Syllabus

Friday, June 7, 2024 5:16 PM

Introduction to Brain Computer Interfacing

CS 4390/5390: instructors Eric Freudenthal with Steve Sands

to also be cross-listed with BME 5390

Prerequisites: None

Ideal enrollment: 20 students total

Preferred time: 3-5 MWF, ideally in CCSB

Brain-Computer Interfaces (BCIs) are a rapidly evolving technology that builds a direct channel between the human brain and the computer . BCIs are used to translate signaling from the brain so that the computer can use it as input for a task . Recent advances in neural interfacing and neural imaging technology have enabled us to better understand and then utilize brain activity for interacting with computers and other devices

This course will examine how neural signals are associated with thoughts, emotions, senses, and intended motion. We will study a few case studies (with applications) of successful BCI such as vision and sound perception and stimulation (such as cochlear implants and vision restoration, and applied examples in neuromarketing. Students will be given hands-on experience recording and analyzing neural activity using neuro-physiology monitors and analysis software.

Learning outcomes

- Basic principles of neurophysiology
- Simple brain anatomy
- Basics of neurosignal processing and analysis
- Introduction to neuro-behavioral experimental design on human subjects
- Familiarity with data collection techniques and software tools for forming and analyzing images from neuro-data.
- Familiar with applications to neuro-marketing

4 week summer semester

Costs (beyond registration)

- Possibly a textbook (TBD)
- Approximately $40 per person in expendable lab supplies (TBD)

First Month

1. Anatomy
    a. Cellular architecture (neurons & neurotransmitters)
    b. Gross mammalian neural architecture
    c. Lab: intro to BCI device
2. The signals
    a. Observable brain signals
    b. non-neural activity
    c. How they're measured
    d. Lab: separating a neuro and non-neural signals
3. Data acquisition
    a. Filtering and analysis tools
    b. Time and frequency analysis
    c. Identifying signals from cortices
4. Applications
    a. Neuro-marketing
    b. Cognitive research
    c. Systems: Neuro-sensing and Neuro-control

- Readings:
    - No textbook (this is a new field)
    - We may assign readings from freely available sources
- Lab supplies: (details tbd)
    - ~$40/student in expendable material
    - $50/team (3 students / team)
    - Students should have windows or mac laptops

- Grading:
    - This is a seminar course.
    - Grading will generally be driven by the instructors' observations of your preparedness and participation in class discussions and (if necessary) intermittent quizzes.
    - Details will be discussed during class.

- Graduate students will be
    - assigned a relevant research paper
    - Which they read, prepare a short (1pp) summary, and present in class
    - This process will be discussed in detail during the course

- Disabilities and Accommodations
    - If you have a disability and need classroom accommodations, please contact The *Center for Accommodations and Support Services* (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.
    - Students are expected to conduct themselves in a professional and courteous manner, as prescribed by the Standards of Conduct: http://hoop.utep.edu/Student_Affairs_Chapter_One-HOP.htm

- Academic Honesty
    - By default, **collaboration and use of 3rd party resources is not permitted** when preparing solutions to problems posed during in-class **tests and quizzes**.
    - Students are **strongly encouraged to collaborate and utilize online resources** when preparing solutions to lab assignments. See section on lab projects (above) for details.

- It is academic dishonestly for students to claim others' creative work as their own.
- If academic dishonesty is suspected: The student conduct office will be contacted for adjudication. A temporary "incomplete" grade will be issued if their investigation extends beyond the grading period.