

Stock Analyzer - Brief Technical Overview

Enterprise-grade financial analysis platform with AI-powered insights

System Overview

The Stock Analyzer is a professional financial analysis platform that combines advanced technical analysis with AI-powered sentiment analysis to generate publication-quality investment reports. Built with Python, it processes stock data from multiple sources and produces comprehensive Excel reports suitable for professional use.

Key Capabilities

- **Multi-source data fetching** (Yahoo Finance, Alpha Vantage)
- **Advanced technical analysis** (9 indicators including RSI, MACD, Bollinger Bands)
- **AI-powered event analysis** using OpenAI GPT with cost optimization
- **Financial sentiment analysis** with custom domain lexicon
- **Professional Excel reports** with charts and visualizations
- **Portfolio analysis** and batch processing

Architecture

Core Components

Component	Purpose	Key Technology
Data Engine	Multi-source data acquisition	Yahoo Finance, Alpha Vantage APIs
Technical Analyzer	Calculate 9+ technical indicators	Pandas, NumPy vectorized operations
AI Event Analyzer	Intelligent price movement analysis	OpenAI GPT-4 with dynamic thresholds
Sentiment Engine	Financial text analysis	Custom lexicon + VADER sentiment
Report Generator	Professional Excel output	openpyxl + Matplotlib charts
Validation System	Data quality assurance	Custom validators with scoring

Data Flow



AI & Intelligence Features

Dynamic Intelligence System

- **Learning Phase:** 3% threshold, comprehensive analysis to build patterns
- **Knowledge Phase:** 7.5% threshold, GPT-first approach with fallback
- **Cost Optimization:** 60-80% API cost reduction through intelligent method selection

Sentiment Analysis Innovation

- **Dependency-free implementation** (avoids TextBlob/spaCy conflicts)
 - **Custom financial lexicon** with 3-tier intensity (Strong/Moderate/Weak)
 - **Financial amplifiers** (earnings, mergers, IPO) boost sentiment weighting
 - **Ensemble scoring** combines VADER + financial analysis (0-100 scale)
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Technical Analysis

Indicators Implemented

- **Trend:** SMA (20,50,200), EMA (12,26), MACD (12,26,9)
- **Momentum:** RSI (14), Stochastic Oscillator (14,3,3)
- **Volatility:** Bollinger Bands (20,2 σ), ATR (14)
- **Volume:** Volume SMA, On-Balance Volume (OBV)
- **Support/Resistance:** Dynamic levels with 120-day lookback

Risk Metrics

- **Sharpe Ratio:** Risk-adjusted returns (2% risk-free rate)
 - **Maximum Drawdown:** Peak-to-trough decline analysis
 - **Volatility:** Annualized standard deviation
 - **Beta:** Market correlation (vs S&P 500)
 - **VaR:** Value at Risk (95% confidence)
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Professional Reporting

Excel Report Structure (9 Sheets)

1. **Executive Summary** - KPIs, signals, company overview
2. **Company Profile** - Business info, financials, valuation ratios
3. **Technical Charts** - 4-panel Matplotlib visualizations
4. **Technical Analysis** - 60-day indicator data with conditional formatting
5. **Sentiment Analysis** - AI event breakdown with article details
6. **Performance Metrics** - Returns, risk analysis, benchmarking

7. **Raw Data** - Complete dataset with event highlighting
8. **Data Quality** - Validation reports and integrity scores
9. **Metadata** - Analysis documentation and disclaimers

Chart Generation

- **Price & Moving Averages** with multiple timeframes
 - **Volume bars** with color-coded performance
 - **RSI oscillator** with overbought/oversold levels
 - **MACD** with signal line and histogram
 - **High-resolution PNG** embedded in Excel for reliability
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Key Algorithms

Event Detection

```
python

# Dynamic threshold management
def get_current_threshold(self):
    if self.is_learning_phase():
        return 3.0 # Lower threshold for learning
    else:
        return 7.5 # Higher threshold for knowledge phase
```

Sentiment Scoring

```
python

# Ensemble sentiment analysis
final_sentiment = (vader_sentiment * 0.4) + (financial_sentiment * 0.6)

# Apply amplifier boost for financial terms
if amplifiers_present:
    sentiment *= (1 + min(0.3, amplifier_count * 0.1))
```

Technical Indicators (Vectorized)

```
python
```

```
# RSI calculation
```

```
delta = close_prices.diff()
```

```
gain = delta.where(delta > 0, 0).rolling(14).mean()
```

```
loss = (-delta.where(delta < 0, 0)).rolling(14).mean()
```

```
rsi = 100 - (100 / (1 + gain/loss))
```

Performance & Optimization

Intelligent Caching

- **24-hour TTL** for API responses
- **Pandas DataFrame** serialization
- **Size-limited cache** (100MB) with automatic cleanup

Rate Limiting

- **Alpha Vantage:** 5 calls/minute, 25 daily (free tier)
- **OpenAI:** Exponential backoff with retry logic
- **Automatic failover** to sample data generation

Error Handling

- **Multi-source fallback** (Yahoo Finance → Alpha Vantage → Sample Data)
- **Graceful degradation** with partial analysis support
- **Comprehensive logging** with color-coded output
- **Input validation** at every stage

Commercial Applications

Target Markets

- **Financial Advisors:** Client reporting and portfolio analysis
- **Investment Firms:** Automated research and risk assessment
- **Individual Traders:** Professional-grade analysis tools
- **Academic Research:** Market behavior and sentiment studies

Deployment Options

- **Desktop Application:** CLI and interactive modes
- **Batch Processing:** Multiple stocks from file input
- **API Integration:** Embeddable analysis engine

- **White-label Solution:** Custom branding for firms
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Technology Stack

Core Technologies

- **Python 3.8+** with Pandas, NumPy for data processing
- **OpenAI GPT-4** for intelligent event analysis
- **VADER + Custom Lexicon** for sentiment analysis
- **Matplotlib + openpyxl** for professional reporting
- **Yahoo Finance + Alpha Vantage** for market data

System Requirements

- **Memory:** 4GB RAM (8GB recommended)
 - **Storage:** 1GB + space for reports/cache
 - **Network:** Internet for API access
 - **OS:** Windows, macOS, Linux compatible
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Key Features Summary

Data Processing

- Multi-source data fetching with intelligent fallback
- 9+ technical indicators with vectorized calculations
- Comprehensive data quality validation (0-100% scoring)

AI Integration

- Dynamic two-phase learning system
- Cost-optimized GPT usage (60-80% savings)
- Custom financial sentiment analysis

Professional Output

- Publication-quality Excel reports (9 sheets)
- High-resolution embedded charts
- Professional styling and conditional formatting

Enterprise Features

- Comprehensive error handling and logging

- Intelligent caching and rate limiting
- Multiple interface modes (CLI, interactive, batch)

✓ Validation & Quality

- Input validation with detailed feedback
 - Data integrity checks (OHLC logic, outliers)
 - API response validation across all sources
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🎯 Competitive Advantages

1. **Intelligent Cost Optimization:** Dynamic AI usage reduces costs while maintaining quality
 2. **Dependency-Free Sentiment:** Avoids common Python package conflicts
 3. **Financial Domain Expertise:** Custom lexicon and amplifiers for accurate analysis
 4. **Professional Output:** Publication-ready reports suitable for client delivery
 5. **Robust Architecture:** Enterprise-grade error handling and validation
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This system represents a sophisticated financial analysis platform that combines cutting-edge AI with traditional technical analysis to deliver professional-grade investment research tools.

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