Subject

Data Mining III

Year: 3   **Credits**: 9 ECTS   **Language**: Spanish

Competencies

Core competences:

CB1. Students have demonstrated knowledge and understanding in an area of study that builds on the foundation of general secondary education and is usually at a level that, while relying on advanced textbooks, also includes certain elements involving cutting-edge knowledge in their field of study

CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the skills that are typically demonstrated through the development and defence of arguments and problem solving within their field of study.

General competences:

CG1. Analytical thinking and ability to respond to complex challenges

Specific competences:

CE2. Have the programming skills required to address the entire data life-cycle

CE3. Have statistical and mathematical skills applied to data science

CE4. Be able to formulate a problem related to the world of data in terms of modeling

Learning outcomes

RA1. Be able to analyze, logically and from different perspectives and disciplines, the complex challenges they face. To this end, identify which are the key and important aspects of the problem, analyze them and, after a critical and reasoned consideration, propose, in a reasoned manner, different creative and transformative alternatives/solutions.

RA9. Have the programming skills required to address the entire data life-cycle

RA10. Have statistical and mathematical skills applied to data science

RA11. Be able to formulate a problem related to the world of data in terms of modeling

Syllabus

Deep Learning:
- Introduction to Deep Learning
- Artificial Neural Nertworks (ARN):
    - Anatomy
    - Perceptron
    - Activation function
    - Loss function
    - Gradient descent
    - Back-propagation
    - Neural network types
    - Sequential API and Functional API
- Recurrent neural networks (RNN):
    - Introduction
    - Backpropagation through time (BPTT)
    - Gradient explosion and banishing
    - Log Short-Term Memory (LSTM)
    - Gated Recurrent Unit (GRU)
    - Advanced characteristics:
        - Recurrent Dropout
        - Bidirectional RNR
        - RNR with states
    - RNR topology

Graph Neural Networks
Evolutionary Multi-Objective Optimisation:

- NSGA-II
- SPEA2
- *Enhanced methods*:
    - DECMO
    - DECMO2

Reinforcement learning:
- Introduction to reinforcement learning (RL)
- Terminology

- ○ Agents
- ○ States
- ○ Observations
- ● Development of a RL based system

Training activities

The training activities planned for this module are the following:

- ▪ Challenge-based learning (3 ECTS)
- ▪ Teamwork (2 ECTS)
- ▪ Workshops (1 ECTS)
- ▪ Online resources (0.5 ECTS)
- ▪ Reflection (0.5 ECTS)
- ▪ Individual work (1 ECTS)

Assessment system

Assessment will be by means of the continuous assessment system, providing constant feedback to both teachers and students on the learning process throughout the academic period:

- ▪ Learning activities involving the presentation of knowledge and individual study may be assessed by means of oral and/or written tests, which will account for a maximum of 60% of the final mark.
- ▪ The training activities aimed at acquiring the practical skills of the subjects will be assessed through the completion of various activities (assignments, case studies, challenges, etc.) accounting for at least 40% of the final mark.

Details of the assessment and marking will be made explicit in the annual academic planning of the subjects, in accordance with the teachers responsible and the determining factors of each course.

Bibliography

- ▪ Chollet, F. 2017. Deep learning with python. Manning Publications.
- ▪ T. Hastie, R. Tibshirani, and J Friedman. The elements of statistical learning: data mining, inference, and prediction. Springer, 2009. Second edition