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- Machine learning methods that can explain the advice they provide to human users (so-called explainable artificial intelligence), and validated methods for image de-identification and data sharing to facilitate wide availability of clinical imaging data sets.

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Imaging research laboratories are rapidly creating machine learning systems that achieve expert human performance using open-source methods and tools. These artificial intelligence systems are being developed to improve medical image reconstruction, noise reduction, quality assurance, triage, segmentation, computer-aided detection, computer-aided classification and radiogenomics.

Machine learning algorithms will transform clinical imaging practice over the next decade. Yet, machine learning research is still in its early stages.

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Figure 1. Error rates on the ImageNet Large-Scale Visual Recognition Challenge. Accuracy dramatically improved with the introduction of deep learning in 2012 and continued to improve thereafter. Humans perform with an error rate of approximately 5 percent.

High-res (TIF) version
(Right-click and Save As)

Figure 2. Diagram illustrates the use of images and narrative reports to produce decision support systems that provide actionable advice. There are several opportunities for AI in medical imaging research (shaded boxes). EMR = electronic medical record.

High-res (TIF) version
(Right-click and Save As)
Figure 3. Diagram shows how foundational and translational research activities are connected. Foundational research leads to new image reconstruction and labeling methods, new machine learning algorithms, and new explanation methods, each of which enhance the data sets, data engineering, and data science that lead to the successful deployment of AI applications in medical imaging. EMR = electronic medical record.