AbstractID: 10960 Title: Dose reduction in CT using non-convex prior image constrained compressed sensing NC-PICCS

Purpose: To demonstrate the dose reduction potential in CT using a novel algorithm (NC-PICCS) based on a non-convex ℓ_0 homotopic approximation. **Methods:** We generalized the Prior Image Constrained Compressed Sensing (PICCS) algorithm to solve an ℓ_0-quasinorm by homotopic approximation using continuation on the parameter *p* (ℓ_p-norm) which starts at p=1 and ends at $p \cong 0$. The algorithm was validated using both computer simulations and *in-vivo* animal studies. A pig perfusion study dataset was used to show the advantages of this novel method over existing compressed sensing approaches. **Results:** the NC-PICCS method allows exact image reconstruction to be achieved from fewer projections than with methods such as standard CS or PICCS, both of which employ a convex ℓ_1 norm. For the synthetic data used, we were able to reconstruct the image with as few as 4 projections when a prior image was available in contrast to 12 projections without a prior image. When the method was applied to the *in-vivo* pig perfusion data the number of projections required for exact reconstruction was about 20. **Conclusions:** the NC-PICCS method provides a framework to highly reduce the dose in CT time series studies. Although there is no theoretical guarantee of finding a global minimum due to the non-convex nature of NC-PICCS, substantial empirical evidence suggests that it performs better than previously reported compressed sensing methods for CT reconstruction in practice.