MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Computer vision**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UOMU0302063**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	الأنظمة الطبية الذكية		**College**	العلوم	
Module Leader	م.م. قصي منير دياب		**e-mail**	qusai.muneer.deyab@uomus.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	M.Sc.	
Module Tutor	م.م. قصي منير دياب		**e-mail**	qusai.muneer.deyab@uomus.edu.iq	
Peer Reviewer Name	ا.د مهدي عبادي مانع		**e-mail**	mahdi.ebadi@uomus.edu.iq	
Scientific Committee Approval Date	1/10/2024		**Version Number**	2.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**UOMU0302052**	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The aims of this course are to introduce the principles, models and applications of computer vision, as well as some mechanisms used in biological visual systems that may inspire design of artificial ones. The course will cover: image formation, structure, and coding; edge and feature detection; neural operators for image analysis; texture, colour, stereo, motion; wavelet methods for visual coding and analysis; interpretation of surfaces, solids, and shapes; data fusion; probabilistic classifiers; visual inference and machine learning; and face recognition. 1. To clearly explain the lines and relation between digital image processing and computer vision from image analysis concepts. 2. Be able to decompose visual tasks into sequences of image analysis operations, representations, specific algorithms, and inference principles 3. To understand the relation among relevant topics of computer vision and image processing with artificial Intelligence (AI). 4. Be Able to analyses the robustness, brittleness, generalizability, and performance of different approaches in computer vision 5. Be Able to describe key aspects of how biological visual systems encode, analyses, and represent visual information 6. Be Able to think of ways in which biological visual strategies might be implemented in machine vision, despite the enormous differences in hardware 7. Understand in depth at least one important application domain, such as face recognition, detection, or interpretation
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. automated medical image analysis, interpretation, and diagnosis 2. robotic manufacturing: manipulation, grading, and assembly of parts 3. OCR: recognition of printed or handwritten characters and words 4. agricultural robots: visual grading and harvesting of produce 5. smart offices: tracking of persons and objects; understanding gestures 6. biometric-based visual identification of persons 7. visually endowed robotic helpers 8. security monitoring and alerting; detection of anomaly 9. tracking of moving objects; collision avoidance; stereoscopic depth
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – computer vision Theory</u> Electromagnetic Spectrum and color. Color in Computer Vision, , Eigenvalues and Eigenvectors (SVD), Convolution and Correlation , Edge Detection for computer vision, Image Gradient, principles of Robotics, learning theory [15 hrs]

	Mathematical operations for extracting structure from images, Shift Theorem , Similarity Theorem, Convolution Theorem, Active contours (“snakes”). Fourier boundary descriptors. [15 hrs] Clustering and Segmentation, Features and Fitting, Feature Descriptors, The completeness of 2D Gabor wavelets , Face detection, recognition, classification and interpretation, Facial expression. [15 hrs]. Texture, color, shape , stereo, and motion descriptors, Intensity Gradient Models [15 hrs] Intelligent technique, Bayesian pattern classifiers, K-nearest neighbor’s classifier, ANN, machine learning Revision problem classes [6 hrs] Part B – matlab and python program Fundamentals Matlab program, edge detection, segmentation. [15 hrs] Mathematical operations, matrices. [7 hrs] Feature extraction, Gabor wavelet, PCA, recognition and classification . [15 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students’ participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	5% (10)	5, 10	LO #1, 2, 10 and 11
	Projects / Lab.	1	15% (10)	Continuous	
	Report	1	5% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	3 hr	25% (10)	7	LO # 1-7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Computer Vision
Week 2	Electromagnetic Spectrum and color. Color in Computer Vision

Week 3	Image restoration
Week 4	Edge Detection
Week 5	Semantic Segmentation ,clustering
Week 6	Features and Fitting
Week 7	Mid-term Exam
Week 8	Dimensionality Reduction
Week 9	Object recognition
Week 10	Classification methods
Week 11	Motion and tracking
Week 12	Intelligent technique, Bayesian pattern classifiers, K-nearest neighbor's classifier, ANN
Week 13	Robotic vison
Week 14	Machine learning and Deep Learning
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1-2	Lab 1: Introduction to matlab program
Week 3-4	Lab 2: Mathematical operations, matrices
Week 5-6	Lab 3: edge detection
Week 7-8	Lab 4: segmentation
Week 9-10	Lab 5: feature extraction
Week 11-12	Lab 6: face recognition
Week 13-14	Lab 7: machine learning

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	COMPUTERVISION:FOUNDATIONSANDAPPLICATIONS,COMPILEDBYRANJAYKRISHNA	
Recommended Texts		

Websites	https://www.cl.cam.ac.uk/teaching/0809/CompVision/CompVisNotes.pdf

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

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.