Module Title:	Computer Vision
Language of Instruction:	English

Credits:	5

NFQ Level:	8

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	This module will be delivered through a mix of lectures, laboratory assignments, and projects including a professional write-up. It will employ a mixture of active/task-based learning, reflective learning, and problem-based learning.

Module Aim:	Computer vision has become commonplace in applications ranging from search to medical application and self-driving cars. This module shall investigate how images are acquired and information extracted by the computer using classical algorithms. The module shall cover how computers represent objects and their alignment and allow students to locate and track feature movement between images.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Assemble an image acquisition system, demonstrating an understanding of its constituent components.
LO2	Design an image acquisition system to demonstrate an understanding of enhancement and pattern matching within images.
LO3	Demonstrate the use of algorithms to track feature movement and displacement between frames of images.
LO4	Collect depth information from multiple (stereo) images and track the location of the feature in the z-plane.
LO5	Complete a project as an individual or in a small group to design and implement a solution for a real world problem.

Pre-requisite learning	
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*	
No recommendations listed	
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*	
A high-level language, statistics, linear algebra.	

Module Content & Assessment

Indicative Content
Acquisition system Image acquisition system using COTS components. Camera, lenses and lens distortion, focal length, aperture, depth of field, exposure, shutter speed, frame rate affect on quality of the image acquisition. Improvements to image acquisition using passive and active lighting, flashes, radiometry.
Image Enhancement Introduction to image enhancement in both the spatial and frequency domains. Contrast enhancement and transformations. Histogram processing. Filtering.
Pattern matching Image convolution and feature detection, e.g. detection of edges and identifying features. Application of feature detectors and descriptors such as MOG, HOG, SIFT, SURF etc.
Feature movement Track the direction of feature movement using motion estimation, alignment, parametric and layered motion, etc.
Depth interpolation Extract depth information using, e.g. epipolar geometry techniques and show different styles of correspondence (dense, sparse) to interpret the depth of a set of images.
Ethics and Safety Ethical use and bias in captured data, reliable use of computer vision in safety systems

Assessment Breakdown	%
Continuous Assessment	20.00%
Project	40.00%
Practical	40.00%

Continuous Assessment				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Short Answer Questions	n/a	1,2	20.00	Week 4

Project				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Project	n/a	1,2,3,4,5	40.00	Sem 2 End

Practical				
Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	n/a	1,2,3,4	40.00	Every Week

No End of Module Formal Examination

ITCarlow reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	Every Week	2.00
Laboratory	Every Week	3.00
Independent Learning	Every Week	5.00
	Total Hours	10.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EERAS_B	Bachelor of Engineering (Honours) in Robotics and Automated Systems	7	Mandatory

Programme Code	Programme	Semester	Delivery