Module Specification

Machine Learning

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Part 1: Information

Module title: Machine Learning

Module code: UFCFAS-15-2

Level: Level 5

For implementation from: 2021-22

UWE credit rating: 15

ECTS credit rating: 7.5

Faculty: Faculty of Environment & Technology

Department: FET Dept of Computer Sci & Creative Tech

Partner institutions: None

Delivery locations: Frenchay Campus

Field: Computer Science and Creative Technologies

Module type: Standard

Pre-requisites: Artificial Intelligence I 2020-21

Excluded combinations: None

Co-requisites: Artificial Intelligence II 2021-22

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module will introduce students to a range of contemporary machine learning techniques, their principles, characteristics and applications to real-world problems, and how to select, apply and evaluate solutions based on these techniques using the state-of-the-art software tools.

Features: Not applicable

Educational aims: The module places an emphasis on the practical applications of Machine Learning techniques to real-world problems, enabling students to gain hands-on experience in developing machine learning solutions to real-world problems.

Outline syllabus: Introduction
Overview of supervised learning, a range of contemporary machine learning techniques; Example applications for such techniques (e.g. NLP, computer vision, text mining); Potential wider societal and ethical implications will be highlighted.

Key technical issues in using ML techniques to solve real-world problems
Training and testing – stopping, imbalance, missing variables, bias and variances in data sets, features, pre-processing, etc. i.e. the realities of handling data
Formulating application problems, involving various types of data and problems with implications of algorithm choices, e.g. text, images, generating different types of learned models, e.g. classification vs regression

Kernel methods
What are kernel methods? Why do we need them?
Support Vector Machines (SVMs) – a high-level overview of SVMs
What is Support Vector Machine? How does it work? How to implement it? How to tune parameters of SVM?
Applications of kernel methods, e.g. classification and regression

Ensembles: bagging/boosting. Random forests
What are ensemble methods? Why do we need them?
What is bagging/boosting? How does it work? How to implement it?
What are random forests? How do they work? How to implement them?

Convolutional Neural Networks (CNNs)
What are CNNs? Why do we need them? How does a CNN work (convolution, ReLu, pooling, finding optimal weights (e.g. backpropagation), hyperparameters)? How to implement it?
Deep learning tricks: Concepts of overfitting and regularization, data augmentation,

dropout, early stopping
Applications of CNNs, image classification, NLP (e.g. text classification).

Part 3: Teaching and learning methods

Teaching and learning methods: Lectures will introduce the core concepts and algorithmic essences of each topic listed in the syllabus. Each topic will be explained and illustrated with intuitive examples, expanded with developing the practical solutions to the real-world problems.

Practical classes will provide supervised activities to cover different problem domains, with an emphasis on developing students' hands-on experience in solving real-world problems using contemporary machine learning techniques.

Scheduled teaching and learning study hours include lectures , practical classes/tutorials/project supervision/software demonstration.

Independent learning study hours include engaged with essential and exploratory reading, practical study, assignment preparation and completion etc.

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

MO1 Compare and contrast the basic principles and characteristics of a range of contemporary machine Learning algorithms (Assessed in component A)

MO2 Select and apply machine learning algorithms to formulate solutions to different types of machine learning problems, taking into account criteria such data availability and characteristics, and problem-specific requirements for balancing speed, accuracy, and explainability (assessed in component B)

MO3 Implement and evaluate contemporary machine learning solutions to application problems using a range of contemporary frameworks. (assessed in component B)

MO4 Demonstrate an awareness of the ethical and societal implications of machine learning solutions (assessed in component A)

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://rl.talis.com/3/uwe/lists/55D39B92-5B06-F6D5-2EAB-3EFA8F509B6D.html

Part 4: Assessment

Assessment strategy: A series of lab-based practical exercises with one-to-one demonstrations to tutors will provide rich opportunities for formative feedback.

The summative assessment will consist of:

A group project creating and evaluating a machine learning solution to a realistic problem. Assessment of this will be an online assignment submission of up to 5,000 words, describing problem identification, analysis and formulation, algorithm selection and application, software implementation including testing and evaluation, and documentation of the project . The group of students will also demonstrate the project during class time which will provide the opportunity for more detailed questioning about the implemented solution, and the contribution of group members.

An individual assignment consisting of a number of tasks to be completed consecutively over a period of four weeks during the term.

The resit will comprise of an individual assignment and an individual piece of coursework requiring the production of software and a written report. The resit

individual assignment will take the same form. The resit coursework will take a similar form to the group work assignment, appropriately reduced in scale and complexity.

Assessment components:

Set Exercise - Component A (First Sit)
Description: An individual assignment consisting of a number of tasks to be completed consecutively over a period of four weeks during the term.
Weighting: 30 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO4

Group work - Component B (First Sit)
Description: Group project
Weighting: 70 %
Final assessment: No
Group work: Yes
Learning outcomes tested: MO2, MO3, MO4

Set Exercise - Component A (Resit)
Description: Same as per main sit
Weighting: 30 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO4

Project - Component B (Resit)
Description: An individual piece of coursework requiring the production of software and a written report. The resit coursework will take a similar form to the group work assignment, appropriately reduced in scale and complexity.
Weighting: 70 %
Final assessment: No

Group work: No

Learning outcomes tested: MO2, MO3, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Computer Science [Sep][FT][Frenchay][3yrs] BSc (Hons) 2020-21

Computer Science [Sep][SW][Frenchay][4yrs] BSc (Hons) 2020-21