Department of ………Computer Science…….

College of ………… Science …………….

University of ………Cihan……….

Subject: Image Processing

Course Book – Year 4 / Second semester

Lecturer name: Dr. Kusay Faisal Abdulrazak

Academic Year: 2023/2024

Course Book

1. Course name	Image processing
2. Lecturer in charge	Dr. Kusay Faisal Abdulrazak
3. Department/ College	Computer Science
4. Contact	**e-mail:** kusay.faisal@sulicihan.edu.krd **Tel:**
5. Time (in hours) per week	**Theory : 2 hr** **Practical : 2 hr**
6. Office hours	2 hr/week
7. Course code	CSC4202
8. Teacher's academic profile	Dr. Kusay Faisal was born in Sheffield, UK, 1977. Received B.SC in electrical and electronics engineering in year 2000. Received M.Sc. and Ph.D. degrees in telecommunication engineering from University Technology Malaysia (UTM) in 2007 and 2013 respectively. He did researches in Wireless communication, Radar, Satellite, LMDS, HAPS, broadband wireless access, and wireless networking fields. Currently he is a part-time lecturer in the faculty of computer science at Cihan University, Sulaimanya, taught the following subjects: · Microprocessor structure . Computer Architecture Design . Parallel Processing . Multimedia . Image processing · MATLAB Programming · Operations Research · English for computer science · Account Software Package · Accounting Information System · Computer Skills
9. Keywords	Analog image, digital image, Image transformation, Fourier transformation, histogram transformation, Wavelet Transform, Image Morphology

10. Course overview:

The course is an introduction to image processing and image analysis techniques and concepts. Areas examined include: Imaging sensors and their principles; Image representation and storage, coding and compression techniques, lossy versus lossless; Techniques for noise

reduction. Image enhancement including contrast manipulation, histogram equalization, edge highlighting; Filtering and transform techniques for image processing including two dimensional Fourier transforms, wavelets and convolution; Spatial transformations and image registration. Segmentation and threshold techniques; Applications of morphology to image processing including erosion, dilation and hit-or-miss operations for binary and grey scale images; Image feature estimation such as edges, lines, corners, texture and simple shape measures. Object classification, template matching techniques and basic image based tracking will also be examined.

11. Course objective:

This course aims to:
1. Introduce the concepts of image processing and basic analytical methods to be used in image processing.
2. Familiarize students with image enhancement and restoration techniques.
3. Explain different image compression techniques.
4. Introduce segmentation and morphological processing techniques.

12. Student's obligation

The student should attend lectures and completion of all tests, attend to all practice, exams, assignments, reports , essays, …etc

13. Forms of teaching

The English language will be used in conducting the lectures. The computer and data show will be used for lectures slides presentation, whiteboard and marker will be used for father explanation.

There will be classroom discussions and the lecturer will give enough time to analyze, evaluate, and solve problems sets throughout the semester. As will as there will be practical class using Visual C# program to get more clarification about image processing.

14. Assessment scheme

The 100 mark will be divided as shown in the table below:

Mid-semester theory exam	25 %
Homework, quizzes	5 %
Classroom activities and attendance	5 %
Mid-semester practical exam	15 %
Final theory exam	35 %
Final practical exam	15 %

15. Student learning outcome:

At the conclusion of this course, you should be able to:

- Demonstrate knowledge of a broad range of fundamental image processing and image analysis techniques and concepts.
- Identify, Demonstrate and apply their knowledge by analysing image processing problems and recognising and employing (or proposing) effective solutions.
- Design and create practical solutions to a range of common image processing problems and to critically assess the results of their solutions, including shortcomings.

16. Course Reading List and References:

- Rafael C. Gonzalez, and Richard E. Woods. "Digital Image Processing", 4th Edition, University of Tennessee 2018.

- M. Sonka, V. Hlavac, and R. Boyle. "Image processing analysis and machine vision", Fourth Edition, Global Engineering: Timothy L. Anderson, 2015.

- M.S. Nixon, and A.S. Aguado. "Feature Extraction and Image Processing," Linacre House, Jordan Hill, Oxford, 2002.

- Donald Hearn, M. Pauline Baker, Computer Graphics with OpenGL, 3rdedition, Prentice Hall, 2010 Chapter 3.

17. The Topics:	Lecturer's name
- Introduction to image processing - Fundamental steps of digital processing - Image transformation 2D Discrete Fourier Transform - Enhancement techniques – Spatial domain "Histogram" - Enhancement techniques – Frequency domain "filter" - Image compression - Wavelet transform - Image Restoration - Image Segmentation - Image Morphology	Dr. Kusay Faisal Theory (2 hrs)

Week No.	Lecture No.	Lecture Topics	
1	1	Introduction to image processing (image processing, analog image, digital image)	
	2	Advantage, disadvantage, motivation, and types of digital image processing	
2	1	Fundamental steps of digital processing	
	2		
3	1	Image transformation (efficient representation, advantages, and definition)	
	2	What is the need of transform? Various image transform	
4	1	2D Discrete Fourier Transform	
	2		
5	1	Enhancement techniques – Spatial domain "Histogram"	
	2		
6	1	Enhancement techniques – Frequency domain "filter"	
	2		
7	1	Exercises practice and General review	
	2		
8	1	Image compression (explain and examples, entropy and code length, run-length coding, VLC "Shannon-Fano algorithm", compression system model, compressor consists, encoding stage, decompressor consists, Huffman Coding, examples).	
	2		
9	1	Wavelet transform(Image Pyramid, Sub-Band Coding, Applications)	
	2	Haar WT (HWT) and Inverse Haar WT (IHWT)	
10	1	Image Restoration (Noise and Its Characteristics, Noise Models, Determining Noise Model)	
	2	Image Restoration in the Presence of Noise Only, Order Statistics Filters, Adaptive Filters, Adaptive Median Filters.	
11	1	Image Segmentation (Detection of Discontinuities, Point Detection, line Detection, edge Detection, Region Oriented Segmentation)	
	2		
	1	Image Morphology (Morphology Operations, Morphology Applications, Hit-or-Miss	

12	2	transformation	
13	1	General examples, exercises, and review	
	2		

18. Practical Topics (If there is any)	Lecturer's name
- Load image: Design and create picture box, label, and button (load the image convert to grey colour). - Convert the image to Red, Green, and Blue color - Mirror image - Enhance the image using Histogram. - Practice on Fourier transformation - Practice on compress the image - Practice on wavelet transform - Practice on noise models and image restoration - Practice on image segmentation	Dr. Kusay Faisal Practical (2 hrs) 07 / 1 / 2024

19. Examinations:

The type of exam the questions usually comes with problems needs to obtain the best solution to these problems, calculator required in the exam. May come one question have some definitions.

20. Extra notes:
None

21. Peer review

Reviewed and signed by:

Head of Department:
Dr. Lway Faisal Abdulrazak

Lecturer:

Dr. Kusay Faisal Abdulrazak