Image Processing

Cihan University Sulaymaniyah

Academic Year: 2025-2026

1. Information on the Programme

1.1. Higher Education Institution	Cihan University
1.2. College	College of Science & Technology
1.3. Department	Department of Computer Science
1.4. Field of Study	Information and Communication Technology
1.5. Cycle of Study[1]	Bachelor's Degree (First Cycle)
1.6. Specialisation/ Study Programme	Computer Science
1.7. Form of Education	Full time

2. Information on the Discipline

2.1. Discipline Name				Image Processing				
2.2. Code				/				
2.3. Language:				English				
2.4. (Theory) Lecturer **E-mail:** **bahast.li@sulicihan.edu.krd** **Tel: /** **Webpage, Google Classroom**				Bahast A.				
2.5. Practical/Seminar/ Laboratory/ Project Lecturer **e-mail:** **Tel:** **Webpage, Google Classroom**				Same as above				
2.6. Year of Study	3rd	**2.7.Semester**	2nd	**2.8. Assessment Type**[2]	CE & WE	**2.9. Discipline Status**	**Content**[3] **Mandotary**[4]	FD MD

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[1] **Cycle of studies - Bachelor «1»**

[2] **(Exam: Written Exam (WE)), and (Continuous Evaluation(CE)).**

[3] **Discipline status (Content) - FD (Fundamental (General) Discipline),**

[4] **Discipline status (compulsoriness) -** MD (Mandatory discipline),

3. Total estimated time (Teaching Hours per Semester)

Total Contact Hours:	**52**
Total Self Study Hours:	**83**
Total No. Hours:	**135**
ECTS:	**5**

No. of Weeks	Contact Hours					Self Study					
	Theoretical	Practical Lab.		Project	Visit	Quiz	Reading	Assignment	Report	Midterm Exam.	Final Exam.
1st Week (Registration)	-	-	-	-	-	-	-	-	-	-	-
2nd Week	2	2				1	2			8	11
3rd Week	2	2				1	2				
4th Week	2	2				1	2				
5th Week	2	2				1	2		9		
6th Week	2	2				1	2				
7th Week	2	2				1	2				
8th Week	2	2				1	2			8	
9th Week	2	2				1	2				
10th Week	2	2				1	2				
11th Week	2	2				1	2		8		
12th Week	2	2				1	2				
13th Week	2	2				1	2				
14th Week	2	2				1	2				
15th Week (Final Exam.)											
16th Week (Final Exam.)											
TOTAL	**26**	**26**				**13**	**26**	**0**	**17**	**16**	**11**

4. Prerequisites (if applicable)

4.1 Curriculum-Related	NA
4.2 Skills-Related	NA

5. Conditions (if applicable)

5.1. For the Theoretical	Pass with at least a 50% threshold
5.2. For the Practical/ Laboratory/ Project	Complete all lab assignments

6. Cumulated Specific Competences

Professional Competencies	Students will demonstrate digital image processing and professional efficacy by analysing, implementing, and managing sophisticated models. This competence enables them to reliably achieve complex and technical objectives.
Transversal Competences	Critical thinking, problem-solving, technical reporting, and teamwork skills

7. Discipline Objectives

7.1. General Objective	This module is designed to foster competence in leveraging image processing principles, enabling students to transition to practical application and make something useful.
7.2. Learning Outcomes	By the end of this module, students should be able to: 1 – Analyse the physical and mathematical processes of image formation, 2 – Compare and contrast the mechanisms of low-level biological vision (retinal processing) with artificial enhancement techniques like histogram equalisation and spatial filtering. 3 - Apply mathematical operators for segmentation and edge detection. 4 – Implement algorithms for correspondence and feature matching to identify and link identical points of interest across multiple viewpoints.

	5 – Evaluate the principles of stereo vision and depth perception to reconstruct spatial information from image pairs. 6 - Formulate solutions for detecting and tracking objects in time-varying sequences. 7 - Describe the hierarchical organization of biological recognition. 8 - Construct a functional image processing pipeline in a high-level programming language (MATLAB)

8. Content

8.1. Theoretical-Number of Hours

Topics		LOs
First week	Enrolment	
Second week	Introduction to image processing	**1, 9**
Third week	Image formation	**2,3**
Fourth week	Low level artificial	**2**
Fifth week	Low & mid level biological	**2, 7,8**
Sixth week	Segmentation	**3**
~~**Seventh week**~~		
Eighth week	Correspondence	**4,5**
Ninth week	Stereo & depth	**5**
~~**Tenth week**~~	Video & motion	~~**6**~~
Eleventh week	Recognition artificial	**7**
Twelfth week	Recognition biological	**8**
Thirteenth week	Revision	
~~**Fourteenth week**~~		

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8.2. Practical Works– Number of Hours	Teaching methods	Observation
First week	Step-by-step tutorial on "The Digital Pixel"	Students can manipulate pixel values directly and explain the difference between a JPG and a RAW image.
Second week	Mathematical derivation of Histograms.	Ability to predict how a histogram will shift before running the code. Successful manual implementation of a log-transform.
Third week	Creating a "Retinal Simulator" using Difference-of-Gaussians.	Students correctly identify that edge detection in biology begins at the retinal level, not just the brain.
Fourth week	Parameter tuning: How orientation affects filtering.	Recognition of why "orientation selectivity" is the building block of all complex vision.
Fifth week	Live derivation of the Sobel Gradient.	Students observe the "noise-sensitivity" of gradients and the importance of pre-smoothing (Gaussian blur).
Sixth week	Logic-puzzles on Watershed & Region Growing.	Understanding "Over-segmentation" issues and how to manually tune thresholding parameters (Otsu's).
~~**Seventh week**~~		
Eighth week	Geometric drawing of Epipolar lines.	Students can explain why simple pixel-matching fails when an image is rotated or scaled.
Ninth week	Visualizing feature maps in a pre-trained network.	Ability to interpret a grayscale disparity map where "brighter = closer." Successful 3D triangulation.
Tens week	Introduce the aperture problem.	Students observe that motion detection is highly sensitive to lighting changes and "ghosting" effects.

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Eleventh week	Under the Hood" of CNNs (Conv/Pool/ReLU).	Students can map high-level biological concepts (V4/IT) to artificial "layers" in a neural network.
Twelfth week	Ethics & Future Trends in Computer Vision.	Synthesis Check: Can the student explain their entire code pipeline from pixel input to classification output?
Thirteenth week	Revision	
~~Fourteenth week~~		

Compulsory Bibliography:

1. Foundations of Computer Vision: Computational Geometry, Visual Image Structures, and Object Shape Detection by James F. Peters
2. Digital Image Processing by Rafael C. Gonzalez
3. Digital Image Processing by Nick Efford

Optional Bibliography:

9. Assessment

Type of Activity	9.1. Assessment Criteria[2]	9.2. Assessment Type	9.3. Percentage of the final Grade
9.4. Theoretical	CE, WE	**Weekly quizzes, assignments, group work**	50%
9.5. Practical/ Seminar/Laboratory	CE	**Lab reports, reports, homework, group work**	50%
Minimum performance Standards: 50%			

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Theoretical Lecturer	Bahast A.
Practice Lecturer	Same as above

Grading Scheme			
Group	**Grade**	**Marks %**	**Definition**
Success Group (50 - 100)	**A -** Excellent	90 – 100	Outstanding Performance
	B - Very Good	80 – 89	Above average with some errors
	C - Good	70 – 79	Sound work with notable errors
	D - Satisfactory	60 – 69	Fair but with major shortcomings
	E - Sufficient	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(0-44)	Considerable amount of work required

Approved by the Curriculum development Committee:	
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Head of the Department/ Dean	

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