Creating and testing the Momentum based algorithm trading strategy in the Indian market

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INTRODUCTION

What is Momentum Trading ?

Momentum trading is an investment strategy focused on buying and selling assets based on recent price trends. Traders use this approach to identify assets with strong upward or downward momentum over short periods, like days or weeks, and capitalize on these trends before they reverse. In India, this strategy is commonly applied to stocks, commodities, and currencies. By analyzing price charts and using tools called momentum stock screeners, traders can gauge the strength and speed of price movements. This approach enables them to make informed decisions and maximize returns, taking advantage of trends in the market as they emerge.

Types of Momentum Trading

Time -Series Momentum

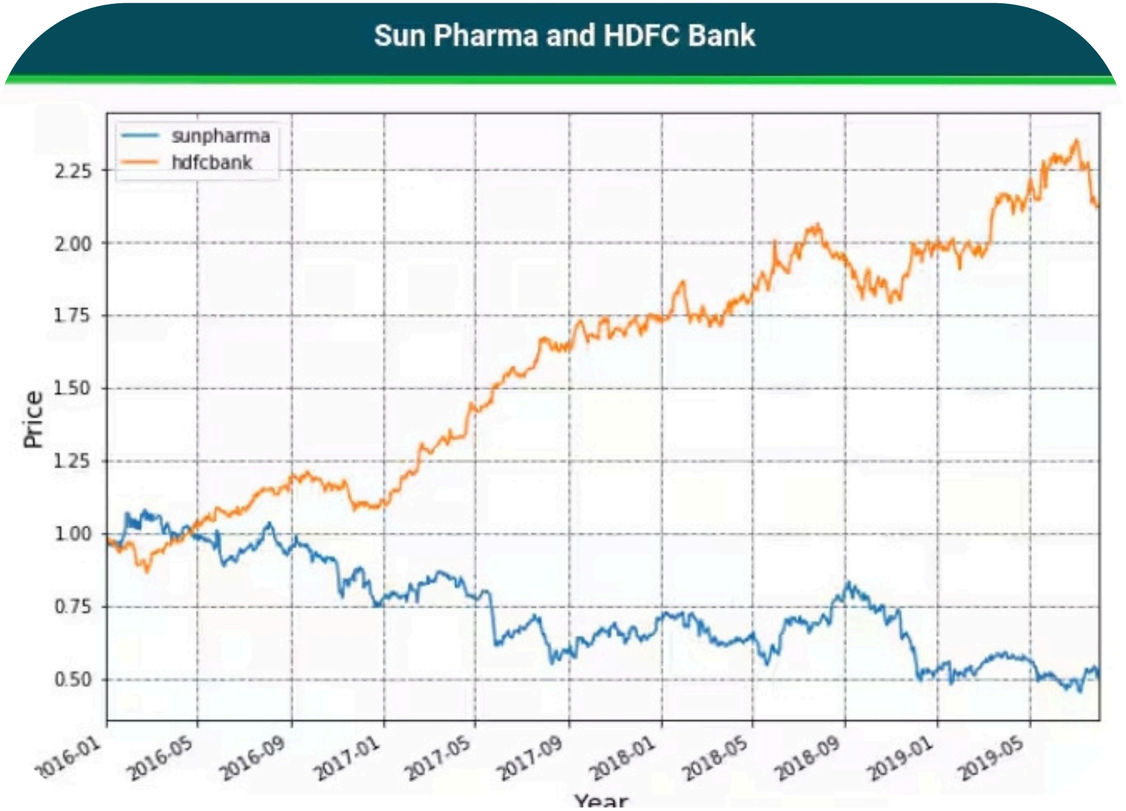
- Application: In time-series momentum trading, traders assess the historical performance of individual assets over a specific period.
- Methodology: Traders identify assets that have achieved a certain percentage profit threshold over a specified historical period, such as the past 3, 6, or 12 months.
- Execution: Assets exceeding this threshold are bought, anticipating that their positive momentum will continue. The focus is solely on the performance of each asset relative to its own historical performance.
- Example: If a stock has gained more than 10% over the past 6 months, it may trigger a buy signal under a time-series momentum strategy.

Cross-Sectional Momentum

- Application: In cross-sectional momentum trading, traders compare the performance of assets relative to each other within a portfolio or universe of assets.
- Methodology: Traders rank assets based on their recent performance relative to other assets in the same universe. For instance, they may rank stocks based on their returns over the past 3 months.
- Execution: The top-performing assets (e.g., top 10) are bought, while the bottom-performing assets are either sold short or avoided. The focus is on selecting assets with the strongest relative performance compared to their peers.
- Example: If a stock ranks among the top 10 performers in terms of returns over the past 3 months compared to other stocks in the same sector, it may be considered for inclusion in a cross-sectional momentum strategy.

Graphical Example of Time Series & Cross Sectionional Momentum

Here ,Asian Paints announced positive earnings on July 24, 2019, and the stock went up that day. And on the following trading days, it continues to move in a positive direction.



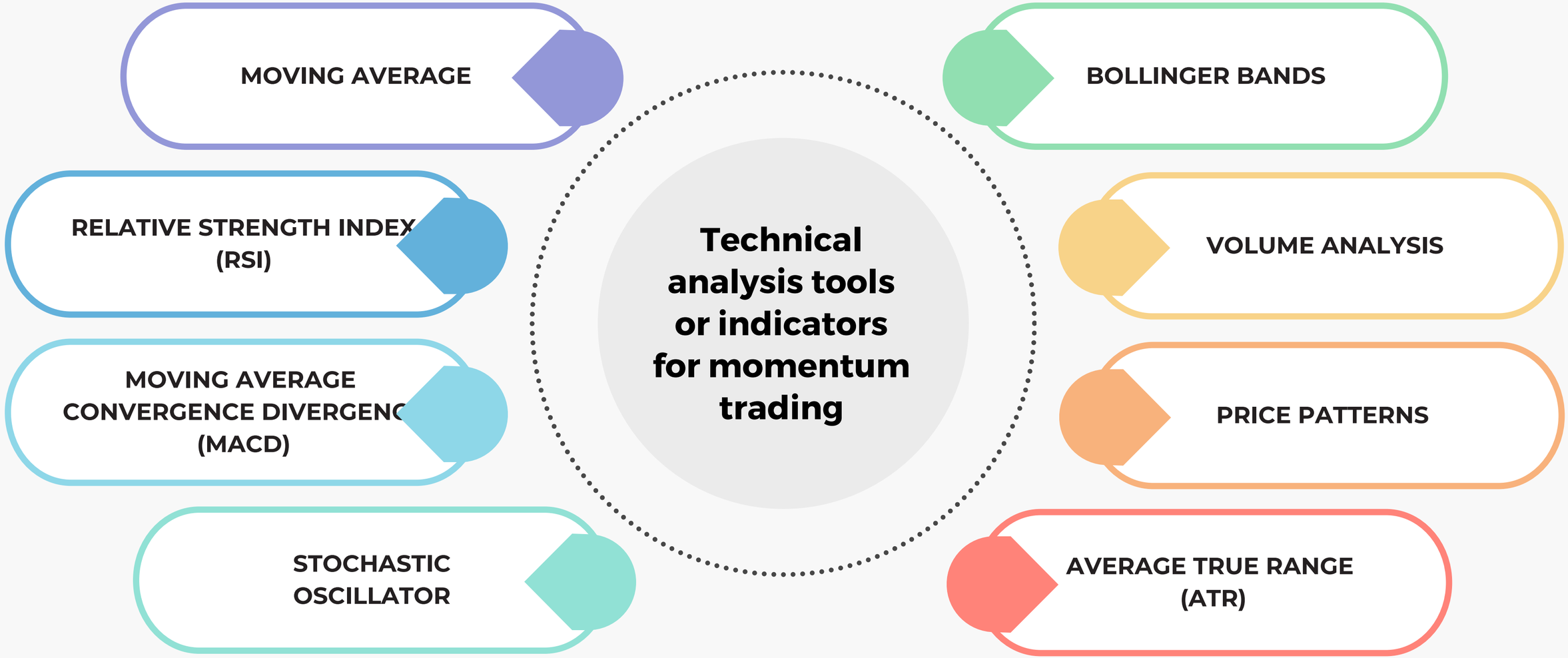
if HDFC Bank has outperformed Sun Pharma last year then the hypothesis is that HDFC Bank is likely to continue to outperform Sun Pharma this year. The below graph shows how HDFC Bank has outperformed Sun Pharma over the last three years.

Short-term momentum trading

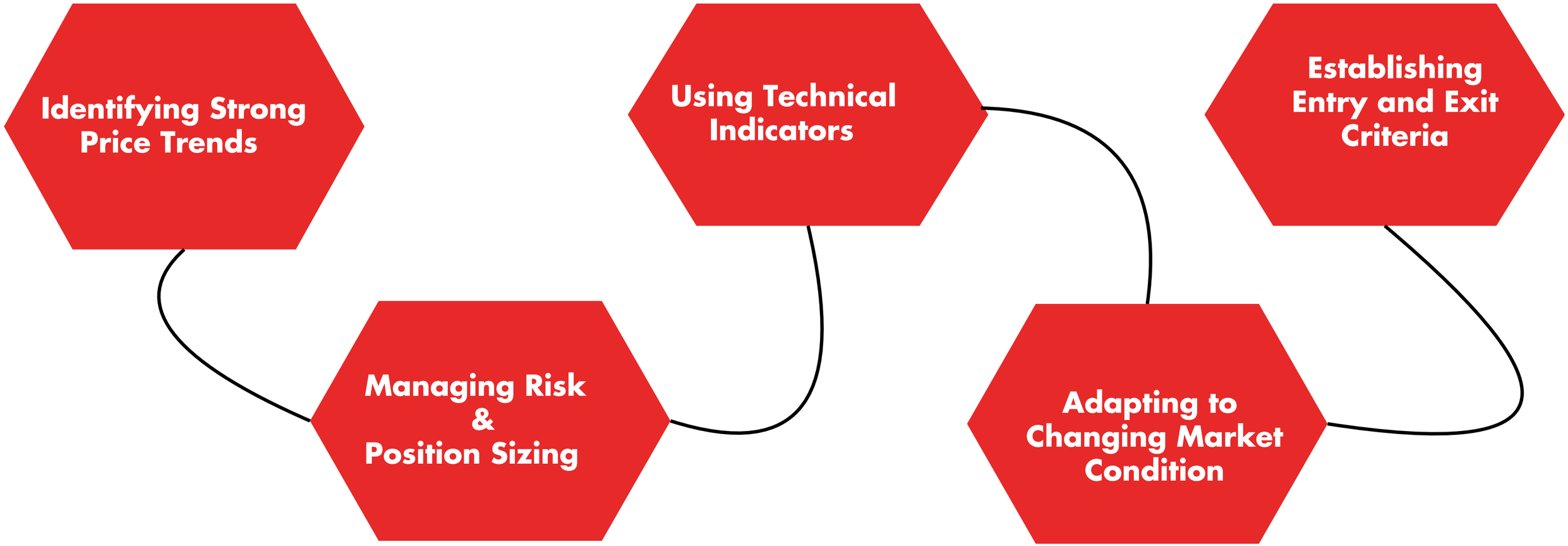
- Focuses on identifying short-term price trends, typically lasting from a few minutes to hours or days.
- Short-term momentum traders, often known as day traders, actively monitor the market for quick price movements.
- Use charts and technical indicators to identify stocks with strong upward momentum or those in a downward trend.
- Typically close all positions by the end of the trading day to avoid risks associated with overnight market fluctuations.
- Aim to capitalize on rapid price movements within the day, reducing exposure to market volatility beyond the trading session.

Longer-term momentum trading

- Long-term momentum traders adopt an extended outlook, analyzing daily, weekly, and monthly charts to identify longer-term trends.
- Use longer time frames to reduce the noise and volatility typically associated with shorter time frames.
- Aim to capture sustained price movements over weeks to months, focusing on established uptrends or downtrends.
- Often combine technical analysis with fundamental analysis to find stocks with strong underlying fundamentals.
- Focus on favorable market conditions to identify securities with the potential for consistent, long-term growth or decline.


MOVING AVERAGE
RELATIVE STRENGTH INDEX (RSI)
MOVING AVERAGE CONVERGENCE DIVERGENC (MACD)
STOCHASTIC OSCILLATOR
Technical analysis tools or indicators for momentum trading
BOLLINGER BANDS
VOLUME ANALYSIS
PRICE PATTERNS
AVERAGE TRUE RANGE (ATR)

How Momentum Trading Work



Factor Affecting Momentum Trading

Market Environment

01

- Market Conditiions
- Time Horizon
- Asset Selection

Risk Mangement

02

- Risk Mangement Techniques
- Pschological Factors

Risk Mangement

03

- News & Events
- Market Sentiments
- Regulatory Factors

KEY TAKEAWAYS WHILE IMPLEMENTING MOMENTUM TRADING STRATEGY

- Understand the Strategy & Define Clear Criteria
- Manage Risk Effectively & Stay Disciplined
- Select Assets Wisely & Use Technical Indicators
- Stay Informed & Continuous Learning
- Backtest and Evaluate

Risks involved while implementing momentum trading strategy

01

TIME-INTENSIVE NATURE

02

HIGH TRANSACTION COSTS

03

MARKET SENTIMENT

04

TREND REVERSALS

05

TIMING OF ENTRY AND EXIT

Role of Big-Data in Momentum Based Algorithm Trading

01 Enhanced Data Sources

- Market Data: Access to high-frequency price, volume, and order book data.
- Sentiment Analysis: Scraping news, social media, and forums to gauge market sentiment.
- Alternative Data: Integrating datasets like web traffic, satellite imagery, and macroeconomic indicators.

02 Improved Signal Accuracy

- Feature Engineering: Utilize big data tools to derive advanced features (e.g., intraday volatility, liquidity metrics).
- Behavioral Patterns: Identify repetitive trading patterns from large historical datasets.
- Dynamic RSI Thresholds: Use machine learning models to optimize RSI levels dynamically based on market conditions.

03 Real-Time Decision Making

- Scalability: Cloud-based big data platforms process and analyze large volumes of streaming data in real-time.
- Low Latency: Employ distributed computing frameworks (e.g., Spark) for faster execution of momentum strategies.

04 Risk Mitigation

- Stress Testing: Simulate strategy performance across billions of scenarios using historical and synthetic data.
- Anomaly Detection: Spot outliers or unusual trading behaviors that might affect momentum signals.

Role of Big-Data in Momentum Based Algorithm Trading

05 Automation with AI

- Algorithm Adaptation: ML models fine-tune momentum strategies in real-time.
- Big Data Pipelines: Automate the ingestion, processing, and deployment of trading strategies.

06 Backtesting at Scale

Leverage big data to backtest strategies across:

- Multiple Stocks: Expand beyond the Nifty 50 to the entire market.
- Extended Timeframes: Decades of historical data to identify long-term effectiveness.
- Market Regimes: Test across bull, bear, and sideways markets.

Creating and Backtesting the Algorithm

Methodology for Creating the Algorithm

Data Retrieval and Preparation

- **Stock Data Source:**
  1. Used Yahoo Finance API to fetch historical data of Nifty 50 stocks.
  2. Data includes critical attributes: Open, High, Low, Close, Volume, and Date.

- **Big Data Connection:**
  1. Used PySpark to process large datasets efficiently, making it easy to analyze multiple stocks at the same time and handle big data using distributed computing.

- **Data Preprocessing:**
  1. Merged and sorted datasets for consistent analysis across all selected stocks.

- **Momentum Indicator - RSI**

  Calculation Logic:

  1. Calculated the Relative Strength Index (RSI) using a rolling 14-day window for each stock.
  2. RSI quantifies momentum by comparing average gains and losses over a given period.

  Formulas:

  1. Daily price change: $\Delta P = P_{today} - P_{yesterday}$
  2. Gains: $\max(\Delta P, 0)$; Losses: $\max(-\Delta P, 0)$
  3. RS: Avg. Gain/Avg. Loss
  4. RSI: 100 - (100/1+RS)

- **Signal Generation:**
  1. Overbought (RSI > 70): Generate Sell Signal.
  2. Oversold (RSI < 30): Generate Buy Signal.

  Big Data Connection:

  1. Spark DataFrame transformations for efficient computation of RSI and trading signals across all stocks.

Creating and Backtesting the Algorithm

Backtesting the Algorithm

Portfolio Simulation Logic

- **Initial Parameters:**
  1. Starting Capital: ₹100,000

Signal-Based Trades:

- **Buy Signals:**
  1. Equally distributed capital among all stocks with Buy signals for the day.
  2 .Calculated shares to purchase based on available capital and stock prices.
- **Sell Signals:**
  1. Sold all shares of stocks flagged with Sell signals, adding proceeds back to the capital.

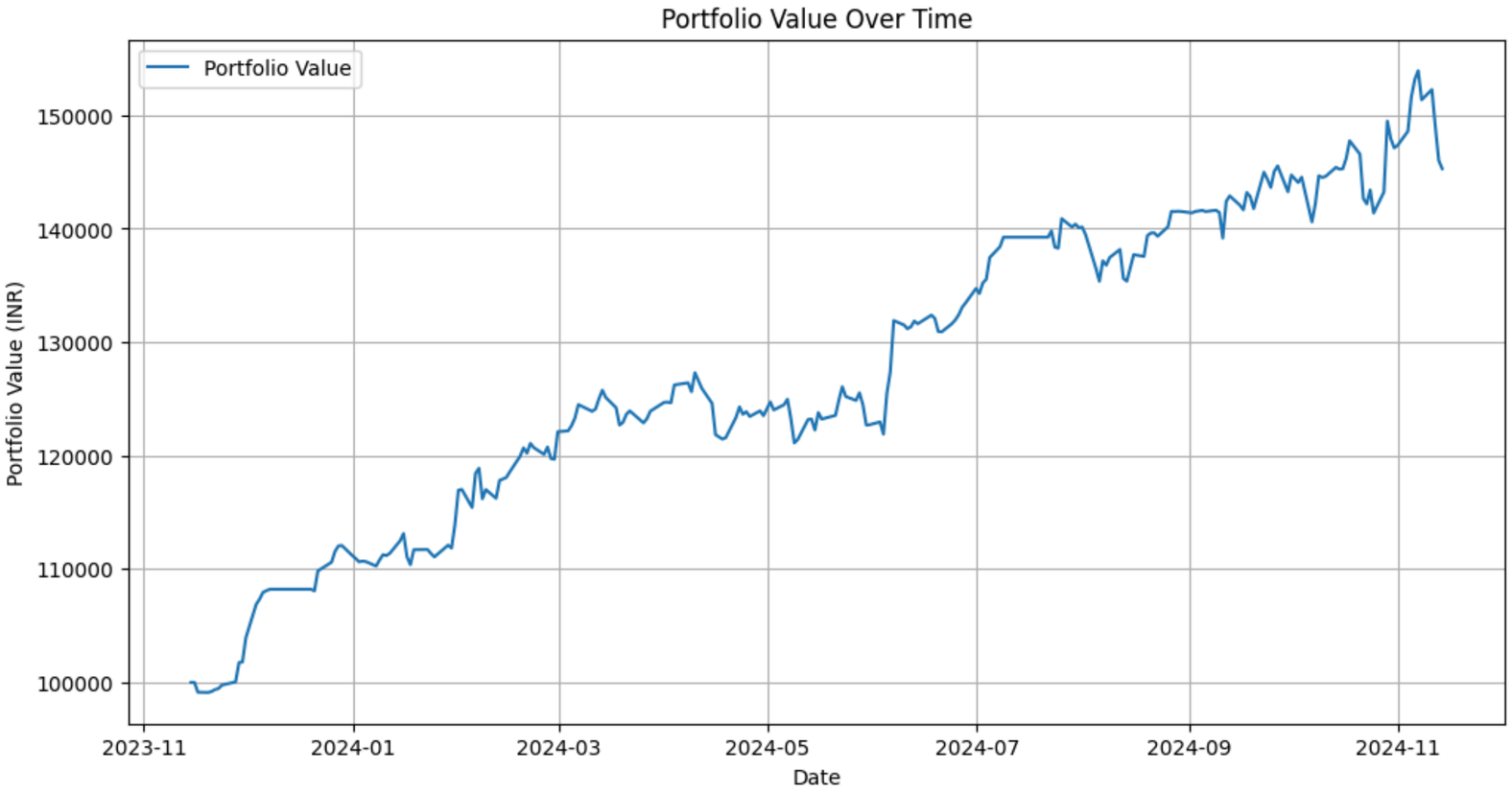
Daily Portfolio Value Calculation:

- Included current cash balance and the market value of held stocks for accurate tracking.
- Utilized PySpark for distributed processing of signals and portfolio computations over the entire dataset.

Big Data Connection:

- PySpark processed daily data for multiple stocks over a year, simulating real-world scenarios where large-scale datasets are analyzed.
- Scalable to integrate datasets across multiple years or extended stock lists (e.g., entire market indices).

Initial Capital	**₹1,00,000**
Final Portfolio Value	**₹1,45,300.34**
Total Returns	**45.3%**



Thank You