# High-Frequency Trading Data Forecasting Model using Quantum-based Approach

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**Introduction:** High-frequency trading (HFT) is a specialized form of algorithmic trading, which represents a major advancement in the trading landscape in recent years. Algorithmic trading allows traders to execute or receive orders within very short time frames, sometimes measured in minutes or even seconds [1]. The core of high-frequency trading relies on high-speed data feeds that provide real-time information and facilitate rapid trade execution for HFT participants. However, conventional time series forecasting methods struggle to account for seasonality and outliers in the data. Support Vector Machine model that forms a hyperplane (between upper and lower boundary of data range to find the most optimized bridge or margin) via kernel which will be used as the foundation for forecasting embedded with quantum computation. SVM performs the best for managing outlier and seasonality identification but is influenced by parameters in the model. This causes SVM to be time consuming and often cannot achieve the optimal classification result. [5].

**Approach:** This research attempts to enhance SVM model optimization through Quantum computing. Quantum approach performs calculations based on qubits, where the probability of an object's state, instead of just 1s or 0s rather applied on superposition. This gives the potential to process exponentially more data compared to classical computers [2]. Datasets used are SP500 HFT dataset and Apple Inc. (AAPL) stocks from 2017 to 2018.

**Results and Discussion:**

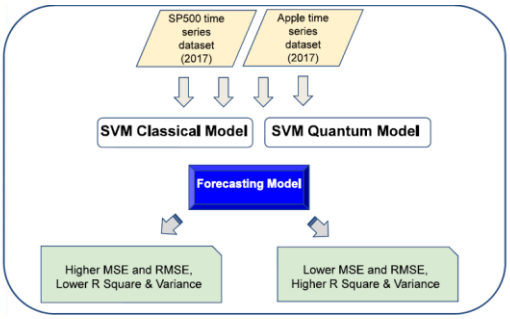


**Fig. 1:** Methodology for Quantum-based SVM HFT forecast method development

| Measurement | SVM Classical Model (CSVM) | | SVM Quantum Model (QSVM) | |
|---|---|---|---|---|
| | SP500 | APPL | SP500 | APPL |
| Mean Squared Error (MSE) | 6.2758 | 2.7042 | 6.2725 | 2.6873 |
| Mean Absolute Error (MAE) | 2.2128 | 1.3329 | 2.2125 | 1.3280 |
| R-Squared Score (R2) | 0.4922 | 0.3547 | 0.4925 | 0.3587 |
| Explained Variance Score (EV) | 0.583821 | 0.59580 | 0.583823 | 0.59592 |
| Memory Used (MB) | 258.68 | 442.05 | 239.56 | 258.01 |
| Time taken (sec) | 0.07 | 0.12 | 2.34 | 2.48 |

**Fig. 2:** Initial experiments results comparisons based on various performance metrics.

Based on the initial experiments, the Quantum-based SVM model for HFT forecasting obtained higher performance when compared to conventional SVM approach with better performances in lower MSE, MAE rates, higher R-squared and Explained Variance score and lower memory usage. However, the conventional SVM approach produced better performance in terms of time-taken, and this would be the challenge for future enhancement of the proposed model.

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