ELEC C4602: Artificial Intelligence and Machine Learning

Module Title:	Artificial Intelligence and Machine Learning
Language of Instruction:	English

Credits:	5

NFQ Level:	8

Module Delivered In	2 programme(s)

Teaching & Learning Strategies:	This module will be delivered through a mix of lectures, laboratory assignments, and projects including a professional write-up. It will employ a mixture of active/task-based learning, reflective learning, and problem-based learning.

Module Aim:	AI and ML techniques are not new, however, due to the internet's ubiquitous availability of data and compute to train ML networks, their performance has, for example, surpassed that of human visual recognition. This module investigates methods of design, training, and validation of classification neural network models to provide the student with a demonstratable understanding of machine learning's underlying scientific principles.

Learning Outcomes	
On successful completion of this module the learner should be able to:	
LO1	Demonstrate the differences between artificial intelligence, machine learning and deep learning systems.
LO2	Compose, assemble, clean, and pre-process training data.
LO3	Train image recognition deep learning models.
LO4	Develop and solve computer vision problems with appropriate models.
LO5	Design the components of an image acquisition system.

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.*
A high-level language, statistics, linear algebra.

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Module Content & Assessment

Indicative Content
Artificial Intelligence Define AI from narrow to broad to general to super-general artificial intelligence. Give examples of different types and fields of AI, such as text and speech recognition, natural language processing, search and recommendation algorithms, vision detection and recognition.
Neural Networks Fully connected networks, representation learning models, and convolution neural networks. Different machine learning (ML) models such as LeNet, AlexNet, VGG, Inception, ResNet, Xception, U-net, Fully Convolutional, Attention.
Machine Learning Supervised, unsupervised, semi-supervised learning, reinforcement learning, and their applications. Linear regression, logistic regression, Support Vector Machines, natural language processing.
Data cleaning and pre-processing Training data analysis and modelling.
Training Different training techniques for models, e.g. optimisation, regularisation, batch normalisation, and dropout
Metrics Confusion matrices, area under the curve (AUC), receiver operator characteristics (ROC), classification accuracy.
Ethics Data privacy, algorithm and data bias, model misuse.

Assessment Breakdown	%
Continuous Assessment	20.00%
Practical	20.00%
End of Module Formal Examination	60.00%

Continuous Assessment

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Short Answer Questions	n/a	1,2,3	20.00	Week 4

No Project

Practical

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Practical/Skills Evaluation	n/a	1,2,3,4,5	20.00	Every Week

End of Module Formal Examination

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Formal Exam	n/a	1,2,3,4,5	60.00	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	Every Week	3.00
Laboratory	Every Week	2.00
Independent Learning	Every Week	6.00
	Total Hours	11.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_EESYS_B	Bachelor of Engineering (Honours) in Electronic Engineering	7	Mandatory
CW_EEROB_B	Bachelor of Engineering (Honours) in Robotics and Automated Systems	7	Mandatory