
Academic Year: (2023 / 2024)

Review date: 31-05-2022

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: PARRADO HERNANDEZ, EMILIO

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

- Basic statistics
- Programming, ideally in python
- Basic machine learning, not mandatory

OBJECTIVES

- To understand basic concepts about financial markets, financial products and the different agents and institutions that operate in the financial markets
- Identify different scenarios of application of AI techniques in problems related with finance
- Understand and work in typical use cases of the application of AI techniques in financial markets

DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to financial products, markets and institutions
 - 1.1 Financial markets and institutions
 - 1.2 Principal markets and indices
 - 1.3 Financial services for retail costumers, corporate clients and investment banks
 - 1.4 Fixed Income
 - 1.5 Equity
 - 1.6 Foreign Exchange
 - 1.7 Derivatives
 - 1.8 Regulation
2. Market structure
 - 2.1. Macrostructure
 - 2.1.1 Auctions
 - 2.1.2 Order books, types of orders, OTC trading
 - 2.1.3 Market making
 - 2.1.4 Low latency trading and high frequency trading
 - 2.2 Microstructure
 - 2.2.1 Limited order books
 - 2.2.2 Empirical analysis of financial data: returns, price correlations, volatility, intraday liquidity
 - 2.2.3 Market Impact
3. Algorithmic trading
 - 3.1 Introduction to trading
 - 3.2 Data sources
 - 3.3 Trading strategies
 - 3.4 Backtesting
4. Roboadvisors
 - 4.1 Introduction to roboadvisors
 - 4.2 Roboadvisors platforms
 - 4.3 Regulation
5. Sentiment analysis
 - 5.1 Introduction to Natural Language Processing
 - 5.2 Applications of sentiment analysis in finance

- 6. Analysis of Market Regimes with artificial intelligence
 - 6.1 Introduction to machine learning for time series
 - 6.2 Hidden Markov Models
 - 6.3 Characterization of market regimes with Hidden Markov Models

- 7. Portfolio management
 - 7.1 Introduction to investing portfolios
 - 7.2 Portfolio configuration
 - 7.3 Portfolio management with machine learning

ASSESSMENT SYSTEM

Continuous evaluation: three projects related with three of the blocks of the course. For each project the students will need to hand in a python notebook. Students will be allowed to work in groups.

Final written exam about the contents of the course

% end-of-term-examination:	30
% of continuous assessment (assignments, laboratory, practicals...):	70

BASIC BIBLIOGRAPHY

- Marcos López de Prado Advances in Financial Machine Learning, John Wiley & Sons Inc, 2018
- Robert Kissell The Science of Algorithmic Trading and Portfolio Management: Applications Using Advanced Statistics, Optimization, and Machine Learning Techniques, Academic Press, 2013