ES3H3-15 Intelligent System Design

24/25

Department
School of Engineering
Level
Undergraduate Level 3
Module leader
Thomas Popham
Credit value
15
Module duration
15 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES3H3-15 Intelligent System Design

Module web page

Module aims

By the end of the module the student should be able to:

1. Perform end-to-end development of a machine learning system, including: gathering of datasets; model selection and training; and testing of system performance.
2. Apply machine learning techniques to solve real-world problems
3. Apply computer vision techniques for solving problems such as face recognition and motion estimation.

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.

Computer Vision Topics:

- Edges, corners, gradients
- Feature detectors
- Image Filtering and Convolution
- Motion estimation / Tracking
- Object detection
  Machine Learning Topics:
- Linear/Ridge/Lasso Regression
- Model fitting techniques: gradient descent, Newton's method.
- Classification: Logistic Regression, Naive Bayes, GDA
- Neural Networks: Back-propagation, shallow and deep architectures

Learning outcomes

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

- 1. Perform end-to-end development of a machine learning system, including: gathering of datasets; model selection and training; and testing of system performance [C6, M6]
- 2. Select, apply and evaluate machine learning techniques for solving real-world problems [C1, M1, C2, M2, C3, M3, C6, M6, C12, M12]
- 3. Select, apply and evaluate computer vision techniques for solving problems such as face recognition and motion estimation [C1, M1, C2, M2, C3, M3]

Indicative reading list

Lei, B., Xu, G., Feng, M., van der Heijden, F., Zou, Y., de Ridder, D. and Tax, D.M., 2017. “Classification, parameter estimation and state estimation: an engineering approach using MATLAB”. John Wiley & Sons.

- Murphy, Kevin P. “Machine learning: a probabilistic perspective”. MIT press, 2012. · Gomaa, Hassan. “Real-Time Software Design for Embedded Systems”. Cambridge University Press, 2016.

Subject specific skills

Ability to conceive, make and realise a component, product, system or process. Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for, often complex, concepts to become reality. Ability to seek to achieve sustainable solutions to problems and have strategies for being creative and innovative.

Transferable skills

Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions.

Apply problem solving skills, information retrieval, and the effective use of general IT facilities.

Communicate (written and oral; to technical and non-technical audiences) and work with others.

Exercise initiative and personal responsibility, including time management, which may be as a team member or leader

Awareness of the nature of engineering business and enterprise in the creation of economic and social value

Overcome difficulties by employing skills, knowledge and understanding in a flexible manner

Be professional in their outlook, be capable of team working, be effective communicators, and be able to exercise responsibility and sound management approaches.

Study

Study time

Type	Required	Optional
Project supervision	2 sessions of 2 hours (3%)	
Practical classes	13 sessions of 2 hours (17%)	
Online learning (independent)	(0%)	2 sessions of 2 hours
Private study	120 hours (80%)	
Total	150 hours	

Private study description

120 hours guided independent study

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A6

	Weighting	Study time	Eligible for self-certification
Lab Assessment 1 Programming assignment	30%		Yes (extension)
In-class test: Machine Learning Programming test	40%		No

	Weighting	Study time	Eligible for self-certification
Group Project	30%		No

Presentation inc. Demo (15 mins + 5 mins Q&A). Peer assessment.

Feedback on assessment

- Support through advice and feedback hours.
- Written feedback on individual projects
- Written feedback on group projects
- Cohort feedback in lectures on coursework performance

Availability

Pre-requisites

To take this module, you must have passed:

- All of
  - ES2D7-15 Systems and Software Engineering Principles

Courses

This module is Core for:

- Year 3 of UESA-HH35 BEng Systems Engineering
- Year 4 of UESA-HH34 BEng Systems Engineering with Intercalated Year
- UESA-HH31 MEng Systems Engineering
  - Year 3 of HH31 Systems Engineering
  - Year 3 of HH35 Systems Engineering
- Year 4 of UESA-HH32 MEng Systems Engineering with Intercalated Year

This module is Core optional for:

- Year 3 of UESA-H115 MEng Engineering with Intercalated Year
- Year 4 of UESA-HH32 MEng Systems Engineering with Intercalated Year
- Year 3 of UESA-H11L Undergradaute Engineering (with Intercalated Year)

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-H11L Undergradaute Engineering (with Intercalated Year)
  - Year 3 of H11L Engineering (with Intercalated Year)

    - Year 4 of H11L Engineering (with Intercalated Year)

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercalated Year
- Year 3 of UESA-H112 BSc Engineering

This module is Option list B for:

- Year 3 of UCSA-G406 Undergraduate Computer Systems Engineering
- Year 3 of UCSA-G408 Undergraduate Computer Systems Engineering
- Year 4 of UCSA-G407 Undergraduate Computer Systems Engineering (with Intercalated Year)
- Year 4 of UCSA-G409 Undergraduate Computer Systems Engineering (with Intercalated Year)