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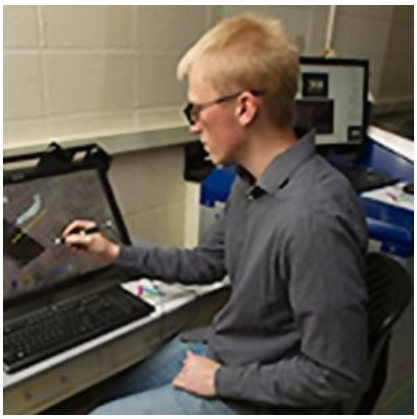
Spectral CT Transforms Shades of Grey



Radiographic images, such as x-rays, mammograms and computed tomography (CT), help detect diseases like cancer in its early stages when treatment can be most effective. As these images are in black and white, detecting the difference between healthy tissue and abnormalities can be difficult. Now, a new technology called spectral (colour) computed tomography — or spectral CT — may provide a solution to this problem by transforming shades of grey to living colour.

Researchers at University of Notre Dame say the spectral CT they are using can detect up to eight x-ray energy channels simultaneously, allowing colour assignment to specific molecular signatures for improved identification of abnormalities, such as tumours.

"The technology promises a transformation for biomedical imaging in general and cancer imaging in particular," explains Bradley Smith, the Emil T. Hofman Professor of Chemistry and Biochemistry and director of the Notre Dame Integrated Imaging Facility (NDIIF).

The spectral CT scanner, which is housed in the NDIIF, is the first commercially available preclinical system in the United States, according to project leaders Ryan K. Roeder, associate professor of aerospace and mechanical engineering, and Tracy C. Vargo-Gogola, senior lecturer in biochemistry and molecular biology with Indiana University School of Medicine at South Bend and the Harper Cancer Research Institute.

While the scanner uses advanced x-ray detector technology made possible by the Medipix3 detector chip developed at the CERN, it is aided by nanoparticle contrast agents that Roeder's lab has created to "target" molecular signatures associated with cancer and other diseases. Individual contrast agents and tissue types can be identified and assigned a specific colour, resulting in a more complete picture than ever realised.

Roeder, Vargo-Gogola and their team are presently investigating spectral CT contrast agents for molecular imaging with support from the National Science Foundation. In addition, the researchers are collaborating with the Kelly Cares Foundation and the Saint Joseph Health System to develop more accurate breast cancer detection methods using molecular imaging for women with dense breast tissue using various molecular imaging approaches, including spectral CT. While these efforts focus on breast cancer, work with this new molecular x-ray scanner is promising for the detection and treatment of many types of cancers, including ovarian, colorectal, lung and metastatic disease.

"Spectral computed tomography (CT) scanning is really the next great enhancement of clinical CT quality," says David P. Hofstra, administrative director of the Diagnostic Imaging and Therapy Division at Saint Joseph Health System in Mishawaka. "It takes us beyond comparing the number of 'slices' to a discussion about

fundamentally better and more clinically valuable imaging."

He notes that spectral CT scanning is already playing important roles in clinical practice by reducing metal artefacts and also by reducing the amount of radiation that is administered to patients.

"In the very near future, spectral CT promises to allow clinicians better means to characterise the material makeup of visualised items (like kidney stones, plaques, uric acid crystals, etc.)," Hofstra adds.

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