MODULE SPECIFICATION

Part 1: Information			
Module Title	Machine Vision		
Module Code	UFMFRR-15-M	Level	Level 7
For implementation from	2020-21		
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: The definition and scope of what is meant by the term 'machine vision' is changing rapidly as, via increasing capabilities often enabled through innovation in machine learning, new and exciting contributions are being made in applications across a wide variety of disciplines - such as robot navigation, human-robot interaction, healthcare technologies and in precision agriculture. Given the ubiquity of camera equipped smartphones and the wide availability and variety of alternative imaging devices (e.g. thermal and RGB-D cameras), one should not be surprised to notice that machine vision technology is increasingly becoming a part of everyday life. Just as how a visual sense is important to human beings, it is arguably just as important to new forms of AI enabled systems. Therefore, the ability to "observe" the world with visual sensors, to "describe" the world from pictures or sequences of pictures, and to use this information to make useful decisions, is core to machine vision applications today.

This module provides an introduction to machine vision including the fundamentals of image formation and image processing as well as state-of-the-art feature extraction and image-based machine learning techniques. The course content is research-informed and practice-led, and as such, aims to provide students with the key skills that meet the needs of industry. The core syllabus is outlined below (note this is by no means an exhaustive list), where all elements are, where possible, supported using example case study materials drawn from current research and practical application.

Educational Aims: This module aims to introduce to students machine vision methods and their applications in differing domains including robot navigation, human-robot interaction and healthcare technologies. Students will be able to gain an understanding of the key issues of the state-of-the-art machine vision research as well as knowledge of designing and implementing machine vision solutions to real-world problems.

Outline Syllabus: Syllabus Outline
1. Basic concepts:
- What is machine vision/computer vision/robotic vision?
- Machine vision vs. human vision
- Machine vision applications across disciplines (e.g. healthcare, agriculture, security, robot navigation, etc.)
- Core stages of the machine vision process

2. Image formation and representation
- Camera model
- Hardware elements: lighting, camera, optical configuration, etc.
- Different types of projection
- Binary, greyscale and colour image representations

3. Basic image processing techniques
- Convolution
- Filtering
- Segmentation

4. Feature extraction
- Edges, corners and gradients
- Invariant features
- Feature detectors and descriptors

5. 3D imaging
- Applications
- Laser triangulation
- Stereo triangulation
- Structured light
- Photometric stereo

6. Machine learning (deep learning) in machine vision
- Machine learning models for image/video analysis (e.g. recognition/classification tasks)
- Data preparation and model validation

7. Generating machine vision code

Teaching and Learning Methods: Scheduled Learning includes lectures and laboratory sessions.

Independent learning includes hours engaged with essential reading, coding and testing, assignment completion and exam preparation, etc.

Part 3: Assessment
First Sit Component A Written Examination (50%): this is an end-of-semester Exam (2-hour) to assess student's understanding of machine vision concepts and techniques. Component B

Written Group Project Report (50%): this is approximately a 5000-word group report that proposes and evaluates machine vision solutions to a given real-world problem. A group mark will be awarded to each group by tutors based on the quality of the Group Project Report. To reflect individual contribution to the group-based activity, peer assessment will be used in line with the EDM group work policy.

Resit:

Component A
Written Examination (50%): this is a 2-hour Exam in controlled conditions to assess student's understanding of machine vision concepts and techniques.

Component B
Individual Project Report (50%): this is a 2000-word individual report that proposes and evaluates machine vision solutions to a given real-world problem.

No further attendance at lectures nor labs is required.

First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Examination (Online) - Component A		50 %	Online Written Examination (50%): this is an end-of-semester Exam (2-hour) in controlled conditions to assess student's understanding of machine vision concepts and techniques.
Report - Component B	✓	50 %	Written Group Project Report (50%): this is a 5000-word group report that proposes and evaluates machine vision solutions to a given real-world problem. A group mark will be awarded to each group by tutors based on the quality of the Group Project Report. To reflect individual contribution to the group-based activity, peer assessment will be used which may allocate a positive or a negative mark to each group member, in addition to the group mark one will receive.
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Examination (Online) - Component A		50 %	Online Written Examination (50%): this is a 2-hour Exam in controlled conditions to assess student's understanding of machine vision concepts and techniques.
Report - Component B	✓	50 %	Individual Project Report (50%): this is a 2000-word individual report that proposes and evaluates machine vision solutions to a given real-world problem.

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
Appraise use of machine vision systems in differing domains.	MO1
Interpret the current key research issues in machine vision.	MO2
Identify requirements of an application task; formulate and constrain a machine vision problem.	MO3
Design and implement machine vision solutions to real-world problems and evaluate algorithm performance.	MO4
Explain, compare and contrast machine vision techniques including image acquisition, feature extraction and machine learning.	MO5

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://rl.talis.com/3/uwe/lists/A1B547D8-85D2-BFCD-9029-443E63D59E22.html

Part 5: Contributes Towards

This module contributes towards the following programmes of study: