COMPUTER ENGINEERING (LM55)

(Lecce - Università degli Studi)

Teaching ARTIFICIAL INTELLIGENCE APPLICATIONS

GenCod A006450

Owner professor Italo EPICOCO

Teaching in italian ARTIFICIAL INTELLIGENCE APPLICATIONS

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SSD code ING-INF/05

Reference course COMPUTER ENGINEERING

Course type Laurea Magistrale

Credits 9.0

Teaching hours Front activity hours: 81.0

For enrolled in 2021/2022

Taught in 2022/2023

Course year 2

Language ENGLISH

Curriculum ARTIFICIAL INTELLIGENCE

Location Lecce

Semester Second Semester

Exam type Oral

Assessment Final grade

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

The course will briefly introduc the multi and many cores processors with a focus on GPUs. The course will provide a broad introduction to Machine Learning and Neural Networks Topics which include: Linear regression, Linear regression with multiple variables, Regularization, Logistic regression, Neural Networks, Advice for Machine Learning, Machine Learning system design, Support Vector Machines. Hands-off are also organized to provide students the capacity to develop specific use cases, using the Python language and Jupiter Notebooks.

REQUIREMENTS

Students are expected to have the following background: Knowledge of basic computer science principles and skills, at a level sufficient to write a reasonably non-trivial computer program. Familiarity with the basic probability theory. Familiarity with the basic linear algebra. Good knowledge of the contents of first level courses on Informatics.

COURSE AIMS	KNOWLEDGE AND UNDERSTANDING: By the end of the course, students will gain knowledge of the python programming and basic theoretical knowledge of Machine Learning as well as the main python libraries for machine learning. APPLYING KNOWLEDGE AND UNDERSTANDING: The students will know how to use and analize data and will be able to develop Machine Learning applications. MAKING JUDGEMENTS The students will also be able to critically assess the different Machine Learning approaches and evaluate the efficiency and accuracy of the results. COMMUNICATION SKILLS: By the end of the course, students will be able to use a clear language and an adequate scientific terminology to argue on the topics dealt with in the course. LEARNING SKILLS: Students will be able to classify, schematize, summarize and process the acquired knowledge. The students will have the appropriate skills to develop and widen their knowledge of machine learning approach with particular regard to the use of reference documentation and other information available online.
TEACHING METHODOLOGY	The course consists of frontal lessons using slides made available to students via the elearnign plartform. The frontal lessons are aimed at improving students' knowledge and understanding through the presentation of theories, models and methods. The exercises are aimed at understanding the algorithms and models presented and require a practical programming skill with the tool and software presented.
ASSESSMENT TYPE	Oral exam. During the exam the student will present a short project based on machine learnging approach; he/she is, then, asked to illustrate theoretical topics in order to verify his/her knowledge and understanding of the selected topics.
ASSESSMENT SESSIONS	Dates for the exams will be published on the official University web site.
OTHER USEFUL INFORMATION	Students may contact the instructor by email or at the end of class meetings or through MSTeams chat.

FULL SYLLABUS	GPU arhcitecture and GPU programming Introduction to Python Machine Learning: What we will learn on Machine Learning. Supervised Learning Algorithms: - Linear Regression - Classihcation. Hypothesis Function for Linear Regression: - Representation of the hypothesis function for regression problems. Linear Regression with one variable - Cost Function: - Analysis of the hypothesis function and the Cost Function - Use of graph for their interpretation (3 hours). Countour Plots: Use of the Contour plots to have a better intuition of the Cost Function (3 hours). Minimization of the Cost Function-Gradient Descent Algorithm: Use of the Gradient Descent to minimize the Cost Function (3 hours). Linear Regression with multiple features: Hypothesis function for Multivariate Linear regression (3 hours). Gradient Descent for Multivariate Linear Regression: Cost Function and Gradient Descent Algorithm for Multivariate Linear Regression (3 hours). Feature Scaling: Practical tricks for making Gradient Descent work well. Learning Rate: Another practical tricks for making Gradient Descent work well. Features and Polynomial Regression: How to use the machinery of Linear Regression to ht very complicated, even very non linear functions. Normal Equation: - Normal Equation as a better way to solve for the optimal value of the Linear Regression parameters - Advantages and disadvantages of Gradient Descent and Normal Equation methods. Normal Equation and Non-Invertibility: Cases of Non-Invertibility. Logistic Regression: How do we develop a Classihcation Algorithm? Logistic Regression - Hypothesis Representation: Mathematical formula dehning the hypothesis for Logistic Regression and its probabilistic interpretation. Decision Boundaries: - What Decision Boundaries mean? - Example for non-linear Decision Boundaries. Logistic Regression-Cost Function: - Cost Function for Logistic Regression - Simplihed Cost Function and Gradient Descent. Multi-class Classihcation: One-versus-all Classihcation. Overhtting and Regularization: - The problem of Overhtting - Regularization - Regularized Cost Function. Neural Networks: Non Linear hypothesis, Neurons and the brain, Model representation, Multi-class classihcation, Cost Function & Backpropagation algorithm Advice for Applying ML: Model selection &Training_Validation_Test sets Machine learning system design_Error analysis, Trading off precision and recall
REFERENCE TEXT BOOKS	Introduction to Machine Learning with Python: A Guide for Data Scientists