QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department

Study plan No.	**2025/2026**		**University Specialization**	Data Science and Artificial Intelligence	
Course No.	0135326		**Course name**	Computer Vision	
Credit Hours	**3**		**Prerequisite Co-requisite**		
Course type	√ MANDATORY UNIVERSITY REQUIREMENT	☐ **UNIVERSITY ELECTIVE REQUIREMENTS**	☐ **FACULTY MANDATORY REQUIREMENT**	☐ **Support course family requirements**	☐ **Mandatory requirements** / Elective requirements
Teaching style	☐ **Full online learning**		☐ **Blended learning**		√ **Traditional learning**
Teaching model	☐ **2Synchronous: 1asynchronous**		☐ **2 face to face : 1synchronous**		√ **3 Traditional**

Faculty member and study divisions information (to be filled in each semester by the subject instructor)

Name	Academic rank	Office No.	Phone No.	E-mail	
Akram Fatayer	**Associate professor**	**9354**	**0791420797**	**a.fatayer@zuj.edu.jo**	
Division number	**Time**	**Place**	**Number of students**	**Teaching style**	**Approved model**

Brief description

This course provides a comprehensive introduction to the principles and applications of computer vision. It covers fundamental topics including image formation, image processing (filtering, transforms), edge and boundary detection, feature detection (SIFT), and object recognition (face detection). The course also explores advanced topics such as object tracking. Emphasis is placed on hands-on learning through a series of labs and assignments where students implement core computer vision algorithms from first principles using Python and OpenCV. The course is designed to equip Data Science and AI students with the foundational knowledge and practical skills to analyze and interpret visual data, preparing them for advanced studies and real-world applications in artificial intelligence.

Learning resources

Course book information (Title, author, date of issue, publisher ... etc)	T1: Szeliski, R. (2022). Computer Vision: Algorithms and Applications (2nd ed.). Springer. 2.T2: Bradski, G., & Kaehler, A. (2008). Learning OpenCV: Computer Vision with the OpenCV Library. O'Reilly Media.
Supportive learning resources (Books, databases, periodicals, software, applications, others)	Lab Handouts: Custom lab manuals developed for the course, covering: •Lab 1: Foundations of Image Processing •Lab 2: Frequency Domain Analysis •Lab 3: Edge Detection from First Principles •Lab 4: Boundary Detection with Hough Transform

	•Assignments: Project-based assignments for each lab to reinforce concepts. •Final Exam Materials: Practice Exam, Cheat Sheet, and Question Bank.			
Supporting websites	• OpenCV Documentation: https://docs.opencv.org/ • Scikit-image Documentation: https://scikit-image.org/docs/stable/ • PyImageSearch: https://www.pyimagesearch.com/			
The physical environment for teaching	√ Class room	√ labs	√ Virtual educational platform	☐ Others
Necessary equipment and software				
Supporting people with special needs				
For technical support				

Course learning outcomes (S= *Skills, C= Competences K= Knowledge,)*

No.	Course learning outcomes	The associated program learning output code
	Knowledge	
K1	Understand the fundamentals of image formation, representation, and processing.	MK1, MK2
K2	Explain the principles of edge detection, feature detection (SIFT), and boundary detection (Hough Transform).	MK2
K3	Describe the architecture of modern object detectors (Viola-Jones) and tracking systems.	MK2
	Skills	
S1	Implement core computer vision algorithms for image filtering, transformation, and analysis using Python and OpenCV.	MS1, MS2
S2	Apply feature detection and description techniques to solve problems in image matching and object recognition.	MS2
S3	Design and implement systems for face detection and object tracking in video streams.	MS2
	Competences	
C1	Analyze and evaluate the performance of different computer vision algorithms for specific tasks.	MC1, MC2
C2	Solve real-world problems by integrating multiple computer vision techniques to build a complete application.	MC1, MC2
C3	Demonstrate critical thinking by selecting appropriate algorithms and parameters for a given computer vision problem.	MC2

Mechanisms for direct evaluation of learning outcomes

Type of assessment / learning style	Fully electronic learning	Blended learning	Traditional Learning (Theory Learning)	Traditional Learning (Practical Learning)
PBL	0	10%	%20	**15%**
Second / midterm exam	%30	%30	%20	**30%**

Participation / practical applications/Quizzes	0	10%	10	**10%**
Asynchronous interactive activities	%30	%10	0	**5%**
final exam	%40	%40	%50	**40%**

Note: Asynchronous interactive activities are activities, tasks, projects, assignments, research, studies, projects, work within student groups ... etc, which the student carries out on his own, through the virtual platform without a direct encounter with the subject teacher.

Schedule of simultaneous / face-to-face encounters and their topics

Week	Subject	learning style*	Reference **
1	Introduction to Computer Vision & Image Formation	Lecture	T1, Ch. 1-2
2	Image Processing I: Point Operations, Histograms	Lecture + Lab	T1, Ch. 3; Lab 1
3	Image Processing I: Spatial Filtering (Convolution)	Lecture + Lab	T1, Ch. 3; Lab 1
4	Image Processing II: Frequency Domain (Fourier Transform)	Lecture + Lab	T1, Ch. 3; Lab 2
5	Edge Detection: Gradient-based (Sobel), Laplacian	Lecture + Lab	T1, Ch. 4; Lab 3
6	Edge Detection: Canny Edge Detector	Lecture + Lab	T1, Ch. 4; Lab 3
7	Boundary Detection: Hough Transform (Lines & Circles)	Lecture + Lab	T1, Ch. 4; Lab 4
8	Midterm Exam	Exam	-
9	Feature Detection: SIFT - Scale-Space & DoG	Lecture	T1, Ch. 7
10	Feature Detection: SIFT - Keypoint Localization & Orientation	Lecture	T1, Ch. 7
11	Feature Detection: SIFT - Descriptor & Matching	Lecture	T1, Ch. 7
12	Face Detection: Haar Features & Integral Image	Lecture	T2, Ch. 14
13	Face Detection: AdaBoost & Attentional Cascade	Lecture	T2, Ch. 14
14	Object Tracking: Change Detection, Template Matching	Lecture	T1, Ch. 8
15	Object Tracking: Feature-Based Tracking	Lecture	T1, Ch. 8
16	Final Exam	Exam	-

*** Learning styles: Lecture, flipped learning, learning through projects, learning through problem solving, participatory learning ... etc.**

**** Reference: Pages in a book, database, recorded lecture, content on the e-learning platform, video, website ... etc.**

Schedule of asynchronous interactive activities (in the case of e-learning and blended learning)

Week	Task / activity	Reference	Expected results
1	Introduction to Robotics: Watch	Video + Quiz	To show

	video on robot applications, complete quiz		understanding of robotics fundamentals
2	Environment Setup: Install Python environment (Conda, PyBullet, OpenCV)	Lab 1 Handout	To prepare development environment
3	Object Detection concepts: Study color spaces and thresholding	Lab 2 Handout	To understand image processing fundamentals
4	Object Detection Lab: Implement color-based object detection	Lab 2 Handout	To apply CV techniques
5	Localization concepts: Solve odometry calculation problems	Lab 3 Handout	To understand position estimation
6	Localization Lab: Implement odometry-based localization	Lab 3 Handout	To implement localization algorithms
7	PBL Preparation: Submit project proposal (topic, objectives, approach)	PBL Guidelines	To define project scope and plan
8	PBL Discussion + Mapping Lab: Create occupancy grid	Lab 4 Handout	To receive feedback and refine project plan
9	Path Planning concepts: Trace A* algorithm execution	Lab 5 Handout	To understand search algorithms
10	PBL Progress Report 1: Submit implementation progress	PBL Guidelines	To demonstrate initial implementation
11	Motion Planning: Analyze trajectory generation methods	Lab 6 Handout	To understand paths vs. trajectories
12	PBL Progress Report 2: Integration testing and debugging	PBL Guidelines	To show system integration
13	Control Lab: Study PID control theory	Lab 7 Handout	To understand control fundamentals
14	PBL Final Implementation: Complete project and prepare presentation	PBL Guidelines	To finalize project deliverables
15	PBL Final Presentation & Demo	PBL Guidelines	To demonstrate complete working system

16	Final Paper Exam	Course materials	