CS 558: Computer Vision

School of Engineering and Science
Spring 2016

Meeting Times:	Wednesday 6:15-8:45 PM
Classroom Location:	X 106
Instructor:	Philippos Mordohai
Contact Info:	Lieb 215, Philippos.Mordohai@stevens.edu, 201 216 5611
Office Hours:	Tuesday 5:00-6:00 PM and by appointment
Course Web Address:	http://www.cs.stevens.edu/~mordohai/classes/cs558_s16.html
Prerequisite(s):	(CS 590 or CS 570 or CS 385 or CS 182) and (MA 232 or equivalent)
Corequisite(s):	N/A
Cross-listed with:	CPE 558

COURSE DESCRIPTION

An introduction to the field of Computer Vision, focusing on the underlying algorithmic, geometric, and optic issues. The course starts with a brief overview of basic image processing topics (convolution, smoothing, and edge detection). It then proceeds on various image analysis topics: binary images, moments-based shape analysis, Hough transform, image formation, depth and shape recovery, photometry, motion, classification, and special topics.

LEARNING OBJECTIVES

After successful completion of this course, students will be able to…

- Design convolving filters for smoothing, differentiation, edge detection and sharpening.
- Explain how a camera measures light and describe the properties of cameras.
- Distinguish orthographic from perspective cameras; define homogeneous coordinates and their relationship to Euclidean coordinates.
- Explain the fundamental/essential matrix and epipolar lines and planes.
- Implement simple edge and corner detectors and explain the usefulness of identifying scale/rotation/translation-invariant image points.
- Describe at least two approaches for object recognition.

FORMAT AND STRUCTURE

This course is comprised of weekly three-hour lectures.

COURSE MATERIALS

Textbook(s):	Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2010.
Other Readings:	Available on course web page
Materials:	None

COURSE REQUIREMENTS

Attendance	Attendance is not mandatory, but there will be at least 10 quizzes during the semester.
Participation	Participation is strongly encouraged.
Homework	There will be four homework assignments.
Quizzes	There will be at least 10 quizzes during the semester, at the beginning of each lecture.
Project	N/A.
Exams	The final exam will be held during the regular final exam period. It is an open book exam.

GRADING PROCEDURES

Grades will be based on:

Homework	(40%)
Quizzes	(25%)
Final Exam	(35%)

ACADEMIC INTEGRITY

Graduate Student Code of Academic Integrity

All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.

All graduate students are bound by the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

Special Provisions for Undergraduate Students in 500-level Courses

The general provisions of the Stevens Honor System do not apply fully to graduate courses, 500 level or otherwise. Any student who wishes to report an undergraduate for a violation in a 500-level course shall submit the report to the Honor Board following the protocol for undergraduate courses, and an investigation will be conducted following the same process for an appeal on false accusation described in Section 8.04 of the Bylaws of the Honor System. Any student who wishes to report a graduate student may submit the report to the Dean of Graduate Academics or to the Honor Board, who will refer the report to the Dean. The Honor Board Chairman will give the Dean of Graduate Academics weekly updates on the progress of any casework relating to 500-level courses. For more information about the

scope, penalties, and procedures pertaining to undergraduate students in 500-level courses, see Section 9 of the Bylaws of the Honor System document, located on the Honor Board website.

EXAM ROOM CONDITIONS

The following procedures apply to quizzes and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Room Conditions on the quiz or exam.

1. Students may use the following devices during quizzes and exams. Any electronic devices that are not mentioned in the list below are not permitted.

Device	**Permitted?**	
	Yes	No
Laptops		X
Cell Phones		X
Tablets		X
Smart Watches		X
Google Glass		X
Other		X

2. Students may use the following materials during quizzes, marked with Q, and exams, marked with E. Any materials that are not mentioned in the list below are not permitted.

Material	**Permitted?**	
	Yes	No
Handwritten Notes *Conditions*:	E	Q
Typed Notes *Conditions*:	E	Q
Textbooks *Conditions*:	E	Q
Readings *Conditions*:	E	Q
Other (specify) – The exam is open book, but no electronic devices are allowed	E	Q

3. Students are not allowed to work with or talk to other students during quizzes and exams.

LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. Student Counseling and Disability Services works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, and psychiatric disorders in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from SCDS staff. The SCDS staff will facilitate the provision of accommodations on a case-by-case basis. These academic accommodations are provided at no cost to the student.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the office of Student Counseling, Psychological & Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/sit/counseling/disability-services. If you have any questions please contact:

Lauren Poleyeff, Psy.M., LCSW - Diability Services Coordinator and Staff Clinician in Student Counseling and Disability Services at Stevens Institute of Technology at lpoleyef@stevens.edu or by phone (201) 216-8728.

INCLUSIVITY STATEMENT

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in education and innovation. Our community represents a rich variety of backgrounds, experiences, demographics and perspectives and Stevens is committed to fostering a learning environment where every individual is respected and engaged. To facilitate a dynamic and inclusive educational experience, we ask all members of the community to:

- be open to the perspectives of others
- appreciate the uniqueness their colleagues
- take advantage of the opportunity to learn from each other
- exchange experiences, values and beliefs
- communicate in a respectful manner
- be aware of individuals who are marginalized and involve them
- keep confidential discussions private

TENTATIVE COURSE SCHEDULE

Week Starting	Topic(s)	Readings	Assignment

January 20	Introduction and cameras	Szeliski Ch. 2.3	
January 27	Image formation, convolution and filtering	Szeliski Ch. 2.2, 2.3 and 3.2	
February 3	Edge, corner and feature detection	Szeliski Ch. 4.1 and 4.2	Homework 1, due 2/10
February 10	Fitting, alignment and tracking	Szeliski Ch.4.3 and 6.1	
February 17	Template matching, image pyramids and optical flow	Szeliski Ch.4.1, 8.1 and 8.4	
February 24	Grouping and segmentation	Szeliski Ch.5.2 and 5.3	Homework 2, due 3/2
March 2	Camera geometry and Structure-from-Motion	Szeliski Ch.2.1 and 7	
March 9	3D reconstruction	Szeliski Ch. 11	
March 16	Object recognition (I)	Szeliski Ch. 14 and notes	Homework 3, due 3/30
March 30	Object recognition (II)	Szeliski Ch. 14 and notes	
April 6	Object recognition (III)	Szeliski Ch. 14 and notes	
April 13	Deep learning for computer vision	Notes	Homework 4, due 4/20
April 20	Context	Szeliski Ch. 14.5 and notes	
April 27	Action and activity recognition	Notes	
May	**Final Exam**		