



SYLLABUS

COLLEGE OF COMPUTING AND SOFTWARE ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE

CS 7367: MACHINE VISION

ACADEMIC TERM: SPRING 2021

Course Information

Class meeting time: 8pm – 9:15pm
Modality and Location: Traditional on Campus.
Location: J110

Instructor Information

Name: Mahmut Karakaya
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Office Location: Atrium Building (J) Room J305B
Office phone: (470) 578 6005
Office Hours: Tuesdays and Thursdays: 5:00 pm - 6:00 pm, or by other than these hours only by appointment
Preferred method of communication: Email

Course Description

This course introduces concepts and techniques in machine vision. It covers a variety of image processing techniques for the design and analysis of efficient algorithms for real-world applications, such as optical character recognition, face detection and recognition, motion estimation, human tracking, and gesture recognition. Topics include basic image enhancement, corner and edge detection, image morphology, linear and non-linear filters, image transformations, camera models, two-dimensional and three-dimensional image geometry, clustering and segmentation, classification, object recognition and Bag-of-Words models, image texture, shape analysis, and tracking.

Prerequisites: CS 6045 or MTRE 6100

Credit Hours: 3-0-3

Course Materials

Required Texts:

Computer Vision: Algorithms and Applications (Texts in Computer Science) 2020 2nd Edition, Springer, by Richard Szeliski, ISBN 978-1-84882-934-3, ISBN 978-1-84882-935-0 (ebook)

Recommended Texts:

- Digital Image Processing, by Rafael Gonzalez and Richard Woods.
- Multiple View Geometry in Computer Vision, by Richard Hartley and Andrew Zisserman.
- Computer Vision: A Modern Approach, by David Forsyth and Jean Ponce.

Technology requirements: Any computer Languages for the simulation

Learning Outcomes

Upon the completion of the course, students should be able to

1. Demonstrate the understanding of basic concepts in digital image processing and analysis.
2. Demonstrate understanding of a variety of digital image processing algorithms.
3. Apply a variety of machine vision techniques such as basic face detection and recognition, motion estimation, human tracking, shape analysis, and gesture recognition.
4. Explain and implement Reconstruction operations such as recover 3D structure of the scene, describe the problem of camera calibration, pose estimation, stereo and structure-from-motion, feature detection, and photometric stereo.
5. Implement different algorithms mentioned in #2, #3 and #4 using a high-level computer language.
6. Read and analyze research papers
7. Develop a research project and paper

Course Requirements and Assignments

Summary of Assignments:

1. Programming Assignment – #1
2. Programming Assignment – #2
3. Programming Assignment – #3
4. Programming Assignment – #4
5. Programming Assignment – #5
6. Programming Assignment – #6
7. Term Project and Presentation

Evaluation and Grading Policies

The final grade will be assessed based on students' progress and findings as follows:

Assessment Criteria:	
Attendances	5%
Homework assignments	30%
Term Project	25%
Midterm exam	20%
Final exam	20%

Grading Scale:	
A	90% - 100%
B	89% - 80%
C	79% - 70%
D	69% - 60%
F	59% or below

Students will receive feedback on each assignment/presentation within one to two week of the assignment and presentation due date.

Course Policies

Attendance: Class attendance is required and very important for successful completion of the course. Students are expected to attend every class and participate in the discussion of research ideas developed by others in the class. Peer feedback is essential and is part of the grade assigned to each of the course assignments stated above. Excused absences must be planned for, when possible, and justified with documentation. The student is responsible for making up missed class sessions. Late arrival that causes disruption, early departure that causes disruption, excessive

conversation among students (a disruption in its own right), inappropriate use of electronic devices that cause disruptions and other actions that disrupt the classroom are unacceptable.

Attendance Grade: Students are allowed to miss three classes during one semester. However, if the students miss more than three classes, for each class the students missed, it will result in one-point reduction from the final score of the class.

Late Homework: Students have three days in total for submitting their homework late. They can use three days for a single homework or use one day for three different homework. After the homework deadline, it will be one day late automatically. Please do not try to count minutes and hours. Total late days cannot be exceeding three days in the entire semester. After using three days, NO late homework submission will be accepted.

Class Participation: Thoughtful, prepared class participation is essential. This research seminar is designed to give students opportunities to engage classmates and professors in conversations about the research process related to computer science. Some conversations started in this seminar will eventually carry over to their graduate work. Students should take advantage of this opportunity to build their research community by engaging fully in class discussions with fellow students and faculty.

Exam: Respondus LockDown Browser and Respondus Monitor (WebCam) may be utilized for Tests. You may need to install and test a Web camera and microphone prior to beginning the semester before Tests. All exams are closed-book and closed-note. NO inside or outside resources or communications are permitted on any exam. Please practice with the questions at the end of each chapter before taking any major exam. D2L will instruct you with the steps required to install and activate both options (watch the following videos) for each exam. A broadband internet connection is required.

General overview video: <https://www.respondus.com/products/lockdown-browser/student-movie.shtml>

Student perspective video: <https://www.youtube.com/watch?v=Apb8tArU6JI>

Warning: Web camera should be on and active during the entire exam period. Turning off or blocking the web camera at any time during any phase of the exam period is strictly prohibited. Students' faces and eyes should be in front of the web camera during the exam period so clear recording can occur and be available for later inspection. Environment check request recording must clearly show the space around the exam space, table, and computer that is used for taking the exam. Any deviation from any of these conditions will be strictly interpreted as dishonesty. According to KSU's policies on academic dishonesty, any student who is found cheating or exercising any form of dishonesty will receive an automatic F grade in the course.

Faculty Conversations: In preparation for the conversations with CS faculty about the research process/method, students must complete assigned background reading. There will articles or book chapters assigned per class. In addition to the assigned articles or chapters, students should review the background information on the professor.

Email Policy: Students are encouraged to use only their official KSU email account since emails from other accounts may not successfully reach the instructor. The instructor will respond to email within 48 hours (not including weekends)

Classroom Behavior: All students are reminded to conduct themselves in accordance with the Student Code of Conduct, as published in the University Catalog. Every KSU student is responsible for upholding the provision. Students who are in violation of KSU policy will be asked to leave the classroom and may be subject to disciplinary action by the University.

Department or College Policies

Students are expected to be aware that the Computer Science department has certain policies in place that govern practices within the department including:

1. "B" or better grade is required for CS 1321/L and CSE 1322/L and their equivalent transfers. All courses used toward any undergraduate degree in the computer science must be completed with an assessed performance grade of "C" or better. This means that all prerequisite courses from the CS Department must have been completed with a "C" or better in order for a student to enter the next course in a sequence.
2. All requests for course overloads must be made through the College advising office and with the approval of the Program coordinator and department chair. The instructor of any course is not permitted to authorize course overloads.

3. All requests for prerequisite bypasses must be made through the College advising office and with the approval of the Program coordinator and department chair. The instructor of any course is not permitted to authorize course overwrites.
4. All students are encouraged to register their current choice of major using the department major change process. Students who are not recorded under their intended major may find that they may be limited from registering for courses they require to complete their intended program of study.

Institutional Policies

Please visit each of the following links for Institutional policies.

Federal, BOR, & KSU Course Syllabus Policies:

https://curriculum.kennesaw.edu/resources/federal_bor_ksu_student_policies.php

Student Resources:

https://curriculum.kennesaw.edu/resources/ksu_student_resources_for_course_syllabus.php

Academic Integrity Statement:

<https://scai.kennesaw.edu/codes.php>

KSU Student Resources

This link contains information on help and resources available to students:

https://curriculum.kennesaw.edu/resources/ksu_student_resources_for_course_syllabus.php

Course Schedule

Course Topics and Outline: Subject to change and more details

WEEK/DATE	TOPIC
1	Introduction and Fundamentals
2	Visual Perception Image Formation Assignment 1
3	Image Enhancement Filtering, Morphological Processing Assignment 2
4	Detecting Edge, Corner, Line, Circle Hough Transform Assignment 3
5	Feature detectors and descriptors Transformations, Geometric Correction Assignment 4
6	Machine Vision Applications Iris Recognition, Face Detection
7	Introduction to neural networks Convolutional neural networks Assignment 5
8	Midterm Exam & Review
9	SPRING BREAK
10	Classification & Detection Assignment 6
11	Segmentation
12	Generative Models GANs
13	Camera models Stereo and Structure from motion
14	Optical flow, Alignment and tracking
15	Project Presentations Term Project
16	Final Exam Reviews

Additional Resources

For CCSE Student resources: <http://ccse.kennesaw.edu/student-resources.php>

KSU Service Desk: The KSU Service Desk is your portal to getting assistance or access to University IT Services.

Students call: 470-578-3555 or email studenthelpdesk@kennesaw.edu

Information and links to Resources for Graduate Students: <http://graduate.kennesaw.edu/students/>

Links to frequently used and helpful services: <http://www.kennesaw.edu/myksu/>