Infrared imaging technology being developed to better detect breast cancer

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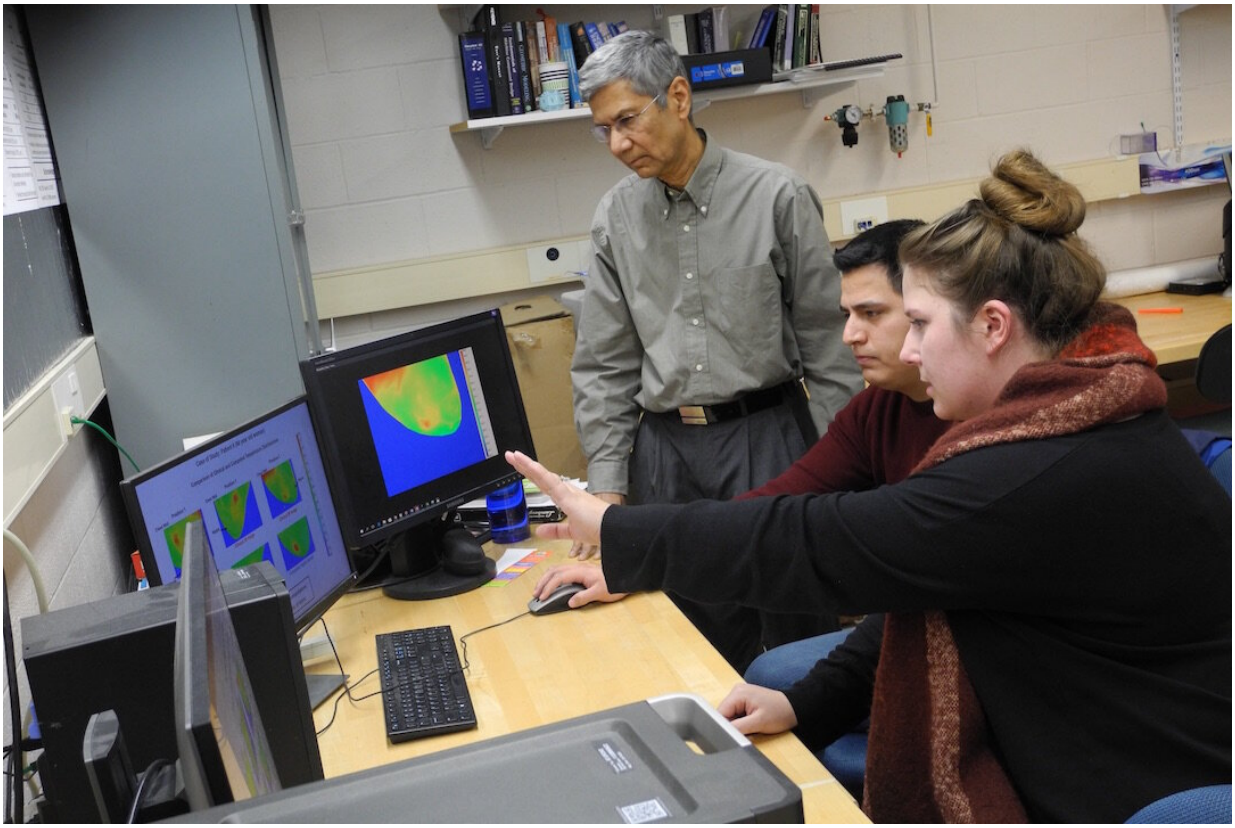

RIT and Rochester Regional Health researchers developed an infrared imaging technology to support current breast cancer detection methods. Professor Satish Kandlikar (left to right) and doctoral students, Jose Luis Gonzalez Hernandez and Alyssa Recinella, discuss an artificial intelligence system that can provide predictive analytics to determine more information about progression of disease. Credit: M. Cometa/RIT

Researchers have found a non-invasive, cost effective method that uses infrared technology to locate hard-to-find breast cancer tumors. For the 40-50% of women with dense breast tissue, where these tumors often hide, this technology could be the difference between early interventions or major surgery.

Faculty and student researchers at Rochester Institute of Technology, and physicians from the Rochester Regional Health System (RRHS), developed a non-invasive process using infrared imaging to better detect cancerous tumors. The team improved an imaging option that is both comfortable and reliable.

"Mammography, although it is good, may not be a complete solution," said Satish Kandlikar, professor of mechanical engineering in RIT's Kate Gleason College of Engineering, who has been involved in advancing thermal imaging technology since the 1990s.

The multidisciplinary team consists of Kandlikar and doctoral students in his Thermal Analysis and Microfluidics Lab, as well as Rochester Regional Health physicians Donnette Dabydeen, a radiologist in the Department of Diagnostic Imaging; Lori Medeiros, breast surgeon, and executive director of the Rochester Regional Breast Center; and Pradyumna Phatak, medical director of the Lipson Cancer Institute and chief of medicine.

"The project is a unique collaboration between a laboratory team at RIT, with years of experience in the heat transfer arena, and clinicians at Rochester Regional who diagnose and treat breast cancer," said Phatak. "Early detection is one of our most effective strategies in the war against breast cancer."

Current patients in the Rochester Regional Health Breast Center volunteer to be tested after an initial mammography that shows

suspicious findings on X-ray films. When referred for a follow-up MRI, these patients can also volunteer to be screened using the infrared system.

"Thermography is definitely not a new technology, it has been around for a long time," said Alyssa Recinella, an engineering doctoral student and a member of Kandlikar's research team. "The reason people are so interested in it is because it does not induce radiation like mammography does, there is no contrast material, like you have with an MRI. It is more comfortable. Patients will not need to be contorted into different positions or smash anything. It is completely non-invasive."

The system consists of an infrared camera, on a track, mounted underneath a cushioned table. It is angled and can be adjusted as the clinician moves it to take images. Recinella works closely with the team of breast cancer experts at the RRHS center—from oncologists and radiologists to researchers and sociologists—on testing and in helping interpret medical information.

"The table we designed and made in the lab has a giant hole in the center of it—which gets a lot of laughs when I first bring patients into the room," she said. The laughter helps break the ice as the serious imaging begins, she added.

Thermography studies have been done in the past, but the technology today is more sensitive and it is through these advancements that the RIT team has been able to show far more detail in images and validate tumor locations. The infrared test takes 20 minutes compared to an MRI which may take up to 45 minutes.

"Current screening modalities rely heavily on digital mammography but this technique has shortcomings, particularly in the significant subset of women who have dense breast tissue. Infrared imaging, using our

technique is easy, quick, non-invasive and cost effective," said Phatak. "Our preliminary data suggest that it may be a very sensitive adjunct to routine screening mammography. Further studies are needed to decide the best way to utilize this technology in practice."

Initial funding for the project was provided by the National Science Foundation through the Early Concept Grants for Exploratory Research program. Grants are given for early stage, potentially transformative research, and the RIT-RRHS team received funding for two-years of work to screen patients and correlate infrared images against original MRI images, to provide validation of the overall process and technology.

Taking the images is only one part of the process. The team is also using advanced computer simulation technology to do predictive analysis on tumor locations and growth. This is similar to artificial intelligence where computing systems can 'learn' to aid diagnosis. Acquiring data about tumor types, size, progression of growth and locations can help physicians assess advancement of disease and determine interventions. Data acquired is based on a highly scientific approach employing advanced mathematical tools, said Kandlikar.

"We believe that our approach will provide a cost-effective and reliable adjunctive tool that is non-radiative and no contact. It is equally effective with dense breast tissue and is well suited to serve remote and underserved populations," he said. "It is time it receives the attention it deserves through large-scale clinical studies."

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