INTERNATIONAL QUALIFICATIONS

AND ASSESSMENT CENTRE (IQAC)

Approved:

2025 y «__» _____

Programme	**LEVEL 4 EXTENDED DIPLOMA IN ARTIFICIAL INTELLIGENCE**		
Unit Number/ Unit Title	UNIT 4 COMPUTER VISION & PATTERN RECOGNITION		
Cohort Code:	L04CVP-U4		
Unit Level	4		
Total GLH	Total qualification time 200/ Total Guided learning hours 90/ Self-guided learning hours 110		
Credits	20 CATS/ 10 ECTS		
Lecturer			
Start Date		**End Date**	

Unit Aims	The unit aims to equip students with the programming skills necessary to implement AI algorithms, using Python as the primary programming language. Students will gain hands-on experience in designing, implementing, and testing AI-based solutions, including the application of machine learning techniques and the use of popular AI development tools and libraries. The ultimate goal is to enable learners to become proficient in translating AI concepts and theories into practical, working AI applications that can address real-world problems.
Differentiation Strategies *(e.g. planned activities or support for individual learners according to their needs)*	The total number of students to be in the lesson is approximately 20. This is a multicultural group of students predominantly between the ages of 24 – 45, with numerous ethnic, gender, and creed background. These are UK academic level 5 students; hence it is assumed that they have practical, theoretical, or technological knowledge and understanding of a subject or field of work to find ways forward in broadly defined, complex contexts. These students must be able to generate information, evaluate, synthesise the use information from a variety of sources. Various approaches to addressing the various identified students needs will be adopted throughout the lesson. Such will include:- 1. Progressive tasks 2. Digital resources

	3. Verbal support 4. Variable outcomes 5. Collaborative learning 6. Ongoing assessment 7. Flexible-pace learning
Equality & Diversity	Variety of teaching techniques will be employed to ensure that the needs of each individual learner are met.
Safeguarding & Prevent	Safeguarding policies and the Prevent duty are strictly observed to ensure the safety, well-being, and inclusivity of all students and staff.
Health & Safety	SIRM H&S policies will be maintained.
Learning Resources	**Teaching and Learning Materials** • "Computer Vision: Algorithms and Applications" by Richard Szeliski • "Pattern Recognition and Machine Learning" by Christopher Bishop • "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani.

Learning Outcome	Assessment Criteria
LO1. Understand the fundamentals of computer vision.	1.1: Explain the basic concepts of image processing. 1.2: Describe the process of feature extraction and representation.
LO2. Implement computer vision techniques.	2.1: Apply filtering techniques for image enhancement. 2.2: Implement edge detection algorithms to identify object boundaries.
LO3. Develop pattern recognition systems.	3.1: Utilize machine learning techniques for pattern recognition. 3.2: Evaluate the performance of pattern recognition systems.
LO4. Apply computer vision and pattern recognition to real-world problems.	4.1: Develop applications for face and object recognition. 4.2: Implement computer vision techniques in robotics and autonomous systems.

No	Learning Outcome / Topic	Learning and Teaching Activities	Which assessment criteria does the session relate to?	Day/month/year/ signature
1.	**Introduction to Computer Vision**	**Introduction to Computer Vision** - Definition, applications, and challenges	LO1: Fundamentals of Computer Vision	
2.	**Digital Image Fundamentals**	**Digital Image Fundamentals** - Pixels, color spaces (RGB, HSV, grayscale), resolution	LO1: Fundamentals of Computer Vision	
3.	**Image Acquisition & Representation**	**Image Acquisition & Representation** - Sensors, sampling, quantization, digital formats	LO1: Fundamentals of Computer Vision	
4.	**Basic Image Processing Operations**	**Basic Image Processing Operations** - Point operations, histograms, intensity transformations	LO1: Fundamentals of Computer Vision	
5.	**Spatial Domain Processing**	**Spatial Domain Processing** - Convolution, kernels, and image filtering basics	LO1: Fundamentals of Computer Vision	
6.	**Frequency Domain Processing**	**Frequency Domain Processing** - Fourier transform and its applications in CV	LO1: Fundamentals of Computer Vision	
7.	**Color Image Processing**	**Color Image Processing** - Color models, processing techniques, and applications	LO1: Fundamentals of Computer Vision	
8.	Half-Term Exam	- Review of LO1 topics: - Practice questions and mock assessment - **Half-term assessment** based on LO1 (theory)		

9.	**Image Preprocessing**	**Image Preprocessing** - Noise reduction, smoothing (Gaussian, median filters)	*LO2: Computer Vision Techniques Implementation*	
10.	**Image Enhancement Techniques**	**Image Enhancement Techniques** - Histogram equalization, contrast stretching	LO2: Computer Vision Techniques Implementation	
11.	**Edge Detection**	**Edge Detection Fundamentals** - Gradient operators (Sobel, Prewitt). **Advanced Edge Detection** - Canny edge detector, Laplacian of Gaussian	LO2: Computer Vision Techniques Implementation	
12.	**Corner & Feature Detection**	**Corner & Feature Detection** - Harris corner detector, Shi-Tomasi method	LO2: Computer Vision Techniques Implementation	
13.	**Scale-Invariant Feature Transform (SIFT) and Speeded Up Robust Features (SURF)**	**Scale-Invariant Feature Transform (SIFT)** - Keypoint detection and description. **Speeded Up Robust Features (SURF)** - Feature extraction and matching	LO2: Computer Vision Techniques Implementation	
14.	Final Exam Preparation & Review	- Comprehensive review of all learning outcomes - Practice questions and revision of key topics	LO1, LO2	
15.	Final Exam	- **Final-term assessment** covering all learning outcomes (theory and practical elements)	LO1, LO2	

16.	Feedback & Reflection	- Review of final exam - Individual feedback on performance - Reflective discussion on key learning points	LO1, LO2	
17.	**Introduction to Pattern Recognition**	**Introduction to Pattern Recognition** - Concepts, applications, and system design **Feature Extraction Methods** - HOG, LBP, Haar-like features **Dimensionality Reduction** - PCA, LDA for feature selection	LO3: Pattern Recognition Systems Development	
18.	**Supervised Learning for Pattern Recognition**	**Supervised Learning for Pattern Recognition** - k-NN, SVM classifiers	LO3: Pattern Recognition Systems Development	
19.	**Unsupervised Learning Approaches**	**Unsupervised Learning Approaches** - Clustering (k-means) for pattern discovery	LO3: Pattern Recognition Systems Development	
20.	**Deep Learning for Pattern Recognition**	**Deep Learning for Pattern Recognition** - CNNs for image classification	LO3: Pattern Recognition Systems Development	
21.	**Model Evaluation Metrics**	**Model Evaluation Metrics** - Precision, recall, F1-score, ROC curves	LO3: Pattern Recognition Systems Development	

22.	**Cross-validation Techniques**	**Cross-validation Techniques** - k-fold, stratified sampling methods	LO3: Pattern Recognition Systems Development	
23.	Half-Term Exam	**Capstone Project** - End-to-end CV application development (e.g., smart surveillance, medical image analysis)		
24.	**Face Detection & Recognition**	**Face Detection & Recognition** - Viola-Jones, Eigenfaces, DeepFace	LO4: Real-world Applications	
25.	**Object Detection**	**Object Detection** - R-CNN, YOLO, SSD architectures	LO4: Real-world Applications	
26.	**Optical Character Recognition (OCR)**	**Optical Character Recognition (OCR)** - Text detection and recognition	LO4: Real-world Applications	
27.	**Image Segmentation and 3D Vision & Stereo Imaging**	**Image Segmentation** - Thresholding, region-based, watershed algorithms. **3D Vision & Stereo Imaging** - Depth perception, point clouds	LO4: Real-world Applications	
28.	**Vision in Robotics and Autonomous Systems**	**Vision in Robotics** - SLAM, visual servoing applications. **Autonomous Systems** - Self-driving car vision systems	LO4: Real-world Applications	
29.	Final Exam Preparation & Review	LO1, LO2, LO3, LO4	LO1, LO2, LO3, LO4	
30.	Final Exam		LO1, LO2, LO3, LO4	