الجامعة الألمانية الأردنية
German Jordanian University

CS330 Image Understanding
Spring 2024/2025

Instructor: Abdullah Alfarrarjeh (abdullah.alfarrarjeh@gju.edu.jo)
Office Hours: Sun/Mon/Tue/Wed 11:00 AM – 12:30 PM

Course Information

Catalogue Data

CS330 Image Understanding (3 Cr. Hr.)
The Image Understanding course teaches techniques to analyze and interpret images using image processing, computer vision, and deep learning. Topics include Image representation, preprocessing, and feature extraction, Segmentation and object detection (e.g., CNNs), Deep learning for classification and recognition, Advanced topics like image captioning and 3D reconstruction, Practical applications in areas like medical imaging and autonomous systems. Students gain practical experience with Python and tools such as OpenCV and TensorFlow.

Course Objectives:

- Learn about image formation
- Learn how to extract image color features
- Learn how to extract image texture features
- Learn how to extract edges in images using several methods (e.g., Prewit, Sobel, Marr-Hildreth, and Canny)
- Learn how to extract local image features using SIFT
- Learn how to conduct content-based image retrieval
- Learn how to classify images
- Learn how to detect objects

Course Learning Outcomes:

Upon successful completion of this course, you will be able:

- To understand serval techniques for representing image using various types of features
- To search images
- To analyze the content of images and extract semantic information (e.g., image classification and object detection)

References

- Computer Vision: Algorithms and Applications, Thirteenth Edition, Richard Szeliski, 2010.
- Computer Vision: A Modern Approach, 2nd Edition, David A. Forsyth and Jean Ponce, 2011, ISBN-13 978-9332550117
- Python Programming: The Ultimate Beginners Guide to Learn Python Machine Learning Step-by-Step", Alex Stark, 2021, ISBN-13: 979-8599089612.
- Several research papers provided throughout the semester.

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Course Topics

- Introduction to Python programming
- Image Formation
- Light & Color
- Image Features (Color Histogram and Textures)
- Content-based Image Retrieval
- Edge Detection
- SIFT
- Bag of Words
- Image Classification using Color Histogram
- Image Classification using Canny Features
- Image Classification using SIFT Features
- Image Classification using Neural Networks
- Introduction to CNN
- Image Classification using CNN
- Object Detection

Course Evaluation:

Grading Component	Points	Date
Midterm Exam	30%	**Between April 10 and April 19**. The exact date and time will be announced by the admission and registration department.
Programming Assignments	30%	
Final Exam	40%	**Between June 14 and June 25.** The exact date and time will be announced by the admission and registration department.

Class Policies

Class Attendance

Class attendance will be taken. You must not be absent for more than 15% of the course lectures, which is 4 class lectures. Exceeding the limits in either one without a genuine excuse could fail you the complete course; The instructor reserves the right for not allowing you to attend any exam or lecture after you exceed the 15% ratio without an excuse.

You are responsible for all course material and announcements covered in class. A fair amount of material will be covered in class that is not in the textbook; you are responsible for all of this material.

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If you miss a class, you must obtain the covered material from a willing classmate. The instructor will not be available (during office hours or other times) to repeat the material covered in class.

Collaboration Policy
Discussing and exchanging ideas is encouraged. You may help each other with general techniques, although specific solutions to homework assignments should be developed individually. However, except if specifically allowed by the instructor, copying from any outside sources (e.g., fellow students, Internet, etc.) on any material to be graded is not permitted and will be considered cheating. Cheating will result in failure of the assignment and perhaps the failure of the class. Each student is responsible for securing his or her work from copying. Each student is expected to abide by University policies on Academic Conduct. For other related references, refer to the Student Handbook.

Due Dates
All assignments must be turned in the class on the due dates for full credit. No assignments will be accepted after class on the due date.

Exams
All exams (including the final exam) will be in-class, closed-book exams. The final exam will be comprehensive, covering material from the entire course, although the last third of the course will be emphasized. The final exam will be held during the final exam week.

Missed Exams
If you have an excusable absence from an exam, your final exam grade may be counted as your missed exam grade. The instructor reserves the right to administer a make-up exam. Barring exceptional circumstances, you must contact the instructor to explain your absence within 48 hours of a missed exam. Otherwise, the absence will be considered unexcused, and your grade for that exam will be zero. Talk to the instructor if you have any foreseeable conflicts with the given exam dates.

Grading Corrections
Ask the instructor for any grading correction requests within the class weeks of receiving the grade, or before the end of the semester, whichever comes first. After that, your grade will not be adjusted. If you find any mistake in grading, please let the instructor know. Your grade will not be lowered.

Email
Email is the preferred and fundamental method of communication between students and faculty. However, please use email wisely as it can be easily abused and misunderstood. Specifically: You may not engage in non-school activities; you may not use email to harass or abuse colleagues, faculty, or the general public.

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Computers

You are encouraged to obtain and utilize your own laptop in connection with school activities.

Printing

You are strongly discouraged from printing unless it is absolutely necessary for your classwork. The university is encouraging the paperless office paradigm, and as such, you are encouraged to use email where possible.