CSE 691: Machine Intelligence with Deep Learning

SYLLABUS FALL-2018

Instructor

Professor Qinru Qiu, Department of Electrical Engineering and Computer Science, Room CST 4-133,
Tel: (315)443-1836, email: qiqiu@syr.edu
Office Hours: Wednesday 10:00am – 12:00pm
Thursday 2:00 pm – 3:30pm

Class Location and Times (Lectures)

Day: Tuesday & Thursday
Location: Science & Tech Center 1-019
Time: 12:30 PM ~ 1:50 PM

Teaching Assistant

Ziyi Zhao

Email: zzhao37@syr.edu

Office Hours: TBD

Location: TBD

Course Web Page

All instructional materials, including lecture notes, homework and lab assignments will be posted on BlackBoard@SU. Look for Blackboard announcement for important messages.

Description

Deep learning technique has resulted many interesting and important applications recently. The success of deep learning is enabled by many emerging factors, including the novel structure of deep neural networks, the improved training method, the abundant training data, and the powerful computing infrastructure. In this course, we will introduce deep learning from these four aspects with an emphasis on software implementation and applications. We will start with basics of classification and neural network models trained using backpropagation and simple gradient descent. Then we will move on to deep convolutional neural networks and recurrent neural networks and enhanced training techniques, such as Adam. We will cover applications from image classification to chatbot design. Students will work with Python implementations for training and inference of simple neural networks and use Neon from Intel Nervana Systems for large scale deep neural networks on both CPU and GPU.

This is a technical elective course.

Prerequisites:

- Python, or C/C++ programming
- College calculus, linear algebra, comfortable with derivatives, matrix vector operations and notations
- Basic probability and statistics

Acknowledgement

This course is supported by Google Cloud Platform Education Grant and Intel.

Learning outcomes

After taking this course, the students should be able to:

1. Understand the basic training and inference techniques and performance criteria of a neural network
2. Explain the structure and neuron functions in a deep convolutional neural network
3. Implement the basic training and inference of a simple neural network in Python
4. Implement a deep convolutional neural network using Neon framework
5. Explain the fundamentals of the GPU acceleration
6. Understand the recent advances in deep learning and machine intelligence
7. Get familiar with other types of neural networks such as LSTM, RBM, etc. (if time allows.)

Topics covered

1. Introductions
2. Classification problem, basic machine learning models
3. Training and inference techniques
4. Image classification problem
5. Python implementation of training and inference
6. Structure of deep convolutional neural networks (DCNN)
7. Neon
8. Using GPU to accelerate learning and inference
9. Other deep learning models beyond DCNN
10. Other interesting applications

Grading policy

Final Project: 20%
Homework: 25%
Midterm Exam: 30%
Quizzes: 20%
Others: 5%

Grading Scale:

90 ~ 100 = As
80 ~ 89 = Bs
70 ~ 79 = Cs
60 ~ 69 = D
Below 60 = F

Homework Policy

Homework assignments are to be submitted through Blackboard website or handed to the instructor on the assignment due date. Assignments submitted after the due date will be deducted 10 points for each day late.

Exams

All exams must be taken at the scheduled time unless a previous arrangement (with a good reason) has been made with the instructor

Attendance

You are expected to attend each class punctually and remain for the entire class period. You need to inform the instructor in advance if you expect to miss a class or leave the course before the end of the semester. If you miss class your absence will be excused by the instructor only if a doctor's certificate or other evidence

is submitted. You remain to be responsible for the work associated with the class you missed, even if your absence has a valid reason. There will be a number of unannounced popup quizzes during the semester.

Academic Honesty

Cheating in any form is not tolerated, nor is assisting another person to cheat. The submission of any work by a student is taken as a guarantee that the thoughts and expressions in it are the students own except when properly credited to another.

Violations of this principle include giving or receiving aid in an exam or where otherwise prohibited, fraud, plagiarism, the falsification or forgery of any record, and any other deceptive act in connection with academic work. Plagiarism is the representation of another's words, ideas, programs, formulae, options or other products of work as one's own work from others, since it is often not possible to determine who the originator or the copier was. Such offense will result in a failing grade "F" and a letter of reprimand in your department student file.

Tentative Course calendar

Week	Material
Week 1	Introduction Basics of machine learning
Week 2	Traditional classifier, SVM, Python and NumPy lab Homework 1 (Python exercise)
Week 3	Training and inference of neural networks
Week 4	Back propagation and gradient decent, image classification, CIFAR 10 dataset Homework 2 (an SVM classifier)
Week 5	More application of neural networks other than image classification
Week 6	More about training Homework 3 (a neural network classifier)
Week 7	Convolutional neural networks
Week 8	Convolutional neural networks, Neon Homework 4 (CNN using Python)
Week 9	CNN using Neon, MNIST dataset Midterm exam
Week 10	Neural networks for object detection Homework 5 (CNN using Neon, CIFAR 10 dataset)
Week 11	Neural style Recurrent neural networks, chatbot, (other examples), RBM
Week 12	GPU acceleration Homework 6 (chatbot using Neon, compare GPU and CPU)
Week 13	Neural talk

Note: The schedule might change during the semester depending on the progress of the class. All departmental, college and university regulation regarding class attendance, course drop, etc will be followed.