

Syllabus

CE7V80 – Neural Networks and Deep Learning

Course Information

Course Prefix Number: CE7V80

Course Title: Special Topics in Computer Engineering - Neural Networks & Deep Learning

Term: Spring 2023

Location/time:

Tuesday, Thursday

11:30am-12:45pm

ECSN 2.112

Instructor Contact Information

Instructor: Dr Berrak Sisman

Email: berrak.sisman@utdallas.edu

Course Website: eLearning

TA: Zongyang Du (zongyang.du@utdallas.edu)

Course Description

Neural Networks and Deep Learning (3 semester credit hours). Students learn the fundamentals of neural networks and deep learning and we'll study the following topic together.

- ◆ From Artificial Intelligence (AI) to Machine Learning, Neural Networks (NNs), Deep Learning
- ◆ Theory of Neural Networks: how to build them, how to optimize them
- ◆ Logistic Regression
- ◆ How to apply NN in real life? Some application areas will be studied.
- ◆ Theory of Deep Learning
- ◆ Loss functions, optimization, overfitting, regularization
- ◆ State-of-the-art deep learning models (DNN, CNN, LSTM, GAN, etc.)
- ◆ Applications of deep learning
 - ❖ CNN for computer vision
 - ❖ LSTM for speech processing
 - ❖ GAN for voice conversion
- ◆ Evaluation methods for NN and Deep Learning
- ◆ Practice sessions on NNs and deep learning

Students will have a final exam that covers all the topics listed above.

Paper Presentations & Critics

The course will also cover state-of-the-paper presentations. Students will write paper critics for the paper that will be presented. The following topics will be covered.

- ◆ History of Deep Learning
- ◆ Convolutional Neural Networks
- ◆ LSTM + Recurrent Neural Networks
- ◆ Generative Adversarial Networks
- ◆ Variational Autoencoders
- ◆ Transformers
- ◆ Speech synthesis and recognition
- ◆ Voice conversion
- ◆ Image classification, object detection and segmentation
- ◆ Self-supervised learning
- ◆ Multi-modal learning

The papers will be shared in the first week of the semester.

We will assign the papers in the 2nd week of the semester. Each student needs to present one paper during 1st – 8th week, and another paper during 8th – 15th week. Presentations will be approximately 20 mins, followed by 10 mins of Q&A.

Project

The course will have a project submission. Students will be presenting their project proposal (1st part of the semester), and their progress & results (2nd part of the semester).

Invited Speakers

We will have two invited talks on different aspects of neural networks and deep learning.

- ◆ Industry: TBA
- ◆ Academia: TBA

Course Learning Objectives

- Ability to understand the basics of neural networks
- Ability to build neural networks from logistic regression
- Ability to build deep learning from a single layer neural network
- Ability to different loss functions, optimization methods for neural networks
- Ability to evaluate deep learning algorithms
- Ability to read and write critics for state-of-the-art deep learning papers
- Ability to apply deep learning for real-life problems
- Ability to understand different applications of deep learning (speech synthesis, recognition, voice conversion, computer vision etc)
- Ability to present research projects.

Textbook

The course structure was inspired by mostly three books.

✓ Michael A. Nielsen, “Neural networks and deep learning”, 2015.
(<http://neuralnetworksanddeeplearning.com/>).

✓ Ian Goodfellow and Yoshua Bengio and Aaron Courville, “Deep learning”, 2016.
(<https://www.deeplearningbook.org/>)

✓ Yaser S. Abu-Mostafa and Malik Magdon-Ismail and Hsuan-Tien Lin. “Learning from data”, 2012.
(<https://work.caltech.edu/library/textbook.html>)

The course also attempts to present the most recent concepts and scientific papers in Artificial Intelligence/Machine Learning/Neural Networks. Arxiv links to the paper PDFs will often be provided, and demo codes might be shown in class.

Grading Distribution and Policies

- ◆ Paper presentations (20%)
- ◆ Paper critic submissions (10%)
- ◆ Project proposal + project presentation (20%)
- ◆ Final exam will be closed book (50%)

Any grading issue must be brought into the instructor’s attention within one week from the date of posting grades on eLearning. After one week, no change in grades will be made.

The following scale indicates the way letter grades are normally assigned:

100-97 A+; 96.9-93 A; 92.9-90 A-; 89.9-87 B+; 86.9-83 B; 82.9-80 B-;

79.9-77 C+; 76.9-73 C; 72.9-70 C-; 69.9-67 D+; 66.9-63 D; 62.9-60 D-; below 60 F

Comet Creed

This creed was voted on by the UT Dallas student body in 2014.

It is a standard that Comets choose to live by and encourage others to do the same: “As a Comet, I pledge honesty, integrity, and service in all that I do.”

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University’s policies and procedures segment of the course syllabus. Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.