

WM9QG-15 Fundamentals of Artificial Intelligence and Data Mining

26/27

Department

WMG

Level

Taught Postgraduate Level

Module leader

Amir Kayhani

Credit value

15

Module duration

4 weeks

Assessment

Multiple

Study location

University of Warwick main campus, Coventry

Description

Introductory description

This module offers a holistic exploration into the realms of applied Artificial Intelligence and Data Mining. It is designed to provide a practical understanding of the entire lifecycle of a data mining project, aligning with the CRISP-DM standard methodology and incorporating a range of data analytics tools and techniques. Students will gain hands-on experience in applying and critically evaluating a wide array of machine learning algorithms, including supervised, unsupervised, and reinforcement learning across various datasets. The module also encompasses the use of AI optimisation algorithms, such as Genetic Algorithms (GA) or Particle Swarm Optimization (PSO), for optimisation tasks. Additionally, it delves into cloud-based Machine Learning tools.

Module aims

This module aims to enable participants to understand, select, implement and evaluate Artificial Intelligence algorithms and Data Mining methods for different applications. In particular, the module highlights several of the most common and in-demand modern algorithms, including classification, regression, clustering, dimension reduction, reinforcement learning and optimisation algorithms. Alongside technical knowledge, participants should develop an understanding of the applicability of different types of machine learning to common problems and best practices for

Artificial Intelligence and Data Mining projects.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Data Science Foundations: Core concepts of Artificial Intelligence, Machine Learning and Data Mining; CRISP-DM methodology, data understanding, data pre-processing & feature engineering, data imbalance handling methods (algorithm level techniques, undersampling, oversampling), hyperparameter optimisation and an introduction to Explainability in AI (XAI) .

Unsupervised learning: Clustering Algorithms; Association Rule Mining; Principal Component Analysis.

Supervised learning: Classification, Theoretical background and classification algorithms (e.g. K-Nearest Neighbours, Decision Trees, Support Vector Machines or Random Forest); Regression models(e.g. Linear models, Logistic Regression or Lasso Regression); Ensemble models (e.g. voting, bagging, or boosting), model selection and evaluation.

Reinforcement Learning: Core concepts of Reinforcement Learning and Reinforcement Learning algorithms (e.g., Q-Learning or Policy Optimization methods.)

AI Optimisation Algorithms (e.g. Genetic Algorithm (GA), Particle Swarm Optimisation (PSO) or Simulated Annealing.)

Learning outcomes

By the end of the module, students should be able to:

- Demonstrate a comprehensive and practical understanding of all stages in a data mining project based on the CRISP-DM methodology.
- Select and apply the appropriate Artificial Intelligence and Machine Learning algorithm and other required steps to implement an optimised solution.
- Critically evaluate different data analysis and Machine Learning tools and techniques, to design a solution with the best-suited tools and techniques for a specific data mining/analysis problem.
- Collaboratively design, implement, and present complex data mining/Artificial Intelligence solutions using robust, efficient, and optimised methods.
- Synthesize existing data mining or Artificial Intelligence methodologies to articulate a solution's rationale, methodology and broader implications.

Indicative reading list

[Reading lists can be found in Talis](#)

[Specific reading list for the module](#)

International

Topics are of high international demand

Subject specific skills

- Data science, data mining and AI fundamental concepts,
- Implementation of machine learning and AI models and solutions
- Ability to apply data analysis and machine learning tools and techniques and critically evaluate the outcomes

Transferable skills

- Critical thinking and analytical reasoning.
 - Problem-solving in complex and uncertain environments.
 - Collaboration and teamwork.
 - Effective technical communication.
 - Independent learning and self-direction.
 - Time and project management.
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Study

Study time

Type	Required
Lectures	10 sessions of 1 hour (7%)
Seminars	10 sessions of 1 hour (7%)
Practical classes	10 sessions of 1 hour (7%)
Online learning (independent)	20 sessions of 1 hour (13%)
Private study	40 hours (27%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Combination of the following:

- Independent learning materials and activities for programming, machine learning and also machine learning in cloud
- Reading list, book chapters and articles

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time	Eligible for self-certification
Group Assessment	30%	18 hours	No
In teams, participants implement a data mining or AI project, present their approach and evaluate their results. Peer Marking Process will be adopted in this assessment.			
Assignment	70%	42 hours	Yes (extension)
The assignment includes the implementation(in Python) of a data mining /machine learning project and a reflective report.			

Assessment group R

	Weighting	Study time	Eligible for self-certification
Individual Presentation	30%		No
Implement and present data mining or AI solution on a dataset, present their approach and evaluate their results in a recorded video.			
Assignment	70%	42 hours	No

Feedback on assessment

Verbal feedback for the group assessment. Written feedback for the assignment.

Availability

There is currently no information about the courses for which this module is core or optional.