

# **ADVANCED DEEP LEARNING MODELS AND METHODS**

Course Logistics

# CALENDAR

The course will be taught in a blended mode: in presence for those who are allowed to join, with remote connections for the other students.

Lectures will be streamed on [Giacomo Boracchi webex room](#)

- February 7<sup>th</sup> 14:15 - 18:30 : *Deep Unsupervised Learning in Images*, Giacomo Boracchi
- February 9<sup>th</sup> 9:00 – 13:00: *Learning with Limited Supervision*, Alessandro Giusti (USI-SUPSI) **Sala Conferenze**,
- February 10<sup>th</sup> 14 – 18: *Deep Reinforcement Learning* Alessandro Lazaric (Facebook Paris). **This will be held online, connect to my webex room**
- February 16<sup>th</sup>, 14:15 - 18:30 *Deep Learning on Graphs and Structured Computation Models*, Jonathan Masci (NNAISENSE). **Sala Conferenze**
- February 17<sup>th</sup>, 14:15 - 18:30 *Variational AutoEncoders with Applications to Anomaly Detection*, Luigi Malagò (TINS, RM) **Room 25.01**
- February 18<sup>th</sup>, 14:15 - 18:30 *Privacy preserving learning*, Matteo Matteucci (Polimi) **Room 3.0.2**

REFERENCES: [HTTPS://BORACCHI.FACULTY.POLIMI.IT/TEACHING/ADVANCEDDLMM.HTM](https://boracchi.faculty.polimi.it/teaching/advanceddlmm.htm)

GIACOMO BORACCHI - TEACHING

## Advanced Deep Learning Models and Methods AA 2021/2022, PhD Course, Politecnico di Milano

### Overview:

The course presents advanced learning problems and how deep learning models have been applied to successfully solve them. In particular, models are considered advanced either in terms of non-conventional data-type being handled (e.g. graphs), the conditions where the learner has to operate (lack / shortage of supervision), or the problem is extremely challenging by itself (e.g. generating a natural image).

More information on the [Course program page](#)

### Organizers:

Giacomo Boracchi, Matteo Matteucci. Politecnico di Milano.

### Dates:

From February 7th 2022 to February 18th 2022, 6 seminars of 4 hours each.

### Enrollment:

Students from other universities are welcome to attend the lectures, but in general cannot take the exam nor receive an official attendance certificate from our secretariat. Students that need an official attendance certificate have to perform an official registration following the procedure on the [PhD website](#). In case this case, an administrative fee (32E) is requested.

### Blended Teaching Modality:

Either in presence or in [my webex room](#). Please check details below, a lecture will be held entirely online

### Schedule and Abstracts:

#### Deep Unsupervised Learning in Images

~~Giacomo Boracchi~~ Professor at Politecnico di Milano

February 7th, 14:15 - 18:30 Sala Conferenze, DEIB, Building 20

Early deep learning models were primarily solving supervised visual recognition problems such as classification, segmentation, detection. More recently, there has been a surge of deep learning methods addressing unsupervised vision tasks, including image restoration, enhancement and anomaly detection. As for their supervised counterparts, deep neural networks (and sometimes even famous pre-trained architectures) turned out to be more effective than traditional model-based solutions. During this lecture I will provide an overview of the image restoration (and in particular image denoising) and anomaly detection problems, describe the most relevant deep learning solutions in the literature, and discuss the most relevant challenges to be addressed by deep learning.

[Slides](#), [Video Recording](#).

I will publish all the recordings, as long as these are fine for the speakers.

## COURSE DETAILS FOR PHD STUDENTS:

- Minimum 70% attendance required. In practice you can skip a single lecture
- We will circulate a link to a MS form right after the break, please connect to webex to get it
- Assessment is pass-or-fail
- The exam consists in giving a talk presenting one paper (or two related papers) concerning the lecture topics
- You have to propose one/two papers that you are interested in. We will review your suggestions and define, possibly together with the speakers, which ones to present. Papers can be selected among those referenced in our slides.
- You can gather in groups of 2 students. The presentation should be around 10' per students + discussion
- We will arrange a few presentation days, where you can book a slot. We will gather papers related to the same topic in the same session, like a conference. Everybody is welcome to attend those presentation as well
- There will be a Q&A at the end of your presentation. Questions are welcome from the audience as well.

## COURSE DETAILS FOR MSC STUDENTS:

- No attendance requirements, but please fill the form
- Exam grading is 18 – 30L as usual
- You can recommend a paper related to the course topics which you are interested in
- Together with the paper, you need to propose a project where you implement and use the model presented in the paper. The simplest option is to reproduce the results, but you can go further proposing variants / studies / new applications.
- The detailed project will then need to be agreed with us.
- You can gather in groups of 2 students (or 3 when thoroughly justified due to an excessive work load).
- You need to write
  - Either a report presenting the work done to reproduce the model and experiments.
  - Either a paper-like resume presenting your solution / application, if this is possible.Templates will be provided
- You need to prepare a 15' presentation
- There is no exam schedule for PhD courses. We will organize a few presentation days where everybody is welcome to attend

# Exam rules

## PHD STUDENTS

Each PhD student should select 2 papers (3 papers for groups of 2 students) that are **related to one of the lecture topic**

The two papers (A,B) can be either:

- Paper A is the basic solution Paper B extends that
- Paper A and Paper B are two different approaches to be compared
- Paper B applies paper A to a specific scenario
- ...

The criteria trivially extends to  $n = 3$  papers

## PHD STUDENTS

Fill in a **form** where:

- You select which topic among the 6 lectures
- The link to the two papers
- 100 word abstract to illustrate how to connect the two / three

**The exam:**

we will arrange presentation sessions where you are invited to attend / present as a at conference.

**Dates:**

- End of April / May
- Mid July
- Beginning of September



## MSC STUDENTS

Each MSc student should select 2 papers (3 papers for groups of 2 students) that are **related to one of the lecture topic**

The two papers (A,B) can be either:

- Paper A is the basic solution that Paper B extends
- Paper A and Paper B are two approaches to be compared
- Paper B applies paper A to a specific scenario
- ....

The criteria trivially extends to  $n = 3$  papers

# MSC PROJECT FOR STUDENTS

## **The project:**

You are requested to implement the solution presented in the paper and or extend it (if there is a public implementation available). Apply the solution to a different domain you prefer

## **The exam:**

Present the results of the project in a paper-like report (6 pages, template provided).

Presentation in a conference like session (poster / oral tbd)

## **Dates:**

- July
- September
- December

## MSC STUDENTS

Fill in a **form** where:

- You select which topic among the 6 lectures
- The link to the two papers
- 100 word abstract to illustrate your project