MODULE SPECIFICATION

Part 1: Information			
Module Title	Advanced Artificial Intelligence		
Module Code	UFCFUR-15-3	Level	Level 6
For implementation from	2022-23		
UWE Credit Rating	15	ECTS Credit Rating	7.5
Faculty	Faculty of Environment & Technology	Field	
Department	FET Dept of Computer Sci & Creative Tech		
Contributes towards	Computer Science BSc (Hons) 2020-21 Computer Science {Foundation} BSc (Hons) 2020-21		
Module type:	Standard		
Pre-requisites	Artificial Intelligence II 2021-22, Machine Learning 2021-22		
Excluded Combinations	None		
Co- requisites	None		
Module Entry requirements	None		

Part 2: Description

This module will introduce you to the latest thinking in addressing key concerns that frequently occur when creating AI-based solutions to real-world problems.

Educational Aims: This module aims at consolidating all knowledge on Artificial Intelligence 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: CMA-ES, PSO, DE
Multi- and Many objective optimisation,
Interactive AI: working with people
Automated Meta-parameter tuning in optimisation and ML

Learning with an absence of data/ costly evaluations, for example some of:

Active / Transfer Learning
Data augmentation for supervised ML: How do you choose valid transforms (e.g. reflection/rotation/translatation 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 do you 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

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

Part 3: Assessment

Students will work in small groups to 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.
Each group will be assigned a tutor 'mentor' who they can request to attend project meetings to provide formative feedback and agree their strategy for allocating marks amongst the group.

Assessment will have two components:
A: In controlled conditions in a lab, the group will present and be questioned on:
- a short video describing the project at a level suitable for a non-technical audience (e.g. management).
- a demonstration of the software solution produced.

B: Online submission of a written document of less than 2500 words, suitable for a more technical audience. This should critically review:

- 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.

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The resit will take a similar form to the group work assignment, appropriately reduced in scale and complexity for an individual project. It will also be assessed via a video, a lab-based software demonstration, and a written report.

First Sit Components	**Final Assessment**	**Element weighting**	**Description**
Group work - Component B	✓	40 %	Technical documentation and critically review of the developed solution in component A. (Groupwork)
Group work - Component A		40 %	Demonstration of implemented AI-based solution to complex problems exhibiting various 'difficult' characteristics. (Groupwork)
Group work - Component A		20 %	Presentation of 'Executive Summary' video (Groupwork)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Project - Component B	✓	40 %	Technical documentation and critically review of the developed solution in component A.
Project - Component A		20 %	Presentation of an 'executive summary' video.
Project - Component A		40 %	Demonstration of implemented AI-based solution to complex problems exhibiting various 'difficult' characteristics.

Part 4: Teaching and Learning Methods

Learning Outcomes

On successful completion of this module students will be able to:

	Module Learning Outcomes
MO1	Critically appraise competing AI-based paradigms and algorithms in the context of the issues posed by particular problems (Assessed in Component B)
MO2	Select and tune appropriate state of the art machine learning and optimisation algorithms to realistic sized problems illustrating properties such as scale, noise, missing data. (Assessed in Component B).
MO3	Synthesise, design, and implement appropriate hybrid systems blending different paradigms for complex problems. (Assessed in Components A and B)
MO4	Demonstrate skills in evaluating systems and presenting findings in ways appropriate to different audiences. (Assessed in Components A and B).

Contact Hours

Contact Hours
Independent Study Hours:

	Independent study/self-guided study	114
	Total Independent Study Hours:	114
	Scheduled Learning and Teaching Hours:	
	Face-to-face learning	36
	Total Scheduled Learning and Teaching Hours:	36
	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/lists/274A371A-686E-B1A0-0D67-172619FBD2A6.html	