H9AIDM: AI Driven Decision Making

Module Code:	H9AIDM
Long Title	AI Driven Decision Making APPROVED
Title	AI Driven Decision Making
Module Level:	LEVEL 9
EQF Level:	7
EHEA Level:	Second Cycle
Credits:	5
Module Coordinator:	Ade Fajemisin
Module Author:	Margarete Silva
Departments:	School of Computing
Specifications of the qualifications and experience required of staff	MSc and/or PhD degree in computer science, mathematics or cognate discipline. May have industry experience also.

Learning Outcomes

On successful completion of this module the learner will be able to:

#	Learning Outcome Description
LO1	Critically assess theories and models of decision making to contextualise artificial intelligence driven approaches for decision making.
LO2	Model and solve a variety of real-world problems as constraint satisfaction and optimisation problems.
LO3	Identify and apply appropriate artificial intelligence driven decision-making approaches (e.g., Bayesian Networks, Fuzzy Systems, Evolutionary Systems) to solve problems across various application domains.
LO4	Implement, compare, contrast, and critically evaluate alternative artificial intelligence algorithmic approaches to determine their suitability for decision making with sample optimisation problems.

Dependencies

Module Recommendations

No recommendations listed

Co-requisite Modules

No Co-requisite modules listed

Entry requirements	Learners are required to hold a minimum of a level 8 honours qualification, or equivalent on the National Qualifications Framework, and must be from a cognate background.

H9AIDM: AI Driven Decision Making

Module Content & Assessment

Indicative Content
Module Introduction Theory & Models of Decision Making (e.g., Simon / Boyd) Structured, semi-structured, unstructured decision making Decision Support Systems Intelligent Decision Support Systems AI/Human Decision Making context (Support, Augment, Replace, Automate) Explainable AI Expert Systems, Case-based & Rule-based systems / Historical Perspective AI approaches to decision making covered in the module Ethical questions and implications
Introduction to Optimization Components of an optimisation problem Maximization and Minimization problems Graph optimization Application to real-world problems such as cutting stock problems, vehicle routing problems, scheduling problems, etc.
Linear and Integer Programming Basic properties of Linear Programming problems Linear Programming formulation Mixed Integer Programming Algorithms for solving optimisation problems: Branch-and-Bound, Branch-and-Price
Constraint Programming Modelling problems using constraint programming Constraint propagation using arc-consistency, node-consistency and path consistency Backtracking search algorithms Local search methods Applications of constraint programming
Bayesian Networks Random variables Bayes's Theorem and Conditional Probability Bayesian Networks Real-world applications of Bayesian Networks, e.g. image processing, information retrieval, troubleshooting, etc.
Fuzzy Systems Fuzzy Sets Fuzzy Logic Membership Functions Fuzzy Reasoning Fuzzy Decision Making
Evolutionary Systems Genetic Algorithms Operators in Genetic Algorithms Stopping Conditions and Constraints Classification of GAs
Evolutionary Systems Swarm Intelligence Memetic Algorithms
Metaheuristics Fitness landscapes Local search Simulated annealing
Metaheuristics Tabu Search Variable neighbourhood search
Hybrid Systems Combining metaheuristics with mathematical programming, constraint programming, machine learning and data mining
Applications Survey and analysis of AI decision making across a number of application domains.

Assessment Breakdown	%
Coursework	100.00%

Assessments

Full Time

Coursework

Assessment Type:	Formative Assessment	**% of total:**	Non-Marked
Assessment Date:	n/a	**Outcome addressed:**	1,2,3,4
Non-Marked:	Yes		

Assessment Description:
Formative assessment will be provided on the in-class individual or group activities. Feedback will be provided in written or oral format, or on-line through Moodle. In addition, in class discussions will be undertaken as part of the practical approach to learning.

Assessment Type:	Continuous Assessment	**% of total:**	40
Assessment Date:	n/a	**Outcome addressed:**	2
Non-Marked:	No		

Assessment Description:
The learner will be required to model and solve a series of problems using integer programming

Assessment Type:	Project	**% of total:**	60
Assessment Date:	n/a	**Outcome addressed:**	1,2,3,4
Non-Marked:	No		

Assessment Description:
Long-form project which the student produces over the course of the entire semester. Student is required to research and utilise a suite of AI based algorithms and approaches to provide decision making capabilities in a chosen application problem domain. The results of applying these techniques should then be critically evaluated. It is required to submit a project report including: (a) the background research that has been conducted, (b) the methodology applied to complete the project, (c) implementation details, (d) experimentation details, (e) evaluation of results, and (f) conclusion.

No End of Module Assessment

No Workplace Assessment

Reassessment Requirement

Coursework Only
This module is reassessed solely on the basis of re-submitted coursework. There is no repeat written examination.

H9AIDM: AI Driven Decision Making

Module Workload

Module Target Workload Hours 0 Hours

Workload: Full Time

Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	In-class lectures	24	Per Semester	2.00
Lab	Application of concepts presented in lectures	24	Per Semester	2.00
Independent Learning	Independent learning	77	Per Semester	6.42
			Total Weekly Contact Hours	4.00

Module Resources

Recommended Book Resources

Frederick S. Hillier,Gerald J. Lieberman. Introduction to Operations Research, [ISBN: 9781259253188].

William Kocay,Donald L. Kreher. (2016), Graphs, Algorithms, and Optimization, Second Edition, CRC Press, p.546, [ISBN: 9781482251166].

Francesca Rossi,Peter Van Beek,Toby Walsh. (2006), Handbook of Constraint Programming, Elsevier Science Limited, p.955, [ISBN: 9780444527264].

Norman Fenton,Martin Neil. (2012), Risk Assessment and Decision Analysis with Bayesian Networks, CRC Press, p.524, [ISBN: 9781439809112].

Supplementary Book Resources

El-Ghazali Talbi. (2009), Metaheuristics: From Design to Implementation.

Kartik Hosanagar. (2019), A Human's Guide to Machine Intelligence, Penguin, p.272, [ISBN: 9780525560890].

Supplementary Article/Paper Resources

Çağrı Koça,Tolga Bektaşa,Ola Jabalib,Gilbert Laporte. (2016), Thirty years of heterogeneous vehicle routing, European Journal of Operational Research, 249, https://doi.org/10.1016/j.ejor.2015.07.0 20

Pablo Martínez Fernándeza, Ignacio Villalba Sanchísa, Víctor Yepesb,Ricardo Insa Franco. Assessment and optimization of sustainable forest wood supply chains – A systematic literature review, Journal of Cleaner Production, 222, https://doi.org/10.1016/j.jclepro.2019.0 3.037

Billie Anderson. (2019), Using Bayesian networks to perform reject inference, Expert Systems with Applications, 137, https://doi.org/10.1016/j.eswa.2019.07.0 11

This module does not have any other resources

Discussion Note:	