WM919-15 Machine Intelligence and Data Science

20/21

Department
WMG
Level
Taught Postgraduate Level
Module leader
Mehrdad Dianati
Credit value
15
Module duration
2 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The aim is to help students build a solid knowledge of key AI techniques that are widely used in development of autonomous vehicles. To understand the application context, an overview of autonomous vehicles technology will be provided, including: Localization, Sensing & Perception and Motion Planning. The module will then focus on practical aspects of AI while the students will gain a strong high level understanding of the underlying theory. The emphasis will be on Deep Learning techniques that are heavily used in driverless vehicles, including: Convolutional Neural Networks (CNN), Supervised and Unsupervised Learning, Recurrent Neural Networks.

Module aims

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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.

- An overview of autonomous vehicles technology
- System architecture
- Localisation
- Sensing and perception
- Motion planning in complex environments
- A general overview of AI systems
- Data science basis for machine intelligence:
- Understanding experimental data and fitting
- Clustering and classification
- Deep learning systems
- Introduction to neural networks
- Deep learning neural networks
- Reinforced learning
- Supervised and unsupervised learning
- Convolutional neural networks
- Recurrent neural networks
- Industry expert seminars
- Tutorials on tools and examples

Learning outcomes

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

- 1. Demonstrate a complete understanding of the high level architectures and principles of autonomous driving systems
- 2. Demonstrate systematic high-level knowledge of the AI systems
- 3. Demonstrate a critical understanding of neural networks architecture
- 4. Demonstrate a comprehensive understanding of Deep Learning
- 5. Demonstrate the mastery of relevant tools used to achieve machine intelligence
- 6. Critically evaluate the socio economic implications of the use of AI technologies in automated transport
- 7. Practically analyse and optimise different types of neural networks used for different automotive tasks
- 8. Critically analyse data sets and techniques for clustering and classification

Indicative reading list

- GOODFELLOW, Ian; BENGIO, Yoshua; COURVILLE, Aaron. Deep learning (adaptive computation and machine learning series). Adaptive Computation and Machine Learning series, 2016, 800.
- RUSSELL, Stuart Jonathan, et al. Artificial intelligence: a modern approach. Upper Saddle

River: Prentice hall, 2003.
- URMSON, Chris, et al. Tartan racing: A multi-modal approach to the darpa urban challenge. 2007.
- GUTTAG, John V. Introduction to computation and programming using Python. Mit Press,

1.

- SAMARASINGHE, Sandhya. Neural networks for applied sciences and engineering: from fundamentals to complex pattern recognition. CRC Press, 2016.
- ASIMOV, Isaac. I, Robot, Robot series. 1950.

A variety of up-to-date sources including:

- Latest government / UK Automotive Council roadmaps for autonomous vehicles
- Latest automotive legislation and standards
- Current academic research in the field of smart connected autonomous vehicles

Subject specific skills

Basic knowledge of AI techniques that are widely used in development of autonomous vehicles, Overview of autonomous vehicles technology: Localization, Sensing & Perception and Motion Planning, Deep Learning techniques that are heavily used in driverless vehicles, including: Convolutional Neural Networks (CNN), Supervised and Unsupervised Learning, Recurrent Neural Networks.

Transferable skills

Critical Thinking, Problem solving, Communication, Information literacy (research skills), Digital literacy, Professionalism

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Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (10%)
Seminars	5 sessions of 1 hour (3%)
Tutorials	10 sessions of 1 hour (7%)
Other activity	45 hours (30%)
Assessment	75 hours (50%)
Total	150 hours

Private study description

No private study requirements defined for this module.

Other activity description

11 hours for interactive presentations, whole group discussion and small group exercises.
1 hour for module review and PMA introduction.
33 Hours of student self-guided study to prepare for the IMAs. Guidance on topics to be studied is provided during lectures and IMA instructions.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group A1

	Weighting	Study time	Eligible for self-certification
Assessed work as specified by department	70%	75 hours	Yes (extension)
A collection of problems and exercises based on material thaught, which the students are expected to solve with written solution			
In module assessments	30%		Yes (extension)
Based on self-study hours (33 hours), specified in section 5. The marks will be spit between some small written assignments and/or oral presentations.			

Assessment group R

	Weighting	Study time	Eligible for self-certification
Assessed work as specified by department	100%		Yes (extension)
100% Assignment			

Feedback on assessment

Scaled ratings for Comprehension, Effort and Presentation. Individual written feedback and overall mark. Formative assessment during the group activities, tutorials, class quizzes.

Availability

Courses

This module is Core optional for:

- Year 1 of TWMS-H33L Postgraduate Award Smart, Connected and Autonomous Vehicles
- Year 1 of TWMS-H33M Postgraduate Certificate Smart, Connected and Autonomous Vehicles
- Year 1 of TWMS-H33N Postgraduate Diploma Smart, Connected and Autonomous Vehicles
- Year 1 of TWMS-H33P Postgraduate Taught Smart, Connected and Autonomous Vehicles