convolutional neural network (CNN)-based artificial intelligence algorithm is capable of accurately analyzing mammogram data to better identify chemoprevention candidates among women with a family history of atypical hyperplasia (AH), lobular or ductal carcinoma in situ (LCIS/DCIS), a researcher reported at the AACR Virtual Special Conference: Artificial Intelligence, Diagnosis, and Imaging held Jan. 13.

Julia E. McGuinness, MD, an oncology/hematology fellow and investigator at Columbia University Irving Medical Center, explained the results of a retrospective trial conducted with colleagues at the school’s Mailman School of Public Health, together with researchers at Baylor College of Medicine and patients from three Chinese hospitals. The retrospective analysis showed the approach could accurately identify which of 728 evaluable women would benefit most from chemoprevention with anti-estrogens such as tamoxifen. Tamoxifen can reduce breast density, a strong predictor of cancer risk, McGuinness noted. Interpretation of density data by radiologists can be somewhat variable and can lead to less accurate screening.

“We developed a novel, fully automated convolutional neural network derived mammographic evaluation that is a more accurate predictor of breast cancer risk,” McGuinness said, adding that “future studies should differentiate one from the other.

“We demonstrated that our CNN-based mammographic evaluation is modifiable with anti-estrogen therapy among high-risk women,” McGuinness said, adding that “future studies should determine whether changes in CNN risk score are associated with development of breast cancer, in order to further evaluate the CNN mammographic evaluation as a potential pharmacodynamic biomarker of response to breast cancer chemoprevention.”

The researchers compared changes in CNN risk score from baseline to follow-up among women who took chemoprevention compared to those who did not. They then conducted multivariable linear regression, adjusting for known breast cancer risk factors such as age, BMI, menopausal status, and race/ethnicity to determine whether receipt of chemoprevention was associated with change in CNN risk score.

Among the 728 subjects, the mean age was 60.4 years; 70.4 percent of the women were postmenopausal and 34.1 percent received chemoprevention with anti-estrogens versus 65.9 percent who did not. Women who received chemoprevention, compared to those who did not, had a greater mean change in CNN risk scores from baseline to 3-5 years of follow-up, at -0.069 and -0.019, respectively.

Multivariate analysis showed that women who received chemoprevention had a 0.038 point (3.8%) greater decrease in risk score compared to those who did not.

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In AI machine learning, a CNN is known as a deep-learning algorithm. It can take in an input image, assign importance to various aspects and objects in the image—learnable weights and biases—and be able to differentiate one from the other.

“The human brain processes a huge amount of information the second we see an image. Each neuron works in its own receptive field and is connected to other neurons in a way that they cover the entire visual field,” McGuinness explained. “Just as each neuron responds to stimuli only in the restricted region of the visual field, called the receptive field in the biological vision system, each neuron in a CNN processes data only in its receptive field as well. The layers are arranged in such a way so that they detect simpler patterns first, such as lines, curves, etc., and then more complex patterns (faces, objects, etc.), enabling the equivalent of ‘sight’ by such a system.”

Kurt Samson is a contributing writer.