

AbstractID: 11082 Title: A Hybrid Algebraic/Inverse Radon Transform Method for Region of Interest Reconstruction of Computed Tomography Images

Purpose: To obtain good ROI image reconstructions from few projections, by mixing a global Inverse Radon Transform (IRT) algorithm with a local algebraic reconstruction algorithm.

Method and Materials: Algebraic methods are very efficient for small images; however, for large images the system of equations is prohibitively large. On the other hand, IRT works very well if sufficient low-noise projections are obtained, but is not accurate for a reduced number of projections. The basic idea of the present approach is to use IRT to generate an approximate image; the contributions to the projections from the ROI and from the rest of the image are subsequently separated; and the former are used for the algebraic reconstruction of the ROI. Various existing algebraic algorithms have been employed for the latter purpose (SVD, ART, EM, and TVR).

Results: Assuming that 20 projections are used, and a ROI of 10x10 (from an initial image of 256x256 pixels) is selected, the matrix of the system is reduced to only ~30,000 coefficients (instead of ~475,000,000); the linear system, that has been severely underdetermined (~7000 equations for 65,536 unknowns) becomes now overdetermined (~ 300 equations for 100 unknowns). The method have been tested for a Shepp-Logan phantom and 10, 20 and 30 projections; the Figure of Merit of the ROI reconstruction is sometimes better by orders of magnitude that the IRT reconstruction. *A priori* knowledge is easier to introduce in algebraic reconstruction; we will show the capabilities of the algorithm to detect a region of constant adsorption coefficient in a background of constant (but different) adsorption coefficient by using a hybrid IRT/TV algebraic reconstruction.

Conclusion: The hybrid Algebraic/IRT algorithm for ROI reconstruction has the potential to improve drastically the quality of the ROI images obtained from few projections.

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