can be extended to the non-linear case (an iteratively linearized inverse model is usually used in optical mammography) and used to statistical priors about structure from MRI or x-ray images. While Li et al [13] demonstrated the utility of multiple such priors, they used a manual adjustment of the weights which could now be replaced with the proposed ReML method outlined here for optimal selection. Using this approach, physiological priors can also be introduced such as a priori expectations to the blood oxygen saturation levels or relative magnitudes of changes (similar to the imposition of a negative correlation between oxy- and deoxy-hemoglobin offered here).

A second application for this method is the analysis of multimodal data. In Huppert et al [21] we described pseudo-Bayesian joint-reconstruction for concurrent optical and functional MRI data, showing that the high temporal resolution of the optical data could be combined with the spatial information of the MRI to generate movies of brain activity matching the benefits of both modalities. In that early work, however, the measurement and parameter covariance were modeled using a priori estimates of these terms. Now, using ReML, the relative noise of the two modalities can be empirically estimated and an optimal combination of the two modalities can be fused to yield the same sorts of movies.

In conclusion, we have shown that the EM and ReML methods offer an empirical method for optimizing the inclusion of multiple prior information in the reconstruction of images from diffuse optical tomography.

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