

ARTIFICIAL INTELLIGENCE 2

Course Infos

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Course Instructor

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Ph.D in Data Science from Scuola Normale Superiore

Member of The Knowledge Discovery and Data Mining Laboratory (**KDD Lab**), a joint research initiative of ISTI Institute of CNR, the Department of Computer Science of the University of Pisa and the Scuola Normale Superiore.

Research activity: explainable artificial intelligence for sequential data (time series, sequences, trajectories...)

Course Instructor

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Office: Room 291, Dipartimento di Informatica

Office hours: please book here

<https://calendar.app.google/V1qb1gvL3MZWtguB8>
or send an email/teams message.



Course Info

- Title: Artificial Intelligence 2
- Course code: 785AA WBH-LM
- 6 CFU
- Mandatory for curriculum “Engineering” and “Biology”

Polo Didattico "San Rossore 1938"

Day	Time	Room
Wednesday	13:45-15:15	D1
Friday	13:45-15:15	E1

Reference Webpage on Teams:

785AA 25/26 - ARTIFICIAL INTELLIGENCE II [WBHR-LM]

https://teams.microsoft.com/l/team/19%3AVU6UC2KK_kFDu4F50WAdSmtgnmR2tFcIT0d4Ly-TLwc1%40thread.tacv2/conversations?groupId=3b84dadf-5b63-46d8-a2d1-8f982fa59250&tenantId=c7456b31-a220-47f5-be52-473828670aa1

Here you can find:

- Course information
- Lecture slides
- Articles and course materials
- Final project assignments

Slides, Exercises and Notebook

Deep learning for healthcare (free PDF, with university access):

- Cao Xiao, Jimeng Sun, Introduction to deep learning for healthcare, Springer Cham (2021)

Deep learning reference (free <https://www.deeplearningbook.org>):

- I. Goodfellow, Y. Bengio and A. Courville, Deep Learning, MIT Press

Machine learning reference:

- P. Tan, M. Steinbach, A. Karpatne, V. Kumar, Introduction to Data Mining, Pearson

Prerequisites

- Basic knowledge of mathematics
- Knowledge of programming in **python**
- Knowledge of the various machine learning techniques presented in the Artificial Intelligence I course

Lecture Types

Frontal

- theory

Practical

- written exercises
- python notebooks



We will use python and in particular **jupyter notebooks**.

You can run jupyter notebooks:

- locally using Anaconda Navigator or Miniconda (preferred way)
- online, e.g., Colab Notebooks

Besides the packages that you used in AI 1 (`sklearn`, `pandas`), you will need:

- `torch` (`conda install conda-forge::pytorch`)
- `skorch` (`conda install conda-forge::skorch`)

How to read these slides

There are formulas because they are an excellent way to summarize data, models, and concepts...

... but I will highlight those that are really important and you need to know for the exercises and the written exam.

Exam

- A written exam, with exercises and questions about methods and algorithms presented during the classes. It can be done during the exam sessions.
- An individual project, that consists in employing the methods and algorithms presented during the classes for solving a specific task.
- An (**optional**) oral exam* that includes: (1) discussing the project report; (2) discussing topics from the course, including theory covered in the written exam.
- There may be an attendance point (+1) for seminars (towards the end of the course)

$$\text{mark (before oral)} = (\text{project_mark} + \text{written_exam_mark})/2$$

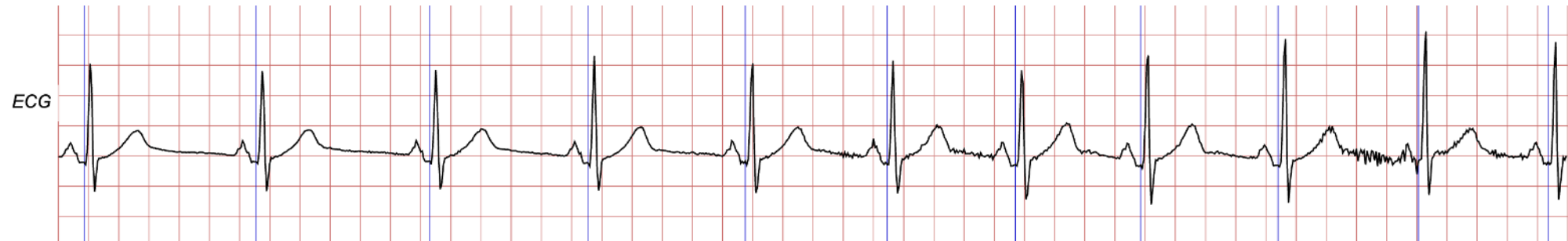
- **IMPORTANT:** up to April's 2026 appello, students from previous years can take the exam with the previous modalities; from June 2026, all students are required to follow the current course guidelines and program.

* Oral exam is not mandatory if you accept the mark with written exam and project. The oral exam can improve your grade. If it lowers and you don't accept it, you must retake the written exam.

Project: Detecting Sleep Apnea

There will be a specific lecture about the project later on!

The project will be about detecting sleep apnea from ECGs. The dataset is a **multimodal** collection of overnight physiological recordings centered on ECG, with reference labels indicating whether sleep apnea is present at each time interval.



Project Guidelines (Tentative)

There will be a specific lecture about the project later on!

- An individual 20 pages report with
 - data understanding
 - data preprocessing
 - solving the task with different solutions depending on the data modality
- Submitting the best prediction in a Kaggle challenge.

Submit it at least one week before the written exam

Roadmap (Tentative)

Category	Topics
Introduction	Intro to the course
ML Basics	Data, Models, Tasks
Linear Regression/Classification	Univariate Regression, SVMs, Logistic
Feedforward Neural Networks	Perceptron, Multilayer Perceptron
Recurrent Neural Networks	RNNs, LSTMs, GRUs
Convolutional Neural Networks	1D CNN, 2D CNN, (Autoencoders)
Attention	Transformers
Advanced Topics	GNNs, Seminars (maybe)