12811 - ASTP - TIME SERIES ANALYSIS AND FORECASTING

Coordinating unit: 200 - FME - Faculty of Mathematics and Statistics
Teaching unit: 715 - EIO - Department of Statistics and Operations Research
1004 - UB - (ENG)Universitat de Barcelona

Academic year: 2009
Degree: MASTER IN MATHEMATICAL ENGINEERING (Syllabus 2006). (Teaching unit Optative)
DEGREE IN MATHEMATICS (Syllabus 1992). (Teaching unit Optative)
ECTS credits: 6

Teaching languages: Catalanian

Learning objectives of the subject

The course is aimed at teaching students to deepen their knowledge of uni- and multivariate time series systems and analysis. They should acquire the theoretical foundation and the methodology for making forecasts when random variables that are not mutually independent are available.

* To learn the necessary techniques and algorithms for automatic model identification as well as for automatic detection of atypical data.
* Students should learn the state space formulation in Markovian models and its use for filtering and smoothing.
* Furthermore, they should learn the Kalman filter and its use for parameter estimation.
* To acquire the knowledge necessary for analyzing and modelling multivariate time series using dynamic regression (transfer function)
* To learn about models with conditional heteroscedasticity applied to economic and financial series, etc., in particular, those for estimating volatility (ARCH, GARCH, ...)

Skills to be acquired
* Learn and know how to use univariate and multivariate models for time series.
* Given a real time series, be able to decide which type of model is the most appropriate.
* Utility and programming of estimation and forecasting algorithms using R.
* Present the analytical results of a real case.

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<td><strong>Automatic detection of atypical data</strong></td>
<td>Types of atypical data. Treatment of missing observations. Estimation of weekday and Easter effects.</td>
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<td><strong>State space models</strong></td>
<td>The Kalman filter. Representation in state space of the ARMA and ARIMA models. Estimation algorithms.</td>
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<td><strong>Dynamic regression</strong></td>
<td>Transfer function. Introduction to multivariate processes.</td>
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<td><strong>Models with conditional heterocedasticity condicional</strong></td>
<td>Statistical characteristics: Asymmetry and Curtosi. ARCH and GARCH models. Properties. Identification and verification of these models</td>
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Qualification system
Based on the exercises solved and handed in by students as well as on the answers to the tests set in the lab sessions, together with the reports on real time series and the partial and final exam results. The final course result (N) is obtained from the partial exam result (Np), the result of practical work carried out in the lab sessions (Nl), the modelling of a real case (Nmr) and the final exam result (Nf), according to the expression:

\[ N = 0.2 \times N_p + 0.1 \times N_l + 0.2 \times N_{mr} + 0.5 \times N_f \]

Prior skills
* Basic skills in mathematical statistics: conditional distributions, momentum of these distributions (expectation and conditional variance).
* Knowledge of multivariate probability distributions, the momentum of these distributions.
* Know how to use statistical software packages: Minitab, R and SAS.

Bibliography
Basic:

Complementary: