Fall 2018 – CIS 5590: Introduction to Deep Learning

Course Description
The objective of the course is to introduce the theory and application of deep learning. The theoretic part introduces the mathematical foundations as well as derivations of models and algorithms in deep learning; while the application part uses real world tasks such as image recognition to help students to learn practical deep learning technologies.

Basic Course Information
- Instructor: Haibin Ling (hbling AT temple.edu, SERC 382)
- Lecture Time: Wed. 5:30-8:00pm, TTLMAN 302
- Office Hours: Wed. 3:00-5:00pmm, or by appointment
- Credits: 3

Prerequisites
A general familiarity with linear algebra, probability and statistics, image processing, programming techniques (Python and C/C++) is essential, and will be assumed. The following courses are prerequisites: CIS 5511 (Programming), CIS 5526 (Machine Learning), OR permission by the instructor.

Textbook and Main References
- Papers assigned in the class.

Lecture Topics
1. Brief introduction
   - History of the development of deep learning
   - State-of-the-art and sampled recent applications
   - Brief review of required background knowledge
2. Classic neural networks
   - Architecture
   - Feedforward networks
   - Gradient-based learning
   - Back-propagation
3. Regularization for deep learning
   - Traditional regularizations in deep learning
   - Semi-supervised learning as regularization in deep learning
   - Multi-task learning as regularization in deep learning
4. Optimization for training deep models
   - Basic algorithms
   - Training tricks: parameter initialization, adaptive learning rates, second-order methods
5. Convolutional networks
   - Convolution in neural networks
   - Pooling
   - Variants of basic convolution function
6. Advanced topics
   - Recurrent and recursive neural networks
   - Attentional model
   - Long short term memory networks
   - Deep generative models
   - Representation learning
   - Selected latest research topics

Grading
- Class participation and homework assignment: 20%
- Paper presentation: 20%
- Project: 20%
- Exams: 40% (quizzes 20%, final 20%)

Final Project: A list of project ideas will be suggested during the course of the semester, but students are free to suggest their own, especially if they relate to their current research. Course projects will be undertaken in small teams (two students) or individually. Each team member will receive the same grade for the project; it is up to the team members to divide the work fairly.

Course Policy
- Homework: should be submitted at the beginning of the class on the corresponding due date. Late submission is NOT allowed.
- Final project: project reports (including middle and final reports) deadlines will be at 11:59pm of the corresponding due date. Late submission will be punished at 10% per day and up to 7 days.
- Class participation: students are expected to attend all classes.
- Cheating: cheating in assignment may result in a grade of F in the course.
- Plagiarism: plagiarism is strictly forbidden.