Towards Color Computed Tomography: Algorithmic Challenges and Opportunities in Spectral CT

Patrick La Riviere
University of Chicago

Energy-sensitive computed tomography (CT) imaging has the potential to improve material identification in vivo, allowing natural calcium and injected iodine to be readily discriminated, enabling different types of kidney stones to be classified, and potentially paving the way for multiple contrast agents to be used simultaneously. Such energy-sensitive CT imaging introduces new demands for system designers and new challenges and opportunities for algorithm developers. While the idea of spectral computed tomography (CT) is nearly as old as CT itself, we will review the recent hardware developments that have finally brought it into the clinic, as well as emerging technologies based on photon counting. We will focus primarily on the algorithmic challenges and opportunities that arise in these technologies, such as the need to engage fully with the non-linear nature of CT acquisition, and the opportunities afforded in working with multi-channel image volumes. In addition to medical CT, we will consider applications in ultra-high resolution synchrotron tomography, where we have been exploring a form of x-ray histology using multiple metal stains and multi-energy acquisition.