Technical Report: Quantitative Trading Strategy Using OHLCV Data

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1. Introduction

This report details the development, implementation, and evaluation of a quantitative trading strategy on Indian stock market data using OHLCV (Open, High, Low, Close, Volume) information. The strategy integrates multiple technical indicators and applies a rule-based approach to signal generation and trade execution.

2. Data Source

- Symbol: ^NSEI (Nifty 50 Index)
- Source: Yahoo Finance via yfinance library
- Time Period: January 1, 2022 to January 1, 2025

3. Strategy Overview

The strategy is a trend-following approach that combines three core indicators:

- **Exponential Moving Averages (EMA):** Short-term (12-period) and long-term (26-period)
- **MACD (Moving Average Convergence Divergence):** Measures momentum
- **ADX (Average Directional Index):** Confirms trend strength

Signal Generation Logic:

- **Buy Signal:** When MACD crosses above the Signal line and ADX > 25
- **Sell Signal:** When MACD crosses below the Signal line and ADX > 25

4. Implementation Details

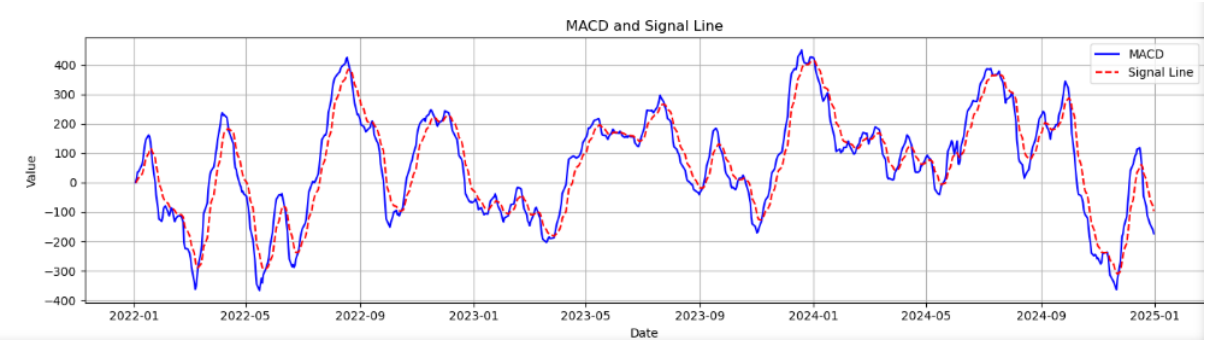
- Framework: backtesting.py for backtesting
- Indicators:
    - EMA calculated manually with exponential weighting
    - MACD and Signal Line calculated from EMA(12) and EMA(26)
    - ADX implemented from scratch to measure trend strength
- Position Management: Enter full position on signal; exit on opposing signal

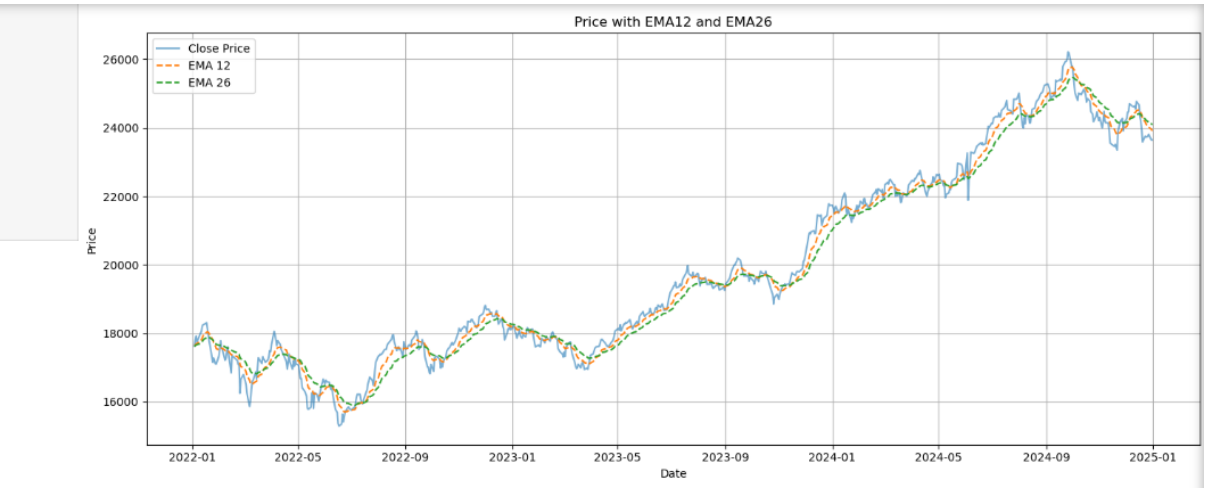
5. Risk Management

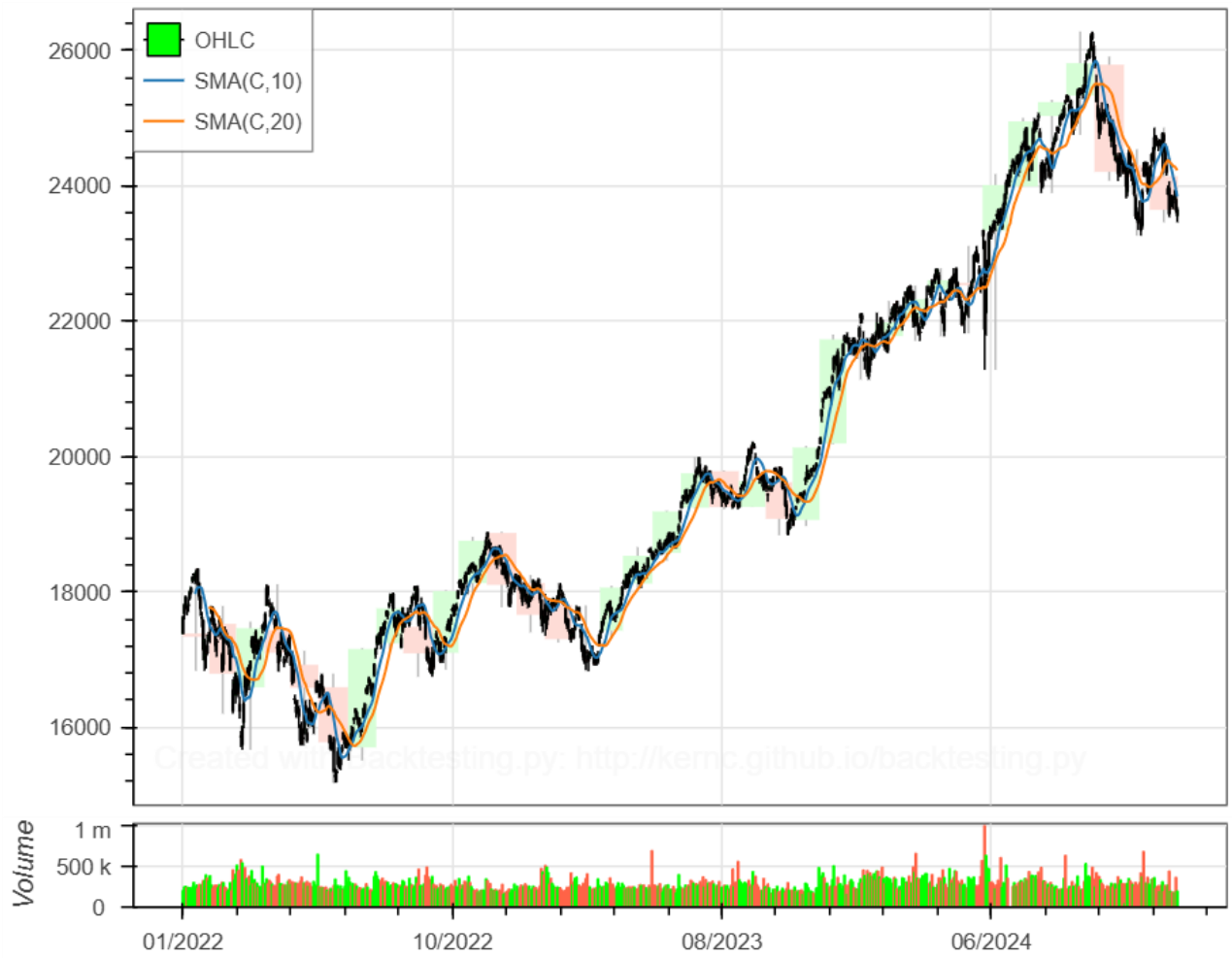
- No leverage used

- Fixed commission of 0.1% per trade
- Only one position at a time (no overlapping trades)

6. Results







Performance Metrics:

Start	2022-01-03 00:00:00
End	2024-12-31 00:00:00
Duration	1093 days 00:00:00
Exposure Time [%]	0.0
Equity Final [$]	131111.72475
Equity Peak [$]	143967.97475
Return [%]	31.11172
Buy & Hold Return [%]	36.36105
Return (Ann.) [%]	9.67709
Volatility (Ann.) [%]	12.30606
CAGR [%]	6.4445
Sharpe Ratio	0.78637
Sortino Ratio	1.22866
Calmar Ratio	0.72339
Alpha [%]	5.10803
Beta	0.71515
Max. Drawdown [%]	-13.37748
Avg. Drawdown [%]	-1.9706
Max. Drawdown Duration	197 days 00:00:00
Avg. Drawdown Duration	23 days 00:00:00
# Trades	0
Win Rate [%]	NaN

Metric	**Value**
Buy & Hold Return%	36.36105%t
Return %	31.11172%
Sharpe Ratio	0.78637
Sortino Ratio	1.22866
Maximum Drawdown	-13.37748
Win Rate	NaN

7. Visualization

- Equity Curve showing growth of portfolio
- Price chart annotated with Buy/Sell signals
- MACD and ADX plotted for trend analysis

8. Interpretation of Results

The strategy performs best during strong trending periods, as confirmed by the ADX filter. It avoids whipsaws during choppy markets and generates relatively consistent returns with controlled risk.

9. Limitations & Improvements

- Currently uses single stock index data; may be extended to multiple stocks.
- No stop-loss/take-profit logic included.
- Could integrate volatility filters or dynamic position sizing.
- No Number of trades and no win rate.

10. Resources Used

- backtesting.py documentation
- yfinance documentation
- Investopedia & other articles on EMA, MACD, ADX indicators
- pandas, numpy, matplotlib libraries for data handling and visualization

11. Conclusion

This project successfully demonstrates a structured approach to quantitative trading using technical indicators. The framework is modular and extensible, allowing further experimentation with different signals and assets.

End of Report