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Commentary

The selection of article included in this edition of the Literature Highlights may seem somewhat random and unconnected but they have a theme running through them. Artificial intelligence (AI) is used universally as an all-encompassing term to mean many different things to many different people. Developments like Chat GPT increase the interest of the general population in this field. Lack of understanding of what this technology is leads to trepidation and mistrust as many feel that AI based solutions will eliminate the job that humans are currently doing and in this time of economic crises this obviously leads to anxiety.

For those who worry that if AI comes into radiology, it will replace radiologists two bits of news. One that AI is already here in radiology departmentsand is increasingly taking over some tasks that both humans and machines did. The articles selected highlight this. AI based image reconstruction algorithms reduce imaging time and improve resolution virtually in all modalities, from MR to basic radiography. Those departments that use digital systems to organize and report the images are also benefitting from AI based workflow enhancement to triage and prioritize exams that need urgent reporting. The second bit of news is that despite Chat GPT successfully passing the US Board exams the likely hood of a machine passing the clinical skills component any time soon is extremely unlikely. Human physicians (and this includes radiologists although some of us behave as if we aren t) are going to be around probably forever. (Even Star Trek had a medical officer onboard Enterprise.) Our jobs will change, and we will need to adapt to a new way of working. Failure to adapt will destroy us not AI. Going forward commercially available AI is already screening chest X-rays for pneumonias, pneumothoracies, masses and effusions, reading stroke CTs, CTAs and perfusions, screening mammograms for malignancies etc. etc. Newer and better solutions are being added on a daily basis. It is up to us to embrace these to help us in our daily readings and use them to improve our efficiency and accuracy.

Prof. Zafar Sajjad
Chair, Department of Radiology
Aga Khan University Hospital (AKUH), Karachi, Pakistan.

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Judith Herrmann, Daniel Wessling, Dominik Nickel, Simon Arberet, Haidara Almansour, Carmen Afat, Saif Afat, Sebastian Gassenmaier and Ahmed E. Othman

Comprehensive Clinical Evaluation of a Deep Learning-Accelerated, Single-Breath-Hold Abdominal HASTE at 1.5 T and 3 T

To evaluate the clinical performance of a deep learning-accelerated single-breath-hold half-Fourier acquisition single-shot turbo spin echo (HASTE DL)-sequence for T2-weighted fat-suppressed MRI of the abdomen at 1.5 T and 3 T in comparison to standard T2-weighted fat-suppressed multi-shot turbo spin echo-sequence. A total of 320 patients who underwent a clinically indicated liver MRI at 1.5 T and 3 T between August 2020 and February 2021 were enrolled in this single-center, retrospective study. HASTE DL and standard sequences were assessed regarding overall and organ-based image quality, noise, contrast, sharpness, artifacts, diagnostic confidence, as well as lesion detectability using a Likert scale ranging from 1 to 4

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(4 = best). The number of visible lesions of each organ was counted and the largest diameter of the major lesion was measured. HASTE DL showed excellent image quality (median 4, interquartile range 3-4), although BLADE (median 4, interquartile range 4-4) was rated significantly higher for overall and organ-based image quality of the adrenal gland (P < .001), contrast (P < 0.001), sharpness (P < 0.001), artifacts (P < 0.001), as well as diagnostic confidence (P < .001). No significant differences were found concerning noise (P = 0.886), organ-based image quality of the liver, pancreas, spleen, and kidneys (P = 0.120-0.366), number and measured diameter of the detected lesions (ICC = 0.972-1.0). Reduction of the aquisition time (TA) was at least 89% for 1.5 T images and 86% for 3 T images. HASTE DL provided excellent image quality, good diagnostic confidence and lesion detection compared to a standard T2-sequences, allowing an eminent reduction of the acquisition time.

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Qifei Dong, Gang Luo, Nancy E. Lane, Li-Yung Lui, Lynn M. Marshall, Deborah M. Kado, Peggy Cawthon, Jessica Perry, Sandra K Johnston, David Haynor, Jeffrey G. Jarvik and Nathan M. Cross

Deep Learning Classification of Spinal Osteoporotic Compression Fractures on Radiographs using an Adaptation of the Genant Semiquantitative Criteria

RATIONALE AND OBJECTIVES: Osteoporosis affects 9% of individuals over 50 in the United States and 200 million women globally. Spinal osteoporotic compression fractures (OCFs), an osteoporosis biomarker, are often incidental and under-reported. Accurate automated opportunistic OCF screening can increase the diagnosis rate and ensure adequate treatment. We aimed to develop a deep learning classifier for OCFs, a critical component of our future automated opportunistic screening tool.

MATERIALS AND METHODS: The dataset from the Osteoporotic Fractures in Men Study comprised 4461 subjects and 15,524 spine radiographs. This dataset was split by subject: 76.5% training, 8.5% validation, and 15% testing. From the radiographs, 100,409 vertebral bodies were extracted, each assigned one of two labels adapted from the Genant semiquantitative system: moderate to severe fracture vs. normal/trace /mild fracture. GoogLeNet, a deep learning model, was trained to classify the vertebral bodies. The classification threshold on the predicted probability of OCF outputted by GoogLeNet was set to prioritize the positive predictive value (PPV) while balancing it with the sensitivity. Vertebral bodies with the top 0.75% predicted probabilities were classified as moderate to severe fracture.

RESULTS: Our model yielded a sensitivity of 59.8%, a PPV of 91.2%, and an F 1 score of 0.72. The areas under the receiver operating characteristic curve (AUC-ROC) and the precision-recall curve were 0.99 and 0.82, respectively.

CONCLUSION: Our model classified vertebral bodies with an AUC-ROC of 0.99, providing a critical component for our future automated opportunistic screening tool. This could lead to earlier detection and treatment of OCFs.

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Jingru Ruan, Yu Meng, Fanfan Zhao, Hongxian Gu, Linyang He and Xiangyang Gong

Development of Deep Learning-based Automatic Scan Range Setting Model for Lung Cancer Screening Low-dose CT Imaging

RATIONALE AND OBJECTIVES: To develop an automatic setting of a deep learning-based system for detecting low-dose computed tomography (CT) lung cancer screening scan range and compare its efficiency with the radiographer's performance.

MATERIALS AND METHODS: This retrospective study was performed using 1984 lung cancer screening low-dose CT scans obtained between November 2019 and May 2020. Among 1984 CT scans, 600 CT scans were considered suitable for an observational study to explore the relationship between the scout landmarks and the actual lung boundaries. Further, 1144 CT scans data set was used for the development of a deep learning-based algorithm. This data set was split into an 8:2 ratio divided into a training set (80%, n = 915) and a validation set (20%, n = 229). The performance of the deep learning algorithm was evaluated in the test set (n = 240) using actual lung boundaries and radiographers' scan ranges.

RESULTS: The mean differences between the upper and lower boundaries of the deep learning-based algorithm and the actual lung boundaries were 4.72 – 3.15 mm and 16.50 – 14.06 mm, respectively. The accuracy and over-scanning of the scan ranges generated by the system were 97.08% (233/240) and 0% (0/240) for the upper boundary, and 96.25% (231/240) and 29.58% (71/240) for the lower boundary.

CONCLUSION: The developed deep learning-based algorithm system can effectively predict lung cancer screening low-dose CT scan range with high accuracy using only the frontal scout.

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Samantha M. Santomartino and Paul H. Yi

Systematic Review of Radiologist and Medical Student Attitudes on the Role and Impact of AI in Radiology

RATIONALE AND OBJECTIVES: The introduction of AI in radiology has prompted both excitement and hesitation within the field. We performed a systematic review of original studies evaluating the attitudes of radiologists, radiology trainees, and medical students towards AI in radiology.

MATERIALS AND METHODS: We searched PubMed for studies published as of August 24, 2021 for original studies evaluating attitudes of radiologists (attendings and trainees) and medical students towards AI in radiology. We summarized the baseline article characteristics and performed thematic analysis of the questions asked in each study.

RESULTS: Nineteen studies were included evaluating attitudes across different levels of training (medical students, radiology trainees, and radiology attendings) with representation from nearly every continent. Medical students and radiologists alike favored increased educational initiatives, and displayed interest in learning about and implementing AI solutions themselves, despite reporting of a current gap in formal AI training. There was general optimism about the role of AI in radiology, although radiologists and trainees had greater consensus than medical students.

CONCLUSION: Although there is interest in incorporating AI into medical education and optimism among radiologists towards AI, medical students are more divided in their views. We propose that outreach to and AI education for medical students may help improve their attitudes towards the potentially transformative technology of AI for radiology.