Algorithmic Trading Backtesting System

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Develop a full stack, automated system for extracting, processing and analyzing financial data to objectively evaluate the performance of trading strategies through rigorous backtesting.

This project demonstrates end to end competency in data engineering, analysis and visualization.

Key Features & Process

Data Acquisition & Engineering: Automated the extraction of high frequency historical price data (Open, High, Low, Close, Volume) directly from the MetaTrader 5 platform API. Engineered a robust data pipeline that cleansed, structured, and validated this data into a reliable format for analysis, ensuring data integrity and readiness for downstream processing.

Strategy Implementation & Backtesting: Programmatically engineered a quantitative trading strategy (Simple Moving Average Crossover) within the Backtrader framework. This involved coding the core trading logic, signal generation, and order execution flow. The system incorporated professional risk management protocols, including dynamic position sizing based on a fixed 2% account risk per trade and automatic stop loss/take profit execution, mirroring real world trading constraints.

Performance Analytics & Visualization: Developed a suite of custom analytical tools to calculate and visualize key performance indicators (KPIs). This involved processing trade logs and equity data to generate insightful dashboards featuring equity curves, maximum drawdown, trade win/loss ratios, and monthly returns heatmaps. This process transforms complex raw data into clear, actionable visual insights for strategic decision making.

Automated Reporting: The system is designed to run end to end, from data fetch to report generation, creating a streamlined and repeatable process for strategy validation. This demonstrates an ability to fully automate a complex data workflow, a key skill for maintaining accurate and timely reporting.

Technical Implementation

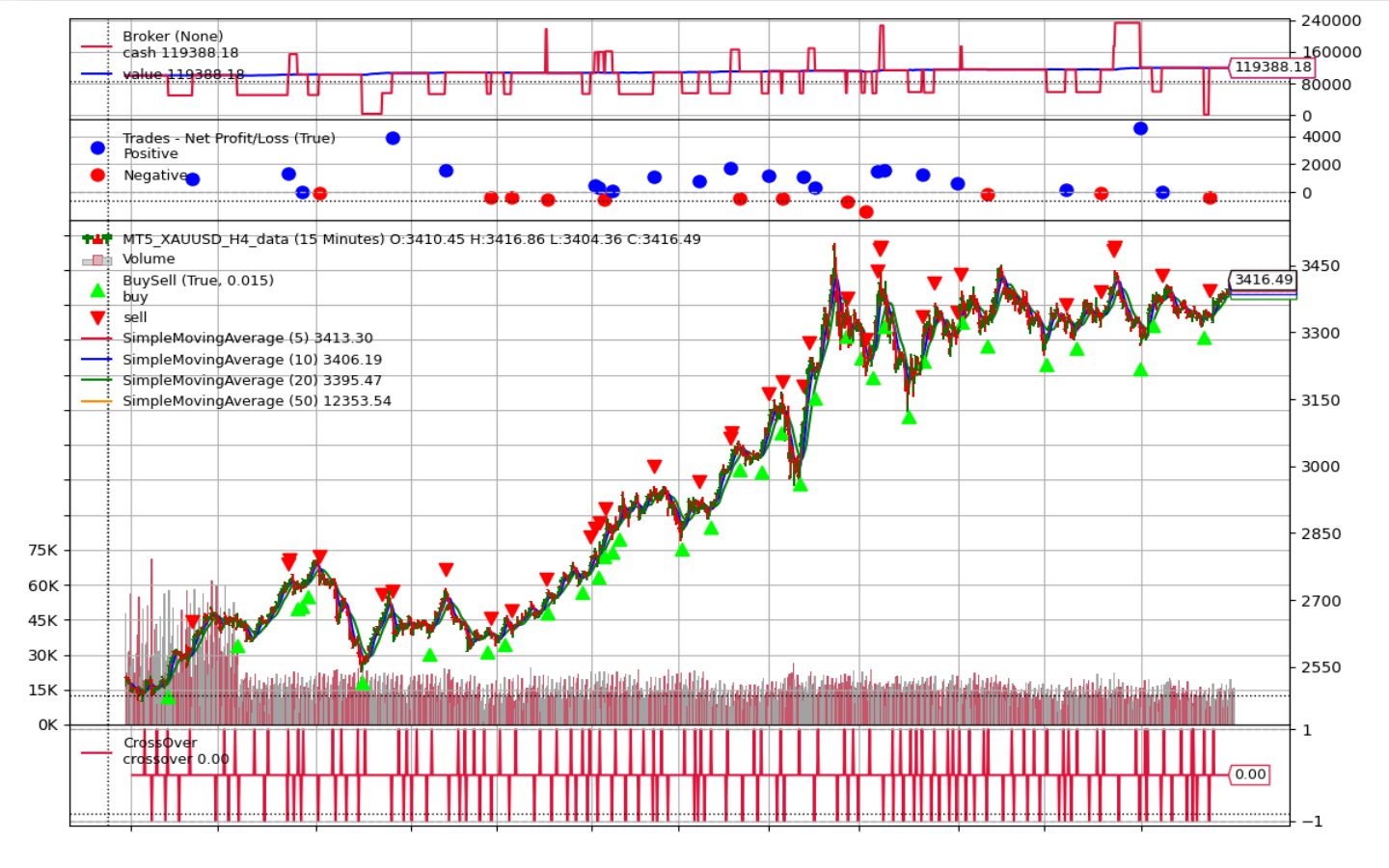
Languages & Libraries: Python, Pandas (Data Manipulation), NumPy (Numerical Analysis), Matplotlib (Visualization) Frameworks & APIs: Backtrader (Backtesting Engine), MetaTrader 5 API (Data Source) Core Skills: Data Pipelines, Algorithmic Logic, Statistical Analysis, Object-Oriented Programming

Metric	Value
Initial Capital	$100,000.00
Final Capital	$119,388.18
Total Return (%)	19.39%
Sharpe Ratio	4.31
Max Drawdown (%)	1.88%
Total Trades	33
Winning Trades	21
Losing Trades	12
Win Rate (%)	63.60%
Highest Win ($)	$4,601.42
Biggest Loss ($)	$-1,389.73
Average Win	$1,246.74
Average Loss	$-492.34
Profit Factor	3.85
Expectancy	$613.40

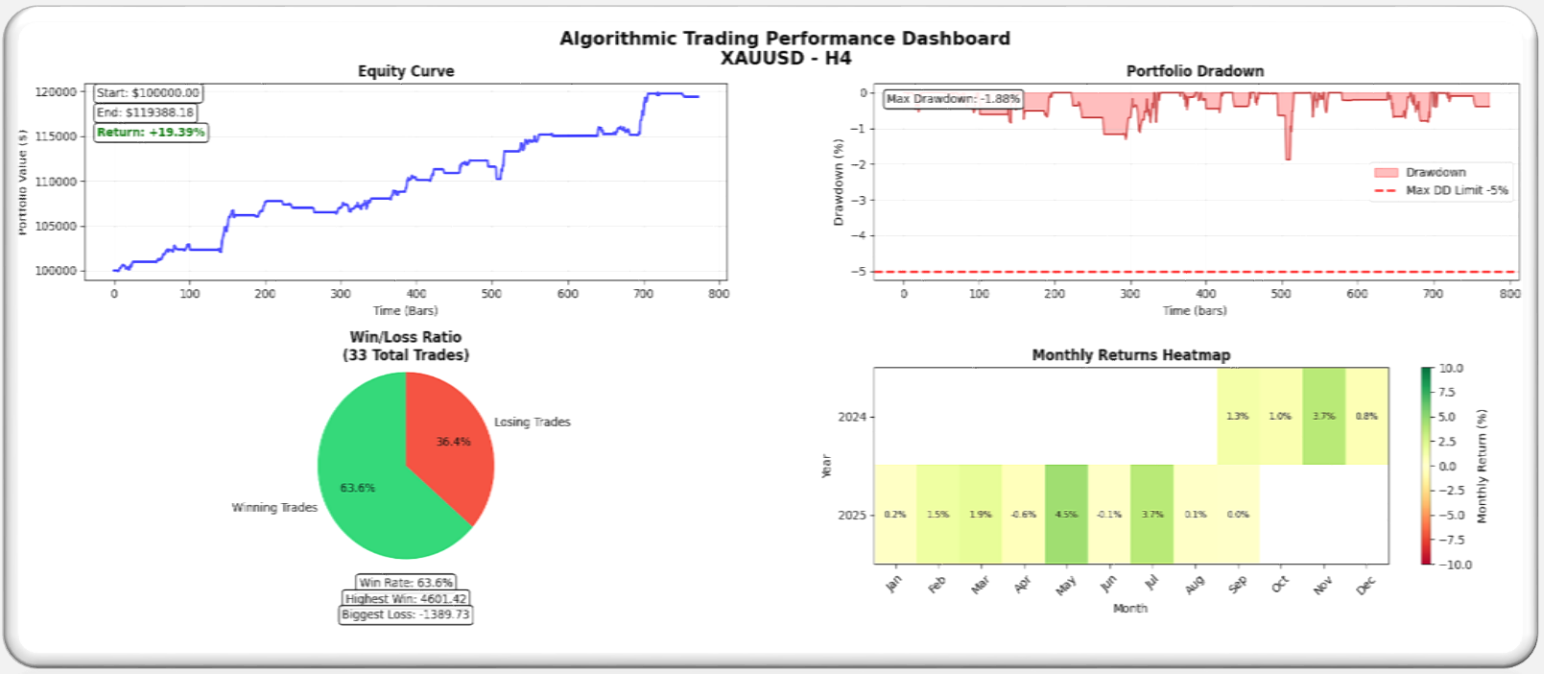
The Importance of Visualization

Raw data alone is insufficient for strategic decision making. The visualization components of this system are critical as they transform complex quantitative results into an intuitive, actionable narrative. The performance dashboard provides an immediate, at glance understanding of strategy health, highlighting key relationships between profitability, risk (drawdown), and consistency over time. This allows for rapid diagnosis of strengths and weaknesses, moving beyond mere profitability to assess the quality and sustainability of performance.

Chart Backtest Output



Performance Dashboard Output



The Visualization Process

The creation of these analytical views.

Metric Selection: Identifying the Key Performance Indicators (KPIs) that truly matter for strategy evaluation total return, risk-adjusted return (Sharpe Ratio), maximum drawdown, and win rate.

Tool Development: Building custom visualization modules using Matplotlib to precisely calculate and plot these metrics, moving beyond standard output to tailored analysis.

Narrative Design: Arranging the individual components (equity curve, drawdown, trade history, heatmap) into a single, cohesive dashboard. This layout tells a complete story, allowing the relationship between different metrics. Such as how drawdown periods correlate with specific market phases to be instantly understood.

Automation: Integrating this visualization step into the automated pipeline, ensuring that every backtest concludes with the immediate generation of a clear, professional grade report, eliminating manual chart creation and ensuring consistency.

Areas For Development & Improvement

A core principle of this project is iterative enhancement. Future development would focus on increasing the sophistication and robustness of the system.

Advanced Analytics: Integrating more complex performance metrics, such as Omega or Calmar ratios, to provide a deeper, more nuanced view of risk adjusted returns beyond the Sharpe ratio.

Machine Learning Integration: Exploring the incorporation of machine learning models (e.g., LSTMs or Gradient Boosting models) for predictive price forecasting or to dynamically adjust strategy parameters based on changing market regimes.

Cloud Deployment & Scalability: Migrating the system from a local script to a cloud-based architecture (e.g., using AWS Lambda or Google Cloud Functions) to allow for parallel backtesting of multiple strategies and symbols, significantly reducing computation time.

Interactive Dashboard: Developing a web based, interactive dashboard (using libraries like Plotly Dash or Streamlit) to allow users to dynamically adjust parameters, filter results, and explore the data in real-time.

Conclusion

In summary, this project serves as a robust demonstration of applied data science and software engineering principles. It provides tangible evidence of the ability to own and manage a complex technical initiative from end to end, initial data acquisition and processing to advanced analysis, full workflow automation, and insightful reporting. The skills showcased, including Python programming, data pipeline engineering, quantitative analysis, and data visualization, are directly transferable to roles requiring meticulous data management, analytical rigor, and the delivery of automated, data driven solutions. This system underscores a capability to leverage technology to solve practical problems with a methodical, efficient, and results-oriented approach.

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