

It's been said that artificial intelligence (AI) is no match for natural stupidity. Employed correctly, however, AI could very much augment the decisions radiologists make and the care that they provide. Indeed, one could argue that AI, as it relates to health care, should perhaps stand for "augmented intelligence."

The fact, however, is that tremendous hype surrounds AI. Along with that hype comes much confusion, lack of clarity, and even fear. The language used to describe advancements in AI often gets muddled, and many do not see the clear differences among AI, machine learning, and deep learning. Lack of clarity also exists around what the advances in AI really mean to clinical radiology practice and operations.

In this three-part series running in May, July and November 2018, renowned medical imaging leaders Eliot Siegel, MD, Lawrence Tanenbaum, MD, and Rasu Shrestha, MD, simplify complex concepts of AI and contextualize them to the practice of radiology. In the process, they guide readers to a greater awareness of, preparation for, and readiness to engage in and capitalize on the AI advancements that are on the horizon.

An imaging tool ready to explode

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The topic of artificial intelligence (AI) is prominent throughout the healthcare enterprise, particularly in imaging services. At present it appears AI is less a competitive force than a mechanism for elevation, augmentation, and expansion of the radiologist's capabilities. Improved algorithms based on AI and machine learning (ML) will make computer assisted diagnosis, detection and study triage (CADx, CADe, CADt) more intelligent and effective, improving lesion detection and classification. The enhanced pattern recognition in ML-based tools promises to assist in identifying cancers before they are evident to the radiologist. Natural language processing (NLP) is already being used to leverage information in a patient's electronic medical record to facilitate billing appropriateness and a more patient-focused diagnostic process.

This explosion in AI and ML products is being fueled by the availability of enhanced

computing and gaming processes that can handle huge amounts of data. Having curated, high-quality data and validation via ground truth remains critical. Data access is problematic, as concerns exist over sharing and patient privacy. Artificial intelligence companies are tackling these challenges by forming alliances with radiology partners around the globe. Arterys, for example, has many domestic partners as well as overseas alliances in such places as Brazil. Enlitic, perhaps the most established company in the imaging AI space, is already working with partners in Canada, Australia, and the U.S. to measure improvements in time-to-diagnosis and error reduction in emergency rooms, where speed and accuracy matter most.

In May 2017, the FDA announced a Digital Health Software Precertification Pilot Program. Its hallmark is to reclassify most software-as-a-medical device (SAMD) as Class

II, which will streamline the approval process. Apps that drive decisions in situations of non-serious risk, as well as inform decisions of serious and non-serious risk, will not require pre-market review or approval (PMA). For established companies that pass muster with the FDA, some apps with a higher level of impact may not require a PMA. Only apps that drive critical decision making, diagnosis, and treatment in critical circumstances will be subject to PMA on a universal basis. As a result, AI-based tools should be accelerated to market.

Arterys stands out in having two AI applications approved by the FDA. The company's first application, Cardio AI, assists in segmenting advanced 4D cardiac and vascular MR studies. Arterys' latest Lung AI and Liver AI tools segment and register longitudinal oncological advanced imaging data sets.

Meanwhile, MaxQ-AI's AccipioIx software is approved by the FDA to prioritize reading of studies in patients with a high likelihood of brain hemorrhage. Viz AI's FDA-approved Contact software detects evidence of stroke on head CT and automatically notifies neurovascular team members to review the studies with a radiologist. Brainomix (collateral vascularity quantification) and Ischemaview (ASPECT scoring) have already been approved for use in stroke in Europe.

MedicVision is already marketing ML-enhanced iterative reconstruction package for MR imaging that offers an approximately 30% reduction in MRI scan times.¹ Subtle Medical's deep learning (DL)-driven tool, yet to be approved, speeds PET and MRI scan times, reduces contrast dose for MRI and PET, and performs super resolution of 3D MRI studies to create thin slices from thick.² Several other entities are working on tools that will eliminate signal from motion on MR images. GE Health-

care is developing DL-based tools for automatic MRI scanning coverage and angulation optimization which should lead to a reduced need for repeat scanning.

Ideally, a data learning architecture should be one that can be applied to multiple applications across imaging, such as lung, colon, and mammography screening. Rather than training models on narrow applications for specific findings, Enlitic is developing models that can be trained to differentiate between "normal" and "abnormal" on a wide variety of studies (eg, pneumothorax, misplaced tubes, and lines on chest x-rays), making the models exceptionally versatile across image types and pathologies.

With all these companies and more involved in AI (50 or so as of the end of 2017) a platform for implementation is the next hurdle to be overcome. Clearly the tools must seamlessly interface with the reading environment and ideally provide no retardant to workflow, making the PACS or advanced visualization workstation the most likely interface. An additional challenge to widespread use will be quantifying the value of AI enhancements and creation of realistic financial models for both industry and users.

This is an exciting and volatile time for radiology and healthcare enterprises. Opportunities to integrate AI abound, but vendor integrity and application validation is critical. Modes of implementation and financial models must be appropriate to ensure success.

REFERENCES

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*Demystifying Artificial Intelligence,
Part III Coming in November:
Rasu Shrestha, MD, shares practical steps
to understanding, implementing,
and unlocking value from AI.*

