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Dean: Prof. T. Sedlarski

TOPICS OUTLINE
for enrollment exam in doctoral program

ANALYTICAL RESEARCH ON DATA /DATA SCIENCE/

Professional direction 3.8 Economy

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1. Modeling and forecasting through regression analysis.
2. Function of the prediction error.
3. Empirical forecasting methods. Moving average. Exponential smoothing.
4. ARIMA(p,d,q) processes with a seasonal factor and fractionally differentiated ARIMA(p,d,q).
5. Bayes theorem . Big Data Analysis Applications.
6. Classification. Logistic regression. Linear and non-linear discriminant analysis.
7. Evaluation of analytical models by cross-validation. A trade-off between bias and variance.
8. Principle of the rolling sample. Monte Carlo simulations.
9. Selection of variables when forming a forecast. Ridge-regression and the LASSO approach.
10. Multivariate statistical analysis. Principal component analysis.
11. Building optimization models. Types and practical solution.
12. Polynomial regression. Modeling using spline functions .
13. Frequency analysis. Spectral density.
14. Data filtering. Wavelet filters for predictive modeling.
15. Support vector machines.

Literature :

1. Hastie, T., Tibshirani , R., Friedman, J., 2009. The elements of statistical learning, Springer.
2. James, G., Witten, D., Hastie, T., Tibshirani , R., 2013. An introduction that statistical learning with applications in R., Springer.
3. Ruppert, D., 2011. Statistics and data analysis for financial engineering. Springer.
4. Tsai , R., 2010. Analysis of Financial Time Series, 3d edition. Wiley Series in Probability and Statistics, John Wiley & Sons, Inc., Hoboken, New Jersey.
5. In, F. & Kim, S., 2013. An Introduction that Wavelets Theory in Finance: A Multiscale Approach. Singapore: World Scientific Publishing Co. Pte. Ltd.
6. McLeish, DL, Monte Carlo Simulation and Finance. John Wiley & Sons, Hoboken, New Jersey, 2005.
7. Cochrane, J., Time Series for Macroeconomics and finance, University of Chicago, 1997.
8. Gençay , R., F. Selcuk , and B. Whitcher , An Introduction that Wavelets and Other Filtering Methods in Finance and Economics, Academic Press, New York, 2002.

Head department:

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Assoc. Dr. B.Lomev