B.Tech Project'24

Real-Time Trading and Finance Strategy Advisor

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I. Introduction

This report describes our efforts and strategy development for trading the BTC/USDT and ETH/USDT. Our Team aims to create a robust algorithm that leverages Market Indicators and extra Innovative tools to capitalize on Trends and Volatility. We are employing unique Data-driven techniques to enhance our Interpretability in trading accuracy and manages risk effectively. Our team has divided tasks by timeframes, working on strategies from minute-level to monthly scales to capture market trends across different trading horizons. This report outlines our current progress, unique methodologies, and the development process for achieving competitive performance.

II. Progress Update

A. *Current Status on BTC and ETH*

A comprehensive analysis was done on the various datasets provided which gave meaningful results for identifying the different anomalies in the data. Below are the results for 1-day BTC dataset.

Kalman Filters: The Kalman Filters help smoothen price fluctuations and noise in the data which is useful for identifying periods of volatility and also in identifying trends. From Sep 2019 to Apr 2020, the plot with its minor fluctuations hints towards a period of **lower volatility** and no significant trends. The plot is oscillating around the zero line which indicates the presence of **mean reversion**.The region from Apr 2020 to Aug 2022 is highly fluctuating and volatile with significant up and down trends. The volatility again decreases towards the end and is followed by gradual recovery.

Z-Score: The Z-Score is useful for identifying outliers in the data and hence significant information about **entry** and **exit** points can be obtained. For the given dataset, the plot had frequent crossings over the the mean-line which indicates the presence of **mean-reversion** in the data. The plot stayed on one side of the mean-line for considerable low durations of time, hinting at the presence of **short trends**.

Seasonal Decomposition: On decomposing the data into trend, seasonal and residual component, critical knowledge can be obtained about the presence of seasonality and trends in the data. The scale of the seasonal component is found to be much shorter than that of the trend which solidifies the **absence** of any **seasonality** in the data.

MACD Gaussian Smoothening: MACD is useful for identifying potential **trend reversals** in the market. Combined with Gaussian Smoothening noise is reduced, helping to highlight overall trends and reduce fluctuations in the histogram. The plot for this was again found to be fluctuating above the zero-line, indicating **absence** of **long trends**.

Dickey-Fuller Test: A Dickey-Fuller Test is used to check if the given time series is stationary or not. The **p-value** was much higher than the critical value of 0.05 which makes doesn't allow to reject the null hypothesis. Thus there is **not** enough evidence to state if the data is **stationary**.

Similarly an analysis on 1-day ETH data gave insights into the **co-integration** present in BTC and ETH data.

Kalman Filters: Identical to the BTC data, there were periods of higher **volatility** in the **middle** while the corners were relatively more stable. The plot repeatedly oscillated along the zero-line indicating at the presence of **mean reversion** in the data.

Z-Score: The plot was over the line for considerable amounts of time indicating at the presence of short trends as well as multiple crossings over the zero-line verified the presence of mean reversion.

Seasonal Decomposition: Similar to BTC, the scale of seasonality was again very minimal in comparison to that of trends and the absence of seasonality can hence be established.

MACD Gaussian Smoothening: The MACD plot was observed to be highly volatile with a large number of fluctuations over the mean line and the graph didn't stay on either side of the line for a considerable amount of time, hinting at the absence of trends. As MACD is relatively slower it sometimes fails to capture trends while other dynamic indicators like Kalman are able to.

Dickey-Fuller Test: The p-value in this case was also found to be much higher than the critical value and we hence fail to reject the null hypothesis. Thus there is not enough evidence to state if the data is stationary.

B. *Future Plans*

Co-Integration: We **regressed BTC** prices onto **ETH** prices. The **residuals** from the regression represent the spread. We then performed the **Augmented Dickey-Fuller test** on these residuals to check for **stationarity**. The **p-value** is **less than 0.05** and then also looked for ADF statistic which was less than the critical value to reject the null hypothesis of a unit root. This was done on **1D time frame** and from **2021-06-01 to 2023-06-30**. Now we will be using this co-integration between them to generate signals individually on each asset and combine them with trend, volume, or momentum indicators indicators.

Strategy Curator: The future plan for developing the Master Strategy for strategy optimization focuses on creating a dynamic system that adjusts to changing market trends and fluctuations. This strategy will leverage a pool of alphas, continuously evaluating their performance across multiple time frames. By identifying the best-performing alphas from recent periods, the strategy will re-weight them to align with evolving market conditions, ensuring the portfolio's responsiveness to market volatility. Initially, the strategy will involve selecting a diverse set of alphas, each curated to specific market conditions. These models will be evaluated using performance metrics to assess their success, and based on this evaluation, the strategy will employ a dynamic re-weighting mechanism. This mechanism will assign higher weights to top-performing alphas while reducing exposure to underperforming ones. The adaptive approach aims to enhance strategy reliability and optimize returns, ensuring the strategy remains effective in real-world scenarios.

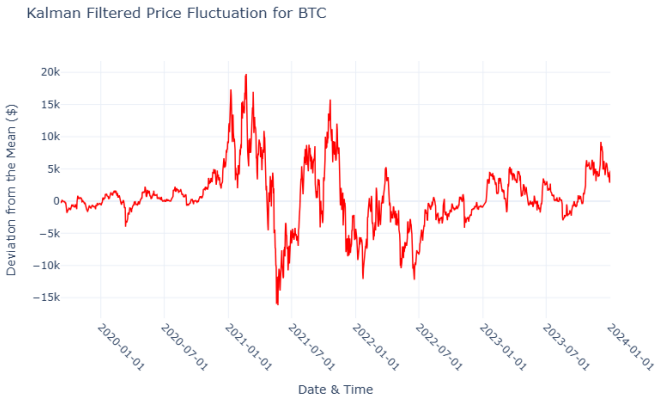

Fig. 1: KALMAN FILTER FOR BTC

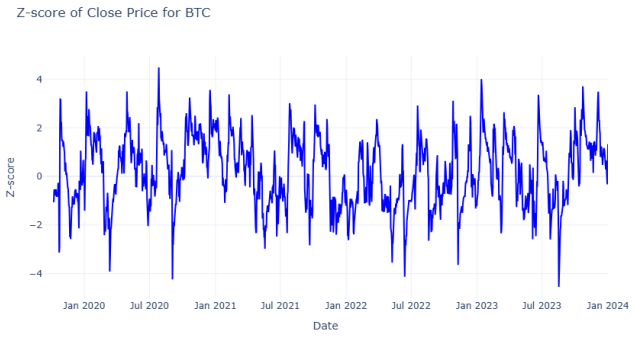

Fig. 2: Z-SCORE FOR BTC

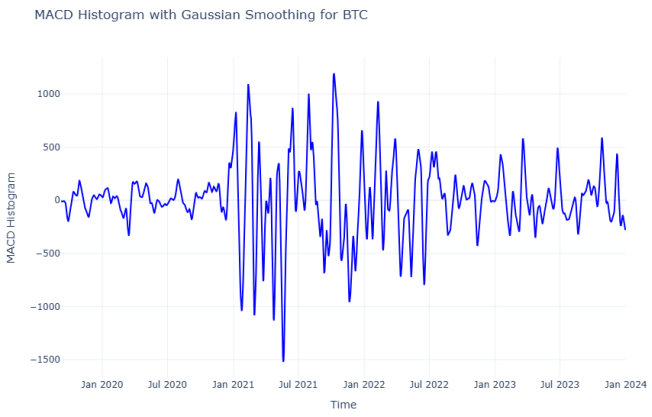

Fig. 3: MACD FOR BTC

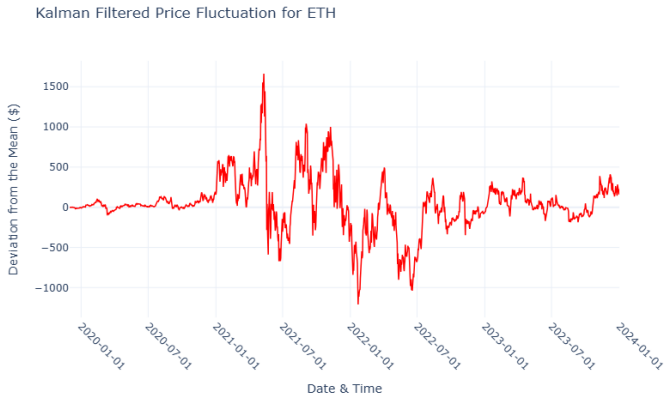

Fig. 4: Kalman for ETH

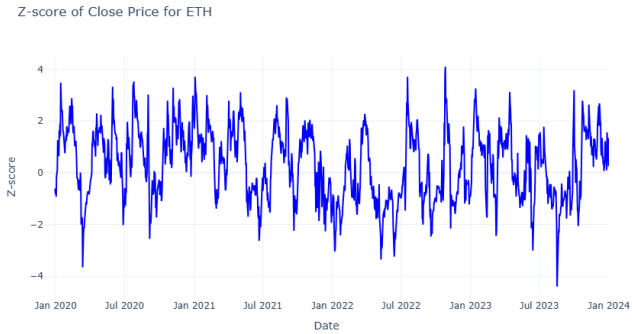

Fig. 5: Z-Score for ETH

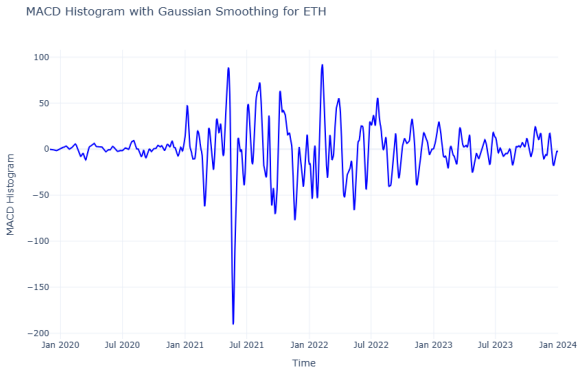

Fig. 6: MACD FOR ETH

III. Strategy Overview

A. *New Candlestick Pattern(for BTC)*

*1) **Overview**:* Our strategy draws inspiration from candlestick reversal patterns, notably **Three White Soldiers**, and **Three Black Crows**, here we identified a **four-candlestick pattern** in BTC signals in a **4h** time frame, which occurred frequently, especially during a trend, and the set of constraints defined are based on **High's and Low's of the candle**. The defined pattern is instrumental in trend reversal or continuation and helps to manage our positions with the prevailing market direction, and also to better position ourselves, in a non-trendy market.

*2) **Core Concept**:* The candlestick pattern that we are using here is a **modified form of Three White Soldiers and Three Black Crows**, the pattern or the set of criteria that we defined here is based on the pattern that we noticed in BTC, with the help of chart analysis, which is similar to Three White Soldiers and Three black crows.

- **Three White Soldiers:** The first candlestick is a bullish candlestick which is formed after a downtrend, and this Green Bullish candle is followed by two more green bullish candles, whose closing price should be above the previous candle's closing price. The closing price should be higher than the opening price and this indicates that the bulls are back in action. This pattern signals a potential Bullish reversal from a downtrend to an uptrend.
- **Three Black Crows:** The first candlestick is a bearish candlestick which is formed after an uptrend, and the Red Bearish candle is followed by two more Red Bearish candles, whose closing price should be below the previous candle's closing price. The opening price should be higher than the closing price and this indicates that the selling pressure is higher than buying. This pattern signals a potential Bearish reversal from an Uptrend to a Downtrend.

Fig. 7: Three White Soldiers

- Three crows' pattern is the opposite of the white soldiers' pattern. The Three Black Crows pattern suggests that the market sentiment has shifted from buying to selling, indicating the start of a downtrend.

Fig. 8: Three Black Crows

- **Pattern Used:** We tried using technical indicators in our initial strategies, but as technical indicators lag, and the BTC price between 2020 and 2023 end, is very trendy, we weren't able to capture most of the trend due to the lagging nature of technical indicators, hence we look for different approaches, and we identified this pattern, which occurred frequently and was observable in 4H time frame.

Fig. 9: Defined Pattern in BTC for given time frame

This pattern draws its inspiration and resemblance from the three white soldiers and three black crows, but is **completely different from these candlestick patterns**, as it requires some set of criteria/constraints that it has to fulfill, and it is **4 candlestick patterns instead of 3**, and it doesn't require all the candles to be Bullish, to signal a potential uptrend, or all the candles to be Bearish, to signal a potential downtrend."

*3) **Challenges** :*

- Facing problems in getting any reasonable returns and high drawdowns due to the lagging nature of indicators; the BTC is highly trendy from 2020 to the end of 2023.
- Trends, high volatility, and the lagging nature of indicators hamper us from entering trades at a better position in such market conditions.

*4) **Solution** :*

- Signal Generation: We have defined some set of rules for this pattern, and if the **4 consecutive candlesticks** follow

this pattern and fulfill the set criteria defined then it will give us a signal that a **potential uptrend or downtrend** is about to occur, and using this we can enter a trend as soon as it occurs or even before it even occurs, and hence allowing us to enter a trend at a much better position.

- **The conditions defined for long and short, are opposite**, the same as Three white soldiers and the Three Crows.
- The signals generated by the **long and short criteria** are **completely independent of each other**, the only reason they can work on their own without any other indicators or other interference, is a cause of a large number of signal generations, which is due to the candlestick pattern fulfilling the set of criteria defined (even within a trend).

*5) **Risk Management** :*

- Backtesting on BTC, alone using these signals generated by the set of defined criteria, led to profitable results, but **a huge drawdown of 45%**, so to counteract this, we used the low of the point where the signals are being **generated as support/resistance**, and if the price reverts to its original low price, then we are generating an opposite signal to square off the position that we initially took.
- Doing this has led to minimizing our drawdowns and making the trade more profitable.
- The new signals generated after including this Risk Management(support/resistance) criteria, we are **able to exit the trades that are based on false signals(immediately)**, and also help in capturing the trend as well, which is **based on price action**, that the consecutive higher low will be above the current higher low in an uptrend, and if the consecutive lower low is below the current lower low, then it will be a downtrend.
- This risk management strategy **draws its inspiration from Three white soldiers and Three black crows**, as they are formed near a trend reversal, and hence can also be **used as support/resistance.**
- If the price falls below the current lower low (if the signal is generated at the previous higher low), then it's a downtrend, and hence our support will be triggered and square-off of the current position will take place, and if the consecutive higher low is above the previous higher low then the support won't be triggered (in an uptrend) and we will continue our trade, which is going in the direction of an uptrend
- We are only using **1 support/resistance** in a trade to time for a clear and holistic view of the BTC price.

*6) **Important**:*

- We haven't used any **-2 or +2 signals** in this case the two signal generations are **completely independent of each other**, the only reason they work on their own is the cause of a large number of signal generations at the lower time frame(here 4h).
- We are trying to find a way to **capture the trend more efficiently**, we tried using **ATR** to define the **Take Profit**, but it **wasn't able to capture the trends to the fullest**, and hence we have to rely on the signals generated by the other criteria defined by us. We are currently trying to use other indicators for better exit conditions, which can capture the trends more effectively.

*7) **Correlation/Key Features**:*

- **Trend**: This strategy relies on identifying trend reversals, it inherently **correlates strongly with trending markets**. This helps us to capture most of the trend, maximizing the strategy's effectiveness and leading to higher returns.
- **Momentum**: This strategy has a **natural correlation with momentum**, as its entry and exit signals are based on candlestick patterns that reflect momentum changes. When momentum supports the signals, and there's strong steady price movement over several candles, it increases the chances that the trend will continue.
- **Volume**: This pattern doesn't have a direct correlation with Volume, but **High trading volume tends to confirm the strength of the trends**, which are identified by our pattern. If the BTC experiences high volume during a trend reversal pattern, it verifies the price action, increasing the probability that the trend will continue.
- **Volatility**: **Volatility is the key element of our pattern strategy**, as the BTC price for the given time frame is volatile, and these patterns work well in trendy markets, hence giving us good profits.

Fig. 10: Defined Pattern signaling uptrend

*8) **Future Improvements**:*

- We are currently working using **different technical indicators** which will allow us to position ourselves better in a trend, allowing us to exit trades at higher highs, and hence not facing the pullback and hence allowing us to make better profits.
- We are also trying to define different sets of criteria other than support/resistance which we did in our risk management, to make it more reliable and for **better risk management**.
- This pattern only works in trendy markets and hence fails to give results in the sideways market, hence we are trying different approaches using **divergence between oscillators and Bollinger bands/ Keltner channels** to overcome those losses suffered during the sideways market.

B. *Technical Indicators Integration(for BTC)*

*1) **Overview**:* This strategy aims to tackle the different states of the market by using various technical indicators which perform well in the respective states. The strategy is found to be most effective and beneficial for the **1-day** time period on the BTC data. EMA crossovers coupled with momentum indicators for capturing trends and accompanied with **PSAR** for generating **exit signals** in **Bearish** market define the main essence of the model. The main goal of the strategy is to successfully identify long trends.

*2) **Core Concept**:* The core concept of the strategy revolves around the following indicators:

- **Parabolic SAR:** A trend-following indicator that helps identify potential reversal points. If it appears as a series of dots above the asset price, it indicates a **Bearish** trend; if it appears below, a **Bullish** trend is signaled. It is often used as an alternative to a trailing stop-loss.
- **RSI**: A momentum indicator which identifies **oversold** and **overbought** conditions. An RSI greater than a particular threshold indicates that the asset is overbought and might pull back while lesser than another particular threshold indicates that the asset is oversold and will rebound.
- **EMA**: A trend indicator which helps in identifying **trend direction** by giving more weightage to recent asset prices and performs well in comparison with SMA which assigns the same weightage to every point.

Equipped with the knowledge of these indicators, one can now move on to the methodology behind the strategy. A flowchart for the same is given in figure 11.

- The main block assesses the condition of the market, identifying whether it is trending up,down, or fluctuating. Using a 7-period EMA of RSI, tracking of these trends is done.
- When an uptrend is detected, the EMA block is triggered. If the $\text{EMA}_9 > \text{EMA}_{20}$, an **uptrend** is confirmed and a **buy** signal is generated. However, if EMA_9 is lower it suggests a potential **trend reversal**; a strong RSI combined with a decreasing EMA hints that the uptrend is losing strength, generating a sell signal.
- If EMA_{RSI} lies between 40 and 60, it indicates fluctuation in the market, leading to the RSI block. If the $\text{RSI}_{cur} > 54$ but lower than the RSI from 2 periods prior, it indicates the potential start of a **downward** trend due to short term loss of momentum. In order to ensure better trend capturing, RSI is shifted by 2 periods. Since this is short term, we close any open long position; otherwise, a new short position is opened. In any other scenario, the position is simply held.
- When EMA_{RSI} is less than 40, it indicates a presence of downtrend and the PSAR block comes into picture. PSAR is known to perform well in **downtrends** where it generates a sell signal quickly thus preventing any further losses.

*3) **Risk Management** :* The PSAR introduces a **dynamic** factor when dealing with stop losses in the market. Due to its inherent ability to trail asset movements, it adapts quickly and effectively to the changes in the trend in the market. It was therefore an excellent option to deal with **volatility** during the highly unstable and volatile period during Jan 2021 to July 2022.

*4) **Key Features**:* The correlation between trends, volatility and momentum is found to be direct while volume holds scope for a non-direct correlation.

- **Trends and volatility:** EMA crossovers help to capture uptrends efficiently by signaling potential entry points when a shorter EMA **crosses** over a longer one, indicating Bullish momentum. On the other hand, Parabolic SAR provides **good exit** conditions in case of downtrends. Thus by proficiently identifying the trends, we are able to adapt to **ever-changing** market conditions.
- **Momentum:** With the help of RSI, the momentum in the market is identified based on the overbought and oversold conditions. In sideways market, temporary **shift in momentum** was captured but still due to a lagging PSAR, the profits couldn't be maximized.
- **Volume:** If the volume rises after a potential reversal then the chances for the trend to turn into bullish are significant. Though it is not currently being incorporated in the strategy, this small implementation holds great promise.

*5) **Challenges and Future Scope**:* In the duration from Jan 2023 to Jan 2024, the model is not performing well due to the sideways nature of the market and as a result the Parabolic-SAR is not able to exit the downtrends quickly. So by the time it exits, the entry signal is generated. This can be improved by further tuning the parameters or using an adaptive PSAR.

C. *New candlestick pattern(for ETH)*

*1) **Core concept** :* This strategy is based on the same pattern as that we used in Strategy 1(III-A), and we maximized our returns using Take Profit and Stop Loss, based on the closing price where the signal is being generated, for risk management.

*2) **Challenges** :* We recognized the same pattern being followed here, in the same 4h time frame, and used the same strategy as we defined in Strategy 1(III-A), but we were facing large drawdowns and the market was very volatile throughout the whole period specified for Ethereum.

*3) **Risk Management** :* For risk management, we used Take Profit and Stop Loss, which is based on the percentage of the closing price where the signal is being generated, cause the market is too volatile, and defining a changing Take profit and Stop loss will also enable us to capture most of the trend. This will help us to make the most out of the high volatility and trends of Ethereum.

*4) **Key Features/Indicators**:* We used the same pattern as we specified in Strategy 1(III-A), and used it on the time frame of 4h, same as what we used in Strategy 1(III-A), and they correlate the same with Volatility, Trends, Momentum, Volume.

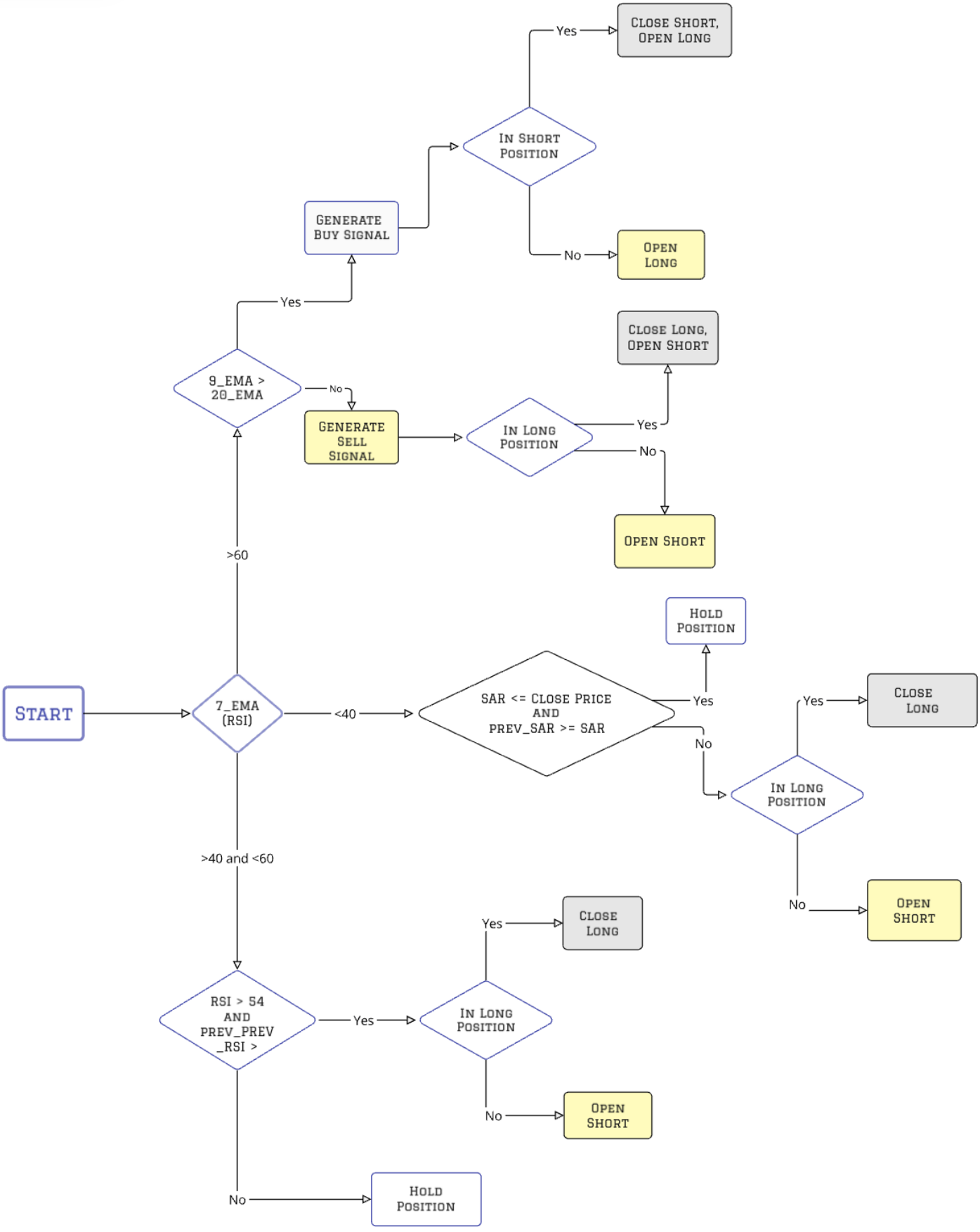

Fig. 11: Methodology

*D. **TFT (for BTC)***

*1) **Overview**:* This strategy uses the Temporal Fusion Transformer (TFT) model to predict Bitcoin price trends. Our goal is to generate trading signals based on predicted price changes: if the predicted price increases by more than **0.125%**, a **long** position is taken; if it decreases by more than **-0.125%**, a **short** position is taken. Volume is used as an unknown real variable, while **month** and **time index** are used as known real variables to provide seasonal context. This approach will be tailored to capture short-term price movements effectively. This is still under development so there might be some flaws in this strategy right now, which will be taken care of before final evaluation. Hereby we are just wanting to show that we are currently working on refining this approach which could lead to incredible results. The intrepretable multi-head attention at the last assures the intrepretability of model which most of the deep learning models lacks.

*2) **Core Concept**:* The core concept of the strategy revolves around the following variables:

- **Predicted Price Change:** The primary signal generated by the TFT model is used to determine trading actions. Based on the threshold values of +0.12% and -0.12%, the model provides us a overview of model's confidence in going long or short on bitcoin market.
- **Volume (Unknown Real Variable):** Acts as an indicator of market interest and liquidity, helping in prediction by including the market behavior on Bitcoin price movement.
- **Month and Time Index (Known Real Variables):** These variables help the model understand seasonal patterns and time-related dependencies in Bitcoin price trends, hence enhancing the temporal awareness.
- By combining these features, the model should be able to make more informed predictions, adjusting for periodic fluctuations and significant short-term changes in the market.

*3) **Risk Management**:* Risk management in this strategy is handled by setting strict entry and exit thresholds, using position sizing, and stop-loss mechanisms:

- **Threshold Optimization:** The threshold of **0.125%** for entry and exit signals is fine-tuned to balance between capturing meaningful price moves and avoiding excessive trades.
- **Strict trades:** It **square off** all trades if the model is **not confident** enough, that is, if change is between -0.125% and + 0.125%.
- **Stop loss:** We will be implementing stop loss in this strategy in the future.

*4) **Key Features**:* The following key features and indicators support the predictive power and effectiveness of the strategy:

- **Predicted Price (TFT Output):** This is the main driver of trading decisions, providing signals for long or short positions based on the model's forecast.
- **Volume:** Serves as an indicator of liquidity and interest in the market, enhancing model predictions by accounting for changes in demand-supply dynamics.
- **Seasonal Indicators (Month and Time Index):** These variables capture patterns in Bitcoin prices over time, adding robustness to the model's understanding of temporal dependencies.

*5) **Challenges and Future Scope**:* Challenges faced include the following:

- **Stop-Loss Implementation**: Integrating a dynamic stop-loss mechanism based on the **Average True Range (ATR)** is a priority to enhance risk management. Integrating ATR-based stop-loss levels promises to make the strategy more responsive to volatility, adapting stop limits based on market conditions to better protect gains and remove potential losses.
- **Testing**: To elevate the model's performance across the time frames, rigorous testing is essential. Methods like **rolling window cross-validation** will be used to assess and improve the model's reliability across various market conditions. This approach ensures that the model is stress-tested, capturing diverse market behaviors and preventing overfitting to a particular period or trend. Now we are justing testing it on last 1000 datapoints of one hour timeframe data and not as per requirements .
- **Reinforcement Learning**: Optimize the model's performance through the application of reinforcement learning techniques. Applying RL will allow the model to continuously learn and adapt its trading decisions based on the experience, optimizing performance by learning from both profitable and adverse market scenarios.

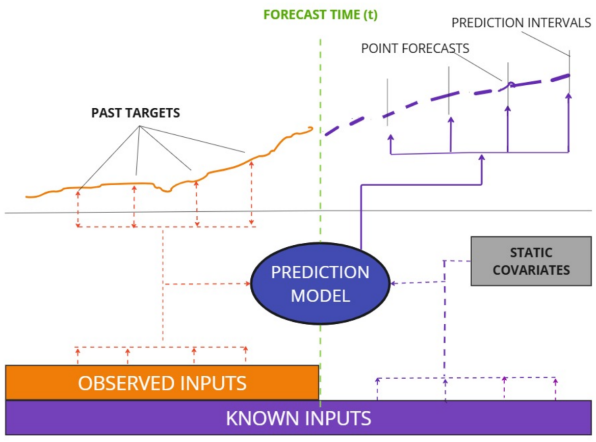

Fig. 12: Regression of BTC onto ETH

IV. Performance Metrics

A. New Candlestick Pattern (for BTC)

1) **Performance:** This strategy generated a strong net profit of $5262.29 and achieved a cumulative profit percentage of 1516.78%, starting with an initial balance of $1,000 and ending at $16,167.75.
2) **Win-Loss:** Out of 41 trades, 19 were winners (46.34% win rate), and 22 were losers. The largest win was $3,786.06, while the largest loss was $1,642.22.
3) **Risk Metrics:**
   - The maximum drawdown observed was 5.27%.
   - Sharpe Ratio (4.30) and Sortino Ratio (56.42) suggest a high level of risk-adjusted returns.
   - Average holding time for trades was 26 days, with a maximum holding time of 245 days.
4) **Fees:** Total fees amounted to $538.53, which were manageable relative to the total profit.

B. Technical Indicators (for BTC)

1) **Performance:** The strategy achieved a net profit of $3,177.53, with a cumulative return of 5,145.16%, significantly outperforming the benchmark return of 514.52% on an initial $1,000 investment.
2) **Win-Loss:** Out of a total of 21 trades, 13 were profitable, resulting in a win rate of 61.9%. All of the trades are defined as long positions, with no short trades executed. The largest winning trade was $1,752.73, while the largest loss amounted to $244.00, indicating effective control over losses.
3) **Risk Metrics:**
   - The strategy maintained a reasonable risk profile, with a maximum drawdown of 8.31% in static terms and a higher compound drawdown of 34.31%.
   - The high Sharpe Ratio of 7.20 and a Sortino Ratio of 38.46 indicate strong performance relative to the risk taken.
   - The average holding time per trade was 30 days, with the longest trade held for 106 days.
4) **Fees:** Total fees for the strategy amounted to $167.16, which is minimal compared to the overall profitability.

C. New Candlestick Pattern (for ETH)

1) **Performance:** The strategy generated a notable net profit of $8,296.88, translating to a cumulative return of 16,189.63%. Taking an initial balance of $1,000, the portfolio grew to $161,995.30.
2) **Win-Loss:** Out of 193 trades, 143 were profitable, giving a high win rate of 74.09%. The largest gain was $98.50, while the largest loss was $329.30, indicating effective control over losses despite occasional larger drawdowns.
3) **Risk Metrics:**
   - The strategy ensured that the risk is relatively low, with a maximum drawdown of 9.97% and an average drawdown of 0.81%.
   - High Sharpe (9.95) and Sortino (15.01) ratios also show risk-adjusted returns, highlighting strong performance relative to risk taken.
   - The average holding period per trade was 3 days, with the longest trade held for 37 days.
4) **Consistency:** The strategy demonstrated strong performance, with an average time to recover losses (TTR) of 46.17 days and a maximum TTR of around 897 days, indicating that periods of drawdown were manageable.
5) **Fees:** Total transaction fees for the strategy were calculated as $65,711.96, which is considerable but compensated by the high overall profitability due to frequent trading.

D. TFT (for BTC)

1) **Performance:**The Temporal Fusion Transformer strategy generated a net profit of $298.16, resulting in a total return of 33.23%. Starting with a balance of $1,000, the portfolio grew to $1,332.29.
2) **Win-Loss:**Out of 29 executed trades, 21 were profitable while the rest generated losses. The largest gain was $146.16, while the largest loss was $7.05.
3) **Risk Metrics:**
   - Maximum drawdown of 1.13% in static metrics (1.39% in compound metrics) and an average drawdown of 0.19% were observed.
   - The high Sharpe ratio (8.29) and Sortino ratio (141.28) indicate strong risk-adjusted returns.
   - The average holding time per trade was around 1 day and 6 hours, with the longest trade held for about 6 days and 7 hours, suggesting a short-term trading approach.
4) **Consistency:**The strategy performed well during periods of loss, with an average recovery time of about 3.25 days. Even in more extended drawdowns, the longest recovery time was around 11 days, helping to keep these periods manageable.
5) **Fees:**Total fees amounted to $52.24, which is modest and did not significantly impact the strategy's profitability.

Strategy	Profit / Loss	Sharpe Ratio	Annualized Return (%)	Max Drawdown	Time to Recovery
New Candlestick Pattern (for BTC)	1516.77%	4.21	100.52%	-4.83%	126.33 days
Technical Indicators (for BTC)	698.28%	7.20	68.09%	-8.3%	136.66 days
New Candlestick Pattern (for ETH)	161895.63%	9.95	534.42%	-9.96%	46.16 days
TFT (for BTC)	33.22%	8.29	1195.65%	-1.38%	11.04 days

TABLE I: Comparison of Strategies

V. PLOTS

Fig. 13: Pattern recognition(BTC)

Fig. 14: Technical Indicators

Fig. 15: Pattern recognition(ETH)

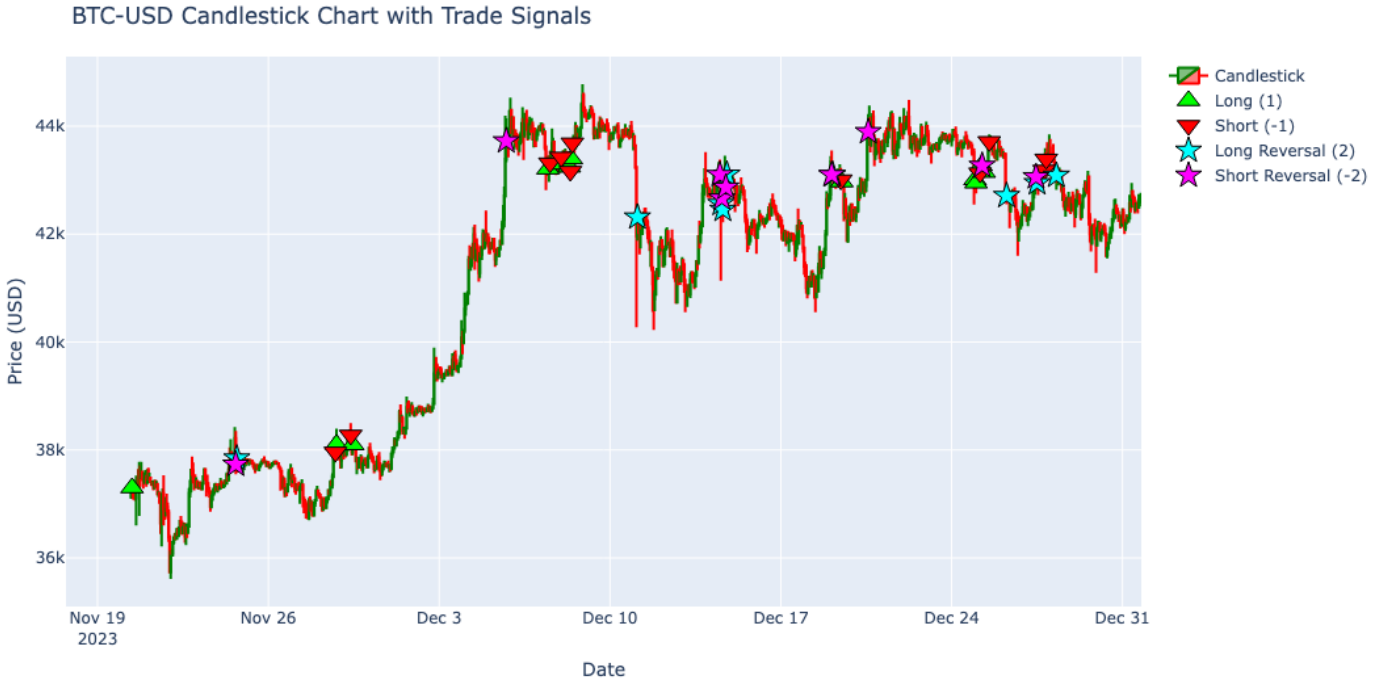

Fig. 16: Temporal Fusion Transformer

VI. Unique Approach and Innovation

A. *Plot for Trend Analysis*

- **Pattern Identification:** We have identified a pattern which is **most frequent in 4h high volatile market**, and used them to get in trades even before, or as soon as they begin, but they may sometimes give false signals, and this mostly leads to high drawdown, when used on their own. To reduce the drawdown and to make the most out of the trend, we paired this candlestick pattern, which is a set of constraints, with Take Profit, and Stop Loss and also tried pairing them with Support and Resistance, but it gave better results with Take Profit and Stop Loss.
- **Portfolio Manager:** This strategy also known as **Master Strategy** dynamically chooses alphas from a pool of alphas to adjust to change in in market trends and fluctuations.This strategy **continuously** evaluates the performance of **individual strategies** over various time frames and selects the one that have performed well in the previous time frame. This strategy adapts by **re-weighting** the alphas to align with trend-shifts, making the overall portfolio more reliable. Work on this is currently in progress, with further testing underway.

B. *Difference from Traditional Methods*

- We have **not used any kind of traditional patterns, in new pattern recognition strategy**, which are widely used by people, instead we took inspiration from an existing trend reversal candlestick pattern, and through chart analysis, recognized this pattern or set of criteria being repeated in **BTC in the 4H** time frame, and the same approach gave us **really good result in Ethereum** when paired with Take Profit and Stop Loss.