



UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

DEEP LEARNING

Anno immatricolazione	2020/2021
Anno offerta	2021/2022
Normativa	DM270
SSD	ING-INF/05 (SISTEMI DI ELABORAZIONE DELLE INFORMAZIONI)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	COMPUTER ENGINEERING
Curriculum	Computer Science and Multimedia
Anno di corso	2°
Periodo didattico	Secondo Semestre (07/03/2022 - 17/06/2022)
Crediti	6
Ore	45 ore di attività frontale
Lingua insegnamento	English
Tipo esame	ORALE
Docente	PIASTRA MARCO (titolare) - 6 CFU
Prerequisiti	Foundations of linear algebra and multivariable calculus. Practical experience with at least one programming language. Some acquaintance with Python and Numpy.
Obiettivi formativi	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.
Programma e contenuti	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

Metodi didattici

Lectures (hours/year in lecture theatre): 30
Practical class (hours/year in lecture theatre): 16
Practicals / Workshops (hours/year in lecture theatre): 0

Testi di riferimento

See the home page of the course (<http://vision.unipv.it/DL>) for lecture slides, suggested readings and software for the exercises.

Modalità verifica apprendimento

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.

Altre informazioni

Obiettivi Agenda 2030 per lo sviluppo sostenibile

[Gli obiettivi](#)