BLG561E Deep Learning

Istanbul Technical University

Department of Computer Engineering

Syllabus - Fall 2018 Term

Professors: Gozde UNAL gozde.unal@itu.edu.tr , Nazım Kemal ÜRE ure@itu.edu.tr

Course web site: Ninova;   CRNs: 14002 (GU);   14003 (NKU)

Lecture Hours: Tuesday 09:30-12:30 (GU) @ Thursday 13:30-16:30 (NKU)

Credits: ECTS 7.5

Course Description

In this course, the following topics are covered in the area of deep learning: Neural Networks and Convolutional Neural Networks, Optimization and Regularization, Supervised and Unsupervised Methods, Discriminative Networks, Training of Networks, Deep Generative Networks, Adversarial methods, Classification applications, Recurrent Neural Networks, Temporal Prediction applications, Advanced deep learning techniques and applications such as Deep Reinforcement Learning.

The specific aims of the course are:
1. To introduce main techniques in Deep Learning
2. To understand the mathematical principles of optimization and regularization of deep learning methods
3. To be able to design deep neural networks for various problems in artificial intelligence
4. To implement solutions to learning problems using various deep neural network techniques

A tentative list of topics for the course is included in the Tentative Course Schedule Table at the end.

Prerequisites: Either an undergraduate level or MSc level Machine Learning course, Probability Theory, Linear Algebra and Numerical Methods courses

Assignments: Programming homework assignments + a term assignment

Grading Policy:

Midterm Exam	30%
Homework Assignments (4)	40%
Final Project (50% Accuracy, 30% Presentation/Jury, 20% Report)	30%

Final Exam (non-VF) Conditions: Following should be satisfied:
At least 2 homeworks submitted and average grades > 30/100
Midterm Exam Grade : >= 25/100

Learning Outcomes of the Course
Upon successful completion of BLG561E, students will be able to:

1.   Know and discuss the main problems, application areas and the techniques of deep learning
2.   Describe, construct and use necessary mathematical tools in deep learning such as optimization, regularization etc.
3.   Design various types of convolutional, fully connected and sequential neural networks and construct and run necessary procedures for training of deep neural networks
4.   Know and apply different mathematical formulations and solution techniques to supervised and unsupervised approaches in learning, specifically discriminative and generative network models
5.   Implement computer realizations of deep learning applications

References

*   No single textbook exists. Some references for deep learning are:

- Deep Learning, I. Goodfellow, Y. Bengio, A. Courville, 2016, MIT Press.
- Deep Learning with Python, F. Chollet, 2017, Manning.
- Fundamentals of Deep LearningDesigning Next-Generation Machine Intelligence Algorithms, Nikhil Buduma, Reilly
- neuralnetworksanddeeplearning.com
- https://github.com/muupan/deep-reinforcement-learning-papers
- Coursera Deep Learning Online Course Series
- Stanford CS231N Deep Learning /Computer Vision Course videos

Course Policies

Discussions among students for course assignments and projects are encouraged. However, what you submit should be always the output of your own efforts and your own work.

Cheating and Plagiarism: "Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one's grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term 'cheating' not be limited to examination situations only, but that it include any and all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one's own work." [1]
Penalties for cheating and plagiarism range from a 0 or F on a particular assignment, through an FF grade for the course, to disciplinary action and to expulsion from the university.
For more information read the **page: ITU Ethics in University:** http://www.odek.itu.edu.tr/?SayfaId=13

Disruptive Classroom Behavior [1]: "The classroom is a special environment in which students and faculty come together to promote learning and growth. It is essential to this learning environment that respect for the rights of others seeking to learn, respect for the professionalism of the instructor, and the general goals of academic freedom are maintained. ... Differences of viewpoint or concerns should be expressed in terms, which are supportive of the learning process, creating an environment in which students and faculty may learn to reason with clarity and compassion, to share of themselves without losing their identities, and to develop an understanding of the community in which they live. ... Student conduct which disrupts the learning process shall not be tolerated and may lead to disciplinary action and/or removal from class."
[1] Reference: http://conduct.ucr.edu/docs/disruptive.pdf

BLG561E Deep Learning - Fall 2018 Semester- Tentative Course Schedule

Week	Date	Topic	Assignments
1	Sep 18	Deep Learning: Introduction	
2	Sep 25	Review of Basic ML Artificial Neural Networks	
3	Oct 02	Backpropagation / Training Networks	
4	Oct 09	Regularization Techniques	HW1 assigned: FCN
5	Oct 16	Convolutional Neural Networks	
6	Oct 23	Supervised Methods, Discriminative Networks	
7	Oct 30	Classification Applications: Pattern and /or Speech Recognition	HW2 assigned: CNN+AE
X	Nov 6	FALL BREAK WEEK	
8	Nov 13	Unsupervised Methods and Autoencoders	
9	Nov 20	Deep Generative Networks: Adversarial methods	
10	Nov 27	Applications of Unsupervised techniques: Sound and/or Image Synthesis	HW3 assigned: GAN
11	Dec 4	Sequence Models: Recurrent Neural Networks, LSTMs,...	
12	Dec 11	Time Series Prediction Application	HW4 assigned: RNN
13	Dec 18	Midterm Week	
14	Dec 25	Introduction to Deep RL	

Note: **This syllabus and schedule are subject to change.** If you are absent from class, it is your responsibility to check on announcements made while you were absent.