Machine Learning

- 1. Course number and name: 020MLRES4 Machine Learning
- 2. Credits and contact hours: 4 ECTS credits, 2x1:15 contact hours
- 3. Name(s) of instructor(s) or course coordinator(s): Youssef El Bakouny
- **4. Instructional materials:** PowerPoint slides; Moodle Ressources; Assignments

References:

 Textbook: Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow, Third Edition. Aurélie Géron. O'Reilly, 2022.

5. Specific course information

a. Catalog description:

Machine learning (ML) is a subfield of Artificial intelligence. It is the science of making the machine learn by examples. The goal of ML is to make a computer that can learn from examples autonomously. The main research topics in ML include: Computer Vision (CV) and Natural Language Processing (NLP) and precision medicine for personalized treatments. The main goal of this course is to acquire a basic understanding of ML algorithms as well as hands-on ML engineering experience with regards to its application to realistic datasets through Python implementations that make use of state-of-the-art libraries such as Scikit-learn, Tensorflow and Keras.

- b. Prerequisites: None
- c. Selected Elective for CCE, EE and ME students

6. Educational objectives for the course

- a. Specific outcomes of instruction:
 - Understand supervised and unsupervised learning.
 - Understand classification, regression, clustering and dimensionality reduction.
 - Implement and evaluate traditional classification, regression, clustering and dimensionality reduction solutions.
 - Implement, analyze and evaluate deep neural network solutions to solve regression, classification and dimensionality reduction problems.
 - Understand and Implement Convolutional Neural Networks (CNN).
 - Understand and Implement Recurrent Neural Networks (RNN).
 - Understand Computer Vision (CV).
 - Understand Generative AI and Natural Language Processing (NLP).

b. PI addressed by the course:

PI	1.3	2.4	2.5	3.2	4.1	4.2	5.1	6.3	6.4	7.1
Covered	X	X	X		X	X		X	X	
Assessed	X	X	X	X			X	X	X	X

7. Brief list of topics to be covered

- Introduction: supervised vs unsupervised learning (2 lectures)
- Traditional Classification supervised learning solutions (2 lectures)
- Traditional Regression supervised learning solutions (2 lectures)
- Traditional Clustering unsupervised learning solutions (2 lectures)
- Traditional Dimensionality reduction unsupervised learning solutions (2 lectures)
- Introduction to Deep Learning (2 lectures)
- Regression and Classification using dense neural networks (2 lectures)
- Image Classification using CNN (2 lectures)
- Introduction to Computer Vision (2 lecture)
- Dimensionality reduction using autoencoders (2 lectures)
- RNN and Long-Short Term Memory (LSTM) networks (2 lectures)
- Introduction to Generative AI and Natural Language Processing (2 lectures)