WM9QC-15 Artificial Intelligence for Industry

26/27

Department
WMG
Level
Taught Postgraduate Level
Module leader
Sulakshan Rajendran
Credit value
15
Module duration
4 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The Artificial Intelligence (AI) for Industry module covers the essential principles and practical applications of robotics and automation tailored specifically for industrial contexts, such as battery manufacturing for electric vehicles or e-mobility for the energy sector. Participants will gain a comprehensive understanding of designing robotic systems, implementing control mechanisms, leveraging automation technologies to optimise process parameters, quality and operational efficiency. The module content includes a blend of theoretical knowledge and hands-on experiences, focusing on how AI technologies can be applied to enhance productivity and innovation in sectors like manufacturing, transport, and energy. Through this module, learners will explore the integration of various classical machine learning approaches and solutions (e.g., regression, classification, or prediction/optimisation models), deep learning (DL), bespoke design of DL models, explainable AI (XAI) and their applications to industrial problems.

Module aims

The Artificial Intelligence (AI) for Industry module aims to equip students with an in-depth understanding of the principles and practical applications of artificial intelligence in robotics and automation, tailored specifically for industrial contexts such as battery manufacturing for electric

vehicles or e-mobility for the energy sector.

The course objectives include:

- Introducing the core concepts of artificial intelligence related to industrial robotics applications, including design methodologies, process quality control, sensor fusion, and machine learning integration.
- In-depth understanding of the advancements and applications of process optimisation and automation technologies, emphasising their deployment in various industrial environments.
- Stimulating critical analysis and discussion about the transformative impact of AI, robotics and automation on industries, workforce dynamics, and society at large.
- Enhancing skills in applying AI approaches and solutions to solve real-world industrial problems.

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.

- Introduction to Artificial Intelligence (AI)-Driven Industrial Robotics: Overview of the history and evolution of robotics, with a focus on the integration of AI; Fundamental components of robotic technology, including sensors, actuators, and AI controllers.
- Industrial challenges, drivers and trends—Smart factory and beyond: Understanding the current challenges, drivers and trends (e.g., Industry 4.0/5.0/6/0, Net zero, or circular economy) and key enabling technologies (e.g., AI, robotics, Internet of Things (IoT), or Cyber-Pyshical Systems (CPS)).
- AI-enhanced process parameters optimisation and control in Industry: Detailed case studies illustrating the application and impact of AI-enhanced process parameters optimisation and control across various industries. Discussion on the challenges and emerging trends in the adoption of AI in industrial environments.
- Advanced Robot Control Systems: Examination of sophisticated control mechanisms (e.g., PID (Proportional – Integral – Derivative), adaptive, or intelligent AI-driven controllers). Overview of control architectures tailored for AI applications (e.g., deliberative, reactive, or hybrid models).
- In-line and in-process Sensors, Signal Processing, and AI: Comprehensive review of sensor technologies enhanced by AI for superior data acquisition and analysis. Signal processing and sensor fusion techniques powered by AI for heightened sensory perception and decision-making accuracy.
- AI and Automation Technologies: Fundamental principles of automation and its transformation through AI. In-depth analysis of AI-driven automation in key sectors: manufacturing, transport or energy. Strategies for integrating AI automation systems with existing business processes for operational excellence.
- Ethical, Legal, and Societal Implications of AI in Industry: Introduction of the ethical and legal considerations in deploying AI-driven robotics and automation. Analysis of the impact of AI

and automation on the workforce, societal structures, and ethical practices in technology use.

Learning outcomes

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

- Critically evaluate the fundamental control mechanisms and automation technologies in the creation of basic robotics systems.
- Assess the application, efficiency, and impact of process parameters optimisation and control in industry.
- Analyse and integrate ethical, legal, and societal considerations in the design and deployment of Artificial Intelligence (AI) approaches in industry, promoting responsible and sustainable technological development.
- Apply theoretical knowledge and practical skills to address real-world industrial problems, demonstrating innovation and technical proficiency.
- Engage in collaborative projects to analyse, optimise or troubleshoot manufacturing process using Artificial Intelligence/Machine Learning approaches.

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Research element

Students will be introduced to different research being carried out in the field to familiarise them with emerging trends.

Interdisciplinary

Integrating data mining/AI with manufacturing processes

International

Topics are of high international demand

Subject specific skills

- Robotics System Design
- Control Systems Implementation
- Process parameters optimization and control
- Defects detection and classification
- Automation Process Integration

- Sensors and Signal Processing
  Ethical and Societal Impact Analysis

Transferable skills

- Problem-Solving and Critical Thinking
- Teamwork and Collaboration
- Project Management
- Communication Skills

Study

Study time

Type	Required
Lectures	10 sessions of 1 hour (7%)
Seminars	20 sessions of 1 hour (13%)
Online learning (independent)	30 sessions of 1 hour (20%)
Private study	30 hours (20%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Private study will include preparing for lectures and seminars, reviewing lecture notes, and engaging with required readings and multimedia resources.

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

	Weighting	Study time	Eligible for self-certification

In groups, students will analyse, optimise or troubleshoot a manufacturing process using machine learning/AI approaches and present their findings. This assessment includes a Peer Marking Activity.

Reassessment component

Individual Presentation			No

Students will analyse, optimise or troubleshoot a different manufacturing process using machine learning/AI approaches and present their findings. This presentation will be recorded and submitted.

Individual Assignment	70%	42 hours	Yes (extension)

Students are required to evaluate a manufacturing process and assess the impact of AI approaches in optimising its systems, while considering the ethical and societal implications.

Assessment group R

	Weighting	Study time	Eligible for self-certification
Individual Assignment	70%	42 hours	No

Feedback on assessment

Verbal feedback for group assessment with a written summary. Written feedback for Individual assignment.

Availability

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