WM9QG-15 Fundamentals of Artificial Intelligence and Data Mining

25/26

Department
WMG
Level
Taught Postgraduate Level
Module leader
Amir Kayhani
Credit value
15
Module duration
4 weeks
Assessment
100% coursework
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 big 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, both structured and unstructured. The module also encompasses the use of AI optimisation algorithms, such as Genetic Algorithms (GA) and Particle Swarm Optimization (PSO), for optimisation tasks. Additionally, it delves into big data tools and techniques, including cloud-based big data 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 genetic 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 AI, Machine Learning and Data Mining and Big Data; CRISP-DM methodology, data understanding, data pre-processing & feature engineering, hyperparameter optimisation.

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

Supervised learning: Classification, Theoretical background; KNN; Decision Trees; Support Vector Machines; Model selection and evaluation, Regression: Theoretical background; Linear models.

Reinforcement Learning: Core concepts of RL, Q-Learning and Policy Optimization methods.

AI Optimisation Algorithms: Genetic Algorithm (GA), Particle Swarm Optimisation (PSO), Simulated Annealing.

Big Data Tools and Techniques: Data Lake, Data Warehouse, ETL/ELT, Data Visualisation.

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 standard methodology.
- Select and apply the appropriate Artificial Intelligence and Machine Learning algorithm and other required steps to implement an optimised solution.
- Critically evaluate different big data analysis 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, including ethical considerations, data privacy, and societal impacts.

Indicative reading list

Chatterjee, C. 2022, Adaptive machine learning algorithms with Python: solve data analytics and machine learning problems on edge devices, [First]. edn, Apress, New York, NY.

Jo, T. 2021, Machine learning foundations: supervised, unsupervised, and advanced learning, Springer, Cham.

Russell, S.J. & Norvig, P. 2021, Artificial intelligence: a modern approach, Global;Fourth; edn,

Pearson, Harlow, United Kingdom.

Sutton, R. S. and Barto, A. G. (2018) Reinforcement learning: an introduction. Second edition. Cambridge, Massachusetts: The MIT Press.

Zollanvari, A. 2023, Machine learning with Python: theory and implementation, Springer, Cham.

International

Topics are of high international demand

Subject specific skills

Data science and data mining, machine learning, AI, reinforcement learning, big data tools and techniques, optimisation

Transferable skills

Programming, statistics and modelling, teamwork, critical analysis

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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)	60 sessions of 1 hour (40%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

No private study requirements defined for this module.

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
Assessment component			
Group Assessment	30%	18 hours	No
In teams, participants create a data mining or AI solution on a real-world dataset and present their approach. Peer Marking Process will be adopted in this assessment.			
Reassessment component			
Individual Presentation with Group Reflection			No
Present data mining or AI solution on a real-world dataset and an individual reflection of group work.			
Assessment component			
Assignment	70%	42 hours	Yes (extension)
The assignment includes a working program that can model a given dataset and a report based on the working program.			
Reassessment component is the same			

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.