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BOOK OF ABSTRACTS

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■ TD-32

Thursday, 13:30-15:00, Room G-220

Neural networks

Chair: *Stefan Lessmann*, Institute of Information Systems, University of Hamburg

1 - Visualizing Forecasts of Neural Network Ensembles

Hans-Jörg von Mettenheim, Leibniz Universität Hannover, Institut für Wirtschaftsinformatik, *Cornelius Köpp*, *Michael H. Breitner*

Advanced neural network architectures like, e.g., Historically Consistent Neural Networks (HCNN) offer a host of information. HCNN produce distributions of multi step, multi asset forecasts. Exploiting the entire informational content of these forecasts is difficult for users because of the sheer amount of numbers. To alleviate this problem often some kind of aggregation, e.g., the ensemble mean is used. With a prototypical visualization environment we show that this might lead to loss of important information.
It is common to simply plot every possible path. However, this approach does not scale well. It becomes unwieldy when the ensemble includes several hundred members. We use heat map style visualization to grasp distributional features and are able to visually extract forecast features. Heatmap style visualization shows clearly when ensembles split into different paths. This can make the forecast mean a bad representative of these multi modal forecast distributions. Our approach also allows to visualize forecast uncertainty. The results indicate that forecast uncertainty does not necessarily increase significantly for future time steps.

2 - Self-Organizing Map of Exchange Rates and Oil and Gold Prices

Sebastián Lozano, Dept. of Industrial Management, University of Seville, *M^{a} Reyes Gómez-Medina*, *Jose L. Salmeron*

In this research the Self-Organizing Map (a.k.a. Kohonen Maps) is applied to the analysis of the interrelationships and dynamic of three important markets: exchange rates (FOREX), oil (Brent) and Gold. The map is trained with approximately 2500 input patterns corresponding to daily data of five variables, namely US $/ EUR , US $/Yen and US $/£ official exchange rates, Brent price and Gold price. An initial map is built and later refined after some input data preprocessing. Viscovery SOMine® is used for the computation and results visualization. The results show the existence of distinct clusters of prototypes corresponding to different time intervals. Each time interval corresponds to different relative values of the input variables. The map, thus, captures the dynamics of these variables. Out-of-sample quantization error is lower for the exchange rates than for the oil and gold prices. It is recommended to re-calibrate the map periodically so as to incorporate the most recent data and thus keep it updated.

3 - Causal-Retro-Causal Neural Networks for Market Price Forecasting

Hans Georg Zimmermann, Corporate Technology CT IC 4, Siemens AG, *Ralph Grothmann*

Physical dynamical systems are modeled in a causal manner, but market behavior is caised by human interaction. Thus, it includes an aspect of rational behavior, i.e. utility optimization. The adjoint equations of an optimal control problem have naturally a retro-causal formulation. The realization of a causal-retro-causal approach with recurrent neural networks allows a significant improvement of the modeling of market prices. We exemplifiy our model on the forecasting of commodity prices.

■ FA-32

Friday, 08:30-10:00, Room G-220

Finance

Chair: *David Wozabal*, Business Adminstration, University of Vienna

1 - Multilevel models in time series forecasting

Vadim Strijov, Computing Center of the Russian Academy of Sciences

Time series in the financial sector may include annual, weekly and daily periodicals as well as non-periodical events. The energy price and consumed volume time series; the time series of consumer sales volume could be the examples. The generalized linear autoregressive models are used to forecast these time series. The samples of the main time-period of the time series correspond to the features of the forecasting models. To boost the quality of the forecast, two problems must be solved. First, we must select a set of features, which forms the model of optimal quality. Second, we must split the time series on the periodical and eventual segments and assign a model of optimal quality of each type of segments. To solve these problems, we estimate the distribution of the model parameters using coherent Bayesian inference. The optimal model for a given time-segment has the most probable value of maximum evidence, which is estimated under conditions of the stepwise regression: the features are added and deleted from the active feature set towards the evidence maximizing. The splitting procedure includes analysis of the model parameters distributions. Consider two forecasting models that are defined on their non-intersecting consequent time-segments. These models are different if the Kullback-Leibler distance between the distributions of their parameters is statistically significant. In this case the time-segment split is fixed; otherwise we consider the models equal and join the time-segments. The proposed approach brings the most precise time-segment splitting than the dynamic time warping procedure and causes increase of the forecasting quality. As an illustration we discuss the automatic detection of seasonal sales and promotions of consumer goods.

2 - An ex-post assessment of forecasting techniques for transport demand

Vassilios Profillidis, Civil Engineering, Democrutis University of Thrace

The science and art of forecasting the evolution of an existing transport phenomenon makes use of various methods: qualitative (Delphi, market survey, scenario writing), statistical (projection of trends, time - series), econometric and gravity. Each method is based on a set of assumptions and has a varying degree of forecasting ability. Usually forecasters argue for the strengths of their method at the moment of doing the forecast. Very seldom, however, an ex - post assessment of forecasts is conducted. In this paper, forecasts conducted by the author for the demand of an airport and a rail connection, which have been published, are evaluated ex-post. It is explained whether and to which degree departing assumptions have been verified, what was the impact of the chosen forecasting technique, how trustworthy the various indices of forecast were. In addition to traditional forecasting techniques, as mentioned above, new techniques such as the fuzzy method can be employed, while considering whether they can contribute to the improvement of accuracy of forecasts.

3 - Formulation of a Sale Price Prediction Model Based on Fuzzy Regression Analysis

Michihiro Amagasa, Management Information, Hokkai Gakuen University