Neural Network Reduces False Positives in CAD

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Using an advanced massive-training artificial neural network (MTANN), computer-aided detection (CAD) scheme, radiologists were able to improve their polyp detection rate and reduce the number of false positives in CT colonography (CTC), based on a study presented at the 2009 Radiological Society of North America (RSNA) annual conference in Chicago.

Kenji Suzuki, PhD, assistant professor of radiology at the University of Chicago, and colleagues developed and applied the MTANNs to the University's in-house CAD system. The presentation at RSNA highlighted the performance study of the CAD with the addition of MTANN in the detection of "difficult" colon polyps, which is the first study of its kind, according to Suzuki.

In developing the CAD system for the study, Suzuki said that the university's existing CAD system had a large number of false positives, as well as a relatively high sensitivity level. While the sensitivity level is comparable to radiologist performance, said Suzuki, the number of false positives of the system was found to be very large when compared to human false-positive rates.

"The human radiologist gets approximately 0.05 false positives per patient, whereas the existing CAD systems had five to 20 false positives per case," explained Suzuki. "If there are such large numbers of false positives, no radiologist will use a CAD system. That's why we developed an MTANN technique [that] is very powerful in false-positive reduction."

After the MTANN technique was implemented into the CAD system, the researchers noted that false-positive rates were reduced to approximately three per patient for "difficult" polyps and one per patient for common or typical polyps. Suzuki noted that these findings reflect the highest performance of a CAD system for CTC in literature to date.

MTANN can reduce the rate of false positives because they are a kind of machine-learning technique, Suzuki said. "We train MTANNs with actual polyps and actual images as opposed to a mathematical model of polyps or some simple mathematical model," he said. "The MTANN can learn actual polyps and actual false positives, so we train [the MTANN] with the major sources of false positives, such as folds, stool and small bowel and the MTANN learns to reduce or remove such false positives."

Fifteen institutions participated in the original trial. In order to test the advanced CAD system, the researchers created a database of 24 false-negative cases with 23 polyps (ranging in size from 6–15 mm, with an average of 8 mm and a mass of 35 mm), all of which were "missed" by radiologists in CTC in the original study.

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Neural networks seem to have questions hanging over their value since a lot of the disasters in financial markets have been blamed on them. This is an interesting example of the technology being used to support decisions rather than make them.

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