CMPE/CMSE 424 – Introduction to Image Processing

Department: Computer Engineering		
Program Name: Computer Engineering/Software Engineering	**Program Code:** 25/29	
Course Number: CMPE/CMSE 424	**Credits:** 4 Cr	**Year/Semester:** 2024-2025 Fall

☐ Required Course   ☒ Elective Course   ☐ Service Course

Prerequisite(s): MATH152

Catalog Description:
Introduction to image processing, digital image fundamentals, image enhancement, image restoration, image analysis, segmentation, image compression

Course Web Page:
https://staff.emu.edu.tr/onsentoygar/en/teaching/cmpe424

Textbook:
1. R. C. Gonzalez and R. E. Woods, *Digital Image Processing,* 3rd Edition, Prentice Hall, 2008.

Reference Book(s):
1. Gonzalez, Woods, and Eddins, *Digital Image Processing Using MATLAB*, Prentice Hall, 2004.

Topics Covered and Class Schedule:
(4 hours of lectures per week)

week 1	Introduction to image processing (A general introduction to image processing, digital image processing problems and applications)
weeks 2-3	Image representation and modeling (Image sampling and quantization, basic relationships between pixels, introduction to mathematical tools used in image processing)
weeks 4-5	Intensity transformations and spatial filtering (Intensity transformation functions, histogram processing, basics of spatial filtering)
weeks 6-7	Image restoration (Degradation/restoration process model, noise models, periodic noise reduction with frequency domain filtering, estimation of degradation function, inverse filtering, Wiener filtering)
weeks 8-9	(Midterm Exams)
week 10-11	Image segmentation (Point, Line and Edge detection, thresholding, region-based segmentation)
eek 12-13	Image compression (Pixel coding, predictive techniques, transform coding of images)
weeks 14-15	Project Presentations
weeks 16-18	(Final Exams)

Laboratory Schedule:
(2 hours of laboratory per week)

week 3	Introduction to MATLAB and Image Processing Toolbox.
week 4	Digital Image Fundamentals (Image Interpolation, Arithmetic and Set Operations)
week 6	Intensity Transformations and Histogram Processing for Image Enhancement
week 10	Image Restoration and Filtering
week 12	Edge Detection on Noisy Images

Course Learning Outcomes:
On successful completion of the course, the student is expected to be able to:
   (1) Understand the basics of image processing such as image representation and modeling
   (2) Learn the fundamentals of image enhancement
   (3) Understand the basics of image restoration
   (4) Learn the fundamentals of image compression
   (5) Understand the basics of image analysis and segmentation
   (6) Develop skills in the concepts of image enhancement, histograms, image restoration, edge detection and image compression
   (7) Develop skills in preparing research projects by teams on recent developments in image processing.
   (8) Develop skills in reading journal articles and writing proposal and final report for the project
   (9) Gain ability in completing a research project and presenting the project in front of other students and instructors
   (10) Gain ability to compare different methods in an image processing application

	Method	No	Percentage
Assessment	Midterm Exam(s)	1	30 %
	Labs	5	10 %
	Term Project	1	20 %
	Final Examination	1	40 %

Relationship of the course to Student Outcomes:
The course has been designed to contribute to the following student outcomes:
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Notes and Policies
Exams:
   - If you miss midterm or final exam and submit a written report to your instructor stating your excuse within 3 days of that examination, you will be able to enter makeup exam.
   - If you miss both midterm and final exams and do not submit any written report, you will get an "NG" grade. In that case, if you submit report for both missed exams, you will be able to enter makeup for one of them only.

Labs:
   - There will be 1 makeup for the missed lab experiments.
   - Exemption for laboratory work will not be provided for students who are repeating the course.

PLAGIARISM
   - Plagiarism (which also includes any kind of cheating in exams, project and lab works) is a disciplinary offence and will be dealt with accordingly. Furthermore, the penalty of plagiarism is to get grade zero for the corresponding exam, project, or lab work.

IMPORTANT REMARKS
   - You should have regular attendance to the lectures for being successful in the course.

Course related materials, laboratory experiments and announcements will be published on the course web site and you will be responsible from all. Note that the course web site will be updated during the semester. Therefore, please check it regularly.

Prepared by: Prof. Dr. Önsen Toygar	**Date Prepared:** 23 September, 2024