Image quality assessment for region-of-interest CT scans

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Context. Region-of-interest computed tomography (CT) refers to the hypothetical situation of using a reduced field-of-view when performing a CT scan. The theoretical basis for image reconstruction in this geometry is now well-known [1]. One potential benefit of region-of-interest scanning is the relatively low

radiation dose to tissues outside the reduced field-of- view [2]. However, the reconstructed region-of-interest might not have the same image quality is the situation for conventional full-field scanning. The goal of the ANR-funded project "ROIdoré" is to understand this dose versus image quality trade-off. The ROIdoré project is based at the TIMC laboratory in Grenoble, with scientific partners in Lyon, Brussels, Salzburg, and Ottawa.
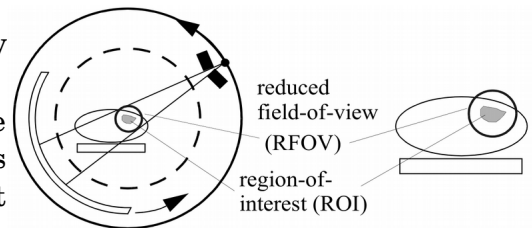
Objective. This project concerns the image quality aspect of the broader ROIdoré project. The objective is to quantitatively match the reconstructed image quality obtained inside the reduced field-of-view (RFOV) with that of the same region reconstructed from full-field measurements. The variable parameter is the number of photons (and their spatial distribution) used in the RFOV scan. In general, "image quality" is notoriously difficult to quantify. One possible approach would be to apply a sophisticated 8-step procedure to evaluate image quality via pixel co-variance measures [3]. The approach is partly experimental, using numerical simulations for a range of RFOV geometries. Validation of the methods developed will be made using phantom data measured on real CT scanners.

Practical Information. The duration of this PFE or Masters project is 6 months. A subsequent Ph.D. might be possible. The primary location is the TIMC laboratory (Grenoble). The supervisors are Rolf Clackdoyle (rolf.clackdoyle@univ-grenoble-alpes.fr) and Laurent Desbat (laurent.desbat@univ-grenoble-alples.fr). A second project on the complementary topic of radiation dose estimation for the ROIdoré project is also available.

References.

[1] Clackdoyle R, Defrise M. 2010. "Tomographic reconstruction in the 21st century. Region-of-interest recon-struction from incomplete data." *IEEE Signal Processing Magazine* **27**: 60-80.
[2] Parsons D, Robar JL. 2015. "An investigation of kV CBCT image quality and dose reduction for volume-of-interest imaging using dynamic collimation." *Medical Physics* **42**: 5258-5269.
[3] Nuyts J, Vunckx K, Defrise M, Vanhove C. 2009. "Small animal imaging with multi-pinhole SPECT." *Methods* **48**: 83-91.