Developing Artificial Intelligence in Radiology

Abstract

Artificial intelligence (AI) is revolutionizing radiological diagnosis in the UK, promising to enhance the accuracy, efficiency, and accessibility of healthcare. The integration of AI into radiology is particularly timely, as the National Health Service (NHS) faces increasing demand for imaging services, coupled with a shortage of radiologists. AI technologies, including deep learning algorithms and machine learning systems, are being developed to assist in interpreting complex medical images such as X-rays, CT scans, and MRIs.

One of the key benefits of AI in radiology is its ability to detect abnormalities quickly and accurately. For instance, AI algorithms can identify early signs of diseases like cancer, strokes, and fractures, often with a precision that rivals or exceeds human expertise. This has the potential to significantly reduce diagnostic errors, expedite treatment plans, and improve patient outcomes. For example, AI tools are already in use in the UK to flag lung nodules on CT scans, assisting radiologists in early cancer detection.

AI also offers efficiency gains. By automating routine tasks, such as identifying normal scans or prioritizing urgent cases, AI can help streamline workflows, reduce waiting times, and alleviate the burden on overworked radiologists. This is critical, as delays in diagnosis can have serious consequences for patient care.

However, the widespread adoption of AI in radiology is not without challenges. Concerns about data privacy, algorithmic transparency, and the potential for over-reliance on AI must be carefully managed. It is crucial to strike a balance where AI complements, rather than replaces, the expertise of radiologists.

Ultimately, AI's role in radiological diagnosis in the UK is poised to grow, offering a future where healthcare is not only faster and more accurate but also more equitable for patients across the country.

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BACKGROUND

Artificial intelligence (AI) encompasses computer algorithms capable of performing tasks normally requiring human intelligence. A subset of artificial intelligence, machine learning has increased the value of diagnostic imaging through quantitative tools. As a result, there have been enormous advances in radiology, including improved image quality, shorter acquisition times, and and improve diagnostic performance specifically in accuracy and to support personalised decision making. In the UK, AI in radiology is still an emerging field due to the need for an optimal AI platform that facilitates new algorithms and software which can be efficiently used by radiologists.

Aim

The role of AI technologies available for delivering effective care starting from diagnostics such as cancer detection to predicting treatment outcomes will be outlined.

Methods

This is a retrospective short review of articles on Al radiology software in the UK, retrieved from websites of RCR and hospitals that have used Al within radiology departments.

Results

The UK has embraced various recent advancements in AI. These include:

- Deep Learning-powered AI is utilized for breast cancer screening through MiaTM, an intelligent assessment tool for mammography within the NHS AI Lab.
- The application of Quantitative Chest-CT (QCT) allows for numerical assessment of lung parenchymal conditions, aiding in the diagnosis of a range of lung disorders.
- To understand COVID-19 better, a national database incorporates CORADS-AI, an automated system that quantifies lung parenchymal disease extent.
- Post-processing image analysis software for chest CT , such as : Icolung (Icometrix) lung imaging AI solution has been used for the analysis of non-contrast chest CT that helps to detect COVID-9 at an early stage and quantifies the lung lesions; Veolity (MeVis) and Veye Chest (Aidence) are dedicated to lung screening program that helps in automatic detection, segmentation and measurement of pulmonary nodules.
- 'BRAINOMIX' introduces tools such as e-CTA for standardised collateral assessment in CTA scans; The E-ASPECTS decision support tool helps assess stroke signs in non-contrast CT images, measuring large vessel occlusions and hyperdense volumes, automatically assessing infarct volume and ASPECTS scoring; e-CTP and e-ILL solutions for faster interpretation of lung fibrosis and tumours
- Integration of AI into reporting workflow systems like RIS and PACS enables radiologists to generate actionable reports using computers.

- Ongoing research explores the fusion of Radiomics and Proteomics, two emerging AI sectors, to develop predictive and prognostic biomarkers for patients with Ovarian Cancer.
- Automated Bone mineral density (BMD) tool on routine CT scans advances osteoporosis screening, allowing tracking of BMD changes over time.
- Virtual reality and augmented reality have great potential in radiology training education with the help of hologram and HololeNs. Two types of AR prototype were introduced. VIPER has been used to assist cancer patients in understanding their radiotherapy treatment. ARTUR has been trialed to educate radiographers for a better understanding of patient positioning.

AI software developed by other companies has been compiled into a table as follows:

AI COMPANY	AI SOFTWARE	FUNCTION
Qure.ai	**qER**	Detection of bleed, strokes, fractures on head ct scans
Contextflow	**SEARCH Lung CT**	Detection of COVID-19 disease pattern & lung nodules
ARTERYS	**Cardio AI assisted cardiac MRI software-.**	Assess perfusion, flow and wall thickness and atrial volumes.
ARTERYS	**Breast AI iCADx#**	Detection of breast cancer and density assessments
ARTERYS	**Chest MSK AI**	Detection and localization of fracture, dislocation, pneumothorax, pleural effusion, and pulmonary nodule
ARTERYS	**Neuro AI**	A platform that assists multiple neuro-radio-workflow.
GLEAMER	**Boneview**	Detection of fractures, effusions, dislocations, bone lesions, worklist prioritization
CERCARE MEDICAL	**Cercare Stroke**	Identification of suspected stroke, LVO & ICH detection
RADIOBOTICS AUGMENTED RADIOLOGY	**RBknee**	Detection of finding related to radiographic osteoarthritis.
NANOX AI	**Bone Health Solution**	X-ray AI assistance for ED physicians to flag in suspected lung abnormalities
BEHOLD AI	**Red Dot**	Detect CXR abnormalities
ANNALISE AI	**Annalise CXR**	Detection of 124 chest findings and worklist triage
IMBIO	**Lung Texture Analysis**	Detect CXR abnormalities

Conclusion

Currently, many AI solutions have been deployed across all major medical imaging modalities, enabled by deep learning, however it is essential to monitor and evaluate the use of each AI products in clinical practice to determine its contribution to improved outcomes and its efficacy in helping radiology workflow. For AI to become an acceptable tool in future, it is essential to monitor and evaluate the use of AI products in clinical practice to determine its contribution to improved outcomes and cost-reduction in NHS.

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