Research techniques for prediction

Academic Year: (2020 / 2021) **Review date: 05-07-2020**

Department assigned to the subject: Department of Statistics

Coordinating teacher: ALONSO FERNANDEZ, ANDRES MODESTO

Type: Electives ECTS Credits : 6.0

Year : Semester :

STUDENTS ARE EXPECTED TO HAVE COMPLETED

Introduction to Statistical Modeling
Statistical Signal Processing
Predictive Modeling

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

Basic Competences:
1. Possess and understand knowledge that provides foundations for the development and / or application of this knowledge, often, in a research context.
2. Apply the acquired knowledge to solve problems in new or unfamiliar environments within multidisciplinary contexts related to their area of study.
3. Integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, should include reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.
4. Possess learning skills that allow them to continue studying in a way that will be self-directed or autonomous.

General Competences:
1. Apply the theoretical foundations of the techniques for the collection, storage, treatment and presentation of information as a basis for the development and adaptation of these techniques to specific problems.
2. Identify the most appropriate data analysis techniques for each problem and apply them for the analysis, design and resolution of these problems.
3. Obtain practical and efficient solutions for problems of treatment of data sets, both individually and as a team.
4. Synthesize the conclusions obtained from these analyzes and present them clearly and convincingly, both in writing and orally.
5. Be able to generate new ideas (creativity) and anticipate new situations, in the contexts of data analysis and decision making.
6. Use skills for teamwork and to relate to others autonomously.

Specific Competences:
1. Use the basic results of statistical inference and regression as a basis for prediction methods.
2. Identify and select the appropriate software tools for the treatment of time series.
3. Use advanced statistical procedures for the treatment of time series in areas such as modeling, inference and prediction.
4. Design systems for the processing of time series, from the initial collection and filtering of them, their statistical analysis, to the presentation of the final results.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to time series
1.1 Examples of univariate time series
1.2 Examples of multivariate time series
1.3 Software for time series analysis

2. Time series decomposition.
2.1 Time series components.
2.2 Classical decomposition.
2.3 ARIMA decomposition.
2.4 STL decomposition.

2.5 Forecasting with decomposition.
2.7 Exponential smoothing techniques.

3. ARIMA models.
3.1 Stationarity and differencing.
3.2 Backshift notation
3.3 Autoregressive models.
3.4 Moving average models.
3.5 Non-seasonal ARIMA models.
3.6 Estimation and order selection.
3.7 Seasonal ARIMA models.
3.7 Forecasting with ARIMA models.

4. Advanced forecasting methods.
4.1 Dynamic regression models.
4.2 Vector autoregressions.
4.3 Dynamic factorial models.
4.4 Forecasting hierarchical or grouped time series.

5. Conditional heteroscedastic models.
5.1 GARCH models.
5.2 Statistical properties.
5.3 Estimating parameters and volatilities.

LEARNING ACTIVITIES AND METHODOLOGY

Theoretical classes will be taught synchronously and interactively online through Blackboard collaborate with support material on the web. Practical classes of resolution of problems, with additional problems in the web and its solutions. Practical computer classes in computer rooms. Realization of a prediction project under the supervision of professors. For the realization of the project it will be required that the student uses statistical / econometric software for the construction of models and its application to predict. Oral presentations of the progress in the projects will be made with debates among the students and a final defense of the project.

ASSESSMENT SYSTEM

20% of the final grade will be obtained through a final evaluation exam of the acquired knowledge. The remaining 80% will be the result of continuously evaluating the student's ability to assimilate the knowledge and skills acquired through four laboratory practices (40%); perform and defend a prediction project (40%).

In the extraordinary call, the final grade will be the maximum between the previous system and 100% of the final exam

% end-of-term-examination:	20
% of continuous assessment (assigments, laboratory, practicals…):	80

BASIC BIBLIOGRAPHY

- Box, G.E.P., Jenkins, G.M. and Reinsel, G.C. Time Series Analysis, Forecasting and Control, Wiley, 2008

- Brockwell, P.J. and Davis, R.A. Introduction to Time Series and Forecasting, Springer, 2008

- Diebold, F.X. Elements of Forecasting, South-Western College, 2001

- Tsay, R.S. Analysis of Financial Time Series, Wiley, 2010

ADDITIONAL BIBLIOGRAPHY

- Gonzalez-Rivera, G. Forecasting for Economics and Business, Pearson, 2013