EE368/CS232 Digital Image Processing

Instructor

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Course assistant

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Schedule

M(W)F 1:30-2:50 pm
Huang 18

Office Hours

JT: Mo, 5-7, Packard 312
BG: by appointment

Course Overview

Introductory graduate-level course on image processing for engineering students. No prior image processing experience is expected. We broadly cover the fundamentals that everybody working with image processing algorithms is expected to understand, including image sampling and quantization, point operations, histograms, color science, image segmentation, morphological image processing, image filtering and correlation, deconvolution, template matching, image transforms, eigenimages, Fisherimages, edge detection, keypoint detection, scale-space image processing, noise reduction and restoration, feature extraction and recognition tasks, image registration. We use practical examples throughout, but emphasize the underlying signal processing principles rather than specific applications. Students learn to apply material by implementing and investigating image processing algorithms in Matlab. Recommended prerequisites: EE261, EE278B or equivalent.

Instructional Format

The course is taught in "flipped classroom" format. All lectures are pre-recorded, edited into shorter topical modules, and supplemented by quiz questions for reinforcement. Lecture videos and quizzes are released every Monday (https://canvas.stanford.edu/courses/110611) during the first 7 weeks of the quarter. You must complete all lectures and quizzes by Monday, 1:30 pm of the following week to receive full credit. On Mondays (or Wednesdays, if Monday is a holiday), the class meets in-person to discuss the lectures of the previous week. Students are expected to attend and come prepared.

Homework Assignments

Homework assignments corresponding to the lecture modules are released weekly, every Monday, during the first 7 weeks of the quarter. Homework assignments require a computer and Matlab. Work load is about 8-12 hours per assignment. Discussions among students are encouraged, however, solutions must be submitted individually. Due date is on Wednesday of the following week at 1:30 pm. Late submission penalty is 30% if submitted by Friday 1:30 pm, no credit afterwards. The first assignment is released on Monday, January 6, 2020 (first day of classes) and due on Wednesday, January 15.

Problem Sessions

Problem sessions that review the weekly assignments are held every Friday, 1:30 – 2:50 pm in Huang 18 during the first 7 weeks of the quarter. The sessions are recorded by SCPD.

Late Midterm Exam

The midterm is a 24-hour take-home exam. Students can choose one of 3 slots in the February 26-29 time window. Problems are similar to the weekly assignments, but should require less time overall (typically 5-6 hours).

Final Project

The final project is a two-week competition to solve a challenging image processing problem using the tools that have been discussed in the class. Solutions must be submitted individually; no collaboration is allowed. Matlab code will be evaluated by the teaching staff on a previously unseen data set. The project is graded based on performance, technical merit, and the quality of the written report. The final project assignment is released on Monday, March 2, 2020. Reports and source code are due on Friday, March 13 (last day of classes).

Projects for Extra Credit

Research projects that complement EE368/CS232 can be arranged on a limited basis. Interested individuals or groups must consult with the instructor before signing up for 3 units of EE390/EE391 or equivalent.

Grading

- Participation 20%
- Homework problems 20%
- Midterm exam 30%
- Final project 30%

Participation grade is based on the classroom discussions as well as timely completion of lecture videos and quizzes; full credit is given for seriously attempting all quiz questions, even if you don’t get 100% of the answers. To calculate the homework grade, we only consider the best 6 out of 7 assignments. The assignment with the lowest score is omitted.

Course Schedule

Week	Classroom Meetings	Topics	Deadlines
Week 1	Mo: Logistics Fr: Problem Session	Introduction, Point Operations, Histograms	
Week 2	Mo: Review Week 1 Fr: Problem Session	Color Science, Color Balancing, Image Segmentation, Region Processing	Mo: Week 1 quizzes due We: Week 1 problems due
Week 3	**We:** Review Week 2 Fr: Problem Session	Morphological Image Processing	We: Week 2 quizzes due We: Week 2 problems due
Week 4	Mo: Review Week 3 Fr: Problem Session	Linear Image Processing and Filtering, Template Matching, Matched Filtering	Mo: Week 3 quizzes due We: Week 3 problems due
Week 5	Mo: Review Week 4 Fr: Problem Session	Eigenimages, Fisher Images, Edge Detection, Hough Transform	Mo: Week 4 quizzes due We: Week 4 problems due
Week 6	Mo: Review Week 5 Fr: Problem Session	Keypoint Detection, Scale Space Image Processing	Mo: Week 5 quizzes due We: Week 5 problems due
Week 7	**We:** Review Week 6 Fr: Problem Session	Feature Based Methods for Image Matching and Retrieval	We: Week 6 quizzes due We: Week 6 problems due
Week 8	Mo: Review Week 7	*Midterm exam (We-Sa)*	Mo: Week 7 quizzes due We: Week 7 problems due Th or Fr or Sa: 24 h exam due
Week 9		*Final project*	
Week 10		*Final project*	Fr: project report, source code due