Detection of Non-Scattering Regions Within Diffusive Regions

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Abstract

Optical Tomography is usually modelled by the diffusion approximation, which is accurate under conditions generally met by light scattering in tissue. One important exception is the presence of non-scattering void regions such as occur in the Cerebral Spinal Fluid (CSF) and ventricles of the brain. One model that can accomodate these regions is the radiosity-diffusion model which treats the propagation of light in the voids by a non-local boundary condition. In this paper we consider a technique to find the location of the void regions by an explicit boundary representation and a perturbation method. The properties of the mapping from void boundary shape $\partial\Xi$ to measured data depends on the mutual visibility of points on $\partial\Xi$, which can lead to failure of a classical optimisation method. We therefore consider stochastic methods based on gradient annealing.