Module Specification

Machine Vision

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Part 1: Information

Module title: Machine Vision

Module code: UFMFRR-15-M

Level: Level 7

For implementation from: 2025-26

UWE credit rating: 15

ECTS credit rating: 7.5

College: College of Arts, Technology and Environment

School: CATE School of Engineering

Partner institutions: None

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body 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.

Features: Not applicable

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
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

Image formation and representation
- Camera model
- Hardware elements: lighting, camera, optical configuration, etc.

- Different types of projection
- Binary, greyscale and colour image representations

Basic image processing techniques
- Convolution
- Filtering
- Segmentation

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

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

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

Generating machine vision code

Part 3: Teaching and learning methods

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.

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

MO1 Identify requirements, constraints, and challenges of machine vision tasks.

MO2 Design and implement machine vision solutions to real-world problems and evaluate algorithm performance.

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 36 hours

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/F055A23B-67D7-1D89-CDD0-DADB26818463.html

Part 4: Assessment

Assessment strategy: This practice-led assessment is designed to reflect real-world applications, allowing students to develop their skills progressively rather than working under last-minute pressure. Through a collaborative Group Project, they address a machine vision problem, applying theoretical knowledge in a practical context. A peer assessment process ensures individual contributions are acknowledged.

Students build expertise through Learning Logs documenting key exercises, a Project Report detailing their solutions, and a Demonstration of their code and results to provide further evidence of meeting the expected learning outcomes. Weekly formative feedback supports continuous development, ensuring steady progress and deeper learning throughout the module.

In summary the portfolio submission for this module consists of the following items:
1. Group Project including data, methodology, results, and evaluation. Maximum Length: 2,500 words and 10 figures. Weighting: 50%
2. A Demonstration of code and visualisation of results of the developed machine vision solutions. Maximum Length: 8 minutes. Weighting: 20%
3. Learning Logs documenting tutorial exercises, including reflections on how they relate to the group project. These exercises are designed to equip you with the necessary skills and knowledge to successfully complete the Group Project. Maximum Length: 1,500 words and 10 figures. Weighting: 30%

The portfolio will be submitted by the end of the last module week. Formative feedback will be provided weekly to students during Group Tutorial sessions.

For the referral opportunity, the submission will be as follows:
1. Individual written report based on new machine vision task (1500 Words, 5 figures) (50%)
2. Learning log documenting a selection of tutorial exercise (800 words, 5 figures) (30%)
3. A pre-recorded video submission of code visualisation of results. Maximum length 8 minutes (20%)

Assessment tasks:

Portfolio (First Sit)
Description: Portfolio of learning log, group report and demo. of machine vision problem
Weighting: 100 %
Final assessment: Yes
Group work: Yes
Learning outcomes tested: MO1, MO2

Portfolio (Resit)
Description: Individual written report, learning log and video demo. of machine vision task

Weighting: 100 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Robotics {Joint Award}[Frenchay] MSc 2025-26

Robotics and Autonomous Systems {Joint Award}[Frenchay] PhD 2025-26

Robotics and Autonomous Systems {Joint Award}[Frenchay] PhD 2025-26