Computer Vision
CSCI 442/542
Spring 2019 Syllabus

Instructor Details

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Office Hours:	TWR 11:00–12:30 , SS403
	Or, by appointment.

Prerequisites

M221: Introduction to Linear Algebra (Critical), CSCI232: Data Structures, STAT341: Introduction to Probability and Statistics (Recommended, not required), or consent of instructor. The course will be taught in python, and previous experience is useful; however, students should be able to manage with strong programming skills in any other language.

Course Objectives

Digital imagery is ubiquitous in the modern era, with cameras found on nearly every new car, telephone, computer, and building. This course will introduce the ways in which these images can be used for quantitative analyses and the various ways that such products are used in contemporary technology. Topics include the fundamentals of image formation and optics, the geometry of images, feature detection and matching, stereo vision and photogrammetry, tracking, and object detection and classification. We will discuss techniques found in commonly used software such as facial recognition, video stabilization, and panorama generation. We will utilize UAVs to capture aerial images, which will serve as the basis for many of the methods we discuss, as well as the basis for student group projects.

Student Outcomes

Upon successful completion of this course, students should have the ability to:

- Understand popular applications of computer vision in contemporary society
- Recognize the theoretical and practical aspects of image processing and computer vision.
- Implement fundamental algorithms used in the pre-processing, analysis, and post-processing of images.
- Understand the linkages between computer vision and artifical intelligence

Course Format

This course will be split evenly between lectures and in-class work on coding projects. As such, a laptop will be most useful, but we can also arrange access to desktops in the classroom. Most work will be done in groups, and thus attendance is mandatory out of respect for your classmates who will be relying on your contributions. The course will consist of 5 substantial coding projects, and groups will be expected to give short presentations on at least one of these projects. All course materials will be disseminated and communicated using the version control software git. There will be no final exam.

Graduate Increment

Graduate students will be expected to participate in biweekly hour-long seminars centered around a peer-reviewed publication in Computer Vision. In consultation with the course instructor, each graduate student will be responsible for selecting a paper and acting as the discussion leader for that paper's associated seminar. These seminars will occur outside of the normal class meeting time, with a suitable venue and schedule to be determined.

Meeting Times/Place

Times: TBD
Place: TBD

Final Exam Time and Place

Time: TBD
Place: TBD

Grading Policy

Grading scale

Students taking the course pass/no pass are required to earn a grade of C or better in order to pass. Pluses and minuses will be added to grades falling in the upper and lower tertile, respectively, of the following letter increments. Note that the lower bound is inclusive, while the upper bound is exclusive.

A	[90-100]
B	[80-90)
C	[70-80)
D	[60-70)
F	[0-60)

Assessments and weights

The following assessments will be used and weighted according to the values in the table to determine final grades.

Component	Description	Weight
Coding projects (5)	Implementation and application of algorithms in computer vision	70%
Oral Presentations	Group presentation of one of the coding projects	10%
Attendance and participation		20%

Textbook

The course will utilize the book Computer Vision: Algorithms and Applications by Richard Szeliski. A pdf of the book is available for free at the author's website.

Tentative schedule:

Week	Topic	Assignments	Reading
1	Introduction and image formation		Ch.1,2
2	Image processing	Project 1	Ch. 3
3	Feature detection and matching		Ch. 4
4	Segmentation		Ch. 5
5	Image alignment and stitching	Project 2	Ch. 6,9
6	Cont.		
7	Structure from motion and 3D reconstruction		Ch.7,11,12
8	Cont.	Project 3	
9	Cont.		
10	Optical flow and motion estimation		Ch. 8
11	Computational photography	Project 4	Ch. 12
12	Facial Recognition		Ch. 14
13	Object Recognition		
14	Object Detection and Deep Vision	Project 5	
15	Cont.		

Attendance Policy

Attendance will be taken. Students informing the instructor of a valid reason for missing class *in advance*, via email, will not be penalized for missing class. Valid reasons include family emergencies and illness.

Academic Integrity

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. I will follow the guidelines given there. In cases of academic dishonesy, I will seek out the maximum allowable penalty. If you have questions about which behaviors are acceptable, especially regarding use of code found on the internet or shared by your peers, please ask me.

Disabilities

Students with disabilities may request reasonable modifications by contacting me. The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. Reasonable means the University permits no fundamental alterations of academic standards or retroactive modifications.