Module Specification

Advanced Artificial Intelligence

Version: 2028-29, v3.0, Approved

Contents

Part 1: Information

Module title: Advanced Artificial Intelligence

Module code: UFCFUR-15-3

Level: Level 6

For implementation from: 2028-29

UWE credit rating: 15

ECTS credit rating: 7.5

College: College of Arts, Technology and Environment

School: CATE School of Computing and Creative Technologies

Partner institutions: None

Field: Computer Science and Creative Technologies

Module type: Module

Pre-requisites: Machine Learning 2027-28

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module will introduce students to the latest thinking in addressing key concerns that frequently occur when creating Artificial Intelligence based solutions to real-world problems.

Features: Not applicable

Educational aims: This module aims at consolidating all knowledge on AI acquired during the previous two years of study. Emphasis will be on the assessment of the

most suitable technics and methodologies to be utilised in achieving appropriate applications that will provide effective and efficient solutions to complex problem situations. The selected methodologies will then be applied to demonstrate the accuracy of the assessment and design of the solutions and allow for further analysis and evaluation of the strengths of the tools utilised.

Outline syllabus: As befits a fast moving field, the syllabus will be adapted to reflect advances, but will typically cover topics such as:
Learning and Search in large, noisy, constrained, and non-stationary environments, for example some of
'Divide-and-conquer' approaches (including co-evolutionary)
Different Sources of uncertainty and how to deal with them
Advanced optimisation algorithms: Covariance Matrix Adaptation Evolution Strategy, Particle Swarm Optimisation, Differential Evolution
Multi- and Many objective optimisation,
Interactive AI: working with people
Automated Meta-parameter tuning in optimisation and Machine Learning (ML)
Learning with an absence of data/ costly evaluations, for example some of:
Active / Transfer Learning
Data augmentation for supervised ML: How does one choose valid transforms (e.g. reflection/rotation/translation of images, type of noise to add to sensor readings) and relate them to problem statement and requirements
Surrogate model-assisted optimisation & "Active" machine learning
Choosing what to evaluate (optimisation)/ ask user to label (ML)
How does one evaluate accuracy and robustness of solutions?
"one-shot" learning
e.g. exemplar SVMs, Control-Monitoring architectures,
Incorporating user constraints & preferences within interactive AI
Recommender systems (collaborative vs content based filtering, latent matrix factorisation etc)
Reinforcement learning in Deep Neural Networks
Adversarial networks/ generative systems

Part 3: Teaching and learning methods

Teaching and learning methods: Each topic will be introduced by lectures and guided reading, illustrated by examples of (i) how it occurs in a context familiar to students then (ii) expanded showing how we have tackled the issues in real-world collaborative research projects. Where appropriate this will be supplemented by talks from industry speakers.
Interwoven throughout each of these topics and their learning opportunities are three assumptions:
(i) Most real world systems will be hybrid in form, blending optimisation, machine learning and (possibly) symbolic reasoning (esp. wrt interactive AI).
(ii) Most domains require documentation of critically informed design decisions and algorithm selection based on relating strengths/weaknesses of different approaches to problem characteristics.
(iii) All real-world applications of AI require the designer to be fully aware of ethical and security implications, and to be able to document their risk analysis and use of appropriate mitigating strategies.

A series of tutorial/lab tasks will provide students with the opportunity to work in groups, designing, implementing evaluating, and documenting solutions to complex problems. These will also form the basis of the module assessment

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

MO1 Critically appraise competing AI-based paradigms and algorithms in the context of the issues posed by particular problems.

MO2 Synthesise, design, and implement appropriate modern AI algorithms to realistic-sized problems illustrating properties such as scale, noise, and missing data.

MO3 Demonstrate skills in evaluating systems and presenting findings in ways appropriate to different audiences.

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/B709C1BD-E8A1-A661-10D1-2218EB69B3E9.html?lang=en-GB&login=1

Part 4: Assessment

Assessment strategy: Students will design, implement and document an AI-based solution to a complex task with 'difficult' characteristics such as time complexity, limited data, or uncertainty in one or more forms.

Assessment will consist of a portfolio containing a demo and a report with github submission , the sum of which will demonstrate the development and communication of one or more AI-based solutions to complex problem(s). The problem(s) chosen will exhibit 'difficult' (from an AI-perspective) characteristics.
The portfolio will include a critical review of:
Challenges presented by the problem characteristics,
Candidate approaches considered,
The design and implementation of the chosen (possibly hybrid) system,
The choice of metrics used to evaluate the proposed solution,
The performance of their chosen system.

The resit will take the same form as the first sit assignment.

Assessment tasks:

Portfolio (First Sit)
Description: Portfolio (demo (20 minutes) and report (1000 words) with github submission)
Weighting: 100 %
Final assessment: Yes

Group work: No
Learning outcomes tested: MO1, MO2, MO3

Portfolio (Resit)
Description: Portfolio (demo (20 minutes) and report (1000 words) with github submission)
Weighting: 100 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Computer Science {Foundation} [Frenchay] BSc (Hons) 2024-25

Computer Science {Foundation} [Frenchay] BSc (Hons) 2024-25

Computer Science [Frenchay] BSc (Hons) 2025-26

Computer Science {Foundation} [Frenchay] BSc (Hons) 2025-26

Computer Science [Frenchay] BSc (Hons) 2026-27

Computer Science {Dual} [Taylors] BSc (Hons) 2026-27

Computer Science {Dual} [Taylors] BSc (Hons) 2026-27

Computer Science [Villa] BSc (Hons) 2026-27

Computer Science [Phenikaa] BSc (Hons) 2026-27

Computer Science [Frenchay] BSc (Hons) 2026-27

Computer Science {Foundation} [Frenchay] BSc (Hons) 2025-26

Computer Science [Villa] BSc (Hons) 2026-27

Computer Science [Phenikaa] BSc (Hons) 2026-27

Computer Science {with International Year One} [UWEBIC] BSc (Hons) 2026-27