

MODULE TITLE	Computational Intelligence	CREDIT VALUE	15
MODULE CODE	COM2014	MODULE CONVENER	Guoqiang Zhang (Coordinator)
DURATION: TERM	1	2	3
DURATION: WEEKS	0	11	0
Number of Students Taking	Module (anticipated)	30	

DESCRIPTION - summary of the module content

Computational intelligence is the science of computational systems that are able to perform specific tasks, adapting to particular data. The module will equip you to design and use computational intelligence to solve a variety of problems such as planning, scheduling, optimisation, using a variety of techniques including biologically inspired computational, fuzzy logic, agent-based models and simulation.

Pre-requisite Modules: COM2013 (Data Science Group Project 2); ECM1400; MTH1004

AIMS - intentions of the module

The aim of this module is to introduce and give you practice in some of the main areas of computational intelligence that can be used to solve problems arising in data science. It aims to give you and understanding of the theoretical basis of these methods and their relation to other artificial intelligence techniques. Specifically, it will introduce classical "crisp" logic and knowledge representation before proceeding to fuzzy logic to cope with uncertain and vague processes. Searching and optimisation arise in many contexts and this module aims to introduce you deterministic and stochastic optimisation methods, particularly evolutionary optimisation.

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 Explain the nature of Computational Intelligence, its scope, and its limitations;

2 Display competence in a range of Computational Intelligence tools and techniques;

3 Explain the theoretical basis for a range of Computational Intelligence methods;

4 Make use of Computational Intelligence methods in practical applications;

Discipline Specific Skills and Knowledge:

5 Describe a number of different programming paradigms; 6 Learn a variety of data science methods and apply them to real problems;

Personal and Key Transferable / Employment Skills and Knowledge:

7 Plan and write a technical report;

8 Adapt existing technical knowledge to learning new methods.

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

• Introduction: history and context of computational intelligence, artificial intelligence and related disciplines;

• Searching for solutions: Depth-first Search, Breath-first Search, Greedy Best-first Search, A* Search, MiniMax Search, MiniMax Search with Alpha-Beta Pruning

• Logic and knowledge representation: Propositional Logic, first-order logic and reasoning strategies; use of propositional and first-order logic as a knowledge representation language;

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

• Evolutionary computation: population-based stochastic search; genetic algorithms, representations and operators; exploration and exploitation;

• Agent-based models and simulation: cellular automata; state-based models; complex systems and emergent behaviour

LEARNING AND TEACHING

LEARNING ACTIVITIES AND TEACHING METHODS (given in hours of study time)	
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Scheduled Learning & Teaching Activities	35.00	Guided Independent Study	1	115.00	Placement / Study Abroad	0.00		
DETAILS OF LEARNING ACTIVITIES AND TEACHING METHODS								
Category	Hours	of study time	Descriptio	n				
Scheduled Learning and Teaching	22		Lectures					
Scheduled Learning and Teaching	13		Workshop	s and tuto	rials			
Guided Independent Study	115		Coursewor	rk; 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 Not Applicable SUMMATIVE ASSESSMENT (% of credit) Coursework 40 Written Exams 60 Practical Exams **DETAILS OF SUMMATIVE ASSESSMENT** % of Credit Size of Assessment (e.g. duration/length) **ILOs Assessed** Feedback Method Form of Assessment Written Exam 60 2 hours (Summer) 1-3, 5-6, 8 Orally, on request 40 Coursework 1 30 hours 2.4.6-8 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)	1-3, 5, 6, 8	August Ref/Def Period
Coursework 1	Coursework 1	2, 4, 6, 7, 8	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.

			RE	SOURCES					
INDIC infor	CATIVE LEARNIN mation that you	G RESOURC are expect	CES - The following list is offe ed to consult. Further guidar	red as an indication of the typ ace will be provided by the Mo	e & lev dule Co	el of onvener			
Basic ELE: <u>h</u> Readi	Reading: ^{ttp://vle.exeter.ac.uk,} ng list for this mod	ule:							
Туре	Author	Title			Edition	Publisher	Year	ISBN	Search
Set	Russell S. and Norvig P.	Artificial Intel	elligence: A Modern Approach			Pearson	2010		[Library]
Set	Ross, T.	Fuzzy Logic w	th Engineering Applications			Wiley	2016	978- 1119235866	[Library]
Set	Wilensky, U. and Rand, W.	An Introductio Complex Syst	n to Agent-Based Modeling: Modeling Natural, Social, and Engineered ems with NetLogo			MIT Press	2015		[Library]
Set	Simon, D.	Evolutionary)ptimization Algorithms			Wiley- Blackwell	2013	978- 0470937419	[Library]
CRED	IT VALUE		15	ECTS VALUE	7.5				
PRE-	REQUISITE MODULE EQUISITE MODULE	:S 5	ECM1400, MTH1004, COM2013, COM	1011, COM2011					
NQF	LEVEL (FHEQ)		6	AVAILABLE AS DISTANCE LEARNIN	IG No				
ORIG	IN DATE		Friday 12 April 2019	LAST REVISION DATE	Tuesd	ay 24 Januai	y 2023	3	
KEY	WORDS SEARCH		None Defined						