Department of Computer Science and Information Systems

MSc CS Project Form

Consult the MSc CS programme intranet page for information about the project. The assessment criteria which examiners apply are reproduced in Section 4 at the end of this form.

1. Brief proposal

After agreeing on a title and brief outline of a project with a supervisor, the student should complete part 1 of this form. There are default values for the weights of the marking aspects for both the proposal and the report. They can be altered in agreement with the supervisor for both the extended proposal (Section 2a and 2b) and the final project (Sections 3a, 3b and 3c). The weights must stay within the ranges given in brackets and must add up to 100. Students should upload the completed form to Moodle. See the programme intranet for more details.

Student details

Student ID	13131340
Name	Edward Gill
Programme	MSc Data Science
Supervisor	George Magoulas
Email	egill12@dcs.bbk.ac.uk

Project details

Title: The Applicability of Machine Learning Methods For Currency Trading

Proposal outline (approximately 200 words):

The availability of immense computing power has opened a veritable Pandora's box of highly complex and computationally intensive models which can now be applied to any dataset, whether appropriate or not. While machine learning models have led to rapid and impressive use cases across a host of different fields of research, this paper will focus on one oft researched area, global financial markets and specifically currency markets.

Applying complex methods within the financial domain will require a different approach from other datasets given the inherent non-stationarity and noisiness of financial time series. The aim of this project is to build on existing research and try to gauge the efficacy of applying machine learning methods to the investment process. This paper will explore various machine learning techniques to assist with the problem of currency forecasting across various time frequencies, whether by using a combination of models to handle different aspects of the trade generation process or as an outright prediction model.

Work plan:

The main aim of the project is to understand how machine learning methods can be applied to currency

forecasting and the classification of macroeconomic regimes in which a particular model (or combination of models) may perform best. The work plan & objectives are described below.

Data Retrieval, Cleaning and Standardisation
One of the most important aspects of a trading model is to ensure that the underlying data is of high quality and doesn't contain erroneous values. The proposed model will use hourly spot exchange rates for G10 currencies, various economic data from the Federal Reserve Economic Database (FRED), the International Monetary Fund (IMF) and the Organisation for Economic Cooperation and Development (OECD) will be used to try to uncover exploitable patterns in the data.
\item This data will also need to be cleaned and mapped to correct date scales so that the model only uses data available at the time of trade signal generation. The raw data itself will need to be standardised to allow the model to understand the true relationships between the features and the output.

Feature Extraction
Feature extraction for financial time series prediction is a very challenging task and given the inherent noise in the data, including features which have an intuitive justification for predicting future prices is important \cite{Arnott2018}. Feature selection driven by mining the training set greatly increases the risk of overfitting and should be avoid when working with financial times series.

Model Training and Architecture Selection
The project itself will test the efficacy of a range of algorithms in trying to predict currency movements, this project will also make use of non price data in order to assist the model in understanding potential regime changes in the trading environment.

Model Validation and Strategy Backtesting
Once a model architecture has been selected, it is important to understand not only classification rates but also how the model would perform in a live market setting. This can be approximated by creating a back testing framework which depicts the models trading performance and also includes the impact of transaction costs.

Testing on Fully Withheld Data
While the test data allows us to understand how the model performs, there will also be an opportunity to analyse how the selected model will work on new unseen data which would provide a useful guide to model generalisation in the future.

Departmental equipment/software required (contact the Systems Group for advice):

Python, Pandas, Numpy,Sci-Kit Learn, Keras, TensorFlow, LaTex

Weights agreed with supervisor: yes

All ethical issues are routine (agreed with supervisor): yes

If ethical issues are not routine, an ethics review form will need to be completed and submitted to the Postgraduate administrator (pg@dcs.bbk.ac.uk) who will forward it to the Department's ethics officer for consideration. The form is available on the research intranet page.

2a. Assessment of the Extended Proposal – Supervisor

The supervisor and second marker should complete the appropriate section of this form. The weighting for each aspect (e.g. 35 for background research) is agreed between the student and supervisor, and can only be altered subsequently by providing a justification. The weights must stay within the ranges given and must add up to 100. Assign a mark for each aspect (e.g. 25 out of 35 for background research) and add these up to give the total mark. **Justify your marks** by writing comments on each aspect for consideration by the examination board and External Examiners. **Separately**, provide an overall evaluation below the table as feedback for the student. Send the completed form to the programme administrator (pgadmin@dcs.bbk.ac.uk).

Supervisor:	**Date returned**:

Aspects	**Comments**	**Weight**	**Mark**	**Revised mark**
Background research		35 (30-40)		
Presentation of the problem – aims and objectives		15 (10-20)		
Plan for developing the solution		30		
Presentation of the proposal		20		
Total	(Add justification for revised marks here if applicable.)	100		

Comments to student:

2b. Assessment of the Extended Proposal – Second marker

Second marker:	**Date returned**:

Aspects	**Comments**	**Weight**	**Mark**	**Revised mark**
Background research		35 (30-40)		
Presentation of the problem – aims and objectives		15 (10-20)		
Plan for developing the solution		30		
Presentation of the proposal		20		
Total	(Add justification for revised marks here if applicable.)	100		

Comments to student:

3a. Assessment of the Report – Supervisor

Complete the appropriate section below (supervisor, second marker, third marker). The supervisor must confirm the date that a running version of the software developed by the student was demonstrated to you. The weighting for each aspect (e.g. 30 for implementation) is agreed between the student and supervisor, and can only be altered subsequently by providing a justification. The weights must stay within the ranges given and must add up to 100. Assign a mark for each aspect (e.g. 20 out of 30 for implementation) and add these up to give the total mark. **Justify your marks** by writing comments on each aspect for consideration by the examination board and external examiners. **Separately**, provide an overall evaluation below the table as feedback for the student. Send the completed form to the programme administrator (pgadmin@dcs.bbk.ac.uk).

Supervisor:	**Date returned**:
I confirm that a running version of software developed by the student has been demonstrated to me on the date shown.	**Date software demonstrated:**

Aspects	**Comments**	**Weight**	**Mark**	**Revised mark**
Specification and design		20 (10-30)		
Implementation, or execution of research		30 (20-40)		
Testing, results, analysis, critical evaluation		30		
Presentation and completeness of report, documentation		20		
Total	(Add justification for revised marks here if applicable.)	100		

Comments to student:

3b. Assessment of the Report – Second marker

Second marker:	**Date returned**:

Aspects	**Comments**	**Weight**	**Mark**	**Revised mark**
Specification and design		20 (10-30)		
Implementation, or execution of research		30 (20-40)		
Testing, results, analysis, critical evaluation		30		
Presentation and completeness of report, documentation		20		
Total	(Add justification for revised marks here if applicable.)	100		

Comments to student:

3c. Assessment of the Report – Third marker

Second marker:	**Date returned**:

Aspects	**Comments**	**Weight**	**Mark**	**Revised mark**
Specification and design		20 (10-30)		
Implementation, or execution of research		30 (20-40)		
Testing, results, analysis, critical evaluation		30		
Presentation and completeness of report, documentation		20		
Total	(Add justification for revised marks here if applicable.)	100		

Comments to student:

4. Assessment Criteria

To **pass (at least 50%)** a project the markers assess whether the project proposal and project report meet the following criteria. They also assess any other aspect of special relevance for the project.

Project Proposal:

- *Background research*: Potential approaches are reviewed and evaluated.
- *Presentation of the problem – aims and objectives*: The proposal specifies a suitable problem, and discusses its requirements.
- *Plan for developing the solution*: A suitable development/research method is chosen. The project is broken down into manageable chunks.
- *Presentation of the proposal*: Assessed as for the report – see below.

Project Report:

- *Specification and design*: Before starting the implementation, a specification and design of the system/software is laid out.
- *Implementation, or execution of research*: The key stages of the implementation/research are explained. The implementation/research is sound.
- *Testing, results, analysis and critical evaluation*: The report attempts to provide a clear and justified reflection upon the contribution and its limitations. It discusses how the software meets the specified requirements. A running version of the software is demonstrated to the supervisor (and an executable/source code on CD/DVD is turned in with the report).
- *Presentation of the proposal/report and documentation*: These are coherent in style and structure. They clearly communicate the student's contribution to the reader.

For a **distinction (at least 70%)**, a student would have to attempt a challenging project (this should be discussed and agreed with the potential supervisor) and gain a high grade under each of the above headings. To award a distinction the markers assess the report according to the following criteria:

Project Proposal:

- *Background research:* The student shows a clear understanding of the researched material. Potential approaches are reviewed and critically evaluated, highlighting strengths and weaknesses of each.
- *Presentation of problem – aims and objectives*: A challenging problem is specified and clearly outlined: this includes its context and the technical/user requirements.
- *Plan for developing the solution*: An appropriate development/research method is chosen and its suitability is well-justified. The project is broken down into subtasks that are logically coherent. In the case of unknowns (e.g. open research questions) "fallback" plans are laid out.
- *Presentation of the proposal*: Assessed as for the report – see below.

Project Report:

- *Specification and design*: The specification and design of the system/software shows a clear understanding of what needs to be done to meet the requirements, and is well-rounded, i.e. the components fit together in a coherent way.
- *Implementation, or execution of research*: The key stages of the implementation/research are clearly explained. The implementation/research is done to a high standard.
- *Testing, results, analysis and critical evaluation*: The solution demonstrates real insight into the problem/research question. There is clear and justified reflection upon the

contribution and its limitations. The key results are accurately analysed and their relevance is explained. It is discussed how the software meets the specified requirements and is shown to be reliable. The author critically assesses the results and draws relevant conclusions from the study. A running version of the software is demonstrated (as above).

- *Presentation of the proposal/report and documentation*: Complex issues are explained clearly and concisely. The content is well-organised and structured in a way that demonstrates the links between the concepts presented. The proposal/report shows that the student clearly understands the researched material. The solution and any other claims made by the students are well-justified. The author uses various resources and cites relevant resources using an appropriate consistent referencing style. The proposal/report is of professional quality and contains very few, ideally no, typographic errors.

Work that meets some, but not all, of the criteria for distinction may be considered for a **merit (between 60% and 69%)**. A merit might be awarded for a respectable, if only partially successful, attempt at a challenging project, or for a less ambitious project carried out, and written up, to a high standard.

The separate examiners grade the project independently and then meet to arrive at an agreed grade. Students may be called upon to make a presentation of their projects to a sub-committee of the Examination Board to demonstrate their grasp of the material.