New signal extraction technique helps breast cancer screening

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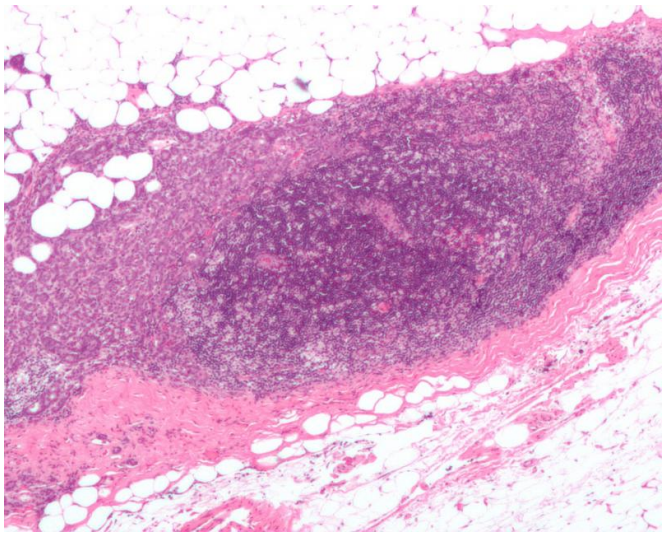

Micrograph showing a lymph node invaded by ductal breast carcinoma, with extension of the tumour beyond the lymph node. Credit: Nephron/Wikipedia

Mammograms are commonly used to screen for breast cancer. In spite of easy access, conventional mammograms cannot find every tumor due to the limited image contrast mechanism.

The measurement of X-ray beam refraction in breast tissues has the potential to be the next generation screening technique for breast cancer. A new technique called X-ray phase contrast imaging (XPCI) provides better soft tissue differentiation and tumor detections.

However, the use of X-ray interferometry made from gold and silicon gratings sharply reduces the X-ray dose efficiency, i.e., inhibiting the patient radiation dose.

Recently, researchers from the Shenzhen Institutes of Advanced Technology (SIAT) of the Chinese Academy of Sciences developed a novel XPCI signal extraction technique using a deep learning method. The technique has shown promising advantages in enhancing signal accuracy and improving the X-ray radiation dose efficiency.

The study was published in *IEEE Transactions on Biomedical Engineering* on July 22.

The researchers designed a deep convolutional neural network named XP-NET, using a special architecture to automatically perform the XPCI signal retrieval and image quality enhancement in a sequence.

Results showed that the XP-NET was able to improve the phase signal accuracy by over 15% compared with the conventional analytical method.

Additionally, both biological specimen and breast phantom studies demonstrated that the phase images acquired with half the radiation dose and processed by the XP-NET showed image quality comparable to the reference images acquired with the standard radiation dose level.

The study demonstrated for the first time that the deep learning method could help to reduce the radiation dose in X-ray phase contrast imaging, enable automatic signal extraction and post-processing, and provide evidence for the future potential preclinical uses of high-quality breast X-ray phase contrast imaging with lower radiation dose levels.

More information: Yongshuai Ge et al. Enhancing the X-ray differential phase contrast image quality with deep learning technique, *IEEE Transactions on Biomedical Engineering* (2020). DOI: 10.1109/TBME.2020.3011119

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