Quality of images produced with a novel photon-counting CT scanner

A novel photon-counting CT scanner will be installed at the Center for Medical Imaging Science and Visualization (CMIV) in Linköping in June 2020. The scanner is similar to the Siemens SOMATOM X.cite model; the main difference is that one energy-integrating detector (EID) is replaced with a photon-counting detector (PCD). The PCD detector uses small detector elements and has spectrometric properties. A previous PCD model (Somatom Count, Siemens Healthineers) showed better spatial resolution and lower noise than CT scanners with EID detectors. The scanner will be used for research purposes; only two units will be installed in the world.

Figure 1: Siemens SOMATOM X.cite. Taken from Siemens Healthineers web.

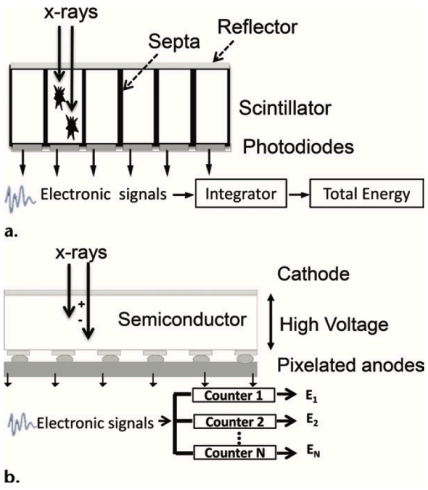

Figure 2: The principles of energy integrating (a) and photon counting (b) technologies. Taken from [2].

The task:

1. Review existing measures of physical image quality.
2. Determine image quality of the PCCT scanner and compare it to image quality of conventional dual-energy and single-energy CT scanners installed at the hospital in Linköping.
3. Work in close collaboration with medical physicists at the Medical Radiation Physics division on the performance evaluation of this new scanner.

Requirements:

The student should be familiar with general principles of computed tomography. Working knowledge of a scripting language (e.g., MATLAB) for the processing of data generated by the scanner is an advantage. Active approach to problem solving will be encouraged; results will be discussed in a research group. Student's location: The unit of Radiological Sciences, Linköping University. Affiliation: Center for Medical Image Science and Visualization (CMIV). Work from home is possible. In this case, regular meetings will be held via Zoom.

References:

[1] Willemink, M.J., Persson, M., Pourmorteza, A., Pelc, N.J., Fleischmann, D., 2018. Photon-counting CT: Technical Principles and Clinical Prospects. Radiology 289, 293–312. https://doi.org/10.1148/radiol.2018172656

[2] Leng, S., Bruesewitz, M., Tao, S., Rajendran, K., Halaweish, A.F., Campeau, N.G., Fletcher, J.G., McCollough, C.H., 2019. Photon-counting Detector CT: System Design and Clinical Applications of an Emerging Technology. RadioGraphics 39, 729–743. https://doi.org/10.1148/rg.2019180115

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