CS 499/595 – Computational Photography

Course Information

Course Section: CS-499-005, CS-595-002
Course Term: Fall 2024
Credit Hours: 3
Time: Friday 10:30am – 1:10pm
Location: Innovation Hall 134

COURSE DESCRIPTION

Research breakthroughs in image analysis/synthesis, coupled with the growth of digital cameras, have resulted in many practical and artistic techniques for creating special effects in photographs and videos. This special topic course gives a broad overview on modern computational approaches for generating digital images and videos with special effects.

This course is a convergence between computer vision, computer graphics, image processing, and photography. It will offer in-depth discussions on a broad range of topics in digital photography and videos, including image/video capturing devices, novel camera models, non-traditional lighting and shading techniques, high dynamic range (HDR) images, image-based 3D reconstruction, as well as many post-processing algorithms for generating context-rich images and videos.

As a project-based course, this course does not have written exams. Evaluation is based upon quality, completeness, demonstrated skill, and originality of produced content, as well as effectiveness of oral presentation and writing.

MAJOR TOPICS COVERED / LEARNING OUTCOMES

- Basics of digital photography
- Human visual perception
- Color theory
- In-camera image processing pipeline
- Image filtering
- Image quality enhancement
- Image composition
- Image matting
- HDR image acquisition and fusion
- Novel computational cameras and displays
- Radiometry and reflectance
- Light field imaging and novel view synthesis
- 3D reconstruction from images
- Neural radiance field

GEORGE MASON UNIVERSITY

Instructor Information

INSTRUCTOR

Name: Jinwei Ye
Email: jinweiye@gmu.edu
Office Hours: Wednesday 9:30am – 10:30am
Location: RSCH 409

TEACHING ASSISTANT

Name: Yong Yang
Email: yyang29@gmu.edu
Office Hours: Wednesday 3pm – 4pm
Location: BUCH D215 (D7)

Course Resources

TEXTBOOKS AND READINGS

RECOMMENDED BOOKS & MATERIALS

- Computer Vision: Algorithms and Applications
  - Author: Richard Szeliski
  - Springer 2022
  - Website: https://szeliski.org/Book/
- Computational Imaging Book
  - Authors: Ayush Bhandari, Achuta Kadambi, Ramesh Raskar
  - MIT Press 2022
  - Website: https://imagingtext.github.io
- Besides these recommended books, students will also read papers in academic conferences and journals, including CVPR, ICCV, ECCV, ICCP, SIGGRAPH, etc.

Grading Information

GRADE ITEMS AND WEIGHTS

The following lists the grade items in this course and each category's weight in the final course grade.

GRADE ITEM	% OF OVERALL COURSE GRADE
Homework 1	10%
Homework 2	10%
Homework 3	10%
Homework 4	10%
Homework 5	10%
Seminar 1 Report	5%
Seminar 2 Report	5%
Final Project Proposal (presentation & report)	10%
Final Project (presentation, report, & code)	30%
TOTAL:	**100%**

LATE SUBMISSION POLICY

Please refer to the course schedule for the assignment submission schedule. Late submission will be penalized by deducting 10% of the grade earned per late day. Submissions will not be accepted after three days past the due date.

GRADING SCALE

The following table describes the grading system:

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
≥97	≥93	≥90	≥87	≥83	≥80	≥77	≥73	≥70	≥67	≥63	≥60	<60

Course Schedule

WEEK	CLASS DATE	CLASS CONTENT	ASSIGNMENTS
1	**August 30, 2024**	**Course introduction & digital photography**	**Out** – Homework 1 **Due** – None
2	**September 6, 2024**	**In-camera image processing pipeline**	**Out** – Homework 2 **Due** – Homework 1
3	**September 13, 2024**	**Image processing & editing (part 1)**	**Out** – None **Due** – Homework 2
4	**September 20, 2024**	**Image processing & editing (part 2)**	**Out** – Homework 3 **Due** – None
5	**September 27, 2024**	**Image processing & editing (part 3)**	**Out** – Homework 4 **Due** – Homework 3
6	**October 4, 2024**	**Coded photography**	**Out** – None **Due** – Homework 4
	October 8, 2024 (1:30pm - 2:30pm)	**Research seminar 1* by Chris Metzler (UMD)**	
7	**October 11, 2024**	**Radiometry & reflectance**	**Out** – Final Project **Due** – Seminar 1 report
8	**October 18, 2024**	**Final project proposal presentations**	**Out** – None **Due** – Final Project proposal files (report)
9	**October 25, 2024 (10:00am - 11:00am)**	**Research seminar 2* by Ming-Hsuan Yang (UC, Merced & Google)**	**Out** – None **Due** – None
10	**November 1, 2024**	**Light field imaging**	**Out** – Homework 5 **Due** – Seminar 2 report
11	**November 8, 2024**	**3D reconstruction (part 1)**	**Out** – None **Due** – Homework 5
12	**November 15, 2024**	**3D reconstruction (part 2)**	**Out** – None **Due** – None
13	**November 22, 2024**	**3D reconstruction (part 3)**	**Out** – None **Due** – None
14	**December 6, 2024**	**Final project presentations**	**Out** – None **Due** – Final project files (code & report)

* Research Seminars are held in ENGR 4201. Class doesn't meet after Research Seminar 2.

(Note: Week numbers are counted by excluding the week of Thanksgiving Recess Nov 25 – Nov 29. **Due day & time for homework submission in a week is Thursday at 11:55pm.**)

Policies and Services

MASON HONOR CODE

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set forth this honor code:

Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

You are expected to familiarize yourself with and adhere to the Honor Code. Student members of the George Mason University community pledge not to cheat, plagiarize, steal, and/or lie in matters related to academic work.

For additional important information, including the Honor Code definitions of cheating, plagiarism, stealing, and lying, see the George Mason University Academic Integrity page.

All work performed in this course will be subject to Mason's Honor Code.

ACADEMIC INTEGRITY EXPECTATIONS

1. Working online requires dedication and organization. Proper preparation is expected every week. You are expected to log in to the course each week and complete the assignments and activities on or before the due dates.
2. Students must check their GMU email messages on a daily basis for course announcements, which may include reminders, revisions, and updates.
3. It is expected that you will familiarize yourself with and adhere to the Honor Code. Student members of the George Mason University community pledge not to cheat, plagiarize, steal, and/or lie in matters related to academic work.
4. It is essential that you promptly communicate any questions or problems to the instructor.

INDIVIDUALS WITH DISABILITIES

The university is committed to providing equal access to employment and educational opportunities for people with disabilities.

Mason recognizes that individuals with disabilities may need reasonable accommodations to have equally effective opportunities to participate in or benefit from the university educational programs, services, and activities, and have equal employment opportunities. The university will adhere to all applicable federal and state laws, regulations, and guidelines with respect to providing reasonable accommodations as necessary to afford equal employment opportunity and equal access to programs for qualified people with disabilities.

Applicants for admission and students requesting reasonable accommodations for a disability should call the Office of Disability Services at 703-993-2474. Employees and applicants for employment should call the Office of Equity and Diversity Services at 703-993-8730. Questions regarding reasonable accommodations and discrimination on the basis of disability should be directed to the Americans with Disabilities Act (ADA) coordinator in the Office of Equity and Diversity Services.

EMAIL POLICY

Web: masonlive.gmu.edu

Mason uses electronic mail to provide official information to students. Examples include notices from the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback.

Students are responsible for the content of university communication sent to their Mason e-mail account and are required to activate that account and check it regularly.

Students are also expected to maintain an active and accurate mailing address in order to receive communications sent through the United States Postal Service

ADDITIONAL SERVICES AND POLICIES

UNIVERSITY POLICIES
Students must follow the university policies. See University Policies.

DIVERSITY
George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study and personal growth.

RESPONSIBLE USE OF COMPUTING
You are expected to adhere to the university policy for Responsible Use of Computing. See University Policies/Computing.

STUDENTS WITH DISABILITIES
Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester.

UNIVERSITY LIBRARIES
University Libraries provides Library services for distance students.

WRITING CENTER
The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing.

You can now sign up for an Online Writing Lab (OWL) session just as you may sign up for a face-to-face session in the Writing Center, which means YOU set the date and time of the appointment.

COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS)
The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance.

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)
The Family Educational Rights and Privacy Act of 1974 (FERPA), also known as the "Buckley Amendment," is a federal law that gives protection to student educational records and provides students with certain rights.