MODULE SPECIFICATION – UNDERGRADUATE PROGRAMMES

KEY FACTS

Module name	Advanced Machine Learning for Finance
Module code	IF3114
School	the Business School
Department or equivalent	UG Programme
UK credits	15
ECTS	7.5
Level	6
Delivery location (partnership programmes only)	

MODULE SUMMARY

Module outline and aims

Modern technologies have generated big data at an unprecedented scale and speed, which has spurred remarkable progress in high-dimensional statistical research and offers alternative solutions to some prominent financial research questions facing the "curse of dimensionality". The finance and banking industries are increasingly using machine learning methods to take data-oriented decisions. This module builds on the fundamental concepts of machine learning learnt in stage 2 and their usefulness in analysing financial data. It is designed to introduce you to some advanced machine learning tools used in the finance industry. The lectures will be based around case studies which will be demonstrated in Python or R.
Coursework will require you to adapt and extend the code provided during the lectures and to carry out a machine learning project from scratch.
The course is focused mainly on practical aspects of machine learning, but some relevant theory will be discussed. This course requires students to have good understanding of econometrics and introduction to machine learning and strong interest in coding.

Content outline

- Trees, random forests, gradient boosting and ensembles
- Unsupervised learning including PCA
- Neural networks and deep learning
- Online learning (vowpal wabbit)
- Text mining and NLP
- Autoencoder
- Reinforcement Learning.

The above lists are indications only, they are not exhaustive and not all of the items will be covered.

To enhance your learning experience the module is designed to reflect contemporary issues in the financial world. As such, a degree of flexibility is expected in the exact content in terms of scope and coverage to ensure relevance to current circumstances.

Pre-requisite modules:
FR2107 Financial Econometrics and IF2211 Machine Learning for Finance

WHAT WILL I BE EXPECTED TO ACHIEVE?

On successful completion of this module, you will be expected to be able to:

Knowledge and understanding:

- Formulate, critique and apply appropriate machine learning models

- Compare techniques for estimating models and select the most appropriate for forecasting

- Evaluate the validity of an application of a model to a particular set of data and interpret your findings

Skills:

- Critically evaluate existing empirical research in finance

- Develop foundations for further study in big data analytics

Values and attitudes:

- Appreciate the implications of appropriately analysing data and of reporting results in an unbiased and transparent fashion. Learn to make the data speak
- Demonstrate an appreciation of ethical issues as they relate to both the subject matter and the wider business world

HOW WILL I LEARN?

A variety of learning and teaching methods will be used in this course.

Lectures are used to introduce context, concepts and techniques illustrated with practical and current examples. You will also have the opportunity to participate in class discussions and work through examples and exercises with the support of the lecturer. It is strongly recommended that you attend ALL lectures.

In addition, there will be regularly scheduled computer labs. The latter are intended to demonstrate the use of Matlab/R and Python for the practical implementation of the material covered during the lectures using a data set provided by the lecturer. The course is highly participative; there will be exercises on the development of empirical

models coherent with financial data and on the explanation of estimation outputs. You are also expected to devote an equivalent amount of learning time in private and/or group study and to work on the suggested exercises on a weekly basis.

Key learning and teaching resources will be put on the module website on Moodle.

Self-directed learning hours are for independent study and account for the **minimum** amount of time you should spend studying independently. For example, carrying out subject research, practicing and reflecting on techniques learned in class, reading widely around the subject to develop a deeper understanding, carrying out activities using the VLE, attending induction and career development workshops, working in groups to complete assignments and presentations, and completing individual assignments and other homework.

Teaching pattern:

Teaching component	Teaching type	Contact hours	Self-directed study hours	Placement hours	Total student learning hours
Lectures	Lecture	8	100	0	108
Lab Session	Practical classes and workshops	14	28	0	42
Totals		22	128	0	150

WHAT TYPES OF ASSESSMENT AND FEEDBACK CAN I EXPECT?

Assessments

This module is assessed by Coursework only

Coursework will consist in writing Matlab/R/Python code for a machine learning applied finance question provided by the module leader . The code will be submitted via Moodle..

Assessment pattern:

Assessment component	Assessment type	Weighting %	Minimum qualifying mark	Pass/Fail?
Coursework	Set Exercise	100	40%	N/A

Assessment criteria

Assessment criteria are descriptions of the skills, knowledge or attributes you need to demonstrate in order to complete an assessment successfully and Grade-Related Criteria are descriptions of the skills, knowledge or attributes you need to demonstrate to achieve a certain grade or mark in an assessment. Assessment Criteria and Grade-Related Criteria for module assessments will be made available to you prior to an assessment taking place. More information will be available in the UG Assessment Handbook and from the module leader.

Feedback on assessment

Following an assessment, you will be given your marks and feedback in line with the University's Assessment Regulations and Policy. More information on the timing and type of feedback that will be provided for each assessment will be available from the module leader.

Assessment Regulations

The Pass mark for the module is 40%. Any minimum qualifying marks for specific assessments are listed in the table above. The weighting of the different components can also be found above. The Programme Specification contains information on what happens if you fail an assessment component or the module.

INDICATIVE READING LIST

Latest editions of:

Hastie, T., Tibshirani, R. and Friedman, J., 2009. *The elements of statistical learning: data mining, inference, and prediction*. Springer Science & Business Media.

Version: 1.0
Version date: Feb 2023
For use from: 2023-24

Appendix:

Please complete the following table which is required for correct set up on SITS, and for external reporting. Further information is available on HESA Cost Centres (here) and HECoS Codes (here). Guidance is also available in the Quality Manual.

CODES		
HESA Codes	**Description**	**Price Group**
133	Business and Management Studies	D
HECOS Codes	**Description**	**Percentage (%)**
100992	The study and development of techniques whereby machines may gain knowledge through experience, deduction or reasoning.	100