**Performance Analysis of Binance Trade Accounts**

**Primetrade.ai Internship Assignment Report**

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# 1. Introduction

This report presents an analysis of historical trade data from Binance accounts over a 90-day period. The objective was to evaluate the performance of different accounts based on key financial metrics and rank them accordingly.

The dataset contained:

* **Port\_IDs**: Unique identifiers for accounts.
* **Trade\_History**: Trade details such as timestamp, asset, trade side (BUY/SELL), price, and more.

The main objectives of the analysis were:

* **Data Cleaning & Transformation**: Extracting relevant features from trade history.
* **Financial Metric Calculation**: Computing ROI, PnL, Sharpe Ratio, Maximum Drawdown, Win Rate, Win Positions, and Total Positions.
* **Ranking Algorithm**: Assigning initial weights manually, followed by Bayesian Optimization to fine-tune the weights for optimal ranking.

# 2. Data Exploration & Cleaning

The dataset was first loaded and explored to understand its structure. Key preprocessing steps included:

1. **Parsing Trade History**: The trade history was stored as a string representation of a list of dictionaries. This was converted into a structured format.
2. **Handling Missing Values**: Accounts with missing trade history were identified and removed.
3. **Exploding Trade Data**: Since each account had multiple trades, the trade history was expanded so that each row represented a single trade.
4. **Data Type Conversions**:
   * Converted timestamps to datetime format.
   * Converted trade quantities, prices, and realized profits to numerical values.

After cleaning, the dataset was ready for further analysis.

# 3. Feature Engineering & Column-Wise Analysis

Several key characteristics of the dataset were analyzed:

* Number of unique accounts (Port\_IDs): Counted the distinct accounts present in the dataset.
* Unique trading pairs (symbol): Identified different asset pairs traded.
* Trade side distribution: Evaluated the ratio of BUY vs. SELL trades.
* Trade price distribution: Analyzed min, max, and mean trade prices.
* Trade volume analysis: Examined quantity (quantity - money in trade) and qty (coin amount).
* Profit distribution: Summarized realized profit values.
* Position Side Distribution: Checked the usage of LONG, SHORT, and BOTH positions.

# 4. Financial Metrics Calculation

To assess the performance of each account, we computed the following financial metrics:

## 4.1 Profit and Loss (PnL)

PnL represents the total realized profit of an account over the period.

PnL=∑realized Profit

Each account’s total PnL was computed by summing all its realized profits.

## 4.2 Return on Investment (ROI)

ROI measures profitability relative to the total capital used in trades.

ROI = [Total PnL)/ (Total Quantity Traded ​)]×100

To avoid division errors, accounts with zero trades were handled separately.

## 4.3 Win Rate

Win Rate determines the proportion of profitable trades.

Win Rate=[( Number of profitable trades)​/( Total number of trades)]×100

Each account’s win rate was calculated by counting trades where realizedProfit > 0.

## 4.4 Maximum Drawdown (MDD)

MDD is a risk metric measuring the largest peak-to-trough decline in cumulative profit.

MDD = min[( Cumulative PnL−Peak PnL​)/ Peak PnL]

Each account’s PnL over time was tracked, and the largest drop from a peak value was recorded as MDD.

## 4.5 Sharpe Ratio

The Sharpe Ratio evaluates risk-adjusted return, calculated as:

Sharpe Ratio= Mean PnL​​ /[(Standard Deviation of PnL)+1e−9 ]

(A small constant 1e-9 was added to prevent division by zero.)

## 4.6 Total and Win Positions

* Total Positions: The total number of trades per account.
* Win Positions: The count of trades with positive realized profit.

# 5. Data Visualization

Several visualizations were created to explore trends:

* Trade Price Distribution: A histogram showing the frequency of different trade prices.
* Cumulative PnL per Account: A line chart depicting how an account’s profit evolved over time.
* Profit vs. Loss Trades: A bar chart illustrating the count of profitable vs. loss-making trades.
* Trading Activity by Hour: A heatmap showing trade frequency at different hours of the day.
* Most Profitable & Least Profitable Assets: A bar chart highlighting the best- and worst-performing assets.

# 6. Ranking Algorithm

We ranked accounts using a scoring system based on financial metrics. This process was done in two stages:

## 6.1 Manual Weight Assignment

Initially, we manually assigned weights to each metric based on its perceived importance:

* PnL: 45%
* ROI: 28%
* Win Rate: 22%
* Sharpe Ratio: 15%
* Maximum Drawdown (MDD): -10% (negative weight due to risk factor)

The score for each account was computed as:

Score=(w1​×PnL)+(w2​×ROI)+(w3​×Win Rate)+(w4​×Sharpe Ratio)+(w5​×MDD)

where w1,w2,w3,w4,w5w\_1, w\_2, w\_3, w\_4, w\_5 were the manually assigned weights.

## 6.2 Bayesian Optimization for Optimal Weights

After manual assignment, we used Bayesian Optimization to determine the best set of weights. This method iteratively adjusted weights to maximize the ranking effectiveness.

* We set the objective function as:
* maxi=1∑n​Scorei
* ​Bayesian Optimization searched for the optimal values of w1,w2,w3,w4,w5w\_1, w\_2, w\_3, w\_4, w\_5.
* This ensured that the best weights were selected based on actual data-driven optimization.

# 7. Top 20 Accounts Selection

After computing scores with optimized weights, we ranked all accounts and selected the Top 20 performers.

The ranking criteria balanced profitability (PnL, ROI, Sharpe Ratio) and risk management (MDD, Win Rate).

# 8. Conclusion

This analysis successfully ranked Binance trading accounts based on their financial performance. The results provide insights into:

* The profitability and risk-adjusted performance of different traders.
* The effectiveness of different trading strategies.
* The variation in trading activity across different times and assets.

The Bayesian Optimization method helped us fine-tune the ranking criteria, making the results more objective and data driven.

This methodology can be extended for real-time monitoring or integrated into automated portfolio management systems.

# 9. Deliverables

The following files were generated:

1. Jupyter Notebook/Python Script: Contains the complete analysis and calculations.
2. CSV File: Includes all calculated financial metrics.
3. Top 20 Accounts List: Ranked based on their performance.
4. This Report: Document on the methodology, findings, and assumptions.