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Introduction to the Issue on Signal Processing Methods in Finance and Electronic Trading

Advances in digital processing, storage, and inter-networking of data and information are increasingly relevant in the global economy. The progress in low-latency computer networking and the affordability of high-performance computing have had significant impact in creating large scale market opportunities for numerous services and products. The financial services industry has already deployed state of the art data collection, distribution, and market execution infrastructure to benefit from this technological progress. These developments offer emerging inter-disciplinary research opportunities for scientists, engineers, and financial industry participants. The special issue compiles such research contributions in financial applications coming from the fields of mathematics, finance, and engineering in order to foster future scientific cross-fertilization.

There are ten papers included in the special issue with research focus spanning from the use of various signal processing methods and techniques for problems in finance applications to the evaluation of companies for their success in internationalization. First, the paper by Agrawal, Mohapatra, and Pollak examines the Capital Asset Pricing Model (CAPM) and quantifies its performance using historical data of the S&P 500 from 1996 to 2010. Zhang, Liu, and Yu forward in their paper a non-analytic instantaneous frequency utilized in a new stock price prediction method and present its effectiveness based on experiments using Hong Kong Hang Seng Index data. In their paper, Akansu and Torun suggest a Toeplitz approximation to the empirical correlation matrix of asset returns using an AR(1) model and its eigenanalysis, offering an analytical framework for market noise filtering and risk management. Djuric, Khan, and Johnston propose a particle filtering method for estimation of the posterior distributions of the log-volatility that is evaluated on S&P 500 data. Rubio, Mestre, and Palomar, in their paper, consider the use of covariance matrix estimators based on shrinkage and weighted sampling utilized for performance analysis and optimal selection of large minimum variance portfolios. Bean and Singer combine various insights from universal portfolios research in order to construct more sophisticated algorithms taking into account transaction costs. Christensen, Murphy, and Godsill propose a new trading algorithm from the popular trend following class of trading strategies employing Bayesian filtering techniques to extract a trend from price observations. Then, Ponta, Scalas, Raberto, and Cincotti present a statistical analysis and an agent-based market microstructure modeling for high-frequency trading simulated by using Genoa Artificial Stock Market data in their paper. Landa-Torres, et al., in the next paper, propose a new method to evaluate the internationalization success of companies that employs a grouping based Harmony Search (HS) approach and an Extreme Learning Machine (ELM) ensemble focusing on the export success of manufacturing companies in Spain. In the concluding paper, Ahrabian, Took, and Mandic forward a trading algorithm that makes its decisions based on phase synchronization between oscillatory components of asset pairs identified by using the Synchrosqueezed Transform (SST).

We expect the signal processing theory and methods coupled with high-performance DSP (HP-DSP) technologies, including GPU and FPGA computing, to play a much more significant role in the financial industry in the coming years by their successful use for improved real-time risk management practices and market efficiency through powerful analytical tools and execution. We hope that this special issue serves the Signal Processing community by increasing awareness of and participation in future research and development on financial signal processing and electronic trading.

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