AbstractID: 13354 Title: Dose reduction and image quality benefits using model based iterative reconstruction (MBIR) technique for computed tomography

Purpose: To demonstrate the image-quality benefits and potential for significant dose reduction with Model-Based Iterative Reconstruction (MBIR) technique incorporating physical model of computed tomography (CT) systems.

Method and Materials: A model based iterative reconstruction (MBIR), a maximum *a posteriori* (MAP) estimate with edge-preserving prior, has been developed for x-ray CT image reconstruction. It utilizes a more accurate physical model of the imaging chain accounting for system-optics, noise and non-idealities in the data, hence improves image quality compared to conventional filtered backprojection (FBP) at significantly reduced dose levels. In this work, a GE multi-slice CT system was used to acquire a set of multi-dose data and standard FBP reconstruction. For resolution assessment, a Catphan600® phantom was scanned at three dose levels (40, 20, and 10 mGy with 120kVp spectrum), and images were reconstructed using two methods: FBP with ASiR, and the MBIR. For artifact and image-quality evaluations, an anthropomorphic CT abdomen phantom (Kyoto Kagaku Co., Ltd) was scanned at four dose levels (120kVp spectrum with 225, 112, 54, and 27 mAs), and a comparative image-quality study between standard FBP and MBIR in slice and multi-planar reformat (MPR) modes was made. In addition, few clinical case studies were also used to compare the imaging performance in actual clinical data.

Results: From the resolution study, we found that even at $1/4^{th}$ dose, MBIR images have improved resolution at significantly reduced noise compared to standard state-of-the-art FBP with ASiR. Use of ASIR provides up to 50% dose reduction with equivalent FBP image-quality. For anthropomorphic phantom, even below $1/8^{th}$ dose, MBIR images outperformed the corresponding FBP images in both, slice and MPR modes, demonstrating immense potential for dose reduction, yet improved image quality, in clinical CT.

Conclusion: Results of the MBIR method demonstrated significant potential for dose reduction and image-quality improvements in clinical CT.