Two-dimensional SPECT imaging with trucated projections

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Abstract

This work investigates extensions to SPECT of results that have been recently published for the inversion of the Radon transform from incomplete (truncated) projections. We assume that the activity function to be reconstructed lies in a convex region of uniform attenuation, so that the SPECT data may be described using the exponential Radon transform. Under this assumption, we first present a new unicity theorem based on the concept of differentiated-backprojection and Plemelj's formula for Hilbert transforms. Of course, this unicity theorem is of limited use in practice because unicity does not imply stability, i.e., unicity does not imply accurate reconstruction can be achieved from real data. However, using our theory, we are also able to discuss stability in a particular geometry. More specifically, we will present a method that allows accurate reconstruction of some regions-of-interest from truncated SPECT projections. Our results are significant for SPECT imaging, as they could allow more accurate reconstruction by focussing the data acquisition on the rays that are most relevant for the region-of-interest.