002 - Introduction to Trading

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**Introduction**

This project focuses on the development of a systematic trading strategy based on technical analysis indicators. The objective is to design, implement, and evaluate a quantitative trading system capable of generating consistent risk-adjusted returns in the cryptocurrency market. As the project was conducted individually, the dataset used corresponds to the Hourly BTCUSDT file, which contains approximately one year of hourly price data for the BTC/USDT trading pair.

The strategy combines three technical indicators to generate long and short trading signals, applying a 2-out-of-3 confirmation rule to increase reliability and reduce false positives. It aims to optimize and maximize the Calmar Ratio, seeking an appropriate balance between profitability and risk by accounting for both returns and drawdowns.

A realistic Backtesting environment was implemented, considering transaction costs of 0.125%, no leverage, and dynamic position management for both long and short trades. To ensure robustness and avoid overfitting, a walk-forward analysis was performed, dividing the dataset into training, validation, and testing periods. The optimization of hyperparameters — such as stop loss, take profit, and indicator periods — was conducted using Optuna for Bayesian optimization.

Finally, the report provides a comprehensive explanation of the strategy’s design, implementation, and performance evaluation, emphasizing robustness, risk management, and statistical validity. Performance is analyzed through standard financial metrics including Sharpe Ratio, Sortino Ratio, Calmar Ratio, Maximum Drawdown, and Win Rate, complemented by portfolio value evolution charts and detailed return tables.

**Detailed description of the strategy and rationale**

The trading strategy implemented in this project is a systematic approach based on technical analysis indicators, designed to generate consistent risk-adjusted returns in the BTC/USDT market. The goal of the strategy is to include a filter mechanism to determine when to enter or exit the market in response to price changes, based on the behavior and direction of the asset, whether it exhibits positive or negative trends.

Additionally, the strategy is designed to operate in a long/short manner, allowing it to generate signals for both buying and selling positions depending on the conditions of the indicators. This approach enables the strategy to take advantage of upward and downward market movements, capturing trends in either direction to maximize potential returns.

**3.1 - RSI (Relative Strength Index)**

The RSI (Relative Strength Index) is a technical indicator that measures the strength of price trends of an asset over a specific period. This indicator was chosen because it helps identify overbought and oversold levels, with values ranging from 0 to 100.

If the RSI is above 70, it means the assets are overbought, which indicates that its price could start to go down. On the other hand, if the RSI is below 30, it means the assets are oversold, suggesting that its price could start to go up.

In our strategy, RSI is used to generate entry and exit signals, helping to reduce false signals while confirming the trend the asset is following. This indicator is expected to work well together with the other two indicators, providing an extra layer of confirmation and improving the reliability of the trading signals.

**3.2 - Momentum**

The Momentum is a technical indicator that measures the speed of price trends of an asset over a specific period (like the RSI). This indicator was chosen because it shows whether the trend is accelerating or slowing down.

If the Momentum is positive, it means that the price is rising, indicating a bullish trend. On the other hand, if the Momentum is negative, it means that the price is falling, indicating a bearish trend.

In our strategy, Momentum is used to confirm the trend direction before opening any position. For example, if the RSI indicates that the asset is oversold, Momentum is checked to ensure it is positive to validate the signal.

**3.3 - Volatility**

Volatility is a technical indicator that measures the degree of price variation of an asset over a specific period. This indicator was chosen because it shows how stable or unstable the market is at a given time.

When volatility is high, it means the price is changing rapidly, indicating a more unpredictable market. When volatility is low, the price moves more slowly and steadily, indicating a more stable market.

In our strategy, volatility is used to filter trading signals. For example, even if Momentum and RSI suggest trade, high volatility could indicate a higher risk of false signals, so the strategy may delay entering a position until market conditions are more favorable.

**3.4 - Signal Generation**

For signal generation, the strategy relies on the combined use of three technical indicators. Based on these, a “2 out of 3 confirmation rule” is applied, meaning that at least two of the indicators must show a buy condition for a long entry, or a sell condition for a short entry.

A buy signal is triggered when at least two indicators show bullish conditions, while a sell signal is triggered when at least two indicators show bearish conditions.

In the Backtesting implementation, once a valid signal is detected, the system automatically executes trades according to the available capital and predefined parameters.

Each position size is dynamically adjusted based on the current level of market volatility depends on if volatility is high, the position size is reduced to limit risk exposure; if volatility is moderate, exposure can be slightly increased to take advantage of favorable market conditions.

Additionally, stop-loss and take-profit levels are defined within the backtest, both based on volatility, with the objective of protecting capital and securing profits when the price moves in favor of the position.

Backtesting system only opens a trade when at least two of the three indicators (RSI, Momentum, and Volatility) confirm the signal. This multi-confirmation rule reduces false entries and ensures that trades are executed only under conditions with a higher probability of success. The strategy is structured as a long/short system, allowing it to take advantage of both bullish and bearish market trends.

**3.4 - Position Management**

For signal generation, the strategy relies on the combined use of three technical

**v Signal Generation / Entry & Exit Rules**

* **Explica cómo se generan las señales de trading:**
  + **Compra (long) o venta (short)**
  + **Confirmación de señales (en tu caso: 2 de 3 indicadores deben coincidir)**
* **Detalla condiciones específicas de entrada y salida.**
* **Incluye si hay filtros adicionales: volumen, volatilidad, drawdown máximo, etc.**

**4. Position Management**

* **Explica cómo manejas las posiciones abiertas:**
  + **Tamaño de posición**
  + **Stop loss / take profit**
  + **Rebalanceo o cierre automático**
* **Menciona cómo las comisiones y los costos de transacción (0.125%) afectan la estrategia.**

**5. Rationale / Reasoning**

* **Explica por qué esta estrategia debería funcionar:**
  + **Relación entre indicadores y comportamiento del mercado**
  + **Evita sobreajuste usando entrenamiento/validación/test**
  + **Control de riesgos mediante drawdowns, volatilidad y reglas de confirm**