Backtested Swing Call Strategies Using EMA Algorithms

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Outline of Topics

Introduction

The stock market offers high returns but is highly volatile and unpredictable. Investors use technical indicators like Moving Averages and sentiment analysis to identify trends. Objective: Provide data-driven insights, backtested strategy with integrated portfolio management to optimize trading decisions.

Problem Statement

Traders face challenges due to unpredictable market movements and inconsistent results. There is a need for reliable, data-driven strategies using technical indicators and market sentiment. EMA-based strategies, combined with sentiment analysis, can improve trade accuracy. Effective portfolio management is essential to optimize returns and manage risk.

Literature Review

TITLE, AUTHOR & YEAR	METHODOLOGY	ADVANTAGES	DISADVANTAGES	LIMITATIONS
Stock Market Prediction: Does Trading Volume Help? (2008) By A. U. Khan, T. Bandopadhyaya, and S. Sharma	Focuses on how trading volume affects stock market predictions using Neural Networks.	Can predict short-term price movements. Simple to implement.	Overfitting may occur due to too many input variables. - Trading volume alone does not significantly improve accuracy	Trading volume as a predictor is ineffective.Focus on short-term prediction only
Stock Price Prediction Using Genetic Algorithms and Evolution Strategies(2012) By Ganesh Bonde ,Rasheed Khaled	Genetic Algorithms (GA) and Evolution Strategies (ES) were applied to predict stock prices. The model evolved trading rules using evolutionary techniques.	Avoids Overfitting: Evolutionary approach ensures better generalization. GA and ES optimize feature selection, reducing irrelevant data.	High Computational Cost: GA/ES require extensive computations. No Real-Time Validation: Results not tested in live markets.	The model is not tested on real-time data, meaning it may perform poorly in live markets.Missing other crucial indicators like sentiment analysis, macroeconomic factors, and financial ratios
Automated Stock Price Prediction and Trading Framework for Nifty Intraday Trading (2013) by A. A. Bhat and S. S. Kamath	Combines Neural Networks with Sentiment Analysis, Technical Indicators, and an Automated Trading System to predict and trade stocks.	Fully automated trading system. Accounts for external factors and sentiment.	Limited to the Indian NIFTY market. High reliance on data quality for sentiment analysis.	Only tested on Indian markets. Relies on sentiment data.
Stock Price prediction using LSTM and SVR(2020) by Gourav Bathla	Uses Long Short-Term Memory (LSTM) and Support Vector Regression (SVR) for stock price prediction.	Handles non-linear stock price movement better than traditional models; reduces vanishing gradient problem.	LSTM is computationally expensive; SVR struggles with large datasets.	Ignores sentiment analysis and fundamental analysis, focusing only on price movement.
Prediction of Trends in Stock Market Using Moving Averages and Machine Learning (2021) by N. R. Raa, S. Dinesh, S. R. Samhitha, and S. P. Anusha	Uses Moving Averages combined with Regression models to forecast stock market trends.	Reduces latency in trading signals; improves trend prediction accuracy.	Moving averages are lagging indicators; cannot handle market volatility well.	Model struggles with rapid trend reversals and unexpected market shocks.
Stock market prediction using the LSTM algorithm with the Relative Strength Index (RSI) and Exponential Moving Average (EMA) indicators(2023) by Rahul Maruti Dhokane, Sohit Agarwal	Combines LSTM with Relative Strength Index (RSI) and Exponential Moving Averages (EMA) to improve prediction accuracy.	Enhances prediction by integrating technical indicators; reduces mean absolute percentage error (MAPE).The inclusion of RSI and EMA refines trend detection, making the system more reliable.Giving Higher Accuracy (80-85%)	Requires extensive feature engineering; model training takes longer due to added complexity.	Limited to technical indicators, lacks fundamental analysis and real-time adaptability.

Figure: Literature Survey

Literature Review

Why we Choose This as our Base Paper:

- **Enhanced Feature Selection**: Combines LSTM with technical indicators (RSI, EMA) for better trend detection.
- **Overcomes Past Limitations**: Avoids sentiment analysis biases (Bhat 2013) and improves upon Bathla (2020), which lacked technical indicators.

Why our Project is Better Than the Base Paper:

- **Real-Time Trading Suitability**
- **Backtesting for Strategy Validation**
- **Actionable Trading Insights**
- **Sentiment Analysis**
- **Portfolio Diversification**
- **Professional PDF Report**

Existing System

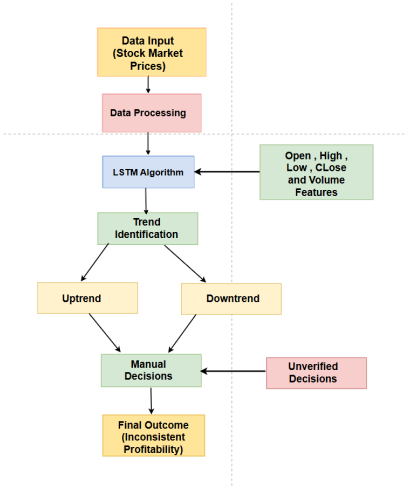

Figure: Flow of Existing System

Proposed Solution

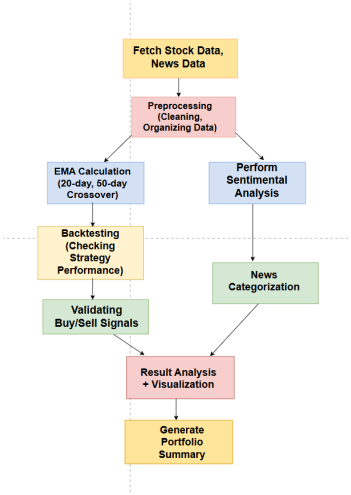

Figure: Proposed Solution Design

Architecture Overview

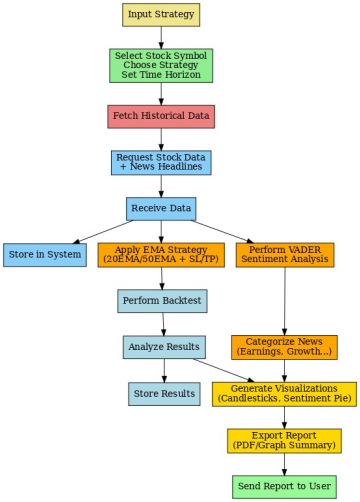

Figure: Architecture Overview

Software Requirements

- **Operating System:** Windows / Linux / macOS
- **Development Platform:** Google Colab
- **Python Version:** Python 3.8 or later
- **Package Manager:** `pip` (Pre-installed in Colab and local Python environments)
- **Python Libraries Used:**
  - `pandas` – Data manipulation and analysis
  - `numpy` – Numerical operations
  - `matplotlib.pyplot` – Data visualization
  - `yfinance` – Fetching historical stock market data
  - `mplfinance` – Candlestick chart plotting
  - `feedparser` – Parsing news headlines from RSS feeds
  - `nltk`– Natural Language Toolkit for text processing,specifically sentiment analysis.
  - `fpdf` – To generate PDF reports.
  - `os` – For creating directories and saving files.

Hardware Requirements

- **Processor:** Intel Core i5 or higher / AMD Ryzen 5 or higher
- **RAM:** Minimum 8 GB (Recommended: 16 GB for smoother performance during backtesting and visualization)
- **Storage:** Minimum 50 GB of free space (SSD recommended for faster data handling, if working locally)
- **Internet Access:** Required for:
  - Fetching real-time and historical stock market data (using `yfinance`)
  - Accessing financial news via RSS feeds (using `feedparser`)
  - Using Google Colab cloud platform
- **Display:** Minimum 720p resolution (Recommended: 1080p or higher for clear visualizations)

Methodology

- **1. Data Collection** – Retrieved 600 days of historical stock prices (e.g. Reliance, NIFTY 50) from Yahoo Finance.
- **2. EMA-Based Trend Detection** – Plotted candlestick charts with 20-day EMA (blue) and 50-day EMA (black) to spot bullish/bearish trends.
- **3. Trade Signal Generation** –
  - Buy Signal: 20EMA crosses above 50EMA
  - Sell Signal: 20EMA crosses below 50EMA
- **4. Backtesting** – Simulated strategy on historical data to compute total returns and trade accuracy.
- **5. Sentiment Analysis** –
  - Fetched real-time news using RSS feeds via `feedparser`
  - Visualized sentiment with pie charts and categorized headlines
- **6. Portfolio Analysis** –
  - Calculated percentage returns, win/loss ratio, and risk levels
  - Compared performance with market peers over 1-year returns
- **7. Visualization and Alerts** –
  - Highlighted buy/sell signals, risk levels, and sentiment alerts
  - Visualized diversified portfolio trends
- **EMA**
  - Exponential Moving Average (EMA) gives higher weight to recent prices
  - **Formula:** $\text{EMA} = (\text{Close} - \text{EMA}_{\text{previous}}) \times \text{Multiplier} + \text{EMA}_{\text{previous}}$

Implementation

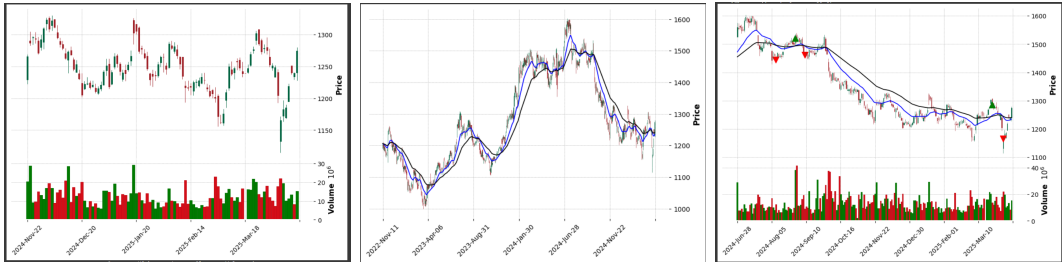

Figure: Strategy Implementation Outputs

Implementation

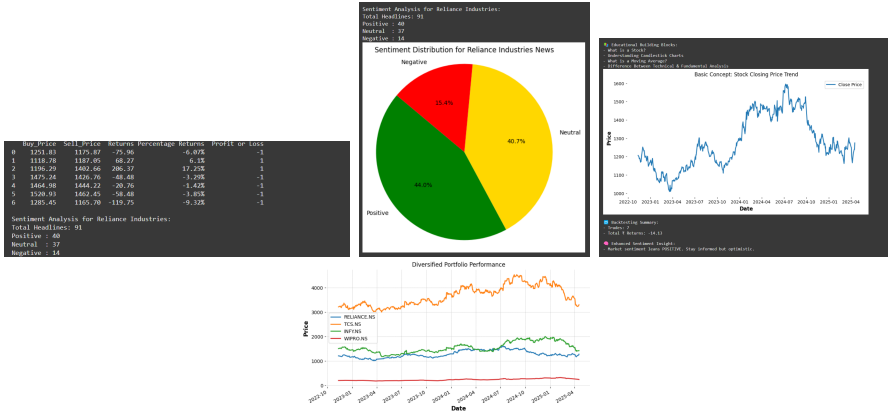

Figure: Strategy Implementation Outputs

Advantages

1. **Comprehensive Technical Analysis**: The project implements candlestick charts, EMAs, and buy-sell signal logic, making it a solid tool for analyzing stock trends.
2. **Sentiment Analysis Integration**: By pulling real-time headlines and analyzing sentiments, it combines *fundamental* and *technical* insights for better decision-making.
3. **Risk Management Logic**: Adding stop-loss and take-profit levels provides a more *realistic trading model* with basic risk mitigation.
4. **Portfolio Performance Evaluation**: The project calculates *returns, win rate*, and uses a **risk meter**, which gives traders a quick view of how well their strategy performs.
5. **Educational and Beginner-Friendly Add-ons**: Explanatory blocks and beginner alerts make the system friendly even for non-experts.
6. **Portfolio Diversification**: Comparing Reliance with industry peers shows how diversification can be visually understood and tracked.

Future Scope

Future Scope

- **Real-Time Trading with API Integration:** Connect the system to live trading platforms (e.g., Zerodha, Upstox) for automated execution of trade signals.
- **Social Media Sentiment Analysis:** Include real-time data from platforms like Twitter and Reddit to better capture public opinion and emerging market sentiment.
- **Scalability Across Asset Classes:**Extend functionality to support cryptocur- rencies, commodities, and forex for broader market application.

Conclusion

Thus our project successfully demonstrates the use of Python-based backtested swing call strategies using EMA algorithms for stock trading. By automating data retrieval, strategy implementation, and backtesting using Python libraries (NumPy, Pandas, Matplotlib, yfinance), it enhances decision-making and reduces reliance on intuition.
The results show promising profitability, and further improvements can enhance accuracy and efficiency. This study contributes to algorithmic trading with a structured, data-driven approach.

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- G. Bathla, "Stock Price Prediction Using LSTM and SVR," IEEE, PDGC, 2020.
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Questions & Answers

Thank You!
Questions are welcome.