From brains to intelligent machines

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- **Class meetings:** MW 4:00pm-5:20pm, MCK 125
- **Office hours:** Thursday 2-4pm (LISB 215)

- Syllabus (https://canvas.uoregon.edu/courses/108784/assignments/syllabus)
- No textbook required, all materials available on Canvas or online.
- **Lecture slides** can be found in Files > Lectures.
  - These SVG files **do not** open directly on Canvas. You need to download each file and open it with a web browser.
  - Use the arrow keys (left/right) to advance through the slides.
- Quick introduction to Canvas (https://canvas.uoregon.edu/courses/26168)

Course description

In this course, designed for non-science majors, we will discuss how the brain and artificial computing systems process information. The course will introduce students to the process of scientific reasoning, and discuss methodologies used by scientists to gain knowledge about how the nervous system works. The course also covers how scientists and engineers attempt to replicate these processes in computers and artificial intelligence systems. The course will illustrate parallels in information processing and computation between biological and artificial systems.

Readings and videos before class will provide background information. The main concepts and skills will be further developed through in-class activities in which students play the role of scientists and engineers solving problems about computation in biological and artificial systems. In the last part of the course, students will discuss the implications to society of intelligent machines and technologies for interfacing brains and machines.

Learning objectives

1. Gain a basic understanding of how the nervous system acquires and processes information.
2. Gain a basic understanding of how every-day computing devices process information and the approaches followed for designing intelligent machines.
3. Analyze and compare approaches for acquiring knowledge about how the brain works.
4. Develop the ability to formulate hypotheses and follow the scientific method to acquire new knowledge.
5. Become a critical reader of popular science writings.
6. Evaluate the impact of brain science and engineering to society.

Grading

- 10% – In-class i>clicker questions and class participation
- 20% – Weekly quizzes (the quiz with the lowest score will be ignored)
- 15% – Mid-term 1
- 15% – Mid-term 2
- 20% – Final project (5% for first part, 5% for second part, 10% for final part).
- 20% – Final exam

Grade	Percentage
A	90%-100%
B	80%-89%
C	70%-79%
D	60%-69%
F	59% and below

Academic Honesty

Group discussions outside of class are encouraged. However, all work submitted as part of this course must be your own. The use of sources must be properly acknowledged. Copying or paraphrasing information from any source without citation is plagiarism. For more information, see http://library.uoregon.edu/guides/plagiarism/students/index.html

The consequences of academic dishonesty will be taken seriously (e.g., an 'F' in the course and a report to the Office of Student Conduct) and are noted on student disciplinary records. If you are in doubt regarding any aspect of these issues, please come and speak with me.

Students with disabilities

If you have a documented disability and anticipate needing accommodations in this course, please make arrangements to meet with me. Please request that the Counselor for Students with Disabilities send a letter verifying your disability.

Course Syllabus

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Week 1:

- Introduction to the course.
- Scientific methodologies and engineering approaches.
- **Online quiz #1** (due Sunday)

Week 2:

- History of computing machines and brain science.
- Components and scales of computing systems.
- **Online quiz #2** (due Sunday)

Week 3:

- How systems acquire information: how brains and machines see and hear.
- Representation of information: coding with bits and action potentials.
- **Submit first report of final project** (due Sunday)

Week 4:

- Review.
- **Mid-term exam #1** (Wednesday).
- **Online quiz #3** (due Sunday)

Week 5:

- Transformations and computations in electronic systems.
- Transformations and computations in neuronal systems.

- **Online quiz #4** (due Sunday)

Week 6:

- Parallels between biological and artificial memory.
- Biological and artificial mechanisms for learning.
- **Online quiz #5** (due Sunday)

Week 7:

- Technologies (fiction and reality) for memory manipulation.
- Activities to prepare for second report of project.
- **Submit second report of final project** (due Sunday)

Week 8:

- Review.
- **Mid-term exam #2** (Wednesday).
- **Online quiz #6** (due Sunday)

Week 9:

- *No class on Monday: Memorial day.*
- Thinking machines: chess programs, IBM's Watson and self-driving cars.

Week 10:

- Neuroprosthetics and brain-machine interfaces.
- Review and conclusions: How far is reality from fiction?
- **Submit final project** (due Wednesday)

Final exam: TBD