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Spatio-Temporal Modeling for fRMI Data

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Abstract

Functional magnetic resonance imaging (FMRI) uses fast MRI techniques to enable studies of dynamic physiological processes at a time scale of seconds. This can be used for spatially localizing dynamic processes in the brain, such as neuronal activity. However, to achieve this we need to be able to infer on models of 4-dimensional data. Predominantly, for statistical and computational simplicity, analysis of FMRI data is performed in two-stages. Firstly, the purely temporal nature of the FMRI data is modeled at each voxel independently, before considering spatial modeling on summary statistics from the purely temporal analysis. Clearly, it would be preferable to incorporate the spatial and temporal modeling into one all encompassing model. This would allow for correct propagation of uncertainty between temporal and spatial model parameters. In this talk, the strengths and the weaknesses of currently available methods will be discussed based on hemodynamic response (HRF) signal modeling and spatio-temporal noise modeling. Specific application to a medical study will also be described.