

# CS342-15 Machine Learning

**24/25**

**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

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## Description

### Introductory description

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

### Module aims

The module covers the main models and algorithms for regression, classification, clustering, and probabilistic classification. Topics such as linear and logistic regression, regularisation, probabilistic (Bayesian) inference, SVMs, neural networks, clustering, and dimensionality reduction are covered. The module primarily uses 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: regularization, linear classifiers

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

## Learning outcomes

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

- Develop an appreciation for what is involved in models that are optimised based on data
- Understand a wide variety of learning algorithms
- Understand how to evaluate models optimised on data
- Understand applications of models to real data and problems.

## 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 science.

Understand the difference between supervised and unsupervised learning.

Understand the difference between machine learning and deep learning.

Design and evaluate machine and deep learning models.

## Transferable skills

Mathematical analysis of learning methods.

Evaluation of algorithms.

Programming skills in python.

## Study

## Study time

<b>Type</b>	<b>Required</b>
Lectures	30 sessions of 1 hour (20%)
Practical classes	8 sessions of 1 hour (5%)
Private study	112 hours (75%)
Total	150 hours

### **Private study description**

Background reading on statistics and probability.  
 Reading supplementary material to reinforce the concepts covered in class.  
 Revision of concepts covered in class.

### **Costs**

No further costs have been identified for this module.

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### **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 D4**

	<b>Weighting</b>	<b>Study time</b>
Individual practical assignment	40%	
Individual practical assignment. This assignment is worth more than 3 CATS and is not, therefore, eligible for self-certification.		
In-person Examination CS342 Exam	60%	

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- Answers provided on Question Paper. No Answerbook required
- Students may use a calculator

#### **Assessment group R3**

	<b>Weighting</b>	<b>Study time</b>
In-person Examination - Resit CS342 resit examination	100%	

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

## Feedback on assessment

Feedback via Tabula for coursework

[Past exam papers for CS342](#)

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## Availability

### Pre-requisites

Students must have studied CS130 and CS131 OR CS146 and CS147 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-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- 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)
- USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
  - Year 4 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
  - Year 5 of G1G4 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
- 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:

- 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-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)