MODULE SPECIFICATION

Part 1: Information			
Module Title	Advanced Machine Vision		
Module Code	UFMFMQ-15-3	Level	Level 6
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	Introduction to Machine Vision 2019-20		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description
Overview: Recent advances in robotic systems have seen more effort being put in developing devices that are capable of interacting with the physical world. Thus, acquiring information by direct sensing of the environment in which these devices operate is fundamental. The engineering and technological uses of machine vision permit its adaptive capability to be included in a variety of machine designs, including robots and other mobile devices. Machine vision allows devices to close the loop by sensing visual information to understand, interpret and operate within their environment. **Educational Aims:** See Learning Outcomes. **Outline Syllabus:** 2D and 3D feature Extraction: Statistical features Geometric features Histogram based Model-based Feature tracking and correspondence mapping: SIFT(Scale Invariant Feature Transform), SURF(Speeded-Up Robust Features) Particle Filtering Motion-features based tracking

Machine Learning and its Application to Machine Vision:
Statistical Machine Learning (PDF and Likelihood models)
Classification and Clustering

Deep Learning Concepts:
CNN (Convolution Neural Network) and RNN (Recurrent Neural Network)
Reinforcement Learning
Actor-Critic Model (Feedback Models)

Teaching and Learning Methods: This module introduces state-of-the art computer vision and machine learning approaches and provides the platform required for the development of advanced robotics and vision systems. Building on introductory concepts of machine vision introduced in UFMFC9-15-3, this module delves into more complex image processing techniques mainly for scene understanding and interpretation and introduces concepts of deep learning.

Independent learning will constitute the remaining study time with an expectation that approximately 46 hours will be spent on self-directed study, a further 40 hours in support of the coursework and 16 hours in exam preparation.

Part 3: Assessment

Assessment strategy:
Students' achievements in the module will be assessed in two components both for the first sit and resit as follows.

Main assessment component (first sit)

Component A : Written Examination:
The examination will assess the every student's understanding and critical awareness of computer vision and machine learning concepts. They will need to be able to apply their understanding to real-life (case) scenarios. The written examination will be of 2 hours duration.

Component B: Group project
Component B will be assessed through a group project that will involve teams of students (ideally groups of 4 students) working on advanced machine vision methods for 2D and 3D scene analysis and understanding. Scenes will be generated using a simulation environment (such as gazebo).

The different elements contribute to Component B as follows:
Group presentation (25 %)
Demonstration of software prototype for scene analysis (25%)
Group Report (50%) of 4000 words.

Formative assessment will be provided as oral feedback throughout the laboratory sessions particularly with respect to the workshop exercises.

Resit assessment:
Component A will be a 2 hour written exam.
Component B will be coursework (individual) where students will be required to research and provide a detailed methodology of solving a real-world problem using machine vision (up to 2000 words).

First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Report - Component B		38 %	Group report (4000 words)
Practical Skills Assessment - Component B		18 %	Demonstration of software prototype for scene understanding

Presentation - Component B		19 %	Group presentation
Examination - Component A	✓	25 %	Written examination (2 hours)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Report - Component B		75 %	Individual research report (up to 2000 words) on a specialist machine vision application
Examination - Component A	✓	25 %	Written examination (2 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**
Develop and demonstrate a good understanding of 2D Imaging data and Data Capture Techniques	MO1
Understand and Implement feature extraction approaches for mapping and tracking	MO2
Demonstrate an understanding of object detection and identification approaches	MO3
Demonstrate understanding of machine learning approaches and their application to Computer Vision based solutions	MO4
Develop understanding of classification approaches (Image or Object)	MO5
Build and demonstrate an understanding to Deep Learning concepts and models	MO6
Demonstrate understanding and application of Deep Learning approaches to Vision Problems (Face recognition etc …)	MO7

Contact Hours

Independent Study Hours:	
Independent study/self-guided study	46
Total Independent Study Hours:	46
Placement Study Hours:	
Placement	56
Total Placement Study Hours:	56
Scheduled Learning and Teaching Hours:	
Face-to-face learning	48

	Total Scheduled Learning and Teaching Hours:	48
	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: