Zheng, Kai; Li, Yuying; Xu, Weidong

Regime switching model estimation: spectral clustering hidden Markov model. (English)


Summary: We propose a novel method for Markov regime switching (MRS) model estimations by spectral clustering hidden Markov model (SC-HMM). The proposed SC-HMM exploits the Markov property of hidden states and utilizes pairwise feature similarities for latent state identifications. It can be applied to general hidden Markov models (HMMs) with continuous observations. In contrast to the maximum likelihood estimation (MLE), SC-HMM predicts latent states and yields conditional distribution statistics without knowledge of types of conditional distributions. To illustrate, SC-HMM is first applied to a simple HMM with discrete observations. We consider the MRS model estimation with continuous observations to further demonstrate SC-HMM. Specifically, based on local observations, we propose a set of features for the MRS estimation. A similarity matrix is determined from derived features and spectral clustering predicts latent states. Conditional distribution statistics and transitional probabilities are estimated based on identified latent states. By conducting simulation studies on both two-state and three-state MRS estimations, we demonstrate that, in comparison with MLE, the proposed SC-HMM is more robust. Furthermore, we demonstrate the validity of SC-HMM by estimating a two-state MRS from the S&P/TSX Composite Index daily and monthly data from 1977 to 2014.

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60Jxx Markov processes
62Pxx Applications of statistics
91Gxx Actuarial science and mathematical finance

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data mining; spectral clustering; hidden Markov models; Markov regime-switching; feature construction

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