DEREE COLLEGE SYLLABUS FOR:

ITC 4568 MACHINE LEARNING **3/0/3**
(Fall 2021) **UK LEVEL: 6**
UK CREDITS: 15

PREREQUISITES:	ITC 2088 Introduction to Programming ITC 2197 Object Oriented Programming Techniques ***or*** ITC 3234 Object Oriented Programming ITC 3006 Mathematics for Computing ITC 4380 Artificial Intelligence Principles MA 2010 Statistics I ***or*** MA 2021 Applied Statistics for Business ***or*** MA 2025 Applied Statistics for Science
COREQUISITES:	None.
CATALOG DESCRIPTION:	Machine learning problem representation and optimization; supervised, unsupervised, adversarial and deep learning; decision trees, neural networks, vector machines, rule-extractors; density-based algorithms.
RATIONALE:	The course introduces the students to Machine Learning, one of the most successful branches of Artificial Intelligence. It provides the theoretical context, as well as practical experience with modern tools and APIs for *learning* accurate models from data, thus exposing students to the major techniques employed in Data Science.
LEARNING OUTCOMES:	As a result of taking this course, the student should be able to: 1. Demonstrate understanding of the nature of the machine learning process and tools. 2. Evaluate and compare major representative algorithms. 3. Apply machine learning concepts in computer vision and image classification. 4. Build robust implementations in framework APIs.
METHOD OF TEACHING AND LEARNING:	In congruence with the teaching and learning strategy of the college, the following tools are used: • Lectures and laboratory sessions. • Office hours held by the instructor to provide further assistance to students. • Use of the online content management system (Blackboard CMS) to further facilitate communication.
ASSESSMENT:	**Summative:** 1st assessment: Midterm exam Short answers and/or case problems — **30%** 2nd assessment: Portfolio of student work and oral assessment — **10%** Final assessment: Project Framework API implementation//sequential data analysis//image classification — **60%** **Formative:**

	Take-home short problems **0%** The formative assessments aim to prepare students for the summative assessments and expose them to teamwork. The 1st summative assessment tests the LOs 1,2. The 2nd summative assessment tests the LOs 1-4. The final summative assessment tests the LOs 1-4. *The final grade for this module will be determined by averaging all summative assessment grades, based on predetermined weights for each assessment. If students pass the **final summative assessment,** which tests all Learning Outcomes for this module, and the average grade for the module is 40 or above, students are not required to resit any failed assessments.*
INDICATIVE READING:	**REQUIRED READING:** 1. S. Theodoridis, "Machine Learning: A Bayesian and Optimization Perspective", Academic Press, 2020. 2. Instructor's notes. **RECOMMENDED READING:** 1. D. Bertsimas, J. Dunn: "Machine Learning under a Modern Optimization Lens", Dynamic Ideas, 2019. *Additional recommended readings list available through Blackboard.*
INDICATIVE MATERIAL: *(e.g. audiovisual, digital material, etc.)*	**REQUIRED MATERIAL**: N/A **RECOMMENDED MATERIAL**: N/A
COMMUNICATION REQUIREMENTS:	Daily access to the course's site on the College's Blackboard CMS and the acg email. Effective communication using proper written and oral English. Use of word processing and/or presentations software for documentation and presentation of deliverables and the final project.
SOFTWARE REQUIREMENTS:	Python 3.8+ scikit-learn Tensorflow 2.0 Orange3+
WWW RESOURCES:	• scikit-learn: machine learning in Python — scikit-learn 0.24.0 documentation (scikit-learn.org) • TensorFlow • https://orangedatamining.com/ • http://introtodeeplearning.com/2020/index.html • https://deeplizard.com/learn/playlist/PLZbbT5o_s2xq7LwI2y8_QtvuXZedL6tQU
INDICATIVE CONTENT:	1. Perspectives of Machine Learning 2. Overview of Probability and Stochastic Processes 3. Algorithm evaluation 3.1. Validation and Cross-Validation 3.2. Expected Loss and Empirical Risk Functions

	4. Supervised Learning 4.1. Classification 4.1.1.Decision Trees 4.1.2.Rule Extractors 4.1.3.Support Vector Machines 4.1.4.Perceptrons and Artificial Neural Networks 4.2. Regression 5. Unsupervised Learning 5.1. Clustering 5.1.1.Expectation Maximization 5.1.2.K-Means and variants 5.1.3.Hierarchical Clustering 5.2. Association Rules 6. Adversarial and Deep Learning 7. Applications in Image Classification