Module Specification

Machine Vision

Version: 2021-22, v3.0, 17 Feb 2022

Contents

Part 1: Information

Module title: Machine Vision

Module code: UFMFC9-15-3

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: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body 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.

Features: Not applicable

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).

Part 3: Teaching and learning methods

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

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

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 36 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/modules/ufmfc9-15-3.html

Part 4: Assessment

Assessment strategy: 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.

The GCET delivery of this exam is a 3 hour face-to-face/invigilated exam. It was agreed that GCET can deliver the exam in a different way to UWE for in-country reasons for 2021/22 and 2022/23 providing there is no change to the UWE assessment during this time.

Assessment components:

Examination (Online) - Component A (First Sit)
Description: Online Examination (3 HOURS)
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO4, MO5

Report - Component B (First Sit)
Description: Assignment
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO6

Examination (Online) - Component A (Resit)

Description: Online Examination (3 hours)
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested:

Report - Component B (Resit)
Description: Assignment
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested:

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Robotics [Sep][FT][Frenchay][3yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies (Manufacturing) [Sep][FT][Frenchay][4yrs] MEng 2019-20

Aerospace Engineering with Pilot Studies (Manufacturing) [Sep][FT][Frenchay][3yrs] BEng (Hons) 2019-20

Aerospace Engineering (Manufacturing) [Sep][FT][Frenchay][4yrs] MEng 2019-20

Aerospace Engineering (Manufacturing) [Sep][FT][Frenchay][3yrs] BEng (Hons) 2019-20

Automation and Robotics Engineering {Foundation} [Feb][FT][GCET][4yrs] BEng (Hons) 2018-19

Robotics {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2018-19

Robotics [Sep][SW][Frenchay][4yrs] BEng (Hons) 2018-19

Aerospace Engineering (Manufacturing) [Sep][SW][Frenchay][5yrs] MEng 2018-19

Automation and Robotics Engineering {Foundation} [Oct][FT][GCET][4yrs] BEng (Hons) 2018-19

Aerospace Engineering with Pilot Studies (Manufacturing) {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2018-19

Aerospace Engineering with Pilot Studies (Manufacturing) [Sep][SW][Frenchay][4yrs] BEng (Hons) 2018-19

Aerospace Engineering with Pilot Studies (Manufacturing) [Sep][SW][Frenchay][5yrs] MEng 2018-19

Aerospace Engineering (Manufacturing) [Sep][SW][Frenchay][4yrs] BEng (Hons) 2018-19

Aerospace Engineering (Manufacturing) {Apprenticeship-UCW} [Sep][FT][UCW][4yrs] BEng (Hons) 2018-19

Aerospace Engineering (Manufacturing) {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2018-19

Aerospace Engineering (Manufacturing) {Apprenticeship-UWE} [Sep][FT][UCW][4yrs] BEng (Hons) 2018-19

Aerospace Engineering [Sep][FT][Frenchay][3yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies [Sep][FT][Frenchay][3yrs] BEng (Hons) 2019-20

Aerospace Engineering with Pilot Studies [Sep][FT][Frenchay][4yrs] MEng 2019-20

Aerospace Engineering [Sep][FT][Frenchay][4yrs] MEng 2019-20

Aerospace Engineering with Pilot Studies [Sep][SW][Frenchay][5yrs] MEng 2018-19

Aerospace Engineering [Sep][SW][Frenchay][5yrs] MEng 2018-19

Aerospace Engineering with Pilot Studies [Sep][SW][Frenchay][4yrs] BEng (Hons) 2018-19

Aerospace Engineering with Pilot Studies {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2018-19

Aerospace Engineering [Sep][SW][Frenchay][4yrs] BEng (Hons) 2018-19

Aerospace Engineering {Foundation} [Sep][FT][Frenchay][4yrs] BEng (Hons) 2018-19

Aerospace Engineering with Pilot Studies {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2018-19

Aerospace Engineering {Foundation} [Sep][SW][Frenchay][5yrs] BEng (Hons) 2018-19