

****Disclaimer****

This syllabus is to be used as a guideline only. The information provided is a summary of topics to be covered in the class. Information contained in this document such as assignments, grading scales, due dates, office hours, required books and materials may be from a previous semester and are subject to change. Please refer to your instructor for the most recent version of the syllabus.

ARIZONA STATE UNIVERSITY
School of Electrical, Computer, and Energy Engineering

EEE 598

ST: Deep Learning for Media Processing and Understanding
Spring 2018 - will be updated for Spring 2019

Course Information

Online using Blackboard under my.asu.edu

<http://lina.faculty.asu.edu/deeplearn/>

Class Hours: Tuesdays & Thursdays 3:00 p.m. – 4:15 p.m. **Location:** Durham LL 104

Instructor:

Prof. Lina Karam
Office: GWC 430
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Fax: (480) 965-8325
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Teaching Assistant:

Mr. Samuel Dodge
Office: GWC 439
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Office Hours:

Instructor (GWC 430): Tuesdays 9:15 a.m. to 10:15 a.m. and Thursdays noon to 1:00 p.m.
Teaching Assistant (GWC 439): To be announced later in class.

Textbook: Ian Goodfellow and Yoshua Bengio and Aaron Courville, *Deep Learning*, MIT Press, 2016. FREE Access at <http://www.deeplearningbook.org/>

Course Prerequisite: EEE 350 Random Signal Analysis or equivalent & {EEE 404 Real-Time Digital Signal Processing OR EEE 407 Digital Signal Processing OR EEE 508 Digital Image and Video Processing} or equivalent & a Programming course.

Objectives:

This course is concerned with understanding the mathematical foundations and fundamentals of deep learning with applications to media classification, processing, restoration, compression, and generation. Examples of media include image, video, text, speech, and audio.

Homework and Labs:

Homework and hands-on labs will be assigned on a regular basis. Any graded material including homeworks and lab assignments, is to evaluate each student's own understanding and performance skills. So, students are not allowed to refer to past solutions and/or solution manuals. Students are encouraged to seek the help of the instructor and TA when they encounter difficulties in solving assigned problems or in performing hands-on lab assignments. Students need to submit to the instructor a hardcopy of their homework on the due date at the

end of class. Labs need to be submitted online as instructed in lab assignments.

Term Project:

The intention of the term project is to give you a chance to investigate a specific area of the deep learning field and its applications. The term project calls for investigating important key publications on the chosen topic, working with and writing related deep-learning based application software. Each term project is to include a final presentation which describes the nature of the work, and the software implementation. Students should work in a group of two on the selected topic; the final presentation should include a section that clearly lists the responsibilities and tasks performed by each student. Since the project accounts for a significant portion of your grade, you are expected to expand a proportional amount of effort on the project.

A final project presentation and demo will be performed by the students at the end of the semester in place of the Final Exam.

Exams:

One Midterm Exam will be given. The exam is to be taken on the date and at time (Arizona time) specified by the instructor. Exams that are not taken on the specified date and during the allowed time period will not be accepted and will be awarded a zero grade. Exam dates and times are listed below in this handout, but these can change if circumstances warrant it. Students who cannot take an exam on the specified date and/or during the specified time should contact the instructor as soon as possible and at least 7 days prior to the specified date for that exam. Also, students need to abide by the exam rules as discussed in class and as written on the front page of the exam.

Academic Integrity:

Students should abide by the Student Academic Integrity Policy and ASU's Student Code of Conduct which can be found at <https://provost.asu.edu/index.php?q=academicintegrity> and <https://students.asu.edu/srr/code>.

The highest standards of academic integrity are expected of all students. The failure of any student to meet these standards may result in suspension or expulsion from the university and other sanctions as specified in the academic integrity policies of the individual colleges. Violations of academic integrity include, but are not limited to, cheating, fabrication, tampering, plagiarism, or facilitating such activities.

If you are not sure if something is allowed or not allowed, you should ask the course instructor.

Class Attendance Policy:

Students are expected to attend the class lectures. Students are responsible for everything covered, announced, or distributed in lectures and/or on course web site including Blackboard.

Grading Formula:

Homework	20%
Labs	25%
Midterm	25%
Final Project and Demo	25%
Class Participation	5%

Important Dates:

Midterm Exam	Thursday 29 March
Labs	Due date as specified on each assigned lab.
Project	Due date as specified on each assigned project.
Final Project Demo	TBD

Subject to Change Notice:

All effort will be made to follow the syllabus, but the syllabus can be modified by the instructor if circumstances warrant it.

EEE 598: Deep Learning for Media Processing and Understanding

Tentative Outline

Basic Concepts in Machine Learning

- Machine Learning Tasks
- Data Representation and Design Matrix
- Experience: supervised and unsupervised
- Performance Measures
- Examples of Unsupervised Learning Algorithms
- Examples of Supervised Learning Algorithms

Probability and Information Theory

- Common Probability Distributions
- Common Functions and Properties
- Information Theory
- Probabilistic Learning

Motivation for Deep Learning

Deep Feedforward Networks

- Architecture
- Gradient-based Learning
- Chain Rule and Back-Propagation

Deep Convolutional Neural Networks (CNN)

- Multi-D Signal Processing Basics
- Architecture
- Pooling
- Efficient Convolution Algorithms
- Neuroscientific Basis
- Application: Computer Vision, Image Generation, Image Compression

Regularization for Deep Learning

Optimization for Training Deep Models

Recurrent and Recursive Nets

- Recurrent Neural Networks (RNNs)
- Recursive Neural Networks
- Long Short-Term Memory (LSTM) and Other Gated RNNs
- Applications: Image Generation, Image Compression, Video Processing, Natural Language Processing

Autoencoders, Generative Models, Generative Adversarial Networks