharing".

ABSTRACT

Integrating the Healthcare Enterprise (IHE) is a joint initiative of healthcare professionals and industry vendors to improve the

way clinical systems in healthcare share information. IHE promotes the coordinated use of established standards such as webservices, DICOM and HL7 to address specific clinical need in support of optimal patient care. Established in 1997, the IHE Radiology Committee, a development domain of IHE, has profiled the clinical use cases to develop a framework of interoperability, known as the IHE Integration Profiles. Integration Profiles are developed specifically to be 'Vendor Neutral'. The first Integration Profile developed by IHE is known as Scheduled Workflow. It specifies how imaging departmental workflow can operate seamlessly between vendors. The Integration Profiles are maintained and published by IHE in the IHE Technical Framework. With the introduction of Cross-Enterprise Document Sharing (XDS) in 2005, IHE has extended the definition of 'Neutral' to include non-imaging content storage in healthcare. This course will specifically deliver and review the IHE Integration Profiles developed by IHE Radiology and the other IHE domain committees profile which can be used by healthcare professionals and the industry for the interoperability specification, procurement and installation of a 'Content' Vendor Neutral Archive (VNA).

SSJ13

Informatics (Business Analytics)

Scientific Papers

IN

AMA PRA Category 1 Credits ™: 1.00

ARRT Category A+ Credit: 1.00

Tue, Dec 2 3:00 PM - 4:00 PM Location: S402AB

Participants

Moderator
William W. Boonn MD : Founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Shareholder, Nuance Communications, Inc Shareholder, Merge Healthcare Incorporated
Moderator
Woojin Kim MD : Co-founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Board of Directors, Montage Healthcare Solutions, Inc Advisory Board, Zebra Diagnostics Ltd
Moderator
Stuart R. Pomerantz MD : Research Grant, General Electric Company

Sub-Events

SSJ13-01

Why Real-time-Monitoring Could Be the Key to Workflow Optimization in Radiology

Achim Escher (Presenter): Nothing to Disclose , Tobias Heye MD : Nothing to Disclose , Elmar M. Merkle MD : Advisor, Siemens AG Advisor, Bayer AG Speakers Bureau, Bayer AG Reserach Support, Bayer AG Reserach Support, Bracco Group Reserach Support, Guerbet SA

CONCLUSION

A real-time-monitoring approach can help to optimize the radiology workflow by making essential process steps and related information available to the staff.

Background

To optimize service quality web-based-monitoring-displays were implemented in 2013/2014. Displays are showing lists of pending studies in critical workflow-steps (protocoling, scheduling, reporting). The goal is time tracking each workflow-step to ensure timely processing to prevent unnecessary delays. Color-coded time thresholds help to adhere to process time objectives. In a further step this monitoring-approach was used to optimize communication between the emergency room (ER) and radiology department. Status update information for each process-step were broadcasted to a central display at the ER.

Evaluation

Protocoling: 2013 data showed a high variability in the mean time period between order entry and protocoling (range 50-76 min.) which decreased from 75 min. to 52 min. (2/2014 vs. 3/2014) following the implementation of the monitoring solution. Scheduling: A high variability in the mean scheduling processing time (range 14-36 min.) was improved by 18 minutes from 2/2014 to 3/2014. Reporting: Since the introduction of real-time-monitoring turnaround-times (TAT) for radiology reports in 6/2013, the median of TAT improved by 100 min. compared to 6 months prior and by 278 min. compared to 2012. Information system in the ER: The patient's status within the radiology scheduling system was displayed in the ER to allow optimized patient management e.g. discharging if an MRI study was arranged. This led to an increase in MRI study referrals (mean before 6.8/week, mean after optimization 15.6/week).

Discussion

Previously high variability in workflow steps indicate an opportunity in workflow optimization and reveal organizational issues causing prolonged process steps. To ensure fast processing of each workflow step color-coded indicators to identify critical time period thresholds are helpful. Real-time-monitoring can help to improve service quality for referring physicians by offering transparency and providing information about the patients' status within the radiology workflow at any time.

SSJ13-02

Can We Predict Patient Waiting Time?

Oleg S. Pianykh (Presenter): Nothing to Disclose , Daniel Ira Rosenthal MD : Nothing to Disclose

CONCLUSION

Through exhaustive predictor analysis we discovered an efficient and accurate PWT predictor formula, much more accurate that constant PWT estimate. It was used to implement waiting area displays, informing patients of their anticipated wait time. This also helped us identify the outliers - patients waiting significantly longer than predicted - and train our staff to assist these patients with their needs. As a result, our PWT provided us with an improved radiology workflow, more informed patients, and staff able to concentrate on more urgent questions.

Background

"How long will it take?" is the most frequent question asked in the waiting rooms. Knowing Patient Wait Time (PWT) allows one to improve patient/staff satisfaction, load-balance departmental resources, develop long-term planning and strategies. Our project addressed the most fundamental question of accurate PWT prediction.

Evaluation

To perform PWT analysis, we used our onsite X-Ray imaging facility with 9 X-Ray units, providing images for orthopedic outpatients. 8478 exams records, corresponding to 13 consecutive weeks of patient visits and 6452 patients, were captured from the RIS database. We defined 23 independent PWT predictor variables, including patient wait line size L, number of patients in exam rooms F, patient arrival/processing rates, patient exam type, patient age, etc. Our goal was to build the most accurate PWT predictor, using as few parameters as possible. Therefore we analyzed all possible linear and quadratic regression predictors with up 4 parameters selected from the original 23-parameter set.

Discussion

We discovered that the most accurate PWT predictor has the following form: PWT = $W_0+k_0L_0+k_tL_t+K_{2t}L_{2t}$, Where: W_0, k_0, k_t, k_{2t} are optimally-chosen coefficients L_t is the patient waiting line size t minutes ago t is the sampling rate. The optimal sampling rate t was found to be 5 minutes. As a result, our PWT formula used the same parameter L, sampled at 5-minute intervals. The value of L was found from RIS as the count of patients, who arrived but have not started their exams yet. The median error for this PWT predictor was only 3 minutes; using all 23 predictors would decrease the error only by a few seconds.

SSJ13-03

Mine Your Data ! - Enhancing Pretest Probability of Imaging through Incorporation of Data Mining Tools in Clinical Workflow

Supriya Gupta MBBS : Nothing to Disclose , Norman B. Thomson MD (Presenter): Stockholder, Nuance Communications, Inc , James Vincent Rawson MD : Nothing to Disclose

CONCLUSION

Implementation of various informatics tools can potentiate efficient clinical workflow and aid radiologists and referring physicians to synchronize their expectations from an imaging exam. Evaluation and knowledge of pretest probability can be used as a marker for assessing imaging exam utilization.

Background

Changing expectations of referring physicians and increasing pay for performance burden for the radiologists creates need for integrating time-saving efficient data mining tools in clinical workflow. Our purpose is to discuss the potential of integrating data mining tool at various steps in radiology workflow to enhance pretest probability of imaging exam.

Evaluation

We enumerate potential of data mining at each step of the clinical workflow to enhance pretest probability: Before placing exam order: Tools for auto-populating relevant patient information like allergies, pregnancy, known chronic disease, family history and contraindications for performing imaging exams. During placement of an exam order: Order entry system at any hospital leverages the most important connection in the workflow. Accurate clinical description (signs, symptoms, physical findings, pertinent lab data) should be well laid out. After order is placed: Data mining tools can be integrated into the viewer to display pertinent patient information during dicttaion to provide differential diagnosis by querying institutional database based on patient age, gender, location, clinical sign and type of imaging exam.

Discussion

Various informatics tools are currently deployed sporadically or in conjunction at various institutions for potentiating clinical and imaging workflow. However, the expectation of a referring physician may not be entirely reflected in this cumulative clinical information. Since radiologists depend on provided history and clinical examination of the referring physician.The implementation of data mining necessitates availability of an integrated EHR which is queriable. Recent push by government for adoption of EHRs should go hand in hand with data mining systems.

SSJ13-04

Department Data Depot: Merging Databases for Composite Wait Time Performance Metrics

Christine M. Zwart PhD (Presenter): Nothing to Disclose , Kun Wang MS : Nothing to Disclose , Ellen Ermer MS : Nothing to Disclose , Amy Kiyo Hara MD : Nothing to Disclose , Clinton V. Wellnitz MD : Nothing to Disclose , J. Ross Mitchell PhD : Co-founder, Calgary Scientific, Inc Intellectual property, Calgary Scientific, Inc Shareholder, Calgary Scientific, Inc

CONCLUSION

By having a singular repository from which we could pull alternative timestamps, we were able to select the most appropriate indicator for exam start time. This type of unified framework for department databases allows easier analysis and comparison of radiology exam workflow.

Background

Most radiology departments make use of multiple databases for storing exam information: a PACS for images;

a RIS for reports; and an EMR for patient data. These systems are complex, often from different vendors, and may not work well together. This makes measurement of critical performance metrics difficult. Furthermore, it is challenging to identify the best source for data when there is overlap. To address this we developed a Department Data Depot (DDD) - a system that pulls data from department systems then uses cross-database relationships to integrate and validate the data into a single Microsoft SQL Server database. We used FileMaker (FileMaker, Inc, Santa Clara, California) to abstract the DDD, allow simple report generation and delivery to web and mobile clients.

Evaluation

The pre-scan time interval is an important metric of department efficiency. It includes the time between patient check-in, appointment, and scan start. We used our EMR for appointment and check-in times. We explored three options for scan-start time: 1) The technologist recorded scan time (previous reporting standard), 2.) The time at which the exam 'arrived' in PACS, and 3.) The time recorded in the DICOM header of the first image. Each scan-start options was retrieved from a different database. Respectively: 1.) RIS, 2.) PACSHealth PACS monitoring (PACSHealth, LLC, Scottsdale, AZ), and 3.) Custom DICOM header parsing software (designed for dose monitoring).

Discussion

The least accurate indicator of start time was the RIS as the recorded scan time marked either the beginning or end of the scan. The most accurate indicator was the DICOM header. For CT, study arrival into PACS was similar to the DICOM indicated start time (due to the initial scout scan). Study arrival, however, was not a good start time indicator for MR where the collection and processing time may delay the first scan's arrival significantly.

SSJ13-05

What Studies Did You Interpret Last Year? – Creation of Capricorn Platform for Monitoring Study Volume and Assessment of Residents' Experience

Yin Jie Chen MD (Presenter): Nothing to Disclose , Po-Hao Chen MD, MBA : Nothing to Disclose , Mary Helene Scanlon MD, FACR : Nothing to Disclose , Tessa S. Cook MD, PhD : Nothing to Disclose

CONCLUSION

Capricorn has been created for residents by residents to provide a tool for visualizing their portfolio of interpreted radiologic studies, an important aspect of residency experience, which is a need currently unfulfilled by existing analytic tools.

Background

Business analytics is an increasingly important element of radiology practice. However, nearly all available tools focus on enterprise-level intelligence; no analytic tools are dedicated to residency training. In radiology resident education, the volume and variety of radiologic studies comprise a critical dimension of learning. We created a resident-centered analytics tool to provide our fellow residents a user-friendly means of analyzing their portfolio of interpreted radiologic studies.

Evaluation

We created an open-source web-based platform called "Capricorn" containing a resident-centric database, in which studies are organized by modality and clinical rotation and visually organized for residents. Secure accounts ensure that a resident can access her personalized volume profile. Prior to implementation, our residents were surveyed for their views towards volume of studies interpreted plus related topics and their opinions on the Capricorn user interface. The response rate for this initial survey is 56% (27/48). In this survey, 88.9% responded that interpretation volume is "very important" or "somewhat important" to their education, and 70.4% responded that it is currently "very inconvenient" or "somewhat inconvenient" to track number of studies interpreted. We then provided the respondents a sample interface of Capricorn, after which 65% to 70% responded 4 or 5 (5 = highest) when rating Capricorn for convenience, usefulness, and functionality.

Discussion

Capricorn provides a birds-eye, comparative view of a resident's volume of interpreted studies, which are currently inconvenient to monitor over time. It should also provide a secure environment to allow residents to benchmark their own performance against historical data or track progress towards volume-related ABR requirements such as mammography. To assess their views over time, additional surveys will be administered in one and six months after the implementation of Capricorn.

SSJ13-06

Determining Imaging Characteristics of KRAS Oncogene Mutations in Colon Cancer Using Word Frequency and Naive Bayes Analysis of Radiology Reports

Siddharth Govindan MD (Presenter): Nothing to Disclose , Quanzheng Li PhD : Nothing to Disclose , Suvranu Ganguli MD : Research Grant, Merit Medical Systems, Inc Consultant, Boston Scientific Corporation , Thomas Gregory Walker MD : Nothing to Disclose , Rahmi Oklu MD, PhD : Nothing to Disclose

PURPOSE

To apply word frequency analysis and a naive Bayes classifier on radiology reports to extract distinguishing imaging descriptors of wild-type colon cancer patients and those with KRAS mutations.

METHOD AND MATERIALS

In this IRB approved study, we compiled a SNaPshot mutation analysis dataset from 457 colon adenocarcinoma patients between March, 2009 to December, 2012. From this cohort of patients, we analyzed the radiology reports of 299 patients (>32,000 reports) who were either the wild type (147 patients) or had a KRAS (152 patients) mutation. We wrote a computer program to determine the frequency of words within the wild type and mutant group radiology reports and using a naive Bayes classifier determined the probability of a given word belonging within either group.

RESULTS

Words with a greater than 50% chance (range 56-58%) of being in the KRAS mutation group and which had the highest absolute probability difference compared to the wild type group included: "several", "innumerable", "confluent", and "numerous." In contrast, words with a greater than 50% chance (range 58-61%) of being in the wild type group and with the highest absolute probability difference included: "few", "discrete", and "[no] recurrent."

CONCLUSION

Words used in radiology reports, which have direct implications on disease course, tumor burden and therapy, show up with differing frequency in patients with KRAS mutations versus wild-type colon adenocarcinoma. More importantly, the study suggest that there are likely characteristic imaging traits of mutant tumors.

CLINICAL RELEVANCE/APPLICATION

Probabilistic word analysis may be useful in identifying unique characteristics and disease course associated with mutated oncogenes. This type of analysis may be applied to radiology reports as well as other types of clinical notes.

SSJ22

Physics (Computer Aided Diagnosis II)

Scientific Papers

PH IN

AMA PRA Category 1 Credits ™: 1.00

ARRT Category A+ Credit: 1.00

Tue, Dec 2 3:00 PM - 4:00 PM Location: S403B

Participants

Moderator
Heang-Ping Chan PhD : Institutional research collaboration, General Electric Company
Moderator
Bram Van Ginneken PhD : Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Canon Inc Research Grant, Toshiba Corporation Research Grant, Riverain Technologies, LLC

Sub-Events

SSJ22-01

Automated Lymphadenopathy Detection by Sparse Linear Fusion of 2D Views

Ari Seff : Nothing to Disclose , Evrim Bengi Turkbey MD : Nothing to Disclose , Le Lu PhD : Nothing to Disclose , Ronald M. Summers MD, PhD (Presenter): Royalties, iCAD, Inc Research funded, iCAD, Inc Stockholder, Johnson & Johnson Grant, Viatronix, Inc

PURPOSE

To develop a new algorithm paradigm for detection of mediastinal and abdominal enlarged lymph nodes (>10 mm in short axis diameter).

METHOD AND MATERIALS

Two CT datasets (90 patients with 388 mediastinal LNs and 86 patients with 595 abdominal LNs) were used in this study. Images were acquired in the portal venous phase with a slice thickness of 1-1.25 mm. All enlarged lymph nodes in the two target regions were marked with a centroid by a radiologist as the reference standard. We applied a new algorithm paradigm of aggregating lymph node detections on 2D views. First, candidate generation within the target region proceeded via a random forest classifier trained with primitive, voxel-level features. Each candidate was cropped as a cube VOI of 45×45×45 voxels. 2D slice sampling along the axial, coronal, and sagittal axes of a VOI resulted in 27 image views per candidate. Histogram of Oriented Gradients (HOG) features were extracted from each 2D view and used to train a robust LibLinear classifier. Following testing, we aggregated the 27 resulting confidence scores per candidate via max-pooling and sparse linear fusion schemes to obtain a final probability score per VOI. Six-fold cross-validation was used in the experiments.

RESULTS

The sensitivities of our automated detection systems were 78.0% at 6 false positives/volume (FP/vol.) (86.1% at 10 FP/vol.) and 73.1% at 6 FP/vol. (87.2% at 10 FP/vol.) for the mediastinal and abdominal datasets respectively. Approximately 20% of the false positives were actually small lymph nodes (<10 mm).

CONCLUSION

We validated a novel approach to automated lymph node detection in CT images that significantly outperforms the previous best reported work.

CLINICAL RELEVANCE/APPLICATION

Detection of lymphadenopathy is crucial in cancer patients to assess staging and treatment response. Automated detection may permit more accurate and time efficient assessment.

SSJ22-02

Performance Assessment of Retroperitoneal Lymph Node Computer-Assisted Detection Using Random Forest and Convolutional Neural Network Machine Learning Classifiers in Tandem

Lauren M. Kim MD (Presenter): Nothing to Disclose , Holger Reinhard Roth PhD : Nothing to Disclose , Le Lu PhD : Nothing to Disclose , Kevin Cherry : Nothing to Disclose , Shijun Wang : Nothing to Disclose , Evrim Bengi Turkbey MD : Nothing to Disclose , Ronald M. Summers MD, PhD : Royalties, iCAD, Inc Research funded, iCAD, Inc Stockholder, Johnson & Johnson Grant, Viatronix, Inc

PURPOSE

To assess the performance of a retroperitoneal lymph node (LN) computer-assisted detection (CADe) system using a novel employing Random Forest (RF) and Convolutional Neural Network (CNN) machine learning classifiers in tandem.

METHOD AND MATERIALS

One radiologist, serving as the standard of ground truth, labeled 595 abdominal LN (>1cm in the short axis) on 86 CT examinations which were assorted into training (60/86), cross-validation (12/86), and test (14/86) sets. CADe was comprised of a two-phased approach, the first consisting of retroperitoneal LN candidate generation by a RF classifier which generated 40 false positives (FP) per patient at maximum sensitivity. Subsequently a CNN classifier using 100 observers was trained at 100% sensitivity with FP detections of the RF classier used as training examples of true negatives. Subsequently, the CADe was set at an operating point to display marks with confidences of at least 0.5. These CADe marks were appraised by an independent, unbiased radiologist who reviewed the 14 CT examinations in the test set and identified each identified retroperitoneal LN as undetected by CADe [false negative (FN)], CADe true positive (TP) representing a LN >8mm in the short axis, or CADe FP.

RESULTS

In an independent analysis by a radiologist, CADe sensitivity on the test set was 83% generating on average 2 FP per patient. No physical feature was definitively determined to elevate the FP rate except the presence of ascites (Chi-square test, $p<0.05$) which elevated the FP rate approximately 4-fold.

CONCLUSION

This retroperitoneal LN CADe is highly sensitive at a low FP rate. Ascites confounds this CADe system, substantially and significantly elevating its FP rate.

CLINICAL RELEVANCE/APPLICATION

The accurate detection of lymph nodes plays a critical role in the diagnosis, staging, and subsequent management of neoplastic malignancy though is an inherently difficult task given their variable size, appearance, and location. Here we present a retroperitoneal LN CADe employing two machine learning algorithms in tandem which substantially outperforms previous state-of-the-art techniques which are reported to generate 3-6 FP per volume of interest (VOI) at sensitivities ranging from 53-61%. With further validation and refinement, our LN CADe may substantially bolster a radiologist's sensitivity and proficiency in the assessment of lymph nodes.

SSJ22-03

Use of Random Forest in a Novel Dynamic Random Conditional Field-based Computer-aided Diagnosis System for Prostate Cancer Segmentation and Labeling on Multi-Parametric MR Images

Karen Elizabeth Burtt BS : Nothing to Disclose , Shijun Wang : Nothing to Disclose , Baris Turkbey MD : Nothing to Disclose , Evrim Bengi Turkbey MD : Nothing to Disclose , Nicholas Petrick PhD : Nothing to Disclose , Peter L. Choyke MD : Researcher, Koninklijke Philips NV Researcher, General Electric Company Researcher, Siemens AG Researcher, iCAD, Inc Researcher, Aspyrian Therapeutics, Inc Researcher, ImaginAb, Inc Researcher, Aura , Peter Pinto : Nothing to Disclose , Bradford J. Wood MD : Researcher, Koninklijke Philips NV Researcher, Celsion Corporation Researcher, BTG International Ltd Researcher, , W. L. Gore & Associates, Inc Researcher, Delcath Systems, Inc Pending research funded, Perfint Healthcare Pvt Ltd Patent agreement, VitalDyne, Inc Intellectual property, Koninklijke Philips NV Intellectual property, BTG International Ltd , Ronald M. Summers MD, PhD (Presenter): Royalties, iCAD, Inc Research funded, iCAD, Inc Stockholder, Johnson & Johnson Grant, Viatronix, Inc

PURPOSE

We demonstrate an automated, supervised prostate computer-aided diagnosis (CADx) system utilizing a novel algorithm based on dynamic conditional random fields (DCRF) and evaluate the performance of this system with and without the use of a random forest (RF).

METHOD AND MATERIALS

Multi-parametric 3T prostate MRI scans were performed on 60 patients using an endorectal coil. Pathology was established using MRI-TRUS fusion biopsies. Cancer and central gland segmentations were established by a trained radiologist for 40 training and 20 test cases on T2 weighted images (T2WI). ADC images and Ktrans maps (from DCE images) were registered to the T2 images using coordinate information. Features included intensities of T2WI, ADC, and Ktrans images, location information, and entropy of 3D sub-volume extracted around each node. A dynamic conditional random field with one layer of observations and two hidden layers was utilized to label and segment prostate lesions. The hidden variables defined whether a voxel was located in the central gland or in the peripheral zone, and whether it represented cancer. The DCRF classifier was trained using pseudo-negative log likelihood. A cascading classifier system was tested with an RF feeding into the DCRF. Prediction maps were generated by applying the classifier to test images. Statistical analysis of receiver operating characteristic (ROC) curves were conducted using the Mann-Whitney U Test.

RESULTS

The proposed DCRF method without RF yielded an AUC of 0.8432 (95% C.I. [0.8422, 0.8441]) for classifying prostate lesions, compared to an AUC of 0.8889 (95% C.I. [0.8881, 0.8897]) using the DCRF with RF. DCRF with RF was found to have a statistically superior AUC compared to DCRF alone ($p<0.01$). Prediction maps and ROC curves are shown in Figure 1.

CONCLUSION

Random forest increases the performance of the proposed DCRF method in classifying cancer on multi-parametric prostate MRI. Clinically useful prediction maps may be generated using the proposed methods.

CLINICAL RELEVANCE/APPLICATION

An improved CADx system may reduce reading time, increase the performance of less expert readers, and decrease inter-observer variability in interpreting prostate MR images.

SSJ22-04

Robust Computer-aided Detection of Tuberculosis in Chest Radiographs Using Energy Normalization

Rick Philipsen MSc (Presenter): Nothing to Disclose , Pragnya Maduskar BEng, MENG : Nothing to Disclose , Laurens Hogeweg : Nothing to Disclose , Jaime Melendez : Nothing to Disclose , Clara Isabel Sanchez MSc, PhD : Nothing to Disclose , Bram Van Ginneken PhD : Stockholder, Thirona BV Co-founder, Thirona BV Research Grant, MeVis Medical Solutions AG Research Grant, Canon Inc Research Grant, Toshiba Corporation Research Grant, Riverain Technologies, LLC

PURPOSE

The performance of computer-aided detection (CAD) algorithms for chest radiography can be influenced by variations in image data coming from different sources. Acquisition settings, detector technology and proprietary post-processing all influence the appearance of radiographs. We developed an algorithm to standardize the appearance of chest radiographs (CXRs) in order to remove these variations prior to image analysis and evaluated its utility for a CAD system aimed at tuberculosis (TB) detection.

METHOD AND MATERIALS

Three data sets of 200 digital CXRs were used: 100 normal / 100 abnormal cases from an Odelca DR system acquired in Zambia; 100 normal / 100 abnormal cases from a digital Atomed mobile X-ray system acquired in The Gambia; 127 normal / 73 abnormal cases from a Philips Digital Diagnost system acquired in the United Kingdom. Reference standard for suspicion of TB was set by an expert reader. To standardize the appearance of CXRs, the image is decomposed into frequency bands using hierarchical unsharp masking. In a training set the average energy (standard deviation) of each frequency band in the central part of the image is determined. Each energy band is scaled to this reference energy, and the input image is reconstructed from the scaled frequency bands. Subsequently the lung fields and mediastinum are segmented via pixel classification and the energy normalization is repeated for region containing the union of lung fields and mediastinum. Cases were processed by a CAD system (CAD4TB v3.07, Diagnostic Image Analysis Group, Nijmegen, The Netherlands) with and without applying the energy normalization method. This CAD system was trained with cases from an Odelca DR system. Performance was measured as area under the ROC curve (Az). Pairwise comparisons were made with bootstrap estimation, considering $p<0.05$ significant.

RESULTS

Without normalization, CAD4TB obtained an Az of 0.80, 0.61 and 0.47 for the data from Zambia, The Gambia, and the United Kingdom, respectively. With normalization, Az increased to 0.87, 0.80 and 0.84. Differences for the data from The Gambia and the United Kingdom were significant.

CONCLUSION

The robustness of CAD for detection of signs of TB on CXRs is improved by standardizing the radiographs prior to analysis.

CLINICAL RELEVANCE/APPLICATION

An automated reading system for CXRs that can be used reliably on data from any digital unit has great potential in TB screening and active case finding.

SSJ22-05

Computer-aided Detection of Prostate Cancer in Multi-parametric Magnetic Resonance Imaging

Geert Litjens MSc : Nothing to Disclose , Nico Karssemeijer PhD : Shareholder, Matakina International Limited Scientific Board, Matakina International Limited Shareholder, QView Medical, Inc Research Grant, Riverain Technologies, LLC , Jelle O. Barentsz MD, PhD : Nothing to Disclose , Henkjan Huisman PhD (Presenter): Stockholder, QView Medical, Inc

PURPOSE

Accurate reporting of multi-parametric prostate magnetic resonance imaging (mpMRI) is difficult and requires substantial experience. We investigate the effect of computer-aided diagnosis (CAD) on the diagnostic accuracy of prostate MRI reporting.

METHOD AND MATERIALS

Two consecutive cohorts of patients were used. One for training/development of the CAD system (347 patients) and one for the prospective evaluation (130 patients). Both cohorts comprise mpMRI and subsequent MR-guided biopsy and pathology. The mpMRIs were ESUR guideline compliant and performed on a Siemens 3T

MRI without the use of an endo-rectal coil. Both cohorts were prospectively reported by one of ten radiologists according to the PI-RADS guidelines. Experience of the radiologists ranged from inexperienced to very experienced (1-20 years). The computer-aided diagnosis (CAD) system comprised of a voxel classification stage and a subsequent candidate segmentation and classification stage. Features include quantified T2, ADC, pharmacokinetics, texture and anatomical characteristics. ROC and FROC analysis was used to evaluate performance. For the prospective validation the CAD system assigned a score to each radiologist-identified lesion. Logistic regression combining the radiologist and CAD scores was used to emulate independent, prospective CAD reading. Subsequently, the diagnostic performance in detecting intermediate-to-high-grade cancer of the CAD system alone, the radiologist alone and the radiologist CAD-system combination was evaluated using sensitivity and specificity for the different PI-RADS thresholds. Bootstrapping was used to assess significance.

RESULTS

FROC analyses showed that the CAD system could detect 82% of all intermediate-to-high-grade lesions at 1 false positive per case. Combined CAD and radiologist score significantly improved the sensitivity at a PI-RADS 4 threshold over the radiologist alone (0.98 for the combination, 0.93 for the radiologist alone, $p = 0.029$). A significantly improved specificity was found at a PI-RADS threshold of 3 (0.25 versus 0.09, $p = 0.013$).

CONCLUSION

CAD can achieve excellent performance. As a second observer to characterize prostate lesions it can improve sensitivity and specificity in discriminating intermediate-to-high-grade cancer.

CLINICAL RELEVANCE/APPLICATION

Improving the performance of mpMRI in the detection of prostate cancer by CAD can prevent unnecessary biopsies.

SSJ22-06

Digital Breast Tomosynthesis: Joint Reconstruction and Planar Projection Framework for Computer Aided Detection of Clustered Microcalcifications

Ravi Kumar Samala PhD (Presenter): Nothing to Disclose , Heang-Ping Chan PhD : Institutional research collaboration, General Electric Company , Yao Lu PhD : Nothing to Disclose , Lubomir M. Hadjiiski PhD : Nothing to Disclose , Jun Wei PhD : Nothing to Disclose , Mark Alan Helvie MD : Institutional Grant, General Electric Company

PURPOSE

To develop a framework utilizing the reconstructed volume and planar projection (PPJ) image of digital breast tomosynthesis (DBT) for computer aided detection (CADe) of microcalcification clusters (MCs).

METHOD AND MATERIALS

With IRB approval and informed consent, DBTs of 154 subjects (307 views) were acquired with a GE prototype system at 21 projections, 3^0 increments, over a 60^0 arc. DBT with 30^0 arc was reconstructed using the central 11 projections to simulate narrow-angle DBT system. SART with multiscale bilateral regularization that we developed to enhance calcifications and suppress noise was used to generate DBT volume and PPJ image. 127 views with MCs were used for training and 104 views with and 76 views without MCs were used for independent testing. Multiscale calcification response (MCR) was derived from the DBT volume. Calcification candidates were extracted by iterative region growing and thresholding of PPJ image, a subset of which with high contrast-to-noise ratio (CNR) and MCR were identified as cluster centroid objects. The CNR threshold t_r and decision rules for classification of true positives (TPs) and false positives (FPs) were determined adaptively based on the statistical properties of the CNR histogram for a given view. Starting from cluster centroid objects, conditional dynamic clustering forms clusters based on t_r and radial distance while continuously adjusting size and centroid position. A convolution neural network (CNN) was trained to classify TPs from tissue structures and artifacts on the PPJ image. FP clusters were further reduced by the CNN response, cluster shape and combination of size, CNR and number of candidates in a cluster. The performance of the joint DBT-PPJ framework was compared to the individual CADe in DBT and PPJ using JAFROC analysis.

RESULTS

At view-based test sensitivities of 80 and 85%, the joint CADe resulted in 0.92 and 3.02 FPs/view. The individual DBT and PPJ CADe achieved a maximum sensitivity of 71% (3.03 FPs/view) and 79% (2.42 FPs/view). JAFROC analysis showed a significant improvement of joint CADe compared to DBT ($p<0.0001$) and PPJ ($p=0.0022$).

CONCLUSION

Joint DBT-PPJ CADe for MCs outperforms individual CADe in DBT and PPJ.

CLINICAL RELEVANCE/APPLICATION

The joint DBT-PPJ framework improves the performance of the CADe system for MCs, further improving its potential as an adjunct in radiologist's workflow for interpretation of DBT.

RC425

Quantitative Imaging: Informatics

Refresher/Informatics

BQ IN PH

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 4:30 PM - 6:00 PM Location: E353A

Sub-Events

RC425A

The Role of Informatics in Quantitative Imaging

Katherine P. Andriole PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand the role of informatics in quantitative imaging. 2) Be able to identify existing limitations in information technologies with respect to quantitative imaging, and conversely see how informatics may assist in filling some of the current gaps in quantitative imaging methods. 3) Become familiar with on-going efforts to address current challenges facing research into and clinical implementation of quantitative imaging applications.

ABSTRACT

Quantitative imaging is increasingly becoming an essential part of biomedical research as well as being incorporated into clinical diagnostic activities. Referring clinicians are asking for more objective information to be gleaned from the imaging tests that they order so that they may make the best clinical management decisions for their patients. Medical Physicists, Researchers, Imaging Scientists, and others may be called upon to identify existing issues as well as develop, validate and implement new approaches and technologies to help move the field further toward quantitative imaging methods. Biomedical imaging informatics tools and techniques such as standards, integration, data mining, cloud computing and new systems architectures, ontologies and lexicons, data visualization and navigation tools, and business analytics applications can be used to overcome some of the existing limitations. The RSNA's Quantitative Imaging Biomarkers Alliance (QIBA) is an initiative with international participation from medical physicists, clinicians, researchers, industry scientists, and government officials all interested in optimizing the potential of quantitative imaging. A major QIBA informatics activity, the imaging data warehouse is in progress. Current status and future plans will be described.

RC425B

Standards for Quantitative Imaging

David A. Clunie MBBS (Presenter): Owner, PixelMed Publishing LLC

LEARNING OBJECTIVES

1) Identify the importance of quantitative imaging principles in the setting of clinical trials. 2) identify the role of standards, including DICOM and others, in the successful application of quantitative imaging principles. 3) Analyze quantitative imaging techniques and apply this knowledge to protocol development in the setting of clinical trials.

RC425C

Clinical and Research Needs for Quantitative Imaging Informatics Tools

Bradley J. Erickson MD, PhD (Presenter): Stockholder, Evidentia Health, Inc

LEARNING OBJECTIVES

1) Become familiar with the quantitative imaging tools that are available for clinical and research uses. 2) Become familiar with the clinical and research problems that are being addressed by quantitative imaging. 3) Become familiar with the clinical and research problems that might be addressed by quantitative imaging in the near future and how to prepare one's practice for these uses.

ABSTRACT

Quantitative imaging is more than just the measurement of structures in images. It is a new way of approaching diagnosis and therapy assessment. While simple linear measurements might qualify as quantitative imaging, it is important to think of QI in a much broader context. In addition to measuring spatial quantities like length, area, and volume, one can measure image values on functional imaging, which might represent a physiologic value. One can measure textures and edge properties, potentially replacing the 'it just looks like it' answer to why an expert can diagnose a certain disease. Measuring change can also be more than just spatial. Spatial change detection is important, of course, and doing it well is a critical component of QI. Measuring change in non-spatial properties is likely to become more important in the future. Finally, while some might believe that genomics will largely replace imaging, there is currently much interest in the use of imaging to provide pervasive and non-destructive prediction of genomic, proteomic, and metabolomic properties that are likely to be of great value to patient care.

RC453

Clinical Decision Support: Lessons from the Medicare Imaging Demonstration

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 4:30 PM - 6:00 PM Location: S104A

Participants

Moderator
Ramin Khorasani MD : Consultant, Medicalis Corp
Ramin Khorasani MD (Presenter): Consultant, Medicalis Corp
Safwan Halabi MD (Presenter): Nothing to Disclose
Keith David Hentel MD, MS (Presenter): Nothing to Disclose
Jonathan D. Darer MD, MPH (Presenter): Nothing to Disclose
Katherine L. Kahn MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Define Clinical Decision Support (CDS) and attributes of effective CDS for imaging to improve appropriate use of imaging. 2) Review implications of recent federal initiatives related to imaging CDS, including the Medicare Imaging Demonstration (MID), Meaningful Use, and Promoting Evidence-based care as part of the recently passed Protecting Access to Medicare Act of 2014 (HR4302). 3) Present the results of Medicare Imaging Demonstration concluded in 2014, to assess impact of targeted professional society guidelines (including the American College of Radiology's Appropriateness Criteria) embedded as CDS on ambulatory high cost imaging procedures for fee for service medicare population. 4) Share and discuss lessons learnt about CDS from some of the participants in the MID.

URL's

www.radhelper.com

RC454

Ergonomics

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 4:30 PM - 6:00 PM Location: S504AB

Participants

William J. Weadock MD (Presenter): Owner, Weadock Software, LLC
Eliot L. Siegel MD (Presenter): Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

LEARNING OBJECTIVES

1) The attendee will learn how the radiology reading room environment can physically affect the radiologist. 2) Learn about repetitive stress injuries and how they may affect radiologists and technologists. 3) Learn about how PACS workstations (including mice, keyboards, screens, etc.); room lighting, sounds and temperature; and room furniture may be optimized to help prevent repetitive stress injuries. 4) Learn how radiologic technologists can also be affected by repetitive stress injuries.

ABSTRACT

This presentation will review the features of a reading a study at a PACS, and the interactions of the radiologist with the various devices. This includes desktops/tables height, chairs, keyboard location, monitor position, mouse position (and cleanliness), microphone positioning, room temperature, sound volume, ambient light, and body positioning. Each of these components will be discussed, showing how to prevent future problems with repetitive stress disorders. The goal is to raise awareness of ergonomics for the radiologist.

RCB35

Hands-on Natural Language Processing: Extracting Value from Imaging Reports (Hands-on)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 4:30 PM - 6:00 PM Location: S401CD

Participants

Scott Leroy Duvall PhD (Presenter): Research Grant, Amgen Inc Research Grant, Anolinx LLC Research Grant, AstraZeneca PLC Research Grant, F. Hoffmann-La Roche Ltd Research Grant, Merck & Co, Inc Research Grant, Mylan Inc Research Grant, PAREXEL International Corporation Research Grant, Shire plc
Daniel L. Rubin MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Describe the workflow of natural language processing, including manual annotation, training, and evaluation. 2) Explain the

role that natural language processing can play in imaging practice and research. 3) Describe different approaches for processing imaging report text. 4) Identify the functions of RadLex and other ontologies in natural language processing. 5) Explore ways that natural language processing could be used to address their current organizational needs. 6) Practice creating manual annotations on imaging reports and discussion challenges and solutions for reliable, efficient annotating. 7) Learn some available open-source tools that can be used for natural language processing and annotation.

ABSTRACT

Natural language processing (NLP) is key to unlocking the vast amount of information in imaging reports that is either typed directly by the clinicians or transcribed from speech recognition. Recent advances in available tools and a shift in mindset towards the development of NLP systems as pipelines of distinct, interchangeable modules have made many common NLP tasks within the reach of all researchers and clinicians. This workshop will provide attendees with a hands-on introduction to NLP and to some current research in which it is used on imaging reports. Participants will be guided through an overview of NLP, some of the current challenges of working with imaging text, and the strengths and weaknesses of different NLP approaches. Manual annotation - used to support NLP - will be introduced and participants will be guided through tools to create annotations. The role of RadLex and other ontologies will be discussed and tools for mapping to these standards will be demonstrated. Participants of the workshop will gain an understanding of how NLP could be used in their organizations to address specific clinical questions and experience with tools to perform simple NLP tasks.

Active Handout

http://media.rsna.org/media/abstract/2014/14002674/RCB35 sec.pdf

RCC35

Technologies for Creating Educational Content and Teaching Files

Refresher/Informatics

IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Tue, Dec 2 4:30 PM - 6:00 PM Location: S501ABC

Sub-Events

RCC35A

Podcasting and Screencasting for Teaching

Mahesh M. Thapa MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify the utility of podcasts and screencasts. 2) List major software packages available for creating podcasts and screencasts. 3) Understand the steps required to create a podcast or screencast.

RCC35B

e-Publishing

Michael L. Richardson MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Know the pros and cons of publishing electronic books. 2) Know the two main formats for publishing electronic books. 3) Be aware of several strategies for converting one's book to electronic form. 4) Know the pros and cons of several software packages used for electronic book conversion.

RCC35C

Lecturing 2.0: Innovative Tools and Techniques to Improve the Way We Teach and Learn

Harprit Singh Bedi MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify techniques to incorporate mobile technology into your teaching program. 2) Appraise your current teaching practices in light of the new pedagogical approaches introduced in the lecture.

RC553

Computer Aided Diagnosis (Development and Clinical Applications)

Refresher/Informatics

IN OI CT BR IN OI CT BR IN OI CT BR

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 8:30 AM - 10:00 AM Location: S404AB

Participants

Moderator
Emanuele Neri MD : Research Consultant, General Electric Company Research Consultant, Bracco Group
Moderator
Hiroyuki Yoshida PhD : Patent holder, Hologic, Inc Patent holder, MEDIAN Technologies

LEARNING OBJECTIVES

1) Understand needs of CAD in radiologic image interpretation. 2) Understand basic concept of CAD in assisting radiologists' image reading. 3) Understand the usefulness of CAD in improving radiologists' performance. 4) Learn historical review of CAD developments. 5) Learn CAD for detection and differential diagnosis of common cancers. 6) Learn ROC analysis of radiologists' performance without and with CAD in observer studies.

ABSTRACT

Computer-aided diagnosis (CAD) has become one of the major research subjects in medical imaging and diagnostic radiology. In this refresher course, the principles of CAD will be presented together with current development and clinical applications.

The CAD is aimed at improving the radiologists diagnostic accuracy, and can be used as primary, concurrent or second reader. The latter is the recommended paradigm. In principle the CAD performs a morphological recognition of the ;pathology; (nodule, focal lesion, polyp, etc) combined with quantitative information (MR signal intensity, CT density, contrast enhancement, volume, etc.

Many different types of CAD schemes are being developed for detection and/or characterization of various lesions in different imaging modalities, including conventional projection radiography, CT, MRI, and ultrasound imaging. Organs that are subjected to research for CAD include the breast, lung, colon, brain, liver, kidney, and the vascular and skeletal systems.

For detection of breast cancer on mammograms, many commercial CAD systems have been used clinically in assisting radiologists worldwide.

For detection of lung cancer, CAD schemes have been developed for detection of pulmonary nodules on chest radiographs and CT images. In addition, CAD schemes have been developed for differential diagnosis of distinction between malignant and benign lesions.

For colon cancer, CAD schemes have been developed for detection of polyps in CT colonography. Observer performance studies with use of ROC analysis indicated an improved performance in radiologists.

URL's

www.rad.unipi.itwww.massgeneral3dimaging.org

Sub-Events

RC553A

Development of a CAD: From Benchtop to Clinic

Ronald M. Summers MD, PhD (Presenter): Royalties, iCAD, Inc Research funded, iCAD, Inc Stockholder, Johnson & Johnson Grant, Viatronix, Inc

LEARNING OBJECTIVES

1) To understand what radiology problems are amenable to computer aided detection. 2) To understand the steps required to develop and validate a radiology computer-aided detection product. 3) To understand the current performance and future trends in computer-aided detection with respect to indications, algorithms, sensitivity, false positive rates and pitfalls.

RC553B

CAD for CT Colonography: Where Do We Stand?

Daniele Regge MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review interpretation pitfalls of CT colonography that could be overcome with CAD. 2) Present different reading paradigms of CAD for CT colonography and analyze their performances. 3) Summarize advantages and limitations of the use of CAD for CT colonography in different clinical settings.

RC553C

CAD for Breast Cancer Detection: Where Do We Stand?

Ulrich Bick MD (Presenter): Equipment support, Hologic, Inc License agreement, Hologic, Inc Royalties, Hologic, Inc Equipment support, Toshiba Corporation Institutional research collaboration, Siemens AG

LEARNING OBJECTIVES

1) To learn about different applications of computer-aided diagnosis (CAD) in breast imaging. 2) To understand the potential and risks of using CAD in mammography screening. 3) To realize the impact of CAD on soft-copy reading and work-flow

RC553D

CAD for Lung Cancer Detection: Where Do We Stand?

Kunio Doi PhD (Presenter): Shareholder, Hologic, Inc License agreement, Hologic, Inc License agreement, Deus Technologies, LLC License agreement, Riverain Technologies, LLC License agreement, Mitsubishi Corporation License agreement, MEDIAN Technologies License agreement, General Electric Company License agreement, Toshiba Corporation Research support, Deus Technologies, LLC Research support, E. I. du Pont de Nemours & Company Research support, Elcint Medical Imaging Ltd Research support, FUJIFILM Holdings Corporation Research support, General Electric Company Research support, Hitachi, Ltd Research support, Eastman Kodak Company Research support, Konica Minolta Group Research support, Mitaya Manufacturing Co, Ltd Research support, Mitsubishi Corporation Research support, Koninklijke Philips NV Research support, Hologic, Inc Research support, Riverain Technologies, LLC Research support, Seiko Corporation Research support, Siemens AG Research support, 3M Company Research support, Toshiba Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

RC554

The Future of Federal Health Information Technology Incentive Programs and Policies: Expert Panel

Refresher/Informatics

IN HP

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 8:30 AM - 10:00 AM Location: S104A

Participants

Moderator
Curtis P. Langlotz MD, PhD : Shareholder, Montage Healthcare Solutions, Inc Advisory Board, Reed Elsevier Advisory Board, Activate Networks, Inc Spouse, Consultant, Johnson & Johnson
Douglas B. Fridsma MD, PhD (Presenter): Nothing to Disclose
John D Halamka (Presenter): Board Member, Imprivata, Inc
David S. Mendelson MD (Presenter): Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Corporation
Paul C. Tang MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand federal health information technology incentive programs and how they can affect practice revenue and operations. 2) Hear the views of experts involved in the regulatory process to understand the intent and context for these programs. 3) Gain insight into recent and upcoming regulatory changes. 4) Decide how your practice should respond to these programs, including Meaningful Use and PQRS.

RCA41

Radio-Genomic Research: Accessing Clinical Imaging-Genomics-Pathology Data from Public Archives—The Cancer Imaging Archive (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 8:30 AM - 10:00 AM Location: S401AB

Participants

C. Carl Jaffe MD (Presenter): Nothing to Disclose
John B. Freymann BS (Presenter): Nothing to Disclose
Justin Kirby (Presenter): Stockholder, Myriad Genetics, Inc
Fred William Prior PhD (Presenter): Research collaboration, Electrical Geodesics, Inc
Lawrence R. Tarbox PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand software methods to extract internet-accessible clinical and image (radiology, pathology and metadata) that power merged data extractions from multiple data sources, and supported by Cloud services and software APIs. 2) Comprehend how the NCI TCIA cancer image archive is linked to the NIH Genome Research Institute's open access genomic database, The Cancer Genome Atlas ("TCGA") to research disease 'signatures' that are essential for 'precision' medicine. 3) Attendees will benefit from this workstation-based hands-on tutorial to learn how to conduct their own independent comprehensive disease research on this emerging scientific frontier.

ABSTRACT

Combined genomic/clinical/pathology data-sets, publically available, are increasingly important to advance disease understanding and treatment. But links to the anatomic-physiologic data that clinical imaging offers has been limited till now by a lack of access to clinically relevant databases/archives that encompass a complete signature of disease. This hands-on session will teach the basic skills for navigating a comprehensive open-access extensive image database (radiology and pathology images) provided in combination by the NIH Cancer Genome Atlas and Cancer Imaging Programs. With this knowledge radiologists and imaging scientists can more readily participate in cutting-edge research by linking imaging to discovery of genomic disease signatures.

URL's

http://cancerimagingarchive.net

RCB41

Hands-on Introduction to Social Media (Hands-on)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credit: 0

Wed, Dec 3 8:30 AM - 10:00 AM Location: S401CD

Participants

C. Matthew Hawkins MD (Presenter): Nothing to Disclose
Safwan Halabi MD (Presenter): Nothing to Disclose
Garry Choy MD, MS (Presenter): Nothing to Disclose
Neil U. Lall MD (Presenter): Nothing to Disclose
Tirath Yogesh Patel MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Appreciate the professional relevance of social media for radiologists. 2) Understand the differences between Facebook pages and personal accounts. 3) Better grasp how hospitals and groups can use Facebook to connect with patients. 4) Setup and use a Twitter account. 5) Understand the purpose of hashtags, lists, and DMs. 6) Get acquainted with other radiologists and radiology organizations on Twitter. 7) Evaluate enterprise solutions for managing multiple social media accounts for larger groups and organizations. 8) Understand how to safely /securely communicate via social media while maintaining HIPAA requirements.

Active Handout

http://media.rsna.org/media/abstract/2014/11035016/RCB41 sec.pdf

RCC41

Next Generation IT to Improve Quality and Safety

Refresher/Informatics

SQ IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 8:30 AM - 10:00 AM Location: S501ABC

Participants

Moderator
Ramin Khorasani MD : Consultant, Medicalis Corp

LEARNING OBJECTIVES

1) Broadly describe the role of IT in helping improve quality and safety for radiology. 2) Discuss some of the key next generation IT requirements to improve quality and safety. 3) Use case examples to demonstrate the use of IT to improve access, appropriateness, report value and results communication and care coordination.

Sub-Events

RCC41A

Improving Appropriateness and Access

Keith David Hentel MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC41B

Improving Value of Radiology Reports

V. Anik Sahni MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC41C

Critical Test Result Communication and Care Coordination

Ramin Khorasani MD (Presenter): Consultant, Medicalis Corp

LEARNING OBJECTIVES

1) Define clinical attributes of critical test results and their relevance to national patient safety goals. 2) Describe functional requirements and current gaps for optimal communication of critical test results. 3) Using a case example, describe how IT tool can be embedded in workflow of radiologists and referring providers to optimize communication of critical test results and help ensure appropriate and timely execution of follow up recommendations made by radiologists.

RCA42

DtiStudio/MriStudio: Integrated Software Resource for White Matter Mapping and

Quantitative Image Analysis (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 10:30 AM - 12:00 PM Location: S401AB

Participants

Kenichi Oishi MD, PhD (Presenter): Nothing to Disclose
Andreia Vasconcellos Faria MD (Presenter): Nothing to Disclose
Johnny Tz-Chieh Hsu MS (Presenter): Nothing to Disclose
Susumu Mori PhD (Presenter): Research Consultant, AnatomyWorks LLC CEO, AnatomyWorks LLC

LEARNING OBJECTIVES

1) Learn practical aspects of DTI calculation: While the tensor calculation is an established process, there are several potential pitfalls and limitations. We will highlight these issues and discuss how we can resolve them. 2) Learn the concepts of image normalization: Image normalization is one of the crucial steps for quantitative image analysis. While this approach is widely used, the technology is far from complete. The issues specific to white matter anatomy and potential solutions will be discussed. 3) Learn atlas-based image analysis: Once the brain is normalized, there are many options for the final quantification step. Advantages and disadvantages of these options will be discussed.

ABSTRACT

Diffusion tensor imaging (DTI) can provide rich anatomical information of the brain white matter. Various white matter tracts, which are not visible in T1 and T2-weighted anatomical scans, can be clearly delineated in DTI-derived maps. The quantification of the white matter anatomy is, however, not straightforward. MriStudio consists of three programs designed for quantification of white matter anatomy. DtiStudio reads image data (such as DICOM) from multiple platforms and calculates various quantitative maps based on tensor calculation. Special emphasis is placed on image quality control at a various calculation steps. DiffeoMap then transforms the patient image into a common atlas space (or transform the atlas to the patient brain). Finally, RoiEditor provides an interface to perform automated or manual white matter segmentation, followed by reporting of anatomical properties of each segmented area. The quantification of 3D anatomical features poses many challenges and there are also difficulties specific to white matter structures. The purpose of this course is to learn various options to study white matter anatomy, practical issues encountered during the quantification, and their advantages and disadvantages.

URL's

https://www.mristudio.org/wiki/Tutorial

Handout:Kenichi Oishi

http://media.rsna.org/media/abstract/2014/11033053/RSNA2014_MRIstudio_handout.pdf

Active Handout

http://media.rsna.org/media/abstract/2014/11033053/RCA42 sec.pdf

RCB42

Creating, Storing, and Sharing Teaching Files Using RSNA's MIRC® (Hands-on)

Refresher/Informatics

IN ED IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 10:30 AM - 12:00 PM Location: S401CD

Participants

Tessa S. Cook MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how to install the RSNA MIRC teaching file. 2) Demonstrate the ability to add new studies and create teaching files. 3) Share teaching file cases with other MIRC servers and other users.

RCC42

Standardized Terminology in Radiology: Applications and New Developments using RadLex and Playbook

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 10:30 AM - 12:00 PM Location: S501ABC

Participants

Moderator
Daniel L. Rubin MD, MS : Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize the need for standardized terminology for radiology imaging examinations. 2) To introduce the RadLex Playbook, which provides standard names for radiology orderables and procedure steps. 3) To demonstrate the value of RadLex Playbook in applications to improve radiology practice and regulatory compliance.

ABSTRACT

Every hospital performs virtually the same types of imaging procedures, but they all name them differently. The lack of a standardized naming scheme for radiology procedures thwarts the ability of radiologists and hospitals to share data or to consistently measure and track imaging procedures in a standard way. The need for standard imaging procedure names recently has been heightened by the emergence of a national dose registry that will establish benchmarks on dose exposure and by interest by FDA and other organizations to track and improve quality measures related to imaging. Thus, the RSNA RadLex project recently created the Playbook, a system for creating standard names for radiology procedures and procedure steps. The RadLex Playbook provides a comprehensive set of standard names in addition to a grammar that enables institutions to map their existing list of terms to Playbook terms. Existing hospital information technology infrastructure can thus adopt Playbook immediately and begin deriving the benefits from this standard terminology. In this presentation we will introduce the Playbook, describe experience adopting it at several institutions, and present use cases on how it will enable radiologists and hospitals to meet emerging regulatory requirements and participate in national quality initiatives. Hospitals, payers, registries, researchers, radiologists, and even patients-will be able to refer to their imaging studies using a common language and communicate radiology information unambiguously.

Sub-Events

RCC42A

Terminology Standardization in CT: Progress and Challenges

Thalia T. Mills PhD (Presenter): Nothing to Disclose , Dianna D. Cody PhD (Presenter): In-kind support, General Electric Company

LEARNING OBJECTIVES

1) Identify challenges associated with non-standard CT terminologies. 2) Compare currently available standard CT lexicons. 3) Explain the role of consensus standards in FDA's regulation of radiological devices.

ABSTRACT

The inconsistency in names used for CT acquisition and reconstruction parameters across different scanner models can be confusing to operators, possibly leading to unnecessary radiation exposure or poor image quality. The AAPM Working Group on Standardization of CT Nomenclature and Protocols (WGCTNP) is working toward a set of consensus recommended CT parameter terms and definitions. Ongoing work includes: identifying relevant terms from existing standard lexicons; mapping generic terms to vendor-specific terminology (lexicon published on the AAPM 'CT Scan Protocols' website); and identifying preferred names based on use in the literature and clinical practice.

RCC42B

RadLex® Playbook: Standardized Terminology for Naming and Coding Imaging Procedures

Daniel L. Rubin MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To recognize the need for standardized terminology for radiology imaging examinations. 2) To introduce the RadLex Playbook, which provides standard names for radiology orderables and procedure steps. 3) To demonstrate the value of RadLex Playbook in applications to improve radiology practice and regulatory compliance.

ABSTRACT

Every hospital performs virtually the same types of imaging procedures, but they all name them differently. The lack of a standardized naming scheme for radiology procedures thwarts the ability of radiologists and hospitals to share data or to consistently measure and track imaging procedures in a standard way. The need for standard imaging procedure names recently has been heightened by the emergence of a national dose registry that will establish benchmarks on dose exposure and by interest by FDA and other organizations to track and improve quality measures related to imaging. Thus, the RSNA RadLex project recently created the Playbook, a system for creating standard names for radiology procedures and procedure steps. The RadLex Playbook provides a comprehensive set of standard names in addition to a grammar that enables institutions to map their existing list of terms to Playbook terms. Existing hospital information technology infrastructure can thus adopt Playbook immediately and begin deriving the benefits from this standard terminology. In this presentation we will introduce the Playbook, describe experience adopting it at several institutions, and present use cases on how it will enable radiologists and hospitals to meet emerging regulatory requirements and participate in national quality initiatives. Hospitals, payers, registries, researchers, radiologists, and even patients-will be able to refer to their imaging studies using a common language and communicate radiology information unambiguously.

RCC42C

Standard Terminology for Radiology Reporting

Charles E. Kahn MD, MS (Presenter): Shareholder, Hotlight Inc Officer, Hotlight Inc

LEARNING OBJECTIVES

1) Define the roles of standardized vocabularies in radiology reporting. 2) Describe how terms from standardized vocabularies are being incorporated to RSNA's radiology reporting templates. 3) Understand how standardized vocabularies allow reporting templates and radiology reports to be interoperable across a variety of languages, information systems, and applications.

ABSTRACT

Standardized terminologies can help radiologists communicate the results of imaging procedures more

effectively. A well-defined terminology can eliminate ambiguity, and can guide radiologists to use appropriate descriptive terms. Standardized vocabularies can overcome language barriers and the limitations of proprietary systems. This presentation will explore the roles of standardized terminologies in the reporting templates being developed by the RSNA Reporting Initiative. Structured reporting gives radiologists the opportunity to incorporate controlled vocabularies, such as RadLex®, into their reports to enhance the reports' clinical usefulness, facilitate data extraction, and improve quality.

SSK12

ISP: Informatics (Quality and Safety)

Scientific Papers

SQ IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 10:30 AM - 12:00 PM Location: S405AB

Participants

Moderator
Woojin Kim MD : Co-founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Board of Directors, Montage Healthcare Solutions, Inc Advisory Board, Zebra Diagnostics Ltd
Moderator
Stuart R. Pomerantz MD : Research Grant, General Electric Company

Sub-Events

SSK12-01 **Informatics Keynote Speaker: Quality Metrics—It's Time to Do It Right**

Woojin Kim MD (Presenter): Co-founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Board of Directors, Montage Healthcare Solutions, Inc Advisory Board, Zebra Diagnostics Ltd

SSK12-02 **The Truth Behind the Fiction: Erroneous Clinical Information in Electronic Radiology Requests**

Maria Twomey MBChB, FFR(RCSI) (Presenter): Nothing to Disclose , Fiachra Gerard Moloney MBBCh, MRCPI : Nothing to Disclose , Jennifer Sammon MBBCh : Nothing to Disclose , Jennifer Murphy MBBCh, MRCPI : Nothing to Disclose , Kevin Noel O Regan MD : Nothing to Disclose , Michael M. Maher MD, FRCR : Nothing to Disclose

PURPOSE

Accurate clinical information is paramount for the radiologist to accurately prioritise, protocol and report an imaging study. The purpose of this study was to investigate the rate of erroneous biochemical and haematological parameters as detailed on electronic requests for CTPA, CT Thorax and abdominopelvic CT.

METHOD AND MATERIALS

A total of 250 electronic requests submitted on a radiology information system over a 6 month period(July -Dec2013) performed in a single institution were randomly selected comprising 100 CTPA, 70 CT TAP and 80 abdominopelvic CT. The creatinine level, haemoglobin level, CRP and WCC levels supplied for each patient by the referring clinician were compared to the reported levels on our institutions biochemical and haematology electronic reporting system.In the CTPA subgroup d-dimer levels and pO2levels were also compared.The level of experience of the referring clinician and the referring department were also recorded.

RESULTS

Overall 45% of the total 250 requests contained erroneous biochemical and/or haematological information.CTPA requests had a significant number of erroneous D-dimer and pO2 levels; 15% reported an abnormal D-dimer result when the actual reported result was normal.A further 25% had reported hypoxia when the reported pO2 was normal. 10% of all requests contained an incorrect normal creatinine level. 30% of abdominopelvic CT requests detailed a low haemoglobin with iron deficiency anaemia, however the formal reported results were normal or revealed a normochromic normocyctic anaemia in 75%. Elevated CRP and/or WCC were reported in 70% of acute abdominopelvic CT requests; 20% of the formal results in this subgroup were normal.A significantly higher incidence of erroneous parameters were supplied by medical physician referrals as opposed to surgeons.

CONCLUSION

This study reveals a high level of erroneous clinical information on electronic requesting which may result in inappropriate prioritisation, protocolling and administration of iv contrast and may effect the accuracy of the consequent radiology report.

CLINICAL RELEVANCE/APPLICATION

Accurate clinical information is essential to enable informed judgment on patient exposure to radiation. The level of erroneous information in this study raises concern; clinicians must be made aware that providing incorrect information is potentially deleterious to patient mangement and does not foster productive professional colleague interaction.

SSK12-03

Contextual CT Radiation Exposure Sentinel Event Detection

Sam J. Weisenthal BA : Nothing to Disclose , Ari Seff : Nothing to Disclose , Xiao Zhang PhD : Nothing to Disclose , Ronald M. Summers MD, PhD (Presenter): Royalties, iCAD, Inc Research funded, iCAD, Inc Stockholder, Johnson & Johnson Grant, Viatronix, Inc , Les Roger Folio DO, MPH : Nothing to Disclose , Jianhua Yao PhD : Royalties, iCAD, Inc

PURPOSE

To detect anomalous radiation events by taking into account exam-specific clinical characteristics, we implement a statistical method for context-dependent CT radiation sentinel event detection directly from DICOM header data that is size and exam-specific rather than a general threshold for all exams/ patient sizes.

METHOD AND MATERIALS

Patient and scanner parameters (study description, scan length, dose length product (DLP), patient age, scanner model) were obtained with an automatic Radiation Exposure Extraction Engine (RE3) for all CT chest abdomen and pelvis exams in January and February 2014 (n=892). BMI data was acquired from RIS. A multivariable regression was applied with scanner model, age, BMI, BMI*scan length, height and weight as predictors for DLP. Using leave-one-out cross validation, we predict a DLP for each exam. All exams with observed DLPs greater than two standard deviations (95th percentile) from the mean residual were flagged. All studies were also analyzed with a simple thresholding model to identify exams with DLPs over two standard deviations above the mean of all exams. Exams flagged by the context-dependent and independent methods were checked for factors in patient weight and multi-phase exams.

RESULTS

Our multivariable regression model detected 18 anomalous exams with a mean DLP of 2678 mGy*cm (1350 to 4101). The context-independent thresholding detected 43 with a mean DLP of 2765 mGy*cm (2206 to 4101). 11 exams were detected by both methods. The average BMI for exams detected by only our context-dependent model (n=7) was 25.6 ±6.5 kg/m2, and that of those only by the thresholding model (n=32) was 36.9±5.2 kg/m2 (mostly obese patients). The average number of acquisitions for exams detected only by our context-dependent model was 1.6 ± 0.8 passes and that of the thresholding model was 2.7±0.58 passes (mostly multi-phase exams).

CONCLUSION

We present a context-dependent CT radiation anomaly detection method using exam-specific variables. Our model takes into account clinical context and therefore detects patient-specific outliers missed by simple thresholding, but does not falsely flag exams that would be detected by simple thresholding due to high exposure from patient weight and multiple phases.

CLINICAL RELEVANCE/APPLICATION

Contextual sentinel event detection allows for earlier detection of individual or systemic excessive radiation exposures.

SSK12-04

Adherence to Standard Nomenclature in CT Protocols: Assessing Consistency of Existing Naming Conventions Used in Clinical Operations

Jenifer Willmann Siegelman MD, MPH (Presenter): Consultant, Bayer AG , Matthew M. Raffol MA : Nothing to Disclose , Mohammad Hadi Bagheri MD : Nothing to Disclose , Ramin Khorasani MD : Consultant, Medicalis Corp , Aaron D. Sodickson MD, PhD : Research Grant, Siemens AG

PURPOSE

Systematic review of CT protocols for patient safety and quality improvement requires consistent, accurate, and intelligible protocol naming. Our goal was to assess naming consistency of our CT protocols via adherence to RadLex body region convention.

METHOD AND MATERIALS

CT protocol names used in our multi-institution hospital system over a 27-month period (2012-2014) were assessed for conformance to the RadLex Playbook naming conventions. 193,000 consecutive CT exams at three institutions on 12 scanners from two vendors with 1622 unique protocol names were examined. Scanner protocol names for the head, neck, abdomen, chest, and spine were manually mapped to RadLex. Single body region clinical protocol names (n=848) were assessed for inclusion of the relevant RadLex body region designation.

RESULTS

54% of protocol names contained the RadLex-prescribed term for body region. Chi-squared tests for independence detected statistically significant variation in conformance rates across body regions ($p < .001$) or scanners ($p<.005$). No significant difference was detected among institutions ($p<.8$). Body region conformance rates were: neck 100%, spine 98%, head 53%, chest 81%, and abdomen 31%. Variation within a single protocol type (unique RadLex ID) was also observed, with as many as 19 unique names across the 3 institutions. Many protocols also deviated from the RadLex conventions by including reference to patient weight categories, contrast timing, clinical indication (PE, stent hypervascular) and number of scanner passes.

CONCLUSION

Variable naming of CT scanner protocols is prevalent within our healthcare system. In the context of accreditation standards, quality improvement and patient safety, healthcare-system wide review of CT protocols to assess the appropriateness of scan parameters and radiation exposure is necessary but is hampered by the current lack of protocol naming standardization due to suboptimal adherence to conventions. Additional modifiers beyond the RadLex terminology may be required to adequately reflect the complexity and diversity of protocol specifications needed for clinical operations. Character limits on scanners may also inhibit full and standardized parameter-specification in all protocol names.

CLINICAL RELEVANCE/APPLICATION

Increased standardization of protocol nomenclature (using Radlex) may enable quality improvement initiatives by facilitating health-system wide protocol review and optimization.

SSK12-05

HITECH Act: The Critical Missing Encryption Tools to Comply

Anne Clara Krok (Presenter): Nothing to Disclose , Nogah Haramati MD : Investor, Kryon Systems Ltd Investor, OrthoSpace Ltd Investor, BioProtect Ltd Board Member, Kryon Systems Ltd Board Member, OrthoSpace Ltd Board Member, BioProtect Ltd Consultant, AFC Industries, Inc Advisory Board, General Electric Company , Karen Ellen Sperling MD : Nothing to Disclose , Shlomit Goldberg-Stein MD : Research Consultant, Intrinsic Therapeutics Inc , Malka B. Finkelstein MD : Nothing to Disclose , Shari Friedman MD : Nothing to Disclose , Mony Weschler MSC, BSC : Nothing to Disclose

PURPOSE

To assess whether the existing electronic encryption and multiplatform tools are sufficient for full compliance with the 2009 HITECH Act by non-tech savvy users operating in USA-based healthcare organizations

METHOD AND MATERIALS

We reviewed all existing encryption tools that are available as stand-alone products as well as tools that are packaged by vendors within more robust healthcare information systems. We reviewed each tool and package for the following characteristics 1. Ability to be used without requiring administrator privileges or authorization to install software on a computer/PC 2. Ability for the user to decrypt the files on-the-fly without requiring installation of the encrypting program on the destination computer/PC 3. Ability to encrypt/decrypt files in a multiplatform environment. Platforms utilized were Microsoft Windows (XP/Vista/7/8), MAC OSX (Versions 7 and higher), Android (Versions 4.0 ICS and higher), and iOS (6 and higher)

RESULTS

No tools were identified that fulfilled all three of the major characteristics.

Several packages were identified that can encrypt and decrypt on-the-fly, but these were all limited by platform.

No USB-stick based tools exist that encrypt and decrypt on the fly without Computer/PC administrator privileges in a mixed Windows PC/Mac OSX environment.

CONCLUSION

Better tools are needed for compliance with the HITECH Act by non-tech savvy physicians USB-stick based tools that could encrypt and decrypt on the fly without Computer/PC administrator privileges might be the most crucial

CLINICAL RELEVANCE/APPLICATION

Physicians collaborate, consult and lecture at institutions that are not their home institutions. Powerpoints and other information should be transported in an encrypted format to be fully HITECH Act compliant. Often, the Computer/PC available at the host institution does not allow software to be installed, and often, cloud services are blocked.

SSK12-06

The Radiologist's Workflow Environment: Evaluation of Disruptors and Potential Implications

John-Paul Jaewoon Yu MD, PhD (Presenter): Nothing to Disclose , Akash Pravin Kansagra MD : Nothing to Disclose , John Mongan MD, PhD : Spouse, Founder, BIOinformative

CONCLUSION

The on-call radiologist operates in a highly disruptive work environment as evidenced by the frequency of interruption by incoming and outgoing telephone calls. Further research is needed to specifically ascertain the effects of frequent interruptions on the performance of on-call radiologists at academic institutions.

Background

Workflow interruptions in the healthcare delivery environment are a major contributor to medical error and have been extensively studied within numerous hospital settings including the nursing environment, the operating room, and on physician workflow. Less understood, though, is the role of interruptions in other highly specialized clinical domains and subspecialty services such as diagnostic radiology. The workflow of the on-call radiologist, in particular, is especially susceptible to disruption by telephone calls and other modes of physician-to-physician communication. Herein, we describe our initial efforts to quantify the degree of interruption experienced by the on-call radiologist and examine its potential implications in patient safety and

overall clinical care.

Evaluation

An annotated list of all completed telephone encounters including call time stamps, duration, and call origin were analyzed. The records cover a period of 13 weeks from midnight July 14, 2012 through 11:59 PM on October 12, 2012 (90 days). Data were analyzed using the R statistical package.

Discussion

A total of 10,378 calls were completed during on-call hours, 5759 (55%) of which were incoming calls. Median call duration was 57 seconds. During a typical 12-hour overnight on-call shift (8PM to 8AM), there were an average of 72 telephone calls with an average total time of 108 minutes spent on the phone. There were an average of 19.3 CT studies during an overnight shift. Average telephone call volume per hour varied from 2.82 to 10.81. Hourly average CT and telephone call volume were highly correlated, with Spearman's rho = 0.75 (rho ? 0 with p < 0.001).

SSK12-07

Adult CT Dose Monitoring Using Web Based Radiation Dose Tracking Software

Kevin Murphy MBBCh, MRCS : Nothing to Disclose , Maria Twomey MBChB, FFR(RCSI) (Presenter): Nothing to Disclose , James Ryan : Nothing to Disclose , Kate Carey : Nothing to Disclose , Patrick Nicholson MBBCh : Nothing to Disclose , Niamh Moore : Nothing to Disclose , Mary-Jane Murphy : Nothing to Disclose , Michael Sheehy : Nothing to Disclose , Owen J. O'Connor MBBCh : Nothing to Disclose , Michael M. Maher MD, FRCR : Nothing to Disclose

CONCLUSION

Radiation dose tracking software results in excellent streamlining of information collection and manipulation. In our study it quickly identified our mean doses for common examinations and pinpointed outliers and helped identify reasons for high radiation doses.

Background

Dose monitoring, audit and CT optimization are key factors in achieving widespread CT dose reduction. We assess the ease and feasibility of using web based radiation dose tracking software (DoseWatch, GEHC) in assessing radiation dose (dose length product, DLP and size-specific dose estimate) at adult CT and comparing these values to published diagnostic reference levels (DRLs)

Evaluation

Following IRB approval, 576 consecutive CT studies were retrospectively assessed (223 thorax, 353 abdomen-pelvis). Information regarding DLP, SSDE, demographics, effective diameter and time of acquisition were automatically obtained from the analysis software. In addition, information on the radiographer experience and inpatient status was also obtained from the radiology information system analysed. Results showed a mean thoracic CT DLP of 282±151 mGycm (range 5-1753) and SSDE of 9.22±1.82 (range 5-16 mGy). Mean radiation dose from CT abdomen-pelvis was 621±231 mGycm (range 244-1582); SSDE 13.7 mGy (range 3-21 mGy). Both studies had mean levels below the published DRLs [thorax: 460 mGycm; abdomen-pelvis 640 mGycm]. 12% had anomalously high doses. These higher doses were significantly associated with inexperienced technologists (p=0.009), out of hours scanning (p=0.04) and multiphase studies (p

Discussion

Our mean thoracic CT dose levels are significantly superior to published DRLs abdominopelvic dose levels are satisfactory when compared with diagnostic reference level. We have identified reasons for aberrantly high doses for certain patients with the use of radiation dose tracking software. This information will be of vital importance in future planning

SSK12-08

Radiation Feedback to Improve Awareness and Decrease Dose

Michael Bazylewicz MD (Presenter): Nothing to Disclose , Ross Warren Filice MD : Nothing to Disclose

PURPOSE

To measure changes in reporting compliance after implementation of a standardized radiation reporting template for interventional radiology reports.
To raise awareness of radiation use by presenting regular feedback at section meetings in an easily consumable format.

METHOD AND MATERIALS

HL7 report data was collected from 2012 to 2014. An algorithm screened free-text interventional radiology reports in real-time to detect use of a standardized dose template and parsed fluoroscopy time for each report into a database. Accuracy of the algorithm was tested by manually comparing recorded data to the reports with iterative refinements to improve performance. Reporting template compliance was calculated monthly. Compliance before and after an educational program and mandatory directive to use the template were compared. Average fluoroscopy time and standard deviations were calculated for a list of top ten procedures. Visualizations were produced to display reporting compliance and average fluoroscopy time for individual physicians with comparisons to departmental means and standard deviations. These reports were presented at regular interventional radiology section meetings.

RESULTS

Accuracy of the algorithm for detecting fluoroscopy time was 98%. The rate of fluoroscopy time recorded in reports before and after mandatory use of a standard template was 66% and 96% respectively. Graphically displaying the radiation data highlighted studies where fluoroscopy time exceeded departmental norms,

identified dictation and procedure tracking errors, and helped refine algorithm accuracy. This data will continue to be presented regularly at section meetings to provide feedback on fluoroscopy use and facilitate future analysis of radiation dose.

CONCLUSION

Use of a standardized template for reporting fluoroscopy time improves radiation dose recording rates and allows data to be consumed and presented. Providing easily consumable feedback on fluoroscopy use raises awareness, identifies outliers, and detects report and tracking errors. We predict that continual feedback at section meetings will decrease radiation use and improve reporting compliance.

CLINICAL RELEVANCE/APPLICATION

The results of this study can be used by radiology departments to improve radiation documentation and raise awareness of radiation use within an interventional radiology department.

SSK12-09

Story of Stickr - Design and Usage of an Automated Biopsy Follow Up Tool

Marc D. Kohli MD (Presenter): Research Grant, Koninklijke Philips NV Research Grant, Siemens AG , Aaron P. Kamer MD : Nothing to Disclose

PURPOSE

Mammographers are legally required to evaluate pathology from each biopsy in order to determine concordance. Many other sub-specialist radiologists find large-scale followup challenging due to task complexity. We set out to design and implement a web-based biopsy follow up worklist application. Important quality metrics such as adequacy rates and diagnostic rates would also be be calculated from data collected.

METHOD AND MATERIALS

Prior to implementation of the worklist, radiology faculty who regularly perform biopsies were surveyed about their biopsy practices. Our application was built to receive biopsy reports and pathology reports in real-time from HL7 feeds. Each radiology report is processed to assign a radiologist and a resident (if applicable). Upon logging in, the faculty or resident is presented with a list of biopsies performed. The biopsies that have associated pathology reports are highlighted. With just two clicks, a biopsy can be marked as adequate/concordant. If biopsies are flagged as inadequate/discordant, an option to visit the hospital paging webpage is presented.

RESULTS

Of the 21 faculty survey respondents (with 8 mammographers), only 43% follow up the pathology results every time. 3 faculty (14%) follow up on their biopsies up to 20% of the time. Over 1300 image-guided biopsy reports have entered the successfully deployed application, with 82% of these reports having been linked with respective pathology, a rate much higher than before discarding a body part matching requirement between reports. The participating physicians have noted concordance/discordance in 23% of biopsies that have pathology.

CONCLUSION

Radiologists, particularly mammographers, have a high rate of biopsy follow up. Many other faculty do not as reliably follow up on their pathology results, instead depending on the referring clinician to determine repeat biopsy necessity. Use of NLP for body part matching in biopsy/pathology reports results in a low number of report matching, but reports matched using only time and patient ID number criteria results in a high number of reports delivered. A biopsy-pathology follow up worklist can be well-integrated into current radiology practice systems.

CLINICAL RELEVANCE/APPLICATION

By automatically populating a web-based worklist with radiology and pathology reports, an otherwise time consuming and tedious task can be educational and add value to patient care.

INS-WEA

Informatics Wednesday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Wed, Dec 3 12:15 PM - 12:45 PM Location: IN Community, Learning Center

Participants

Moderator
Asim F. Choudhri MD : Nothing to Disclose

Sub-Events

INS158

Classification of Interstitial Lung Disease Patterns Based on Local Discrete Cosine Transform

Features of HRCT Images (Station #1)

Andreas Christe (Presenter): Nothing to Disclose , Marios Anthimopoulos : Nothing to Disclose , Stergios Christodoulidis : Nothing to Disclose , Stavroula Mougiakakou : Nothing to Disclose

PURPOSE

The classification of HRCT image patches with interstitial lung disease (ILD) abnormalities, as a basic component towards the quantification of the various ILD patterns in the lung.

METHOD AND MATERIALS

Based on the publicly available TALISMAN database consisting of 113 HRCT scans, a dataset with nearly 2500 ILD image patches was created with size equal to 21×21pixels. Six lung patterns were considered: normal, ground glass opacity (GGO), consolidation, reticulation, honeycombing and the combination of reticulation with GGO. Initially each patch is described by a feature vector which is then fed to a machine learning classifier. Feature extraction relies on a filter bank containing the 25 basis functions of the 5x5 Discrete Cosine Transform (DCT). After convolving the image with the filter bank, the 10-quantiles are computed on the filter responses for describing the distribution of local frequencies that characterize image texture. Quantiles are points taken at regular intervals from the cumulative histogram of the image; 10-quantiles are 9 values splitting the histogram to 10 intervals. Moreover, the minimum and maximum value of every filter response is added, together with the 32 gray-level histogram values of the original image. The final feature vector with 307 values is fed to a random forest (RF) with 40 trees for the classification.

RESULTS

The proposed ILD pattern methodology achieved an overall accuracy in the order of 90% outperforming state-of-the-art methods tested in the same data, by at least 7%. The sensitivity (%)/specificity (%) were: normal - 98.8/97.8; GGO - 81.3/98.8; consolidation - 92.7/99.5; reticulation - 85.6/95.7; honeycombing - 86/98.9; and combined reticulation/GGO - 88.2/94.8.

CONCLUSION

The combination of the proposed DCT-based features with RF classification showed very promising results outperforming many state-of-the-art methods. Future work includes investigating of the extension of the proposed 2D fixed-scale filter bank to multiple scales and three dimensions.

CLINICAL RELEVANCE/APPLICATION

DCT-based features and random forest classification are powerful tools from the fields of computer vision and machine learning which can help in the field of lung CT image analysis for the diagnosis of ILDs.

INS159

Registration Method for Gadoxetate Disodium-enhanced MR and Radiation Dose Distribution Maps Using an Extracted Liver-region Mask (Station #2)

Toru Higaki PhD (Presenter): Nothing to Disclose , Yuko Nakamura MD : Nothing to Disclose , Fuminari Tatsugami : Nothing to Disclose , Tomoki Kimura MD,PhD : Nothing to Disclose , Yasushi Nagata MD, PhD : Nothing to Disclose , Kazuo Awai MD : Research Grant, Toshiba Corporation Research Grant, Hitachi Ltd Research Grant, Bayer AG Research Consultant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd

PURPOSE

The delivery of radiotherapy to hepatic tumors has been limited by the high radiation sensitivity of the liver parenchyma. While the development of radiation concentration techniques allows addressing liver tumors by radiotherapy, radiation exposure of the normal parenchyma continues to present problems. Radiotherapy-induced damage depends on the radiation dose. Gadoxetate disodium (EOB) is an MR contrast medium that is specifically taken up by hepatocytes and the degree of EOB enhancement is reflective of focal liver function. We developed a method for the assessment on EOB-enhanced MRI (EOB-MRI) scans of focal liver damage induced by radiation. Here we propose a robust and accurate technique for the fusion of EOB-MRI and radiation dose-distribution maps.

METHOD AND MATERIALS

Using a 3T MRI scanner (Vantage Titan 3T, Toshiba Medical Systems, Tokyo, Japan) we performed EOB-MRI in 5 patients considered eligible for stereotactic body radiotherapy (SBRT). Planning CT scans were acquired on a multi-detector CT instrument (LightSpeed RT16, GE Healthcare, Wisconsin, USA). Treatment plans were developed with the aid of a radiation therapy planning system (Pinnacle3, Philips Healthcare). We segmented a liver region from the planning CT using a liver region mask extracted by the physicians involved in the planning of SBRT. After segmentation we applied a deformable registration method (3D Slicer, http://slicer.org) for EOB-MRI to align these scans with the planning CT scans. The EOB-MRI scan and the dose map were aligned because the dose maps and the planning CT scans involved the same coordinate system. We compared the accuracy of the registration method with and without liver segmentation to evaluate the performance of our method. The dice similarity coefficient (DSC) was used to evaluate the registration methods.

RESULTS

With the proposed method, the DSC was 0.58±0.19 in the initial position, 0.86±0.06 after rigid registration, and 0.91±0.04 after deformable registration. With conventional registration these values were 0.58±0.19, 0.86±0.05, and 0.86±0.14, respectively.

CONCLUSION

Desterilization of the extracted liver region mask yielded robust and accurate deformable registration.

CLINICAL RELEVANCE/APPLICATION

By segmenting organs using an organ region masks created at the time of radiation therapy planning, the accuracy of deformable registration can be improved without additional efforts.

INS160

MOI-RADS: An Automated QA Tool to Prospectively Track Discrepancies in Secondary Interpretations in Musculoskeletal Imaging (Station #3)

Asheesh K. Harsha MD (Presenter): Nothing to Disclose , Kristin L. Weber MD : Nothing to Disclose , J. Bruce Kneeland MD : Nothing to Disclose , Woojin Kim MD : Co-founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Board of Directors, Montage Healthcare Solutions, Inc Advisory Board, Zebra Diagnostics Ltd , Oleg Shargorodsky : Nothing to Disclose , Tessa S. Cook MD, PhD : Nothing to Disclose

PURPOSE

To implement an automated quality assurance tool to prospectively track discrepancies in musculoskeletal (MSK) exam reads submitted for secondary radiology interpretation at a tertiary center with a high volume of orthopedic oncology patients; and to further assess the patient care impact and accuracy of these interpretations.

METHOD AND MATERIALS

From 7/1/13 to 4/1/14 subspecialty MSK radiologists compared their final interpretations of outside exams submitted for secondary read with the original reports. A standard macro was included in the report indicating the level of (dis)agreement and the potential to affect clinical management. The following scale was used: no difference in interpretation (A); clinically unimportant difference in detection (Bd) or interpretation (Bi); clinically important difference in detection (Cd) or interpretation (Ci). A modifier "d" indicated that additional clinical information was available at the time of secondary interpretation. A database was developed to query the radiology information system, analyze the report, assign a discrepancy category and ensure compliance. Definitive diagnosis and evidence of management change due to the second interpretation were identified via chart review.

RESULTS

Of 301 studies, 285 (95%) provided an outside report. There were 68 (24%) discrepancies with 45 (16%) reports suggesting clinically important differences; 9 were differences in detection and 36 in interpretation. When clinical information was available, the secondary read changed management in 30 (75%) patients with the remaining 10 (25%) experiencing no management change despite the indication by the secondary interpreter. No management occurred in all category B cases. When the final diagnosis for category B and C cases was discoverable, the outside radiologist was correct in 21 (40%) cases and the secondary interpreter was correct in 49 (92%) of 53 discrepant studies.

CONCLUSION

A quality assurance tool to track discrepancies in MSK imaging second opinions successfully integrated in the clinical workflow demonstrated a 24% discrepancy rate, 11% rate of clinical management change, and overall accuracy of 92% emphasizing the patient care benefit of a secondary consultation radiology service.

CLINICAL RELEVANCE/APPLICATION

By facilitating analysis and quantification, informatics tools underscore the value-added benefit of secondary interpretations by subspecialty radiologists to patients/referring physicians.

INS161

Accuracy of SSDE Calculation using Radiation Dose Tracking Software (Station #4)

Kevin Murphy MBBCh, MRCS : Nothing to Disclose , Charles Sullivan : Nothing to Disclose , Antionette O'Connor : Nothing to Disclose , Maria Twomey MBChB, FFR(RCSI) (Presenter): Nothing to Disclose , Niamh Moore : Nothing to Disclose , Mary-Jane Murphy : Nothing to Disclose , Michael Sheehy : Nothing to Disclose , Owen J. O'Connor MBBCh : Nothing to Disclose , Michael M. Maher MD, FRCR : Nothing to Disclose

CONCLUSION

Capability for automated SSDE measurements with dose-tracking software is a very welcome development and will be an important component of dose management strategies using these techniques.

Background

Accurate dose tracking is essential for CT protocol optimization and audit. Size-specific dose estimate (SSDE) calculation requires a user dependent time-consuming measurement of the anteroposterior (AP) and lateral diameters of the body part being imaged. We assess the accuracy and convenience of an automated SSDE calculation tool via DoseWatch that utilizes the median image of the CT radiograph.

Evaluation

2 readers manually calculated SSDE on 100 thorax (Tx) & 100 abdomen-pelvis (A-P) adult CT exams independently. These results were compared to values calculated by DoseWatch software. There was no significant difference between manual (12.13±3.06mGy) and automated (12.28±2.82mGy) estimations for A-P SSDE values (mean 1%/0.16mGy difference). A small but significant (p

Discussion

A time efficient reproducible automated SSDE calculation tool is essential for accurate dose tracking. This automated tool meets these criteria and is particularly accurate in calculating abdominopelvic doses. CT thorax SSDE calculations were comparable with manual calculations.

INS162

A Cloud Based Solution for the Digital Imaging World: International Collaboration in Radiation Oncology (Station #5)

Aaron Odom MS (Presenter): Nothing to Disclose

CONCLUSION

The implementation of cloud based technology in radiation oncology permits patient access to remote specialists and experts, and facilitates multi-disciplinary team approach to diagnosis and treatment.

Background

The application of cloud based technology to diagnostic imaging and radiation oncology offers huge potential for expansion of multi-disciplinary cancer diagnosis and treatment. Even with the widespread use of DICOM protocols, traditional picture archiving and communication systems (PACS) require the transport of physical data storage media, or time-consuming collaborative configurations between institutions. Cloud based technology allows fast, individual-to-individual level collaboration across the globe.

Evaluation

Quentry (Brainlab AG , Munich, Germany) is a cloud-based collaboration platform that enables medical professionals to share and organize patient imaging studies and supporting documentation in order to help bridge the gap between expert knowledge and timely access to patient data. Radiating Hope is a multinational non-profit focused on improving cancer outcomes in underserved areas of the developing world by providing modern equipment, expert knowledge and operational support to radiation clinics in Africa. Quentry allows upload, storage, viewing and communication between users via a simple web interface. Collaboration requires only an internet connection and the creation of login credentials.

Discussion

Radiating Hope partnered with Quentry to improve knowledge transfer between clinical experts and local practitioners with the goal of ultimately improving clinical confidence concerning patient imaging, planning and treatment. Quentry provides the technical infrastructure for sharing imaging studies, reports, and treatment protocols between participants. Quentry is being used by experts in the Americas to mentor and collaborate with local clinic staff in Africa on patient imaging and radiation oncology treatment plans.

INE026-b

Scalable Distributed Open Source Medical Image Storage, Compute, and Search Platform (custom application computer demonstration)

David William Piraino MD (Presenter): Medical Advisory Board, Agfa-Gevaert Group , Daniel W. Palmer PhD : Nothing to Disclose , Naveen Subhas MD : Research Grant, Siemens AG , Nancy A. Obuchowski PhD : Research Consultant, Siemens AG Research Consultant, Hologic, Inc Research Consultant, CVUS Research Consultant, Elucid Bioimaging Inc , Daniel Felipe Gonzalez : Nothing to Disclose , Michael Ciancibello : Nothing to Disclose , Katie Hulme : Nothing to Disclose

Background

Picture Archiving and Communication Systems (PACS) and Radiology Information Systems (RIS) have been optimized for consistency and transactional performance. New concepts for processing and search of "Big Data" have been developed that favor availability and scalability over consistency. These "Big Data" technologies can be used to process, store, and search medical imaging information. This poster presents an architecture that uses an open source non-SQL scalable distributed database (Riak) as its base storage, search, and processing architecture. We demonstrate how this architecture can be used for search, image processing, and analysis. Riak is a key value database that uses consistent hashing (figure) to equally distribute information and processing to many nodes. Information is located on more than one node for redundancy, fault tolerance, and distributed processing. This distributed database provides map reduce, link walking, and secondary indexes for querying and processing. The open source search engine Solr is included for free text and discrete value search. Open source applications (Mirth, DMC4CHE, and MySQL) are included on each node to provide distributed DICOM and HL7 connectivity and relational database functionality. ImageJ and R are also included on each node to provide image processing functionality and statistics processing. The physical nodes run behind a load balancer to distribute external processing requests.

Evaluation

The system is presently receiving de-identified radiology reports and DICOM images. DICOM images are stored in DICOM, JPEG, and PNG formats. DICOM header elements are stored as simplified JSON documents. Search over greater than 7 million reports takes 1-2 seconds from a Web frontend. During failure of any node the system continues to receive, process, and provide search results.

Discussion

The system is able to store, process and search radiology reports and DICOM images in a distributed manner.

CONCLUSION

"Big Data" and non-SQL information processing technologies can be used for distributed medical image and report storage, processing, and search.

INE027-b

Federated Access to Images, Annotations and Measurements to Optimize the Review and Auditing of Imaging Data Submitted in Clinical Trials (custom application computer demonstration)

Ashish Sharma (Presenter): Nothing to Disclose , Nadir Saghar : Nothing to Disclose , Darryl Tharpe : Nothing to Disclose , Tony Pan MS : Nothing to Disclose , Ross Warren Filice MD : Nothing to Disclose

Background

Easy reproducible access to imaging and annotation data to support clinical trial results is an important part of clinical trial review and auditing. It is typically challenging to access this data, since it is often stored in proprietary formats and not easily accessible. Measurements are reported on CRFs while images reside on CDs. The latter often do not show the actual measurement or locate the structures that were actually measured. Consequently measurements on images are challenging to verify. Here we describe an informatics-based approach to enable the review of image and annotation data captured during a trial. It utilizes Service-oriented architecture (SOA) to federate databases that manage DICOM images and annotations to facilitate 'single-click' access to reproducibly recreate annotated-images.

Evaluation

This project uses two databases that manage images and annotations. DICOM images can be stored in NBIA (an open source research image data management system). Annotations are described using the AIM model and stored as DICOM SR or as XML objects. All databases are exposed via a secure REST API. The REST API for NBIA is similar to WADO-RS. The API for AIM annotations includes the ability to convert the annotations into HTML5 compliant format that can be rendered in web applications. The APIs, also include the ability to federate images and annotations. Finally, a web application was developed that allow a reviewer to review images and annotations.

Discussion

This pilot replicates the workflow of image review in clinical trials. The use of SOA allows us to easily construct systems that can securely federate images and annotations without overhauling existing data management systems. REST APIs make it easy to create presentation platforms that can advance the adoption of quantitative imaging.

CONCLUSION

Standardizing image and annotation data facilitates storage of this data in accessible sites along with development of presentation platforms that give 'single-click' access to any image and markup directly from a review document. Such standardization also allows important research applications across clinical trial data sets such as quantitative imaging biomarker development.

INE028-b

A Web-based Open Source Platform for Radiology Education using Rapid Reinforced Learning Mechanics (custom application computer demonstration)

Po-Hao Chen MD, MBA (Presenter): Nothing to Disclose , Alexander T. Ruutiainen MD : Nothing to Disclose , Howard Lee Roth MD : Nothing to Disclose , Tessa S. Cook MD, PhD : Nothing to Disclose

Background

The premise of rapid reinforcement learning theory posits that education is a feedback loop consisting of rapid, repetitive performance paired with immediate, unambiguous feedback. Software design literature cites this mechanism as the source of enjoyment one receives from otherwise banal activities such as matching tiles of arbitrary shape into straight lines (also known as Tetris) or propelling wingless avians against predetermined wooden structures (Angry Birds). Identifying basic abnormalities such as neuroforaminal narrowing on MRI or architectural distortions on mammography are skills that may be best improved by practice. We created a web-based platform and API to allow radiologists to easily create or use modules using game-like mechanics to encourage trainees to practice these basic skills.

Evaluation

Our web-based application is designed in PHP, with visual effects written using JavaScript and is compatible with a variety of browsers, including iOS- or Android-powered products. Users can choose to complete a learning module of their choice. Each module contains a focused learning objective such as 'degenerative disc disease on MRI.' Each module contains a set of brief cases, each designed to take 15 seconds or less to complete, immediately followed by visual feedback. Mechanics such as a countdown timer, score, achievement, and leaderboard are available as motivational tools. Educators can design rapid-reinforcement modules and choose to either publically share or keep them private. Users may consent to provide anonymous data for quality metrics on each module.

Discussion

Our application should provides a safe virtual environment where trainees are encouraged to learn basic identification skills by immediate feedback. Its mobile-friendly nature, along with the simplicity of each module's objective, is amenable to short bursts of learning on-the-go as well as dedicated learning sessions. The data-recording mechanism provides feedback for educator-researchers on the efficiency and quality of their modules.

CONCLUSION

A cross-platform, open-source, web-based application can be used to motivate radiology trainees in honing basic image interpretation skills.

INE029-b

A Diagnostic Imaging Education System for Lung CT Images based on Image-Retrieval Technology for Medical Books and DICOM Images (custom application computer demonstration)

Hirohiko Kimura MD, PhD (Presenter): Nothing to Disclose , Toyohiko Sakai MD : Nothing to Disclose , Kenji Kondo : Employee, Panasonic Corporation , Kazutoyo Takata : Employee, Panasonic Corporation , Kazuki Kozuka : Employee, Panasonic Corporation , Masakai Kiyono : Employee, Panasonic Corporation , Masayuki Inubushi : Research collaboration, Panasonic Corporation , Mariko Toyooka MD : Research collaboration, Panasonic Corporation

Background

Daily clinical operations generate a vast amount of medical images, which increase radiologists' workloads, and reduce their available time for educating medical students, residents, or new radiologists. While medical books and teaching files are critical for self-education, finding specific sources within many pages or files is difficult. Earlier, we proposed an image-retrieval technology based on radiologists' knowledge, for the accurate location of related images. In this study, we propose a diagnostic imaging education system for lung computed tomography (CT) images, based on similar technology.

Evaluation

The proposed system handles cases from medical books and picture archiving and communication systems (PACS), and combines the benefits of medial books and real digital imaging and communications in medicine (DICOM) cases. In medical books, diagnostic methods for most diseases are described. In contrast, real DICOM cases are more varied in appearance for a given disease, and contain three-dimensional lesion structures constructed of multiple slice images. To operate the system, a user first scans relevant medical book pages by selecting thumbnails of retrieval results, and then finds distinctive traits of some likely diseases. Second, the user specifies a disease from a list of similar cases, and learns the common features of the disease by browsing actual DICOM images.

Discussion

Currently, the system is linked to our hospital's radiology department system, and employs a trial database containing 981 images from two medical books, and 1,147 cases from our hospital PACS. Further, the system allows easy access to relevant information from medical books and teaching files for cases met in daily clinical practices.

CONCLUSION

The current study introduces a diagnostic imaging education system based on image-retrieval technology for medical books and DICOM images. This system could help medical students and radiologists master diagnostic imaging, and encourage more widespread use of these systems.

INE030-b

Open Source Radiology Resident Educational Dashboard App To Measure Clinical Experience (custom application computer demonstration)

Shlomo Minkowitz BA, MD (Presenter): Nothing to Disclose , Kurt T. Teichman BSC, MENG : Nothing to Disclose , Charles Herrmann MS : Nothing to Disclose , Kevin William Mennitt MD : Nothing to Disclose , Robert D. Zimmerman MD : Nothing to Disclose , George Lee Shih MD, MS : Consultant, Image Safely, Inc Stockholder, Image Safely, Inc Consultant, Angular Health, Inc Stockholder, Angular Health, Inc

Background

Radiology residents are required to learn vast amounts of information during their residency and are evaluated according to various curriculum guidelines. However, tracking how many of which imaging studies residents review and matching those numbers with the goals of the rotation is challenging. We have developed an open source dashboard app that integrates with RIS / PACS, providing residents with real-time feedback on the volume and types of exams correlated with their rotation goals as defined by the educational committee and clinical divisions.

Evaluation

Our resident dashboard app currently tracks the volume of exams by modality per rotation week for each resident. For example, the figure below shows the dashboard for one week on a neuroradiology rotation, showing that the resident reviewed 40 CTs and 10 MRs in one week, and compares that against the volume goals per week for that rotation which are specific for a PGY level (35 CTs and 5 MRs for a 1st year resident on neuroradiology), symbolized by the orange circle. Resident can view their personalized real-time dashboards during the rotation, or afterwards with aggregate views of the volume of cases by rotation and modality.

Discussion

Our resident dashboard provides real-time information to residents matched with rotation goals, which can be further studied to evaluate any potential correlation with resident educational experience. In our future work, we intend to analyze the effectiveness of the dashboard by applying the software retrospectively to define an "education profile" for each resident, and then look for any potential gaps between rotation goals defined by each division and actual modality exposure for each rotation. In addition to volume, we will eventually include similar goals for the different pathologies that should be seen over the course of their residency.

CONCLUSION

An open source educational dashboard app (http://bit.ly/residentdashboard?) may help improve resident education by giving them real-time feedback as a way to supplement the Radiology Milestones project, and possibly help to identify resident-specific deficiencies.

INE031-b

Putting Together a Low-cost, High Performance Server for Radiology Teaching Files Using RSNA's MIRC Installed on a Raspberry Pi Control Board (custom application computer demonstration)

Andre Martins Pereira MD (Presenter): Nothing to Disclose , Mostafa Atri MD : Nothing to Disclose , Martin E. O'Malley MD : Nothing to Disclose , Patrik Rogalla MD : Nothing to Disclose

Background

Building a teaching file in our radiology program was a project for a long time, but had not yet been implemented due to several factors. We decided to implement RSNA's MIRC (Medical Imaging Resource Center) on Linux installed on a Raspberry Pi, which had not yet been done.

Evaluation

We used the Raspberry Pi to act as the server. It features a 700MHz ARM chip and 512 MB of RAM. We attached a 1 TB external hard drive to add storage space. We installed Debian Linux as the operational system and then proceeded to install MIRC. Although MIRC does not demand a separate web server software to work, we installed Apache and MySQL in in order to have a fully functional web server, able to host additional webpages and run automated tasks via PHP scripts. The administrator is responsible for general MIRC administration (adding users, etc.) and also for checking uploaded cases and having them approved for public viewing.

Discussion

Having a case-based teaching file in our department was perceived as complex and expensive. The use of open-source software and RSNA's MIRC installed on a low-cost Raspberry Pi allowed us to overcome initial fears of spending significant amounts of money on an initiative we didn't know would be successful. Case loading time was comparable to other MIRC sites available on the Internet. Administration of the server is virtually non-existent, as most of tasks are automated. Administration of MIRC itself is very straightforward and basically consists in adding new users to the usertable and checking new cases to make sure no patient information is present before being published. Overall satifaction with the system was very good.

CONCLUSION

We were successful in installing and running RSNA's MIRC on a Raspberry Pi. Two servers were assembled, one acting as a backup. The total cost for each of the servers was around $150.00. The setup is a good alternative to a full-size server for educational purposes and allows a department to have a teaching file of its own at a reasonably low cost, important for educational institutions especially in developing countries. It also allows for an excellent environment for testing the feasibility of pilot educational or research projects.

INE032-b

Interactive Web Application for Asynchronous Active Learning in Radiology (custom application computer demonstration)

Seth Joshua Berkowitz (Presenter): Nothing to Disclose , David Andrew Glazier MD : Nothing to Disclose , Jonathan B. Kruskal MD, PhD : Author, UpToDate, Inc

Background

Radiology teaching files traditionally contain key images with annotations and captions. Static images show the features of a given diagnosis, but do not adequately prepare one to interpret an exam with hundreds, or even thousands, of images. We have designed a cross-browser web application for building and viewing interactive teaching files that simulates the experience of using a PACS workstation under the instruction of an experienced radiologist.

Evaluation

A collection of 71 cases was created to prepare our 10 first-year radiology residents for their pre-call exam. Cases were viewed in our custom web application, complete with image scrolling, zoom, pan, and windowing capability. Average case rating (1 through 5) was 4.6. The average time spent viewing each case was 159s.

Discussion

Existing educational resources cannot capture the experience of learning at a workstation with a seasoned radiologist. Our teaching file was designed to emulate this personal experience in an e-learning tool. Images can be viewed blindly or with descriptive annotations. Text captions are unambiguously linked with their image annotation through color highlighting. Key images are presented in the context of the image stack, encouraging exploration of findings on multiple slices and planes. Annotations of a common structure can be combined in a set and connected via hyperlinks to the findings text. The application enables study retrieval from PACS, automatic anonymization, connection of multiple imaging studies, and markup of images.

CONCLUSION

Our web based teaching file allows radiologists to build a rich layer of instructive metadata over the full set of images within an exam to facilitate asynchronous learning of image interpretation. By interacting with the complete data set, users actively hone their search patterns, visualize pathology in multiple dimensions, and increase their speed of exam evaluation. This clinically relevant teaching tool will appeal to life-long learners of radiology and is translatable beyond residency to maintenance of certification exam practice and continuing

medical education.

INE033-b

Mobile Case-based Learning : A Database Approach (custom application computer demonstration)

Christine M. Zwart PhD (Presenter): Nothing to Disclose , Amy Kiyo Hara MD : Nothing to Disclose , J. Ross Mitchell PhD : Co-founder, Calgary Scientific, Inc Intellectual property, Calgary Scientific, Inc Shareholder, Calgary Scientific, Inc

Background

Case-based training is a staple of radiology education. We recently developed an approach to case-based training that uses a database structure for building interesting case files rapidly and allowing for files to be used and reused in a variety of formats. Our system utilizes two database structures, one housing traditional book elements (text-based case histories, descriptions, key images, and multiple choice questions) and one housing radiology exam elements (dcm4chee, an open source PACS). The complete case-based teaching system makes use of FileMaker (FileMaker Inc., Santa Clara, California) for designing front-end user interfaces and ResolutionMD (Calgary Scientific, Calgary, Canada) for allowing users to interact with the full radiological exam. Both platforms can be used via the web on a computer or through 3rd party apps on iOS devices.

Evaluation

We evaluated the utility and design of our iPad learning platform with three staff radiologists and three fellows using 39 cases of Crohn's disease. We evaluated the new platform in comparison to an existing learning system that uses a paper format for book elements and ClearCanvas (ClearCanvas, Toronto, Ontario) on a dedicated laptop for image exams. We found enthusiasm for an electronic learning format; however several criticisms were offered related to the layout and 'buttonology' of our iPad tool, and users expressed a desire for a web-based option.

Discussion

Based on feedback from the initial evaluation, we refined the interface and adjusted several aspects of content delivery. Importantly, the database structure allows modifications to the learning tool template to be made quickly and content redeployed without significant input or effort from the provider of the interesting case.

CONCLUSION

We have developed a new system based on two databases allowing rapid deployment of interesting cases in polished and interactive teaching and learning tools. Our initial evaluation provided us with an opportunity to exploit this layered (interface on top of database) method for content delivery and make changes to the interface without adjustment to the core content or its storage format.

RCA43

National Library of Medicine: Save Searches, Get Updates: The Free PubMed My NCBI Tool (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 12:30 PM - 2:00 PM Location: S401AB

Participants

Holly Ann Burt MLIS (Presenter): Nothing to Disclose
Patricia Devine MLS (Presenter): Nothing to Disclose
Jamie T. Dwyer MLS (Presenter): Nothing to Disclose
Stephanie Friree MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Use My NCBI to personalize PubMed. 2) Understand how to save search strategies and create email alerts. 3) Use filters to link to library full-text articles and to focus PubMed searches. 4) Understand how to save collections of citations including a personal bibliography.

ABSTRACT

In this hands-on workshop session, explore the free My NCBI tool in PubMed. Discover how to save search strategies, create email alerts to keep up with the latest publications, create instant links to library full-text resources, and build permanent online bibliographies. Topics covered include creating a free My NCBI account, adding search and library filters to PubMed, using My Bibliography to create an online list of personal publications, and the link between the NIH Manuscript Submission System and PubMed. Important notes on PubMed searching will also be included. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov); MEDLINE is a subset of PubMed.

URL's

http://nnlm.gov/training/resources/myncbi8.pdf

Handout:Holly Ann Burt

RCB43

Creating and Delivering Online and Mobile Education Content: From Online Courses to Interactive iBooks (Hands-on)

Refresher/Informatics

IN ED IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 12:30 PM - 2:00 PM Location: S401CD

Participants

Moderator
George Lee Shih MD, MS : Consultant, Image Safely, Inc Stockholder, Image Safely, Inc Consultant, Angular Health, Inc Stockholder, Angular Health, Inc

LEARNING OBJECTIVES

1) Assess the potential of online and mobile e-learning innovations to augment your residents', medical students', and staff's educational curricula. 2) Acquire the domain knowledge to use already available content (eg, PowerPoint presentations) to both create video content and deploy e-learning courses on modern web-based and mobile platforms. 3) Acquire the domain knowledge to create an interactive Apple iBook (electronic books) with text, images, video, and interactive questions.

ABSTRACT

1. From OpenCourseWare to the Khan Academy, and now to Coursera, e-learning has been dramatically improved over the last decade, changing education from the normal classroom into learning done at convenience, and also allows for more creative and engaging content during the typical lecture. Stanford Med published positive initial findings in utilizing video-based lectures in an interactive class setting. Leveraging this new way of learning, requires knowledge about the types of technology and platforms for these courses. 2. The workflow required to host an e-learning course can be summarized in 3 steps: (a) creating the educational content, (b) hosting the materials, and (c) making the materials available to the intended audience. E-content today typically consists of lecture slides along with video recordings captured by technology like TechSmith Camtasia (non-free) and Apple Quicktime (free). Once the materials are created and edited, one must choose a suitable hosting platform realistic to the skills and goals of the instructor with options that include coursesites.com, iTunes U, and YouTube / Google Hangouts. Students can then be invited to view the material or the content can be made available to the public. 3. Creating and publishing e-books is a great way to share your teaching material as an engaging interactive tool. Publishing in e-book format solves many logistical problems of conventional publishing and the e-book format has interactive features that paper books can't match. We will review the process of creating your own e-book from assembling material to layout design to submitting for e-publication. Specifically Apple iBooks Author software will be used to demonstrate converting an existing Powerpoint presentation or journal publication into an e-book. In addition, the course will go over how to publish with or without DRM (copy-protection) and ways to obtain an ISBN for publishing for sale. Online resources will also be reviewed.

Sub-Events

RCB43A **Screencasting Basics on the Desktop and on the iPad**

Ian Ross Drexler MD, MBA (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCB43B **Massive Open Online Course (MOOC) Creation and Hosting**

Kurt T. Teichman BSC, MENG (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

Active Handout

http://media.rsna.org/media/abstract/2014/14002177/RCB43B sec.pdf

RCB43C **Interactive iBooks to Supplement your Online Course**

Richard S. Ha MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC43

The RSNA Image Share Network - How It Operates and How to Put It into Your Office

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 12:30 PM - 2:00 PM Location: S501ABC

Participants

Moderator
David S. Mendelson MD : Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Corporation
Wyatt Michael Tellis PhD (Presenter): Officer, EyePACS, LLC

LEARNING OBJECTIVES

1) Understand the goals of the RSNA Image Share project. 2) Understand the technical architecture of the RSNA Image Share. 3) Learn the steps necessary to implement in your local environment.

URL's

http://www.rsna.org/Image_Share.aspx

INS-WEB

Informatics Wednesday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Wed, Dec 3 12:45 PM - 1:15 PM Location: IN Community, Learning Center

Sub-Events

INS163

Delegating Imaging Order Entry: How Common Is Proxy Ordering and Does It Influence Appropriateness of Advanced Inpatient Imaging Requests? (Station #1)

Chad Klochko MS, MD (Presenter): Nothing to Disclose , Andrew Kent Moriarity MD : Nothing to Disclose , Matthew O'Brien MD : Nothing to Disclose , Safwan Halabi MD : Nothing to Disclose

PURPOSE

To measure the rate of proxy delegation in the inpatient setting for advanced imaging requests and identify differences in proxy utilization and request appropriateness before and after implementation of clinical decision support between provider and proxy groups and by specialty.

METHOD AND MATERIALS

An IRB approved retrospective review was performed of 68,976 requests for advanced imaging examinations over 34-months with a 17-month cross-over for clinical decision support (CDS) implementation. The rate of proxy entry and request appropriateness score generated by point of care CDS using the American College of Radiology Appropriateness Criteria was analyzed by specialty.

RESULTS

There were 22,564 and 46,405 inpatient requests for advanced imaging prior to and following implementation of CDS respectively originating from 43 distinct clinical specialties. Electronic order entry was delegated to a proxy in 86.4% and 85.8% of requests respectively. The largest contributors to overall advanced inpatient imaging volume were neurology (24%), internal medicine (14%), neurosurgery (10%), hospitalists (9%) and general surgery (6%). One-quarter (11 of 43) specialties had a 100% rate of proxy request entry delegation, 19 more had rates greater than 90% and only 6 had rates lower than 50%. Acute care surgery, cardiothoracic surgery, interventional radiology, orthopedic surgery, pediatrics, and thoracic surgery demonstrated a slight increase in the average request appropriateness when entered by the responsible physician compared to a proxy. No specialties demonstrated a significant decrease in request appropriateness when the request was entered by the physician compared to a proxy.

CONCLUSION

Proxy ordering is the most common method of submitting electronic requests for advanced imaging in our inpatient population with the majority of referring services utilizing proxies more than 75% of the time. A minority of specialties demonstrated a slight increase in overall request appropriateness when advanced imaging requests were entered by the responsible physician compared to a proxy provider. Clinical decision support did not significantly increase request appropriateness in either group.

CLINICAL RELEVANCE/APPLICATION

Proxy entry of advanced inpatient imaging is common and the appropriateness of such requests is comparable to direct entry by the supervising physician, therefore this practice should be permitted.

INS164

Computer-aided Detection of Epileptic Foci on 18F-FDG-PET Images (Station #2)

Toru Higaki PhD (Presenter): Nothing to Disclose , Daisuke Komoto MD : Nothing to Disclose , Yoko Kaichi : Nothing to Disclose , Koji Iida : Nothing to Disclose , Yutaka Hirokawa : Nothing to Disclose , Kazuo Awai MD : Research Grant, Toshiba Corporation Research Grant, Hitachi Ltd Research Grant, Bayer AG Research Consultant, DAIICHI SANKYO Group Research Grant, Eisai Co, Ltd

PURPOSE

On 18F-FDG-PET scans epileptic foci are demonstrated as a defect in FDG uptake. However, if the lesions are bilateral or subtle their detection can be difficult. We developed a computer-aided diagnosis (CAD) system that compares 'normal-' and patient FDG-PET images to identify epileptic foci.

METHOD AND MATERIALS

We enrolled 16 volunteers and 6 patients undergoing 18F-FDG-PET scanning on a Discovery ST16 PET/CT scanner (GE). We administered 3 MBq/kg of 18F-FDG to all patients and volunteers. All normal- and patient FDG-PET images were normalized based on the statistical parametric mapping (SPM) PET template and a 'normal' database was generated. We applied the voxel-based z-test to all images, extracted voxels with significantly decreased uptake ($p<0.05$), and defined clusters of neighboring extracted voxels as 'lesion candidates'. For each lesion candidate we calculated the likelihood value by multiplying the mean z-value with the volume. Finally, we ranked the lesion candidates according to the likelihood value and displayed them on MR images. Definitive diagnosis of the epileptic foci was by a neurosurgeon specializing in epileptology based on MRI-, FDG-PET-, magnetoencephalogram-, and clinical findings.

RESULTS

In 5 patients the first- or second-ranked lesion candidates identified by our CAD system coincided with epileptic foci identified by the neurosurgeon (1st candidate in 4 patients, 2nd candidate in 1). In the other patient the 12th-ranked candidate coincided with the epileptic focus; in this patient uptake in the epileptic focus was not significantly decreased.

CONCLUSION

Our CAD system accurately detected epileptic foci in which the ^{18}F-FDG uptake was significantly decreased.

CLINICAL RELEVANCE/APPLICATION

Our new CAD system may help to detect epileptic foci before surgery for epilepsy.

INS165

Hepatocellular Carcinoma Detection in Arterial Phase of CT Using Directional Features and Machine Learning Algorithm (Station #3)

Atul Kumar : Nothing to Disclose , Kai-Che Liu : Nothing to Disclose , Ching-Chun Huang PhD : Nothing to Disclose , Ming Hsun Lee : Nothing to Disclose , Lihsun Chen : Nothing to Disclose , Yen-Yu Wang (Presenter): Nothing to Disclose , Hurng-Sheng Wu : Nothing to Disclose

PURPOSE

To automatically detect the hepatocellular carcinoma in the arterial phase CT scan of liver with the help of image gray level features in different directions (using Gabor filter with Gray Level Co-occurrence Matrix) and machine learning algorithms (using Support Vector Machine and Artificial Neural Network).

METHOD AND MATERIALS

After approval from IRB, arterial phase liver CT scan image data of patients having histopathological diagnosis of hepatocellular carcinoma were retrieved from the radiology data archive of Show Chwan Memorial Hospital, Taiwan. The study was done in 125 images. Post-processing of the images was done with a median filter and an adaptive contrast enhancement technique. The images were subdivided into squares of 30x30 pixels, and based upon their content the squares were tagged as normal (liver parenchyma), tumor (hepatocellular carcinoma) and blood vessels by a radiologist. A total of 918 squares were used in the study, out of which 70% were used for training and 30% were used for test of the classification model. Directional features of the image was extracted by applying Gabor filter (a Gaussian filter function modulated by a sinusoidal plane wave) generating 18 Gabor images for each CT image. For each of the tagged region in the corresponding Gabor images, a Gray Level Co-occurrence Matrix (GLCM) based features such as energy, contrast, correlation and homogeneity were calculated. Using these features, support vector machine (SVM) and artificial neural network (ANN) classification algorithms were applied on the training squares to make mathematical classification models. The models were then applied to detect hepatocellular carcinoma in the test squares.

RESULTS

The sensitivity for the tumor detection was 94% with SVM and 95% with ANN classification. The overall accuracy of the classification for three different regions (tumor, vessels and normal liver) were 96% and 97% with SVM and ANN respectively.

CONCLUSION

An artificial intelligence based system for detection of hepatocellular carcinoma in liver CT was studied. The sensitivity and accuracy of the system may further improve with larger number of data.

CLINICAL RELEVANCE/APPLICATION

The proposed system would be a helpful tool to physicians for automated screening for the detection of hepatocellular carcinoma.

INS166

Using a Peer Review Application to Identify Clinically Significant Errors (Station #4)

Dorothy Amy Sippo MD (Presenter): Nothing to Disclose , Gorkem Sevinc : Co-founder, InSight Medical Technologies Officer, InSight Medical Technologies , John William Nance MD : Nothing to Disclose , Paul G. Nagy PhD : Nothing to Disclose , Brandyn D Lau MPH : Nothing to Disclose

CONCLUSION

Using our application, we found that 3% of cases selected for daily peer review contained clinically significant errors. These represent an opportunity for targeted quality improvement and continuing education. The fact that two thirds of clinically significant errors resulted from failure to identify a finding suggests that search patterns may be improved by identifying commonly missed findings.

Background

The Joint Commission and American College of Radiology require radiologists to participate in peer review. We have developed an application to facilitate the peer review process at our academic medical center. The purpose of this study is to assess the frequency of clinically significant findings during the peer review process using our application.

Evaluation

We included all radiographic cases selected for peer review (first two cases each day) from January 2013 through March 2014. We also included all cases with independently identified discrepancies, cases where a second radiologist's reading was different than the original radiologist. For each case, a reviewing radiologist could: (1) concur with the original radiologist; (2) disagree due to failure to identify a finding; (3) disagree with the interpretation of a finding. If the reviewing radiologist disagrees with the original radiologist, they must specify their findings and stratify the error as: (1) clinically significant; (2) not clinically significant. Reviews of outside imaging were excluded from analysis.

Discussion

Of 4992 cases selected for peer review, the reviewing radiologist disagreed with the original radiologist in 368 (7.4%) cases. 150 cases contained clinically significant findings, resulting from 94 (62.7%) identification errors and 56 (37.3%) interpretation errors. Overall, 3% of peer reviewed cases contained clinically significant errors. Out of 90 studies with a reported discrepant finding, the reviewing radiologist identified 60 (66.7%) cases where the original radiologist failed to identify a finding, of which 43 (71.7%) were clinically significant. Among the remaining 30 (33.3%) cases with interpretation errors, 18 (60%) were clinically significant. Overall, 68% of discrepant findings were clinically significant.

INS167

A Novel Solution for a Secure Image Sharing Solution Using Enterprise Online File Sharing (Station #5)

Arnon Makori MD (Presenter): Medical Advisory Board, Carestream Health, Inc , Roni Zaharia : Consultant, RZ Software Services

CONCLUSION

Our novel solution can help many medical organizations confronted with the difficult task of securely connecting External Imaging Providers to their PACS, and improve patient care.

Background

External Imaging Providers (EIP) in 150 sites perform 500K imaging studies for our HMO per year in addition to over 4M performed internally in 50 centers and 12 hospitals.IT Security policy doesn't allow EIP to access our internal network.While DICOM is the used for Medical Imaging, Enterprise File Sharing (EFS) gains popularity for delivering other digital documents within and across enterprise boundaries.We've combined EFS and DICOM to create image-sharing solution with our EIP so that all external studies can be stored in our PACS.

Evaluation

An appliance in the EIP site (EIPA) encapsulates a DICOM Storage SCP and a EFS Client Software. Modalities sends the studies performed for our HMO to the EIPA using DICOM. The EIPA publishes the studies securely using the EFS client. The EFS server is installed in our DMZ. Antivirus scanner checks every uploaded file. Another EFS client pulls the files into our network.Once inside our network, the content of every DICOM file is validated for correctness of demographic information, key elements (e.g. Accession Number, Study ID) and other DICOM tags required by our PACS. Once validated, the studies are sent to the PACS using DICOM protocol. Every EIPA sends a 'heartbeat' file periodically. The heartbeats are monitored and an alert is raised when not received on time. The heartbeat file contains a list of DICOM files stored on the EIPA. A reconciliation process compares the list from the EIPA with the list of files that arrived to the EFS Server.

Discussion

Our solution combines Modern File Sharing Technology and DICOM Protocol, eliminating the need for manual import of external studies into our PACS.The solution successfully passed evaluation phase where it processed hundreds of studies per day. Major Advantages: Eliminate cumbersome VPN configuration; automatic; Scalable; Secure; EFS agnostic - other products including consumer services, Google Drive, DropBox, etc. can be utilized. Note: encryption of the DICOM files may be required when using consumer online file sharing.

RCA44

Structured Annotation and Image Markup (AIM) Template and Toolsets (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 2:30 PM - 4:00 PM Location: S401AB

Participants

Pattanasak Mongkolwat PhD (Presenter): Nothing to Disclose
Justin Kirby (Presenter): Stockholder, Myriad Genetics, Inc

LEARNING OBJECTIVES

1) To introduce the participant to collecting image annotations as coded terminologies in a structured manner using NCIP Annotation and Image Markup (AIM) Version 4.0. 2) To provide an overview of and where to obtain the AIM tools used to create image annotations. 3) To provide an end-to-end demonstration on how to use the tools including AIM Template Builder, AIM Template Service, and AIM on Clearcanvas.

ABSTRACT

One of the major challenges associated with "big data" as it relates to imaging informatics is the lack of structured metadata for collecting image annotation information. The Annotation and Imaging Markup (AIM) version 4.0 information model captures pixel descriptions of an image interpreted by a human or machine with graphical drawings and related calculation results placed on the image into a single common information source. This course will demonstrate how the AIM project tools generate annotations and markup using coded terminologies in a way that automatically maintains the association to the images. The result is an interconnected suite of tools which allows researchers to easily generate minable structured metadata for research. In this course, participants will receive an overview on generating image annotations and markup as coded terminologies in a structured manner utilizing freely available open source tools developed through the National Cancer Informatics Program (NCIP). First, we will introduce the AIM Template Builder for creating structured data entry templates. Next, we will discuss the AIM Template Service which allows for centralized storage and sharing of these AIM templates. Finally, we will cover the AIM on Clearcanvas workstation which is used to import and display the AIM templates alongside the image data and allows for structured annotation and markup creation. These tools allow study designers and imaging interpreters to focus on clinical problems and the types of information needed for collection without also comprehensively understanding the AIM model.

URL's

http://www.radiology.northwestern.edu/research/areas-of-research/Imaging-Informatics-home/Presentations.html

RCB44

3D Printing (Hands-on)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 2:30 PM - 4:00 PM Location: S401CD

Participants

Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation
Peter Constantine Liacouras PhD (Presenter): Nothing to Disclose
Timothy Mueller (Presenter): Nothing to Disclose
Amir Imanzadeh MD (Presenter): Nothing to Disclose
Dimitris Mitsouras PhD (Presenter): Nothing to Disclose
Nicole Wake MS (Presenter): Nothing to Disclose
Andreas Giannopoulos MD (Presenter): Nothing to Disclose
Tatiana Kelil MD (Presenter): Nothing to Disclose
Catherine Phillips MD (Presenter): Nothing to Disclose
Beth A Ripley MD, PhD (Presenter): Nothing to Disclose
Asha Sarma MD (Presenter): Nothing to Disclose
Hansol Kim MD (Presenter): Nothing to Disclose
Tianrun Cai MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To familiarize radiologist with the general indications for 3D printing in biomedical imaging. 2) To learn the basic principles of an STL file. 3) To obtain "hands-on" experience in creating a STL file from radiology DICOM images. 4) To learn an approach to STL file manipulation to achieve a 3D printed model.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

Active Handout

http://media.rsna.org/media/abstract/2014/14003457/RCB44sec.pdf

RCC44

Workflow Tools to Optimize Departmental Operations

Refresher/Informatics

LM IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Wed, Dec 3 2:30 PM - 4:00 PM Location: S501ABC

Participants

Moderator
Bradley J. Erickson MD, PhD : Stockholder, Evidentia Health, Inc

Sub-Events

RCC44A

Managing Your Department with Workflow Engines

Bradley J. Erickson MD, PhD (Presenter): Stockholder, Evidentia Health, Inc

LEARNING OBJECTIVES

1) Become familiar with workflow engine technology. 2) Understand how workflow engines can be used within a radiology department. 3) Understand strengths and weaknesses of workflow engines compared to alternative methods like databases.

RCC44B

Measuring Your Department with the SWIM Lexicon

Marc D. Kohli MD (Presenter): Research Grant, Koninklijke Philips NV Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Describe existing heterogeneity of workflow terminology. 2) Explain benefits arising use of a standard nomeclature for workflow steps. 3) Provide details regarding how the SWIM lexicon could be applied in the learner's environment.

ABSTRACT

In current practice, standard workflow steps such as the arrival of a patient to the imaging department, and completion of the exam are tracked in a very heterogenous manner with imprecise terminology. In order to better understand and compare workflow across radiology departments, a common language must be devised and deployed. The SIIM Workflow Initiave In Medicine (SWIM) lexicon aims to address this challenge. We will illustrate how the SWIM lexicon can be used to measure and compare workflow in a radiology department.

RCC44C

Monitoring Your Department with Dashboards

Christopher D. Meenan (Presenter): Stockholder, Analytical Informatics, Inc

LEARNING OBJECTIVES

1) Describe what a radiology department dashboard entails. 2) Give three examples of key performance indicators for a radiology department. 3) Explain how dashboards have created an impact in other practices.

SSM13

Informatics (Image Sharing)

Scientific Papers

IN

AMA PRA Category 1 Credits ™: 1.00

ARRT Category A+ Credit: 1.00

Wed, Dec 3 3:00 PM - 4:00 PM Location: S403A

Participants

Moderator
Rasu B. K. Shrestha MD, MBA : Advisory Board, General Electric Company Medical Advisory Board, Nuance Communications, Inc Editorial Medical Advisory Board, Anderson Publishing, Ltd Advisory Board, KLAS Enterprises LLC Advisory Board, Peer60
Moderator
Gary J. Wendt MD, MBA : Medical Advisory Board, McKesson Corporation Stockholder, TeraMedica, Inc Medical Advisory

Board, HealthMyne Owner, WITS(MD), LLC

Sub-Events

SSM13-01 Cloud-based Implementation of an Open Source Breast Density Analysis Tool

Jason Daehn Balkman MD (Presenter): Nothing to Disclose

CONCLUSION

Open source computer vision tools may be implemented in a cloud-based web application for the analysis of radiologic images. A mammographic breast density quantification tool was developed and made publicly available as a zero footprint web application. This architecture may potentially be extended to other areas of radiology, encouraging more collaborative, transparent, and standardized approaches to image processing.

Background

Radiologic image processing is frequently performed using proprietary tools on local servers. This may limit institutional access to specialized software and lead to varied image analytics between facilities. A cloud-based platform for developing, testing, and utilizing image analysis tools could help standardize these activities and improve access to radiology software. This work focuses on breast density quantification as a potential application for such technology.

Evaluation

Amazon Web Services were used to launch a configurable cloud server. Open source computer vision software tools, including Python-based OpenCV, Scikit-image, Mahotas, and Scipy/Numpy were installed on the remote cloud server. Breast density analysis algorithms were implemented using these tools, capable of handling DICOM, TIFF, and JPEG image formats. Software code was uploaded to a collaborative open source repository, GitHub (github.com/jbalkman/qadense) for reference. JavaScript and HTML scripts were used to create a front-end public website, QADense.com (Quantitative Analysis of Breast Density, pronounced "KAY-dense"). The website was connected to the configured cloud server using an NGINX webserver and Flask development environment.

Discussion

The public website was freely accessible through a modern web browser such as Chrome. Mammograms could be uploaded to the website using a simple drag and drop of image files onto the website. A typical 14 MB mammogram uploaded in less than five seconds. Mammograms were analyzed by clicking a website button, with processing times under 10 seconds and all cloud server content deleted after analysis. Quantitative data, including both area and volumetric-based calculations were presented in table format, along with a visual representation of processed images.

SSM13-02 VeNOS: A Vendor Neutral Open Source DICOM Solution for Cloud-based Medical Image Sharing

Jason Daehn Balkman MD (Presenter): Nothing to Disclose , Yves Martelli MS : Nothing to Disclose

PURPOSE

Sharing medical images across institutions for educational or clinical purposes frequently requires access to remote data and viewing software, as well as compliance with various file formats. The movement towards cloud technology and zero footprint web applications should enable a nonproprietary solution to this challenge.

METHOD AND MATERIALS

A zero footprint web-based DICOM viewer written entirely in JavaScript and HTML5 for mobile phones, tablets, and computers was uploaded to an open source repository, GitHub (github.com/ivmartel/dwv). Image windowing was made programmatically available by caching pixel data. Mechanisms for viewing local, online and PACS images were developed as part of the software. The DICOM viewer was deployed to a universally accessible server domain, venosviewer.appspot.com, and integrated with an existing cloud database of images on a separate server domain, developed using Google Cloud SQL and Blobstore.

RESULTS

The DICOM viewer and cloud database were freely accessible via the VeNOS website running on a modern web browser with no additional software requirement. Local and online DICOM or JPEG images could be loaded into the viewer using the "File" dialog box. Local DICOM images loaded at a rate of approximately 2-3 slices per second for 529 kilobyte size slices. Images from the cloud database could be selected through the "Cross Domain Cloud-based Case File" dialog box. Cloud-based sequences also loaded into the viewer at approximately 2-3 slices per second for a typical wireless connection, though latencies were disproportionately greater for sequences containing over 50 slices. Methods for image annotation, scrolling, zooming, and windowing were functional features of the web application.

CONCLUSION

A vendor neutral open source DICOM viewer to display local PACS or online cloud-based medical images was developed and integrated with an existing cloud database on a separate server domain. This architecture demonstrates the feasibility of viewing remote cloud-based images without the need for downloadable or proprietary software. Increased latencies experienced when loading large cloud-based image stacks were likely the result of numerous cross-domain HTTP requests.

CLINICAL RELEVANCE/APPLICATION

This work combines a zero footprint DICOM viewer web application and a cloud-based case file, demonstrating the potential for open source medical image sharing between institutions and across server domains.

SSM13-03

DICOM Imaging Metadata: Inconsistency of Institution Name and Institution Address Information Impacts Interoperability

Kevin W. McEnery MD (Presenter): Advisor, Koninklijke Philips NV , Habib Tannir MS : Nothing to Disclose

PURPOSE

To determine the consistency of institutional naming identification as stored in the DICOM header tags: Institution Name (0x00080080) and Institution Address (0x00080081).

METHOD AND MATERIALS

The study period included CT modality "outside" image studies presented for storage to PACS with original study date study from 1/1/2013 - 4/1/2014. DICOM header tags including Institution Name and Institution Address were abstracted into a SQL database and then analyzed. Manual review of image name and address data indicated a distribution of cases from across the United States as well as countries outside the USA.

RESULTS

A total of 34,829 external CT studies presented to PACS for storage were analyzed. Institution Name and Address field contained data for 12,221 (35.09%) studies. Institution name only was provided in 22,287 (63.99%) studies. For 296 (0.85%) no information was stored in either name or address tag. For 25 (0.07%) studies information was stored in only the address field. For studies with both name and address there were 2,977 unique Name and address combinations. However, in numerous instances the combinations were redundant given inconsistency of address standardization: for example naming street, city, state on one modality device and only city, state on another.

CONCLUSION

Inconsistency in identification of origination organization in DICOM fields containing Institution Name and Address adversely affects the utility of the DICOM standard to enable imaging interoperability. This analysis has demonstrated in a majority of instances this data is incomplete. While this does not impact the ability of image transfer to PACS it does impact the continuity of care in the instance when additional prior studies are needed. Imaging organizations, such as the RSNA or ACR should engage to provide visibility to this issue to further enhance the capabilities of the DICOM standard. However, the solution to the issue ultimately is the responsibility of each imaging organization to ensure that every modality is configured to consistently and accurately identify institution name and address.

CLINICAL RELEVANCE/APPLICATION

The DICOM standard has provided the standard to allow successful image study transfer either with CD-based media or direct electronic transfer. However, inconsistency in normalization of data within elements within the DICOM header adversely impacts efficient interoperability across healthcare enterprises.

SSM13-04

A Review of Online Conferencing Solutions for Radiology Consultation and Discussion

Charles T. Lau MD (Presenter): Nothing to Disclose , Ahmed El-Sherief MD : Nothing to Disclose , Joseph Thomas Azok MD : Nothing to Disclose , Jason K. Lempel MD : Nothing to Disclose , Ruchi Yadav MD : Nothing to Disclose , Rahul Dinkar Renapurkar MD : Nothing to Disclose

PURPOSE

BACKGROUND Traditionally, radiologists and healthcare providers seeking to consult or discuss imaging studies with each other found it necessary to be in the same location at the same time. With the proliferation of picture archiving and communication systems (PACS) since the 1990's, the constraints of geography and space upon imaging consultation and discussion have generally disappeared for colleagues working at a shared medical institution. However, colleagues working in different institutions continue to be hampered - though increasingly less so, with the advent of popular online conferencing solutions.

METHOD AND MATERIALS

EVALUATION The communal evaluation and discussion of imaging studies is a practice that dates practically as far back as the field of radiology itself. This can occur whenever an individual seeks the opinion of a more experienced colleague, an individual seeks to educate her trainees or colleagues, or when healthcare providers embark upon a multidisciplinary discussion of a particular patient. In the last several years, online conferencing solutions have proliferated and now permit individuals to discuss imaging studies with each other from any distance and sometimes non-synchronously. This development may have far reaching effects upon the quality of radiology practice and education throughout in the world.

RESULTS

DISCUSSION Five popular online conferencing solutions are evaluated: Apple FaceTime, Google Hangout, Citrix GoToMeeting, Microsoft Skype, and Cisco Webex. The capabilities, strengths, and weaknesses of each solution will be discussed. Issues such as encryption/HIPAA compliance, cost, ease of use, number of participants

supported, reliability, and image quality will be explored for each service.

CONCLUSION

CONCLUSION Multiple online conferencing solutions currently exist, services that permit radiologists and healthcare providers to consult and discuss imaging studies with each other, free of the bounds of geography and time. However, the strengths and weaknesses of each service vary, and solutions that work favorably in one setting may work less favorably in others.

CLINICAL RELEVANCE/APPLICATION

Third-party online conferencing solutions permit healthcare providers to share and discuss imaging studies free from traditional geographical constraints; however, choosing the most optimal solution requires an understanding of each solutions' strengths and weaknesses.

SSM13-05

VNA and XDS - An Appraisal of Two Different Approaches to the Problem of How to Make all Patient Data Available at Multiple Points of Access within and across Institutions

Paul R. Hart BA (Presenter): Employee, TeraMedica, Inc

CONCLUSION

Based on the evidence, the paper concludes: - VNA and XDS technologies are complementary - Even so, it is possible to have most but not all of the same benefits from a single implementation of each solution, but…. - The size and nature of the projects matter and can determine the appropriateness of a single or combined solution.

Background

Building on the vast experience of PACS, RIS and HIS enabled by the now almost universal adoption of DICOM and HL7, as well as the growing number of IHE profiles in medical institutions over the last quarter century, the march toward the widespread establishment of the full-blown Electronic Medical Record (EMR) is continuing at a pace. Key among the drivers bringing about these changes since the turn of the millennium, and increasingly over the last 3-5 years, have been the Vendor Neutral Archive (VNA) and Cross-Enterprise Document Sharing (XDS) and XDS for images (XDS-i).

Evaluation

Three health IT project implementations are presented:
- VNA-only solution
- XDS-only solution
- combined VNA-XDS solution

VNA and XDS/XDS-i are compared to ascertain if one technology is better able to meet the needs of medical institutions to make all patient data available to clinicians at multiple points of access.

Discussion

The paper identifies and addresses a series of questions that arise from the proposition that a combined or shared archive can help produce improved clinical outcomes, including:
- Are VNA and XDS alternatives, or are they complementary?
- If they are alternatives, why adopt one solution in preference to the other?
- If complementary, in what ways?
- If implementing one solution, is the other necessary?
- Which functions belong uniquely to one and which to the other?
- Would it be possible to pick the best features of each and make a hybrid solution?
- If an enterprise implements both technologies as a combined solution, is it necessary to make one of them the primary service?

SSM13-06

Leveraging Internet Based Media Streaming Techniques for Transferring Radiology Information

Shujah Das Gupta BSC : Nothing to Disclose , Prasanth Kollaikal MS (Presenter): Nothing to Disclose

PURPOSE

Sharing media over the internet (especially video) has led to several improvements in stream of large data objects. Medical Images are currently one of the largest chunks of unmanaged information which exist today and can potentially benefit by leveraging these mechanisms.

METHOD AND MATERIALS

Both, video streaming sites (e.g., YouTube) and Torrent based file sharing application leverage principles which can be reused for transferring imaging information while complying with existing standards. Conceptually, these are present in the DICOM standard in the form of multiple association support. However, these can be further streamlined to improve data transfer and compression rates.

RESULTS

In order to maximize the benefits of video streaming techniques, the following assumptions are made: • For data exchange between sites, the content is consumed primarily at a study level instead of as independent images • For mobile/handheld devices, a lossy representation of the data is acceptable as these devices are

typically used for collaborative as opposed to diagnostic purposes The DICOM standard relies on TCP as its base mechanism for transferring data. However, most media streaming sites use UDP for transferring information as it does not require a packet level acknowledgement. As a result, applications can continuously send packets of data to maximize bandwidth utilization which is tracked through a flow control management system. In order to integrate with existing workflows, video streaming techniques only need to be leveraged at the slowest portion of the network; usually internet based transfers (i.e., max-flow min-cut theorem) and can be reconstructed into full objects or retransmitted over TCP once the packets have reached the destination systems. The intermediate transfer can be abstracted from the participating systems provided that the data is appropriately formatted once it reaches the destination Security concerns can be mitigated by obfuscating the PHI data in the packets via common encryption algorithms which can be decrypted by participating systems through a common key.

CONCLUSION

As large imaging studies are becoming increasingly common, the transfer of data over networks is a key bottleneck especially for Image Sharing workflows and Tele-radiology. Video sharing mechanisms offer a logical improvement opportunity to improve the performance of transferring clinical data.

CLINICAL RELEVANCE/APPLICATION

N.A.

RC653

Current and Next Generation Health IT Tools to Enable Radiation Exposure Reduction - A Practical Guide

Refresher/Informatics

SQ IN CT SQ IN CT

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 8:30 AM - 10:00 AM Location: E353A

Participants

Moderator
Rasu B. K. Shrestha MD, MBA : Advisory Board, General Electric Company Medical Advisory Board, Nuance Communications, Inc Editorial Medical Advisory Board, Anderson Publishing, Ltd Advisory Board, KLAS Enterprises LLC Advisory Board, Peer60

LEARNING OBJECTIVES

1) Number of CT scans is increasing annually. 2) Wider adoption/ availability of CT scanners. 3) Indications for CT use are increasing (without possible consideration for risks). 4) Rapid increase in number of protocols: Varying equipment leading to protocol variance. A thorough outline of patient-centric approach to dose optimization will be covered, as well as data mining dose data for improved quality, safety and outcomes.

ABSTRACT

The acceptance of the risks associated with radiation is conditional on the benefits to be gained from the use of radiation. The risks must be restricted and protected against by the application of radiation safety standards. A significant part of the challenge of patient dose management in CT arises from the fact that over-exposure in CT is frequently not detected. In contrast to film based radiography where overexposure results in a dark image, increasing dose in CT and in other digital imaging techniques results in images with: (1) less noise (improved visual appearance) and (2) fewer streak artifacts, (3) although not necessarily with greater diagnostic information. Image quality in CT often exceeds the clinical requirements for diagnosis. It is critical to have a thorough understanding of the basics of radiation dose in CT before we explore the multiple issues around opportunities to reduce these dose parameters. Furthermore, it is also critical to comprehend the role of newer technologies, innovations and developments that are rapidly taking place to address radiation dose reduction in CT - both on the vendor as well as on the private and academic communities. A through and comprehensive understanding of the quality and patient safety issues around this is also critical to making sound decisions around imaging on multiple levels. Different organs have different sensitivities to radiation. Tissue Weighted Factor, WT takes into account the risk to the person exposed to radiation that is not uniform over the entire body. As an example, if 1 mSv is received only by the lungs, this results in an effective dose to that person of 0.12 mSv. This means that 1 mSv received by the lungs poses approximately the same risk as 0.12 mSv to the entire body. Fundamentals such as these will be presented in easily digestible chunks in the refresher course. Also covered will be Protocol Optimization, Scanner Interfacing, Data Connectivity and Interoperability.

Sub-Events

RC653A

Before the Scan: Optimizing Dose before the Patient Is On the Table

Rasu B. K. Shrestha MD, MBA (Presenter): Advisory Board, General Electric Company Medical Advisory Board, Nuance Communications, Inc Editorial Medical Advisory Board, Anderson Publishing, Ltd Advisory Board, KLAS Enterprises LLC Advisory Board, Peer60

LEARNING OBJECTIVES

1) Number of CT scans is increasing annually. 2) Wider adoption/ availability of CT scanners. 3) Indications for CT use are increasing (without possible consideration for risks). 4) Rapid increase in number of protocols: Varying equipment leading to protocol variance. A thorough outline of patient-centric approach to dose optimization will be covered, as well as data mining dose data for improved quality, safety and outcomes.

ABSTRACT

The acceptance of the risks associated with radiation is conditional on the benefits to be gained from the use of radiation. The risks must be restricted and protected against by the application of radiation safety standards. A significant part of the challenge of patient dose management in CT arises from the fact that over-exposure in CT is frequently not detected. In contrast to film based radiography where overexposure results in a dark image, increasing dose in CT and in other digital imaging techniques results in images with: (1) less noise (improved visual appearance) and (2) fewer streak artifacts, (3) although not necessarily with greater diagnostic information. Image quality in CT often exceeds the clinical requirements for diagnosis. It is critical to have a thorough understanding of the basics of radiation dose in CT before we explore the multiple issues around opportunities to reduce these dose parameters. Furthermore, it is also critical to comprehend the role of newer technologies, innovations and developments that are rapidly taking place to address radiation dose reduction in CT - both on the vendor as well as on the private and academic communities. A through and comprehensive understanding of the quality and patient safety issues around this is also critical to making sound decisions around imaging on multiple levels. Different organs have different sensitivities to radiation. Tissue Weighted Factor, WT takes into account the risk to the person exposed to radiation that is not uniform over the entire body. As an example, if 1 mSv is received only by the lungs, this results in an effective dose to that person of 0.12 mSv. This means that 1 mSv received by the lungs poses approximately the same risk as 0.12 mSv to the entire body. Fundamentals such as these will be presented in easily digestible chunks in the refresher course. Also covered will be Protocol Optimization, Scanner Interfacing, Data Connectivity and Interoperability.

RC653B

During the Scan: Patient-Centric Imaging

Tessa S. Cook MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC653C

After the Scan: Data-Mining Dose Data for Improved Quality, Safety, and Outcomes

Jenifer Willmann Siegelman MD, MPH (Presenter): Consultant, Bayer AG

LEARNING OBJECTIVES

View learning objectives under main course title.

RC654

Health IT Incentive Programs: Experience from Private Radiology Practices

Refresher/Informatics

IN **IN**

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 8:30 AM - 10:00 AM Location: S103CD

Participants

Moderator
J. Raymond Geis MD : Nothing to Disclose
Alan D. Kaye MD (Presenter): Nothing to Disclose
James Whitfill MD (Presenter): President, Lumetis, LLC
Alberto F. Goldszal PhD, MBA (Presenter): Advisory Board, FUJIFILM Holdings Corporation Advisory Board, MedInformatix, Inc
Douglas B. Fridsma MD, PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Learn options for radiologists to approach Health IT Incentives (Meaningful Use). 2) Understand mechanics to attest for Health IT Incentives (Meaningful Use Stages 1 and 2). 3) Understand the future for radiology and Health IT Incentives Programs.

ABSTRACT

Governmental Health IT Incentives such as Meaningful Use of electronic health records are dramatically changing healthcare and radiology. This session focuses on their effect on private practice radiologists. Speakers will demonstrate the spectrum of approaches to Meaningful Use, from full radiology implementation to the temporary 'opt-out' choice. New this year is a high-level ONC (Office of the National Coordinator) perspective on current and future Health IT Incentives and how they may affect radiologists.

RCC51

Practical Informatics for the Practicing Radiologist: Part One (In conjunction with the Society for Imaging Informatics in Medicine)

Refresher/Informatics

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 8:30 AM - 10:00 AM Location: S501ABC

LEARNING OBJECTIVES

1) Define and describe the fundamental components of imaging informatics in a very practical and easy-to-understand way. 2) Understand methods to minimize distraction and reporting time when using speech recognition and structured reporting. 3) Understand the history and basic principles of business analytics.

Sub-Events

RCC51A

A Patient's Journey through Imaging Informatics

Marc D. Kohli MD (Presenter): Research Grant, Koninklijke Philips NV Research Grant, Siemens AG

LEARNING OBJECTIVES

1) Describe the three major systems used in radiology departments and their function. 2) Provide details regarding the HL7 and DICOM standards including how they are important in radiology workflow. 3) Describe the function of an interface engine in a modern healthcare system.

ABSTRACT

Understanding how the basic systems in a radiology department interact to provide complete workflow is and important building-block for radiologists interested in informatics. This presentation will outline the RIS, PACS, and Voice recognition systems and illustrate how they interact as we follow a patient through the radiology department.

RCC51B

Challenges in Enterprise Imaging

Alex Towbin MD (Presenter): Author, Amirsys Inc Shareholder, Merge Healthcare Incorporated Consultant, Guerbet SA

LEARNING OBJECTIVES

1) Describe the concept of an enterprise imaging archive. 2) Describe the differences between DICOM-based imaging and non-DICOM-based imaging. 3) Identify the unique challenges associated with incorporating non-DICOM images into an enterprise imaging archive.

ABSTRACT

Over the past 20 years, the field of radiology has built an impressive digital infrastructure, automating many portions of the imaging process from the time of order entry through image distribution. With the advent of small, low-cost, high quality digital cameras, other medical specialties have turned to imaging to visualize and document disorders yet, they have not implemented the same type of digital infrastructure as radiology. Today, thousands of medical images are obtained in hospitals each day. With the increasing reliance on imaging, there is a greater need to build systems and processes to obtain, store, and distribute these images across the enterprise so that health care providers can better care for their patients. Even though many of these problems have been solved in radiology, the solutions are not easily transferred to other specialties due to the differences in imaging hardware and the image acquisition workflow. The purpose of this talk is to describe the problems facing hospitals as they begin to build enterprise imaging archives and to discuss potential solutions to these problems.

RCC51C

The Road Ahead in Radiology Informatics

Paul G. Nagy PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Discuss the current state of market penetration of RIS and PACS in the US. 2) Identify several commercial areas of innovation in the RIS. 3) Illustrate a model for a practice to assess how competitively they are leveraging informatics.

RCA52

National Library of Medicine: Free Online Databases: Images and More (Hands-on)

Refresher/Informatics

IN IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 10:30 AM - 12:00 PM Location: S401AB

Participants

Holly Ann Burt MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Identify freely available online image databases and data archives and know their contents and value. 2) Identify freely available online case studies and educational materials. 3) Become familiar with online drug, contrast agents, and other substance databases. 4) Understand basic searching skills across a variety of databases.

ABSTRACT

The National Library of Medicine (NLM) is only one of many agencies which support freely available online databases and data archives. In this hands-on workshop, explore the rich variety of online resources for radiographic images and data, imaging tools, drugs and contrast agents, and education (e.g. case studies). Databases covered include PubMed/MEDLINE, the National Cancer Institute's Cancer Imaging Archive, MedlinePlus.gov and RadiologyInfo for patients and families, plus search engines and portals offering a radiology option. Learn which databases may be the best starting point for your research.

URL's

http://nnlm.gov/training/resources/onlinedatabases.pdf

Handout:Holly Ann Burt

http://media.rsna.org/media/abstract/2014/14003435/onlinedatabasesRSNA2014.pdf

RCB52

3D Printing (Hands-on)

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 10:30 AM - 12:00 PM Location: S401CD

Participants

Frank John Rybicki MD, PhD (Presenter): Research Grant, Toshiba Corporation
Peter Constantine Liacouras PhD (Presenter): Nothing to Disclose
Timothy Mueller (Presenter): Nothing to Disclose
Amir Imanzadeh MD (Presenter): Nothing to Disclose
Dimitris Mitsouras PhD (Presenter): Nothing to Disclose
Nicole Wake MS (Presenter): Nothing to Disclose
Andreas Giannopoulos MD (Presenter): Nothing to Disclose
Tatiana Kelil MD (Presenter): Nothing to Disclose
Catherine Phillips MD (Presenter): Nothing to Disclose
Beth A Ripley MD, PhD (Presenter): Nothing to Disclose
Asha Sarma MD (Presenter): Nothing to Disclose
Hansol Kim MD (Presenter): Nothing to Disclose
Tianrun Cai MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To familiarize radiologist with the general indications for 3D printing in biomedical imaging. 2) To learn the basic principles of an STL file. 3) To obtain "hands-on" experience in creating a STL file from radiology DICOM images. 4) To learn an approach to STL file manipulation to achieve a 3D printed model.

URL's

http://www.brighamandwomens.org/Departments_and_Services/radiology/Research/aisl.aspx

Active Handout

http://media.rsna.org/media/abstract/2014/14003458/RCB52sec.pdf

RCC52

Practical Informatics for the Practicing Radiologist: Part Two (In conjunction with the Society for Imaging Informatics in Medicine)

Refresher/Informatics

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 10:30 AM - 12:00 PM Location: S501ABC

Sub-Events

RCC52A

Saving Your Body (and Your Mind): Redesigning the Radiology Reading Environment

Eliot L. Siegel MD (Presenter): Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge

Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

LEARNING OBJECTIVES

1) Describe three issues with human factors related to the modern reading room. 2) Indicate potential solutions for lighting, ambient noise, and ergonomic challenges.

RCC52B

Changing Information Systems: A Survival Guide

Steven C. Horii MD (Presenter): Consultant, Carestream Health, Inc Investigator, Bracco Group Spouse, Employee, Siemens AG Consultant, PACSGEAR, Inc

LEARNING OBJECTIVES

1) Describe common issues facing departments changing vendors. 2) Explain the techniques that can be used at time of contracting to ensure future access to data. 3) List techniques used for image migration.

RCC52C

So Many Images, So Little Time: Advanced Imaging Techniques

Adam Eugene Flanders MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To appreciate the diversity of advanced visualization techniques. 2) To understand how advanced visualization extends the value of medical imaging. 3) To learn how advanced visualization has changed traditional workflow strategies. 4) To appreciate some of the pitfalls of automation and the need for expert supervised assessment of advanced visualization output.

SSQ11

Informatics (Results and Reporting)

Scientific Papers

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 10:30 AM - 12:00 PM Location: S403A

Participants

Moderator
William W. Boonn MD : Founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Shareholder, Nuance Communications, Inc Shareholder, Merge Healthcare Incorporated
Moderator
Scott Leroy Duvall PhD : Research Grant, Amgen Inc Research Grant, Anolinx LLC Research Grant, AstraZeneca PLC Research Grant, F. Hoffmann-La Roche Ltd Research Grant, Merck & Co, Inc Research Grant, Mylan Inc Research Grant, PAREXEL International Corporation Research Grant, Shire plc
Moderator
Richard K.J. Brown MD : Investor, RadExchange, LLC

Sub-Events

SSQ11-01

Automatically Synthesizing a Patient Problem List through Key Phrase Extraction from prior Reports

Merlijn Sevenster PhD (Presenter): Employee, Koninklijke Philips NV , Thusitha Mabotuwana : Nothing to Disclose , Piotr Roman Obara MD : Nothing to Disclose , Yuechen Qian : Nothing to Disclose , Paul J. Chang MD : Co-founder, Stentor/Koninklijke Philips Electronics NV Technical Advisory Board, Amirsys, Inc Research Contracts, Koninklijke Philips NV Medical Advisory Board, lifeIMAGE Inc Medical Advisory Board, Merge Healthcare Incorporated

PURPOSE

Referring physicians can provide limited clinical history information when ordering imaging studies, especially with the use of computerized physician order entry (CPOE), which may adversely affect the diagnostic accuracy of the radiological interpretation and study value. To compensate for sparse clinical information, radiologists must consult different IT systems. This is time inefficient and workflow disruptive. We evaluate an algorithm that automatically synthesizes key phrases from prior reports and presents them in a "problem list" format.

METHOD AND MATERIALS

A natural language processing algorithm was developed that parses out sections from prior radiology reports, extracts key noun phrases from the reports' clinical history sections and filters out phrases that are duplicates or do not assert a condition ("r/o PE"). Independent of algorithm development, 7 chronic conditions were selected (such as cirrhosis and HIV) that are potentially significant. For each condition, 20 patients were selected per IRB 11-0193-E. For each patient, 1 year's worth of radiology reports were obtained and deidentified. For each of the 140 reports, the algorithm's key phrases were obtained and scrutinized to contain direct reference to the known condition or indirect reference. In addition, it was checked if the patients' problem list from the EMR (Epic) contained the known condition.

RESULTS

In 59% of patients, the condition was mentioned in the clinical history section of a prior radiology report. For these patients, a phrase describing the condition was correctly extracted by the algorithm in 94% of cases. The condition was mentioned in the CPOE order in 77% of cases. On all patients, the EMR problem list directly referenced the condition in 74% of patients.

CONCLUSION

When present, key noun phrases synthesized from prior radiology reports by NLP can be more reliable than the EMR problem list. Such technology can be leveraged to fill the clinical information gap radiologists experience in their routine workflow, which is partly but not entirely addressed by the EMR. However, since relevant conditions were not always mentioned in prior radiology reports, other electronic tools to automatically extract information from the EMR also need to be developed.

CLINICAL RELEVANCE/APPLICATION

Extracting clinical context from prior reports by NLP can help to fill the clinical information gap radiologists experience in their routine workflow

SSQ11-02

An Evaluation of Automated RadLex Encoding of Free Text Pediatric Orthopedic Medical Imaging Reports

Robyn Alexandra Cairns MD, FRCPC (Presenter): Consultant, McKesson Corporation , Thomas Rosenal MSc, MD : Nothing to Disclose , Francis Y. Lau MSc, PhD : Nothing to Disclose

CONCLUSION

The performance of the NCBO Annotator for correctly extracting all clinically relevant terms and excluding irrelevant terms is limited but RadLex encoding of correctly extracted terms is more accurate. The NCBO Annotator shows promise as a viable alternative to time intensive manual processing for simply identifying and encoding existing RadLex preferred concepts in free text radiology documents.

Background

Content from narrative medical imaging (MI) reports could be more efficiently applied to clinical decision support and other applications in electronic health records if coded relevant terms were generated from the MI reports. The National Center for Biomedical Ontology (NCBO) Annotator is an open source ontology-based web service that automatically identifies ontologic terms from free text and returns codified terms. The objective of this study was to determine if domain relevant terms can be accurately extracted and encoded from free text paediatric orthopaedic MI reports using the NCBO annotator with RadLex, a terminology for radiology, applied as the reference ontology.

Evaluation

The NCBO annotator results for extraction and RadLex encoding of retrospectively collected free text paediatric orthopaedic MI reports were evaluated separately for 51 reports. The overall extraction performance, recall (sensitivity) and precision (positive predictive value), of the NCBO Annotator was evaluated by comparing the automated extracted terms to a "gold standard list" of relevant terms manually generated for each report by a paediatric musculoskeletal radiologist. The contextual correctness of coding of the relevant NCBO Annotator extracted terms was also assessed by comparing the NCBO Annotator RadLex encoding results with manual RadLex encoding results.

Discussion

A comparison of 1055 NCBO extracted terms with the 711 manually identified terms included in the 51 gold standard extraction lists demonstrated a recall rate of 50% and precision of 34% for the NCBO Annotator. Analysis of the encoding of the relevant NCBO extracted terms (n=353) found that 98% of the terms were RadLex exact match terms and these terms were encoded in correct clinical context 88% of the time.

SSQ11-03

Structured Feedback from Patients on Actual Radiology Reports: A Novel Approach to Improve Reporting Practices

Andrew John Gunn MD : Nothing to Disclose , Mark David Mangano MD (Presenter): Nothing to Disclose , Dushyant V. Sahani MD : Research Grant, General Electric Company , Giles W. Boland MD : Principal, Radiology Consulting Group Royalties, Reed Elsevier , Garry Choy MD, MS : Nothing to Disclose

PURPOSE

Patients are increasingly being given direct access to their radiology examination results and thus becoming end-readers of the issued report. However, patients' perceptions of these reports are largely unknown. Herein, we describe our experience in receiving structured feedback from patients on actual radiology reports as a means to improve reporting practices.

METHOD AND MATERIALS

Eight reports (2 radiographs, 2 ultrasounds, 2 CTs, and 2 MRIs) were randomly selected from our system for review. The selected reports were de-identified and placed in random order prior to review. For each report, patients were asked to rate their level of comprehension, identify any problems in the report, and free-text any questions a patient may have about the report. Potentially confounding factors such as prior experience with radiology reports, patient educational status, and report length were also examined.

RESULTS

104 patients (45 males; 59 females) participated in the study (832 total evaluations). The mean level of report comprehension was 2.53 (1-5 scale) with "unclear or technical language" (59.6% of evaluations) and "too long" (10.2% of evaluations) being the most commonly cited problems. An explanation of the report in lay terms (20.1% of evaluations) was the most common request in the free-text portion. There was an inverse relationship between report length and patient comprehension (r2=0.69, p=0.01, df=6). Longer reports were also correlated with a higher number of patient-identified problems (r2=0.72, p=0.008, df=6). Patients who had prior experience with their own radiology reports indicated a greater comprehension (mean=2.76) than patients with no prior experience (mean=2.26; p=0.0006). No correlation between the patients' educational status and report comprehension was identified (r2=0.005, p=0.91, df=3).

CONCLUSION

Radiology reports are not well understood by patients, who identified the technical language and long length of reports as the most common problems. Longer reports tended to be less well understood and have more patient-identified problems. Radiologists should consider this structured feedback from patients when attempting to establish a more patient-centered practice.

CLINICAL RELEVANCE/APPLICATION

Structured feedback from patients on actual radiology reports is a feasible and patient-centered approach to improving reporting practices which has not been previously described.

SSQ11-04

EXTraction of Numerical Data (EXTND): A Novel Tool to EXTEND Clinical Radiology Research Using Automated Numerical Data Collection

Tianrun Cai MD (Presenter): Nothing to Disclose , Kanako Kunishima Kumamaru MD, PhD : Nothing to Disclose , Amir Imanzadeh MD : Nothing to Disclose , Elizabeth George MD : Nothing to Disclose , Ruth M. Dunne MBBCh : Nothing to Disclose , Frank John Rybicki MD, PhD : Research Grant, Toshiba Corporation , Carlos J. Gonzalez Quesada MD : Nothing to Disclose , Zoha Hussain : Nothing to Disclose , Andetta Rotilla Hunsaker MD : Nothing to Disclose , Arash Bedayat MD : Nothing to Disclose , Rani S. Sewatkar MBBS : Nothing to Disclose

PURPOSE

Numerical data (eg, blood pressure, heart rate) recorded in the Electronic Medical Record (EMR) are important information in radiology clinical outcomes research. The purpose of the study was to develop and validate EXTND, a novel tool that automatically collects important numerical data through the processing medical reports.

METHOD AND MATERIALS

Software design
EXTND was written in-house using Python. Pattern matching, word segmentation, and lexical analysis were the main technologies used.
1: Standardize report format
2: Build a list of abbreviations by using Unified Medical Language System
3: Process a medical report using the module of Natural Language Toolkit and search relevant key words
4: Extract numerical data following the key words and send them to a set of functions to perform validity testing in terms of normal ranges, value structures, and units
5: Collect validated numerical values

Software application
A total of 69,406 free-text medical records in the hospital EMR database for the 2070 consecutive patients (08/2003-05/2010) with acute pulmonary embolism diagnosed with CT pulmonary angiography at a single, large, teaching hospital were evaluated using EXTND. Heart rate, blood pressure, temperature, respiratory rate, and oxygen saturation measured at the time closest to the CT acquisition were collected for all patients.

Software validation
Manual review of 285 documents (from the 69,406 above) from a randomly selected sub-cohort of 149 patients was performed. The accuracy of EXTND was assessed using the manual EMR review as reference standard.

RESULTS

For all 2070 patients, EXTND rapidly and effectively acquired the data elements. Using the manual data as reference standard, the positive predictive value (PPV) and sensitivity (with standard errors) were as follows: PPV Sensitivity Heart rate 0.953 (0.016) 0.970 (0.013) Blood pressure 0.911 (0.022) 1.000 (0) Temperature 0.942 (0.021) 0.991 (0.009) Respiratory rate 0.988 (0.021) 0.991 (0.009) Oxygen saturation 0.938 (0.018) 0.943 (0.008)

CONCLUSION

EXTND is a novel tool with high accuracy in acquiring clinical numerical parameters that are important in pulmonary embolism outcomes research

CLINICAL RELEVANCE/APPLICATION

EXTraction of Numerical Data (EXTND) that was developed to extract key numerical metrics for pulmonary embolism research can potentially be applied to other clinical radiology research

SSQ11-05

The Impact of a Structured Design and a Computer-aided Diagnosis Tool on the Quality of Prostate

Multiparametric MRI Reports

Patricia Silveira MD (Presenter): Nothing to Disclose , Ruth M. Dunne MBBCh : Nothing to Disclose , Nisha Sainani MD : Nothing to Disclose , Stuart G. Silverman MD : Author, Wolters Kluwer nv , Clare M. C. Tempany-Afdhal MD : Research Grant, InSightec Ltd Research Consultant, Profound Medical Inc , Ramin Khorasani MD : Consultant, Medicalis Corp , Ronilda Lacson MD, PhD : Nothing to Disclose

PURPOSE

Assess the impact of implementing a structured design and a computer-aided diagnosis (CAD) tool on the quality of prostate multiparametric MRI (mp-MRI) reports.

METHOD AND MATERIALS

Institutional review board approval was obtained for this HIPAA-compliant pre-/post-interventional study performed at a 793-bed, quaternary care, academic medical center. We randomly sampled prostate mp-MRI reports finalized between August 1, 2012 and July 31, 2013. An intervention consisting of a structured design and a CAD tool integrated into PACS workstations was implemented on February 1, 2013; and was accompanied by a 1-hour targeted instructional program for radiology faculty and trainees. Primary outcome measure was quality of prostate mp-MRI reports, classified as sub-standard, standard and optimal quality using report quality metrics derived by institutional abdominal radiologists' consensus. Following manual report review, chi-square or Student t-tests were used to compare report quality six months pre- and post-intervention. Logistic regression analysis was performed to control for confounders and determine factors associated with standard quality reports.

RESULTS

A total 312 prostate mp-MRI reports were analyzed. Post-intervention, optimal quality reports and standard reports increased significantly from 0/156 [0%] to 21/156 [13.5%] ($p<0.001$), and from 47/156 [30.1%] to 89/156 [57.1%] ($p<0.001$), respectively. When controlling for confounding factors, use of either structured design or CAD increased the likelihood of a standard quality report (OR=2.8; $p=0.011$ and OR=3.4; $p=0.002$, respectively).

CONCLUSION

Implementing a structured design and a CAD tool significantly improved the quality of prostate mp-MRI reports, but documentation of quality metrics on prostate mp-MRI reports still needs additional improvement. Potential next steps are automated monitoring of report content through the use of natural language processing tools, feedback to radiologists using quality dashboards, education targeting quality metrics awareness, financial incentives for adherence, and mandatory use of the new technologies.

CLINICAL RELEVANCE/APPLICATION

Documentation of quality metrics might improve referring physicians' management decision-making process and, therefore, patient care.

SSQ11-06

Important Non-urgent Radiology Findings. A Novel Solution Using a Voice Dictation Macro and the TIBCO Application Integrated within the Soarian EMR (Siemens Medical) to Prevent These Findings from Falling through the Cracks

Jonathan S. Movson MBChB (Presenter): Nothing to Disclose , Timothy Paul : Nothing to Disclose , Cynthia M. Cobb : Nothing to Disclose , Daniel M. Golding MD : Nothing to Disclose , Andrew Karn : Nothing to Disclose

PURPOSE

It is well known that non-urgent but important findings "fall through the cracks" of patient care. This is particularly likely to happen in the emergency room setting. To ensure that these results are always communicated either to the patient's primary care physician or to the patient, our radiology department worked with our IT group to develop a solution to identify and communicate these findings.

METHOD AND MATERIALS

When a radiologists makes a finding that is considered to be important to patient care but not immediately life-threatening, they insert a macro at the end of the report using our voice dictation system (Nuance:Powerscribe). Specific characters in the macro designated by a radiology report category system (RADCAT) are recognized by the Cloverleaf interface engine and a copy of the report is sent to the TIBCO iProcess (The Information Bus Company) application. The TIBCO iProcess has a web based front end that is used by dedicated personnel at three affiliated hospitals to review and process these reports. They contact the patient's primary care physician or if necessary the patient, and document that communication of the finding has taken place. A copy of the 'closed report' is sent to the EMR for reference and medico-legal reasons.

RESULTS

We are able to audit the TIBCO system to determine how often the communication loops is closed. Results: Between June 2012 and August 2013, 3956 radiology reports were noted by our radiologists to contain important non-urgent findings. We have documented that 99.5% of these findings were successfully communicated to physicians and/or their patients. The 0.5% of patients whom we were unable to contact generally are either homeless or provided false information at the time of registration.

CONCLUSION

The system we created was rapidly adopted by our radiologists due to its ease of use. The web front end of the TIBCO application allows for the efficient use of the human resources in a multi-facility insitution like ours. We believe that we have virtually eliminated the risk of failure to communicate important but non-urgent findings at our institution.

CLINICAL RELEVANCE/APPLICATION

Using the combination of an interface engine and an application like TIBCO, it is possible to create novel solutions to complex patient care problems without disrupting the workflow of the radiologists.

SSQ11-07

Clinical Trial Management and Analysis Utilizing Multimedia Structured Reporting

David Joseph Vining MD (Presenter): Royalties, Bracco Group CEO, VisionSR Stockholder, VisionSR , Andreea Pitici : Employee, Eloquentix, Inc , Cristian Popovici : Employee, Eloquentix, Inc , Adrian Prisacariu : Employee, Eloquentix, Inc , Berhan Pirimoglu MD : Nothing to Disclose , Radu Rosu : CEO, Eloquentix, Inc

CONCLUSION

Multimedia structured reporting provides a means to automate and imrove the efficiency of clinical trial management and analysis.

Background

Clinical trials are dependent upon radiologists for efficient tumor assessment. We have developed a multimedia structured reporting system that facilitates this task by aggregating structured data from cohorts to automate the management and analysis of clinical trial data.

Evaluation

We developed a structured reporting system that captures key images, metrics and voice descriptions during a radiologist's interpretative session of oncological studies using any vendor's image display system, and then assembles the data in a multimedia structured report. Our software provides a means to link image findings from serial examinations to generate graphical disease timelines which show progression of disease at individual anatomical sites. Specific image findings can be designated as "target lesions" from which the calculation of the response criteria can be performed, such as that prescribed by the Response Evaluation Criteria in Solid Tumors (RECIST). Our system then aggregates structured data from cohorts in real-time to automate the managment and analysis of clinical trial data, including the generation of Waterfall plots, Progression Free Survival (PFS) and Overall Survival (OS) rates, Kaplan-Meier survival curves.

Discussion

Improving the efficiency of clinical trials could signficantly reduce the costs associated with developing new therapies. We have created a multimedia structured reporting solution that is capable of aggregating structured data from cohorts of patients in order to achieve this aim.

SSQ11-08

An Automatic Bone Mineral Density Reporting System

I-Ta Tsai MD (Presenter): Nothing to Disclose , Meng-Yuan Tsai : Nothing to Disclose , Ming-Ting Wu MD : Nothing to Disclose , Kuen-Huang Chen MD : Nothing to Disclose

CONCLUSION

We constructed an efficient and reliable AR web application of BMD. It prevented human errors from technicians, typists and radiologists. It facilitates current clinical service and has potential academic applications.

Background

The reports of bone mineral density (BMD) are based on a diagnostic algorithm on the numeric data. In retyping these data manually, a few mistakes might be made, and the process is time-consuming. We constructed an web application using Ruby on Rails, an open source web application framework. By importing the data generated by a dual-energy x-ray absorptiometry (DXA) scanner, the web application can automatically generate structure reports integrated with the electronic medical records.

Evaluation

For comparison of reporting speed, in Jan 2014, 500 examinations were randomized into Automatic Group (AG) and Manual Group (MG). With 25 examinations per test unit, the average time spent of report generation in AG and in MG (dictation and check) was 264 seconds and 1,452 seconds, respectively ($p < 0.001$). For evaluation of the accuracy, 5,120 examinations during Jan 2013 and Dec 2013 were enrolled retrospectively. With an AutoHotKey script, the context of automatically generated reports (AR) were compared with the formal manual reports (MR). There were 383 discrepant reports. The accuracy of calculation of T and Z scores in AR is 100%. The errors in AR were key-in errors by technicians (0.64%, 33/5120) and need of additional judgements (0.57%, 29/5120); in MR, there were misreading of T or Z score (2.32%, 119/5120), mis-assignment of hip level (2.17%, 111/5120), dictation error (1.21%, 62/5120) and data omission (0.57%, 29/5120). The overall accuracy of AR and MR is 98.8% and 93.7%, respectively ($P < 0.001$). The mis-categorization of BMD in AR and MR is 0.039% (2/5120) and 0.273% (14/5120), respectively ($P = 0.17$).

Discussion

Ancillary radiological comments such as degenerative change of spine with relative high T scores in MR were not generated in current AR. Revised algorithm would give a warning message in the future AR. The structured database could be integrated for epidemiological statistics such as normal range of our population.

SSQ11-09

Teaching a Machine to Annotate Radiology Text

Eamon Johnson MS (Presenter): Nothing to Disclose , Michael D. Torno DSc : Nothing to Disclose , William Christopher Baughman MD : Nothing to Disclose

CONCLUSION

The involvement of expert annotators is critical when we encounter new data and metadata, yet expert involvement can be decreased when the data conform to prior patterns. This work uses additional metadata to provide a partial solution to reducing the need for expert involvement in the text annotation process.

Background

Ideally, the data analysis revolution would aid physicians in making diagnoses and offer an automated secondary analysis. Training machines to provide this functionality generally requires data sets vetted by experts as a starting point. However, the lack of annotated text corpora for training computational models is a perennial problem in medical informatics. The cost of creating annotated corpora is high, because informaticists must design annotation schemes and train physicians to make the annotations, and physicians must invest effort in making annotations. Even then, expert physicians are not necessarily expert-or willing-annotators.*This project analyzes methods for leveraging existing clinical annotations to build richly annotated data sets automatically.*

Evaluation

The source data consist of 700,000 diagnostic radiology text reports, each of which contains physician name, full interpretation text, modality, body area, and an ICD-9-CM code reflecting the initial diagnosis. An NLP pipeline based on cTAKES was used to extract medical concepts from the interpretation text, and a correlation between the codes and the concepts extracted from the reports was constructed.

Discussion

The output of the analysis is a ranked evaluation of concept correlation with 448 ICD-9-CM codes, with discussion of underlying factors, sources of noise, and sources of bias. For a portion of codes with low-noise and low-bias characteristics, strategies for automatic annotation of records are presented.

INS-THA

Informatics Thursday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Thu, Dec 4 12:15 PM - 12:45 PM Location: IN Community, Learning Center

Participants

Moderator
Christopher Ross Deible MD, PhD : Nothing to Disclose

Sub-Events

INS168

Patient-centered Imaging: The Effect of Radiologists' Protocolling Imaging Requests (Station #1)

Andrew Kent Moriarity MD (Presenter): Nothing to Disclose , Matthew O'Brien MD : Nothing to Disclose , Chad Klochko MS, MD : Nothing to Disclose , Safwan Halabi MD : Nothing to Disclose

PURPOSE

To measure how often radiologists alter the initial advanced imaging request using an electronic protocolling system and analyze how the implementation of clinical decision support for inpatient requests impacted the need for protocolling by radiologists.

METHOD AND MATERIALS

An IRB approved retrospective review was performed of 218,904 requests for computed tomography (CT), magnetic resonance (MR) and nuclear medicine (NM) examinations over a 29-month period. Information collected for each request included the patient setting, the body part to be imaged, the imaging protocol requested, the requested use of contrast media and the responsible physician. Point of care generated clinical decision support (CDS) appropriateness scores were examined for inpatient requests.

RESULTS

During request protocolling, radiologists changed the modality or examination type of 86,122 requests (39.3%) and the use of contrast for 18,796 requests (8.5%). The overall rate of change for emergency department (ED), inpatient (IP) and outpatient (OP) patients was 18.3%, 35.7% and 42.9% respectively. Rates are also compared across the 43 distinct clinical specialties of the requesting physician. There were 13,568 and 12,881 IP requests examined in the 7-months prior to and following implementation of CDS. There was no significant

difference in the percentage requests changed during protocolling after implementation of CDS for CT protocol, NM protocol or the use of CT contrast. The rate of change for MR protocol increased after CDS from 38.0% to 40.0% while the rate of change for MR contrast decreased from 19.3% to 16.1%.

CONCLUSION

More than one-third of inpatient and outpatient imaging requests are altered by radiologist protocolling with the type of examination performed changed four times more often compared to the addition or removal of contrast material. Implementation of clinical decision support at the time of inpatient request entry did not significantly reduce the rate of changes made during protocolling.

CLINICAL RELEVANCE/APPLICATION

Protocolling imaging requests by radiologists is an important value added activity that ensures the right patient receives the correct examination for the appropriate clinical indication.

INS169

Texture Analysis with Predictive Modeling of Solid Appearing Pancreatic Serous Cystadenomas versus Neuroendocrine Tumors (Station #2)

Franco Verde MD (Presenter): Nothing to Disclose , Siva P. Raman MD : Nothing to Disclose , Linda Chi Hang Chu MD : Nothing to Disclose , Yifei Chen BS : Nothing to Disclose , Peng Huang : Nothing to Disclose , Elliot K. Fishman MD : Research support, Siemens AG Advisory Board, Siemens AG Research support, General Electric Company Advisory Board, General Electric Company Co-founder, HipGraphics, Inc

PURPOSE

To investigate the ability of CT texture analysis (spatial frequency analysis) to distinguish between solid appearing, pancreatic serous cystadenomas (SCs) versus neuroendocrine tumors (NETs). Besides imaging appearance and clinical information, this tool hopefully allows for additional layer of confidence for differentiating between the two similar appearing tumors.

METHOD AND MATERIALS

IRB approval was obtained for retrospective review. Pathology proven 10 SCs and 10 NETs were obtained with similar CT appearance. Patients all had arterial and venous phase imaging. Both phases in 3 or 5 mm thick sections were uploaded to local server with TexRAD (TexRAD LTD, Somerset, UK). Region of Interest (ROI) was drawn around at all slices with discrete tumor visualized. Additional thresholding was applied to exclude attenuation values below -50HU. Analysis utilizes Laplacian of Gaussian spatial band-pass filters from 2mm to 6mm to highlight heterogenity of the ROI. Range of higher order statistics were obtained from the software (mean pixel intensity, entropy, standard deviation of pixel intensity, kurtosis, and skewness at each filter size. A random forest statistical model, already created at our institution, for other applications of TexRad on other tumors, was be applied to this dataset. This model will attempt to predict the histology in a prospective manner. Modeling was performed on 7 SCs and 7 NETs. Biostatistician, blinded to test patients, applied statistical model to each slice of test patients. A best guess to final diagnosis was made for each patient compared to radiologist leading diagnosis.

RESULTS

Modeling: 360 arterial and 360 venous phase slices, from 7 SCs 240 arterial and 240 venous phase slices, from 7 NETs 'Out-of-bag' error estimate rate: 5% Testing: 439 arterial and 439 venous phases from 4 SCs and 6 NETs. 4/4 SCs were correctly predicted. 4/6 NETs were correctly predicted Radiologist leading diagnosis: 0/4 SCs were correctly predicted 6/6 NETs were correctly predicted

CONCLUSION

Texture analysis has proven to be a superior adjunct to distinguish serous cystadenomas versus neuroendocrine tumors, difference between surgery and surveillance.

CLINICAL RELEVANCE/APPLICATION

Use of TexRAD (CT texture analysis) to predict histology of pathology proven, solid appearing, pancreatic serous cystadenoma versus neuroendocrine tumors.

INS170

Shape Constrained Active Contour Model for High Intensity Focused Ultrasound Image Segmentation (Station #3)

Weixin Si (Presenter): Nothing to Disclose , Weiming Wang PhD : Nothing to Disclose , Zhiyong Yuan PhD : Nothing to Disclose , Pheng Ann Heng PhD : Nothing to Disclose

PURPOSE

In order to improve the performance of ultrasound-guided high intensity focused ultrasound (HIFU) therapy for uterine fibroid ablation, we develop a fast and accurate approach for uterine fibroid segmentation in HIFU images.

METHOD AND MATERIALS

Ultrasound-guided HIFU therapy is a new type of noninvasive procedure for uterine fibroid ablation and it is desirable to design a reliable method to segment the uterine fibroids from HIFU images, which usually exhibit intensity inhomogeneity and blurred edges. To this end, we propose to segment HIFU images by combining local region information and shape constraint. Specifically, we employ a localized active contour model to deal with inhomogeneous images so that the contour can precisely capture the boundaries in nonuniform regions. In order to avoid boundary leakages at blurred edges, we incorporate a priori shape information to constrain the contour during the evolution. Lastly, we adopt the multiscale approach to accelerate the performance.

RESULTS

We test the proposed approach with twenty HIFU images, and the size of each image is 524*413. To validate the performance of our approach, we compare it with other five classical segmentation methods: GAC (Geodesic Active Contours) model, CV (piecewise constant) model, LCV (piecewise smooth) model, RSF (Region Scalable Fitting) model and LGF (Local Gaussian Fitting) model. Experimental results show that our approach outperforms all the other methods and can accurately segment the uterine fibroids from HIFU images. We further employ the widely used Dice Similarity Coefficient (DSC) measure to quantitatively evaluate the segmentation methods. In all the tested images, our approach achieves the highest accuracy of 0.94 in DSC measurement. Lastly, the segmentation time of our approach is about 15 seconds, which is only one eighth of the LCV model.

CONCLUSION

We propose a fast and accurate approach to segment uterine fibroids from HIFU images. The approach can automatically detect the boundaries of uterine fibroids after the user specifies the initial contour. In all the tested images, the segmentation results satisfy the requirements of the doctors, indicating its potential in ultrasound-guided HIFU therapy.

CLINICAL RELEVANCE/APPLICATION

The operation time of ultrasound-guided HIFU therapy is very long, and it is thus essential and meaningful to design a fast and accurate method for uterine fibroid segmentation in HIFU images.

INS171

Important Non-Urgent Imaging Findings: Use of a Hybrid Digital/Administrative Support Tool for Facilitating Clinician Communication (Station #4)

Evan Johnson MD (Presenter): Nothing to Disclose , Andrew B. Rosenkrantz MD : Nothing to Disclose , Joseph J. Sanger MD : Nothing to Disclose

PURPOSE

The workflow of both radiologists and clinicians could benefit from a system to assist the communication of imaging findings that require further action but that do not pose a risk of immediate patient harm. In this study, our aim is to evaluate the usage and associated outcomes of such a tool that provides a hybrid digital/administrative solution for communication of important non-urgent imaging findings.

METHOD AND MATERIALS

This retrospective study was IRB-approved. The tool developed and implemented by our department allows the radiologist to click a button in the dictation software during study interpretation to mark a case for clinician follow-up. After report sign-off, a departmental secretary then faxes the report to the physician's office, calls to confirm receipt, and electronically logs these actions. We reviewed the tool's log for a two-week period in January 2013 for various factors relating to its usage and associated outcomes.

RESULTS

Of 229 entries, 84.7% occurred from 7am-5pm, and 16.3% overnight. 99.6% were successfully faxed with phone confirmation; 85.1% were confirmed by the next business day. For 31.1% confirmed on the same business day, the average delay until confirmation was 222±130 minutes. 59.4% were for "in-network" patients whose care is tracked within our EMR. Of these, 33.1% had evidence in the EMR of a subsequent action taken by the patient's provider (median delay of 3 days; action occurring on date of ticket entry in 15/45 instances). Most common studies for which the tool was used were chest radiograph (25.8%), chest CT (19.2%), bone radiograph (14.0%), and abdominal ultrasound (11.4%). Most common reasons for usage were lung nodule/mass (32.8%), other lung parenchymal abnormality (11.4%), and osseous fracture (10.05%). 66.8% contained a recommendation for additional imaging, which was performed in 49% of those cases (median delay 21 days). 45% of the performed follow-up imaging had findings warranting further action.

CONCLUSION

Our data show the effectiveness of the tool in assisting the communication of important imaging findings, thereby frequently facilitating early clinician action, as well as in providing documentation of this notification.

CLINICAL RELEVANCE/APPLICATION

The communication tool enhances patient care with minimal workflow disruption, thus assisting radiologists in adding value to their practice.

INE120

Fundamentals of Texture Analysis and Potential Uses in Clinical Imaging (Station #5)

Hei Shun Yu MD (Presenter): Nothing to Disclose , Karen Buch MD : Nothing to Disclose , Brian Thomas Tischler MD : Nothing to Disclose , Naznin Daginawala MD : Nothing to Disclose , Baojun Li PhD : Nothing to Disclose , Hernan Jara PhD : Patent holder, qMRI algorithms Research Grant, General Electric Company Royalties, World Scientific Publishing Co , Akifumi Fujita MD : Nothing to Disclose , Jorge A. Soto MD : Nothing to Disclose , Osamu Sakai MD, PhD : Speaker, Bracco Group Speaker, KYORIN Holdings, Inc Speaker, Eisai Co, Ltd , Stephan W. Anderson MD : Nothing to Disclose

TEACHING POINTS

Post-processing image analysis techniques have played an important role in advanced medical imaging modalities. Texture analysis, originally used to evaluate the integrity of television and computer monitor screens, has started to be used in diagnostic image analysis techniques. Texture analyses involve an extraction of subtle texture features from the image which are then used for a variety of classification tasks such as distinguishing normal from abnormal tissue. Texture analysis offers a quantitative method for detecting subtle changes within an image based on local spatial patterns and pixel intensities.

The purpose of this exhibit is to:
1. Describe the basics of texture analysis and parameters that make up texture analysis.
2. Discuss a variety roles of texture analysis in diagnostic imaging.

TABLE OF CONTENTS/OUTLINE

1. Review basic technique and fundamentals of texture analysis
2. Review role of texture analysis in diagnostic imaging
-CT and MRI uses for texture analysis in medical imaging
-Role of texture analysis in quantitatively defining image quality
3. Describe uses of texture analysis for different regions of the body
-hepatic fibrosis
-tumor classification: brain, liver, etc
-osseous mineralization
4. Potential future applications for texture analysis

INE035-b

Emergency Medicine and Diagnostic Radiology Data Sharing for Improved Quality Assurance (hardcopy backboard)

Kevin Hamilton BS : Nothing to Disclose , Mark Daly BS : Stockholder, Analytical Informatics, Inc , Wayne C. LaBelle : Nothing to Disclose , Christopher D. Meenan (Presenter): Stockholder, Analytical Informatics, Inc , Dan Lemkin MD : Nothing to Disclose

Background

In a busy emergency medicine department, timely delivery of radiology and other diagnostic results is critical to departmental efficiency and appropriate patient care. In some cases however, patients may be discharged before all diagnostic results are received due to coverage, volumes or other ancillary issues. When discrepant or unexpected results are received post discharge, departmental quality assurance processes ensure appropriate delivery of care and follow-up with the patient. These QA processes however are typically labor intensive and paper based, requiring significant resources for efficient delivery.

Evaluation

We created a web-based application to automate our Department's QA processes and provide real-time data sharing between departments at our medical center. We created a web service to share radiology report information from our Radiology Department's quality platform that was consumed by the clinical quality assurance application created by the Emergency Medicine Department.

Discussion

Our application leverages the radiology web service to receive updated reports and exam details from emergency patients after discharge. We collect all aspects of the patient's visit in order to do effective quality assurance, ensure appropriate measures have been taken and deposit that information in our registry. If any follow-up is necessary, our application provides the user with numerous options to get in touch with the patient. If the resident is unable to contact the patient/emergency contact by phone, he/she may choose to send a letter for follow-up to the patient.

CONCLUSION

Our approach highlights how patient care can be improved through improved inter-departmental data sharing and collaboration by leveraging web-based applications and modern web standards. Our approach optimized QA processes for discharged patients by aggregating disparate information and providing a unified view. By organizing all of the information regarding the patient's demographics, medications, exams, and discharge instructions into one centralized location that is easy to read, we were able to improve our QA processes, reduce waste and ultimately deliver better care to our patients.

INE036-b

Personalized Medicine: A New Paradigm of Decision Support using the Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial Dataset (hardcopy backboard)

Arjun Sharma MD (Presenter): Nothing to Disclose , James Jason Morrison MD : Nothing to Disclose , Jason Michael Hostetter MD : Nothing to Disclose , Kenneth Chung-Yi Wang MD, PhD : Co-founder, DexNote, LLC , Eliot L. Siegel MD : Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research

Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

Background

The Prostate, Lung, Colorectal and Ovarian Cancer (PLCO) Screening Trial dataset provides an unparalleled resource for matching patients with the outcomes of demographically or diagnostically comparable patients. Using these matched data, an individualized diagnostic decision-support system can personalize imaging, testing, follow-up intervals, intervention, and prognosis. They can also be incorporated into CAD algorithms to improve diagnostic efficacy by providing a priori likelihood of disease information.

Evaluation

Released in 2009, the PLCO Screening Trial enrolled ~155,000 participants from 1993 to 2001 to determine whether certain screening exams reduced mortality from prostate, lung, colorectal and ovarian cancer. A web-based application was developed using JavaScript to query this subset of patient information against a given patient's demographics and risk factors. Analysis of the matched data yields outcome information which can then be used to guide management decisions and imaging software. Prognostic information is also estimated via the proportion of matched patients that progress to cancer.

Discussion

The US Preventative Services Task Force provides screening recommendations for cancers of the breast, colorectal tract, and most recently lungs. Additional controversial screening modalities include the use of PSA for prostate cancer and ultrasonography or serum CA-125 for ovarian cancer. There is wide variability in adherence of clinicians to these guidelines and others published by the Fleishner Society and various cancer organizations. Data mining the PLCO dataset for clinical decision support can optimize the use of limited healthcare resources, focusing screening on patients for whom the benefit to risk ratio is the greatest and most efficacious.

CONCLUSION

A data driven, personalized approach to cancer screening maximizes the economic and clinical efficacy and enables early identification of patients in which the course of disease can be improved. Our dynamic decision support system utilizes a subset of the PLCO dataset as a reference model to determine imaging and testing appropriateness while offering prognostic information for various cancers.

INE038-b

Informed Consent: A New Model for Patient Education (hardcopy backboard)

Louis Morel MD : Nothing to Disclose , Adam DeFoe MD : Nothing to Disclose , Johanna Schubert MD : Nothing to Disclose , Attila Csordas MD : Nothing to Disclose , Sean David Pietrini MD (Presenter): Nothing to Disclose , Shawn Stone : Nothing to Disclose

Background

According to the United States Institute of Medicine, nearly half of all American adults have limited health literacy, limiting their participation in the informed consent process.When studied, up to forty-five percent of patients are unable to recall the major risks of surgery or know the exact nature of their operation. This lack of true informed consent can be a basis for malpractice cases and increases the chances of patient safety incidents or medical error. To address this issue we created tablet-ready, image rich point-of-care presentations to use while obtaining informed consent for IR procedures.

Evaluation

Attendings and residents collaborated to create tablet-ready informed consent presentations for commonly performed IR procedures (port placement, percutaneous biopsy, IVC filter, etc) using Microsoft PowerPoint displayed in PDF format. Procedures are explained with the help of images and diagrams, and the risks, common complications and their percentage likelihood clearly displayed with references. QR codes are built into the presentation to allow for quick lookup of additional videos or literature.

Discussion

Image rich tablet based consent improves the patients understanding of the procedure's details, risks and benefits, and also serves as a checklist for the provider. Referenced, up-to-date data regarding risks and outcome builds trust between the physician and patient. Residents and attendings enjoy continued success with the pre-made presentations as response from patients has been overwhelmingly positive. Patients were able to ask more in depth questions regarding the procedure proving their improved level of understanding and engagement. While we used an iPad mini due to it's white coat pocket size compatibility, this platform can adapt to any tablet. The added benefit of internet access allows one easy access to online images. Informational videos can also easily be added and displayed.

CONCLUSION

Informed consent is vital to every IR procedure. Unfortunately, truly informed patients are not the norm due to limited health literacy. We embraced tablet technology to assist in the informed consent process and have enjoyed positive results with better informed patients.

INE041-b

Computerized Detection and Classification of Pulmonary Pathologies from CT Images: Current Approaches, Challenges, and Future Trends (hardcopy backboard)

Awais Mansoor PhD (Presenter): Nothing to Disclose , Ulas Bagci PhD, MSc : Nothing to Disclose , Ziyue Xu PhD : Nothing to Disclose , Brent Foster : Nothing to Disclose , Georgios Z. Papadakis MD : Nothing to Disclose , Ken Olivier : Nothing to Disclose , Jason M. Elinoff : Nothing to Disclose , Anthony F. Suffredini MD : Nothing to Disclose , Jayaram K. Udupa PhD : Nothing to Disclose , Daniel Joseph Mollura MD : Nothing to Disclose

TEACHING POINTS

1. To identify the clinical importance of lung pathology detection, segmentation and classification. 2. To review the state-of-the-art image segmentation approaches for pathological lungs from CT scans. 3. Computerized techniques for disease detection and quantifications. 4. To discuss the future of lung segmentation methods and explain how engineering advancements in CT plays a valuable role.

TABLE OF CONTENTS/OUTLINE

1. Introduction a. Lung disease and imaging patterns in pulmonary CT. b. Clinical importance of pathology segmentation and classification. 2. Segmenting Lung Pathologies from CT images a. Fleischner Society's descriptions for imaging patterns of lung diseases. b. Computer aided analysis of of CT images of lungs. c. Determining lung and pathology volume as imaging markers in diagnostic tasks. 3. The Use of Advanced Imaging Features to Accurately Classify Imaging Patterns. a. Review of optimal textural feature selection for pulmonary pathology classification. b. Review of optimal machine learning classifiers for pulmonary pathology classification. 4. The Challenges of Segmentation and Classification of Lung Pathology a. Image quality. b. Sufficient discriminative information. c. Time needed for analysis. 5. Concluding Remarks and future trends.

INE042-b

Normalization of the Reconstruction Kernel Effects with Image-based Kernel Conversion Technique in the Measurement of Emphysema Index in CT (hardcopy backboard)

Hyeongmin Jin (Presenter): Nothing to Disclose , Jong Hyo Kim PhD : Nothing to Disclose

Background

The emphysema index (EI) in CT is a quantitative measure of emphysema, which is known to be affected by reconstruction kernel. This study presents an image-based kernel conversion technique which converts CT image of sharp kernel to that of standard kernel and compares the result with MTF-based kernel conversion method in the measurement of EI.

Evaluation

Sixty cases of CT exams obtained with 120kVp, 40mAs, 1mm thickness, of 2 reconstruction kernels (B30f, B50f) were selected from the low dose lung cancer screening database of our institution. An image-based kernel conversion technique, which converts by applying a conversion function, was performed to the CT data set of B50f to create a converted B30f data set. The conversion function(F_{con}) which is the ratio of the spectral components of target and source kernel images, was produced using a training dataset. F_{con} in the MTF-based method, was the ratio of MTFs which were measured with small bead object in 2 reconstructed images. The EI (RA950) was measured with a software package (Pulmonalyzer, Seoul, South Korea) and compared for data sets of B50f, B30f, and the converted B30f. The accuracy of kernel conversion was evaluated with the mean and standard deviation of pair-wise differences in EI.

Discussion

Population mean of EI was 28.89±6.48% for B50f data set, 10.96±6.37% for the B30f data set, and 11.27±6.83% for the converted B30f data set. The pair-wise differences in EI between B30f and the converted B30f is 0.78±1.07% with image-based method, and 4.91±1.73% with MTF-based method.

CONCLUSION

Our study demonstrates the feasibility of image-based kernel conversion method for normalization of kernel effect in measurement of EI with superior performance to that of MTF based approach. This technique has a potential to be used in evaluating the longitudinal changes of EI even when the CT was reconstructed with different kernels.

RCA53

Creating a 3D Printing Lab for Anatomic Modeling in Radiology

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 12:30 PM - 2:00 PM Location: S401AB

Participants

Moderator
Jane Sexton Matsumoto MD : Nothing to Disclose

LEARNING OBJECTIVES

1) To review what 3D printing is and how it can be applied using radiology data. 2) To understand the important steps in creating a 3D printing lab that creates individual anatomic models using imaging data. 3) To describe the role anatomic models play in clinical care, education and research. 4) To describe the value added by anatomic models in the care of complex patients.

ABSTRACT

Our initial experience using 3D printing took place seven years ago when we created life-sized anatomic models of conjoined twins using CT data to aid in the surgical planning of the complex, high risk separation. The surgeons found the models invaluable and 3D printing has since become and important tool in the planning of many complex surgeries. Working collaboratively with surgeons, we have created over 100 individualized life-sized anatomic models for surgical and interventional cases using both CT and MR data. We will demonstrate this technology with models including skeletal, cardiovascular, neurologic, craniofacial, hepatic and renal cases. Collaboration between the radiologist and surgeons is an essential part of the process to ensure understanding of what the surgeons need and what anatomical relationships are important to demonstrate. The demand for 3D models is growing rapidly in our practice. Over half of our models have been created in the last year after we established a dedicated radiology based Anatomic Modeling 3D printing lab. We will share the steps we took to establish our lab and the technical and organizational lessons learned. This technology offers a radiology department a new opportunity to offer an important value-added contribution to patient care. It also has tremendous potential for education and research. The radiologists' combination of skill and experience in imaging anatomy, pathology and imaging technology places them in a unique position to create laboratories that translate 3D printing technology into clinical practice.

Sub-Events

RCA53A

3D Printing of Imaging Data: Why and How It Developed and the Value It Offers

Jane Sexton Matsumoto MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53B

3D Printing: Orthopedic, Oncologic, Neurosurgical, and Forensic Applications

Jonathan Michael Morris MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53C

Developing a Cardiovascular 3D Printing Practice

Thomas Andrew Foley MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53D

Anatomic Modeling: Impactful Genitourinary, Gastrointestinal and Aortoiliac Relationships

Terri Jo Vrtiska MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53E

Building, Supporting and Funding a Radiology 3D Printing Lab

Linda Nesberg (Presenter): Nothing to Disclose , Joel L. Kuhlmann (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA53F

Medical Physics and 3D Printing: Exploration and Opportunity

Kiaran Patrick McGee PhD (Presenter): Nothing to Disclose , Shuai Leng PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

ABSTRACT

According to the American Association of Physicists in Medicine, the primary responsibility of the clinical medical physicist is to facilitate the production of quality of diagnostic images consistent with the available technology while simultaneously optimizing patient safety. The introduction of additive or 3D printing technologies is

providing previously unimagined opportunities to improve both image quality and safety through the development of 3D printed objects for research, clinical quality control, maintenance and testing purposes. The purpose of this presentation is to describe the development of 3D printed objects for the purposes of medical physics testing and quality control in a variety of research and clinical settings. Particular emphasis will be placed on the development of patient specific phantom models derived from multiple imaging modalities and how these devices can be used to optimize image quality for complex clinical imaging situations. Attention will also be given to demonstrating how these models can be used for optimizing image quality and reducing patient dose in modalities that use ionizing radiation. Phantoms for both routine clinical quality control and acceptance testing of clinical imaging equipment will also be described. Finally, the spatial accuracy and precision of these 3D phantoms will be described.

RCB53

Creating, Storing, and Sharing Teaching Files Using RSNA's MIRC® (Hands-on)

Refresher/Informatics

IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 12:30 PM - 2:00 PM Location: S401CD

Participants

Frederick Ethan Weiss MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Learn how easy it is to install the new and improved RSNA teaching file software with the one-click installer. 2) Learn how to create, organize, and share teaching files, create conference documents and save interesting cases for yourself, your group or your department.

RCC53

Quantitative Imaging and Informatics (In Association with the Society for Imaging Informatics in Medicine)

Refresher/Informatics

BQ IN BQ IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 12:30 PM - 2:00 PM Location: S501ABC

Participants

Moderator
Adam Eugene Flanders MD : Nothing to Disclose
Moderator
Luciano Monte Serrat Prevedello MD,MPH : Nothing to Disclose

LEARNING OBJECTIVES

1) Develop an understanding of what quantitative imaging is and how it may revolutionize the way we practice diagnostic radiology today. 2) Learn the research advances and the current clinical applications of this technology. 3) Appreciate the current challenges involved in using these tools clinically and understand the steps required for a successful clinical implementation.

ABSTRACT

Medicine has undergone a gradual evolution in which diagnostic imaging has become the centerpiece in establishing a clinical diagnosis and in assessing disease response. In recent years, the focus has changed such that for some disease categories (e.g. oncology) we now perceive medical imaging as a phenotypic expression of the genetic makeup of that disease. To that end, imaging now serves as a biomarker of genetic disease subtypes with features that may offer clues to understanding the natural behavior of the disease and specific changes that may occur as part of a therapeutic response. It is now well recognized that there is a substantial amount of objective information contained within diagnostic imaging studies that can be exploited beyond the level of simple measurements. The extraction of quantitative and semi-quantitative information from imaging studies that is both useful and reproducible is the challenge and opportunity for clinical trials research and radiologic reporting today and in the future. This session will explore the revolution and evolution of quantitative imaging; providing attendees with research advances, clinical applications, and the challenges of clinical implementation.

Sub-Events

RCC53A **What is Quantitative Imaging?**

Katherine P. Andriole PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Be able to describe what is meant by quantitative imaging. 2) Understand existing issues in implementing quantitative imaging techniques in the clinical arena as well as in the research realm, and see how informatics tools may help. 3) Be aware of on-going international efforts to address current challenges and to move quantitative imaging forward.

ABSTRACT

Quantitative imaging has rapidly evolved in recent years from a promising research activity to an essential clinical tool. Physicians consider the objective metrics obtained from imaging studies, in making critical patient management decisions. What is meant by quantitative imaging will be described using illustrative real-world use cases. Existing issues including technical as well as workflow challenges will be discussed. An introduction to imaging informatics tools and techniques such as standards, integration, data mining, cloud computing, ontologies, data visualization and navigation tools, and business analytics applications that may assist in filling current gaps in the clinical implementation of quantitative imaging will be given. An overview of activities of the RSNA's Quantitative Imaging Biomarkers Alliance (QIBA), an international initiative whose goal is to optimize the potential of quantitative imaging, including a description of the data warehouse project will be provided.

RCC53B

Informatics Approaches to Enable Quantitative Imaging in Real World Radiology Practice

Daniel L. Rubin MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) To highlight limitations in current radiological quantitative imaging practice and identify opportunities for improvement through informatics. 2) To introduce Annotation and Image Markup (AIM) as a new standard for capturing and sharing quantitative imaging metadata. 3) To demonstrate new AIM-enhanced tools that can streamline and improve quantitative imaging assessment and workflow for the radiologist.

ABSTRACT

Radiology practice is increasingly a quantitative endeavor. Radiologists frequently need to measure the length of lesions to track treatment response or measure the size of structures to for diagnostic assessment. Current practices of quantitation are cumbersome; measurements are recorded as screen captures that cannot be processed by machine, and the numbers must be transcribed into a radiology report. It is currently exceedingly difficult to create structured databases of quantitative image information for discovery about how, say, change in tumor size over time relates to drug treatment. Quantitative imaging is currently at best a labor-intensive process and at worst error-prone. We have been developing informatics methods to streamline the electronic capture of quantitative imaging results as "image metadata" in structured format that can be easily processed by computers. Tools that we are producing will allow the radiologist to perform quantitative imaging assessment in their current routine workflow-measuring lesions on the PACS, while simultaneously their measurements will be captured and transmitted in standardized formats to applications that can automate accurate reporting, analysis, and decision support. In the future such tools will even help researchers to discover new ways that quantitative signals in images can improve assessment of treatment and prediction of disease course.

RCC53C

QI Clinical Use Cases Outside of Oncology

Eliot L. Siegel MD (Presenter): Research Grant, General Electric Company Speakers Bureau, Siemens AG Board of Directors, Carestream Health, Inc Research Grant, XYBIX Systems, Inc Research Grant, Steelcase, Inc Research Grant, Anthro Corp Research Grant, RedRick Technologies Inc Research Grant, Evolved Technologies Corporation Research Grant, Barco nv Research Grant, Intel Corporation Research Grant, Dell Inc Research Grant, Herman Miller, Inc Research Grant, Virtual Radiology Research Grant, Anatomical Travelogue, Inc Medical Advisory Board, Fovia, Inc Medical Advisory Board, Toshiba Corporation Medical Advisory Board, McKesson Corporation Medical Advisory Board, Carestream Health, Inc Medical Advisory Board, Bayer AG Research, TeraRecon, Inc Medical Advisory Board, Bracco Group Researcher, Bracco Group Medical Advisory Board, Merge Healthcare Incorporated Medical Advisory Board, Microsoft Corporation Researcher, Microsoft Corporation

LEARNING OBJECTIVES

1) List the current greatest challenges to quantitative imaging from an informatics perspective. 2) Describe how data from clinical trials and the electronic medical record can provide decision support tools associated with the application of quantitative imaging. 3) Be able to articulate the requirements for 'next generation' quantitative imaging and opportunities for improvement of the current generation of CAD software.

ABSTRACT

In the current and future era of Big Data and advanced algorithms to model and diagnose complex disease, structured reporting, natural language processing and quantitative imaging have become essential elements for diagnostic imaging. Additionally it is absolutely essential that our imaging reports including scanning parameters, diagnosis, findings, recommendations, etc. as well as quantitative measurements and impressions from the pixel data be made available for the next generation of diagnostic, staging, and treatment algorithms. Currently there are several major challenges to making these imaging data accessible in a machine recognizable manner and these will be listed, including the application of a method to 'tag' medical images and a means of structuring and classifying findings made by radiologists and other human interpreters as well as computer algorithms that make quantitative measurements and computer aided detection and diagnosis. Once these data are available they can be utilized for decision support in radiology such as determination of which patients should be screened, estimation of the likelihood of malignancy when a nodule is detected, and refinement of CAD algorithms based on a priori estimates of likelihood of disease.

INS-THB

Informatics Thursday Poster Discussions

Scientific Posters

IN

AMA PRA Category 1 Credits ™: .50

Sub-Events

INS172

Visualizing the Relationships among MRI Protocols and Diseases, Signs and Symptoms Coded by ICD-10 Using Network Analysis (Station #1)

Ayako Yagahara (Presenter): Nothing to Disclose , Shintarou Tsuji : Nothing to Disclose , Naoki Nishimoto PhD : Nothing to Disclose , Jyunya Katahata : Nothing to Disclose , Katsuhiko Ogasawara PhD, MBA : Research Grant, TSURUHA Holdings Inc , Tomoyasu Tsuzuki : Nothing to Disclose

PURPOSE

MRI examination protocols in varied combinations are decided by patient's diseases, signs or symptoms. The purpose of our study is to visualize the structure of the relation among patient's diseases, signs and symptoms and MRI examination protocols.

METHOD AND MATERIALS

We acquired 17,154 brain MRI examination application forms in Hokkaido University Hospital (from Jan 2010 to Feb 2013). We coded disease names by ICD (International Statistical Classification of Diseases and Related Health Problems)-10 manually in all forms and extracted 751 forms completed at 1.5 tesla MRI, and described a disease which is coded to "Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified" (ICD-10 R00-R99). Protocols were defined as the combination of MRI protocols and slice orientation (e.g. T1WI Axitial). We applied a network diagram consisted of nodes and links as the method of visualization and structure. Nodes correspond to disease code and protocols, and links were expressed as the relation of them. The network diagram was created by force based algorithm using visualizing software Gephi.

RESULTS

The number of nodes was 93: disease codes were 32 and MRI protocols were 61. That of links was 349. Average protocols per an examination were 4.3. "Headache" (R51), "Dizziness and giddiness" (R42) and Abnormal findings on diagnostic imaging of central nervous system (R90) were more than 100 forms and existed in the center of the network. Lowest frequency diseases such as Nausea and vomiting (R11) tend to spread outward. R51 linked 9 protocols; by contrast R42 and R90 linked more than 20 protocols. In protocols, T1WI, FLAIR, T2WI, DWI axitial were existed the center. Location of nodes in the network and the number of relation to protocols were no relation. The number of the relation was reflected the distance of the links and the relation of all nodes represented by the positional relation in the network diagram.

CONCLUSION

Network diagram consisted of 93 nodes and 349 links visualized the complex relations among MRI protocols and disease. The strength of relations among nodes were represented by the positional relations.

CLINICAL RELEVANCE/APPLICATION

This study will contribute to assist education and decision making for radiologists and radiologic technologists engaged in MRI examination by simply visualize the complex relations.

INS173

Segmentation of Bronchial Trees Using a Vector Stream Information in Low-Dose CT Images: Application to COPD Patients (Station #2)

Sang-Joon Park MD (Presenter): Nothing to Disclose , Doohee Lee : Nothing to Disclose , Jin Mo Goo MD, PhD : Research Grant, Guerbet SA , Hyun-Ju Lee MD, PhD : Nothing to Disclose , Chang Hyun Lee MD, PhD : Nothing to Disclose , Chang Min Park MD, PhD : Nothing to Disclose

PURPOSE

To develop an accurate segmentation technique for bronchial trees in the lung parenchyma and to investigate its performance compared with previously reported extraction algorithms.

METHOD AND MATERIALS

Thirty-two COPD patients with GOLD stage 1 were selected for investigating the performance of the airway segmentation scheme in this study. The images were obtained with low-dose chest CT (40 mAs at 120 kVp) using soft reconstruction kernel (Sensation 16). A PC-based in-house software was developed for fully automated segmentation of the pulmonary airways using the following steps: 1) intensity adaptive region-growing (IARG) technique, 2) eigenvalues-ratio of the Hessian matrix, 3) vector-based feature identification (VFI) scheme with false positive (FP) reduction process. The performance of segmentation results from the proposed technique was evaluated with Hessian-based method and VFI without FP reduction scheme and was compared to that of IARG for all subjects.

RESULTS

The average branch count (BC) and tree length (TL) of 32 subjects were 104±28.6 (1679.3±500.7 mm) with only IARG method, 129.9±31.9 (1910.3±560 mm) with combination of IARG and Hessian methods, and 128.9±31.8 (1904.7±464.9 mm) with combination of IARG, Hessian method, VFI with FP reduction scheme, respectively. Segmentation results with combined methods extracted more branches compared with that of only IARG method (p=0.003, respectively), while the proposed and Hessian-based methods showed no significant difference each other in extracting BC (p=0.59). However, the percentage of FP voxels decreased by 57.5±16.6% after applying VFI with FP reduction scheme (p=0.001). Our system was equipped with an Intel i7

CPU at 3.4 GHz and 16 GB memory, and the mean time of the whole processing was 51.84±14.37 seconds.

CONCLUSION

By using novel airway segmentation techniques comprising VFI with FP reduction scheme, we could segment airway branches up to 128.9±31.8 BC and 1904.7±464.9 mm TL even if some cases showed difficult appearance for identifying small airways accompanying leakages. This study can be a vital role as a preprocessing step for regional analysis of pulmonary airways and their functions in the lung parenchyma for various lung diseases in the clinical environment.

CLINICAL RELEVANCE/APPLICATION

This study could provide a method to segment the airways up to 58% FP reduction rates.

INS174

A Client-Server Tool for Automatic Fast GPU-based Detection of Squamous Epithelium Tissue Regions in Histology Images (Station #3)

Zhiyun Xue : Nothing to Disclose , Benjamin Bryant : Nothing to Disclose , Rodney Long : Nothing to Disclose , Sameer Antani (Presenter): Nothing to Disclose , Hamed Sari-Sarraf PhD : Nothing to Disclose , George Thoma PhD : Nothing to Disclose , Mitchell Wachtel MD : Nothing to Disclose

PURPOSE

An essential step in diagnosis of cervical intraepithelial neoplasia (CIN) is identifying squamous epithelium tissue on histological slides. We have previously reported a method [1] for automatically and rapidly isolating such regions in multi-gigapixel digitized slide images. In this work, we report on our development of a networked tool that enables multiple users to simultaneously use server-based GPUs for the purpose.

METHOD AND MATERIALS

Our method for automatic epithelium tissue detection in cervical tissue images using GPU computing [1] is 1500 times faster than prior method. Additionally, in [1], we use image compression data and machine learning to achieve comparable accuracy at significantly high computational speedup. Our method is tested on 11 images. The disadvantage of the method is that it requires every user to have access to high-end computers with modern GPUs designed for general purpose computing, and the move large images (100s of MB in size) to their computers for processing. It also makes it hard to collaborate and discuss clinical results. To address these challenges, we report on a novel implementation of our method as a client-server software architecture that makes available server-based GPUs as a common computing resource thereby enabling simultaneous access to the method. We also developed an intuitive GUI for the purpose. Client-server high performance computation architecture for a critical clinical task addresses these challenges.

RESULTS

Our novel implementation of the fast algorithm allows multiple researchers to use the networked GPU-based image processing resource, avoid large image file transfers, and collaborate on clinical tasks.

CONCLUSION

We developed a client-server tool that uses GPUs to automatically segment epithelium tissues from digitized histology slides for CIN detection. No longer is it necessary for every user to be equipped with a high-end computing capability. REFERENCE: [1] ; Fast GPU-based segmentation of H&E stained squamous epithelium ....

CLINICAL RELEVANCE/APPLICATION

A network-based tool that provides automatic and fast segmentation of squamous epithelium from multi-gigapixel digitized histology slides assists the detection of CIN.

INS175

Communication of Significant Unexpected Radiological Findings Using an Automated iPACS Radiology Alert System (Station #4)

Karl James MBBCh, MRCS : Nothing to Disclose , Jennifer Murphy MBBCh, MRCPI : Nothing to Disclose , Patrick Nicholson MBBCh (Presenter): Nothing to Disclose , Max Frederick Ryan MBBCh : Nothing to Disclose

CONCLUSION

Efficient diagnosis is seen to be possible with a well established electronic communication system. The fact that new cancer was confirmed in almost one third of the CXR alerts indicates the importance of clinicians receiving and acting on these alerts. The study also highlights that 20% of potential cancer alerts were not officially acknowledged by the clinician. Although the majority of patients had timely follow-up, there were causes for concern with delayed diagnosis and follow-up failures that must be addressed.

Background

Failure to communicate important radiological findings is a major patient safety issue and is now the third largest cause of litigation against radiologists in the USA. In our institution, an alert system exists whereby the radiologist can directly alert the referring clinician of a significant radiological finding by selecting an icon on the iPACS workstation. The clinician is then obliged to acknowledge the alert. A RIS manager follows up any unacknowledged alerts and escalates alerts as necessary.

Evaluation

Data on all PACS alerts issued in our institution over a 1 year period was collected and analysed for the source of referral, modalities used, report turn around time, time to clinician acknowledgment of the alert and

duration/outcome of follow-up. Any failures to acknowledge alerts or to follow-up were also noted.

Discussion

372 alerts were issued over the 1 year study period. 49% (181) of alerts were issued due to a suspected cancer diagnosis and of those 67% (121) arose from a chest X-ray report. 57% of the 'cancer' alerts were acknowledged by clinicians within 3 days, however, 19% (35) of the 'cancer' alerts were never acknowledged and 5 of these patients did not receive the recommended follow-up. CT follow-up was recommended in 103 CXR reports and was performed in less than 1 month in 50% (53). 5 patients had to wait more than 90 days for the CT scan and of those patients, 3 patients subsequently had a CT diagnosis of lung cancer. 20% (21)of patients never had a CT thorax for reasons including loss to follow-up, resolution on subsequent plain imaging, etc. Analysis of subsequent CT thorax results found that previously undiagnosed cancer was detected in 31% (26) patients.

MSE-THB

Multisystem/Special Interest Thursday Poster Discussions

Education Exhibits

OT

AMA PRA Category 1 Credits ™: .50

Thu, Dec 4 12:45 PM - 1:15 PM Location: MS Community, Learning Center

Sub-Events

MSE122

3-D Printing in Radiology—How to Get Started (Station #1)

Alex Marro BSc (Presenter): Nothing to Disclose , Mark Daniel Cicero : Nothing to Disclose , Walter H. Mak MD : Nothing to Disclose , Timothy Richard Dowdell MD : Nothing to Disclose , Taha Bandukwala MD : Nothing to Disclose

TEACHING POINTS

1) 3-D printers are now affordable and will continue to decrease in cost. They are poised to be a part of imaging departments in the future. 2) Outline the steps in creating a 3-D model from CT images: 1) image acquisition 2) segmentation using a bone window 3) crop the mask and make edits 4) perform 3-D reconstruction 5) apply post-processing to smooth out artifacts 6) import to printer software 7) set printer parameters and print 3) Review of literature in current and anticipated use of 3D printed models in healthcare. 4) Given their expertise in imaging, radiologist should be involved in the processing and post processing of data files, and review the printed 3-D model for accuracy and quality assurance.

TABLE OF CONTENTS/OUTLINE

1) A brief history of 3-D printing 2) The process of creating 3-D parts from CT images 3) Current and future applications of 3-D printing in healthcare 4) Role of the radiologist in 3-D model reconstruction

RCB54

Productive Tools and Technology for the Academic Radiologist (Hands-on)

Refresher/Informatics

IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 2:30 PM - 4:00 PM Location: S401CD

Participants

Moderator
Mahesh M. Thapa MD : Nothing to Disclose
Jonelle Marie Petscavage-Thomas MD, MPH (Presenter): Consultant, Medical Metrics, Inc
Michael L. Richardson MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Know some of the latest technology for text processing. 2) Learn some of the latest technology for health in the workplace. 3) Be aware of technology that can make the RSNA meeting more pleasant and productive.

RCC54

Natural Language Processing: Extracting Information from Radiology Reports to Improve Quality

Refresher/Informatics

IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 2:30 PM - 4:00 PM Location: S501ABC

Participants

Moderator
Paras Lakhani MD : Nothing to Disclose

LEARNING OBJECTIVES

1) Place natural language processing (NLP) in context of the history of radiology reporting. 2) Review how NLP is used in disciplines outside of radiology. 3) Understand basic NLP methods. 4) Assess the applicability of NLP to radiology reports.

ABSTRACT

Natural Language Processing (NLP) refers to the automated extraction of meaningful information from narrative text. Some NLP systems use simple rules to categorize text according to whether a particular concept may be present. More sophisticated systems use part-of-speech tagging and grammatical parsing to extract concepts and relationships from text. Some NLP systems use statistical approaches that can learn to categorize text automatically based on a test set of positive and negative examples. When applied to radiology reports, NLP systems are most frequently used to identify and retrieve reports of interest, such as reports containing a critical result, an incidental finding, or a recommendation for follow up. NLP systems are simpler to construct and more accurate when the structure of the analyzed text is constrained in some manner. Several real-world examples of both simple and sophisticated NLP systems in radiology will illustrate the spectrum of applicable techniques and the potential benefit to radiology practice.

Sub-Events

RCC54A

Natural Language Processing to Solve Problems in Clinical Practice

Michael Ethan Zalis MD (Presenter): Co-founder, QPID Health Inc Chief Medical Officer, QPID Health Inc Stockholder, QPID Health Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC54B

Unlocking Information from Text: Pulmonary Embolism, Pneumonia, and Report Clarity

Wendy Chapman PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RCC54C

Extracting Critical Test Results and Communications from Reports: Validation and Results

Paras Lakhani MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) See a real-world example of a NLP solution used to identify critical radiology results and documentation of communication. 2) Understand logic of text-mining algorithms designed to identify critical test results, and how they can be applied to large databases. 3) Learn principles of validation of document retrieval from NLP systems. 4) Demonstrate results of an NLP system used to identify critical radiology results.

ABSTRACT

The Joint Commission requires timely communication of critical results to an appropriate healthcare provider, and the American College of Radiology's Practice Guideline for Communication recommends documentation of communication of critical results in the radiology report. NLP techniques can be used identify radiology reports containing critical results and documentation of communication with high accuracy. Such algorithms may be used for Joint Commission compliance, performance monitoring, and quality assurance initiatives.Examples of specific text-mining algorithms that identify critical results will be provided. Also, the process of validating and determining the effectiveness of such algorithms using precision and recall will be discussed.

RCC54D

So Many to Choose: An Overview of Natural Language Processing Methodologies and When to Use Each

Scott Leroy Duvall PhD (Presenter): Research Grant, Amgen Inc Research Grant, Anolinx LLC Research Grant, AstraZeneca PLC Research Grant, F. Hoffmann-La Roche Ltd Research Grant, Merck & Co, Inc Research Grant, Mylan Inc Research Grant, PAREXEL International Corporation Research Grant, Shire plc

LEARNING OBJECTIVES

1) Review information extraction methods for building rule-based, grammar-based, and machine-learning NLP systems with examples of when to use each. 2) Demonstrate the creation of manually created reference standards against which to measure NLP systems. 3) Present a survey of open-source tools for NLP and manual chart review and how these can be built upon.

ABSTRACT

Natural language processing (NLP) is a term that describes a range of techniques for identifying, understanding, and analyzing information from text. Some of the earliest applications of NLP in medicine were on imaging reports. Attendees will be walked through both simple and complex NLP methods with examples of how and when they are best used in imaging. Several open-source tools will be demonstrated with information provided on how these tools can easily be built upon for customized needs.

RC753

Decoding the Alphabet Soup (IHE®, MIRC®, RadLex®, Reporting): Whirlwind Tour of RSNA Informatics Projects

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 4:30 PM - 6:00 PM Location: E261

Participants

Moderator
John Eng MD : Nothing to Disclose

LEARNING OBJECTIVES

1) Articulate the main objectives of each of the RSNA-sponsored informatics projects. 2) Identify the practical problems being addressed by each project. 3) Understand the relationships between these informatics projects.

ABSTRACT

The RSNA is a longstanding leader in developing and promoting informatics tools and technologies for the practicing radiologist. In this refresher course, leaders of four of RSNA's most important informatics projects will introduce their respective projects, discuss the latest work, and describe what these projects mean to the practicing radiologist. MIRC is a set of free software tools for managing radiology teaching files and clinical imaging trials. RadLex is a unified system of radiology terminology that allows standardized description and indexing of many kinds of radiology information for diverse applications. The Reporting project creates and maintains a collection of best-practice radiology report templates. IHE is an organization that promotes standardized communication between all types of health information systems such as PACS.

URL's

http://www.rsna.org/Reporting_Initiative.aspx

Sub-Events

RC753A

IHE

David S. Mendelson MD (Presenter): Spouse, Employee, Novartis AG Advisory Board, Nuance Communications, Inc Advisory Board, General Electric Company Advisory Board, Toshiba Corporation

LEARNING OBJECTIVES

View learning objectives under main course title.

RC753B

MIRC

Krishna Juluru MD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC753C

RadLex

Daniel L. Rubin MD, MS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC753D

Reporting

Charles E. Kahn MD, MS (Presenter): Shareholder, Hotlight Inc Officer, Hotlight Inc

LEARNING OBJECTIVES

View learning objectives under main course title.

URL's

http://www.radreport.org/

RC754

Health IT Incentive Programs: Implications for Radiology IT Vendors. What Your Customers will Demand and Your Competition will Provide

Refresher/Informatics

IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 4:30 PM - 6:00 PM Location: S504AB

Participants

Moderator
Keith J. Dreyer MD,PhD : Nothing to Disclose
Robert Cooke (Presenter): Vice President, National Decision Support Company Founder, Imaging Elements
Cree Michael Gaskin MD (Presenter): Author with royalties, Oxford University Press Author with royalties, Thieme Medical Publishers, Inc

LEARNING OBJECTIVES

1) Understand what technology Radiology groups will need for Meaningful Use. 2) Learn how to be a competitive supplier of Meaningful Use products. 3) Understand the concept of Radiology Meaningful Use. 4) Understand the various technical and operational approaches that radiology groups can pursue to achieve Meaningful Use. 5) Understand how these will vary given a group's practice scenario. 6) Understand how to evaluate your IT product offerings to meet the needs of radiology groups seeking to become eligible for Meaningful Use incentives. 7) ?Explore future IT product offerings that would encompass concepts that the radiology community truly project MU for radiology.

RCA55

National Library of Medicine: Find Articles You Need: Searching PubMed/MEDLINE Efficiently (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Thu, Dec 4 4:30 PM - 6:00 PM Location: S401AB

Participants

Holly Ann Burt MLIS (Presenter): Nothing to Disclose
Tony Nguyen MLIS (Presenter): Nothing to Disclose
Patricia Devine MLS (Presenter): Nothing to Disclose
Jamie T. Dwyer MLS (Presenter): Nothing to Disclose
Stephanie Friree MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Understand how PubMed constructs a query and how to develop and refine effective search strategies in radiology. 2) Use PubMed tools including Clinical Queries, Related Articles, Single Citation Matcher and Loansome Doc. 3) Build focused searches using the Medical Subject Headings (MeSH) vocabulary for radiology and limit searches to radiology-oriented journals. 4) Understand how to save and download citations.

ABSTRACT

This hands-on workshop covers key searching techniques, changes to PubMed and how to develop effective search strategies for PubMed and MEDLINE. Topics covered include: why keywords don't always give the results you expect, how to limit to specific journals, quick searches to find evidence-based citations, how to access full-text articles, and downloading citations to reference manger programs. The National Library of Medicine (NLM) provides free web access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov). MEDLINE is a subset of PubMed which includes links to sites providing full text articles and to other related databases and resources.

URL's

http://nnlm.gov/training/resources/pubmed8.pdf

Handout:Holly Ann Burt

http://media.rsna.org/media/abstract/2014/14003441/pubmedRSNA2014.pdf

RC854

Health IT Tools to Improve Quality and Safety in Radiology (An Interactive Session)

Refresher/Informatics

SQ IN ARLM ARLM

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Fri, Dec 5 8:30 AM - 10:00 AM Location: S402AB

Participants

Moderator
Kevin W. McEnery MD : Advisor, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Describe a practical framework for measuring quality and value in radiology to help drive performance improvement initiatives. 2) Using case example, describe how measuring quality and value can improve performance and sustain change inside the radiology department. 3) Using case example, describe how measuring quality and value can improve performance and sustain change across the healthcare enterprise. 4) Panelists will discuss how radiology practices can practically begin to introduce measurements of quality and value and use such measurements to drive and sustain needed change.

Sub-Events

RC854A

Measuring Quality in Radiology, A Practical Framework

Jenifer Willmann Siegelman MD, MPH (Presenter): Consultant, Bayer AG

LEARNING OBJECTIVES

View learning objectives under main course title.

RC854B

Using Quality Metrics to Drive Change and Improve Quality in Diagnostic Radiology: Case Example

Paul G. Nagy PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

View learning objectives under main course title.

RC854C

Using Quality Metrics to Drive Change and Improve Quality Across the Enterprise

Kevin W. McEnery MD (Presenter): Advisor, Koninklijke Philips NV

LEARNING OBJECTIVES

View learning objectives under main course title.

RCA61

National Library of Medicine: Save Searches, Get Updates: The Free PubMed My NCBI Tool (Hands-on)

Refresher/Informatics

IN IN IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Fri, Dec 5 8:30 AM - 10:00 AM Location: S401AB

Participants

Holly Ann Burt MLIS (Presenter): Nothing to Disclose
Patricia Devine MLS (Presenter): Nothing to Disclose
Jamie T. Dwyer MLS (Presenter): Nothing to Disclose
Stephanie Friree MLIS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Use My NCBI to personalize PubMed. 2) Understand how to save search strategies and create email alerts. 3) Use filters to link to library full-text articles and to focus PubMed searches. 4) Understand how to save collections of citations including a personal bibliography.

ABSTRACT

In this hands-on workshop session, explore the free My NCBI tool in PubMed. Discover how to save search strategies, create email alerts to keep up with the latest publications, create instant links to library full-text resources, and build permanent online bibliographies. Topics covered include creating a free My NCBI account, adding search and library filters to PubMed, using My Bibliography to create an online list of personal publications, and the link between the NIH Manuscript Submission System and PubMed. Important notes on PubMed searching will also be included. The National Library of Medicine (NLM) provides free web

access to nearly 24 million citations for biomedical and clinical medical articles through PubMed (available online at PubMed.gov); MEDLINE is a subset of PubMed.

URL's

http://nnlm.gov/training/resources/myncbi8.pdf

Handout:Holly Ann Burt

http://media.rsna.org/media/abstract/2014/14003434/myncbiRSNA2014.pdf

RCC61

Optimizing PowerPoint Slides

Refresher/Informatics

IN ED IN ED

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Fri, Dec 5 8:30 AM - 10:00 AM Location: S501ABC

Participants

William J. Weadock MD (Presenter): Owner, Weadock Software, LLC
Sarah C. Abate BS (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Review the components of an optimal slide presentation. 2) Learn about common errors made in slide preparation and how they can be avoided. 3) Learn about how to improve the quality of a presentation by using optimal different slide backgrounds, font size and color, and image sizes. 4) Learn tips to ensure a smooth presentation.

ABSTRACT

Electronic presentations are very common in radiology practice. This hands-on demonstration and questions and answer session will show attendees how to optimize their presentations. The focus will be on the use of slide templates, color selection (font and background), font and image size, and animations. Additional review of image and video display and management will be covered. Demonstrations will include tips to decrease time creating and modifying presentations. Bring your questions!

RCC62

Managing Radiology IT in the EHR World

Refresher/Informatics

LM IN LM IN

AMA PRA Category 1 Credits ™: 1.50

ARRT Category A+ Credits: 1.50

Fri, Dec 5 10:30 AM - 12:00 PM Location: S501ABC

Participants

Moderator
J. Raymond Geis MD : Nothing to Disclose

LEARNING OBJECTIVES

1) Identify EHR components relevant to radiology. 2) Understand how to assess and use those components to your advantage. 3) Discover potential and pitfalls of EHRs.

Sub-Events

RCC62A **Radiology in the EHR World: What You'll Need to Know**

Keith J. Dreyer MD,PhD (Presenter): Nothing to Disclose

LEARNING OBJECTIVES

1) Learn what challenges are faced by radiology departments and practices as hospital systems continue to make the move towards enterprise EHR deployment. 2) Understand how radiology IT and informatics solutions can interface with EHR solutions and manage the gaps and overlaps in EHR deployment.

RCC62B **EHR/RIS Optimization of Imaging Workflow for the Enterprise**

Peter B. Sachs MD (Presenter): Advisor, Koninklijke Philips NV

LEARNING OBJECTIVES

1) Review the typical radiology department work flow in an EMR environment. 2) Identify the key work flow items that may require optimization. 3) Identify the key components necessary to carry out optimization. 4) Review examples of optimaztions carried out at the author's institution. 5) Discuss the impact these optimizations have had on radiology workflow/efficiency and patient care.

ABSTRACT

The development and deployment of electronic medical records has resulted in a significant impact on radiology work flow both postive and negaitve. Moving from paper driven to an electronic processes requires a highly functional, multi-disciplinary team to address break-fixes as well as optimizations. This presentation will review the optimal structure of the team and then discuss the requisite skill sets of the team members to insure gettting the most out of the EHR to drive high quality, efficient, patient-centered work flow in the radiology departmen.

RCC62C

Electronic Health Record Driven Workflow for Diagnostic Radiologists - You Might Actually Want This

Cree Michael Gaskin MD (Presenter): Author with royalties, Oxford University Press Author with royalties, Thieme Medical Publishers, Inc

LEARNING OBJECTIVES

1) Present EHR driven workflow for the diagnostic radiologist at the speaker's institution. 2) Discuss radiologist engagement in EHR implementation for radiology-centric optimization. 3) Discuss impacts of EHR driven workflow on diagnostic radiologists' efficiency and quality of care delivery as well as user satisfaction.

ABSTRACT

Electronic Health Records (EHRs) are touted to improve the quality and efficiency of clinical care. As a result, EHR-meaningful use legislation has been passed in the U.S. to financially incentivize adoption of this technology. Still, some radiologists remain skeptical that the benefits of EHRs are applicable to their practice and some fear that the technology could even unnecessarily complicate their workflow. One newer model for integrating EHRs into radiologists' practice is to use an EHR to drive diagnostic radiologist workflow, rather than the more traditional or widespread models of PACS driven or third-party RIS driven workflow. This newer model provides opportunity to leverage EHR technology and data for the benefit of radiology-related care delivery. This presentation shares a radiologist-centric viewpoint from one institution which has successfully adopted EHR-driven workflow for diagnostic radiologists. Though the process of implementation is touched upon, the presentation focuses on the resultant clinical workflow and the impacts on quality, efficiency, and radiologist satisfaction.

RCC62D

PACS and Radiologist Workflow in a Multi-Enterprise Environment

Gary J. Wendt MD, MBA (Presenter): Medical Advisory Board, McKesson Corporation Stockholder, TeraMedica, Inc Medical Advisory Board, HealthMyne Owner, WITS(MD), LLC

LEARNING OBJECTIVES

1) Understand workflow challenges for a radiologist operating a multi-enterprise environment. 2) Understanding requirements for environments with a single versus multiple medical record numbers a. PACS b. Dictation systems c. EHR. 3) Using a master patient index to link patient's across sites.

ABSTRACT

As a radiology department expands across multiple organizations there are several challenges that are created. Among these is the capability of the PACS, dictation systems and electronic medical record to operate in a single versus a multiple medical record number environment. These challenges are complicated further if there is no master patient index to link patient's across the multiple sites. All of these need to be taken into consideration prior to attempting to deploy a single workflow solution in multiple environments. Some possibilities that are discussed include using systems that function in a multiple medical record number environment, making changes to the demographic information in an interface engine or simply guaranteeing that each site uses unique identifiers. The benefits of having a single workflow solution across multiple environments is significant and helps to justify the cost of implementing in maintaining this type of environment.