Course Unit	Intelligent Systems			Field of study	Informatics		
Master in	Electrical and Computers Engineering			School	School of Technology and Management		
Academic Year	2023/2024	Year of study	1	Level	2-1	ECTS credits	6.0
Type	Semestral	Semester	1	Code	5070-792-1105-00-23		

Workload (hours)	162	Contact hours	T -	TP 60	PL -	TC -	S -	E -	OT -	O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): Rui Pedro Sanches de Castro Lopes

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Discern when should use a classical solution and discern when should use an inductive solution
2. Establish a chronological and functional sight on the techniques of AI and its connections to other sciences
3. Know and understand the functioning of the artificial intelligence main models
4. Implement properly the IS knowledge in solving practical problems
5. Understand the limitations and advantages of the computer intelligence techniques
6. Adapt the IS techniques to specific case studies, for example, Pattern Recognition problems.

Prerequisites

Before the course unit the learner is expected to be able to:
1. Know how to implement algorithmic solutions in a classical mode.
2. Know the fundamentals of linear algebra, calculus and logic.

Course contents

Uncertain knowledge. Neural networks. Boosting algorithms. Deep Learning. Practical implementation of multiple cases.

Course contents (extended version)

1. Uncertain knowledge
   - Bayes model
2. Neural Networks
   - Single layer neural networks
   - Nonlinear separation
   - Multilayer neural network
   - BackPropagation
   - Neural networks performance
   - Cross-Validation
3. Boosting algorithms
   - Haar-cascade
4. Deep Learning
   - Deep learning theory
   - Convolution neural networks (CNN)
   - Recurrent neural networks (RNN-LSTM-GRU)
   - Auto-enconders
   - GAN
5. Practical implementation of multiple cases using OpenCV
6. PCA
7. Python and PyTorch introduction

Recommended reading

1. Bishop C. (2007). Pattern Recognition and Machine Learning. Singapore: Springer. 978-0387310732
2. Haykin S. (1999). Neural Networks: A Comprehensive Foundation. New York: Prentice Hall. 978-0132733502
3. Russell, S. J. , & Norvig, P. (2002). Artificial Intelligence: A Modern Approach. New York: Prentice Hall. 978-0137903955
4. Funge, J. , & Millington, I. (2009). Artificial Intelligence for Games. New York: CRC Press. 978-0123747310
5. Ian Goodfellow et al. (2016). Deep Learning. Mit Press. 978-0262035613

Teaching and learning methods

The curricular unit works in articulation with the Blended Intensive Program in Machine Learning for Data Science, organized by the StarsEU partners.

Assessment methods

1. Distributed Assessment - (Regular, Student Worker) (Final, Supplementary)
   - Practical Work - 75%
   - Intermediate Written Test - 25%
2. Final exam - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100%

Language of instruction

English

Electronic validation

Rui Pedro Sanches de Castro Lopes	Tiago Miguel Ferreira Guimaraes Pedrosa	Paulo Jorge Pinto Leitão	José Carlos Rufino Amaro
11-10-2023	25-10-2023	26-10-2023	31-10-2023