

MODULE TITLE	Machine Learning and AI	CREDIT VALUE	15
MODULE CODE	СОМ3023	MODULE CONVENER	Dr Tinkle Chugh (Coordinator)
DURATION: TERM	1	2	3
DURATION: WEEKS	0	12 weeks	0
Number of Students Taking	Module (anticipated)	30	

DESCRIPTION - summary of the module content

This module will explore machine learning and artificial intelligence at an advanced level. It examines some of the theoretical foundations of machine learning and AI, together with some advanced techniques. In particular it examines Bayesian probability and fuzzy logic for dealing with uncertainty, and their relations to information theory. It also introduces techniques for dealing with temporally or spatially structured data, and reinforcement learning.

AIMS - intentions of the module

The aim of this module is to provide a strong theoretical basis for machine learning methods that you have already encountered and to introduce new methods for connected data and reinforcement learning. It aims to build on and enhance your analytical skills, and to put into practice methods for new machine learning and Al paradigms.

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. Demonstrate the theoretical foundations of machine learning and AI methods;
- 2. Choose appropriate analysis methods for new problems;
- 3. Understand the principles underlying different machine learning and AI techniques;
- 4. Understand principles of machine learning and AI for spatially and temporally connected models;
- 5. Understand the principles and practice of reinforcement learning systems.

Discipline Specific Skills and Knowledge

- 6. Describe and compare different theoretical approaches to a single problem;
- 7. Learn a variety machine learning and AI methods and apply them to real problems.

Personal and Key Transferable / Employment Skills and Knowledge

- 8. Plan and write a technical report;
- 9. Adapt existing technical knowledge to learning new methods.

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

Indicative syllabus plan; precise content may vary from year to year.

Bayesian methods: theoretical perspectives; conjugate families; Monte Carlo sampling methods; approximations including Laplace approximations, variational approximation, expectation propagation.

Fuzzy logic: measurements and modelling in the face of incomplete knowledge; vagueness and uncertainty. Fuzzy set theory; Dempster-Shafer theory; fuzzy logic operators and process.

Information theory: information, entropy; coding; learning from an information theoretic point of view.

Learning in spatially and temporally connected models: Hidden Markov models; Markov Random Fields.

Reinforcement learning: Multi-armed bandits; finite Markov decision processes; temporal difference learning; on and off policy learning.

LEARNING AND TEACHING

LEARNING ACTIVITIES AND TEACHING METHODS (given in hours of study time)								
Scheduled Learning & Teaching Activities	35.00	Guided Independent Study	y	115.00	Placement / S	tudy Abroad	0.00	
DETAILS OF LEARNING ACTIVITIES AND TEACHING METHODS								
Category	Hours	of study time	Descriptio	n				
Scheduled Learning and Teaching	20		Lectures					
Scheduled Learning and Teaching	15		Workshops	s and tuto	rials			
Guided Independent Study	115		Coursewor	k, private	study, reading			

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			

SUMMATIVE ASSESSMENT (% of credit)								
Coursework	30	Written Exams	70	Practical Exams	0			
DETAILS OF SUMMATIVE ASSESSMENT								
Form of Assessment	% of Credit	Size of Assessment (e.g. duration/lengt	th)	ILOs Assessed	Feedback Method			
Written exam Technical exercise and report	70 30	2 hours 30 hours		1, 2, 3, 4, 5, 6 1, 2, 3, 4, 5, 6, 7, 8, 9	Orally on request 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				
Written Exam	Written exam (2 hours)	1-6	August Ref/Def period				
Technical Exercise and Report 1	Technical Exercise and Report	All	August Ref/Def period				

RE-ASSESSMENT NOTES

Reassessment will be by coursework and/or written exam 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

Basic reading:

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

Web based and Electronic Resources:

Other Resources:

Readir	ng list for this module:							
Туре	Author	Title		Edition	Publisher	Year	ISBN	Search
Set	Bishop, C.	Pattern Recognition and Machine Learning		1	Springer	2006	978- 0387310732	[Library]
Set	Russell, S. and Norvig, P.	Artificial Intelligence: A Modern Approach 4			Pearson	2016	978- 1292153964	[Library]
Set	Mackay, D.J.C.	Information Theory, Inference, and Learning		1	Cambridge	2006	978- 0521642989	[Library]
Set	Hastie, T., Tibshirani, R., and Friedman, J.	The Elements of Statistical Learning: Data Mining, Inference, and Prediction 2		2	Springer	2017	978- 0387848570	[Library]
Set	Sutton, R.S., Barto, A. and Bach, F.	Reinforcement Learning: An Introc	duction 2	2	MIT Press	2018	978- 0262039246	[Library]
CRED	IT VALUE	15	ECTS VALUE	7.5				
PRE-REQUISITE MODULES		MTH2006, COM2011						
CO-R	EQUISITE MODULES							
NQF I	LEVEL (FHEQ)	5	AVAILABLE AS DISTANCE LEARNI	NG No				
ORIGIN DATE		iday 12 April 2019 LAST REVISION DATE		Tue	Tuesday 24 January 2023			
KEY WORDS SEARCH		None Defined						