ECE/CS 559: Neural Networks

University of Illinois, Chicago

Spring 2020

1 Time and Venue

Days: Every Monday, Wednesday and Friday.
Time: Between 3:00 pm and 3:50 pm (Afternoon)
Place: Behavioral Sciences Building 140.

2 Course Description

This is a graduate-level introductory course on artificial neural networks. Inspired by biological neural networks, which include our brains and central nervous systems, we will study networks of interconnected computation units (mathematical neurons) that enable highly-parallel computation, non-linear function approximation, etc. Such networks have a wide-array of practical applications including pattern (character, image, license plate, fingerprints, face, ...) recognition and classification, clustering, prediction, medicine, image compression, gaming, security, and many others. Some specific topics include models of mathematical neurons, the perceptron, the gradient descent and LMS algorithms, learning methods, multilayer networks, the backpropagation algorithm and its implementation details/tricks, associative memory, recurrent networks and Hopfield networks, support vector machines, principal component analysis, convolutional networks, and generative adversarial networks.

3 Instructor

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Office Hours: Monday and Wednesday, 10:00am-11:00am, or by appointment.

4 Teaching Assistants

TBA.

5 Prerequisites

Basic knowledge of linear algebra, programming skills. For programming, MatLab or Python is recommended, but other languages are fine provided that you can perform linear algebra, do file operations, generate graps, etc. You may also use Octave, which has almost the same syntax and functionality as MatLab and is available online for free. There are also many tutorials on Matlab, Python, and Octave.

6 Suggested Textbooks

It is highly recommended that the students attend the class regularly and take notes. In addition, the following textbook will be one of our main references, although it is not mandatory that you purchase it.

- S. Haykin, *Neural Networks and Learning Machines*, 3rd edition, Pearson Prentice-Hall, 2009.

The following textbooks are also suggested for additional/independent reading.

- M. Nielsen, *Neural Networks and Deep Learning*, 2016. [Online] Available: http://neuralnetworksanddeeplearning.com
- Ö. Morgül, *EEE 443/543 Lecture Notes, Bilkent Univ.* [Online] Available: http://kilyos.ee.bilkent.edu.tr/∼eee443/
- J. M. Zurada, *Introduction to Artificial Neural Systems*, PWS Publishing Company, 1995.
- M. H. Hassoun, *Fundamentals of Artificial Neural Networks*, The MIT Press, 1995.
- C. M. Bishop, *Neural Networks for Pattern Recognition*, Oxford, 1995.
- L. Fausett, *Fundamentals of Neural Networks: Architectures, Algorithms, and Applications*, Prentice Hall International, Inc., 1994.
- D. Graupe, *Deep Learning Neural Networks - Design & Case Studies*, World Scientific Publishing Co., July 2016.
- B. D. Ripley, *Pattern Recognition and Neural Networks*, Cambridge University Press., 1996.

We may cover material that is not available in any one of the references above. Therefore, to reemphasize, students are encouraged to attend the class regularly and take notes. I will also post polished lecture notes online.

7 Grading

Homeworks:	25%
Midterm 1:	25%
Midterm 2:	25%
Midterm 3:	25%
Final:	25%

- **The worst of Midterm 1, Midterm 2, Midterm 3, and Final grades will be dropped. That is why, in the above allocation, each is assigned 25% of the overall grade.**
- Attendance is not mandatory, but students are encouraged to attend the classes.
- Homeworks will focus on problem solving and/or mini computer projects.
- Grading policy: Curve.

8 General Policies

8.1 Late policy

Homeworks will be submitted electronically to Gradescope. Homeworks that are not submitted by the deadline will get a 5 point penalty every hour. This means, if the deadline is 3pm, and you submit at 3:00pm + 1 second, you will get -5 points as penalty. At 5:34pm, the penalty will be -15 points, and so on.

Also, to accommodate for unforeseen circumstances, one homework with the lowest grade (including 0 for a missing one) will be dropped. This means that you can skip one homework without asking permission.

8.2 Collaboration on assignments

You are allowed to discuss with your classmates, but you are supposed to do your assignment individually. If we notice that two assignments reports (homeworks, project reports) are identical, both students will get a 0 grade for that homework; they will also be subject to the rules of UIC Academic Integrity Policy.

8.3 Exam Policy:

- All the exams are closed book, closed notes, no cheat sheets, no calculators, etc.
- You will be given the opportunity to take a make-up exam only in cases of medical or personal emergencies, which must be verified. If such an emergency occurs, call me or leave a note (or phone message) with the department secretary as soon as possible. For non-emergencies, note that the lowest of the three exams grades will be dropped. Non-emergencies include weddings, conferences, etc.

8.4 Religious Holidays:

Students who wish to observe their religious holidays should notify instructor by the tenth day of the semester of the date when they will be absent unless the religious holiday is observed on or before the tenth day of the semester. In such cases, the students should notify the instructor at least five days in advance of the date when he/she will be absent. Every reasonable effort will be made to honor the request.

8.5 Academic Integrity:

Dishonest actions by students including plagiarism will result in appropriate disciplinary action. Intentional use or attempt to use unauthorized assistance, materials, information, or people in any examination, quiz, or assignment may lead to penalties such as a failing grade. UIC Academic Integrity Policy will be followed.

9 Some important days of the semester

- January 20, Monday: Martin Luther King, Jr., Day. No classes.
- February 14, Friday: Midterm 1.
- March 13, Friday: Midterm 2.
- March 23-27, Monday-Friday: Spring Vacation. No classes.
- April 10, Friday: Midterm 3.
- Some day between May 4-8: Final exam (To be announced by the university).

10 Miscellaneous

Course Website: Piazza and Gradescope.