MODULE SPECIFICATION

Part 1: Information			
Module Title	Introduction to Machine Vision		
Module Code	UFMFLQ-15-2	Level	Level 5
For implementation from	2019-20		
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		
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 will play a key role in 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: 1. 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.

2. Image formation:

Pinhole camera and Lenses

Different types of projection: Perspective, weak perspective and orthogonal

Focus, depth of field, field of view and lens flaw.

3. Binary images:

Feature extraction: segmentation (connectivity), region mensuration

Erosion and dilation

Skeletonization.

4. 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.

5. 3D Image analysis:

Applications (particular emphasis on robotics)

Laser triangulation

Stereo triangulation

Projected patterns

Photometric stereo

Latest hybrid techniques.

6. Machine vision in Robotics:

In agriculture, picking robot

In manufacture

Face / emotion recognition

Simultaneous localization and mapping (SLAM).

7. Management appraisal:

Why vision, safety and reliability, quality, flexibility, economic justification.

8. Generating machine vision code, e.g. Matlab, NI CVI or LabVIEW.

Teaching and Learning Methods: See Assessment Strategy.

Part 3: Assessment

Component A

Assessed via an end of semester Exam (3 hour) in controlled conditions to assess the student's understanding of concepts and techniques. The paper to be comprised both of questions with multiple short-answer sections as well as of longer case study type questions – the latter based around topical practice- and research-informed materials. Together these assess for recollection of key facts as well as breadth and depth of understanding via application of knowledge in machine vision system modelling, design and analysis. Students will be required to answer from a selection of questions.

Component B

Assessed via an individual assignment for which the student submits a single report covering both the structured activities undertaken during the tutorial sessions plus a project based learning style task, centred on a practice-led real-world case study problem.

Second assessment opportunity

Takes the form of exam and assignment. No further attendance at classes is required. While the exam is similar, the assignment uses an extended case study investigation to test the same learning outcomes without requiring use of the University computing facilities. Students are required to demonstrate the same level of understanding via application of knowledge in machine vision hardware, image processing and analysis techniques in solving real-word problems - detailing and justifying their reasoning, their choices and the operation of their algorithms, all within the context of their general approach to solving a project based case study problem.

First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Written Assignment - Component B		50 %	Assignment (up to 4000 words)
Examination - Component A	✓	50 %	Examination (3 hours)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Written Assignment - Component B		50 %	Assignment (up to 4000 words)
Examination - Component A	✓	50 %	Examination (3 hours)

Part 4: Teaching and Learning Methods

Learning Outcomes

On successful completion of this module students will achieve the following learning outcomes:

Module Learning Outcomes	Reference
Demonstrate knowledge and understanding of facts and theories from the current canon of machine vision	MO1
Show an understanding of the capabilities and limitations of the state of-the-art and be aware of the current areas of research activity	MO2
Demonstrate the process of applying a range of algorithmic methods to provide imaging-based solutions to problems in differing domains	MO3
Show skills in analysing the requirements of an application task (Assessed in A) and in the selection of available technologies and techniques to meet users' needs	MO4
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	MO5
Demonstrate management of information through finding, assessing and using technical literature and other information sources	MO6

Contact Hours

Independent Study Hours:	
Independent study/self-guided study	114
Total Independent Study Hours:	114
Scheduled Learning and Teaching Hours:	
Face-to-face learning	36
Total Scheduled Learning and Teaching Hours:	36
Hours to be allocated	150
Allocated Hours	150

Reading List

The reading list for this module can be accessed via the following link:

https://uwe.rl.talis.com/index.html

Part 5: Contributes Towards

This module contributes towards the following programmes of study: