

## **Executive Summary: Strategies and Machine Learning in Jupiter Lab & Freqtrade**

### **Project Overview:**

This project focuses on using machine learning to optimize trading strategies for crypto currency pairs using Jupiter Lab and Freqtrade, a free and open source crypto trading bot.

We choose two trading strategies to analyze in this project: “Exponential Moving Average”, “Simple Moving Average/Relative Strength Index/Bollinger Bands”. The strategies were coded into Jupyter Notebooks using Python. These strategies were then run using BTC/USD data from January 2019 to January 2023.<sup>1</sup> The strategy returns were calculated and compared to the actual returns from for a baseline on model performance. The OHLCV coin data and strategy indicators were combined into one dataset before being separated into training and testing sets for our models. Model runs were done with three, multivariate classification models: Support Vector Classifier, RandomForest Classifier, and k Nearest Neighbor Classifier. The model predictions were evaluated, optimized and backtested, before a final analysis of best strategy and best model was chosen.

The Freqtrade bot was used as the deployment GUI of the best strategy. From this platform, live and historical data could be used to dry run, backtest and monitor the strategy performance. The bot also has the ability to execute the trade transactions live. Freqtrade allows easy access to data from multiple exchanges of hundreds of crypto coins, pre-formated strategy options, AI model options, and backtesting options, so the strategy can easily be changed and enhanced within the bot. The integrated WebUI in the bot makes visualization of the strategy easy.

### **Target Goal:**

Identify the best of two trading strategies for Bitcoin data, and trial 3 machine learning models for best predictive performance. Demonstrate the deploying and backtesting of the best strategy on FreqTrade.

### **Analysis Details:**

\*Jupiter Lab\*

1. The Data Import: Bitfinex 1 hour, BTC/USD data was imported as csv
  - Data was cleaned and formatted then saved to csv files for standardization and offline access
2. The Trading Strategy: strategy indicators and entry exit conditions
  - 2 trading strategies, one that focuses on trend only and one that considers price trend, momentum and volatility
  - When strategy conditions are met, ‘signals’ are applied to the coin data to compute the buy/sell action and hourly returns. The Strategy returns are compared to the actual returns for evaluation of the strategy’s overall performance.
3. The Machine Learning Models: 3 different classification models run with the strategy indicator and signal data, to see how accurately the model can predict the buy/sell signals.

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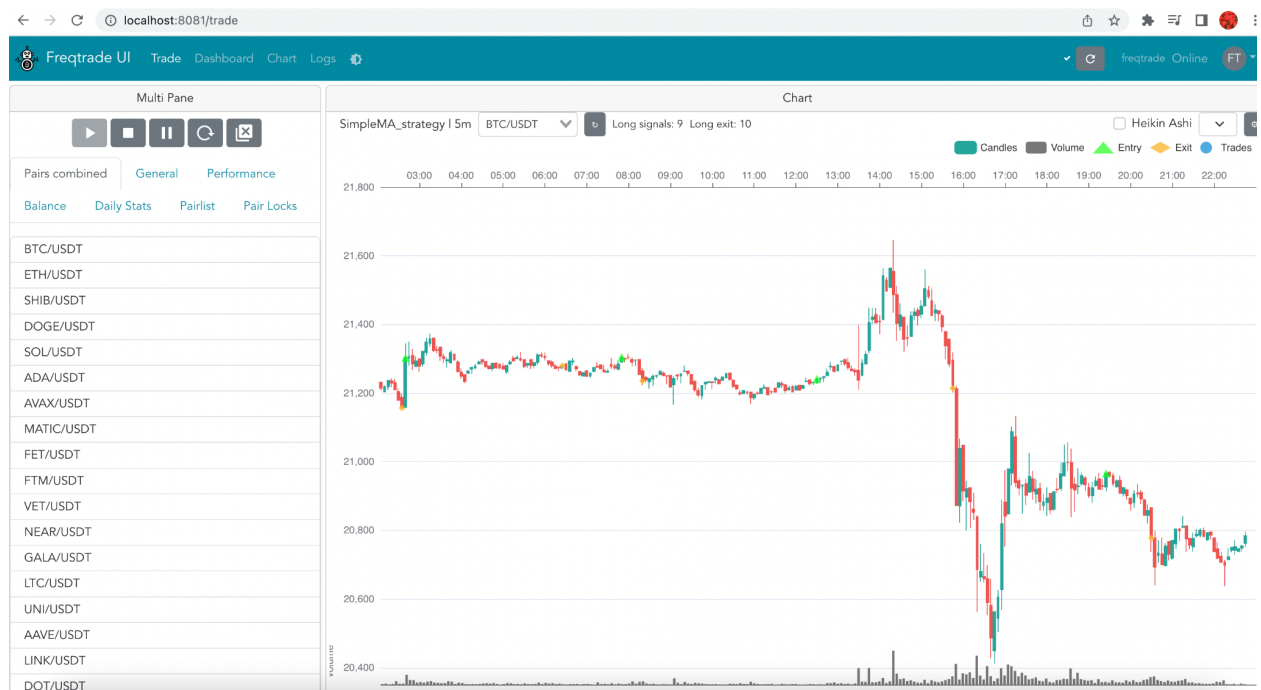
<sup>1</sup> This coin and dataframe is an excellent example of many market fluctuations from pre-pandemic, pandemic volatility and post-pandemic (pre-recession?).

- Data is split into training and testing sets, scaled and resampled if data is unbalanced
  - Model runs are evaluated for accuracy and precision, then adjusted for optimization
4. The Backtesting: The strategy and model are backtested on different historical data and re-evaluated for performance.

#### \*FreqTrade\*

1. Cloned the freqtrade github repository in the local machine and built it. All the steps to build on the Mac M1 chip are included in this project's repository in the following document.  
([https://github.com/KausarHina/algorithmic\\_trading\\_prj/blob/main/freqtrade\\_MacOS\\_M1\\_Installation.pdf](https://github.com/KausarHina/algorithmic_trading_prj/blob/main/freqtrade_MacOS_M1_Installation.pdf))
2. Created freqtrade strategy (SimpleMA\_strategy.py) as per the strategy built and tested in jupyter lab .
3. Downloaded the data using the freqtrade command.
4. Backtested the strategy using the freqtrade command.
5. Deployed the freqtrade bot using the back tested strategy in Dry-Run mode in the local machine.
6. Monitored the freqtrade bot using the WebUI.

Here is the deployed freqtrade WebUI using the **SimpleMA\_strategy** strategy:



#### Market Application:

This analysis could be used to guide one's crypto trading decisions. It could also be used for education purposes on a youtube channel or blog/articles, for example

SoftwareTesting Help wrote,

“ Best 10 Crypto Trading Bots for 2023, Review and Comparison”, Dec 28,2022,  
<https://www.softwaretestinghelp.com/best-crypto-trading-bots/> . Lastly, this sort of user experience feedback is essential to the developers of Freqtrade to improve their platform for users of all skill levels and operating systems.

Our experiences trying these strategies on both platforms provided a great deal of learning experiences as well as “advantages/disadvantages”, “pros/cons” evaluations about python, coding, strategies, trading, as well as machine learning. Being able to provide comparison reviews by users of all skill levels is valuable information that is monetizable on a small scale or on a large scale platform's marketing campaign.

### **Summary:**

Through the analysis of simple trade strategies on Bitcoin data we were able to establish which strategy performed best in which market conditions, as well as the strengths and weaknesses of each strategy in different market conditions. Each machine learning model demonstrated its aptitude, or inaptitude, toward handling the price volatility during the prime pandemic years of 2020-2021. All of the analysis detail are included in the Analysis Summary documentation. The deployment of these strategies to the Freqtrade bot proved challenging. Installment of the software on the newer Mac M1 chip was not easy or intuitive, so only possible because of the knowledge of our development team. Once deployed, the bot proved effective in backtesting and running the strategy in dry run mode. It was also easily applied to other coin data pairs. Final conclusion is that running analysis on trading strategies with machine learning did improve the returns when paired with the right model. We found that performing the process in Jupiter lab allowed us to see the exact details of the strategy, training/testing, and model design with ease, while this process was slightly more difficult in Freqtrade. Once information was configured correctly in the bot, the modification and visualization, and backtesting options were made far easier.

### **Team Members:**

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