CS 217 Fundamentals of Image and Video Processing

Winter 2024

Course Credits: 4
Contact Hours: 56 hours
Instructor: TBA
Email: TBA

COURSE OBJECTIVES

This course aims to introduce students to fundamental concepts and methodologies in digital image and video processing, fostering a solid foundation for subsequent study and research in this dynamic field. The course covers the theoretical foundations, such as fundamentals of imaging physics, examples of fields that utilize digital image processing, and hands-on implementation of digital image processing algorithms. Topics include image enhancement, image restoration, image segmentation, and image compression, and more.

Upon completion of this course, students will be able to:

1. Grasp the fundamental principles of imaging physics, understand the factors influencing visual perception and how these principles can be applied in imaging systems.
2. Explore the mathematical foundations and tools used in image processing.
3. Develop competence in digital image processing, learning algorithms for image enhancement, restoration, and other processing tasks for different applications.
4. Interpret and apply edge detection, image segmentation, and representation for image recognition.
5. Explore more advanced topics in imaging science, preparing themselves for more in-depth investigation in this field.
6. Gain practical, hands-on experience through laboratory Exercises.

PREREQUISITES

MAT 130 Linear Algebra

CS 120 Introduction to Computer Science I

GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

ITEM	POINTS
Lab Assignments	60 Points
Midterm Exam	15 Points
Final Project	25 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F$.

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

R. C. Gonzalez, R. E. Woods, ***Digital Image Processing***, 3rd Edition, Pearson, 2007.

Recommended (Optional) Texts or Other Materials:

Supplemental materials might be included to illustrate or expand on textbook readings.

COURSE TOPICS

MODULE	TASKS
Module 1	**Topics:** Topic 1: Introduction and Course Overview Topic 2: Structure of the Human Eye, Light, Brightness Adaption and Discrimination Topic 3: Image Sensing and Acquisition Topic 4: Image Sampling and Quantization, Basic Relationship between Pixels **Assessments:** Lab Assignment#1

Module 2	**Topics:** Topic 5: Examples of Fields that Use Digital Image Processing Topic 6: Fundamental Steps in Digital Image Processing Topic 7: Components of an Image Processing System Topic 8: Mathematical Tools Used in Digital Image Processing **Assessments:** Lab Assignment#2 Lab Assignment#3
Module 3	**Topics:** Topic 9: Intensify Transformations and Spatial Filtering Topic 10: Intensify Transformations and Spatial Filtering (Cont.) Topic 11: Filtering in the Frequency Domain Topic 12: Filtering in the Frequency Domain (Cont.) **Assessments:** Midterm Exam Lab Assignment#4
Module 4	**Topics:** Topic 13: Image Restoration Topic 14: Color Image Processing Topic 15: Image Compression Topic 16: Morphological Image Processing **Assessments:** Lab Assignment#5 Lab Assignment#6
Module 5	**Topics:** Topic 17: Edge Detection and Image Segmentation Topic 18: Edge Detection and Image Segmentation (Cont.) Topic 19: Representation and Description Topic 20: Object Recognition **Assessments:** Lab Assignment#7 Final Project

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow

University Academic Administration Office, the student might get a written warning and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

LEARNING REQUIREMENTS

1) Late assignments are not acceptable and are subjected to grade deductions.
2) Assignments submitted in the wrong format will be counted as not submitted.
3) Failure to submit or fulfill any required course component results in failure of the class.
4) Make-up for midterm and final exams only with valid excuses, as defined by the University.
5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

ACEDEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.

DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.