SCHEDA DELL'INSEGNAMENTO (SI)

" MACHINE LEARNING FOR ENGINEERING "

SSD ING-INF/05

DENOMINAZIONE DEL CORSO DI STUDI: INGEGNERIA MECCANICA PER LA PROGETTAZIONE E LA PRODUZIONE

ANNO ACCADEMICO 2022 - 2023

INFORMAZIONI GENERALI - DOCENTE

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INFORMAZIONI GENERALI - ATTIVITÀ

ANNO DI CORSO: I o II
PERIODO DI SVOLGIMENTO, SEMESTRE: II
CFU: 6

INSEGNAMENTI PROPEDEUTICI (se previsti dal Regolamento del CdS)

"None"

EVENTUALI PREREQUISITI

"None"

OBIETTIVI FORMATIVI

The aim of the course is to present the main Machine Learning techniques for solving classification problems, numerical prediction and clustering and the management and development methodologies of a Machine Learning process, from data preparation to results evaluation.
The course will also allow you to develop practical skills in solving real problems in the engineering field through Machine Learning techniques, thanks to exercises carried out with commercial and / or open source tools.

RISULTATI DI APPRENDIMENTO ATTESI (DESCRITTORI DI DUBLINO)

Knowledge and understanding

The student must know the main Machine Learning and Deep Learning algorithms. The student must also demonstrate that he is able to choose the most suitable Machine Learning algorithm to solve a specific classification and / or numerical prediction and / or clustering problem, based on the requirements of the problem itself. Finally, the student must demonstrate that he is able to choose the appropriate data preparation techniques and must know the techniques necessary for evaluating the performance of Machine Learning and Deep Learning algorithms.

Applying knowledge and understanding

The student must demonstrate to be able to solve real problems, in engineering, classification, numerical prediction or clustering using Machine Learning techniques. The student must also demonstrate that he can correctly evaluate the performance of the systems he builds.

PROGRAMMA-SYLLABUS

Introduction to Artificial Intelligence (AI): past, present, future, opportunities and ethics. (0.25 CFU)
Introduction to Machine Learning (ML): basic concepts, mathematical, statistical, and computational fundamentals. Styles of learning: regression, classification and clustering. (0.5 CFU)
Performance evaluation: training and testing, cross-validation, model selection. (0.5 CFU)
ML Classical Techniques: Linear and Logistic Regression, Naïve Bayes, Decision Trees, SVM, Neural Networks, KNN, k-Means. (2.5 CFU)
Feature Engineering basics: Attribute Selection, PCA. (0.25 CFU).
Ensemble Learning: Bagging, Boosting, Randomization (0.25 CFU).
Deep Learning: Convolutional Neural Networks, Deep Autoencoders and Recurrent Neural Networks. (0.5 CFU)
Tools and packages for Machine Learning (KNIME, WEKA, Python scikit-learn and Keras libraries). (0.75 CFU)
Application of ML techniques for engineering applications: energy analytics, industry 4.0, electronics, mechanics, and fluid-dynamics. (0.5 CFU)

MATERIALE DIDATTICO

- *Ian H. Witten, Frank Eibe, Mark A. Hall, "Data mining: practical machine learning tools and techniques", 3rd ed., The Morgan Kaufmann.*
- *Lecture notes by the teacher*

MODALITÀ DI SVOLGIMENTO DELL'INSEGNAMENTO-MODULO

The teacher will use: a) lectures for about 60% of the total hours, b) exercises to practically deepen theoretical aspects for about 35% of the total hours, c) seminars for about 5% of the total hours.

VERIFICA DI APPRENDIMENTO E CRITERI DI VALUTAZIONE

valutazione finale e la sua compilazione deve essere coordinata dal docente referente del corso.

a) **Modalità di esame:**

Nel caso di ***insegnamenti integrati*** *l'esame deve essere unico.*

L'esame si articola in prova	
scritta e orale	
solo scritta	
solo orale	X
discussione di elaborato progettuale	X
altro	

b) Modalità di valutazione:

The discussion of the project work weighs 1/10, while the oral exam weighs 9/10.