New AI Technology Provides Accurate Breast Density Classification

An artificial intelligence (AI) tool can accurately and consistently classify breast density on mammograms, according to a recent study in Radiology: Artificial Intelligence [1].

Breast density reflects the amount of fibroglandular tissue in the breast commonly seen on mammograms. High breast density is an independent breast cancer risk factor, and its masking effect of underlying lesions reduces the sensitivity of mammography. The accurate measurement of breast density is therefore of key importance. In clinical practice, breast density is visually assessed on two-view mammograms, most commonly with the American College of Radiology Breast Imaging-Reporting and Data System (BI-RADS) four-category scale, which ranges from Category a for almost entirely fatty breasts to Category d for extremely dense breasts. However, the system has limitations, principally because visual classification is prone to both inter- and intra-observer variability.

To overcome this variability, researchers in Italy have recently developed software for breast density classification using an AI approach involving deep learning with convolutional neural networks, which is capable of discerning subtle patterns in images beyond the capabilities of the human eye. The researchers trained the software, known as TRACE4BDensity, under the supervision of seven experienced radiologists who independently visually assessed 760 mammographic images.

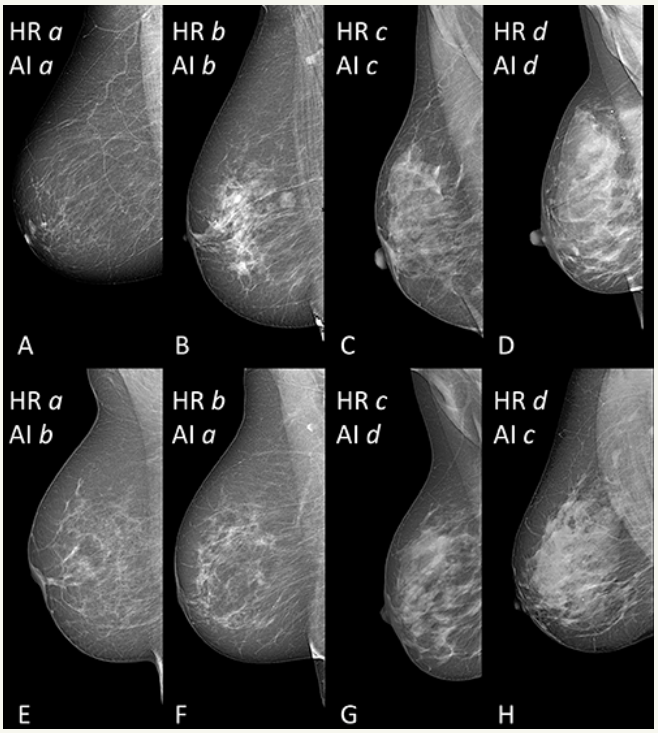
External validation of the tool was performed by the three radiologists closest to the consensus on a dataset of 384 mammographic images obtained from a different center.

The TRACE4BDensity software showed 89% accuracy in distinguishing between low density (BI-RADS categories A and B) and high density (BI-RADS categories C and D) breast tissue, with an agreement of 90% between the tool and the three readers. All disagreements were in adjacent BI-RADS categories.

"*The particular value of this tool is the possibility to overcome the suboptimal reproducibility of visual human density classification that limits its practical usability,*" said study co-author Dr. Sergio Papa from the Centro Diagnostico Italiano in Milan, Italy. "*To have a robust tool that proposes the density assignment in a standardized fashion may help a lot in decision-making.*"

Such a tool would be particularly valuable, the researchers said, as breast cancer screening becomes more personalized, with density assessment accounting for one important factor in risk stratification.

"*A tool such as TRACE4BDensity can help us advise women with dense breasts whether they should, after a negative mammogram, have supplemental screening with ultrasound, MRI or contrast-enhanced mammography,*" said study co-author Dr. Francesco Sardanelli, from the IRCCS Policlinico San Donato in San Donato, Italy.



Selection of mammographic MLO views of breasts with different breast density from women between 51 and 68 years of age.

Images A–D. Examples of agreement between human readers (HR) and AI in four patients: Category a (patient of 68 years),; b (patient of 66 years); c (patient of 51 years), and d (patient of 54 years); Image B shows an example of a breast with a benign mass.

Images E–H. Examples of HR-AI disagreement; Image E was classified as a by HR, and as b by AI (patient of 67 years); Image F was classified as b by HR, and as a by AI (patient of 68 years); Image G was classified as c by HR, and as d by AI (patient of 55 years); Image H was classified as d by HR, and as c by AI (patient of 52 years).

Reminder of BI-RADS categories: category a (almost entirely fatty); category b (scattered fibroglandular); category c (heterogeneously dense); category d (extremely dense).

The researchers plan additional studies to better understand the full capabilities of the software.

"*We would like to further assess the AI tool TRACE4B-Density, particularly in countries where regulations on women density is not active. In such situations we would evaluate the usefulness of such the AI density dteermination tool for radiologists and patients*," said study co-author Christian Salvatore, Ph.D., senior researcher, University School for Advanced Studies IUSS Pavia and co-founder and chief executive officer of the company DeepTrace Technologies who developed the new system. *http://www.deeptracetech.com/*

REFERENCE

1. Magni V *et al.* Development and Validation of an AI-driven Mammographic Breast Density Classification Tool Based on Radiologist Consensus Radiology: Artificial Intelligence 2022; 4(2):e210199. *https://doi.org/10.1148/ryai.210199*