

ECE 547: Topics in Image Processing
Spring 2017
<https://courses.engr.illinois.edu/ece547/>

Instructor:

Prof. Alex Schwing (aschwing@illinois.edu, 103 Coordinated Science Lab (CSL))
Lectures: Tuesdays and Thursdays, 11am to 12:20pm, 3081 ECE Building
Office hours: Tuesdays, 1pm (103 CSL)

Teaching Assistants:

Purpose of the Course:

The goal of the course is to provide an understanding of recent research topics in image processing. After having completed the class the students should be familiar with the underlying techniques that are frequently used in publications related to image processing.

Prerequisites:

ECE 310 (Digital Signal Processing) and ECE 313 (Probability with Engineering Applications) or equivalent; familiarity with one programming language (Matlab/Python/C++/Lua);

Course Material:

Recent papers available online. Links will be provided.

Course Overview:

Upon completion of this course you should be able to

1. Explain the mathematical theory and principles underlying recent image processing algorithms
2. Relate different algorithms and understand when, why and how to use them
3. Think critically, ask questions, and apply problem solving techniques
4. Research, present, and report a chosen project within a specified time

Course Format:

Every Tuesday I'll be introducing an image processing topic and a related technical algorithm. Every Thursday we will have two/three student presentations. Each presentation is about a single paper on either recent progress related to the topic or a recent contribution corresponding to the algorithm.

Grading Policy:

1. **33.3% -- Presentation of a recent paper (30min+10min questions):** Every Thursday there will be 2 or 3 student presentations related to the topic of the week. Each presentation should cover one recent paper, e.g., an arXiv submission. Those presentations should be in style similar to a talk that you'd give at a conference. Your talk will be followed by 10min of questions from all attendees. Grades are based on both the presentation (organization, clarity, fluency) as well as the quality of the answers.

2. **33.3% -- Project + Report + 5min Spotlight Presentation:** There will be a mini-project consisting of a written report (6 page paper excluding references, NIPS format, arbitrary length supplementary material) and a 5min spotlight presentation. A list of suggested topics will be provided, but student suggestions are welcome too. Please confirm your project before starting to work on it.
3. **33.4% -- Written Exam:** There will be a closed book exam, testing the understanding of algorithms and their relationships at the end of the semester.

Course plan:

Additional information related to course projects and reading material as well as presentation scheduling can be found on the more detailed syllabus available on <https://courses.engr.illinois.edu/ece547/secure/> (NetID and Password required).

Week of	Tuesday Topic	Students to Present (2/3 per slot)
Jan. 16	How to present / Image Processing & Filtering	Edge Detection using Linear Filtering and Fourier Transform
Jan. 23	Edge Detection using Logistic Regression	1
Jan. 30	Object Detection using SVMs	2
Feb. 6	Image Classification using Deep Neural Networks	3
Feb. 13	Stereo using Deep Neural Networks	4
Feb. 20	Image Denoising/Optical flow using Markov Random Fields	5
Feb. 27	3D Scene Understanding using Conditional Random Fields/structured SVMs	6
Mar. 6	Image Segmentation using Deep Structured Models	7
Mar. 13	Image Generation using Variational Auto-Encoders	8
Mar. 20	Spring Break	
Mar. 27	Image Generation using Generative Adversarial Networks	9

Apr. 3	Image Completion using RNNs/LSTMs/GRUs	10
Apr. 10	Caption Generation/Visual QA using RNNs with Attention	11
Apr. 17	Playing Atari using Deep Q-Learning	12
Apr. 24	Spotlight Project Presentations	13
May 1	Spotlight Project Presentations	No class on Thursday