A VIRTUAL STRATEGY FOR FAST ITERATIVE RECONSTRUCTION IN INTERIOR TOMOGRAPHY WITHOUT A PRIORI KNOWLEDGE

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Abstract

Interior tomography (INT) enables 3D high resolution investigations of a sample in a small region of interest. Achieving high-quality reconstructions of underconstrained (i.e., undersampled and noisy) INT datasets is a challenge that cannot be addressed with analytical methods like filtered backprojection (FBP).

Here we propose a simple and computationally efficient strategy to perform iterative reconstructions of underconstrained INT tomograms without any a priori knowledge of the object support or the attenuation coefficients in specific regions. First, a so-called virtual sinogram is created with the following procedure: (i) reconstruction of the original dataset with edge-padded FBP (FBP-E) [1]; (ii) gradient removal [2]; (iii) setting to zero all pixels outside the field of view; (iv) forward projection of the image. This virtual sinogram, simulating a non-INT tomogram, is then reconstructed with the alternate direction method of multipliers plug-and-play [3].

The virtual strategy, tested on INT underconstrained simulated and real datasets, yields reconstructions of higher quality with respect to FBP-E. Furthermore, it is 3 orders of magnitude faster compared to standard iterative methods, due to the usage of the forward regridding projectors [4,5]. We show that reconstructions computed by the proposed algorithm can be more easily segmented with standard methods.

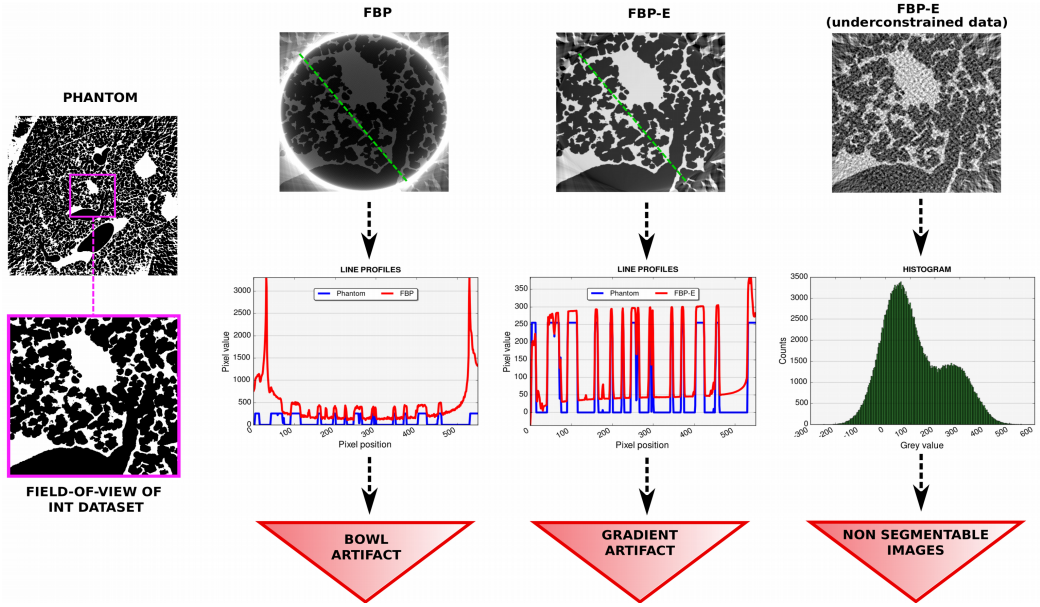

Figure 1: Simulation of the problems (bowl-artifact, gradient artifact, non-segmentability of low-quality analytical reconstructions) arising when dealing with INT datasets.

References

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