

"Machine Learning in Economics"
Interactive Book of Abstracts*

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Thursday, 17.05.2018	Friday, 18.05.2018
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2 Abstracts

2.1 [Wolfgang Karl Härdle](#)

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Welcome Speech

Econometrics looks at raw numbers and informational objects created by different economic data. The Digital Society creates information and numbers from many scientific disciplines. The assessment of data though makes is hard to find structures and requires a skill full analysis of this massive raw material. This is in particular true for the economic sciences. The thoughts on machine learning presented here meets these challenges and offers ways to handle the questions arising in this evolving context. We propose three levels of analysis and lay out how one can react to the challenges that come about. Concrete examples concern Credit default swaps, Dynamic Topic modeling, Crypto currencies and above all the quantitative analysis of real data.

2.2 [Piotr Jaworski](#)

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On Evolution of the Yield Curve of Hybrid Bonds

Hybrid securities provide long term funding for financially sound issuers. Since they are more risky they offer the higher interest than the standard senior bonds.

In my talk, on the example of the Volkswagen AG case, I will discuss the the market performance of both types of financial instruments in the scenario of an extragoneous shock. I will compare the behaviour of the yield curves of hybrid bonds versus the senior ones. It shows that the spread between yields is more volatile for small maturities then for longer ones.

2.3 [Alisa Kolesnikova](#)

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Volatility Index for Cryptocurrencies - VCRIX

The cryptocurrency market brings along higher historical risk compared to traditional markets. Yet the implied volatility is of even higher importance since it allows for an expectation about the future risk. For the US market CBOE offer the VIX, in Germany VDAX is provided as a measure for implied volatility, both based on the respective options market. Given the absence of a developed cryptocurrency derivatives market, a methodology gets introduced to create VCRIX, a parent index to CRIX. VCRIX was able to grasp the risk induced by the cryptocur-rency market accurately, providing an MDA of 51 % compared to CRIX realized volatility. In an application of

the methodology to the US market, we are able to track the performance of VIX with an MDA of 60 %. VCRIX is shown to be an accurate measure for implied volatility, thus proved to be a proper basis for option pricing.

2.4 [Ostap Okhrin](#)

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Statistics is Everywhere

Why some board games are very interesting for children, whereas others are extremely boring? Who is the target audience of the film "Twilight"? How is the weather going to be tomorrow or the day after tomorrow? How in January next year? Who is genetically closer related: pigeon and parrot or eagle and falcon? Can a writer be identified by the style of writing? This talk will take you on a journey through statistics.

2.5 [Andrea Barletta](#)

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It Only Takes a Few Moments to Hedge Options

In a complete and arbitrage-free market, the uncertainty of an option payoff can be hedged by taking offsetting positions in one or several securities deemed to be driving its risk. In principle, hedge ratios such as the delta and the gamma are model-independent quantities and can be determined based on the knowledge of the state-price density (SPD). However, the amount of information necessary to identify the SPD could be collected only if there were infinitely many derivative securities traded in the market. Thus, in all practical situations, hedge ratios must be estimated based on an incomplete source of information. Here, it is shown how to address this issue within a nonparametric framework involving orthogonal polynomials.

2.6 [Jiao Can](#)

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Optimal Design of Product Reliability, Sales and Promotion under the Nonrenewable Warranty

We propose an optimization model to jointly design and determine product reliability, warranty policy, regular price, promotion price, and lengths of regular sales and promotions. These decision variables are correlated and influence the quantity of sales, the cost of research and development, the production cost, the warranty cost, and ultimately the total profit attainable from launching a new product.

2.7 Magdalena Mojsiewicz

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Co-author: Małgorzata Guzowska

Modelling of Mortality among Old Groups

In a paper, authors present a numerical calculation related to the probability of dying within a year and mortality rate among people aged 80 years and over. According to "Force of Mortality between the Ages 80 and 120" (Theatcher, Kannisto, Vaupel), the applicability of the following models was analyzed: Heligman-Pollard, Kannisto, logistic and Coale-Kisker. After appropriate modification of the formulas, the authors proposed a hyperbolic-tangent model.

2.8 Jenher Jeng

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Very Deep Learning on Domino Effects with the Capital Market Simulation Game WALEX

WALEX is a game system designed to simulate the capital market and train people to learn global dynamic asset allocation GDAA. Domino effects, defined to describe long short-term memory (or even long-memory) properties of financial time series in a practical sense, can provide the key for machine learning algorithms to analyze capital markets' behaviors in much deeper insights and more structural perspectives. In this talk, based on the game mechanism of WALEX in the domino-formation of critical historic market events, we present a framework of combining numerical signal-processing and text-mining techniques to train computer programs of intelligence augmentation to build an ambitious platform of macro/robo hybrid-advisory for personalized investment portfolios.

2.9 Junjie Hu

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Electricity Consumption Optimization Based on Time Series Forecasting

In this project, we aim to use both econometric models and deep learning method(LSTM) to forecast electricity consumption of a chemical product. Using production schedules as exogenous variables, both approaches reach high forecasting accuracy. On our further study, we will propose optimization solutions for production and configure trading strategy on energy market based on our forecasting result.

2.10 Robert Navrátil

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Co-author: Jan Večeř

Maximum Volatility Portfolio

High volatility is usually considered as undesirable property in finance as it is synonymous with risk. Given a reference asset, such as a stock index and its individual components, there is a trading strategy that trades in the individual assets subject to no shorting constraints that maximizes the volatility with respect to the index. Such strategy has many positive properties with regard to several well established concepts of quantitative finance. Moreover, the strategy is closely related with a passport option on the actively traded portfolio. We shall show the performance of the maximal volatility strategy on world currencies.

2.11 Mariusz Doszyń

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Intermittent Demand Forecasting: Empirical Verification

Forecasting methods are often valued by means of simulation studies. For intermittent demand items there are often very few non-zero observations, so it is hard to check any assumptions. Therefore, it seems important to verify the forecasting methods on the basis of real data. Therefore the main aim of the article is an empirical verification of several forecasting methods applicable in case of intermittent demand.

In the article six methods were applied to construct separate forecasting systems: Croston's, SBA (Syntetos-Boylan Approximation), TSB (Teunter, Syntetos, Babai), MA (Moving Average), SES (Simple Exponential Smoothing) and SESAP (Simple Exponential Smoothing for Analogous subPeriods). The latter method (SESAP) is an author's proposal dedicated for companies facing the problem of seasonal items. A data set from the real company was used to apply all the above forecasting procedures. That data set contained monthly time series for about nine thousands products. The forecasts accuracy was tested by means of both parametric and non-parametric measures.

The general conclusion is that in the analyzed company a forecasting system should be based on two forecasting methods: TSB and SESAP, but the latter method should be applied only to seasonal items (products sold only in specific sub periods). It also turned out that Croston's and SBA methods work worse than much simpler methods, such as SES or MA.

2.12 [Alla Petukhina](#)

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Portfolio Allocation Strategies with Cryptocurrencies

Current study aims to identify pro and con arguments of crypto-currencies as a new asset class in portfolio management. We investigate characteristics of the most popular portfolio-construction rules such as Mean-variance model (MV), Risk-parity (ERC) and Maximization diversification (MD) strategies applied to the universe of cryptocurrencies and traditional assets. We evaluate the out-of-sample portfolio performance as well as we explore diversification effects of incorporation of crypto-currencies into the investment universe. Taking into account a low liquidity of crypto-currency market we also analyze portfolios under liquidity constraints. The empirical results show crypto-currencies improve the risk-return profile of portfolios. We observe that crypto-currencies are more applicable to target return portfolio strategies than minimum risk models. We also found that the MD strategy in this market outperforms other optimization rules in many aspects.

2.13 [Alice Buccioli](#)

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Portfolio Optimization in Contagious Markets

We study the impact of market contagion on portfolio management. To model possible recurrence in the arrival of extreme events, we equip classic Poisson jumps with long memory via past-weighted randomization of the likelihood of their occurrences (Hawkes processes). Within this framework, we tackle the problem optimal portfolio selection in terms of ES, consistent with the practice in the financial industry. We use GMM to estimate the model on three US sector indexes. The moment conditions of the model are computed efficiently in closed form applying a novel technique. Given parameter estimates, we minimize, at a monthly frequency in the period 2001-2016, the ES of a portfolio consisting of the three indexes. We find that the weights of the optimal portfolio are significantly adjusted when the level of contagion is high. Finally, we perform an extensive out-of-sample back-test and find that the Hawkes jump-diffusion model outperforms two traditional models that are commonly implemented.

2.14 [Xinwen Ni](#)

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LDA application in the analysis of Christmas Songs, NASDAQ News and Shakespeare

We are facing the information explosion and data flood. The exponential growth of the new media, such as Twitter and Facebook, results an big influence in our political and financial decisions, which makes the analysis of them more pressing and important. Latent Dirictlet Allocation (LDA), a generative statistical model, can be

widely applied in topic modeling. With general explanation of LDA, I will show some basic analysis results about Christmas songs, NASDAQ News and the works of Shakespeare.

2.15 [Iryna Okhrin](#)

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Sentiment Analysis for Movie Recommender System

We apply text mining tools to predict the success of a Hollywood movie before the release date. Empirical evidences show that a movie with an intensive (and expensive) promotion becomes sometimes a low rating on the Internet Movie Database (IMDb) by viewers and some movies get an unexpected high rating. What are the first signs that the movie will be successful or will fail? We study the dependence between the movie rating and the promotion before/after the release date, the activity on twitter before/after, we make an analysis of the messages on twitter.

2.16 [Andrija Mihoci](#)

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Co-authors: Wolfgang Karl Härdle and Christopher Hian-Ann Ting

Adaptive Order Flow Forecasting with Multiplicative Error Models

A flexible statistical approach for the analysis of time-varying dynamics of transaction data on financial markets is here applied to intra-day trading strategies. A local adaptive technique is used to successfully predict financial time series, i.e., the buyer and the seller-initiated trading volumes and the order flow dynamics. Analyzing order flow series and its information content of mini Nikkei 225 index futures traded at the Osaka Securities Exchange in 2012 and 2013, a data-driven optimal length of local windows up to approximately 1-2 hours is reasonable to capture parameter variations and is suitable for short-term prediction. Our proposed trading strategies achieve statistical arbitrage opportunities and are therefore beneficial for quantitative finance practice.

2.17 [Yegor Klochkov and Jigao Yan](#)

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Co-authors: Cathy Yi-Hsuan Chen and Wolfgang Karl Härdle

Network autoregression with estimated adjacency matrix

In this ongoing work we consider a vector autoregressive model with network effect. Zhou et al. (2017) proposes a model with regression of a value of a networks's unit to a lagged mean of those connected to it. In real life

application, however, one does not usually has the adjacency matrix at hand. We suggest to use Lasso estimator with linear restrictions to estimate sparse weighted adjacency matrix.

2.18 [Krzysztof Dmytrów](#)

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Application of Multiple-Criteria Decision-Making Techniques for Selected Take-out Techniques in Order-picking

For the shared storage system, selection of locations in the order-picking is the multiple-criteria decision-making problem. In the literature of the subject there are several take-out strategies. The goal of the article is the comparison of the results of designations of the picker's route obtained by means of the two take-out strategies (priority of partial units and quantity adjustment) with the results obtained for other system of weights. The Composite Measure of Location's Attractiveness (Polish abbreviation - TMAL) method with three decision criteria: distance from the I/O point, degree of demand satisfaction and the number of other picked products in the neighbourhood of analysed location will be used. After selection of locations, the picker's route will be designated by means of the s-shape heuristics. The analysis will be performed by means of the simulation experiment, where one hundred of 10-element orders will be generated for each method and the picker's route length and time will be compared.

2.19 [Jan Večeř](#)

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Dynamic Probability Scoring Rules, Statistical Martingale Testing and Model Selection

We present a novel approach for measuring the quality of a time evolving probability estimates. The basic idea of our approach is that if we have two different probability estimates of the outcome, one can use this discrepancy for setting a trade of these two values against each other. The exact trading price set by this procedure and the corresponding volume is determined by optimization of some utility function that describes the hypothetical behavior of these two bettors. This creates a sequence of trades that matches every discrepancy that was not reflected in the past trades. We show that the expected profit loss of the true probability series is positive against any other probability sequence regardless of the choice of the utility function. As the true probability evolution is a martingale, this procedure can be used as a martingale test. In addition, this approach also gives a procedure to select a statistically optimal model, so it can also be used for model selection.

2.20 [Anna Zalewska](#)

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Modified CoVaR in Portfolio Optimization

The purpose of this talk is to offer an insight into the portfolio optimization problem with risk measured by the modified conditional value-at-risk which is an alteration of CoVaR as introduced by Adrian and Brunnermeier, i.e. it is based on the stress event of chosen asset being at most (instead of equal to) the opposite of its value-at-risk level. The problem is considered under the normality assumption. Using modified CoVaR significantly complicates the model and requires the use of copulas.

2.21 [Sascha Vökler](#)

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Co-author: Peter Kurz

Computational Intelligence in Product-line Optimization: Simulations and Applications

Product-line optimization based consumer preferences data collected via conjoint analysis is an important issue to market researchers. Since it is a combinatorial NP-hard optimization problem, several computational intelligence heuristics have been proposed to ensure at least near-optimal solutions. Except the genetic algorithms and simulated annealing none of these approaches were compared to each other in terms of solution quality. This work tries to close this gap. Therefore existing algorithms for the single product case like ant colony optimization and particle swarm optimization will be extended to product-lines and other algorithms like the multiverse optimizer, harmony search and tabu search are introduced. The algorithms' performances will be demonstrated on market share maximization in two ways: a Monte Carlo simulation with artificial conjoint data and an example with real conjoint data from a prepaid and postpaid study conducted by TNS Infratest in 2014.

2.22 [Jacek Batóg](#)

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Co-author: Iwona Foryś

Estimation of Airport Noise Compensation for Real Estate Owners: Application of Cluster Analysis and GLMs

In the paper a problem of noise compensation related to the localization of real estate (single family houses) in the restricted areas created around airports will be undertaken. To estimate the level of those indemnities we will use general linear models. The set of explanatory variables will contain quantitative (i.e. floor space,

ground surface, distance from the airport), as well as qualitative attributes (technical condition, restricted area occurrence, subjective localization) of real estates. The influence of outliers indicated by means of cluster analysis and existence of real estate submarkets on the received results will be also considered.

2.23 [Georg Pflug](#)

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Stochastic Quasigradient Methods with Applications in Shape Optimization

We consider stochastic gradient- and quasigradient methods in Hilbert spaces and investigate their convergence properties. The application of these methods is not in economics (although it might be), but in stochastic shape optimization. We study the problem of finding the optimal shape of an object under random forces and disturbances. The optimal shapes (at the moment in 2D) are then printed on a 3D printer as will be demonstrated.

2.24 [Raphael Reule](#)

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Programming and Prejudice: Interdisciplinary Regulation with Machine Learning Methods

While the digital economy is unfolding with unprecedented speed, the legal system in both scholarship and practice is lagging behind in its attempt to accommodate these new economic phenomena and innovations. While a number of government and legislative reports have highlighted the necessity to adapt the legal system to the reality of the digital economy powered by machine learning, legislation and legal scholarship has only insufficiently heeded this call...

2.25 [Zdenek Hlávka](#)

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Co-authors: M. Hušková and S.G. Meintanis

Detection of Change-Points in Martingale Difference Sequences

We discuss testing procedures which detect if the observed time series is a martingale difference sequence. Furthermore, tests are developed that detect change-points in the conditional expectation of the series given its past. The test statistics are formulated following the approach of Fourier-type conditional expectations and have the advantage of computational simplicity. The limit behavior of the test statistics is investigated under the null hypothesis as well as under alternatives. The performance of the bootstrap version of the test is compared in finite samples with other methods for the same problem and a real-data application is also included.