AbstractID: 13538 Title: Radiation Dose Reduction in Medical X-ray CT Using Equally-Sloped Tomography

Purpose: An exact Fourier-based iterative reconstruction technique termed Equally-Sloped Tomography (EST) has recently been developed to allow a reduction of radiation dose while maintaining image quality. Here we optimize this technique by incorporating a Gradient Descent algorithm with mathematical regularization constraints, including the Non-Local Means Total Variation model. Using this technique, we conducted a series of comparative experiments to quantify the image quality, and explore radiation dose reduction in CT through reduction of X-ray flux. **Method and Materials:** A standard quality control phantom containing multiple contrast visibility and resolution inserts was imaged using a Siemens Somatom Sensation 64 scanner. The X-ray flux was systematically lowered from 583mAs to 39mAs. All scans were performed under axial mode with constant tube current. Comparison reconstructions were produced by Filtered-Back Projection (FBP) with a standard uncropped ramp filter. The resolution, signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) were measured and compared as a function of flux. **Results:** Compared to the FBP reconstruction of 500mAs, the optimized EST reconstruction of 50mAs has comparable SNRs and CNRs. The low-contrast regions of the phantom exhibit similar visibility. In addition, no resolution degradation is observed in the low-dose EST reconstruction. **Conclusion:** As radiation dose is linearly proportional to the X-ray flux, our results indicate that the optimized EST technique may potentially reduce the CT dose up to 90%, while producing comparable image resolution, quality and contrast as the full-dose FBP reconstruction. The reasons that EST allows for significant reduction of the CT dose are because (i) an exact Fourier-based iterative algorithm is used in the reconstruction where both physical and mathematical constraints can be naturally incorporated, (ii) the algorithm is guided towards a lowest-possible noisy state, which is also strictly consistent with the measured data. **Conflict of Interest:** Research sponsored by UC Discovery / TomoSoft Technologies Grant #ITL07-10166.