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Challenges to Clinical Artificial Intelligence Adoption in Radiology and Strategies to Address them.

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Abstract

The current trend toward increasing use of AI in medical imaging will continue. A 2021 ACR Data Science Institute report on the prevalence of AI use within radiology groups showed that approximately 30% of radiologists were currently using AI in their practice [1]. Those figures were 17% in 2018 and 0% in 2015. Another confirmation of the growing expectation of AI within medicine is the recently released 2021 Artificial Intelligence/Machine Learning (AI/ML)-Based Software as a Medical Device (SaMD) Action Plan which further outlines the FDA's approach to overseeing this technology [2]. Additionally, CMS has established a payment schedule for AI with both new CPT codes as well as New Technology add-on Payment. A recent report estimates that by the year 2026 the medical imaging AI world market will reach annual spending of $1.4 billion [3].

Before we identify certain categories of pitfalls, first we may briefly outline the roadmap of what radiologist want. The ACR DSI poll referenced above showed that there were five tasks of AI that surpassed the 50% threshold of being desired by respondents. In decreasing order these were: lesion detection, anatomic measurements, worklist prioritization, image quality improvement, process improvement. These desires can be mapped to the wheels of AI requirements for adoption which include performance, workflow, time, and cost [4]. This article will review possible AI medical imaging pitfalls through this framework.

Keywords: Artificial Intelligence; Workflow; AI Pitfalls; AI adoption; datasets.

Performance

Without improvements in performance, which may be determined by myriad metrics, there will be no drive to adopt AI in medicine. Review of the current literature shows a growing body of use cases which appear to show performance improvement related to the two most desired tasks – lesion detection and anatomic measurement or characterization. Some of the most significant pitfalls to this continued progress involve low quality input data, intellectual property concerns, and data security issues. Many training datasets which are used to create and further train algorithms are often relatively small and few contain truly diverse patient data. Many are from a single or handful of institutions with unique patient cohorts. The resulting siloed and fragmented datasets result in brittle algorithms that may not translate to clinical practice effectively.

However, the amount of data potentially available for analysis is the sum of all digital imaging archives from all practices worldwide. To overcome the well-known computer science mantra of garbage in garbage out we need cleaner, larger datasets to develop algorithms that are robust enough for clinical use. We also need to continue collecting long term data on algorithms to quantify their true clinical impact. Another area of potential impact is the development of more granular personalized risk models. Currently, multiple initiatives are underway to create larger federated data sets which will directly address these pitfalls.

Workflow

Radiologists also desire AI to help with worklist prioritization and image quality, and these have been some of the first real world

applications that have appeared in clinical practice. However, getting AI deeper into the clinical workflow often proves to be more challenging than many practices anticipate. Many products need to send data off site for cloud-based analysis while others may maintain a local or virtual server for the algorithm behind the practice's own firewall. If a cloud-based product is considered, does it comply with local data security processes if data leaves the site of acquisition? If a local server is used, who maintains the IT infrastructure and performs regular quality control, troubleshooting, and maintenance? Is patient confidentiality maintained and are there potential medicolegal issues? Many algorithms use newly acquired data for continued training and refinement. In that case how are intellectual property rights divided? All parties will want something, and currently no clear path is evident for moving commercial products into many practices.

One way of overcoming these challenges may be the creation of common pathways that become the "rules of the road" regarding division of intellectual property, incorporation of new images into ongoing training datasets, and data security. Over time if these issues are dealt with effectively, trust will grow, and adoption will follow. The evolution of Web 3.0 may reveal a path forward given its focus on decentralization and blockchain technology which allow content creators – in this case radiology groups or even patient - to be compensated in some fashion for their data input.

Time

A major benefit of effective algorithms might be their ability to expedite interpretations of abnormal exams, which maps to the desire to have AI improve our processes. This may be accomplished by both worklist prioritization and lesion identification. Multiple examples of these programs exist across anatomical sites and modalities. A major, if not controversial, use case of AI in pursuit of radiologist time saving is the identification of negative exams and subsequent creation of a standardized structured report that never needs to be reviewed by a radiologist. It doesn't take a leap of imagination to anticipate that ambitious AI firms would aim to displace an expensive radiologist as justification for purchase of their product. However, there is a larger discussion that must evolve regarding the medicolegal considerations and implications of having a machine influencing or directing medical care. Will we reach a point where patients are comfortable not having a radiologist review image before a report is issued? Who will be held accountable for mistakes? The medical field will perhaps be able to judge the prevailing sentiments based on observation of how our society approaches the expectations and guardrails that develop around autonomous vehicles.

Cost

As the last requirement for adoption, we must determine who will pay for these services. Patients are unlikely to pay out of pocket for these technologies while they are still largely developmental, so practices and companies are unlikely to even consider seeking direct reimbursement. That leaves practices and insurance companies. With shrinking reimbursement, local practices are unlikely to decide if the investment is worthwhile without demonstrated gains in efficiency or outcomes. Insurance is the last option and recently the first pathway for reimbursement by CMS has been established. This will likely lead to commercial insurers following suit. Although, this process may seem protracted, reimbursement for AI in radiology has developed much more rapidly than in other specialties [5]. The most convincing data for all parties involved will be long term outcomes, and those projects are currently underway.

Highlights

- AI in medical imaging is here to stay and is growing exponentially in adoption and capabilities.
- However, there is much uncertainty around long term outcomes and initiatives are underway to gather more evidence about the impacts of AI on medical management.
- Certain pitfalls regarding performance, workflow, time, and cost are present.
- Possible solutions for these pitfalls may be found by building robust datasets, monitoring long term patient outcomes, and monitoring the societal expectations of related but non-medical developments in AI.

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