



Comprehensive Report on Financial Analysis and Forecasting

Introduction

Project Objective

The goal of this project is to create an automated system for analyzing companies' financial indicators and forecasting stock prices based on historical data. The system leverages GPT-4o-mini for generating financial reports and TimeGPT for predicting market trends.

Motivation for Topic Selection

Investors and analysts often face the challenge of processing large volumes of financial data. The use of generative AI automates the analysis process, while TimeGPT enables highly accurate forecasts.

Workflow

1 Data Collection and Preparation

- Yahoo Finance API is used to retrieve historical stock prices and financial metrics (financial ratios and balance sheet data).
- 2–3 key indicators are selected from each financial reporting block, covering profitability, liquidity, and indebtedness.
- Time series are constructed based on quarterly stock prices.

2 Model Training or Adaptation

- GPT-4o-mini is used to generate text-based analysis of financial indicators. Prompts are dynamic and include real values for precision.
- TimeGPT is applied to forecast stock prices 3 months ahead.
- FastAPI integrates all modules into a REST API for ease of use.

3 Solution Integration

- The API provides users with a structured financial analysis and stock price forecast.
 - All modules are organized according to the clean architecture principle, ensuring separation of logic.
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Challenges and Solutions

1 Technical Issues

- **Resource Constraints:** TimeGPT requires significant computing power.
- **Execution Speed:** Using Prophet instead of TimeGPT significantly speeds up forecasting and can be considered as an alternative.
- **Data Quality:** Incomplete financial reports from some companies complicate the analysis.

2 Solutions Implemented

- Optimized financial indicator processing by verifying data availability beforehand.
 - Used TimeGPT only for short-term forecasts (3 months) to balance speed and accuracy.
 - Split the logic into modules for easier integration and expansion.
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Results

1 Achieved Metrics

- **TimeGPT Forecast Accuracy:** ~85% (based on test samples).
- **Report Generation Time:** < 10 seconds.
- **Forecast Calculation Time:** ~3–8 seconds per company.

2 Comparison with Existing Methods

Method	Forecast Accuracy	Execution Time
Prophet	75%	1 second
TimeGPT	85%	3–8 seconds
Random Walk Model	60%	0.5 seconds

Additionally, feedback was collected from 10 analysts.

- All 10 preferred this system over traditional report generation.
- 7 out of 10 noted the adequacy and accuracy of the analysis.
- 3 suggested improvements: more financial indicators, better trend detail, and macroeconomic context.

Example of a Standard Report Description Generated by ChatGPT-4

Intel Corporation (ticker: INTC) has published its financial results for the fourth quarter and the full year of 2024. For the year, the company's revenue amounted to \$53.1 billion, which is 2% less compared to the previous year. The net loss reached \$18.76 billion, while in 2023, the company had a net profit of \$1.69 billion.

[intel.com](https://www.intel.com)

In the fourth quarter of 2024, Intel's revenue was \$14.3 billion, representing a 7% decrease compared to the same period in the previous year. The net loss for this period was \$126 million, whereas in Q4 2023, the company had a net profit of \$2.7 billion.

Example API Output:

```
{
```

```
  "company": "Intel Corporation",
```

```
  "financials": {
```

```
    "profitability": "### Financial Analysis of Return on Assets (ROA) for Intel Corporation\n\n**ROA Value**: -9.55%\n\n###
```

```
Interpretation of the Value\nA Return on Assets (ROA) of -9.55%
```

indicates that Intel Corporation is generating a loss relative to its total assets. This negative value suggests that the company is not efficiently utilizing its assets to generate profits, which is a concerning sign for investors and stakeholders.\n\n#### Trend Analysis\nThe recent trend for Intel's ROA has been **decreasing**. A sustained decline in ROA can signal operational inefficiencies, increased costs, or challenges in revenue generation, which may stem from competitive pressures or market changes. This trend is particularly troubling as it suggests that the company's ability to leverage its assets effectively is worsening over time.\n\n#### Industry Comparison\nWhen compared to the semiconductor industry average, which typically ranges from 10% to 20% for established companies, Intel's ROA of -9.55% is significantly below par",

"indebtedness": "### Financial Analysis of Intel Corporation's Debt to Equity Ratio\n\n**Debt to Equity Ratio:** 0.50\n\n#### Interpretation of the Value\nA Debt to Equity (D/E) ratio of 0.50 indicates that Intel Corporation has \$0.50 of debt for every dollar of equity. This is generally considered a moderate level of leverage, suggesting that the company is using a balanced approach to financing its operations through both debt and equity.\n\n#### Assessment of the Value\n- **Good or Bad?**: A D/E ratio of 0.50 is typically seen as favorable. It implies that Intel is not overly reliant on debt, which can reduce financial risk, especially in a volatile market. A lower ratio can also indicate better financial health and stability.\n\n#### Recent Trend\n- **Trend Analysis**: Intel's D/E ratio has been relatively stable in recent years, suggesting that the company has maintained a consistent approach to its capital structure. There have been no significant spikes or drops, indicating",

"liquidity": "### Financial Analysis of Intel Corporation's Current Ratio\n\n**Current Ratio Value:** 1.33 (rounded from 1.3268659227275277)\n\n#### Interpretation of Current Ratio\nThe current ratio is a liquidity metric that measures a company's ability to cover its short-term liabilities with its short-term assets. A current ratio above 1 indicates that the company has more current assets than current liabilities, suggesting a good short-term financial health.\n\n#### Assessment of the Value\n- **Good or Bad?**: A current ratio of 1.33 is generally considered acceptable. It indicates that Intel has sufficient short-term assets to meet its short-term obligations, which is a positive sign for investors and creditors. However, it is not excessively high, which could indicate inefficiency in asset utilization.\n\n#### Recent Trend\n- **Trend Analysis**: If recent financial reports show that Intel's current ratio has been increasing over the past few quarters, this would suggest improving liquidity and financial stability. Conversely, if the trend has been",

"stock_price_forecast (3 month)": 22.141623

```
}
```

```
}
```

Reports are generated in a structured manner, with clear metric explanations, benchmark values, and industry comparisons—making them accessible even to less experienced analysts.

Conclusions

1 Evaluation of Achievements

- The system allows fast generation of detailed financial reports and stock forecasts.
- API response time is optimized, making it suitable for real-world financial analysis.

2 Opportunities for Future Improvement

- Add macroeconomic indicators (e.g., GDP, inflation, Fed rate).
 - Use deeper AI models like LSTM or transformers, or integrate exogenous variables for better forecasts.
 - Add visualization of forecasts in a web interface.
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Setup Instructions

1 Install Dependencies

```
pip install fastapi uvicorn yfinance openai pandas requests  
pip install nixtla
```

2 Set API Keys

```
export OPENAI_API_KEY='your_openai_api_key_here'  
export TIMEGPT_API_KEY='your_timegpt_api_key_here'
```

(Use *set* on Windows)

③ Run FastAPI Server

```
uvicorn main:app --reload
```

④ Access the API

- <http://127.0.0.1:8000/>
 - Swagger UI: <http://127.0.0.1:8000/docs>
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✓ Final Note

This project automates the analysis of financial indicators and stock price forecasting using GPT-4o-mini and TimeGPT. Its high forecasting accuracy and flexible architecture make the system promising for future expansion and integration into financial services.