University Relations:
News Release

UNIVERSITY OF CALGARY

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March 29, 2012

Engineers develop method to spot breast cancer several months before tumours appear

Computer technology is key to detecting early signs of breast cancer

Engineers at the University of Calgary's Schulich School of Engineering, in collaboration with the Alberta Breast Cancer Screening Program, have developed a software system that flags subtle signs of breast cancer sooner than ever before. The work has won an award from the Institute for Cancer Research for making a significant contribution to cancer research.

The system focuses on detecting architectural distortion, which refers to specific patterns in breast tissue that are often missed during routine screening. These patterns can be precursors to tumours and they may appear more than a year before more obvious signs of breast cancer such as lumps in breast tissue.

Raj Rangayyan, Shantanu Banik and Leo Desautels combined advanced computer technology with mathematical algorithms to process images of mammograms and digitally analyze them. They are the first experts to focus on architectural distortion for early detection of breast cancer using mammograms taken before a clinical diagnosis.

They studied 106 images of routine screening of women who later developed breast cancer. In 80 per cent of those images, the new system detected architectural distortion an average of 15 months before lumps or other signs of cancer were clinically diagnosed, with a moderate false-alarm rate of about five per image.

"This study demonstrates that it is possible to develop sophisticated computational methods to detect early signs of breast cancer," explains Raj Rangayyan, professor in electrical and computer engineering at the Schulich School of Engineering and a collaborator with the Department of Radiology at the University of Calgary's Faculty of Medicine. "Until now, computer-aided diagnosis systems have focused mostly on finding lumps and calcification in breast tissue."

Because architectural distortion usually appears before tumours, detecting it could lead to earlier diagnosis of breast cancer and improve the survival rate.

"The hope is that these techniques, in the future, could lead to more efficient detection of early and subtle signs of breast cancer at the pre-mass-formation stage," says Shantanu Banik, post-doctoral research associate.

Before this technology can become a regular part of breast cancer screening, experiments with larger sample sizes are needed. The number of false alarms needs to be reduced by refining algorithms and mathematical characterization techniques. The new method also must be tested on the latest version of digital images that are currently used in mammography. As computer technology advances and image quality improves, research results are expected to be even better in the future.

This research has been recognized as a significant contribution to cancer research by Canada's Institute for Cancer Research, which awarded a Publication Prize to the research team. Rangayyan's research program is supported by the Natural Sciences and Engineering Research Council of Canada (NSERC).

The paper entitled "Detection of Architectural Distortion in Prior Mammograms" was published in *Transactions on Medical Imaging*, the most respected journal in its field. It is published by the Institute of Electrical and Electronics Engineers, the world's largest professional association for the advancement of technology.

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