MODELING AND CLASSIFICATION OF MULTIPLE TIME SERIES VIA HIERARCHICAL MIXTURE OF AUTOREGRESSIONS

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Abstract

We propose a class of hierarchical-mixture-of-expert (HME) models to analyze multiple time series. Specifically, we consider HME models in which the experts, or building blocks of the model, are time-varying autoregressions (TVAR) in the univariate case, and vector autoregressions (VAR) in the multivariate case. The TVAR-HME and the VAR-HME models considered here partition the covariate space, specifically including time as a covariate, into O overlapping regions called overlays. In each overlay, a number M of TVAR or VAR models compete with each other so that the most suitable model for that overlay will be favored by a large weight. The weights have a particular parametric form that allows the modeler to include relevant covariates other than time.

The proposed class of models provides a way to infer the underlying structure of multiple non-stationary time series. In addition, these models allow the assessment, in a probabilistic fashion, of the various states of the multiple time series over time.

Issues related to parameter estimation, model selection, model checking and latent structure in multiple time series are investigated. We apply the new methodology to the analysis of multiple channel EEG data sets.

Key Words: Multivariate time series, Mixture-of-Experts, Latent Structure, Autoregressions