MODULE SPECIFICATION

Part 1: Information			
Module Title	Machine Vision		
Module Code	UFMFC9-15-3	Level	Level 6
For implementation from	2018-19		
UWE Credit Rating	15	ECTS Credit Rating	7.5
Faculty	Faculty of Environment & Technology	Field	Engineering, Design and Mathematics
Department	FET Dept of Engin Design & Mathematics		
Contributes towards			
Module type:	Standard		
Pre-requisites	None		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description

Overview: Vision is a powerful sense in humans; it allows us to make sense of, to navigate through and to interact with the world about us. In our everyday life, machine vision has already become well established in many areas ranging from manufacturing, to medicine, to security. Developments in machine vision also hold the key to allowing the realisation of future autonomous and smart devices, such as robots, to interact with us as humans, to understand and respond to our needs, i.e. human-computer interaction.

This module provides an introduction to the state of the art as well as exploring future directions in machine vision.

Educational Aims: The course content is both industry- and research-led and aims to provide students with skills that meet the needs of industry.

Outline Syllabus: Basic Concepts:
Machine vision, in the context of computer and human vision.

Machine vision applications: robot guidance, object recognition and tracking, image understanding, inspection (e.g. aircraft) and quality control, metrology, security (biometrics), medical applications.
The five stages of the machine vision process.
Hardware elements: lighting, camera, optical configuration, frames-store, resolution v field of view, monochrome v colour. Image acquisition and display: photosensitive devices, digitisation.
2D Image analysis

Binary images:
Feature extraction: segmentation (connectivity), region mensuration.
Erosion and dilation.
Skeletonization.

Grey level images:
Histogram analysis.
Image pre-processing: brightness/contrast enhancement, standard mappings: negation, thresholding, sharpening, smoothing.
Thresholding.
Convolution (edge detection).
Hough space domain transformations.
Feature extraction: area, perimeter, shape descriptions.

3D Image analysis:
Applications (particular emphasis on robotics).
Laser triangulation.
Stereo triangulation.
Projected patterns.
Photometric stereo.
Latest hybrid techniques.

Interfacing and data collection

Management appraisal: why vision, safety and reliability, quality, flexibility, economic justification.

Generating machine vision code.

Current research (e.g. surface inspection, 3D metrology, face / emotion recognition, etc).

Teaching and Learning Methods: Scheduled Learning.
This module will use lectures and practical tutorial classes, industrial visits, guest presentations, web based material, library based references, as well as laboratory demonstrations and supporting background hand-out literature and video material. It is expected that the student will carry out independent learning outside the formal
sessions.

Independent learning includes hours engaged with essential reading, case study preparation, assignment preparation and completion etc. The student is expected to spend about 114 hours outside of the scheduled time in these activities.

Contact : 36 hours
Self-directed learning : 42 hours
Hours Course work : 42 hours
Exam preparation : 30
Total hours : 150

Part 3: Assessment

Component A:
Assessed via an end of semester Exam in controlled conditions to assess the student's understanding of concepts and techniques.

Component B:
Assessed via an individual assignment for which the student submits a single report based on the eight activities undertaken during the tutorial sessions.

Second assessment opportunity:
Takes the form of exam and assignment. No further attendance at classes is required.

First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Report - Component B		50 %	Assignment
Examination - Component A	✓	50 %	Examination (3 hours)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Report - Component B		50 %	Assignment
Examination - Component A	✓	50 %	Examination (3 hours)

Part 4: Teaching and Learning Methods

Learning Outcomes

On successful completion of this module students will be able to:

	Module Learning Outcomes
MO1	Demonstrate knowledge and understanding of facts and theories from the current canon of machine vision
MO2	Show an understanding of the capabilities and limitations of the state-of-the-art and be aware of the current areas of research activity
MO3	Demonstrate the process of applying a range of algorithmic methods to provide imaging-based solutions to problems in differing domains
MO4	Show skills in analysing the requirements of an application task and in the selection of available technologies and techniques to meet users' needs
MO5	Demonstrate cognitive and intellectual skills in the evaluation of economic and wider societal benefits of new applications and an awareness of issues surrounding the introduction of new technology in its commercial, socio-economic and environmental context
MO6	Demonstrate management of information through finding, assessing and using technical literature and other information sources

<table>
<tr><td>Contact Hours</td><td>
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<tr><td colspan="2">Contact Hours</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Independent Study Hours:</td></tr>
<tr><td>Independent study/self-guided study</td><td>114</td></tr>
<tr><td>Total Independent Study Hours:</td><td>114</td></tr>
<tr><td colspan="2">Scheduled Learning and Teaching Hours:</td></tr>
<tr><td>Face-to-face learning</td><td>36</td></tr>
<tr><td>Total Scheduled Learning and Teaching Hours:</td><td>36</td></tr>
<tr><td>Hours to be allocated</td><td>150</td></tr>
<tr><td>Allocated Hours</td><td>150</td></tr>
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<tr><td>Reading List</td><td>The reading list for this module can be accessed via the following link:

https://uwe.rl.talis.com/modules/ufmfc9-15-3.html</td></tr>
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