Module Code:	CONL708

Module Title:	Machine Learning

Level:	7	**Credit Value:**	15

Cost Centre(s):	GACP	JACS3 **code**: HECoS code:	I460 100992

Faculty:	FAST	**Module Leader:**	Bo Liu

Scheduled learning and teaching hours	15 hrs
Guided independent study	135 hrs
Placement	0 hrs
Module duration (total hours)	150 hrs

Programme(s) in which to be offered (not including exit awards)	Core	Option
MSc Computer Science (online)	✓	☐
MSc Computer Science with Big Data Analytics	✓	☐
MSc Computer Science with Cyber Security	✓	☐

Pre-requisites
Studied CONL701 Critical Research for Postgraduate Study

Module Aims
This module aims to provide students with a broad understanding of machine learning techniques, the 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.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Identify problems that can be solved using machine learning methods.	KS3	KS4
2	Understand the characteristics of various machine learning methods and make informed decisions regarding what machine learning method(s) should be applied theoretically to a given problem.	KS1	KS3
		KS5	KS10
3	Accurately understand the terminologies widely used in machine learning and data science and apply them in practice.	KS1	KS4
4	Apply machine learning methods using a software package, including understand and revise existing machine learning programs from a third party.	KS3	KS4
		KS5	KS6
		KS10	
5	Evaluate and compare different machine learning methods for a given problem experimentally and select the appropriate methods(s) considering various assessment criteria.	KS1	KS3
		KS5	KS6
		KS10	
6	Display the results of machine learning methods and propose appropriate improvements to methods.	KS1	KS3
		KS5	KS6
		KS10	

Transferable skills and other attributes
Communication and leadership Time management Problem-solving Data analysis Commercial awareness

Derogations
None

Assessment:
Indicative Assessment Tasks:
The assessment tasks include a coursework (week 6) and a project (week 8). The coursework focuses on fundamental concepts and basic methodologies as well as the appropriate use of them. The project is based on a real-world case study, and the students will be asked to make use of the learned knowledge, compare the results of different approaches and communicate the result with the end user via a concise and understandable report.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration or Word count (or equivalent if appropriate)
1	1,2,3	Coursework	25%	1,000 (equiv)
2	4,5,6	Project	75%	2,000 (equiv)

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 login and engage on a regular basis throughout the eight-week period 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. The use of a range digital tools via the virtual learning environment together with 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.

Syllabus outline:
Fundamental concepts in machine learning Mathematics fundamentals Curve fitting K-nearest neighbour Naive Bayes rules Artificial neural networks Support vector machines Gaussian process Ensemble methods Dimension reduction
Indicative Bibliography:
Essential reading
Alpaydin, E. (2014). *Introduction to machine learning.* 3rd ed. MIT press.
Other indicative reading
Bell J. (2015) *Machine Learning: Hands on for Developers and Technical Professionals.* John Wiley & Sons Press Burkov A. (2019) *The Hundred-page Machine Learning Book.* Self-published.