POLITECNICO
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Artificial Neural Networks and Deep Learning

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Eng. Eugenio Lomurno – eugenio.lomurno@polimi.it
Dr. Francesco Lattari – francesco.lattari@polimi.it
but also ...
Prof. Giacomo Boracchi – *giacomo.boracchi@polimi.it*
Eng. Loris Giulivi – loris.giulivi@polimi.it

«Me, Myself, and I»

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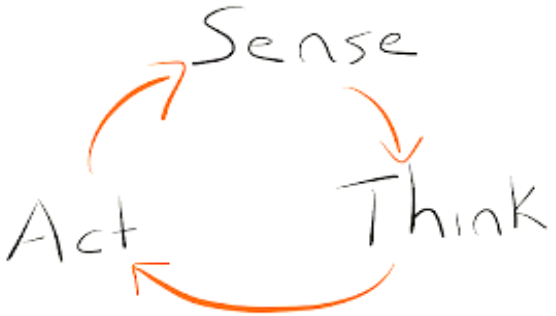
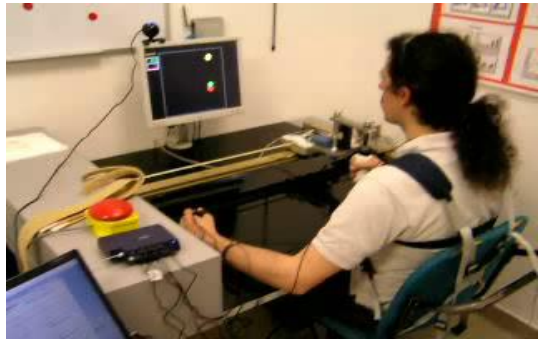
My research interests

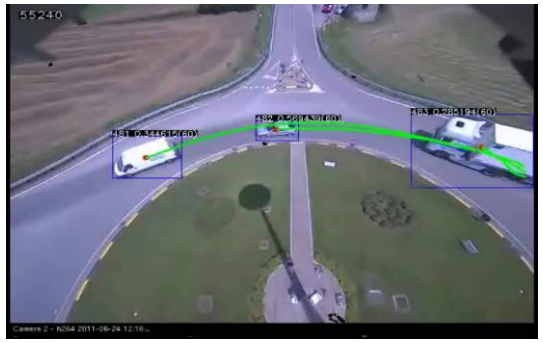
- Robotics & Autonomous Systems
- Machine Learning
- Pattern Recognition
- Computer Vision & Perception

Courses I teach

- Robotics (BS+MS)
- Machine Learning (MS)
- Deep Learning (MS+PhD)
- Uncertainty in AI (MS)







Enable physical and software autonomous systems to perceive, plan, and act without human intervention in the real world

Course Objectives

"The course major goal is to provide students with the theoretical background and the practical skills to ***understand and use Neural Networks,*** *and, at the same time, become familiar and with* ***Deep Learning for solving complex engineering problems*** *… especially* ***in vision tasks****"*

A Course with Code Sharing

This course is offered to Computer Science and Engineering students

- 054307 - ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING - 5 CFU
- Prof. Matteo Matteucci, Eng. Eugenio Lomurno, Eng. Francesco Lattari

… equivalent course for Bioengineering and Mathematical Engineering

- 056869 - ARTIFICIAL NEURAL NETWORKS AND DEEP LEARNING - 5 CFU
- Prof. Giacomo Boracchi, Eng. Loris Giulivi

You can attend the other in case you miss one or two …

The same teachers will teach the same topics to both classes, but you need to be enrolled in the right course and attend the right lectures …

The Teachers

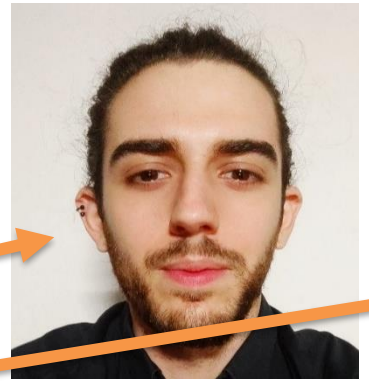
Official teacher, please refer to me for bureaucratic stuff!

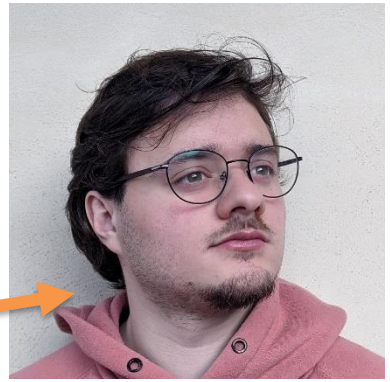
Prof. Matteo Matteucci

- Neural Networks
- Deep Learning
- Sequence Learning

Prof. Giacomo Boracchi

- Computer vision
- Deep models for vision





Eugenio Lomurno, Loris Giulivi, Francesco Lattari

- Programming with Keras (python)
- Online Challenge (python)

A detailed schedule is published on the course website don't panic!

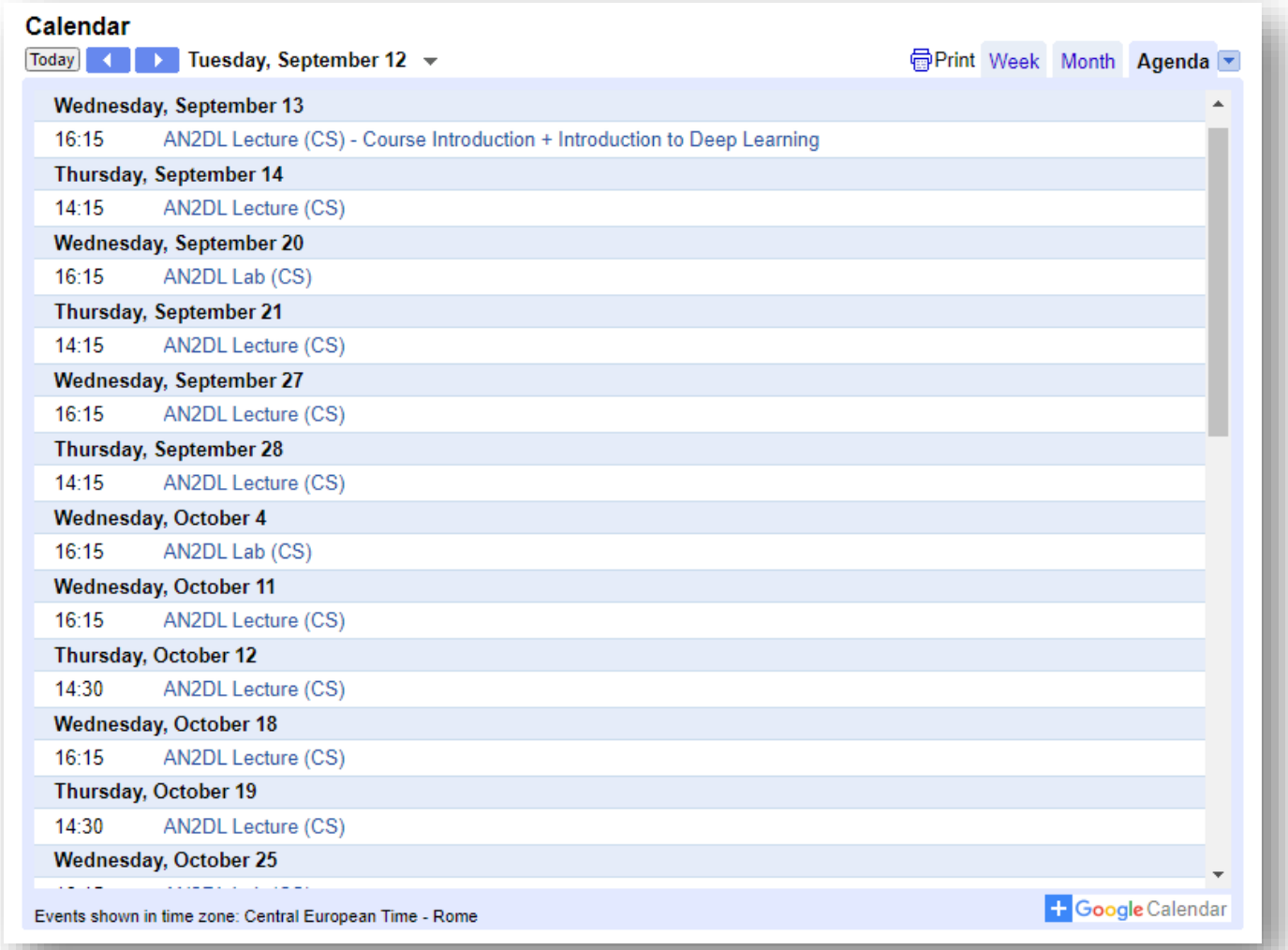
A Google Calendar for you!

https://boracchi.faculty.polimi.it/teaching/AN2DLCalendar_CS.htm

Each event includes

- Teacher & room
- Possibly last-minute slides
- Links to video recordings

Also this link is published on the course website!



Course Website and Detailed Schedule

All details and info are on the course website

https://chrome.deib.polimi.it/index.php?title=Artificial_Neural_Networks_and_Deep_Learning

How to get there?

- Goto https://chrome.deib.polimi.it
- Accept the risk of not having the proper certificates (a few times)
- Select "Artificial Neural Network and Deep Learning" on the left

What do you find there:

- Link to the detailed schedule !!! -> Google Calendar
- Last minute announcements
- Slides, notes, references, …

Course syllabus

Introduction to Neural Network and Deep Learning — **2h lecture**

Neural Networks and Deep Learning — **16h lectures**

- From the Perceptron to neural networks
- Backpropagation and neural networks training
- Best practices in neural network training
- Recurrent architectures
- Autoencoders and long short-term memories

Visual Recognition with Deep Neural Networks — **16h lectures**

- Image Classification and Convolutional Neural Networks
- CNN Training Tricks and Best Practices
- CNN for Advanced Vision Tasks (Segmentation, Detection,…)

ANN and Deep Learning Coding (with Keras) — **16h practicals**

Lectures Schedule and Timings

Classes (there is no real distinction between lectures and exercises):

- Wednesday, 16:15 – 18:15, in T2.2 (starts at 16:30 ends at 18:10)
- Thursday, 14:15 – 16:15, in T2.1 (starts at 14:30 end at 16:10)

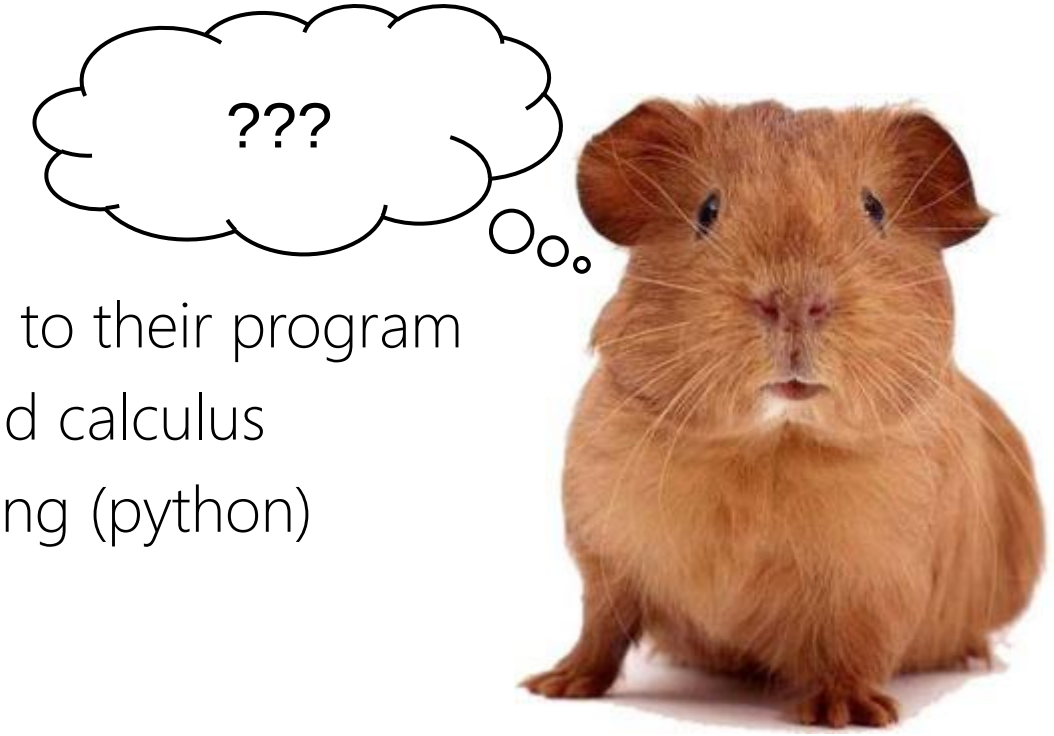
Check the detailed schedule for holidays and lecture topics

- Lectures will not be streamed
- Lectures will be recorded and made available afterwards
- You can attend the BIO – MTM, but ***need to be authorized*** and check the detailed schedule as they are not aligned!

CSE: https://boracchi.faculty.polimi.it/teaching/AN2DLCalendar_CS.htm

BIO+MTM: https://boracchi.faculty.polimi.it/teaching/AN2DLCalendar.htm

The Students



Students are expected to:

- To attend the proper classes according to their program
- Feel confortable with basic statistics and calculus
- Feel confortable with basic programming (python)
- Be curious and willing to learn …

Students are not expected to:

- Know more than what is usually tought in basic engineerig courses
- Know already about machine learning (althought it doesn't hurt)
- Be hyper-skilled python hackers (you'll not need it)
- …

Course Evaluation!

Grading comprises a theoretical part and a practical part:

- Written examination covering the whole program up to 20/30 ✚
- Home project in the form of 2 coding challenges up to 10/30 =
- Final score will be the sum of the grades of the two 30/30

Written Examination

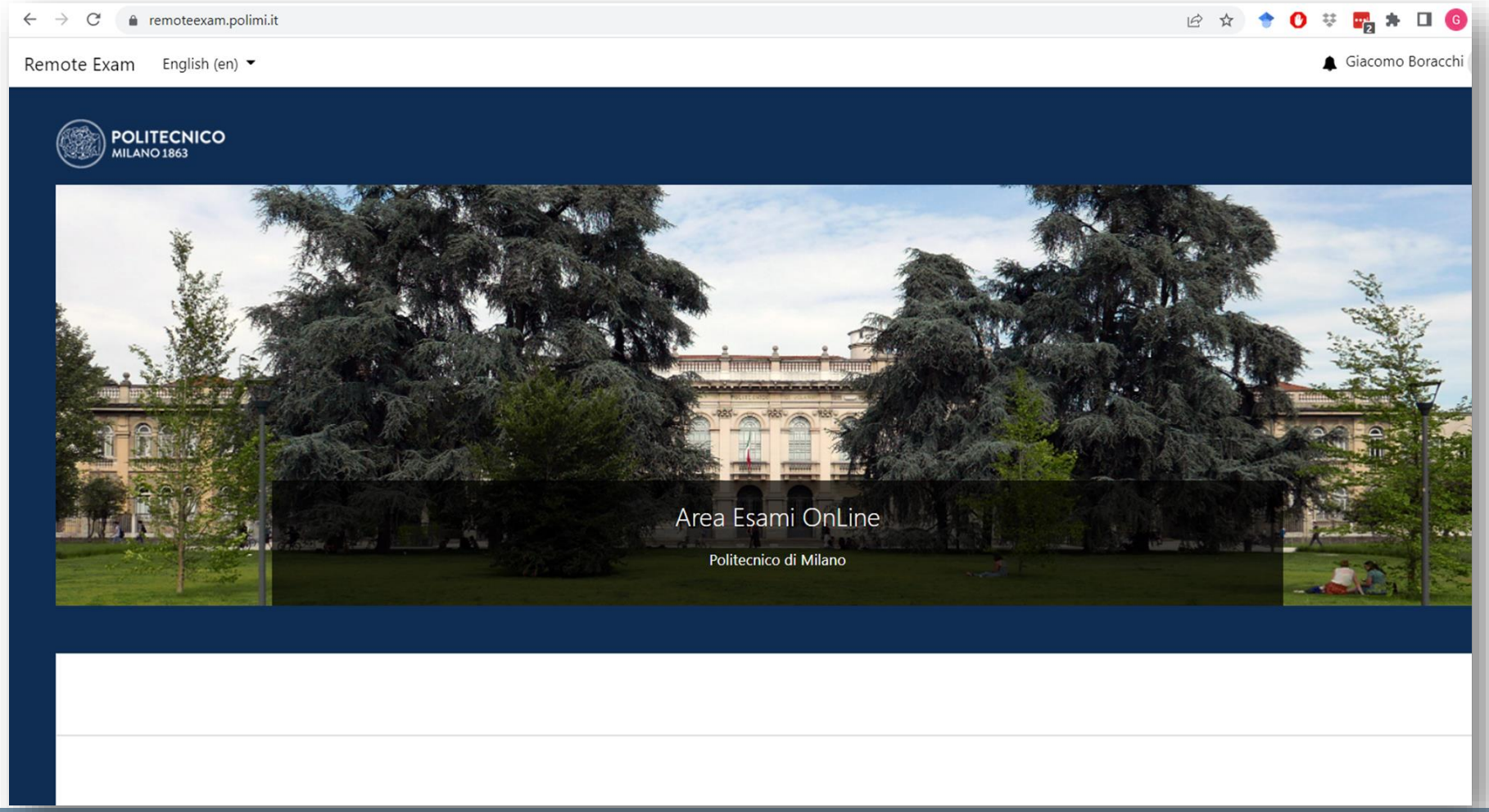
Digital exam on moodle:

- Bring your own laptop!
- We will use the platform: https://remoteexam.polimi.it/
- Safe Exam Browser (SEB) will be required
- SEB does not run on Linux…. Sorry for that… make sure you can borrow a Windows or Mac laptop

Please, make sure you can run the test quiz well ahead the exam.

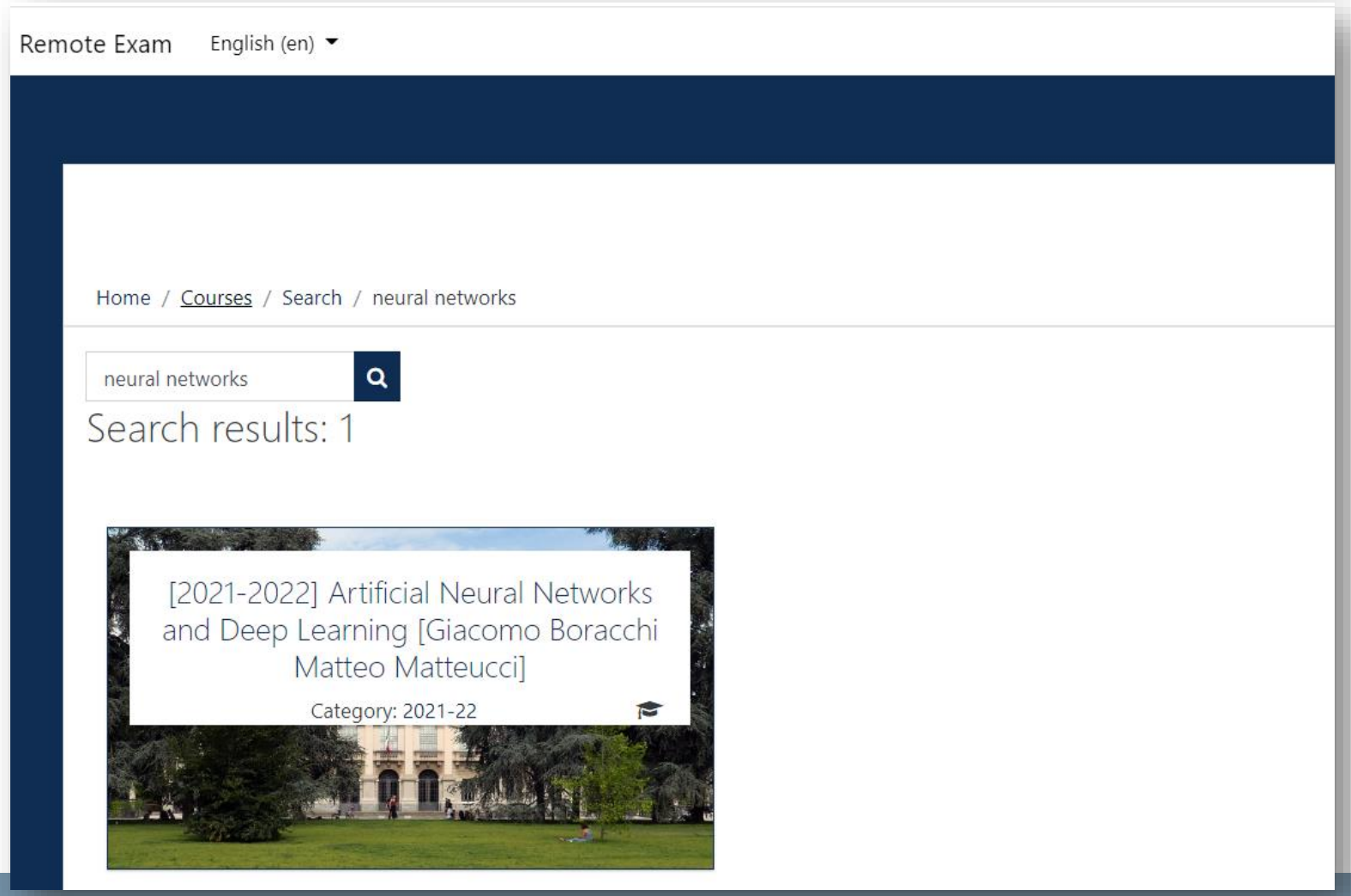
Written Examination

Go to https://remoteexam.polimi.it/



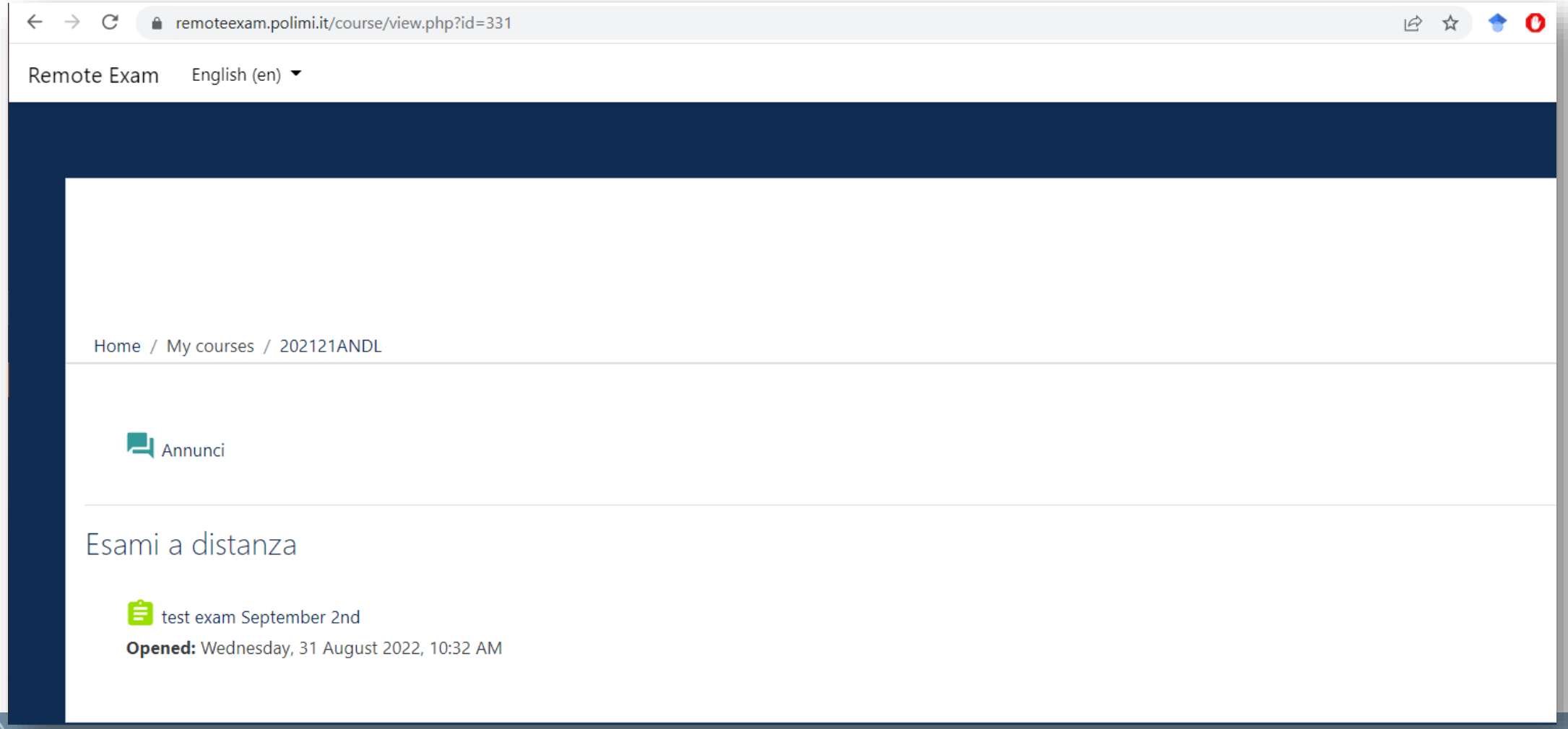
Written Examination

Search for our course (2023-2024 edition!!!)



Written Examination

Run the test (it is already there)



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Comments and notes about the grading

- 10 points of the theoretical part will be given by Prof. Matteucci
- 10 points of the theoretical part will be given by Prof Boracchi
- 5 points for each homework challenge are given by Francesco Lattari
- Homework challenges are not repeated, they are just run once a year
- Challenge 1 around 2nd November, Challenge 2 around 6th December

Challenges are graded based on what you do, not based on the position in the rank!

Course Evaluation!

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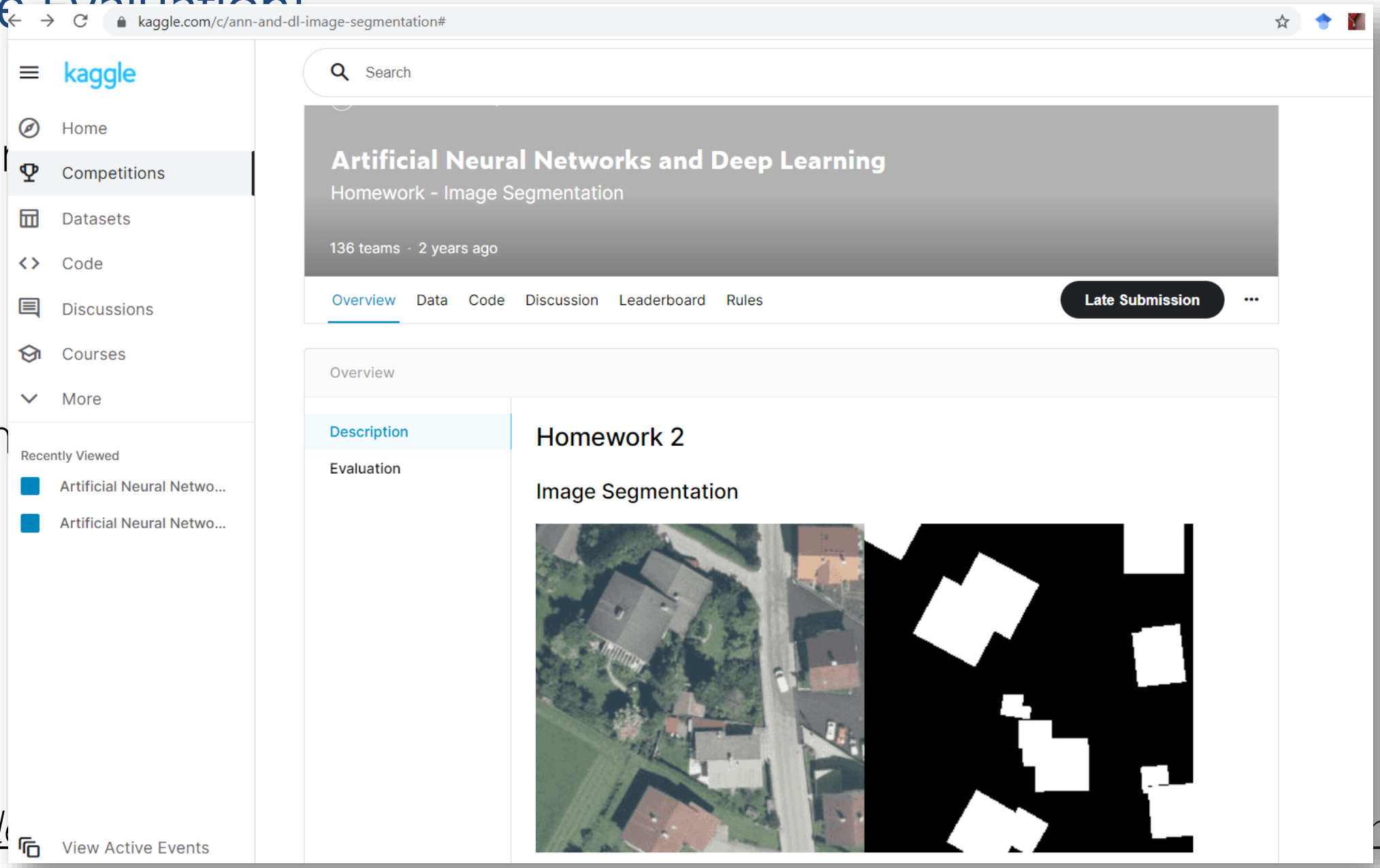

Course Evaluation!

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Comments

- 10 poi
- 10 poi
- 5 poir
- Home
- Challenge 1 around 2nd November, Challenge 2 around 6th December

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year

Laude is meant to reward brilliant students that:

- Actively participate to lectures
- Provide outstanding homework solutions
- Solve the written exam very timely

Challenges are graded based on what you do, not based on the position in the rank!

Synergies with Other Courses

AN2DL is a course on machine learnin… courses on the same topic, but it has b… …ith:

Even taking them all the overlap ends up to be at most 10h (<20%)

- *Machine Learnig*: there you see classical machine learning tools, some concepts such as generalization, overfitting, and crossvalidation might be similar …

  Machine Learnig: up 4-5h out of 60h (< 10%)

- *Uncertainty in Artificial Intelligence*: neural networks have been removed from this course and they have been replaced by Bayesian Networks and Graphical Models …

  Uncertainty in AI: up 0h out of 60h (0%)

- *Image Analysis and Computer Vision*: the feature learning part has been removed from Image and Computer Vision , there is just a shared background on image filtering…

  Image Analysis: up 2h out of 60h (< 4%)

- *Data Mining and text Mining*: does not cover neural networks and it is mostly based on unsupervised methods

  Data Mining and Text Mining: up to 4-5h out of 60h (< 10%)

Ironing out the kinks …

Some details have not been sorted out yet today, working on those ..

- WeBeep Use
  - No we use the calendar and enrolled students emails
- Projects/Competitions:
  - How many people per group (2-3 people)
  - Competitions out 2nd November & 6th December
- Practical evaluation of challenges:
  - Not doing it scores up to 0 points
  - Doing it with basic tools present in class up to 1-4 points (?)
  - Doing it with passion and in a propositive manner up to 5 points (?)
  - Automated scoring / code plagiarism check (?)

Frequently Asked Question (up to now)

I cannot attend all classes, do you follow a book?

You can find all covered topics on the Deep Learning book, but we are going to present the course in a personalized manner. Slides will be made available as well as lecture recordings.

I am not a computer scientist, will I be able to do the challenges?

We are going to use simple libraries, we expect with basic competencies in programming you should be able to do it autonomously (so far CSE students not best in challenges, mixed teams allowed)

Are you going to stream/record lectures?

We are going to record and share links on the Google Calendar. No lecture streaming, though.

I have overlaps can I attend AN2DL with BIO/MTM ?

*Sure, that's fine by us. However, please inform us so that we can keep track of how many students are going to attend. **Notice**: calendar is optimized for you to take this class the second year, do so!*

Other questions?