The Blavatnik School of Computer Science and AI
The Raymond and Beverly Sackler Faculty of Exact Sciences
TEL AVIV UNIVERSITY

Project Proposal

First Option : Stocks Prediction

Workshop in Data Science

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Background & Topic

Motivation for this task

- **Short-term** decision making in trading
- **Evaluating** ML performance on noisy time-series data

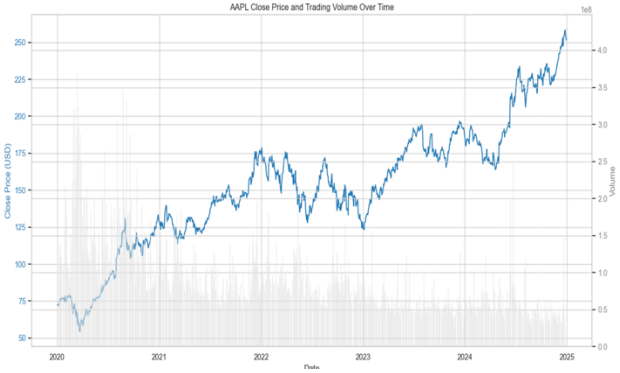
The Task

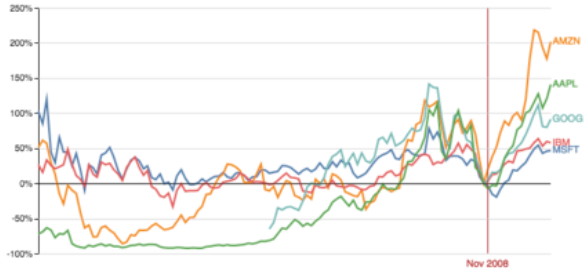
Binary Classification based on the past data, **predict** if Apple's stock will **increase** or **decrease** in the future .

Main dataset
Yahoo Finance's API- Apple's Stock

Additional dataset
Other Stocks

Additional dataset
Google News



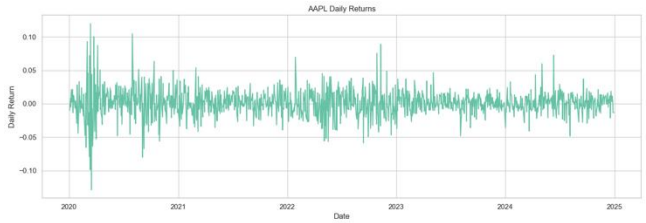


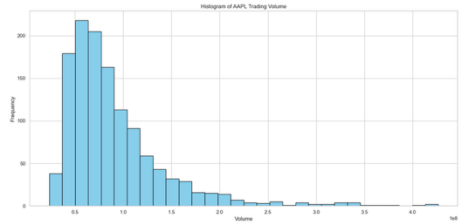
Google News

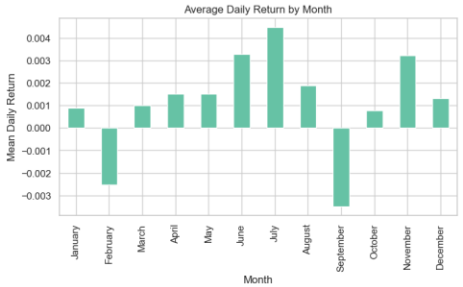
Feasibility Analysis

Initial Data Exploration

- **Total Samples:** 1275 t.s. for each stock
- **Core Features:** Open, Close, High, Low, Volume

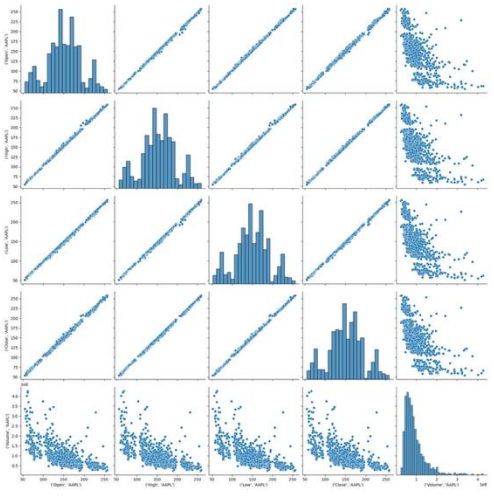






Expected Challenges:

- **Feature Engineering -** Daily return, Moving Average, Volatility etc.
- **Seasonality**
- **News Sentiment Analysis**

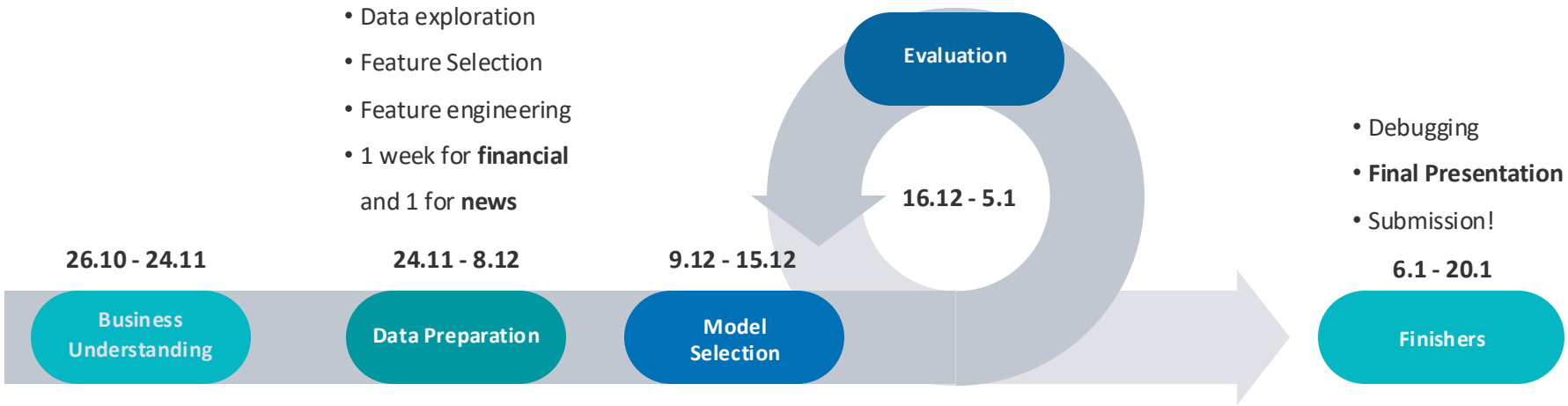


Why is this Feasible?

- **Classification and not exact price**
- **Highly-documented data**

Methodology

Project Work Plan



Success Criteria

- **Accuracy prediction- 55%–60%**
- **Feature engineering-** features improve the model and have a meaning
- **Stability Over Time-** across different years

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Second Option :
Detecting Autism Patterns in Brain Signals

Beyond Static Averages: Quantifying Temporal Dynamics in Calcium Imaging

Background & Topic

The Biological Problem

- **Context:** Shank3 mutation cause Autism.
- **Discovery:** Recent reveals this mutation affects OPC cells.
- **The Phenomenon:** Mutant cells exhibit a "Fading Phenotype"

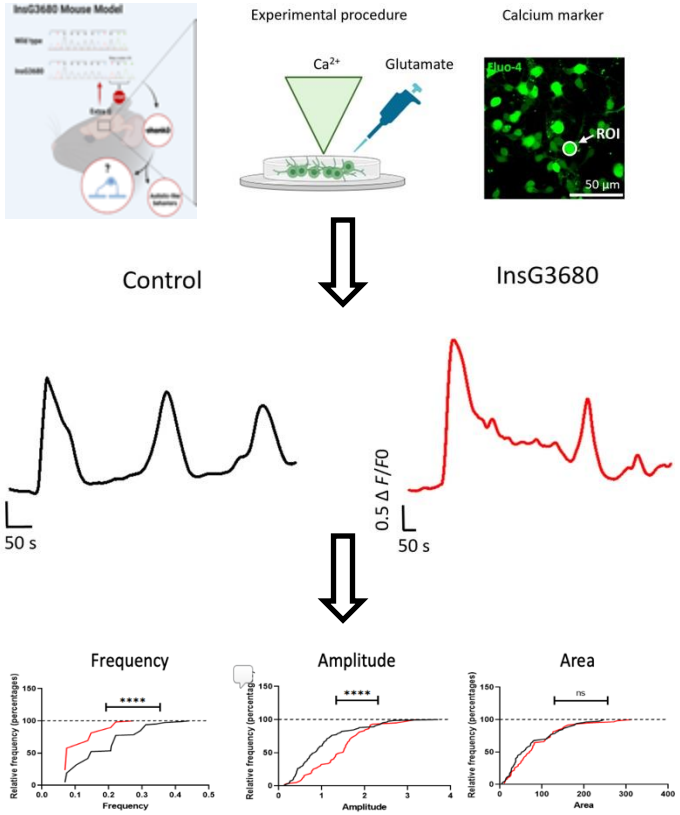
The Task

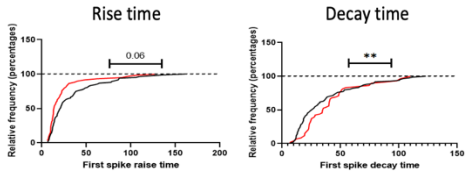
Supervised Binary Classification: Predict WT vs. Mutant .

Source	Data Type	Dimensions
Boaz Barak's Lab	Time-Series (Calcium Traces)	810 Frames (15 min) x 1000 ROIs

The Baseline

- **Existing analysis:** relies on static averages
- **The Current Limitation:** High information loss.



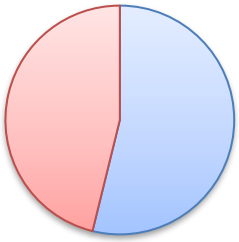


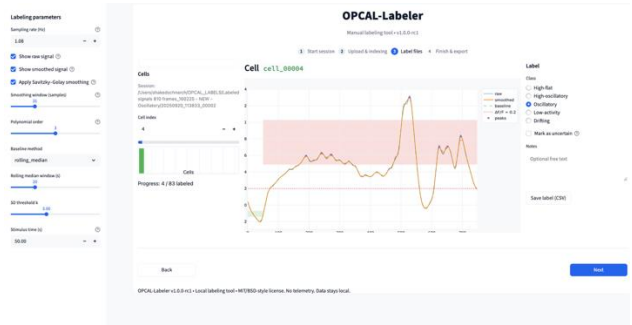
Feasibility Analysis

Curation Pipeline:

Initial Data Exploration

- **Total Samples (ROIs):** N = 4,600
- **Time Series Length:** 810 frames (15 mins) @ 1.1s interval.
- **Key Event:** Glutamate Injection at frame ~102.





Our DS Innovation: Temporal Feature Engineering

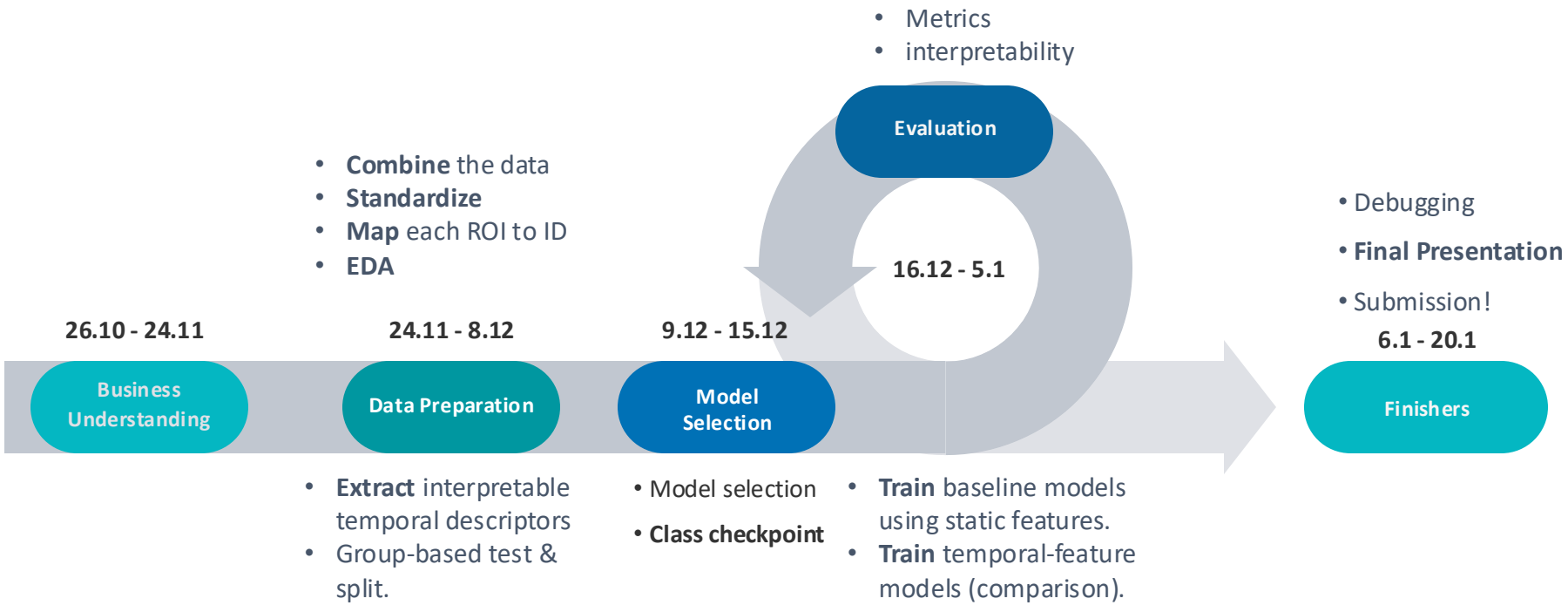
- **Proposed Features**: Decay Slope (rate of decline), Early-vs-Late activity ratio, Stability across time.
- **Group-level split** by animal to prevent data leakage.

Why is this Feasible?

- **Scientific Validity:** The "Fading" effect is a documented biological mechanism.
- **Baseline Evidence:** Baseline showed that even simple achieve partial separation.

Methodology

Project Work Plan



Success Criteria

- **Quantitative:** Improvement over the static baseline.

  Better generalization across animals in group-based test splits.
- **Qualitative :** Identification of **new** temporal features that capture the fading signature.

Stocks vs. Brain Signals

Stocks

- ✓ Excellent documentation and reliable API
- ✓ Include data integration between two data sources
- ✓ Feasible and intuitive
- ✗ Hard to achieve strong results
- ✗ Complex feature engineering
- ✗ Train-test split

Brain Signals

- ✓ Clear and well-justified scientific value
- ✓ Highly feasible classification task
- ✓ Chance of clear and strong results
- ✗ Domain-specific challenge
- ✗ Hard to visualize for general audience
- ✗ Train-test split

Preference: focus on stocks