Spectral X-ray technology for medical and security applications

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ABSTRACT

We have developed a world-first portable triple-layer X-ray detector capable of generating both a traditional X-ray image and two low and high atomic number (Z) material separated images using a single X-ray exposure using industry standard imaging techniques. Material subtracted images allow for both, better visualization of objects and quantification of materials making spectral imaging particularly useful for a variety of medical and non-destructive testing (NDT) applications. For example, in medical imaging, challenging pathologies like pulmonary edema, cavitations, pneumothorax, and pulmonary nodules can be better visualized in a soft tissue window image.

In addition, coronary arterial calcium (CAC) and bone mineral density (BMD) can, for the first time, be quantified using the spectral detector with a regular X-ray source available at any hospital. Alternately, in NDT, material identification and quantification has already been in commercial use in airport conveyor belt style 'color' baggage security scanners. With spectral X-ray, that quantification capability is, for the first time, available in a portable form factor allowing for new field applications.

This talk will describe the physics of spectral X-ray, state-of-the-art technological developments and new and emerging applications in medical and security verticals. Of particular interest to the audience will be emerging 2.5D tomosynthesis and 3D cone-beam computed tomography (CBCT) to enable depth localization and identification of features within a medical or NDT object.

BIO

Dr. Karim S. Karim is a Professor in the Department of Electrical and Computer Engineering at the University of Waterloo. He has secured more than $15M in research grant funding, trained over 40 PhD and MASc students, and has co-authored 250+ publications and 50+ patents.

He is a founder and Chief Technology Officer of KA Imaging, a university of Waterloo spinoff company that makes innovative X-ray detectors and systems for medical, veterinary, scientific and industrial markets.

Dr. Karim has developed novel imaging devices and systems since 1998 and has both supported and founded multiple startups over the past two decades. One of his "color" X-ray innovations is now starting to replace black and white medical X-ray globally, while another is used in ultrasonic fingerprint sensors in mobile phones and tablets.