



**POLITECNICO
DI MILANO**

Neuroengineering (10 ECTS) class introduction: 2021-2022



Prof. Pietro Cerveri
pietro.cerveri@polimi.it

Neuroengineering part I

Prof. Alessandra Pedrocchi
alessandra.pedrocchi@polimi.it

Neuroengineering part II



Class info

Data	Dove	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
Lunedì	III.B					NEUROENGINEERING [I.C.] esercitazione Squadra1 (dal 13/09/2021 al 20/12/2021)							
Martedì	AULA VIRTUALE LEO					NEUROENGINEERING [I.C.] lezione Squadra1 (dal 14/09/2021 al 21/12/2021)							
Mercoledì													
Giovedì	AULA VIRTUALE LEO					NEUROENGINEERING [I.C.] lezione Squadra1 (dal 16/09/2021 al 23/12/2021)							
Venerdì	3.1.3						NEUROENGINEERING [I.C.] esercitazione Squadra2 (dal 17/09/2021 al 17/12/2021)						
Sabato													

Pietro CERVERI (part I)

Consultation time by appointment (email)

Monday 13.30 – 15.30 Building 21, via Golgi, 39 Milano, 4° floor

e-mail: pietro.cerveri@polimi.it

Alessandra PEDROCCHI (part II)

Consultation time by appointment (email)

Monday 13.30 – 15.30 via Golgi 39 Milano (campus Città Studi Building 21, 4° floor)

e-mail: alessandra.pedrocchi@polimi.it



Course organization and time table



		MONDAY (PRESENCE 3 hrs)	TUESDAY (VIRTUAL 3hrs)	THURSDAY (VIRTUAL 2hrs)	FRIDAY (PRESENCE 3 hrs)	
13/09/21	W1	Course presentation	Artificial neural networks (ANN)	Perceptron, learning and delta rule	PRACTISE basic NN (group 2)	
20/09/21	W2	PRACTISE basic NN (group 1)	Multi-layer ANN and backpropagation	Deep learning paradigm	PRACTISE FFNN (group 2)	
27/09/21	W3	PRACTISE FFNN (group 1)	Convolutional neural networks (CNN)	Autoencoder NN	Master thesis presentation	
04/10/21	W4	SEMINAR Python/TensorFlow (group 1)	GRADUATION	Encoding/Decoding networks	SEMINAR Python/TensorFlow (group 2)	
11/10/21	W5	Generative Adversarial Net (non duplicated)	Concepts of explainable AI	Computational Neuroscience 1	PRACTISE EBRAINS platform (group2)	
18/10/21	W6	PRACTISE EBRAINS platform (group1)	Computational neuroscience2	Neurorobotics	Comp. neuroscience journal club (group2)	
25/10/21	W7	Comp. neuroscience journal club (group 1)	Rehabilitation robotics 1	Rehabilitation Robotics 2	Rehab Robotics journal club (group2)	
01/11/21	W8	NO CLASS	Neuroprostheses 1	Neuroprostheses 2	Rehab robotics journal club (group1)	
08/11/21	W9	NO CLASS	NO CLASS	in vitro neuroengineering 1 flipped + 2	interdisciplinary seminars (non duplicated)	
15/11/21	W10	Project workshops				Mid-term exam Pedrocchi
22/11/21	W11					
29/11/21	W12					
06/12/21	W13					
13/12/21	W14					
20/12/21	W15	Public presentation of finalist projects				

Mid-term Part II Pedrocchi, Nov 20th (hour and class TBD)



Goals

Development of projects help students apply abstract ideas and think critically about what they have learned. Learning efficiency increases in small groups

Competitive learning-> CONTEST

Key features

- Team work (small group of students)
- Selection of one well-defined and favorite topic
- Deep study of state-of-the-art literature and tailored lab activities
- Support by an expert tutor, besides one of the two professors
- Project implementation in competing small groups
- Public presentation



STEP 0 PREPARATION (8-12 NOV)

- Nov 8th: Project topic presentations- for each group, forums on WeBeep with presentations of tutors and goals of the PW (with relevant papers) and schedule of project revisions (weekly appointments, possibly in presence)
- Deadline Nov 11th: Each student will rank his/her priorities in the project topic list (selection by webform)
- Nov 12th: According to selection results and maximum group sizes, professors finalize and publish the groups

STEP 1 (15-25 NOV)

- Personal study of the relevant papers - A few (2-3) reference papers (recent and relevant) are available on each forum.
- Each student has to study deeply the papers of his/her PW group
- Nov 16th -17th Meeting #1: literature review discussion
- Nov 18th-22nd Meeting #2: lab activities for project data and tool presentations (in presence, if possible)
- Subdivision in competitive teams (maximum 4/5 students each team)



PW schedule

STEP 3 (26 NOV-10 DIC)

- Weekly meetings (possibly in presence) of each team with tutors (about 1 hr per team, following the published schedule)

STEP 4 (13 DIC- 20 DIC)

- Each team will arrange a video (maximum 3 min)
- Dec 14th: Video delivery date
- Dec 17th: Video evaluation, selection of winners (one winner per topic)
- Dec 20th: Winners will undergo public final presentation and discussion, possibly in presence

08/11/2021	W9	Publication of topics	Students ranking		Allocation to topics
15/11/2021	W10		Group literature discussion	Group literature discussion	LAB tools recap for each group
22/11/2021	W11	LAB tools recap for each group?	Project development - weekly meeting with tutors		
29/11/2021	W12	Project development - weekly meeting with tutors			
06/12/2021	W13	HOLIDAYS	HOLIDAYS	Project development -- weekly meeting with tutors	
13/12/2021	W14	Video preparation	Videoclip delivery?	evaluation of videoclips	selected finalists
20/12/2021	W15	Public presentation of finalist projects			



Ranging from 0 to 32 (1/3 of the final grade) considering

- feedbacks from tutors about the effort and the work during the PW meetings
- Video evaluation (including communication efficacy)
- (only for winners) final presentation and discussion (max 5 points):
 - originality of the idea, feasibility, communication skills.

NON ATTENDANCE OR PARTIAL ATTENDANCE

- In case, a student does not participate to the PW activities (or participates only to 2 meetings out of 5)
 - the PW evaluation is NULL.
 - He/she is admitted to an optional oral exam with both professors on the whole exam syllabus (not recommended).
- In the case of participation to 3 out of 5 PW meetings and the final video, the evaluation of the student will consider the partial attendance.



Overall evaluation

Plain average of three sub-scores (each in 32th):

Score Part I
CERVERI

Score Part II
PEDROCCHI

Score Project
Workshop (PW)

1st part :
0 to 32

+

2nd part :
0 to 32

+

3rd part :
0 to 32

3



Inline progress evaluation

- Part I Prof. Cerveri
 - Online using Microsoft forms
- Part II Prof. Pedrocchi (written open questions)
 - Mid term written test (optional) on Saturday November 20th, it fully replaces the Part II written exam.
 - In presence [only in case of general prescriptions or strong personal motivations on-line :pen and paper - upload of photos]



- On WeBEEP you will find :
 - slides of the lectures, with notes
 - supporting material (lecture notes; chapters of books; scientific reviews; papers)
 - example of exams
- Google drive (Prof. Cerveri) you will find:
 - data for PW
 - Python source code for DT