Module Specification

Advanced Machine Vision

Version: 2021-22, v1.0, 24 Jul 2019

Contents

Part 1: Information

Module title: Advanced Machine Vision

Module code: UFMFMQ-15-3

Level: Level 6

For implementation from: 2021-22

UWE credit rating: 15

ECTS credit rating: 7.5

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Delivery locations: Frenchay Campus

Field: Engineering, Design and Mathematics

Module type: Standard

Pre-requisites: Introduction to Machine Vision 2021-22

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body 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.

Features: Not applicable

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)

Part 3: Teaching and learning methods

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.

Module Learning outcomes:

MO1 Develop and demonstrate a good understanding of 2D Imaging data and Data Capture Techniques

MO2 Understand and Implement feature extraction approaches for mapping and tracking

MO3 Demonstrate an understanding of object detection and identification approaches

MO4 Demonstrate understanding of machine learning approaches and their application to Computer Vision based solutions

MO5 Develop understanding of classification approaches (Image or Object)

MO6 Build and demonstrate an understanding to Deep Learning concepts and models

MO7 Demonstrate understanding and application of Deep Learning approaches to Vision Problems (Face recognition etc …)

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 46 hours

Placement = 56 hours

Face-to-face learning = 48 hours

Total = 150

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/index.html

Part 4: Assessment

Assessment strategy: 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).

Assessment components:

Examination (Online) - Component A (First Sit)

Description: Online examination

Weighting: 25 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO4, MO5, MO6

Report - Component B (First Sit)

Description: Group report (4000 words)

Weighting: 38 %

Final assessment: No

Group work: Yes

Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6, MO7

Practical Skills Assessment - Component B (First Sit)

Description: Demonstration of software prototype for scene understanding

Weighting: 18 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6, MO7

Presentation - Component B (First Sit)

Description: Group presentation

Weighting: 19 %

Final assessment: No

Group work: Yes

Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6, MO7

Examination (Online) - Component A (Resit)

Description: Online examination

Weighting: 25 %

Final assessment: Yes

Group work: No

Learning outcomes tested:

Report - Component B (Resit)
Description: Individual research report (up to 2000 words) on a specialist machine vision application
Weighting: 75 %
Final assessment: No
Group work: No
Learning outcomes tested:

Part 5: Contributes towards

This module contributes towards the following programmes of study: