

Bachelor Project

Modern Covariance Matrix Approximation in Finance

Duration: 4 months

Mentors at USI: Prof. Olaf Schenk, Aryan Eftekhari

Working place: Lugano, Switzerland

Prerequisites

The candidate should have working experience with Matlab and have completed coursework in linear algebra and statistics. During the BSc project, you will be working together with the researchers at the ICS and will have the chance to get familiar with the most important libraries used in numerical linear algebra.

Estimating (inverse) covariance matrices is a ubiquitous task in multivariate analysis that is particularly important in financial applications. An accurate approximation of such matrices becomes notoriously difficult when the number of observations is less than the number of random variables. In such cases, the unbiased sample covariance matrix has a high degree of uncertainty. This research project explores modern techniques that address these challenges.



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The two research directions we will pursue are "covariance matrix cleaning" and "penalized maximum log-likelihood." In the first method, we augment the unbiased sample covariance matrix based on some "a priori" (probabilistic) knowledge. The second method approaches the problem by minimizing the L1 regularized likelihood function to recover a sparse approximation of the (inverse) covariance matrix. Using existing frameworks, we will use the approximated (inverse) covariance matrix to solve the optimal mean-variance portfolio of financial assets.

Contact information and application

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