

ESE 577 — Deep Learning Algorithms and Software

Instructor: Jorge Mendez-Mendez

Fall 2024

1 Lecture

Thursdays 6:30 pm – 9:20 pm, Frey Hall 216. Attendance is mandatory. During lectures, we will do an overview of the technical contents of the course, tie together the high-level motivation for the ideas we'll cover, and go over concepts in detail.

Recitation A 3-hour lecture is too much for anyone (including myself!). To alleviate this, we will use the second half of the lecture as recitation, where we will do exercises on the whiteboard and some Python coding.

2 Office hours

Mondays and Wednesdays, 3:00 pm – 5:00 pm, Light Engineering Building, Room 145.

3 Course description

This course is an introduction to deep learning which uses neural networks to extract layered high-level representations of data in a way that maximizes performance on a given task. Deep learning is behind many recent advances in AI, including Siri's speech recognition, Facebook's tag suggestions and self-driving cars. Topics covered include basic neural networks, convolutional and recurrent network structures, deep unsupervised and reinforcement learning, and applications to problem domains like speech recognition and computer vision. Classes will be a mix of short lectures and tutorials, hands-on problem solving, and project work in groups. Fall, 3 credits, grading ABCF.

4 Lecture schedule

The following schedule is tentative and subject to change.

- 08/29 – Introduction to machine learning, regression, regularization
- 09/05 – Gradient descent
- 09/12 – Logistic regression
- 09/19 – Features
- 09/26 – Neural nets: multilayer perceptrons, backpropagation
- 10/03 – Convolutional neural nets (CNNs)
- 10/10 – Modern neural nets: early stopping, dropout, batch normalization, skip connections
- 10/17 – Sequential data, recurrent neural nets
- 10/24 – Transformers
- 10/31 – Unsupervised learning
- 11/07 – Markov decision processes (MDPs)
- 11/14 – Reinforcement learning
- 11/21 – Deep reinforcement learning
- 11/28 – No classes (Thanksgiving break)
- 12/05 – The future of deep learning

5 Recommended books

- “Deep learning with Python,” (2nd edition) by François Chollet
- “Deep learning: A visual approach,” by Andrew Glassner
- “Deep learning with Pytorch,” by Eli Stevens, Luca Antiga, and Thomas Viehmann
- “Deep learning,” by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
- Deep learning has become so popular, that you can find blogs and tutorials for just about any topic. I encourage students to browse around to find additional material.

6 Grading

The following evaluations will take place throughout the semester:

- 10% quizzes: 14 quizzes, one at the end of every class. I will keep only the best 10 grades for each student.
- 20% homework: approximately 10 homework assignments, roughly weekly
- 20% project: single larger project toward the end of the semester
- 20% midterm: date TBD
- 30% final: date determined by the registrar's office

Late days Assignments turned in late will receive a penalty of 20% per day. The full 20% penalty is applied at midnight immediately after the deadline for each assignment. Each student will be granted three automatic 1-day extensions on homework assignments.

Collaboration policy Students are responsible for writing their own quizzes, assignments, projects, and exams. For homework assignments, students are welcome (and encouraged) to discuss problems with one peer, **but each student must write their own assignment writeup and code individually**. The peer must be listed at the top of the writeup for each assignment.

7 Student Accessibility Support Center Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: <https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-disabilities> and search Fire Safety and Evacuation and Disabilities.

8 Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work

as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html.

9 Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.