Digital Image Processing
EE368/CS232

Instructor: Bernd Girod
Course assistant: Jayant Thatte

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

Office hours BG: by appointment
Office hours JT: Packard 106, Mo 5-7
Why do we process images?

- Acquire an image
  - Correct aperture and color balance
  - Reconstruct image from projections

- Prepare for display or printing
  - Adjust image size
  - Color mapping, gamma-correction, halftoning

- Facilitate picture storage and transmission
  - Efficiently store an image in a digital camera
  - Send an image from space

- Enhance and restore images
  - Touch up personal photos
  - Color enhancement for security screening

- Extract information from images
  - Read 2-d bar codes
  - Character recognition
  - Depth estimation

- Many more ... image processing is ubiquitous
EE368/CS232 Instructional Format

- Flipped classroom
  - Pre-recorded lectures, released every Monday during first 7 weeks of quarter
  - Chunked into shorter modules, supplemented by quiz questions for reinforcement
  - On Mondays (or Wednesdays, if Monday is a holiday), class meets in-person to discuss the lectures of the previous week. **Students are expected to attend and come prepared.**
  - SCPD students submit short video “My take-aways from last week” in lieu of attending

- Homework assignments
  - Weekly problem sets that closely correspond to concurrent lectures
  - Friday classroom sessions lead by CA discuss problems and provide guidance
EE368/CS232 Homework Assignments

- **Weekly problem sets**
  - Released Mondays, correspond to the lectures of that particular week
  - About 8-12 hours of work, requires computer + Matlab
  - Discussions among students encouraged, however, individual solution must be submitted
  - Due 9 days later (Wednesday 1:30 pm).
  - Late submission: 30% penalty if submitted by Friday 1:30 pm. No credit afterwards.
  - Submit 6 out of 7 assignments for credit (worst out of 7 is discarded)

- **Problem set submission:**
  - Electronic online submission via Gradescope.
  - Enrollment: [http://www.gradescope.com](http://www.gradescope.com) - create an account, then use entry code 9PRV3V
  - First assignment released on January 6 (first day of class), due January 15
EE368/CS232 Midterm

- 24-hour take-home exam
- Problems similar to weekly assignments
- Typically requires 5-6 hours of work
- 3 slots, **February 26 – 29**
EE368/CS232 Final Project

- Two-week competition to solve a challenging image processing problem
- Assignment (including representative data set) will be released **March 2**
- Solutions submitted individually, no collaboration allowed.
- Matlab code will be evaluated on previously unseen data set
- Submission of written report and source code **March 13, 11:59 p.m.**
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<thead>
<tr>
<th>Week</th>
<th>Classroom Meetings</th>
<th>Topics</th>
<th>Deadlines</th>
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<tbody>
<tr>
<td>Week 1</td>
<td>Mo: Logistics, Fr: Problem Session</td>
<td>Introduction, Point Operations, Histograms</td>
<td>Mo: Week 1 quizzes due</td>
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<td>We: Week 1 problems due</td>
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<td>Week 2</td>
<td>Mo: Review Week 1, Fr: Problem Session</td>
<td>Color Science, Color Balancing, Image Segmentation, Region Processing</td>
<td>Mo: Week 1 quizzes due</td>
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<td>We: Week 1 problems due</td>
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<td>Week 3</td>
<td>We: Review Week 2, Fr: Problem Session</td>
<td>Morphological Image Processing</td>
<td>We: Week 2 quizzes due</td>
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<td>We: Week 2 problems due</td>
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<td>Week 4</td>
<td>Mo: Review Week 3, Fr: Problem Session</td>
<td>Linear Image Processing and Filtering, Template Matching, Matched Filtering</td>
<td>Mo: Week 3 quizzes due</td>
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<td>We: Week 3 problems due</td>
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<td>Week 5</td>
<td>Mo: Review Week 4, Fr: Problem Session</td>
<td>Eigenimages, Fisher Images, Edge Detection, Hough Transform</td>
<td>Mo: Week 4 quizzes due</td>
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<td>We: Week 4 problems due</td>
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<td>Week 6</td>
<td>Mo: Review Week 5, Fr: Problem Session</td>
<td>Keypoint Detection, Scale Space Image Processing</td>
<td>Mo: Week 5 quizzes due</td>
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<td>We: Week 5 problems due</td>
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<td>Week 7</td>
<td>We: Review Week 6, Fr: Problem Session</td>
<td>Feature Based Methods for Image Matching and Retrieval</td>
<td>We: Week 6 quizzes due</td>
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<td>We: Week 6 problems due</td>
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<td>Week 8</td>
<td>Mo: Review Week 7</td>
<td>Midterm exam (We-Sa)</td>
<td>Mo: Week 7 quizzes due</td>
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<td>We: Week 7 problems due</td>
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<td>Th or Fr or Sa: 24 h exam due</td>
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<td>Week 9</td>
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<td>Final project</td>
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<td>Week 10</td>
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<td>Final project</td>
<td>Fr: project report, source code due</td>
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EE368/CS232 Grading

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

- Not graded on curve
Show of Hands

Have you previously taken an image processing class?
(a) Yes
(b) No
Show of Hands

Are you currently working on a project that involves image processing?
(a) Yes
(b) No