Time series models for computing activation in fMRI

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Two novel time series models for computing activation in functional magnetic resonance imaging (fMRI) are introduced which utilize the inherently complex valued nature of fMRI data and model its temporal dependence with an AR(p) process. One is a complex AR(p) model that uses the complex data; the other is a Rician AR(p) model, where the Rician distribution of the magnitude is derived from treating the phase data as "missing" in an EM algorithm context. Both models are derived from Rowe & Logan (2004), which models the real and imaginary time series as independent, with phase-coupled means determined by linear model structure and the same temporal covariance matrix -- which we assign an AR(p) structure. Previous fMRI time series models are reviewed which use only the magnitude data, rely on distributional approximations, and/or make prewhitening approximations not made in these models.