

MODULE TITLE	Learning from Data		CREDIT VALUE	15
MODULE CODE	ECMM445		MODULE CONVENER	Dr Edward Chuah (Coordinator)
DURATION: TERM	1	2	3	
DURATION: WEEKS	11	0	0	
Number of Students Taking Module (anticipated)	30			

DESCRIPTION - summary of the module content

Artificially intelligent machines and software must assimilate data from their environment and make decisions based upon it. Likewise, we live in a data-rich society and must be able to make sense of complex datasets. This module will introduce you to machine learning methods for learning from data. You will learn about the principal learning paradigms from a theoretical point of view and gain practical experience through a series of workshops. Throughout the module, there will be an emphasis on dealing with real data, and you will use, modify and write software to implement learning algorithms. It is often useful to be able to visualise data and you will gain experience of methods of reducing the dimension of large datasets to facilitate visualisation and understanding. The module will also cover some recent neural network architectures and related learning algorithms.

AIMS - intentions of the module

This module aims to equip you with the fundamentals of machine learning and at the same time discuss technical aspects of some well-known machine learning models and related learning algorithms. It will provide a thorough grounding in the theory and application of machine learning and statistical techniques for classification, regression and unsupervised methods (clustering and dimension reduction). The module will cover kernel methods and neural networks (feed-forward architectures only).

INTENDED LEARNING OUTCOMES (ILOs) (see assessment section below for how ILOs will be assessed)

On successful completion of this module you should be able to:

Module Specific Skills and Knowledge

1. Apply principles for statistical and neural pattern recognition to novel data.
2. Analyse novel pattern recognition and classification problems, establish models for them and write software to solve them.

Discipline Specific Skills and Knowledge

3. Utilise a range of supervised and unsupervised pattern recognition and machine learning techniques to solve a wide range of problems.
4. State the importance and difficulty of establishing principled models for pattern recognition.

Personal and Key Transferable / Employment Skills and Knowledge

5. Use Python or other programming languages for scientific analysis and simulation.
6. Identify the compromises and trade-offs that must be made when translating theory into practice.
7. Critically read and report on research papers.

SYLLABUS PLAN - summary of the structure and academic content of the module

Topics (with associated exercises and seminar discussions):

- Taxonomy of problems and approaches in machine learning and statistical modelling
- Supervised Learning - Classification and Regression
 - o Decision tree.
 - o Similarity-based Learning.
 - o Error based learning.
 - o Neural Network concepts.
 - o Ensemble learning concepts.
 - o Model and classifier evaluation.
- Unsupervised Learning
 - o Clustering: hierarchical, partitional and density based.
 - o Cluster Evaluation.
 - o Association Rules.
- Data description and pre-processing
 - o Dealing with lass and imbalance and resampling.
 - o Missing values and imputation.
 - o Noise and Outlier Detection
 - o Feature Selection

LEARNING AND TEACHING

LEARNING ACTIVITIES AND TEACHING METHODS (given in hours of study time)

Scheduled Learning & Teaching Activities	42.00	Guided Independent Study	108.00	Placement / Study Abroad	0.00
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DETAILS OF LEARNING ACTIVITIES AND TEACHING METHODS

Category	Hours of study time	Description
Scheduled learning and teaching activities	22	Lectures
Scheduled learning and teaching activities	20	Workshops/tutorials
Guided independent study	50	Individual assessed work
Guided independent study	58	Private study

ASSESSMENT

FORMATIVE ASSESSMENT - for feedback and development purposes; does not count towards module grade

Form of Assessment	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Feedback on practical work	12 hours	All	Oral
MCQ mock quiz	1 hour	All except 5	Online quiz

SUMMATIVE ASSESSMENT (% of credit)

Coursework	40	Written Exams	60	Practical Exams	0
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DETAILS OF SUMMATIVE ASSESSMENT

Form of Assessment	% of credit	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Multiple choice questions (MCQ) exam – closed book	60	2 hours - Summer Exam Period	All except 5	Oral on request
Coursework/Project	40	4,000 words	All	Written

DETAILS OF RE-ASSESSMENT (where required by referral or deferral)

Original Form of Assessment	Form of Re-assessment	ILOs Re-assessed	Time Scale for Re-assessment
Summative Exam	Written exam (60%)	All except 5	August Ref/Def period
Summative Coursework	Coursework (40%)	All	Completed over summer with a deadline in August

RE-ASSESSMENT NOTES

Referred and deferred assessment will normally be by examination. For referrals, only the examination will count, a mark of 50% being awarded if the examination is passed. For deferrals, candidates will be awarded the higher of the deferred examination mark or the deferred examination mark combined with the original coursework mark.

RESOURCES

INDICATIVE LEARNING RESOURCES - The following list is offered as an indication of the type & level of information that you are expected to consult. Further guidance will be provided by the Module Convener

Basic reading:

ELE: <http://vle.exeter.ac.uk/>

Web based and Electronic Resources:

Other Resources:

Reading list for this module:

Type	Author	Title	Edition	Publisher	Year	ISBN	Search
Set	Duda and Hart	Pattern Classification and Scene Analysis	2nd	Wiley	2002	0471056693	[Library]
Set	Webb, A.	Statistical Pattern Recognition	2	Wiley	2002	0-470-84513-9	[Library]
Set	Murphy, K.	Machine Learning: A Probabilistic Perspective	1st	MIT Press	2012	978-0-262-018029	[Library]
Set	Bishop, John C.	Pattern recognition and machine learning		Springer	2006		[Library]
Set	Haykin, S.	Neural Networks and Learning Machines	3	Pearson, Prentice Hall		978-0-13-14713-9-	[Library]

CREDIT VALUE	15	ECTS VALUE	7.5
PRE-REQUISITE MODULES	None		
CO-REQUISITE MODULES	None		
NQF LEVEL (FHEQ)	7	AVAILABLE AS DISTANCE LEARNING	No
ORIGIN DATE	Monday 23 April 2018	LAST REVISION DATE	Wednesday 09 June 2021
KEY WORDS SEARCH	Data; machine learning; pattern recognition; probability.		