ITERATIVE VS ANALYTIC RECONSTRUCTION METHODS FOR POSITRON EMISSION TOMOGRAPHY'S: COMBINING THE BEST OF BOTH APPROACHES

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Dedicated small animal positron emission tomography (PET) scanners have become one of the main tools in biomedical research. New technologies and new reconstruction methods have been developed to reach the high spatial resolution and sensitivity that these studies require. Among them, statistical reconstruction algorithms like OSEM have shown superior image quality than conventional analytic reconstruction techniques, like Filtered Back-Projection (FBP).

One of their key advantages is the ability to incorporate an accurate model of the PET acquisition process through the use of a modeled system response matrix (SRM). These two families of emission tomography reconstruction methods have been developed independently of each other, and this has created some difficulties in both approaches. For example, there is a lack of knowledge about how to find the optimal filter for the FBP reconstruction, or how to get rid of the increasing noise in the image as the iteration number progress in OSEM. Frequency analysis of PET data, commonly applied in analytical methods, can provide useful information for statistical reconstruction.

On the other hand, the main parameters of the SRM can be used to deduce analytically how to create a filter for FBP. A link between system response matrix parameters and the filters employed in FBP reconstructions is established in this work. Based on such a relationship, we propose a new method that combines data processing in the frequency domain, based on the SRM properties with the advantages of iterative reconstruction. The improvement in the quality of the images reconstructed with this new method is quantified.