LEAD: Data Science and Machine Learning 2

Module Title:	Data Science and Machine Learning 2
Language of Instruction:	English

Credits:	5

NFQ Level:	8

Module Delivered In	1 programme(s)

Teaching & Learning Strategies:	There will be 4 hours for practical work and lectures. The practical sessions will provide students with the immediate opportunity to implement and reinforce the material presented in the lectures. Formal lectures, group-based activities, class discussion, case studies and laboratory sessions may be used in the presentation of this module. Typically, the lectures will be short (20-30 minute lectures) with the practical sessions providing students with the immediate opportunity to implement and reinforce the material presented in the short lectures. Lectures - communication of knowledge and ideas from the lecturer to the student. Students will be encouraged to engage in active discussion of material during lectures. Computer Laboratories – instruction classes will typically take place in computer lab. Problem Solving Exercises – students will work as individuals and as part of a team to develop solutions to data science problems using software engineering. Students will be working in a small team on an assigned case study or project. E-Learning – This module may be supported with on-line learning materials (Blackboard). Independent Learning – the emphasis on self-directed independent learning is intended to develop strong and autonomous work and learning practices.

Module Aim:	The aim of this module is to provide students with a comprehensive understanding of and ability to evaluate and utilise data science, AI and machine learning tools and techniques ethically and legally in organisations from a software engineering perspective.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Understand, evaluate, communicate and apply key principles, theories and techniques with respect to data science and machine learning in organisations from a software engineering perspective.
LO2	Understand, evaluate, communicate and apply key principles, theories and techniques (particularly software engineering technologies) with respect to advanced machine learning and deep learning in organisations from a software engineering perspective.
LO3	Understand, evaluate and communicate the key principles, theories and techniques behind ethics, data and legal standards as they relate to data science, machine learnig and deep learning from a software engineering perspective.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is recommended before enrolment in this module.*
No recommendations listed
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.*
No requirements listed

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Module Content & Assessment

Indicative Content
AI, ML, D 1. What are artificial intelligence (AI), machine learning (ML), deep learning (DL) 2. Representations and software tools, techniques and technologies and representations used in machine learning and deep learning 3. Introduction to supervised, unsupervised, semi-supervised, reinforcement learning etc.
Unsupervised Machine Learning 1, Unsupervised machine learning including clustering - k-means, k-medoids, fuzzy c-means, agglomerative and divisive hierarchical clustering etc.
Supervised Machine Learning 1. Supervised machine learning to include, for example, support vector machines, naïve Bayesian classifiers, k-nearest neighbour and introduction to neural networks etc.
Deep Learning 1. Neural networks - back-propagation, gradient descent standard feed forward neural networks, recurrent neural networks, convolutional neural networks etc. 2. Deep learning application areas - natural language processing, image processing, spam detection etc. 3. Deep learning architectures etc.
Reinforcement Learning and Emerging AI/ML techniques 1. Reinforcement Learning, Q learning, State–action–reward–state–action (SARSA), Monte Carlo methods, DQN etc 2. Emerging machine learning, deep learning tools and techniques

Assessment Breakdown	%
Project	60.00%
End of Module Formal Examination	40.00%

No Continuous Assessment

Project

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Project	Practical programming project - the purpose of this applied project is to allow the learner, for example, to follow the data science process and prepare data so that statistical/ML techniques can be applied to the data to gain insights. This project may/may not have a significant group aspect at the discretion of the module lecturer and will typically involve a significant applied/programming component	1,2,3	60.00	Week 12

No Practical

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	Final written en of module examination	1,2,3	40.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

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Module Workload

Workload: Full Time		
Workload Type	*Frequency*	*Average Weekly Learner Workload*
Lecture	12 Weeks per Stage	2.00
Estimated Learner Hours	15 Weeks per Stage	5.13
Laboratory	12 Weeks per Stage	2.00
	Total Hours	125.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_KCSOF_B	Bachelor of Science (Honours) in Software Development	8	Mandatory