

CSC 249/449 Machine Vision

Department of Computer Science

University of Rochester

Syllabus for Spring 2019

Last updated: January 7, 2019

Instructor: Prof. Chenliang Xu

Teaching Assistants:

- Yapeng Tian, Graduate TA
- Jing Shi, Graduate TA
- Zhiheng Li, Graduate TA
- Yutong (Kelly) He, Undergraduate TA
- Chaoying Xue, Undergraduate TA

Instructor & TA's Office Hours: Check course webpage.

Course Webpage: <http://www.cs.rochester.edu/~cxu22/t/249S19/>

Meeting Times and Location: TR 12:30-13:45 in 101 Goergen Hall

Information Flow: This course primarily uses Blackboard to manage information flow. The course ID is *CSC249.2019SPRING.52339*. It will be used for posting announcements, lecture notes, assignments, and submitting work. The instructor's course website is primarily the public portal to the site for broad research in what the course covers. It contains an outline of course schedule. It may not be updated regularly throughout the term.

This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Piazza. Find our class page at: <https://piazza.com/rochester/spring2019/csc2492019spring52339/home>

Course Description: Fundamentals of computer vision, including image formation, elements of human vision, low-level image processing, and pattern recognition techniques. Advanced topics include modern visual features, graphical models, model-based and data-driven approaches, and contextual inference, as well as illustrative examples of successes and challenges in applications. CSC 449, a graduate-level course, requires additional readings and assignments.

Rough Topic Outline:

- **Features and Filters:** image transforms, linear filtering, edges and corners, scale space, feature extraction, feature matching, optical flow
- **Segmentation and Grouping:** Gestalt principles, segmentation by clustering, image as graphs, interactive segmentation, robust fitting and RANSAC, Hough transform
- **Recognition:** feature learning, convolutional and recurrent neural networks, advanced CNN architectures, attention mechanisms, feature visualization, image classification, object detection, instance segmentation, scene parsing, image captioning, visual and sound, video analysis

- **Image Formation and Multiple View Geometry:** camera models, light and color, camera calibration, alignment, stereo vision

Prerequisites: Basic knowledge of probability and linear algebra; data structures, algorithms; programming experience. For assignments and projects, the most common programming language is Python.

Textbook: We will use the following textbook by Szeliski, which is freely available online.

- Computer Vision: Algorithms and Applications, Szeliski, Springer, 2011.

In addition, we recommend the following textbooks as supplementary reading.

- Computer Vision: A Modern Approach, 2nd Edition, Forsyth and Ponce, Pearson, 2012.
- Deep Learning, Goodfellow, Bengio and Courville, The MIT Press, 2016.
- Multiple View Geometry in Computer Vision, 2nd Edition, Hartley and Zisserman, Cambridge University Press, 2004.

Course Work and Evaluation

- **Homework Assignments (50%):** There will be five homework assignments over the term. Each will be a mix of analytical problems and programming problems to test whether students are understanding the foundational topics. They will be done independently by each student.
- **Midterm Exam (20%):** There will be one in-class midterm exam in March.
- **Project & Presentation (30%):** Students will form groups with up to two members to implement a course project. Full-scale project developments will be made through the term culminating in an oral/poster presentation and a report at the end of the term.

Late Work Policy: Lose 1% per hour passing the deadline for each assignment. We will not accept your submission after 72 hours over the deadline. All assignments should be submitted on Blackboard.

Regrading: Any questions about the grading of a piece of work must be raised within one week of the date that the work was returned by the teaching assistant or the instructor. In other words, if you do not pick up your work in a timely fashion, you may forfeit your right to question the grading of your work.

Code of Conduct: Check [here: http://www.cs.rochester.edu/~cxu22/t/coc.txt](http://www.cs.rochester.edu/~cxu22/t/coc.txt) for classroom "etiquette" expectations.

Academic honesty: All assignments and activities associated with this course must be performed in accordance with the University of Rochester's Academic Honesty Policy. More information is available at [here: http://www.rochester.edu/college/honesty/](http://www.rochester.edu/college/honesty/). You are expected to read, understand and follow the policy.

Disabilities: If you need an accommodation based on the impact of a disability, please contact me privately during the first two weeks to discuss your specific needs. Alternatively, contact Center for Excellence in Teaching and Learning at 585-275-9049 in room 1-154 Dewey Hall to coordinate reasonable accommodations.