

MODULE TITLE	Learning from Data	CREDIT VALUE	15
MODULE CODE	ECM3420	MODULE CONVENER	Dr Chico Camargo (Coordinator), Dr Diogo Pacheco, Dr Marcos Oliveira
DURATION: TERM	1	2	3
DURATION: WEEKS	12 weeks	0	0
Number of Students Taking Module (anticipated)	60		

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.

Prerequisite module: ECM1400, ECM1415 or ECM1701

AIMS - intentions of the module

This module aims to equip you with the fundamentals of machine learning in a computer science context. It will provide a thorough grounding in the theory and application of machine learning and statistical techniques for classification, regression and unsupervised methods. We will pay particular attention to methods for visualising complex datasets.

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 pattern recognition to novel data;
- 2 Analyse novel pattern recognition and classification problems, establish models for them and write software to solve them;
- 3 Utilise a range of supervised and unsupervised pattern recognition and machine learning techniques to solve a wide range of problems.

Discipline Specific Skills and Knowledge:

- 4 State the importance and difficulty of establishing principled models for pattern recognition;
- 5 Use Python or other programming languages for scientific analysis and simulation.

Personal and Key Transferable / Employment Skills and Knowledge:

- 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
 Decision tree.
 Similarity-based Learning.
 Error based learning.
 Neural Network concepts.
 Ensemble learning concepts.
 Model and classifier evaluation.
 Unsupervised Learning
 Clustering: hierarchical, partitional and density based.
 Cluster Evaluation.
 Association Rules.
 Data description and pre-processing
 Dealing with lass and imbalance and resampling.
 Missing values and imputation.
 Noise and Outlier Detection
 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 question (MCQ)	60	2 hours - Summer Exam Period	All except 5	Oral on request
Coursework	40	50 hours	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-reassessment
MCQ exam	Written exam (60%) - 2 hours	All except 5	August Ref/Def period
Coursework	Coursework (40%)	All	Completed over summer with a deadline in August

RE-ASSESSMENT NOTES

Reassessment will be by coursework and/or exam (containing multiple choice questions and open-ended questions) in the failed or deferred element only. For referred candidates, the module mark will be capped at 40%. For deferred candidates, the module mark will be uncapped.

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

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	Christopher Bishop	Pattern Recognition and Machine Learning		Springer	2007	978-0387310732	[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]

CREDIT VALUE	15	ECTS VALUE	7.5
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PRE-REQUISITE MODULES	ECM1701, ECM1415, ECM1400
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CO-REQUISITE MODULES

NQF LEVEL (FHEQ)	3 (NQF level 6)	AVAILABLE AS DISTANCE LEARNING	No
ORIGIN DATE	Thursday 06 July 2017	LAST REVISION DATE	Thursday 05 October 2023
KEY WORDS SEARCH	Data; machine learning; pattern recognition; probability.		