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Module specification

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Module Code	CONL708
Module Title	Machine Learning
Level	7
Credit value	15
Faculty	FACE
HECoS Code	100992
Cost Code	GACP

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
MSc Computer Science with Artificial Intelligence	Core
MSc Computer Science with Big Data Analytics	Core
MSc Computer Science	Core
MSc Computer Science with Cyber Security	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	15 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	0 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	**15** hrs
Placement / work based learning	0 hrs
Guided independent study	135 hrs
Module duration (total hours)	150 hrs

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Initial approval date	04/09/2019
With effect from date	01/01/2020
Date and details of revision	27/06/2024 - Programme revalidation
Version number	2

Module aims

This module aims to provide students with a broad understanding of machine learning techniques, key concepts, and methodology, as well as their applications to real-world problems. The following topics are covered in this module: fundamental concepts in machine learning, curve fitting, lazy learning methods, artificial neural networks, linear models and kernel methods, ensemble methods and dimension reduction. Without disregarding the theoretical foundations of the above techniques, the mathematics behind the machine learning techniques is not emphasized. Instead, students will get hands-on experience on how to use the learned techniques to solve real-world engineering and business case studies. By the end of the course, students will be able to link real-world problems to machine learning techniques, suggest the most suitable machine learning method, apply it using a software package and evaluate its performance.

Module Learning Outcomes - at the end of this module, students will be able to:

1	Systematically identify and delineate problems that can be effectively addressed using machine learning methods.
2	Attain a profound comprehension of Diverse Machine Learning Techniques and Their Distinctive Attributes.
3	Acquire an in-depth proficiency in the terminologies prevalent in Machine Learning and Data Science.
4	Apply machine learning methods using software packages, including the ability to understand, modify, and improve existing machine learning programs developed by third parties.
5	Critically evaluate and compare different machine learning methods for specific problems experimentally.
6	Display the results of machine learning methods clearly and effectively. Propose and justify appropriate improvements to methods based on experimental outcomes and critical evaluations, showing self-direction and originality in tackling and solving problems related to machine learning applications.

Assessment

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Indicative Assessment Tasks:

The assessments will be in the form of two portfolio tasks, the first will include the analysis of a dataset while the second will be machine learning techniques to apply to it.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1, 2, 3	Portfolio	40%
2	4, 5, 6	Portfolio	60%

Derogations

None

Learning and Teaching Strategies

The overall learning and teaching strategy is one of guided independent study requiring ongoing student engagement. Online material will provide the foundation of the learning resources, requiring the students to log in and engage regularly throughout the eight weeks of the module. There will be a mix of suggested readings, discussions and interactive content containing embedded digital media and self-checks for students to complete as they work through the material and undertake the assessment tasks. A range of digital tools via the virtual learning environment and additional sources of reading will also be utilised to accommodate learning styles. There is access to a helpline for additional support and chat facilities through Canvas for messaging and responding.

Indicative Syllabus Outline

- Introduction to Machine Learning
- Supervised Learning, Classification and Classification Algorithms
- Python practice, Regression techniques in supervised learning
- Python practice, Unsupervised Learning, Clustering and Clustering Algorithms
- Applying Reinforcement Learning
- Applying Neural Networks for Machine Learning
- Machine Learning Implementation

Indicative Bibliography:

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads

E. Alpaydin, *Introduction to Machine Learning*, 4th ed. Cambridge, MA: The MIT Press, 2020.

Other indicative reading

W. Lee, Python Machine Learning, Hoboken, NJ: Wiley, 2019.

N. Ceder, *The Quick Python Book*, 3rd ed. Shelter Island; NY: Manning Publications, 2018.

M. Lutz, *Learning Python,* 5th ed. Sebastopol, CA: O'Reilly Media, 2013.