Using Artificial Intelligence to Interpret Screening Mammograms

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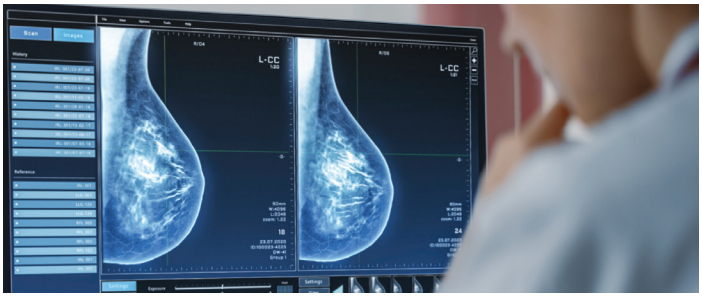
"Screening mammography is the cornerstone of breast cancer detection," says Cheryce Poon Fischer, MD, professor of radiology, section chief and director of the Iris Cantor Breast Imaging Center. During the 12 months ending in October 2021, over 38 million screening mammograms were performed in the U.S. "The sheer volume of screening mammograms is staggering, requiring a large number of highly subspecialized radiologists for accurate interpretation," continues Dr. Fischer.



UCLA is currently exploring what role machine learning (ML) and artificial intelligence (AI) can play in managing the high daily workload for radiologists by aiding in the interpretation of screening mammograms. "A reliable AI system could help with workflow by efficiently triaging patients with suspicious findings on screening exams and by helping mammographers reduce callback rates," explains Dr. Fischer. Decreasing callback rates reduces patient radiation exposure, allays patient anxiety and frees up physician time to increase overall efficiency.

While computer-aided detection (CAD) systems have been under development for decades, the first CAD software was not approved for use by the FDA until 1998. CAD systems are very different from the ML algorithms that are currently generating a great deal of interest in many areas of radiology. While CAD could highlight focal areas of increased breast tissue density and microcalcifications, it has not proved to be impactful in helping radiologists interpret image data or in increasing efficiency.

AI systems for mammography use deep convolutional neural networks that learn how to classify image data. Such systems are able to aid in breast cancer detection in a more nuanced way than could earlier CAD systems by more adeptly handling ambiguous data. Today's AI systems evaluate mammography images and assign numerical values to indicate the risk of breast cancer. These AI systems provide a score for each finding on a mammogram, calculating the probability of cancerous tissue for each suspicious area of interest.

Dr. Fischer points out that current AI systems are not intended to replace the human radiologist, but to serve as a smart assistant in interpreting screening mammograms. The numerical results of the AI system's evaluation are available to radiologists in real time as they review images, helping them better and more quickly interpret the entire study.

UCLA is embarking on an extensive and multi-pronged research program to evaluate the performance of AI in assisting the interpretation of screening mammograms and contributing to the clinical practice of screening mammography, as well as how AI should be practically integrated into the high-volume clinical workflow. The research is starting with a retrospective study testing ML algorithms on 5,000 screening mammograms performed at UCLA from 2010 to 2015. Various competing ML algorithms have been tested by their developers, who have reported their findings and have made claims about their algorithm's accuracy based on that data. "There is, however, concern that the performance measures of these ML algorithms using the vendors' test cases may not be fully generalizable to the screening mammograms performed at UCLA," explains Hannah Milch, MD, assistant professor of radiology, who serves as one of the lead investigators in this research. "There might be differences in patients' diversity, breast density, medical and surgical history, race, ethnicity and breast cancer risk." After assessing how the different ML algorithms perform on our own archived data set, UCLA will install one of the systems and perform a prospective clinical trial to fully evaluate how it performs in UCLA's everyday screening mammography workflow. "While there are some interesting clinical trials coming out of Europe, we're expecting to be at the forefront of actually using and prospectively studying AI in reading screening mammograms," explains Dr. Milch.

Drs. Fischer and Milch and their colleagues are also thinking about the practical adoption and future developments needed. "Present AI systems do not look at prior films when they do their interpretation, whereas the human radiologist does," says Dr. Fischer. "If the AI system could look at prior films and add that information to what it detects in the present films, it will be more useful, more accurate, and more able to diagnose very early stages of cancer by detecting subtle digital imaging changes in the breast tissue that may be difficult for the human eye to perceive." Other information that could be incorporated to improve future AI systems includes demographics such as patient age, cancer history, genetic information and even social determinants of health.

Foreseeing a day when AI will play an even larger role in triaging screening mammograms, Dr. Fischer notes that many of the breast imaging radiologist's hours are currently spent assessing healthy women. "With a robust, dependable AI system, we could decrease the time spent on evaluating normals in the daily workload, freeing us to spend more time on complex diagnostic exams, cross sectional MRI exams, biopsies and other interventional procedures — areas where AI cannot replace humans."