Biological and Artificial Intelligence  
**Neuro 140/240**  
Harvard College/Graduate School of Arts and Sciences: 207645  
**Spring 2023**

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**Overview**

This course provides a foundational overview of the fundamental ideas in computational neuroscience and the study of Biological Intelligence. At the same time, the course will connect the study of brains to the blossoming and rapid development of ideas in Artificial Intelligence. Topics covered include the biophysics of computation, neural networks, machine learning, Bayesian models, theory of learning, deep convolutional networks, generative adversarial networks, neural coding, control and dynamics of neural activity, applications to brain-machine interfaces, connectomics, among others. Lectures will be taught by leading Harvard experts in the field. 

Lectures presented by: **Born, Barbu, Drugowitsch, Kreiman, Pehlevan, Sompolinsky, Ullman, Murphy.**

**Class website**

http://klab.tch.harvard.edu/academia/classes/BAI/bai.html

https://canvas.harvard.edu/courses/114899 (login required)

Lecture notes, slides, reading assignments, and other information will be posted in the class web site.

**Location:** Zoom Online Meeting

**Meeting Times**  
Tuesdays: 3:00 pm to 5:00 pm
FIRST CLASS = January 24, 2023

Contact information and office hours

Main faculty: Gabriel Kreiman
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3 Blackfan Circle, CLS 18047. Boston, MA 02115
Office hours:
https://calendar.x.ai/gabrielkreiman/virtual

Teaching assistants:

Pranav Misra
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Prerequisites:
Recommended:
Math (Maa/Mab, Math1A,1B, Math19a or equivalent).
Physical Sciences 1.
Life Sciences 1a (or Life and Physical Sciences A)
Life Sciences 1b. [or equivalent]
MCB80
CS50

Topics:
- Introduction to artificial intelligence
- Introduction to computational neuroscience
- Machine learning
- Reinforcement learning
- Visual recognition
- Computer vision
- Deep convolutional networks
- Neural networks
- Neural coding
- Learning and memory
- Animal intelligence
- Collective intelligence

Suggested books

There won’t be an official book for the class. Here are some interesting books that touch upon some of the topics covered in class. The class will not follow any of these books.

Press.


Projects

A highlight of the course will be hands-on direct exposure to projects in the field:

- A list of projects will be provided the first week
- Students have to choose one and only one project
- With approval from the TA and Faculty, students can propose a variation of one of the proposed projects or a project of their own.
- Students work on their projects throughout the course. There will be office hours and consultation with the TAs via email request
- Approximately half-way through the course (see schedule), students must give a short presentation of their ongoing work with the project.
- At the end of the course (see schedule), students must hand-in a final report on their project.
- At the end of the course (see schedule), students must give a final presentation of their project.

Grading
Final grades will be computed as follows:

- Deliverable 1: 5%
- Deliverable 2: 5%
- Midterm project proposal: 20%
- Deliverable 4: 5%
- Final project report: 65%

**Schedule**

Schedule posted on class web site