UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	AI and Distributed Computing
Module Code	ELE7038-B
Academic Year	2022/3
Credits	20
School	Department of Biomedical and Electronics Engineering
FHEQ Level	FHEQ Level 7

Contact Hours	
Type	Hours
Laboratories	20
Lectures	20
Directed Study	160

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 2

Module Aims

Artificial Intelligence and Distributed Computing are envisaged to be the two key technologies for the development of future satellite systems. This module aims to provide students with knowledge of these two important technologies and how they can be combined to create distributed artificial intelligence and be applied to satellite systems, whether it is for analyzing satellite data or for intelligent satellite systems design.

Students will learn to use different software including Python-based platforms for machine learning and distributed computing such as TensorFlow, Weka, Matlab and Ray to develop applications for engineering or computer systems or to analyse engineering or scientific data.

Outline Syllabus

- AI techniques such as case-based reasoning, rule-based systems, artificial neural networks, genetic algorithms, fuzzy models, multi-agent systems, swarm intelligence, reinforcement learning and hybrid systems.
- ML algorithms including supervised and unsupervised learning, deep learning, shallow learning, reinforcement learning.
- Distributed computing including client and server model, distributed transaction processing, distributed computing vs parallel computing.
- AI and Distributed Computing software platforms including TensorFlow, Weka, Ray, Matlab and related programming languages including Python.
- Applications of AI and distributed computing to satellite systems, applications and data.

Learning Outcomes	
Outcome Number	Description
LO1	Critically evaluate and apply a range of state-of-the-art principles, concepts, methods, tools and technologies in Artificial Intelligence, Machine Learning and Distributed Computiong, and their pros and cons.
LO2	Apply ML and DC in engineering and technical problems.
LO3	Apply ML and DC techniques and tools to resolve engineering and computational challenges, which underpin the understanding and applications of these technologies in engineering or computer systems.
LO4	Apply the main algorithms of ML and the use of AI and DC software platforms such as TensorFlow, Weka, Ray; design, implement and test ML algorithms in a distributed environment for engineering and scientific applications or data.
LO5	Critically analyse the role of AI or AI based products and services as an essential component in the critical infrastructures of our society considering the ethics, threats and vulnerabilities of AI and the importance of responsible use of AI.

Learning, Teaching and Assessment Strategy

Learning and teaching will be directed, supported, and reinforced through a combination of face-to-face or online lectures and laboratories, as well as through directed and self-directed study supported by learning materials available in CANVAS. Face-to-face or online drop-in sessions will be scheduled to assist students who require extra support.

The module will be delivered and assessed over four consecutive weeks, with lectures and laboratories delivered spreading over the first 3 weeks and the fourth week dedicated for completing the project report for the coursework. Extra tutorials or laboratory sessions can be arranged upon request by students to ensure that every student understands the theory and knows how to use the software tools.

Lectures and laboratories will be recorded live to cater for students who may not be able to attend face-to-face lectures due to extenuation circumstances. In the event of face-to-face delivery not being possible, recorded synchronous online or pre-recorded lectures and laboratories will be delivered and uploaded to CANVAS to enable students watch the presentations, videos at their own time.

Formal lectures will focus on the theoretical aspects and applications of AI/ML and distributed computing. Laboratories, some of which will be assessed, will consolidate the theory with practical implementations using suitable software platforms. Through laboratory sessions, students will learn to programme in Python, in Matlab and will familiarise themselves with using different software tools such as TensorFlow and Ray to complete different tasks involving the design and implementation of AI and distributed computing algorithms.

Assessment will be a combination of a portfolio laboratory work (LOs 1&2) and a project report for a courework (LOs 3&4) which critically assess students understanding of LOs. The laboratory work will assess students ability to apply the skills and knowledge they have learnt to solve specific tasks in relation to the design and implementation of distributed AI algorithms using appropriate software platforms. Students will then curate these problem solving skills in the laboratory report. Coursework develop students independent learning skills and apply AI plus distributed computing techniques to satellite systems. Activities in the coursework could be the design of a distributed AI algorithms for satellite system design based on a set of system requirements or can be a project to analyse satellite data using distributed learning techniques. Students will exercise project management, research and problem solving skills. Both laboratory report and project report contribute 50% towards the module grade. Appropriate feedback, formative and summative, will be given to the assessment.

Mode of Assessment			
Type	Method	Description	Weighting
Summative	Laboratory Report	Individual formal laboratory activities portfolio, comprised of a discussion of objectives, procedures, and results.	50%
Summative	Coursework - Written	Project report (min. 2000 words) detailing analysis of practical research carried out in coursework & reflection on it.	50%

Reading List
To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html

Please note:
This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.

---

https://bradford.ac.uk