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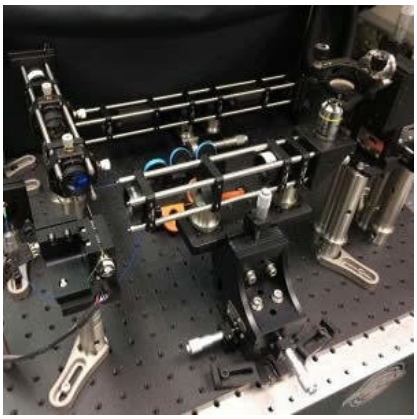
Computer-Aided Imaging Technique Reduces Risk of Second Breast Cancer Surgery



A new study shows that one in four women with breast cancer who opt for a lumpectomy will need a second surgery. This not only increases cost but also increases the risk of complications. A new imaging technique may help solve this problem. Findings are published in Medical Image Analysis.

Second surgeries in breast cancer are quite common primarily because currently the only way surgeons can confirm that there are no cancer cells in the margin is by performing a frozen section. This is often done to evaluate the tumour margin. If a positive margin is identified, the tissue is removed and is then sent for a histopathological evaluation. However, the frozen section can miss the tumour margin on the tissue surface and the histopathology results are generally not available for several days.

Surgeons want to find a more accurate way to find out in real time whether the margins are free of cancer cells or not. This is the goal that was undertaken by Chao Zhou, assistant professor of electrical engineering at Lehigh University and his Lehigh collaborator Sharon Xiaolei Huang, associate professor of computer science and engineering. They created a computer-aided diagnostic technique using cutting-edge imaging technology and the latest advances in artificial intelligence to detect the difference between cancerous and benign cells in real time. Their goal is to develop it so that it can be used during surgery and could complement histopathology thus reducing the need for a second breast cancer surgery.

Study findings show promising results with a classification accuracy of over 90%. The technique applies optical coherence microscopy (OCM) as a diagnostic tool. Features that are extracted from the OCM images are then used to train the computer system to identify different types of tissues. Every pixel in the image is identified - whether its fat, carcinoma or another type of cell. In addition, texture, colour and contrast of the images is also extracted and a machine learning algorithm is used to select features that are most discriminating.

Multiple types of texture features were examined and it was determined that Local Binary Pattern (LBP) features were the most effective for classifying tissues imaged by OCM. The research team also integrated Average Local Binary Pattern (ALBP) and Block-Based Local Binary Pattern (BLBP) to compare the intensity value of each neighbor pixel and average intensify value of pixels in blocks around the center pixel. This was useful because texture patterns of different scales appear in human breast tissue OCM images. By integrating LBP, ALBP and BLBP, classification accuracy improved significantly.

The authors state: "Our experiments show that by integrating a selected set of LBP and the two new variant (ALBP and BLBP) features at multiple scales, the classification accuracy increased from 81.7% (using LBP features alone) to 93.8% using a neural network classifier. In addition, we used these multi-scale and integrated

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image features to achieve high sensitivity - 100% - and specificity - 85.2% - for cancer detection using the OCM images."

This new imaging technique and image analysis could be a significant step toward enabling real-time diagnosis of breast cancer tissue in the operating room and could minimise the need for a second surgery.

Source: Medical Image Analysis
Image Credit: Chao Zhou, Lehigh University

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