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PhD Thesis Presentation

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Estimation of Covariance Matrix for High-Dimensional Data and High-Frequency Data

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ABSTRACT

My thesis has two chapters. In the first chapter, we discuss a parsimonious approach to estimation of high-dimensional covariance matrices via the modified Cholesky decomposition with lasso. Two different methods are proposed. They are the equi-angular and equi-sparse methods. We use simulation to compare the performance of the proposed methods with others available in the literature, including the sample covariance matrix, the banding method, and the L_1-penalized normal loglikelihood method. We then apply the proposed methods to a portfolio selection problem using 80 series of daily stock returns. To facilitate the use of lasso in high-dimensional time series analysis, we develop the dynamic weighted lasso (DWL) algorithm that extends the LARS-lasso algorithm. In particular, the proposed algorithm can efficiently update the lasso solution as new data become available. It can also add or remove explanatory variables. The entire solution path of the L_1-penalized normal loglikelihood method is also constructed.

The second chapter is about multivariate volatility estimation. We propose an estimator that extends the realized kernel method, which was introduced for univariate data. We look at the estimator from a different view and suggest a natural extension. Several asymptotic properties are discussed. Also we investigate the optimal kernels and provide a regularization method that enables us to obtain positive-definite covariance matrix. We conduct a simulation study in order to verify the asymptotic theory and see the definite sample performance.
