CS342-15 Machine Learning

20/21

Department
Computer Science
Level
Undergraduate Level 3
Module leader
Victor Sanchez
Credit value
15
Module duration
10 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module aims to provide students with an in-depth introduction to two main- areas of Machine Learning: supervised and unsupervised

Module aims

It will cover some of the main models and algorithms for regression, classification, clustering and probabilistic classification. Topics such as linear and logistic regression, regularisation, probabilistic (Bayesian) inference, SVMs and neural networks, clustering and dimensionality reduction. The module will use primarily the Python programming language and assumes familiarity with linear algebra, probability theory, and programming in Python.

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.

Intro to Supervised/Unsupervised Learning

- `Decision Trees`
- Linear regression: OLS, regularization, linear classifiers

- Logistic Regression, Multi-class logistic regression Ranking Support Vector Machines
- Feature selection latent factor models (PCA)
- Clustering (k-means, soft k-means)
- Ensemble methods such as Random Forest and Ada Boost
- Probabilistic methods (Bayesian view)
- Model evaluation and model selection
- Introduction to neural networks and convolutional neural networks
- Autoencoders

Learning outcomes

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

- Develop an appreciation for what is involved in Learning models from data
- Understand a wide variety of learning algorithms
- Understand how to evaluate models generated from data
- Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

Indicative reading list

- Mitchell T, Machine Learning, McGraw-Hill, 1997
- S. Rogers and M. Girolami, A first course in Machine Learning, CRC Press, 2011
- C. Bishop, Pattern Recognition and Machine Learning, 2007
- D. Barber, Bayesian Reasoning and Machine Learning, 2012
- Duda, Hart and Stork, Pattern Classification, Wiley-Interscience.

Subject specific skills

Understand the concept of learning in computer and science.
Understand the difference between supervised and unsupervised learning.
Understand the difference between machine lea ring and deep learning.
Design and evaluate machine and deep learning algorithms.

Transferable skills

Mathematical analysis of learning methods.
Evaluation of algorithms.
Programming skills in python.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Practical classes	9 sessions of 1 hour (6%)
Private study	111 hours (74%)
Total	150 hours

Private study description

Background reading on wireless networks.
Reading of supplemental material to reinforce the concepts covered in class.
Revision of concepts covered in class.

Costs

No further costs have been identified for this module.

Assessment

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

Students can register for this module without taking any assessment.

Assessment group D1

	Weighting	Study time
Individual practical assignment (4 labs) The practical assessment consists of 4 labs: 1 lab on Principal Component Analysis – 10% 1 lab on Neural Networks – 10% 1 lab on Denoising autoencoders – 10% 1 lab on Convolutional Neural Networks – 10%	40%	
Online Examination Exam	60%	

- Online examination: No Answerbook required
- Students may use a calculator

Assessment group R

	Weighting	Study time
Online Examination - Resit CS342 resit examination	100%	

- Answerbook Pink (12 page)
- Students may use a calculator

Feedback on assessment

Feedback via Tabula for coursework

Past exam papers for CS342

Availability

Pre-requisites

Students must have studied CS130 and CS131 OR CS136 and CS137 or be able to show that they have studied equivalent relevant content.

Courses

This module is Optional for:

- UCSA-G4G1 Undergraduate Discrete Mathematics
  - Year 3 of G4G1 Discrete Mathematics
  - Year 3 of G4G1 Discrete Mathematics
- Year 3 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year
- USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
  - Year 3 of G1G3 Mathematics and Statistics (BSc MMathStat)
  - Year 4 of G1G3 Mathematics and Statistics (BSc MMathStat)
- Year 4 of USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)

This module is Option list A for:

- Year 4 of UCSA-G504 MEng Computer Science (with intercalated year)
- UCSA-G500 Undergraduate Computer Science
  - Year 3 of G500 Computer Science
  - Year 3 of G500 Computer Science
- UCSA-G502 Undergraduate Computer Science (with Intercalated Year)
  - Year 4 of G502 Computer Science with Intercalated Year

    - Year 4 of G502 Computer Science with Intercalated Year
- UCSA-G503 Undergraduate Computer Science MEng
    - Year 3 of G500 Computer Science
    - Year 3 of G503 Computer Science MEng
    - Year 3 of G503 Computer Science MEng
- 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)
- USTA-G302 Undergraduate Data Science
    - Year 3 of G302 Data Science
    - Year 3 of G302 Data Science
- Year 3 of USTA-G304 Undergraduate Data Science (MSci)
- Year 4 of USTA-G303 Undergraduate Data Science (with Intercalated Year)

This module is Option list B for:

- USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
    - Year 3 of GG14 Mathematics and Statistics
    - Year 3 of GG14 Mathematics and Statistics
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)