1. **Title of the module**

MAST9420 (MA942) Data Science with R

1. **School or partner institution which will be responsible for management of the module**

School of Mathematics, Statistics and Actuarial Science

1. **The level of the module (e.g. Level 4, Level 5, Level 6 or Level 7)**

Level 7

1. **The number of credits and the ECTS value which the module represents**

15 credits (7.5 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Autumn

1. **Prerequisite and co-requisite modules**

Pre-requisite: None.

Co-requisite: None

1. **The programmes of study to which the module contributes**

MSc in Applied Actuarial Science also with Industrial Placement and International Masters

MSc in Statistics also with Industrial Placement and International Masters

MSc in Statistics with Finance also with Industrial Placement and International Masters

1. **The intended subject specific learning outcomes**

**On successfully completing the module students will be able to:**

* 1. demonstrate systematic understanding of the concepts involved in machine learning;
  2. demonstrate the capability to solve complex problems using a high level of skill in calculation and manipulation of the material in the following areas: Supervised learning with R; data science for actuarial science, finance and other areas.
  3. apply a range of concepts and principles in supervised learning in loosely defined contexts, showing good judgement in the selection and application of tools and techniques.

1. **The intended generic learning outcomes.**

**On successfully completing the module students will be able to:**

* 1. work competently and independently, be aware of their own strengths and understand when help is needed;
  2. demonstrate a high level of capability in developing and evaluating logical arguments;
  3. communicate arguments confidently with the effective and accurate conveyance of conclusions;
  4. manage their time and use their organisational skills to plan and implement efficient and effective modes of working;
  5. solve problems relating to qualitative and quantitative information;
  6. make effective use of information technology skills such as online resources (Moodle), internet communication;
  7. communicate technical and non-technical material effectively;
  8. demonstrate an increased level of skill in numeracy and computation;
  9. demonstrate the acquisition of the study skills needed for continuing professional development.

1. **A synopsis of the curriculum**

Introduction: Machine learning anddata visualisation with R.

Classification and prediction: Generalised linear model (GLM), linear discrimination analysis (LDA), k-nearest neighbors (KNN). R-based worked examples.

Resampling methods: Cross-validation (CV) and bootstrap. R-based worked examples.

Regression tree-based methods: Classification and regression trees (CART), bagging, random forests and boosting. R-based worked examples.

Support vector machines (SVM): Support vector classifier, regression SVM. R-based worked examples.

Machine Learning in Action:

(a) Biomedical and health data analysis;

(b) Bond default data analysis;

(c) Insurance data analysis;

(d) Financial data analysis;

(e) Other big data analysis.

1. **Reading List (Indicative list, current at time of publication. Reading lists will be published annually)**

Bishop, C. M. (2006), Pattern Recognition and Machine Learning. Springer, New York

James, G, Witten, D., Hastie, T., Tibshirani, R. (2013) Introduction to Statistical Learning. Springer, New York.

Sweeting, P. (2011) Financial Enterprise Risk Management. Cambridge University Press. Cambridge.

1. **Learning and Teaching methods**

Total contact hours: 44 hours

Private study hours: 106 hours

Total number of study hours: 150 hours.

1. **Assessment methods.**

13.1 Main assessment methods

Assessment 1: Computer exercises requiring approximately 10-15 hours to complete 10%

Assessment 2: Computer exercises requiring approximately 10-15 hours to complete 15%

Examination: 2 hours 75%

13.2 Reassessment Methods

Like-for-like.

1. **Map of Module Learning Outcomes (sections 8 & 9) to Learning and Teaching Methods (section12) and methods of Assessment (section 13)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | 8.1 | 8.2 | 8.3 | 9.1 | 9.2 | 9.3 | 9.4 | 9.5 | 9.6 | 9.7 | 9.8 | 9.9 |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |
| Private Study | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Lectures/Exercise Classes/terminal sessions | **X** | **X** | **X** |  | **X** | **X** |  | **X** |  | **X** | **X** |  |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |  |
| Examination | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** | **X** |
| Assessment 1 | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Assessment 2 | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |

1. **Inclusive module design**

The School recognises and has embedded the expectations of current disability equality legislation, and supports students with a declared disability or special educational need in its teaching. Within this module we will make reasonable adjustments wherever necessary, including additional or substitute materials, teaching modes or assessment methods for students who have declared and discussed their learning support needs. Arrangements for students with declared disabilities will be made on an individual basis, in consultation with the University’s disability/dyslexia student support service, and specialist support will be provided where needed.

1. **Campus(es) or Centre(s) where module will be delivered:**

Canterbury

1. **Internationalisation**

This module covers key principles, theories and concepts of finance that are used in a global environment. Mastery of the subject-specific learning outcomes, 8.1 to 8.3, will equip students to apply these principles, theories and concepts in a wide range of international contexts. The module team is drawn from the School of Mathematics, Statistics and Actuarial Science, which includes many members of staff with international experience of teaching, research collaboration and of working in relevant industrial contexts.

Examples covering various international applications are included in the module where appropriate.

**FACULTIES SUPPORT OFFICE USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs( Q6&7 cover sheet) |
|  |  |  |  |  |
|  |  |  |  |  |