MASTER'S THESIS

Some contributions to estimation in advanced time series models--VARMA and BSM

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SOME CONTRIBUTIONS TO ESTIMATION IN ADVANCED TIME SERIES MODELS - VARMA AND BSM

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Abstract

Maximum likelihood (ML) estimation, by means of the Kalman filter and state space models, has been widely used in time series analysis. In practice, many time series models can be cast in state space forms. In this thesis, two well-known models, VARMA and BSM, are considered. In the process of getting final ML estimates, good initial guesses are usually required. Two fast algorithms, the modified Spliid algorithm (MSP) and the accelerated EM algorithm, are proposed in this thesis for VARMA and BSM respectively. The results indicate that the performances of the algorithms are better than the original ones. Once initial guesses are obtained by these new algorithms, the likelihood function can then be maximized by some nonlinear optimization methods. Since the number of parameters involved in VARMA is usually very large, a new large-scale optimization algorithm, truncated Newton method with nonmonotone line search technique, is suggested. For BSM, the parameters usually must satisfy some constraints. Thus, a new optimization algorithm, the SNTO method, which is suitable in this case, is introduced. Numerical results show that the truncated Newton method is efficient for problems with large number of parameters. On the other hand, the SNTO method is particularly useful for multi-modal functions. In addition, a parallel version of SNTO is presented in this thesis, in order to show the abilities of parallel algorithms in optimization problems. Real-life data are fitted by different models, including VARMA and BSM. Corresponding forecasting results are recorded. The results show that both VARMA and BSM are adequate for forecasting. Further developments, including parallel algorithms in optimization and Kalman filtering, and some new approaches in state space modeling are suggested.

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