



DEEP LEARNING	
Enrollment year	2020/2021
Academic year	2021/2022
Regulations	DM270
Academic discipline	ING-INF/05 (DATA PROCESSING SYSTEMS)
Department	DEPARTMENT OF ELECTRICAL, COMPUTER AND BIOMEDICAL ENGINEERING
Course	COMPUTER ENGINEERING
Curriculum	Computer Science and Multimedia
Year of study	2°
Period	2nd semester (07/03/2022 - 17/06/2022)
ECTS	6
Lesson hours	45 lesson hours
Language	English
Activity type	ORAL TEST
Teacher	PIASTRA MARCO (titolare) - 6 ECTS
Prerequisites	Foundations of linear algebra and multivariable calculus. Practical experience with at least one programming language. Some acquaintance with Python and Numpy.
Learning outcomes	The course follows a conceptual pathway that starting from simple linear regression to the sophisticated aspects of state-of-art of deep convolutional neural networks, deep recurrent networks and deep reinforcement learning. A unifying mathematical approach is followed throughout this path, to encompass and make it possible to understand the basic features of modern software frameworks for deep learning, such as TensorFlow.
Course contents	1) Deep Supervised Learning Algebraic model, foundations of tensor calculus

	Learning as representation, evaluation and optimization Single-layer networks as universal approximators Dataset in tensor representation for calculus Flow diagrams, automatic differentiation Regression and classification, softmax Deep layered representation, modularity Ottimizzazione 2) Deep Convolutional Neural Networks Convolutional layers and complex architectures Data augmentation and Transfer learning Layered learning, different optimization processes Fallibility and adversarial models Classification, object detection, segmentation 3) Deep Recurrent Networks Temporal unfolding, shared-parameters layers Long-Short Term Memory (LSTM) 4) Deep Reinforcement Learning On-policy and off-policy learning Actor critic and advance function Neural MCTS: AlphaZero e MuZero
Teaching methods	Lectures (hours/year in lecture theatre): 30 Practical class (hours/year in lecture theatre): 16 Practicals / Workshops (hours/year in lecture theatre): 0
Reccomended or required readings	See the home page of the course (http://vision.unipv.it/DL) for lecture slides, suggested readings and software for the exercises.
Assessment methods	The evaluation includes the realization of a project, to be agreed in advance. The final exam is an interview about the theory, together with the discussion of the project.
Further information	
Sustainable development goals - Agenda 2030	\$lbl_legenda_sviluppo_sostenibile