ACADEMIC PROGRAM

MACHINE LEARNING II

B.F.A. IN **COMPUTER SCIENCE**

MODALITY: ON CAMPUS

ACADEMIC YEAR: 2023-2024

Name of the course:	Machine Learning II
Degree :	Computer Science
Location:	Centro Universitario de Tecnología y Arte Digital
Area:	Data Engineering
Year:	4º
Teaching period:	2
Type:	OBM
ECTS credits:	6
Teaching modality:	On campus
Language:	English
Lecturer / Email	-
Web page:	http://www.u-tad.com/

SUBJECT DESCRIPTION

Area description

The contents of the subject allow students to understand the flow of searching, ingesting, storing, processing and analyzing data information and brings students closer to the techniques and technologies necessary for managing large amounts of data.

Subject description

This subject teaches algorithms for the automatic creation of intelligent systems based on data sets from specific application domains, in order to extract and model the knowledge contained in them for subsequent application in intelligent decision support systems.

The models addressed are deep learning algorithms and artificial neural networks, focusing on their mathematical development and their use with the programming language (Python).

COMPETENCIES AND LEARNING OUTCOMES

Competencies

BASIC AND GENERAL SKILLS

CG1 - Ability to understand, schedule and solve problems trough software development

CG3 - Knowledge of the scientific fundamentals applicable to the resolution of computer problems

CG4 - Ability to simplify and optimize computer systems by understanding their complexity

CG9 - Ability to learn, modify and develop new software solutions

CG10 -Use of creative techniques to carry out computer projects

CG11 - Ability to search, analyze and manage information for insights capture

BC1: Students should demonstrate knowledge in an area of study that builds upon the foundation of general secondary education and goest beyond at a level that, while supported by advanced textbooks, also encompasses certain aspects derived from the cutting edge of their field of study.

BC2: Students should be able to apply their knowledge to their work or vocation in a professional manner, and they should possess the competencies typically demonstrated through the development and defence of arguments as well as problem-solving within their field of study.

BC3: Students must possess the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that involve reflection on socially, scientifically, or ethically significant issues.

BC4: Students should be capable of conveying information, ideas, problems, and solutions to both specialized and non-specialized audiences.

BC5: Students should have developed the learning skills necessary to pursue further studies with a high degree of autonomy.

TRANSVERSAL SKILLS

CT1 - Knowledge of the definition, scope and implementation of the fundamentals of project management methodologies for technology projects

CT2 - Knowledge of the main sectorial players and the life cycle of a digital content development and commercialization project

CT4 -Ability to update the knowledge acquired in the management of digital tools and technologies according to the current state of affairs of the sector and the technological solution

CT5 -Development of the basic skills for digital entrepreneurship.

SPECIFIC SKILLS

CE3 - Knowledge of relational algebra and querying in procedural languages for the design of standardized database schemas based on entity-relationship models

CE10 - Ability to work with a release manager and generate application documentation automatically.

Learning outcomes

Upon completion of the degree, the graduate will be able to:

- To know and develop storage procedures and data management in distributed environments.

- To know and apply supervised, unsupervised and semisupervised learning techniques.

- To know and apply Deep Learning techniques

- To be able to retrieve information using web scraping or standard APIs

- To know and understand Natural Language Processing techniques

- To be able to analyze social networks contents.

- To understand the nature and representation of digital images.

- To know the applications of neural networks to the analysis and generation of sound, static images and video.

- To develop software solutions for computer vision.

- To develop a fully-fledged data project applying iterative methodology from design to delivery.

CONTENTS

Kernel-based methods

Deep neural networks

SUBJECT SYLLABUS

Topic 0. Introduction to Deep Learning

0.1. What is it? Context.

0.2. Applications and classification of Deep Learning techniques

Topic 1. Artificial Neural Networks (ANNs)

1.1. Introduction

1.2. Input characteristics and limitations of the M-P Neuron

1.3. Perceptron

1.3.1. Introduction

1.3.2. M-P Neuron vs Perceptron

1.3.3. Activation functions

1.3.4. Model construction

Topic 2. Deep Artificial Neural Networks

1.1. Multilayer Perceptron

1.1.1. Architecture

1.1.2. Notation and operation

1.1.3. Main components

1.1.4. Activation function

1.2. Forward Propagation

1.2.1. Introduction

1.2.2. Forward Propagation with the Multilayer Perceptron

1.2.3. Forward Propagation for multiple inputs

1.3. Error and optimization functions in ANNs

Topic 3. Training of Deep Neural Networks

3.1. Computational graph

3.2. Chain rule

3.3. Training RNAs

3.4. Regression and Classification with ANNs

Topic 4. Tools and Techniques

4.1. Introduction to Keras

4.2. Activation functions

4.3. Optimization Features

4.4. Hyperparameter selection

4.5. Tensorflow 2.0

4.6 Considerations

TRAINING ACTIVITIES AND TEACHING METHODOLOGIES

TRAINING ACTIVITIES

LEARNING ACTIVITIES	Total hours	Hours of presence
Theoretical / Expository classes	29,38	29,38
Practical classes	23,25	23,25
Tutorials	4,00	2,00
Independent study and autonomous work of the student	50,00	0,00
Elaboration of work (group or individual)	31,88	0,00
Evaluation Activities	5,25	5,25
Project Follow-Up	6,25	6,25

TOTAL	150	66,13

Teaching methodologies

Expository method or master lesson

Case learning

Learning based on problem solving

Project based learning

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

Just in time Teaching (JITT) or classroom on time

Expository method or master lesson

Case method

Learning based on problem solving

Project based learning

Cooperative or collaborative learning

inquiry learning

Flipped classroom methodology

Gamification

TEMPORAL DEVELOPMENT

DIDACTIC UNITS / TOPICS TIME PERIOD

Topics 0 and 1. Introduction and RNAs Week 1, 2

Topic 2. Deep Learning Weeks 3, 4, 5, 6

Topic 3. Training Weeks 7 and 8

Topic 4. Tools and techniques Week 9 until the end of the course

EVALUATION SYSTEM

ASSESSMENT SYSTEM	MINIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)	MAXIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)
Assessment of participation in class, exercises or projects of the course	10	30
Assessment of assignments, projects, reports, memos	40	80
Objective test	10	60

GRADING CRITERIA

ASSESSMENT SYSTEM	ORDINARY EVALUATION	EXTRAORDINARY EVALUATION
Assessment of participation in class, exercises or projects of the course	10	10
Assessment of assignments, projects, reports, memos	50	50
Objective test	40	40

General comments on the evaluations/assessments

● To pass the subject in the ordinary call, both the completion of the exercises and the final project are optional, with only the exam being mandatory. A final grade of 5.0 (out of 10) is required, that is, if you do not complete the exercises or the project, the grade on the exam should be at least 10.0.

● If you do not pass the exam in the ordinary call, in the extraordinary call the exam will count 100% of the grade and it is necessary to obtain at least a grade of 5.0 (out of 10) to pass.

LIST OF REFERENCES (BOOKS, PUBLICATIONS, WEBSITES):

Basic Bibliography:

● R manuals, http://cran.r-project.org/manuals.html

● James, G., Witten, D., Hastie, T., Tibshirani, R. 'An Introduction to Statistical Learning with Applications in R'. 2013 Springer. ISBN: 978-1-4614-7138-7

● Andriy Burkov, 'The Hundred-Page Machine Learning Book' 2019. ISBN-13: 978-1999579500

Recommended Bibliography:

● Michael J. Crawley, "The R Book", 2nd Edition, Wiley, 2013. ISBN: 978-0-470- 97392-9

● Robert I. Kabacoff. 'R in Action: Data Analysis and Graphics with R'. Second Edition 2015. Manning Publications Co. ISBN:978-1-61729-138-8

● Brett Lantz, 'Machine Learning with R'. Third Edition 2019 Packt Publishing. ISBN: 978-1-78216-214-8

● Tom M. Mitchell, 'Machine Learning'. 1997 McGraw-Hill. ISBN: 0070428077

● Thomas Mailund, 'Beginning Data Science in R: Data Analysis, Visualization, and Modeling for the Data Scientist'. 2017 Press. ISBN-13: 978-1484226704

● Graham Williams, 'Data Mining with Rattle and R'. 2011 Springer. ISBN: 978-1- 4419-9889-7

REQUIRED MATERIALS, SOFTWARE AND TOOLS

Type of classroom
Theory classroom

Board and projection system

Materials:
Laptop with at least 4GB of RAM

Software:
RStudio y Anaconda (con Jupyter Notebook)