# **H9FAI: Foundations of Artificial Intelligence**

Module Code:		H9FAI					
Long Title		Foundations of Artificial Intelligence APPROVED					
Title		Foundations of Al					
Module Level:		LEVEL 9					
EQF Level:							
EHEA Level:		nd Cycle					
Credits:							
Module Coordinator:		r Moldovan					
Module Author:		nir Moldovan					
Departments:		chool of Computing					
Specifications of the qualifications and experience required of staff		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	al understanding of the theory and concepts underpinning Artificial Intelligence.					
LO2	Critically analyse the	alyse the capabilities and limitations of current AI techniques.					
LO3	Evaluate and apply t	luate and apply the principles, models and algorithms of AI to recognise, model and solve various problems.					
LO4	Review, compare, ar	npare, and contrast the latest Al industry and research developments.					
LO5	Develop and enhance	hance 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 A

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

#### **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.

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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.); Al techniques applied to improve accuracy and overcome challenges with rec sys; Overview of commercial and public cloud Al services for recommendation (e.g., Amazon Personalize, Microsoft Personalizer, Google Cloud Recommendations Al, 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

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:60Assessment Date:n/aOutcome 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 Al 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								
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 C	ontact 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								

## **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-exercises/]

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: