VNIVERSITAT DE VALÈNCIA

Course Guide
36520 Advanced Forecasting Techniques in Business

COURSE DATA

Data Subject	
Code	36520
Name	Advanced Forecasting Techniques in Business
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1332 - Degree in Business Intelligence and Analytics	Faculty of Economics	3	First term

Subject-matter

Degree	Subject-matter	Character
1332 - Degree in Business Intelligence and Analytics	24 - Herramientas y Técnicas de Análisis de Datos	Obligatory

Coordination

Name	Department
PAVIA MIRALLES, JOSE MANUEL	110 - Applied Economics

SUMMARY

Advanced Prediction Techniques in Business is a compulsory subject assigned to the area of Quantitative Methods for Economics and Business which is part of the Data Analysis Tools and Techniques subject taught in the first term of the third year of the Degree in BUSINESS INTELLIGENCE AND ANALYTICS, with a total workload of 6 ECTS credits.

In a degree that aims to develop professionals with comprehensive business knowledge and who are capable of exploring and exploiting, with a business vision, the growing data flows (both internal and external) that the new digital reality is providing, a subject such as Advanced Prediction Techniques in Business is fundamental. With billions of data produced daily and with our ability to collect and store them increasing faster than our ability to analyse them, being able to extract value by building (semi-) automatic predictive models for a correct decision-making and definition of business actions is a competency that new graduates clearly need.

Being able to combine the creative potential of the human being and flexibility of thought in a process guided by knowledge, coupled with the storage and computer processing capacity available, allows us to find new opportunities and solutions to the most complex problems through a well-informed decision-making process. Having instruments with which to support the production, creation and analysis of predictions, thereby allowing the generation of new business models or getting more out of current businesses, enables opportunities to be exploited and adequately monetised, extracting value from new tools and algorithms.

This subject addresses the most advanced prediction methods and their application in the company and business environment. Understanding the prediction philosophy based on machine learning methods and being able to apply the available algorithms to different problems associated with the business environment is part of the basic skills acquired through this subject. Compression at a higher level to be able to adapt current algorithms to new realities, data sets or specific problems will be part of the deeper understanding acquired through this subject.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

There are no specified enrolment restrictions in relation to other subjects of the curriculum.

Although no restrictions have been established, it is assumed that in order to successfully study this subject the student has previously studied the contents of the subjects Exploratory Data Analysis and Databases, Chance, Uncertainty and Inference, Data Mining in Business, Forecasting with Temporal Data and Forecasting with Cross-Sectional Data.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1332 - Degree in Business Intelligence and Analytics

- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Acquire basic training that can be used to learn new methods and technologies and to adapt to new situations in academic and professional areas.

- Be able to solve problems and to communicate and spread knowledge, skills and abilities, taking account of the ethical, egalitarian and professional responsibility of the activity of business intelligence and analytics.
- Be able to make autonomous decisions in digital environments characterised by the abundance and dynamism of data.
- Know and know how to properly use the appropriate quantitative and qualitative methods to reason analytically, evaluate results and predict economic and financial magnitudes.
- Be able to apply analytical and mathematical methods for the analysis of economic and business problems.
- Be able to plan, organise, monitor and evaluate the implementation of business strategies.
- Demonstrate skills for analysis and synthesis.
- Be able to analyse and search for information from diverse sources.
- Be able to learn autonomously.
- Be able to use ICT, both in academia and in professional practice.
- Be able to define, solve and present complex problems systemically.
- Be able to work in a team demonstrating commitment to quality, ethics, equality and social responsibility.
- Apply methods and techniques of analysis, synthesis and graphical representation by means of software tools.
- Express situations of uncertainty and randomness using mathematical, synthetic and graphic languages.
- Use software tools to solve problems under uncertainty.
- Distinguish between the explanatory and predictive approaches in data analysis and in business.
- Apply supervised machine learning techniques using software.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

See the description in Spanish

DESCRIPTION OF CONTENTS

1. MACHINE LEARNING

1. Supervised, unsupervised and semi-supervised learning.
2. Reinforced learning.
3. Predicting with least squares and nearest neighbors.
4. The bias-variance binomial.
5. Overparameterization and overfitting.
6. Randomization.

2. MODEL SELECTION AND ASSESSMENT

1. The predictive approach.
2. Training and test sets.
3. Tuning parameters.
4. Discrete and continuous response models.
5. Classification models.
6. Unbalanced data. Confusion matrix and other measures of model accuracy.
7. Application.

3. LINEAR MODELS

1. Linear models for regression.
2. Regularization in regression models.
3. Cross validation.
4. Ridge, lasso and elastic net.
5. Linear models for classification.
6. Application.

4. RESAMPLING AND AGGREGATION

1. Boostrap.
2. Bagging.
3. Random Forest.
4. Boosting.
5. (Extreme) Gradient boosting.
6. Application.

5. AN INTRODUCTION TO DEEP LEARNING

1. Neural networks.
2. The perceptron: forward propagation.
3. Gradient descent: back propagation.
4. Recurrent neural networks (RNN).
5. Convolutional neural networks (CNN).

6. RECOMMENDER SYSTEMS

1. Objectives of a recommender system.
2. Types of recommender systems.
3. User-based collaborative system.
4. Item-based collaborative system.
5. Validation.
6. Application

7. OTHER EXAMPLES OF BUSINESS APPLICATIONS

1. Leakage risk detection.
2. Pricing.
3. Fraud detection.
4. Marketing. Uplift modelling.

8. OTHER PREDICTION TECHNIQUES

1. Support Vector Machine.
2. Naïve Bayes.
3. Bayesian Networks.

WORKLOAD

ACTIVITY	Hours	% To be attended
Computer classroom practice	45,00	100
Theory classes	15,00	100
Development of group work	5,00	0
Development of individual work	30,00	0
Study and independent work	30,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	5,00	0
Resolution of case studies	15,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The subject is fundamentally structured around practical sessions where, via the resolution of practical examples, the theoretical content of the theory classes will be introduced, established and reinforced.

In the theory sessions, with a weekly duration of 1 hour, the main content of the topics that make up the subject will be presented, introducing the relevant elements and concepts and contextualizing them with respect to the different prediction problems within a business environment and applied to the world of business. The predominant teaching method in the theory classes will be the participatory master class.

In the practical sessions, which have a duration of 3 hours, the teacher will propose situations (real or fictitious) of problems or case studies that the students must solve with the application of techniques and use of appropriate computer programs, carrying out, if appropriate, oral presentations or debates, individually and/or in teams. In the practical classes, projects and situations will be proposed that the students will have to solve by delivering the determined outputs within a given time.

EVALUATION

The subject will be evaluated from the following three perspectives:

1. Practical exam with the help of computer systems, in which a given situation must be resolved by applying the appropriate techniques, with their corresponding justification, using the data provided to answer the questions posed.

2. Evaluation of the practical activities completed by the student during the course, based on the preparation of papers/reports and/or oral presentations, and with the student defending the decision-making process.

3. Continuous evaluation of the student, based on his/her participation and involvement in the teaching-learning process.

The assigned percentages will be specified in the Teaching Guide at the beginning of the course.

REFERENCES

Basic

- Aggarwal, C.C. (2018) Neural networks and deep learning: A textbook. Springer.
- Gorakala, S. K. y Usuelli, M. (2015) Building a Recommendation System with R, Packt Publishing.
- James, G., Witten, D., Hastie, T. y Tibshirani, R. (2013) An Introduction to Statistical Learning with Applications in R. Springer.
- Hastie, T., Tibshirani, R. y Friedman, J. (2008) The Elements of Statistical Learning. Data Mining, Inference and Prediction. 2nd edition. Springer.

Additional

- Aggarwal, C.C. (2016) Recommender Systems: The Textbook. Springer.
- Aggarwal, C.C. (2020) Linear Algebra and Optimization for Machine Learning. Springer.
- Kuhn, M. y Johnson, K. (2013) Applied Predictive Modeling. Springer. New York.
- Theobald, O. (2018) Machine Learning for Beginners: Make Your Own Recommender System. Scatterplot Press
- Wickham, H. y Grolemund, G. (2017). R for Data Science. OReilly Media, Inc.