Module Definition Form (MDF)

Module code: MOD009701	**Version:** 1 **Date Amended:** 07/Feb/2024

1. Module Title
Machine Learning in Finance

2a. Module Leader
Vitaliy Milke

2b. School
School of Computing and Information Sciences

2c. Faculty
Faculty of Science and Engineering

3a. Level
7

3b. Module Type
Standard (fine graded)

4a. Credits
15

4b. Study Hours
150

5. Restrictions

Type	Module Code	Module Name	Condition
Pre-requisites:	None		
Co-requisites:	None		
Exclusions:	None		
Courses to which this module is restricted:	None		

LEARNING, TEACHING AND ASSESSMENT INFORMATION

6a. Module Description

Algorithmic trading has long been a dominant part of activity in the financial and securities markets. In recent years, machine learning and elements of artificial intelligence have been added to standard econometric algorithmic trading approaches. Machines analyse market behaviour, recognise patterns for successful trading, analyse text and video news, and calculate risks.

Most state-of-the-art innovations, including AI, are first tested in financial and stock markets. This module is an introduction to the wide variety of research approaches to analysing stocks, currencies, commodities, cryptocurrencies, futures and other derivatives using machine learning. It uniquely combines a clear introduction to the financial instruments with advanced code for intraday, HFT and swing types of algorithmic trading.

The module will primarily use the Python programming language and assumes familiarity with basic linear algebra, probability theory, and programming in Python.

The practical sessions include working with real-world financial data for machine and deep learning. You will gain hands-on introductory experience as a Quant researcher at a hedge fund, clearing and analysing datasets and even creating and implementing trading models and calculating risks. You will get a chance to present your learnings as reports or presentations.

6b. Outline Content

The Machine Learning in Finance module will cover the following sections:

- Introduction to financial markets and securities. Introduction to financial and stock market data: obtaining data and advanced visualisation.
- Financial data preprocessing.
- Automation of trading using popular financial frameworks. Using APIs for direct access to stock exchanges and brokers.
- Hierarchical clustering of different financial markets' behaviours based on Unsupervised Learning,
- Trading volatility in financial markets.
- Intraday trading and pattern recognition using CNNs and RNNs.
- Swing trading with machine learning, risk management and money management. Machine learning and cryptocurrencies: systematic risks, financial fraud and trading behaviour strategies.
- Introduction to High-Frequency Trading (HFT). Financial market microstructure. Testing trading strategies using machine learning. Financial error metrics and efficiency ratios.
- Reducing biases and overfitting in machine learning return predictions.
- NLP and Generative neural networks for financial markets.

6c. Key Texts/Literature

The reading list to support this module is available at: https://readinglists.aru.ac.uk/

6d. Specialist Learning Resources

Laboratory with computers and relevant software packages

7. Learning Outcomes (threshold standards)		
No.	**Type**	**On successful completion of this module the student will be expected to be able to:**
1	Knowledge and Understanding	Demonstrate understanding of machine learning, data mining and AI techniques principles, focused on financial and stock market analysis using fintech frameworks and technologies.
2	Knowledge and Understanding	Critically analyse the risks as well as advantages and disadvantages of various machine learning methods for financial analysis and trading behaviour.
3	Intellectual, practical, affective and transferrable skills	Demonstrate skills in using and implementing machine learning and analytical techniques to solve practical problems in finance and trading using real financial datasets.
4	Intellectual, practical, affective and transferrable skills	Apply the acquired toolset to design, develop, evaluate, troubleshoot and optimise end-to-end machine learning solutions to real-world problems in finance.

8a. Module Occurrence to which this MDF Refers				
Year	**Occurrence**	**Period**	**Location**	**Mode of Delivery**
2026/7	ZZF	Template For Face To Face Learning Delivery		Face to Face

8b. Learning Activities for the above Module Occurrence			
Learning Activities	**Hours**	**Learning Outcomes**	**Details of Duration, frequency and other comments**
Lectures	12	1-4	Lecture 1 hr x 12 weeks
Other teacher managed learning	12	1-4	Practical 1 hr x 12 weeks
Student managed learning	126	1-4	Self-study and research. Online course materials, supporting lectures, supplementary reading and tutorials are provided on Canvas.
TOTAL:	150		

9. Assessment for the above Module Occurrence

The assessment for some modules includes a presentation (see below for details on how this particular module is assessed). We recognise that presenting, especially to a large group, can cause significant anxiety or distress for some students. If this may affect you, please contact your Module Leader or the Disability and Neurodiversity Service as early as possible. We will work with you to consider appropriate reasonable adjustments. Depending on your individual needs, these might include, for example, presenting to a smaller group or presenting only to a member of academic staff.

Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
010	Practical	1-4	50 (%)	Fine Grade	40 (%)
Timed in-class test, 45 mins, 1000 words equiv.					

Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
011	Coursework	1-4	50 (%)	Fine Grade	40 (%)
Coursework (Report/Project), 1,500 words equivalent					

In order to pass this module, students are required to achieve an overall mark of 40% (for modules at levels 3, 4, 5 and 6) or 50% (for modules at level 7*).

In addition, students are required to:
(a) achieve the qualifying mark for each element of fine graded assessment as specified above
(b) pass any pass/fail elements

[* the pass mark of 50% applies for all module occurrences from the academic year 2024/25 – see Section 3a of this MDF to check the level of the module and Section 8a of this MDF to check the academic year]