H9FAI: Foundations of Artificial Intelligence

Module Code:	H9FAI
Long Title	Foundations of Artificial Intelligence APPROVED
Title	Foundations of AI
Module Level:	LEVEL 9
EQF Level:	7
EHEA Level:	Second Cycle
Credits:	5
Module Coordinator:	Arghir Moldovan
Module Author:	Arghir Moldovan
Departments:	School of Computing
Specifications of the qualifications and experience required of staff	MSc and/or PhD degree in computer science or cognate discipline. Experience lecturing in the field. May have industry experience also.

Learning Outcomes	
On successful completion of this module the learner will be able to:	
#	**Learning Outcome Description**
LO1	Demonstrate critical understanding of the theory and concepts underpinning Artificial Intelligence.
LO2	Critically analyse the capabilities and limitations of current AI techniques.
LO3	Evaluate and apply the principles, models and algorithms of AI to recognise, model and solve various problems.
LO4	Review, compare, and contrast the latest AI industry and research developments.
LO5	Develop and enhance interpersonal communication skills to become a successful member of a working team.

Dependencies	
Module Recommendations	
No recommendations listed	
Co-requisite Modules	
No Co-requisite modules listed	

Entry requirements	Internal to the programme.

H9FAI: Foundations of Artificial Intelligence

Module Content & Assessment

Indicative Content

Introduction to Artificial Intelligence
Defining Artificial Intelligence; Foundations of AI: philosophy, maths, psychology, computing, linguistics, logic, probability theory; Historical evolution of the field.

Types of AI
Weak vs. strong AI; Narrow vs. general vs. super intelligence; Classical vs. statistical AI; Use cases and examples of applications for the different types of AI.

Business applications of AI
The opportunities and challenges of AI for business; Building safe, ethical, explainable and responsible AI applications; Use cases and examples of AI applications in business.

Agents
Precepts, actions, goals, environment; Rational agents; Environments representation; Agent functions and programs; Types of agents: simple reflex agents, reflex agents with state, goal based agents, utility based agents.

Solving Problems by Searching
Defining search problems; Searching for solutions; Performance; Uninformed search strategies; Informed Search strategies; Heuristic functions.

Solving Problems by Searching
Local search algorithms and optimisation problems; Adversarial search.

Reasoning
Propositional Logic; First Order Logic; Inference in First Order Logic; Planning.

Knowledge Representation
Ontological Engineering; Categories and objects; Events; Semantic networks.

Bayesian Networks
Quantifying uncertainty; Bayes' rules and its use; The semantics of Bayesian networks; Conditional distributions and efficient representation of them; Inference in Bayesian networks.

Learning
Types of learning (e.g., deductive vs. inductive, supervised vs. unsupervised vs. semi-supervised, reinforcement learning); Learning from examples (e.g., regression, classification); Brief overview of artificial neural networks; Learning probabilistic models.

Reinforcement Learning
Formulating a reinforcement learning problem; Classification of reinforcement learning algorithms (e.g., model-free vs. model-based); Markov Decision Processes; Value functions; Reinforcement learning examples.

Recommended Systems
Recommender systems types and models (e.g., collaborative filtering, content-based filtering, multi-criteria systems, etc.); Recommender systems challenges (e.g., scalability, sparsity, cold start, etc.); AI techniques applied to improve accuracy and overcome challenges with rec sys; Overview of commercial and public cloud AI services for recommendation (e.g., Amazon Personalize, Microsoft Personalizer, Google Cloud Recommendations AI, Coveo Relevance Cloud, Yusp, etc.). Recommender systems examples and case studies including ethical implications (e.g., Netflix Prize data anonymisation and legal case).

Assessment Breakdown	%
Coursework	60.00%
End of Module Assessment	40.00%

Assessments

Full Time

Coursework

Assessment Type:	Formative Assessment	% of total:	Non-Marked
Assessment Date:	n/a	Outcome addressed:	1,2,3,4,5
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:	Project	% of total:	60
Assessment Date:	n/a	Outcome addressed:	1,2,3,4,5
Non-Marked:	No		

Assessment Description:
In this project students will have to propose an Artificial Intelligence-based application, appraise the business value and innovation of the application, analyse, and define the application requirements, document, and justify the use of AI principles, models, and algorithms. Students will work in groups and will also have to consider the ethical implications of their project will be evaluated as part of the Data Governance and Ethics module. The final submission will consist of a written report documenting the work.

End of Module Assessment

Assessment Type:	Terminal Exam	% of total:	40
Assessment Date:	End-of-Semester	Outcome addressed:	1,2,3,4
Non-Marked:	No		

Assessment Description:
The examination will be of two hours duration and may include a mix of: theoretical, applied and interpretation questions.

No Workplace Assessment

Reassessment Requirement

Repeat examination
Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.

Reassessment Description
The reassessment strategy for this module is by repeat examination that covers all learning outcomes.

H9FAI: Foundations of Artificial Intelligence

Module Workload				
Module Target Workload Hours 0 Hours				

Workload: Full Time				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Classroom & Demonstrations (hours)	24	Per Semester	2.00
Tutorial	Practical/Tutorial	12	Per Semester	1.00
Independent Learning	Independent learning	89	Per Semester	7.42
			Total Weekly Contact Hours	3.00

Workload: Blended				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Classroom & Demonstrations (hours)	12	Per Semester	1.00
Tutorial	Practical/Tutorial	12	Per Semester	1.00
Directed Learning	Directed learning	12	Per Semester	1.00
Independent Learning	Independent learning	89	Per Semester	7.42
			Total Weekly Contact Hours	3.00

Module Resources

Recommended Book Resources

    Stuart Russell, Peter Norvig. (2020), Artificial Intelligence, 4. Pearson Higher Education, p.1136, [ISBN: 978-0134610993].

Supplementary Book Resources

    Andrew Burgess. (2018), The Executive Guide to Artificial Intelligence: How to Identify and Implement Applications for AI in Your Organization, 1. Palgrave Macmillan, p.181, [ISBN: 978-3319638195].

    Steven Finlay. (2021), Artificial Intelligence and Machine Learning for Business: A No-Nonsense Guide to Data Driven Technologies, 4. Relativistic, p.226, [ISBN: 978-1999325381].

    Mariya Yao,Adelyn Zhou,Marlene Jia. (2018), Applied Artificial Intelligence: A Handbook For Business Leaders, TOPBOTS, p.246, [ISBN: 978-0998289021].

This module does not have any article/paper resources

Other Resources

    Exercises for Artificial Intelligence: A Modern Approach, [https://aimacode.github.io/aima-exercis es/]

    Code for Artificial Intelligence: A Modern Approach, [https://github.com/aimacode/aima-python]

    Spinning Up in Deep RL!, [https://spinningup.openai.com/]

    Zhang, Q., Lu, J. & Jin, Y.. (2021), Artificial intelligence in recommender systems, Complex Intelligent Systems, 7, Springer, https://doi.org/10.1007/s40747-020-00212 -w

Discussion Note: