



**L-Università  
ta' Malta**

## **Intelligent Algorithmic Trading Assignment**

The goal of this project is to develop an autonomous system for autonomous trading. The idea is to apply **ONE** artificial intelligence / machine learning (ML) algorithm of your choice to investigate claims that when these techniques are used for trading purposes, they can improve on standard technical trading approaches. At a high level, the objectives of this assignment are the following:

1. Pick a popular technical trading strategy based on technical indicators or charts. Typically, the strategy should be composed in a combination of technical indicator rules (e.g. trend, volume and volatility indicators) or else follows a charting strategy (e.g. Candle stick patterns). \*
2. Investigate the performance of your trading strategy without the use of AI/ML.
3. Select a metaheuristic or a ML model (or a combination of) and indicate how they can be used in conjunction with your selection in step one to improve trading performance.

\*Optionally, students who are interested in portfolio management might opt for a portfolio optimisation problem, using standard Markowitz model as the benchmark.

### Deliverables

You are expected to provide your assignment in the form of a paper applying a format using Latex (apply IEEE format, available online). It is expected that the paper is 10-12 pages in length, including references.

In addition to the paper, you are expected to submit a separate word document or jupyter notebook that includes the code (documented, inline, as required).

### Format

As an indication, your paper is expected to follow this structure (you can create further sub-sections if you deem that the outcome will make the paper more readable and structured):

1. Abstract
  - Not more than 100 words description of your work
2. Introduction
  - Discuss the theoretical difficulties to predict markets from finance literature. In this section also refer to claims from other papers with regard to profitability (or not) of technical analysis / indicators.
  - Briefly discuss and refer to findings from other recent work in general from the AI/ML field in this domain.

- Define objectives. Explain what you are trying to optimise (profit? Risk? Both?). Why have you selected this objective function?
- What instrument/s and period will you be testing? Provide your reasoning behind this selection. It is suggested that a selection of not less than 10 instruments is selected (e.g. a mix of stocks, or currencies, or futures, or ETFs).
- Explain briefly the approach (regression? Classification? Hybrid model?). Also, provide your reasoning on why you have chosen the specific method. In your explanation, describe briefly the dependent and independent variables that you decide to apply later.
- Briefly explain and refer to other work in this area, in particular with respect to your ML model of preference.
- Explain possible existing gaps in other papers and how you intend to differentiate.
- Explain the main contributions of your work.

### 3. Literature Review

- Expand on findings from other recent work in general from the AI/ML field in this domain.
- Expand on other work in this area with respect to your AI/ML model of preference.
- In your references and descriptions, provide a critical analysis of this work, indicating, possibly, any gaps or “weaknesses” that will be addressed in your approach.

### 4. Method

- Brief overview of approach
- Models Description - Detailed explanation of your chosen dependent variable and features (e.g. technical indicators / charts), the selected AI/ML model and the mathematical underpinnings (in the context of your applied specific model and experiment described in the paper). Your description should also explain feature selection and any data pre-processing methods applied and the rationale behind choosing the specific methods.
- Configurations and Parameters that will be tested (both for vanilla technical indicators, or charts, and for the AI/ML model), including the rationale why these were selected and how they will be optimised in-sample prior to out-of-sample testing. It is expected that the AI/ML model will combine/make use of the vanilla technical indicators/charts in order to be able to compare the benchmark model without AI/ML and then the possible AI/ML improvements.
- Model evaluation – how you intend to evaluate the chosen technical indicators and AI/ML model. Also, include a description of the data that you will be using for your experiment, including the underlying distributions. The number and selection of instruments (stocks, forex, etc) should be representative enough to build solid arguments. Your description should also include your rationale in choosing the specific instruments. It is expected that **2019 data is utilized only for out-of-sample testing** (out-of-sample testing should at least cover 6 months, preferably a year).
- Description of your trading algorithm, applied trading strategy and constraints. It is expected that the vanilla chart patterns / technical indicators model and the AI/ML model use a similar trading algorithm in order to be able to compare both models on the same grounds.

## 5. Results and Evaluation

- Present and discuss results from standard technical indicators and other benchmark models (e.g. buy and hold, random model).
- Present and discuss results from the AI/ML model (individually or in conjunction with, depending on approach).
- Discuss variations between the two models, attributing any benefits (or not) from your suggested AI/ML model.
- In view of the results Re-iterate/re-validate the contributions that were identified in section 2.

## 6. Conclusion

- Summarize experiments, findings and main contributions.

## 7. References