CS6673 Neural Network Computing

Computer Science and Engineering
Tandon School of Engineering
Fall 2018

Time/Location:

Tuesday: 6:00 - 8:30 pm / 2 MTC 812(8th floor)

Instructor

Prof. K. Ming Leung

email

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Office

2 MTC: 10.096

Office Hours

Monday: 10:00 am - 11:00 am
Tuesday: 10:00 am - 11:00 am, and 4:00 - 5:50 pm

Catalog Description

This course gives an introduction to neural network models and their applications. Organization and learning in neural network models including perceptrons, adalines, backpropagation networks, recurrent networks, adaptive resonance theory and the neocognitron are discussed. Application in areas such as decision systems, nonlinear control, speech processing and vision is explored.

Prerequisites

The pre-requisite for this course is CS 5403 (Data Structures and Algorithms) or its equivalent. Undergraduate student may take this course if they have already taken CS 1114 or CS1133, and the undergraduate math sequence. Basically the student must

be capable of writing computer programs in a modern programming language to solve scientific and engineering problems. There is no specific programming language that is required. Students must also have taken linear algebra or its equivalent.

Textbooks

A book on the more classical topics on neural networks: *Neural Networks – A Systematic Introduction*, by R. Rojas, Springer-Verlag, Berlin Heidelberg New York, ISBN-13: 978-3-540-60505-8. A free online copy is available from our NYU library.

A very readable textbook: *Neural Networks and Deep Learning*, by Michael Nielsen, Determination Press, 2015.
Click this link to view it free of charge: `http://michaelnielsen.org/`.

A must-read textbook on deep learning: *Deep Learning*, by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press, 2016
Click this link to view it free of charge: `http://www.deeplearningbook.org`.

Course Learning Outcomes (Direct Measures)

1. Practical Applications of Neural Networks
2. Feedforward neural networks
3. Iterative neural networks
4. Use of neural networks in pattern recognition, classification and association
5. Use of neural networks in data clustering
6. Supervised and unsupervised learning

Topics Covered (tentative)

1. Introduction to Artificial Neuron Networks.
2. Neural Networks for Pattern Classification.
3. Perceptron for Pattern Classification.
4. ADALINE for Pattern Classification.
5. Back Propagation Algorithm for Multilayer Network.

6. Important Considerations to Facilitate Deep Learning
7. Convolutional Neural Network to Classify Visual Patterns
8. Building and Training a Deep CNN from Scratch
9. Transfer Learning in a Deep CNN
10. Learning Vector Quantization.
11. Neural Networks for Pattern Association.
12. Iterative Bidirectional Memory.
13. Iterative Discrete Hopfield Net.
14. Hamming Net.
15. Self-Organized Map.
16. Adaptive Resonance Theory - ART1
17. Radial Basis Function Networks

Grading Scheme

At the end of the semester, your grand total score will be computed according to the formula:

Total = Homework (25%) + Midterm 1 (25 %) + Midterm 2 (25 %) + Project (25 %)

Homework

Homework assignments must be submitted in hardcopy form before the start of the class on the day it is due. There will be about a total of 8 or 9 such assignments. Collaboration with anyone is not allowed.

Midterm 1

The first midterm will cover roughly the material from the first half of the course.

Midterm 2

The second midterm will cover roughly the material from the second half of the course. It will be held during the last class of the semester.

Project

Details will be posted several weeks into the semester.

Please note that homeworks will continue to be assigned even after the project has been posted. Thus it is important for you to start working on the project as soon as it is posted and not wait till shortly before its due date. It is especially important for a project since it is often hard to gauge the degree of difficulty of the project until it is close to being completed.

Academic Misconduct

Students in the class must obey the Code of Conduct of the School of Engineering (http://engineering.nyu.edu/academics/code-of-conduct/academic-misconduct). In particular, pay attention to the policies and procedures on academic misconduct. Students must write their own code, and take their own tests. Any student who is found to be violating this policy will be given a failing grade for the course and will be reported to the authorities as described in the University's Student Code.

Students with Disabilities

If you are student with a disability who is requesting accommodations, please contact New York Universitys Moses Center for Students with Disabilities at 212-998-4980 or mosescsd@nyu.edu. You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at (http://www.nyu.edu/csd). The Moses Center is located at 726 Broadway on the 2nd floor.