COURSE OUTLINE

INTRODUCTION TO MACHINE LEARNING

1. GENERAL

SCHOOL	CLASSICS AND HUMANITIES		
DEPARTMENT/UPS	HUMANITIES / DIGITAL APPLICATIONS IN ARTS AND CULTURE		
LEVEL OF STUDIES	UNDERGRADUATE – LEVEL 6		
COURSE CODE	**XXXXX**	**SEMESTER**	4TH
COURSE TITLE	INTRODUCTION TO MACHINE LEARNING		

TEACHING ACTIVITIES *If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
	3	6
Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.		

COURSE TYPE *Background, General Knowledge, Scientific Area, Skill Development*	BACKGROUND
PREREQUISITES:	NO
TEACHING & EXAMINATION LANGUAGE:	GREEK
COURSE OFFERED TO ERASMUS STUDENTS:	YES
COURSE URL:	https://eclass.duth.gr/courses/XXXXXX/

2. LEARNING OUTCOMES

Learning Outcomes

Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.

Upon successful completion of the course, participants will be able to:

- Understand, describe, and interpret key terms related to machine learning.
- Identify the basic problems that can be solved through machine learning techniques, such as classification, regression and clustering.
- Apply appropriate machine learning algorithms to address specific problems.
- Process data using computational techniques to prepare a dataset.
- Evaluate machine learning model accuracy.
- Utilize tools and libraries to implement machine learning models (e.g., Scikit-learn, TensorFlow, Keras).

General Skills

Name the desirable general skills upon successful completion of the module

Search, analysis and synthesis of data and information,
ICT Use
Adaptation to new situations
Decision making
Autonomous work
Teamwork
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project design and management
Equity and Inclusion
Respect for the natural environment
Sustainability
Demonstration of social, professional and moral responsibility and sensitivity to gender issues
Critical thinking
Promoting free, creative and inductive reasoning

- Critical thinking and problem solving
- Analytical ability to understand and evaluate machine learning algorithms
- Teamwork
- Programming skills to develop and implement machine learning algorithms
- Data manipulation and understanding of the processes involved in data preprocessing

3. COURSE CONTENT

1	Introduction to Machine Learning	• Familiarization with the students and presentation of the course objectives, expected learning outcomes, and requirements • Introduction to Machine Learning and its applications • Basic categories: supervised, unsupervised and reinforcement
2	Data processing	• Data cleaning techniques and handling missing data and noise.
3	Linear models for classification and regression	• Linear regression: Theory and applications • Logistic regression: Introduction and classification applications • Training and evaluating linear models
4	Nonlinear models and polynomial regression	• Polynomial regression and higher order models • Model Complexity & Overtraining
5	Support Vector Machines (SVM)	• Theory and principles of SVM • Linear and Nonlinear SVM Classification • Hyper parameter tuning
6	Decision Trees and Ensemble Methods	• Decision Trees: Theory, advantages and disadvantages • Additive models: Random Forests, Bagging, Boosting • Application and model optimization
7	Clustering algorithms and unsupervised learning	• K-means and hierarchical clustering • Advantages and restrictions of unsupervised learning • Examples of clustering applications
8	Principles of Neural Networks	• Introduction to artificial neural networks • Structure and training of neural networks
9	Deep Learning and Convolutional Neural Network (CNNs)	• Deep Learning Networks: Introduction • Introduction to Convolutional Neural Network and applications to image processing • Training and Fine-Tuning CNNs
10	Reinforcement Learning models	• Introduction to Reinforcement Learning • Environments, policies and rewards • Reinforcement Learning for independent systems
11	Evaluation and Optimization for Machine Learning models	• Model Performance Metrics: Accuracy, Precision, Recall, F1-score, ROC. • Split for datasets: Train, Validation, Test • Model optimization techniques: Cross-validation, Gridsearch.
12	Tools and libraries for Machine Learning	• Introduction to Scikit-learn, TensorFlow, Keras and PyTorch. • Hands-on application of algorithms through libraries. • Using Google Colab and other tools for practical model development.
13	Recap	• Recap and resolving questions • Student feedback

4. LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD *Face to face, Distance learning, etc.*	• Lectures • Active learning (hands-on learning) - Experiential learning • Collaborative learning
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) *Use of ICT in Teaching, in Laboratory*	Use of ICT in teaching and communication with students • PPT presentations • Teaching material, announcements and communication through the eClass platform

<table>
<tr><td>Education, in Communication with students</td><td>• Student study of supplementary material related to course content
• Communication with students via email</td></tr>
<tr><td>TEACHING ORGANIZATION
The ways and methods of teaching are described in detail.
Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.

The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</td><td><table><tr><th>Activity</th><th>Workload/semester</th></tr><tr><td>Lectures</td><td>26</td></tr><tr><td>Laboratory Exercise</td><td>13</td></tr><tr><td>Essay</td><td>37</td></tr><tr><td>Weekly projects/tasks</td><td>46</td></tr><tr><td>Study and analysis of bibliography</td><td>55</td></tr><tr><td>Written examination</td><td>3</td></tr><tr><td>Total</td><td>180</td></tr></table></td></tr>
<tr><td>STUDENT EVALUATION
Description of the evaluation process

Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others

Please indicate all relevant information about the course assessment and how students are informed</td><td>Formative

Mid-term written examination: 20%
Final written examination: 80%

Oral examination upon student’s request.</td></tr>
</table>

5. SUGGESTED BIBLIOGRAPHY

- Greek:
  1. Μπότσης Δ, Διαμαντάρας Κ (2019) Μηχανική μάθηση
  2. Haykin S (2010) Νευρωνικά Δίκτυα & Μηχανική Μάθηση, 3η Έκδοση
- Foreign:
  1. Andreas C. Müller & Sarah Guido (2016) Introduction to Machine Learning with Python: A Guide for Data Scientists
  2. AurélienGéron (2022) Hands-On Machine Learning with Scikit-Learn, Keras&TensorFlow (3rd Edition).

ANNEX OF THE COURSE OUTLINE

Alternative ways of examining a course in emergency situations

Teacher (full name):	XXXXXXXX
Contact details:	XXXXXXXX
Supervisors:	YES
Evaluation methods:	Mid-term written examination: 30% Final written examination: 70%
Implementation Instructions:	**Mid-term written examination (30%):** The purpose of the progress report is to assess student performance halfway through the semester, allowing for evaluation of their progress in the machine learning course. The report will be submitted through eClass on a specified date, which will be announced to students during the initial lectures. The evaluation considers students' overall attendance, participation, and performance in the course. **Final written examination (70%):** The final written examination assesses understanding of the fundamental theories, concepts, and principles of the course. The exam will be conducted in person on a date and time announced in advance, along with the duration and content of the exam.