Syllabus: Image Processing and Computer Vision (IMGS 682)
Spring 2016
Instructor: Prof. Christopher Kanan
Teaching Assistant: Xuewen Zhang

Course Description: This course will cover methods in image processing and computer vision, with an emphasis on the state-of-the-art techniques currently used in academia and industry. Topics will include image filtering, edge detection, corner detection, segmentation, object\image\face classification, object detection, morphological operators, object tracking, camera calibration, image registration, and activity classification. Students are expected to have some familiarity with with college-level calculus, linear algebra, and basic probability and statistics (conditional probability, mean, variance, etc.). There will be an extensive amount of computer programming in the course. Class 3, Credit 3 (S)

Prerequisites: IMGS-616 or permission of the instructor.

Class Location and Time: Tuesdays and Thursdays, 9:30AM - 10:45AM, CAR-2155

Required Text: The main book for the class is "Computer Vision: Algorithms and Applications" (2011) by Richard Szeliski. While you can buy a hardcopy of the text, it is also freely available online. You can download a PDF of the book here: http://szeliski.org/Book/drafts/SzeliskiBook_20100903_draft.pdf There will also be readings from other sources.

Instructor Contact:

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Evaluation and Grading: The final course grade will be weighted as follows:

Homework:	40%
Project:	40%
Midterm:	10%
Final:	10%

Homework: Your homework submissions must cite any references used (including articles, books, code, websites, and personal communications). All solutions must be written in your own words, and you must program the algorithms yourself.

Your homework solutions must be prepared in LaTeX and output to PDF format. If you don't already know LaTeX, this is an excellent opportunity to start using it. Many academic conferences and journals require LaTeX formatted submissions. Your solutions should include all diagrams, written explanations, code, and program output relevant to the problem.

Project: You are required to complete a project. Your project should be at the frontier of computer vision and image processing, but it does not necessarily need to move the frontier forward. You may use the programming language of your choice. Replicating results from a recent paper and comparing it to other works, would be a good project. Feel free to run your early ideas by me. The schedule for the project is as follows:

1. **Project Proposal**: The project proposal will clearly state what you plan to do. It should contain a list of three to six milestones and deadlines. You should list the questions the project will address and that will be discussed in the report. You should list what software you will be using or will build upon. Describe the datasets you will use and how how will you know if the project is successful. Describe the hypotheses you will test and the related work. The proposal should be a well organized document in continuous english, and it should not be merely an outline. You should be able to re-use much of the text for the final report.
2. **Revised Project Proposal**: The revised proposal should take into account the comments received by the instructor and TA. It should be two to four pages long (not including references) and formatted in NIPS or CVPR format. It should be typeset using LaTeX, and submitted as a PDF (under 10MB).
3. **Project Report**: The project report will describe the project, i.e., what you did and the result. It should be four to eight pages long (not including references) and formatted in NIPS or CVPR format. It should be typeset using LaTeX, and submitted as a PDF (under 10MB). Read NIPS and CVPR papers to get an idea for what the style and formatting should be.
4. **Project Presentation**: You will give a 10 minute talk on your project.

Policy on Late Work: Late work will **not be accepted. You will have 3 to 5 weeks to do each homework assignment. Assignments may involve a large time commitment, and you are unlikely to complete them by the deadline if you wait until the night before. I urge you to begin them immediately after they are assigned.**

Programming Environment: The course and homework assignments will be taught in MATLAB. MATLAB is an easy to learn environment that is widely used for computer vision in academia and industrial research. While MATLAB is used for teaching, you are welcome to do the homework assignments in Python 2 or Python 3 as well, although the instructor and TA may not be able to assist you with programming questions for these languages. For the class project, you may use the programming environment of your choice. I suggest MATLAB, Python, C++, or Lua (for Torch 7). Note that we will be unable to provide any programming help for projects.

Notes on Plagiarism: Plagiarism is a serious offense and is in violation of the RIT Student Academic Integrity Policy (http://www.rit.edu/academicaffairs/policiesmanual/d080). If you are unsure of what constitutes plagiarism in written documents, a good description can be found here: http://isites.harvard.edu/icb/icb.do?keyword=k70847&pageid=icb.page342054

Plagiarism does not just occur in written documents; it also occurs in code. Many of the algorithms we will code and problems we will solve have been solved by others who have posted code (in various programming languages) online. It is unacceptable (and it is considered plagiarism) to copy code developed by others and submit it as your own. (This includes code that is written by your fellow students!) Even making minor changes, such as changing variable names, function names, formatting, etc., is not enough to allow you to claim your submission as your own because the underlying structure of the code remains unchanged.

If you do consult any online sources of code, you must properly attribute the corresponding sections in your code to their original source, as you would add quotations, footnotes, or references in a written document. The consequences of plagiarism, whether in code or in written documents, are at the discretion of the instructor, and can be as severe as automatic failure of the course.

Academic Accommodations: RIT is committed to providing reasonable accommodations to students with disabilities. If you need accommodations such as special seating, note taking services, or extended time or a different environment due to a disability, please go to the Disability Services Office. It is located in the Student Alumni Union, room 1150. If you receive accommodation approval, you must make me aware of this fact prior to the date that accommodations with be necessary.

Course Schedule: The following schedule lists dates for class topics. The content in this schedule is tentative and subject to change. It is your responsibility to attend class and to remain informed of any changes that may be announced.

Lecture	Week	Date	Assignments	Class Topics / Activities
1	1	1/26	Homework 1 Assigned	Introduction, Course Overview
2		1/28		Math Background Review
3	2	2/2		Classifiers Part 1
4		2/4		Classifiers Part 2
5	3	2/9		Principal Component Analysis
6		2/11	Homework 2 Assigned	Image Properties and Point Operations
7	4	2/16	Homework 1 Due	Color Spaces and Color Constancy
8		2/18		Linear Filtering
9	5	2/23		Morphological Operators
10		2/25	Project Proposal Due	Edge Detection, RANSAC
11	6	3/1		Corner Detection
12		3/3	Homework 3 Assigned	Engineered Features (HoG, DoG, SIFT)
13	7	3/8	(WACV)	Homographies and Image Stitching
14		3/10	Homework 2 Due	Motion Detection / Background Subtraction
	8	3/15	Revised Project Proposal Due	Midterm Review
		3/17		Midterm Exam
	Break	3/22		Spring Break
		3/24		Spring Break
15	9	3/29		(Unsupervised) Segmentation Overview
16		3/31		Segmentation: K-Means
17	10	4/5	Homework 4 Assigned	Segmentation: Normalized Graph Cuts
18		4/7	Homework 3 Due	Object Recognition: BoW Approaches
19	11	4/12		Object Recognition: Gnostic Fields
20		4/14		Object Recognition: Deep Learning
21	12	4/19		Object Detection: Sliding Window Approaches
22		4/21		Object Detection: R-CNN
23	13	4/26		Activity and Video Classification
24		4/28		Object Tracking
25	14	5/3	Homework 4 Due	Semantic and Instance Segmentation
26		5/5		Visual Question Answering
		5/7 (Sat)	Final Project Presentations	
27	15	5/10		Everything else in Computer Vision
		5/12		Final Review
	16	TBD		Final Exam