Utilizing Wavelet Transform for ML Reconstruction in Positron Emission Tomography

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ABSTRACT

A classical technique for reconstruction of Positron Emission Tomography (PET) images from measured projections is based on the maximum likelihood (ML) parameter estimation combined with the Expectation Maximization (EM) algorithm. We incorporate the Wavelet transform (WT) into the ML framework, and obtain new iterative algorithms that incorporate local and multiresolution properties of the WT within the structure of the EM algorithm and the recently proposed conjugate barrier (CB) algorithm. Using the WT allows one to embed regularization procedures (filtering) into the iterative process, by imposing a subset of wavelet coefficients with a desired resolution on the objective function. Properties of the proposed algorithm are demonstrated on reconstructions of a synthetic brain phantom, and the quality of reconstruction is compared with standard methods.

Keywords – medical imaging, positron emission tomography, expectation maximization, wavelets.