Bayesian spectral modeling for multiple time series

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Abstract

The problem of modeling multiple time series in the spectral domain arises naturally in fields where information about frequency behavior is relevant and several signals are recorded concurrently. For example, multichannel electroencephalography (EEG) records measurements of electrical potential fluctuations at multiple locations on the scalp of a subject. I will present a hierarchical Bayesian modeling approach to spectral density estimation for multiple time series, where the log-periodogram of each series is modeled as a mixture of Gaussian distributions with frequency-dependent weights and mean functions. The implied model for each log-spectral density is a mixture of mean functions with frequency-dependent weights. In addition to accommodating flexible spectral density shapes, a practically important feature of the proposed formulation is that it allows for ready posterior simulation through a Gibbs sampler with closed form full conditional distributions for all model parameters. I will show results for multichannel electroencephalographic recordings, which provide the key motivating application for the proposed methodology. I will then present some extensions for non-stationary time series.