Abstract ID: 16638 Title: Further investigation of improved reconstruction algorithm for tomosynthesis plus few discrete projections: noisy projections and TV filtration

Purpose: Investigations over the past few years have demonstrated some of the benefits and shortfalls of tomosynthesis in radiation therapy for patient positioning or dose tracking. Tomosynthesis generates excellent image quality in one reconstruction plane; however, there is a loss of edge and frequency information in the additional planes due to the spatial incompleteness of the projection data. In our previous study, we demonstrated improved results from a new discrete frequency interpolation technique (DFIT), which is used to incorporate tomosynthesis limited arc projection data and three additional "filling" projections. Here, we continue investigation into DFIT by studying noisy projections for the data and incorporation of total variation (TV) noise reduction into the reconstruction processing.

Methods: For this investigation, we simulated a Shepp-Logan phantom to generate 93 parallel beam projections with ±5% uniform random noise. 90 of these projections were over a 90-degree tomosynthetic arc. The remaining three projections were evenly spaced (i.e. 22.5, 45, and 67.5 degrees from the end of the arc) to help "fill in" the incomplete data. DFIT+TV was used to reconstruct images by interpolating frequency values into the gaps of the Fourier spectrum, inverse Fourier transforming from frequency to image space, adding the resultant image to a filtered backprojection (FBP) image, and finally applying a TV noise reduction step.

Results: The images by traditional FBP, DFIT, FBP+TV and DFIT+TV are compared visually and using horizontal and vertical line profile plots. Additionally, contrast results are examined. The DFIT+TV images show improved edge delineation in the usual tomosynthesis "blurred" direction and improved reconstructed contrast.

Conclusions: The addition of limited "filling" discrete projections and DFIT+TV can be used to improve the reconstruction accuracy and quality of short arc imaging. Future work will study DFIT+TV in the cone beam geometry.

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