

TEACHING GUIDE

Subject Information	
Full Name	Big Data and Artificial Intelligence in Finance
Code	0000012218
Degree	Master's Degree in Finance
Taught in	Advantere School of Management
Level	Postgraduate Official Master's Degree
Term	Third Quarter
Credits	3,0 ECTS
Type	Elective
Person in charge	Emilio Llorente
Office hours	Continuous availability via email

Professor Information	
Professor	
Name	Emilio Llorente Cano
Department / Area	Advantere School of Management
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SPECIFIC SUBJECT INFORMATION

Subject contextualization

Contribution to the professional profile of the degree

Artificial Intelligence-based analysis of financial asset markets

The financial professional must incorporate the latest advances in data science into economic knowledge when advising on investments and creating management products. All this in a logical and understandable framework, based on the application of mathematical optimization technologies, artificial intelligence and risk analysis. Through the application of the different topics developed within the course, the asset manager can obtain a real-time analysis of the financial markets, and make portfolio decisions according to new scenarios, always under the fulfillment of the client's requirements

Machine Learning. Through the construction of the decision process we will be able to detect and describe structural patterns in market behavior. Our goal is to make sense of the enormous volume, variety and speed at which data, that can affect the behavior of investable assets, is generated. Thus, we will transform them into relevant information that is finally used to make asset allocation decisions in all assets susceptible to being part of the investment universe of a client or product (for example, an Investment Fund).

Decision-making processes based on Machine Learning include a complexity in the treatment of input data as well as output data. This implies that the student will learn both supervised and unsupervised learning methodologies. At the same time, and since learning models are likely to generate non-generalizable solutions in future market environments, the assembly methodologies will be emphasized to improve the robustness and reliability of the processes developed during the evolution of sessions in the course.

Competences – Objectives		
Competences		
GENERAL		
CG.1	Project-based learning: Ability to develop and execute in its different phases collective financial projects based on real situations, proposing real solutions and making efficient all interactions with the team, clients and any other participant	
	RA1	Ability to engage in the development of experimental collective projects based on the real world, managing and aligning the client's needs with the available resources, optimally distributing the work, communicating and projecting its different phases, proposing real solutions and making efficient all interactions with the team, clients and other stakeholders.
CG.3	Teamwork: Apply techniques and methodologies that promote teamwork and mutual collaboration in talent management projects to be carried out with companies and organizations	
	RA1	Be committed to and cooperate in the roles defined for the achievement of the goals related to the defined and assigned tasks, activities, projects and responsibilities
CG.9	Digital competence: Employ, take advantage of and use, in an efficient and safe manner, the technological and digital resources applied in the financial management of organizations	
	RA1	Be able to critically, creatively and safely use information and communication technologies in financial management in organizations, using applications and taking advantage of Internet resources
CG.10	Technical Capacity: Capacity of analysis, synthesis and projection, applied to situations, problems and models in the financial field	
	RA1	Be able to deal with the analytical study of cases and scenarios, as well as to carry out synthesis of information and data
SPECIFIC		
CE.05	In-depth knowledge of new business activities within the financial sector, as well as value generation processes based on new technologies and their impact on the current and future financial ecosystem	
	RA1	Know the evolution and triggers within the financial industry of the disruption of new technology-intensive business models while understanding the profound impact on both the value chain and performance of these companies as well as on the dynamics of competition within the financial industry generated by these same technologies. within the financial industry itself that these same technologies generate
CEOPT2	Know and apply modeling and data analytic techniques to estimate investor and/or market behavior, as well as to create investment risk management strategies and models, and how artificial intelligence, process automation and machine learning can optimize these processes and make them more efficient	
	RA1	Know how to identify and measure the different types of risks (operational, credit, market) in financial institutions and financial products
	RA2	Design and use quantitative models generated in Matlab, R-Studio and/or Python from Artificial Intelligence techniques for risk control

	RA3	Know and know how to apply new methodologies, techniques and technologies that directly and indirectly impact data analysis models
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THEMES AND CONTENT

Contents-Themes
Basic Models in Machine Learning
Supervised Learning (I)
Classification and Regression Trees Multi-Class Learning
Supervised Learning (II)
Support Vector Machines Multi-Classroom Learning
Supervised Learning (III)
Multi-Label Learning
Unsupervised Learning
Hierarchical Clustering Self-Organizing Maps
Machine Learning Assembly Models
Assembly Methods: Classification and Regression Trees
Random Forest Boosting
Assembly Methods: Support Vector Machines
Analysis of Inputs and Outputs of Financial Market Information
Market Analysis

<p>Macroeconomic Data</p> <p>Valuation Data</p> <p>Market Sentiment Data</p>
Discrete Analysis of the Behavior of Financial Assets
<p>Definition of Classes</p> <p>Labels Definition</p>
Multi-Active Decision Model Construction
Rationality of the problem statement in a Machine Learning environment
<p>Volume, Variety, Velocity</p> <p>Dimensionality paradox</p> <p>Clustering methods by machine</p> <p>learning Class creation</p> <p>MultiClass vs. Multilabel</p> <p>Best Fit Algorithm</p>
Model Validation Test
<p>In-Sample Test</p> <p>Out-of-Sample Test</p>
Final Model of Tactical Asset Allocation to a Portfolio
Explainability
<p>Importance of Decision Factors</p> <p>Model Interpretability</p>

TEACHING METHODOLOGY

General methodological subject aspects

Presential Methodology: Activities

Cooperative work of students who, in pairs or small groups, are given a task, case or assumption that requires sharing information and resources among members in order to achieve the common goal. Based on the case method, studied by each student and discussed by each group before the individual interventions of each general session.

Exhibitions on their competencies and skills to get a job

Presentations should be evaluated and critiqued by the rest of the classmates or by the professor in order to go deeper into the topic

Lessons of an expository nature

Non-presential Methodology: Activities

Individual study

Individual reading of texts of different types (cases, books, magazines, articles, press, Internet publications, reports on practical experiences, etc.) related to the subjects of study

Cooperative work of students who, in pairs or small groups, are given a task that requires the sharing of information and resources among members with a view to achieving the common goal

SUMMARY OF STUDENT WORK HOURS

PRESENTIAL HOURS					
Professor Exposition	Student exhibition. Debates and group dynamics	Exercises and problem solving. Elaboration of applied work	Analysis and documentation	Tutorial sessions	Development of real projects for organizations
7	9	12	0	1	1
NON-PRESENTIAL HOURS					
Professor Exposition	Student exhibition. Debates and group dynamics	Exercises and problem solving. Elaboration of applied work	Analysis and documentation	Tutorial sessions	Development of real projects for organizations
0	0	35	23	1	1

ECTS CREDITS: 3.0 (90.00 hours)

EVALUATION AND GRADING CRITERIA

Graded Activities	Evaluation Criteria	% of Total Grade
<p>Assessment of individual or group work carried out by students, some of them presented in class.</p>	<ul style="list-style-type: none"> • Work adequacy to the objectives set • On-time delivery • Goal adequacy and focus • Reached goals • The participation of ALL members of each team in the presentations and elaborations is required 	<p>50</p>
<p>Oral and written examinations, public defenses and multiple-choice tests, concept tests and case studies as exams</p>	<ul style="list-style-type: none"> • Throughout the program, exams or written tests will be given to test the solidity of the concepts acquired. • In order to pass the course, the final exams and tests of each section of the course must be passed. If there are several exams in the same section or block of a course, the weighted average of them must be higher than 5.0 as a necessary condition to pass the course. 	<p>30</p>
<p>Participation and utilization of the classes</p>	<ul style="list-style-type: none"> • When we talk about participation, it is clear that both the positive and the negative ones are counted and that the quality of participation is as important as the quantity. The students' participation in class, the quality and timeliness of their interventions, the quality in the preparation and presentation of the work, predisposition and commitment, initiative, attendance. 	<p>20</p>

Grades

The evaluation criteria of the subject are governed by the following regulations:

1. All students must comply with 100% attendance on the days set for this subject. Any absence must be justified.
2. The final grade corresponds to the sum of the graded activities, evaluation criteria and % of total grade described in the Evaluation and Grading Criteria section.
3. Individual and group work must be delivered on time and in the manner planned by the subject professor.
4. A final mark below 5 implies the completion of an extraordinary test. The final grade in this exam may not be higher than the median of those passed at the time of set exams.

The Evaluation Criteria to enroll for a second year

The student enrolled in the subject for the second year must comply with the individual and group tasks set by the subject professor. The same evaluation criteria described in the Evaluation and Grading Criteria section will be maintained.

For those circumstances not foreseen in this Teaching Guide, the Advantere School of Management Regulations and the Comillas General Regulations will apply.

Graded Activities	Evaluation Criteria	% of Total Grade
Individual work	In order to pass the course, the student must hand in all the assignments given by the professor	15
Performance of written exams, tests, multiple-choice tests, concept concepts and resolution of case studies case studies in the form of exams, individually or in groups	In order to pass the course, the student must hand in all the assignments given by the professor	70
Participation	Timely interventions, generating constructive debate for the subject matter	15

Students enrolled in the course for the second consecutive year, as long as it is justified by work needs, may excuse their attendance to class in a maximum percentage of 65% of the scheduled sessions, although they must comply with all the face-to-face evaluative activities and also with the partial and final exams.

Evaluation criteria to be applied in the case of dispensation of schooling:

In cases of schooling dispensation, provided that the student duly justifies it, the grading criteria will be 70% exam (if the subject allows it, two exams will be developed, 35% each) and 30% for individual work. The individual work will serve to control the evolution of the student's learning. In those cases in which it is not possible for the student to answer in writing, and provide evidence to justify it, only in those cases the exam may be oral and the content of the student's answers will be transcribed.

Health alert criteria:

Students must be permanently identified, in class with an identification sign and remotely with their full name. Students should not change the spaces they occupy in the classroom, until a professor or the program management indicates they can do so.

Failure to comply with any of the health recommendations during class sessions may result in failure of the course

BIBLIOGRAPHIES AND RESOURCES

Basic Bibliographies

Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning series), Kevin P. Murphy

Pattern Recognition and Machine Learning (Information Science and Statistics), Christopher M. Bishop

Data Mining: Practical Machine Learning Tools and Techniques, Third Edition (The Morgan Kaufmann Series in Data Management Systems), Ian H. Witten, Eibe Frank, Mark A. Hall

Pattern Recognition, Fourth Edition, Sergios Theodoridis, Konstantinos Koutroumbas