

Fina_Resear_Financial_AI_Assistant

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0.1 Group 5

AAI 520 - Final Project

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0.2 Project Outline

This is an LLM powered research assistant that finds key financial details on publicly traded companies using their stock ticker. The assistant is able to plan and execute key tasks leveraging several tools in order to generate a final output.

Core Agent Functions

- Planning: The assistant has the ability to plan at each step.
- Tool Use: The assistant dynamically integrates APIs such as Yahoo Finance, SEC, as well as News APIs, we search APIs, and other tools.
- Self-Reflection: The assistnat has a specific agent focused on evaluation and output quality, including human in the loop feedback before concluding.
- Memory/Learning: The assistant also has memory to maintain context across runs.

Workflow Patterns * Prompt Chaining: The agent dynamically follows a prompt chaining pattern between tool aclls including: News ingestion → preprocessing → classification → extraction → summarization

- Routing: The agent dynamically routes to specialist analyzers setup as tools to review earnings, draw graphs, and analyze market sentiment.
- Evaluator-Optimizer: The assistant ultimately performs an evaluation and optimizes the output incorporating human feedback.

Attribution: This code leveraged several sources including. 1. LangGraph Intro to LangGraph course: <https://academy.langchain.com/courses/take/intro-to-langgraph/> 2. Hugging Face Course:<https://huggingface.co/learn/agents-course/en/> 3. Geek for Geeks Tutorial: <https://www.geeksforgeeks.org/artificial-intelligence/introduction-to-langchain/> 4. Perplexity AI for research and debugging. Accessed during October, 2025 5. Google Gemini within Colab for coding and debugging. Accessed during October, 2025

1 Setup

The project incorporates several tools and libraries which are imported here.

```
[1]: %%capture --no-stderr
%pip install --quiet -U \
    langgraph \
    langchain_openai \
    langgraph_sdk \
    langgraph-prebuilt \
    langchain-perplexity \
    huggingface_hub \
    openai \
    yfinance \
    langchain-google-genai \
    langchain-community \
    transformers \
    datasets \
    bitsandbytes accelerate sentence-transformers \
    faiss-cpu \
    ddgs\
    langchain-huggingface

[2]: #Import key libraries
import os
import requests
import re
import textwrap
import matplotlib.pyplot as plt
import pandas as pd
from datetime import datetime, timedelta
from pprint import pprint, pformat

from bs4 import BeautifulSoup

from langchain_core.tools import StructuredTool

from IPython.display import Markdown, display
from langchain_google_genai import ChatGoogleGenerativeAI
from langchain_community.chat_models import ChatPerplexity #updated
from langchain_openai import OpenAI, ChatOpenAI
from langchain_core.output_parsers import StrOutputParser
from langchain.agents import AgentExecutor, initialize_agent, Tool, AgentType
from langchain.chains import LLMChain
from langgraph.prebuilt import create_react_agent
import yfinance as yf
from langchain_community.tools.yahoo_finance_news import YahooFinanceNewsTool
from transformers import pipeline
```

```

from langchain_community.document_loaders import WebBaseLoader
from langchain.tools import Tool

#Memory
from dataclasses import dataclass
from datetime import datetime
from typing import Dict, List, Optional, Any, Union

```

WARNING:langchain_community.utils.user_agent:USER_AGENT environment variable not set, consider setting it to identify your requests.

For experimentation, multiple LLMs were included. The following APIs are required in the code:

1. Gemini: <https://ai.google.dev/>
2. Hugging Face: <https://huggingface.co/>
3. OpenAI: <https://openai.com/api/>
4. Fin News:<https://finnhub.io/docs/api/market-news>
5. Tavily: <https://www.tavily.com/>

```

[3]: #Run in Google Colab
from google.colab import userdata

#API Keys from Colab Secrets
gemini_key = userdata.get('GEMINI') #Used for agents in setup and validation
hf_key = userdata.get('HF_TOKEN') #Used for agents in setup and validation,
↳also for sentiment analysis tool
openai_key = userdata.get('OPENAI')
fin_news = userdata.get('FIN_API_KEY') #For web search on financial news
tavily_key = userdata.get('TAVILY_API_KEY') #For web search

```

Note: We experimented with more APIs during the project, such as Perplexity, and others, but landed on this core set.

```

[4]: #Download and set up Hugging Face model
from huggingface_hub import login #Connect to HF using API key accessed above
login(token=hf_key)

import warnings

#Suppress length warnings
warnings.filterwarnings("ignore", category=UserWarning, module="huggingface_hub.
↳utils._auth")

llm_hf = pipeline(
    "text-generation",
    model="meta-llama/Llama-3.2-1B-Instruct",
    device= -1
)

```

```

config.json: 0%|          | 0.00/877 [00:00<?, ?B/s]
model.safetensors: 0%|          | 0.00/2.47G [00:00<?, ?B/s]
generation_config.json: 0%|          | 0.00/189 [00:00<?, ?B/s]
tokenizer_config.json: 0%|          | 0.00/54.5k [00:00<?, ?B/s]
tokenizer.json: 0%|          | 0.00/9.09M [00:00<?, ?B/s]
special_tokens_map.json: 0%|          | 0.00/296 [00:00<?, ?B/s]
Device set to use cpu

```

```

[5]: from transformers import AutoModelForCausalLM, AutoTokenizer, pipeline
      from langchain_huggingface import HuggingFacePipeline

      model_id = "HuggingFaceTB/SmolLM2-1.7B-Instruct"
      tokenizer = AutoTokenizer.from_pretrained(model_id)
      model = AutoModelForCausalLM.from_pretrained(model_id)

      hf_pipe = pipeline(
          "text-generation",
          model=model,
          tokenizer=tokenizer,
          max_new_tokens=256,
          temperature=0.7,
          device=-1
      )

      llm_hf = HuggingFacePipeline(pipeline=hf_pipe)

```

```

tokenizer_config.json: 0.00B [00:00, ?B/s]
vocab.json: 0.00B [00:00, ?B/s]
merges.txt: 0.00B [00:00, ?B/s]
tokenizer.json: 0.00B [00:00, ?B/s]
special_tokens_map.json: 0%|          | 0.00/655 [00:00<?, ?B/s]
config.json: 0%|          | 0.00/908 [00:00<?, ?B/s]
model.safetensors: 0%|          | 0.00/3.42G [00:00<?, ?B/s]
generation_config.json: 0%|          | 0.00/132 [00:00<?, ?B/s]
Device set to use cpu

```

```

[6]: #Setup Gemini to use in Agents
      llm_gemini = ChatGoogleGenerativeAI(
          model="gemini-2.0-flash",
          google_api_key=gemini_key
      )

```

```
)
```

```
[7]: #Setup Open AI to use
llm_openai = ChatOpenAI(
    model="gpt-3.5-turbo", # "gpt-3.5-turbo", "gpt-4-mini", "gpt-5-mini" ...
    openai_api_key=openai_key, # Your OpenAI API key
    temperature=0.0           # (optional) set as needed
)
```

```
[8]: #Test APIs
print("OpenAI Response:")
response_openai = llm_openai.invoke("Explain how neural networks work in 10_
↳words or less.")
print(response_openai.content)

print("\nGemini Response:")
response_gemini = llm_gemini.invoke("Explain how neural networks work in 10_
↳words or less.")
print(response_gemini.content)

print("\nHugging Face Response:")
response_hf = llm_hf.invoke("Explain how neural networks work in 10 words or_
↳less.")
print(response_hf) # Keeping this as 'response_hf' for now to match the_
↳original print structure
```

OpenAI Response:

Neural networks learn patterns from data to make predictions.

Gemini Response:

Networks learn patterns by adjusting connections between artificial neurons.

Hugging Face Response:

Explain how neural networks work in 10 words or less.

1.1 Learning/Memory

Memory across analysis runs

```
[9]: #MEMORY AGENT
#Session-scoped memory

@dataclass
class MemoryItem:
    symbol: str
    question: str
    answer: str
```

```

    created_at: str
    meta: Dict[str, Any]

class SessionMemory:
    def __init__(self, max_items: int = 200, max_per_symbol: int = 10):
        self._store: Dict[str, List[MemoryItem]] = {}
        self.max_items = max_items
        self.max_per_symbol = max_per_symbol

    def remember(self, symbol: str, question: str, answer: str, **meta) -> None:
        symbol = (symbol or "GENERIC").upper().strip()
        item = MemoryItem(
            symbol=symbol,
            question=(question or "").strip(),
            answer=(answer or "").strip(),
            created_at=datetime.utcnow().isoformat(timespec="seconds"),
            meta=meta or {}
        )
        bucket = self._store.setdefault(symbol, [])
        bucket.append(item)
        if len(bucket) > self.max_per_symbol:
            del bucket[0 : len(bucket) - self.max_per_symbol]
        self._cap_global()

    def recall(self, symbol: str, question: Optional[str] = None) -> Optional[str]:
        symbol = (symbol or "GENERIC").upper().strip()
        bucket = self._store.get(symbol, [])
        if not bucket:
            return None
        if not question:
            return bucket[-1].answer
        q = (question or "").strip()
        for item in reversed(bucket):
            if item.question == q:
                return item.answer
        return None

    def latest(self, symbol: str) -> Optional[MemoryItem]:
        symbol = (symbol or "GENERIC").upper().strip()
        bucket = self._store.get(symbol, [])
        return bucket[-1] if bucket else None

    def _cap_global(self):
        all_items = []
        for sym, bucket in self._store.items():
            for it in bucket:

```

```

        all_items.append((it.created_at, sym, it))
    if len(all_items) <= self.max_items:
        return
    all_items.sort(key=lambda x: x[0]) #Oldest first
    to_drop = len(all_items) - self.max_items
    cutoff = set(id(it) for _, _, it in all_items[:to_drop])
    for sym in list(self._store.keys()):
        self._store[sym] = [it for it in self._store[sym] if id(it) not in cutoff]
    ↪cutoff]

def extract_symbol(text: str) -> str:
    """
    Grab a likely ticker from the user_input like 'Analyze the SPY stock
    ↪ticker'.
    Simple heuristic: first ALL-CAPS token 1-5 chars (e.g., AAPL, MSFT, SPY).
    Falls back to 'GENERIC' if none found.
    """
    if not text:
        return "GENERIC"
    candidates = re.findall(r"\b[A-Z]{1,5}\b", text)
    #Light filter for common English words
    stop = {"THE", "AND", "FOR", "WITH", "FROM", "THIS", "THAT", "YOUR", "HAVE", "HOLD"}
    for c in candidates:
        if c not in stop:
            return c
    return "GENERIC"

def as_text(x: Any) -> str:
    """
    Normalize whatever comes back from planner/tools/evaluator/optimizer into a
    ↪string.
    Works with LangChain AgentExecutor outputs (dict), AIMessage, or raw str.
    """
    try:
        # AIMessage / ChatMessage
        if hasattr(x, "content"):
            return str(x.content)
        # Agent-like dicts
        if isinstance(x, dict):
            if "output" in x and isinstance(x["output"], str):
                return x["output"]
            if "messages" in x and isinstance(x["messages"], list):
                return "\n\n".join(
                    (m.content if hasattr(m, "content") else str(m))
                    for m in x["messages"])

```

```

        )
        # plain string
        if isinstance(x, str):
            return x
        return str(x)
    except Exception:
        return str(x)

def query_memory(stock_symbol, session_memory):
    print('query memory stock symbol = ', stock_symbol)
    if stock_symbol in session_memory._store:
        recent_memory = session_memory._store.get(stock_symbol)[-1].answer
        return recent_memory

```

```
[10]: SESSION_MEMORY = SessionMemory() #Create session memory for overall function
```

2 Tool Agent

The tools agent performs the majority of the agent functions outlined for this project. By giving one agent access to these tools and specialists, it is able to plan, and dynamically select which tool is the best one to accomplish the goal.

This approach leverages the autonomy that agents can have to perform dynamic research tasks.

First the tools are defined, including testing/debugging code step by step.

2.1 Tool Functions

```
[11]: #Yahoo Finance Tool
def get_stock_summary(ticker: str) -> str:

    """Gets detailed financial info for a given stock symbol."""

    try:
        stock = yf.Ticker(ticker) #Use teh defined stock ticker
        data = stock.info

        #Return as much data from the API as you can to fill in the report
        return (
            f"Company: {data.get('longName', 'N/A')} ({ticker})\n"
            f"Sector: {data.get('sector', 'N/A')}\n"
            f"Price: ${data.get('regularMarketPrice', 'N/A')}\n"
            f"Market Cap: {data.get('marketCap', 'N/A')}\n"
            f"P/E Ratio: {data.get('trailingPE', 'N/A')}\n"
            f"52-Week High: {data.get('fiftyTwoWeekHigh', 'N/A')}\n"
            f"52-Week Low: {data.get('fiftyTwoWeekLow', 'N/A')}\n"

```



```

        f"Dividend Yield: {data.get('dividendYield', 'N/A')}\n"
        f"Beta: {data.get('beta', 'N/A')}\n"
        f"Revenue: {data.get('totalRevenue', 'N/A')}\n"
        f"Profit Margin: {data.get('profitMargins', 'N/A')}\n"
    )
    except Exception as e:
        return f"Error retrieving data for {ticker}: {e}"

#Define the LangGraph tool
yahoo_api_tool = Tool(
    name="YahooFinanceAPI",
    func=get_stock_summary,
    description="Retrieves detailed Yahoo Finance company data such as price,
↪valuation metrics, and financial ratios."
)

```

```

[12]: #For debugging
      print(yahoo_api_tool("AAPL"))

```

```

/tmp/ipython-input-1016834510.py:2: LangChainDeprecationWarning: The method
`BaseTool.__call__` was deprecated in langchain-core 0.1.47 and will be removed
in 1.0. Use :meth:`~invoke` instead.

```

```

    print(yahoo_api_tool("AAPL"))

```

```

Company: Apple Inc. (AAPL)
Sector: Technology
Price: $247.45
Market Cap: 3672254447616
P/E Ratio: 37.606384
52-Week High: 260.1
52-Week Low: 169.21
Dividend Yield: 0.42
Beta: 1.094
Revenue: 408624988160
Profit Margin: 0.24295999

```

```

[13]: import xml.etree.ElementTree as ET

#Define a summarizer for SEC content
def summarize_sec_document(doc_url: str) -> str:
    headers = {"User-Agent": "tpoole@sandiego.edu"}
    resp = requests.get(doc_url, headers=headers)
    if resp.status_code != 200:
        return f"Could not access doc: {doc_url}"
    doc_text = resp.text

```

```

# Try XML parsing first (most filings)
try:
    root = ET.fromstring(doc_text)
    values = []
    for item in root.iter():
        if item.tag.lower() in ['transactionamount', 'transactioncode', 'issuename']:
            values.append(f"{item.tag}: {item.text}")
    return " | ".join(values) if values else "No key XML findings found."
except ET.ParseError:
    # Fallback: try HTML/text parsing
    soup = BeautifulSoup(doc_text, 'html.parser')
    summary = soup.get_text(separator=' ', strip=True)
    return summary[:400] # Return first 400 chars as summary

def get_sec_filings(ticker: str) -> str:
    cik_url = "https://www.sec.gov/files/company_tickers.json"
    headers = {"User-Agent": "your_email@example.com"}
    cik_resp = requests.get(cik_url, headers=headers)
    if cik_resp.status_code != 200:
        return f"SEC.gov rejected request: {cik_resp.status_code}"

    try:
        cik_data = cik_resp.json()
        cik_lookup = {item['ticker']: item['cik_str'] for item in cik_data.
        values()}
        cik = cik_lookup.get(ticker.upper())
    except Exception as e:
        return f"Error parsing CIK data: {e}"

    if not cik:
        return f"CIK for {ticker} not found."

    filings_url = f"https://data.sec.gov/submissions/CIK{cik:0>10}.json"
    filings_resp = requests.get(filings_url, headers=headers)
    try:
        data = filings_resp.json() if filings_resp.status_code == 200 else {}
        filings = data.get('filings', {}).get('recent', {})
        if not filings: return f"No filings found for {ticker}."
        forms = filings.get('form', [])[:3]
        filing_dates = filings.get('filingDate', [])[:3]
        primary_docs = filings.get('primaryDocument', [])[:3]
        accessions = filings.get('accessionNumber', [])[:3]

        result = []
        for form, date, doc, acc in zip(forms, filing_dates, primary_docs,
        accessions):

```

```

        # Build the SEC document URL:
        doc_url = f"https://www.sec.gov/Archives/edgar/data/{int(cik)}/{acc.
↪replace('-', '/')}/{doc}"
        summary = summarize_sec_document(doc_url)
        result.append(f"{form} on {date}:\n{doc_url}\nSummary: {summary}\n")
        return "Latest filings with summaries:\n" + "\n".join(result)
    except Exception as e:
        return f"Error loading filings for {ticker}: {e}"

sec_api_tool = Tool(
    name="SECEDGARAPI",
    func=get_sec_filings,
    description="Retrieves and summarizes key findings from recent SEC filings_
↪by ticker"
)

```

```

[14]: #For debugging & Validation
print(sec_api_tool("AAPL"))

```

Latest filings with summaries:

144 on 2025-10-16:

https://www.sec.gov/Archives/edgar/data/320193/000195004725008030/xsl144X01/primary_doc.xml

Summary: Form 144 Filer Information UNITED STATES SECURITIES AND EXCHANGE COMMISSION Washington, D.C. 20549 Form 144 NOTICE OF PROPOSED SALE OF SECURITIES PURSUANT TO RULE 144 UNDER THE SECURITIES ACT OF 1933 FORM 144 144: Filer Information Filer CIK 0002050912 Filer CCC XXXXXXXX Is this a LIVE or TEST Filing? LIVE TEST Submission Contact Information Name Phone E-Mail Address 144: Issuer Information Name o

4 on 2025-10-03:

https://www.sec.gov/Archives/edgar/data/320193/000121415625000011/xslF345X05/wk-form4_1759530830.xml

Summary: SEC FORM

4 SEC Form 4 FORM 4 UNITED STATES SECURITIES AND EXCHANGE COMMISSION Washington, D.C. 20549 STATEMENT OF CHANGES IN BENEFICIAL OWNERSHIP Filed pursuant to Section 16(a) of the Securities Exchange Act of 1934 or Section 30(h) of the Investment Company Act of 1940 OMB APPROVAL OMB Number: 3235-0287 Estimated average burden hours per response: 0.5 Å Å Check this box if no longer

4 on 2025-10-03:

https://www.sec.gov/Archives/edgar/data/320193/000176709425000009/xslF345X05/wk-form4_1759530744.xml

Summary: SEC FORM

4 SEC Form 4 FORM 4 UNITED STATES SECURITIES AND EXCHANGE COMMISSION Washington, D.C. 20549 STATEMENT OF CHANGES IN BENEFICIAL OWNERSHIP Filed pursuant to Section 16(a) of the Securities Exchange Act of 1934 or Section

```
[15]: #A tool to visit webpage to collect information
#This was built for the SEC, but they didn't like this web crawler, and did not
      ↪ permit it

STOCK_SITES = {
    "tipranks": "https://www.tipranks.com/stocks/{ticker}/stock-analysis",
    "marketbeat": "https://www.marketbeat.com/stocks/{ticker}/",
    "zacks": "https://www.zacks.com/stock/quote/{ticker}",
    "simplywallst": "https://simplywall.st/stocks/us/{ticker}"
}

def visit_webpages_for_symbol(ticker: str) -> dict:
    """
    Fetches and reads webpage information for a given stock ticker from all
    ↪ defined sites.
    Returns a dictionary with site names as keys and page content as values.
    """
    results = {}
    for site, url_pattern in STOCK_SITES.items():
        try:
            url = url_pattern.format(ticker=ticker)
            loader = WebBaseLoader(web_path=url)
            documents = loader.load()
            results[site] = documents[0].page_content[:1000]
        except Exception as e:
            results[site] = f"Error fetching {url}: {e}"
    return results

# Define the tool for agent use
visit_webpages_tool = StructuredTool.from_function(
    func=visit_webpages_for_symbol,
    name="VisitWebpagesForSymbol",
    description="Fetches and reads webpage information for a given stock ticker
    ↪ from all major analysis sites."
)

[16]: #Print for debug
result = visit_webpages_tool.invoke({"ticker": "AAPL"})
pretty_str = pformat(result, width=100)
lines = pretty_str.split('\n')
for line in lines[:25]:
    print(line)
```

[illegible]

```
[17]: #Financial news lookup
def get_fin_news(symbol: str) -> str:
    api_key = fin_news
    url = "https://newsapi.org/v2/everything"
    params = {
        "q": symbol,
        "apiKey": api_key,
        "sortBy": "publishedAt",
        "language": "en"
    }
    response = requests.get(url, params=params)
    if response.status_code != 200:
        return f"API error {response.status_code}: {response.text[:200]}"
    data = response.json() #Return data in JSON
    articles = data.get("articles", [])
    if not articles:
        return f"No news found for {symbol}. Full message: {data.get('message', '')},"
    return "\n".join([a["description"] or a["title"] for a in articles[:7]])
```

```

#Define tool
news_api_tool = Tool(
    name="NewsAPI",
    func=get_fin_news, #Assumes you've defined this class
    description="Finds recent financial news on stock symbol"
)

```

```

[18]: #For debugging
print(get_fin_news("AAPL"))

```

Anker Japan DisplayLink 8K+4Kx2 Anker Prime
 (14-in-1, Triple Display, D [...])
 The post Anker Japan DisplayLink 8K 4K60Hz x2 Anker Prime
 (14-in-1, Triple Display, DisplayLink) first ap...

Investors weighed corporate earnings against the escalating US-China trade war. Apple has updated the iPad Pro lineup, MacBook Pro 14 , and Apple Vision Pro, to feature the all new M5 chip. These are basically spec-bump updates focused on the new M5 chip architecture, with no new hardware redesign or major new features or changes otherwi...

In many ways, Apple's (AAPL) 2025 story has been one of quiet resilience. Despite sluggish global smartphone demand, the world's most valuable business was able to find new ways to bend the curve.

Its success had everything to do with supply-chain recalibrat...

The analyst believes the next innings in the AI revolution will be written with mergers and acquisitions.

Apple's (NASDAQ:AAPL) iPhone 17 Pro and Pro Max maintain stable global lead times, while the iPhone Air remains widely available with nearly all configurations in stock.

AAPL is demonstrating strength. Stay ahead of the curve here.

According to the Bank of Am...

Apple (NASDAQ:AAPL) stock gained on Wednesday after it unveiled the new M5 chip, featuring advanced graphics processing units (GPUs) with Neural Accelerators, high-performance central processing units (CPUs), and a faster Neural Engine, which supercharges App...

```

[19]: #Web search tool with Tavily
def get_fin_news_tavily(symbol: str) -> str:
    """
    Searches for and extracts news impacting the given stock symbol.
    Performs a deep extraction with Tavily's advanced read (HTML parsing and
    ↪markdown conversion).
    """
    query = f"News on {symbol}"
    api_url_search = "https://api.tavily.com/search"
    api_url_extract = "https://api.tavily.com/extract" #Added to try and get
    ↪better content

```

```

#Search for related news articles
payload_search = {
    "query": query,
    "api_key": tavily_key,
    "max_results": 15, #Increased up from 5 for final runs
    "search_depth": "advanced", #Search for more contextually relevant pages
    "include_raw_content": False
}

search_response = requests.post(api_url_search, json=payload_search)
if search_response.status_code != 200:
    return f"Tavily search error: {search_response.status_code}␣
↪{search_response.text}"

results = search_response.json().get("results", [])
links = [r.get("link") for r in results if r.get("link")]

#Extract full article contents using Tavily Extract API
if not links:
    return "No articles found for this stock symbol."

payload_extract = {
    "urls": links,
    "api_key": tavily_key,
    "extract_depth": "advanced", #Deeper DOM parsing, better for long␣
↪articles
    "include_images": False,
    "format": "markdown" #Returns Markdown-formatted summaries
}

extract_response = requests.post(api_url_extract, json=payload_extract)
if extract_response.status_code != 200:
    return f"Tavily extract error: {extract_response.status_code}␣
↪{extract_response.text}"

extracted_articles = extract_response.json().get("results", [])
if not extracted_articles:
    return "No extractable content retrieved."

#Structure extracted results for downstream summarization or agent␣
↪reflection
summaries = [] #Instantiate blank list
for article in extracted_articles: #Add to list
    link = article.get("url", "")
    content = article.get("content", "No text content")
    summaries

```

```
#Define Tool
tavily_news_tool = Tool(
    name="TavilyNews",
    func=get_fin_news_tavily,
    description="Searches for and extracts detailed financial news impacting_
↳the given stock symbol."
)
```

```
[20]: #For debugging
print(get_fin_news_tavily(symbol="AAPL"))
```

No articles found for this stock symbol.

```
[21]: from langchain_core.tools import tool
#Create the pipeline once, outside the function for efficiency
sentiment_classifier = pipeline(
    "sentiment-analysis",
    model="distilbert-base-uncased-finetuned-sst-2-english"
)

@tool
def analyze_sentiment(text: str) -> int:
    """Analyzes sentiment using DistilBERT."""
    result = sentiment_classifier(text)[0]
    return 1 if result["label"].upper() == "POSITIVE" else -1
```

```
config.json: 0%|          | 0.00/629 [00:00<?, ?B/s]
model.safetensors: 0%|          | 0.00/268M [00:00<?, ?B/s]
tokenizer_config.json: 0%|          | 0.00/48.0 [00:00<?, ?B/s]
vocab.txt: 0%|          | 0.00/232k [00:00<?, ?B/s]
Device set to use cpu
```

```
[22]: # Example usage:
print(analyze_sentiment.invoke({"text": "I love this product!"}))
```

1

```
[23]: def earnings_analyzer(symbol: str, context: str = "", yahoo_tool=None,
↳sec_tool=None) -> str:
    # Use dummy data if no tool is provided
    yahoo_data = yahoo_tool if yahoo_tool else yahoo_dummy
    sec_data = sec_tool if sec_tool else sec_dummy

    # Example analysis logic
```



```

analysis = (
    f"Earnings Analysis for {symbol}:\n"
    f"Yahoo Finance: {yahoo_data['summary']}\n"
    f"SEC Filing: {sec_data['filing_text']}\n"
)
return analysis

#Define tool
earnings_specialist = Tool(
    name="EarningsAnalyzer",
    func=earnings_analyzer,
    description="Analyzes earnings context and info for a stock symbol, using memory/context and sources."
)

```

[24]: *#For debugging*

```

yahoo_dummy = {
    "symbol": "AAPL",
    "earnings": {
        "quarter": "Q3 2025",
        "eps_actual": 2.15,
        "eps_estimate": 2.10,
        "revenue_actual": 82000000000,
        "revenue_estimate": 81500000000,
        "surprise": 0.05,
        "date": "2025-07-28"
    },
    "summary": "Apple reported better-than-expected earnings for Q3 2025, beating analyst estimates on both EPS and revenue."
}

sec_dummy = {
    "symbol": "AAPL",
    "filing_type": "10-Q",
    "filing_date": "2025-07-28",
    "filing_text": (
        "Apple Inc. reported net sales of $82 billion for the quarter ended June 2025, "
        "with net income of $19 billion. The company highlighted strong performance in its services segment."
    )
}

print(earnings_analyzer("META"))

```

Earnings Analysis for META:

Yahoo Finance: Apple reported better-than-expected earnings for Q3 2025, beating analyst estimates on both EPS and revenue.

SEC Filing: Apple Inc. reported net sales of \$82 billion for the quarter ended June 2025, with net income of \$19 billion. The company highlighted strong performance in its services segment.

```
[25]: #Add Duck Duck Go
from langchain.tools import DuckDuckGoSearchRun
search = DuckDuckGoSearchRun()

duck_duck_go_search = Tool(
    name="DuckDuckGoSearch",
    func=search.invoke,
    description="Useful for when you need to answer questions about current_
events. You should ask targeted questions."
)
```

```
[26]: duck_duck_go_search('GOOG')
```

```
[26]: 'Google LLC (/ u ə l / , GOO-gəl) is an American multinational technology
corporation focused on information technology, online advertising, search engine
technology, email, cloud ... Alphabet Inc (NASDAQ: GOOG ) is one of the trending
stocks. Barton Crockett, Rosenblatt Securities senior analyst and managing
director, said in a recent program on CNBC that OpenAI is... Theoretical content
"Anywhere and everywhere"Watch the latest video from Goog (@ goog .1738). GOOG
vs. GOOGL: A Tale of Two Ticks (and No, We're Not Talking About Lyme
Disease)The Great Share Split Caper Alphabet C ( GOOG .0) made a dramatic 8.71%
price swing on one of the most volatile trading days recently, with a trading
volume of 48.9 million shares.'
```

```
[27]: #Define the plotting function
def plot_stock_52_week(symbol: str) -> str:
    """
    Plots the last 52 weeks (1 year) of stock closing prices for the given_
symbol.
    Returns the filepath to the saved chart image.
    """
    try:
        end_date = datetime.today()
        start_date = end_date - timedelta(weeks=52)

        # Download 1-year historical stock data
        data = yf.download(symbol, start=start_date, end=end_date)

        if data.empty:
```

```

        return f"No data found for {symbol}. Please check the symbol or try
again later."

    # Plot closing price over time
    plt.figure(figsize=(10, 5))
    plt.plot(data.index, data['Close'], label='Closing Price',
color='dodgerblue', linewidth=2)
    plt.title(f"{symbol} Stock Price (Last 52 Weeks)", fontsize=14, pad=15)
    plt.xlabel("Date", fontsize=12)
    plt.ylabel("Price (USD)", fontsize=12)
    plt.grid(True, linestyle='--', alpha=0.6)
    plt.legend()

    # Save plot to file
    filename = f"{symbol}_52week_chart.png"
    plt.savefig(filename, bbox_inches='tight')
    plt.close()

    return f"Stock chart saved as {filename}"
except Exception as e:
    return f"Error generating chart for {symbol}: {e}"

#Wrap as a LangGraph Tool
stock_chart_tool = Tool(
    name="StockChart52Weeks",
    func=plot_stock_52_week,
    description="Plots and saves a 52-week stock price chart for the given
symbol using Yahoo Finance data."
)

```

```

[28]: from datetime import datetime, timezone
from langchain.tools import Tool

def get_timestamp(_: str = "") -> str:
    """
    Returns the current date and time in ISO 8601 format.

    This tool can be used by the agent to log events, timestamp analyses,
    or align data with real-world time context. It supports chaining with
    other workflow nodes that require temporal awareness.
    """
    return datetime.now(timezone.utc).isoformat()

timestamp_tool = Tool(
    name="TimestampTool",
    func=get_timestamp,

```

```

        description="Returns the current date and time in ISO 8601 format, useful_
        ↪for logging or aligning time-based analyses."
    )

```

```
[29]: print(get_timestamp())
```

```
2025-10-17T07:20:44.809180+00:00
```

```
[30]: #Create the tools list
tools = [
    yahoo_api_tool,
    sec_api_tool,
    news_api_tool,
    tavily_news_tool,
    earnings_specialist,
    duck_duck_go_search,
    stock_chart_tool,
    analyze_sentiment, # Use the analyze_sentiment function here
    timestamp_tool,
    visit_webpages_tool
]
```

2.2 Define Tools Agent

Note: This agent leverages the LangGraph ReAct agent framework. The basis of this agent is an LLM that is prompted to reason about what it should do, take an action, and then observe the results to evaluate if it should act again, or be done. In addition to that basic framework, the prompt contains critical functions and workflows for the agent to perform.

This prompt engineering is a balance to get a thorough enough agent to select multiple tools, while not creating an agent that is either too lazy, quitting with too few API calls, or too aggressive.

```
[31]: #Tools Agent Prompt & Function

ANALYSIS_PROMPT = """
System Role: You are a detailed Financial Research Agent designed to analyze_
    ↪companies, securities, and markets with a structured workflow.

**Your goal** For {symbol}, provide a ~50 word investment summary, based on_
    ↪extensive reserach.

Include {context_memory} to improve your answers.

NEVER INCLUDE YOUR THOUGHT PROCESS IN THE RESULTS.

**Core Functions**

```

1. Planning:

Develop and print out a plan for each given stock symbol. Include a plan for a
↳ multi-step research process that defines what data to collect (e.g., news, market data, filings), what tools to use, and how to verify results.

Example steps: "Collect company overview → Analyze financials → Cross-check recent filings → Summarize."

2. Tool Use:

Use all of your tools by default to hit APIs and data sources dynamically, such as
↳ Yahoo Finance, SEC EDGAR, news APIs, and any specialist analyzers. Choose the right tools and calls autonomously based on the goal of each stage.
↳ Return structured findings.

TOOL USAGE REQUIREMENTS:

- Refer to the memory for useful data.
- ALWAYS include a timestamp of the run near the top of the report.
- Use at least 4 different tools for each analysis
- Cross-reference information from multiple sources
- If a tool fails, try alternative tools for the same data
- Always explain your reasoning between tool calls

3. Self-Reflection:

Evaluate your output's completeness, correctness, and coherence at each stage.
↳ If key data (e.g., P/E, recent filings, or market indicators) appears missing or uncertain, perform iterative refinement using another reasoning pass or additional tool calls.

4. Memory/Learning:

Retain useful context from prior analyses (observations, missing data, errors, patterns in company performance). Use this "brief memory" to improve future research quality and efficiency.

Workflow Logic

Follow a defined sequence for every research request:

* Ingest → Preprocess → Classify → Extract → Summarize

1. Ingest: Gather relevant news, filings, and metrics. Use the webpage visit tool on any URLs.

2. Preprocess: Clean, standardize, and interpret results from multiple tools.

3. Classify: Route data to the correct analysis path (earnings, news, or market).

```

4. Extract: Pull core signals, events, or values.

5. Summarize: Synthesize insights in your final output.

6. Routing:
    * Choose appropriate specialist analyzers according to data type:

    * NewsAnalyzer for press, sentiment, or event narratives.

    * MarketAnalyzer for indices, performance data, and macro context.

7. Evaluation: Review reasoning and completeness, recall tools again if needed.

**Final Report**
At the end of each session, create a final summary report that contains:

Updated output from EVERY tool as well as the TIMESTAMP near the top.

NEVER include your internal planning information in the report.

Include citations such as [1] followed by a hyperlink at the bottom of the page
↳for further review.

Respond in clear, organized Markdown, including headings, bullet points, and
↳labeled data sources for readability.

**STOPPING RULE:** Once you have basic financials, recent news, and market
↳context, conclude your analysis. Do not seek additional tools or data.

Be thorough - this analysis will inform major investment decisions.

"""

#Define the agent
tools_agent = create_react_agent(
    model=llm_openai, #Can use gemini here
    tools=tools,
    prompt=ANALYSIS_PROMPT, #Feed in the prompt outlined above
    debug=True
)

```

```

[32]: #User Input
user_input = "COST" #Search for information on this company ticker

# Create your formatted prompt

```

```

formatted_prompt = ANALYSIS_PROMPT.format(
    symbol=user_input, # ex. "TGT"
    context_memory=query_memory(user_input, SESSION_MEMORY)
)

```

```

query_memory_stock_symbol = COST

```

```

[33]: #Build & run agent call to ensure this step works
tools_output = tools_agent.invoke({
    "messages": [
        {"role": "user", "content": formatted_prompt}
    ]
})

```

```

[values] {'messages': [HumanMessage(content='\nSystem Role: You are a
detailed Financial Research Agent designed to analyze companies, securities, and
markets with a structured workflow.\n\n**Your goal** For COST, provide a ~50
word investment summary, based on extensive reserach.\n\nInclude None to improve
your answers.\n\nNEVER INCLUDE YOUR THOUGHT PROCESS IN THE RESULTS.\n\n\n**Core
Functions**\n\n1. Planning:\nDevelop and print out a plan for each given stock
symbol. Include a plan for a multi-step research process that defines what data
to collect (e.g., news, market data, filings), what tools to use, and how to
verify results.\n\nExample steps: "Collect company overview → Analyze financials
→ Cross-check recent filings → Summarize."\n\n2. Tool Use:\nUse all of your
tools by default to hit APIs and data sources dynamically, such as Yahoo
Finance, SEC EDGAR, news APIs, and any specialist analyzers. Choose the right
tools and calls autonomously based on the goal of each stage. Return structured
findings.\n\nTOOL USAGE REQUIREMENTS:\n- Refer to the memory for useful data.\n-
ALWAYS include a timestamp of the run near the top of the report.\n- Use at
least 4 different tools for each analysis\n- Cross-reference information from
multiple sources\n- If a tool fails, try alternative tools for the same data\n-
Always explain your reasoning between tool calls\n\n3. Self-
Reflection:\nEvaluate your output's completeness, correctness, and coherence at
each stage. If key data (e.g., P/E, recent filings, or market indicators)
appears missing or uncertain, perform iterative refinement using another
reasoning pass or additional tool calls.\n\n4. Memory/Learning:\nRetain useful
context from prior analyses (observations, missing data, errors, patterns in
company performance). Use this "brief memory" to improve future research quality
and efficiency.\n\n\n**Workflow Logic**\n\nFollow a defined sequence for every
research request:\n* Ingest → Preprocess → Classify → Extract → Summarize\n\n1.
Ingest: Gather relevant news, filings, and metrics. Use the webpage visit tool
on any URLs.\n\n2. Preprocess: Clean, standardize, and interpret results from
multiple tools.\n\n3. Classify: Route data to the correct analysis path
(earnings, news, or market).\n\n4. Extract: Pull core signals, events, or
values.\n\n5. Summarize: Synthesize insights in your final output.\n\n6.
Routing:\n * Choose appropriate specialist analyzers according to data
type:\n\n * NewsAnalyzer for press, sentiment, or event narratives.\n\n *
MarketAnalyzer for indices, performance data, and macro context.\n\n7.

```

Evaluation: Review reasoning and completeness, recall tools again if needed.

Final Report

At the end of each session, create a final summary report that contains:

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STOPPING RULE: Once you have basic financials, recent news, and market context, conclude your analysis. Do not seek additional tools or data.

Be thorough - this analysis will inform major investment decisions.

```
{
  "additional_kwargs": {},
  "response_metadata": {
    "id": "7d1141f4-ab90-4ab2-9416-10fbe5f6a628"
  },
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    "agent": {
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          content="",
          additional_kwargs={
            "tool_calls": [
              {
                "id": "call_BmY2xwRrF4PkpF03bf6n0o49",
                "function": {
                  "arguments": '{"__arg1": "now"}',
                  "name": "TimestampTool",
                  "type": "function"
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                      "reasoning_tokens": 0,
                      "rejected_prediction_tokens": 0
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                    "prompt_tokens_details": {
                      "audio_tokens": 0,
                      "cached_tokens": 0
                    }
                  },
                  "model_name": "gpt-3.5-turbo-0125",
                  "system_fingerprint": None,
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                  "service_tier": "default",
                  "finish_reason": "tool_calls",
                  "logprobs": None
                },
                "id": "run--4b3a527a-be59-4cb1-a7f4-2645e9a065a4-0",
                "tool_calls": [
                  {
                    "name": "TimestampTool",
                    "args": {
                      "__arg1": "now"
                    },
                    "id": "call_BmY2xwRrF4PkpF03bf6n0o49",
                    "type": "tool_call"
                  }
                ],
                "usage_metadata": {
                  "input_tokens": 1761,
                  "output_tokens": 16,
                  "total_tokens": 1777,
                  "input_token_details": {
                    "audio": 0,
                    "cache_read": 0
                  },
                  "output_token_details": {
                    "audio": 0,
                    "reasoning": 0
                  }
                }
              ]
            }
          }
        )
      ]
    },
    "values": {
      "messages": [
        HumanMessage(
          content="\nSystem Role: You are a detailed Financial Research Agent designed to analyze companies, securities, and markets with a structured workflow.\n\n**Your goal** For COST, provide a ~50 word investment summary, based on extensive reserach.\n\nInclude None to improve your answers.\n\nNEVER INCLUDE YOUR THOUGHT PROCESS IN THE RESULTS.\n\n\n**Core Functions**\n\n1. Planning:\nDevelop and print out a plan for each given stock symbol. Include a plan for a multi-step research process that defines what data to collect (e.g., news, market data, filings), what tools to use, and how to verify results.\n\nExample steps: \"Collect company overview → Analyze financials → Cross-check recent filings → Summarize.\"\n\n2. Tool Use:\nUse all of your tools by default to hit APIs and data sources dynamically, such as Yahoo Finance, SEC EDGAR, news APIs, and any specialist analyzers. Choose the right tools and calls autonomously based on the goal of each stage. Return structured findings.\n\nTOOL USAGE REQUIREMENTS:\n- Refer to the memory for useful data.\n- ALWAYS include a timestamp of the run near the top of the report.\n- Use at least 4 different tools for each analysis\n- Cross-reference information from multiple sources\n- If a tool fails, try alternative tools for the same data\n- Always explain your reasoning between tool calls\n\n3. Self-Reflection:\nEvaluate your output's completeness, correctness, and coherence at each stage. If key data (e.g., P/E, recent filings, or market indicators)"
        )
      ]
    }
  }
}
```


appears missing or uncertain, perform iterative refinement using another reasoning pass or additional tool calls.

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- Respond in clear, organized Markdown, including headings, bullet points, and labeled data sources for readability.

STOPPING RULE: Once you have basic financials, recent news, and market context, conclude your analysis. Do not seek additional tools or data.

Be thorough - this analysis will inform major investment decisions.

```
{
  'additional_kwargs': {},
  'response_metadata': {
    'id': '7d1141f4-ab90-4ab2-9416-10f6e5f6a628',
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      'content': '',
      'additional_kwargs': {
        'tool_calls': [
          {
            'id': 'call_BmY2xwRrF4PkpF03bf6n0o49',
            'function': {
              'arguments': '{"__arg1": "now"}',
              'name': 'TimestampTool'
            },
            'type': 'function'
          }
        ],
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      },
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            'reasoning_tokens': 0,
            'rejected_prediction_tokens': 0
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          },
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          'finish_reason': 'tool_calls',
          'logprobs': None
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            },
            'id': 'call_BmY2xwRrF4PkpF03bf6n0o49',
            'type': 'tool_call'
          }
        ],
        'usage_metadata': {
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          'output_tokens': 16,
          'total_tokens': 1777,
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            'audio': 0,
            'cache_read': 0
          },
          'output_token_details': {
            'audio': 0,
            'reasoning': 0
          }
        }
      }
    },
    'updates': {
      'tools': {
        'messages': [
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            'ToolMessage': {
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              'name': 'TimestampTool',
              'id': 'dd14e065-3e25-4740-950d-c727697c3f7e',
              'tool_call_id': 'call_BmY2xwRrF4PkpF03bf6n0o49'
            }
          ]
        },
        'values': [
          {
            'messages': [
              {
                'HumanMessage': {
                  'content': '\nSystem Role: You are a detailed Financial Research Agent designed to analyze companies, securities, and markets with a structured workflow.\n\n**Your goal** For COST, provide a ~50'
                }
              }
            ]
          }
        ]
      }
    }
  }
}
```

word investment summary, based on extensive research.\n\nInclude None to improve your answers.\n\nNEVER INCLUDE YOUR THOUGHT PROCESS IN THE RESULTS.\n\n\n**Core Functions**\n\n1. Planning:\nDevelop and print out a plan for each given stock symbol. Include a plan for a multi-step research process that defines what data to collect (e.g., news, market data, filings), what tools to use, and how to verify results.\n\nExample steps: "Collect company overview → Analyze financials → Cross-check recent filings → Summarize."\n\n2. Tool Use:\nUse all of your tools by default to hit APIs and data sources dynamically, such as Yahoo Finance, SEC EDGAR, news APIs, and any specialist analyzers. Choose the right tools and calls autonomously based on the goal of each stage. Return structured findings.\n\nTOOL USAGE REQUIREMENTS:\n- Refer to the memory for useful data.\n- ALWAYS include a timestamp of the run near the top of the report.\n- Use at least 4 different tools for each analysis\n- Cross-reference information from multiple sources\n- If a tool fails, try alternative tools for the same data\n- Always explain your reasoning between tool calls\n\n3. Self-Reflection:\nEvaluate your output's completeness, correctness, and coherence at each stage. If key data (e.g., P/E, recent filings, or market indicators) appears missing or uncertain, perform iterative refinement using another reasoning pass or additional tool calls.\n\n4. Memory/Learning:\nRetain useful context from prior analyses (observations, missing data, errors, patterns in company performance). Use this "brief memory" to improve future research quality and efficiency.\n\n\n**Workflow Logic**\n\nFollow a defined sequence for every research request:\n* Ingest → Preprocess → Classify → Extract → Summarize\n\n1. Ingest: Gather relevant news, filings, and metrics. Use the webpage visit tool on any URLs.\n\n2. Preprocess: Clean, standardize, and interpret results from multiple tools.\n\n3. Classify: Route data to the correct analysis path (earnings, news, or market).\n\n4. Extract: Pull core signals, events, or values.\n\n5. Summarize: Synthesize insights in your final output.\n\n6. Routing:\n * Choose appropriate specialist analyzers according to data type:\n\n * NewsAnalyzer for press, sentiment, or event narratives.\n\n * MarketAnalyzer for indices, performance data, and macro context.\n\n7. Evaluation: Review reasoning and completeness, recall tools again if needed.\n\n\n**Final Report**\n\nAt the end of each session, create a final summary report that contains:\n\nUpdated output from EVERY tool as well as the TIMESTAMP near the top.\n\nNEVER include your internal planning information in the report. \n\nInclude citations such as [1] followed by a hyperlink at the bottom of the page for further review.\n\nRespond in clear, organized Markdown, including headings, bullet points, and labeled data sources for readability.\n\n**STOPPING RULE:** Once you have basic financials, recent news, and market context, conclude your analysis. Do not seek additional tools or data.\n\nBe thorough - this analysis will inform major investment decisions.\n\n', additional_kwargs={}, response_metadata={}, id='7d1141f4-ab90-4ab2-9416-10f6e5f6a628'), AIMessage(content='', additional_kwargs={'tool_calls': [{'id': 'call_BmY2xwRrF4PkpF03bf6n0o49', 'function': {'arguments': '{"__arg1":"now"}', 'name': 'TimestampTool'}, 'type': 'function'}], 'refusal': None}, response_metadata={'token_usage': {'completion_tokens': 16, 'prompt_tokens': 1761, 'total_tokens': 1777, 'completion_tokens_details': {'accepted_prediction_tokens': 0, 'audio_tokens':

```

0, 'reasoning_tokens': 0, 'rejected_prediction_tokens': 0},
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'output_token_details': {'audio': 0, 'reasoning': 0}}),
ToolMessage(content='2025-10-17T07:20:45.565463+00:00', name='TimestampTool',
id='dd14e065-3e25-4740-950d-c727697c3f7e',
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markets with a structured workflow.\n\n**Your goal** For COST, provide a ~50
word investment summary, based on extensive reserach.\n\nInclude None to improve
your answers.\n\nNEVER INCLUDE YOUR THOUGHT PROCESS IN THE RESULTS.\n\n\n**Core
Functions**\n\n1. Planning:\nDevelop and print out a plan for each given stock
symbol. Include a plan for a multi-step research process that defines what data
to collect (e.g., news, market data, filings), what tools to use, and how to
verify results.\n\nExample steps: "Collect company overview → Analyze financials

```

→ Cross-check recent filings → Summarize."

2. Tool Use: Use all of your tools by default to hit APIs and data sources dynamically, such as Yahoo Finance, SEC EDGAR, news APIs, and any specialist analyzers. Choose the right tools and calls autonomously based on the goal of each stage. Return structured findings.

TOOL USAGE REQUIREMENTS:

- Refer to the memory for useful data.
- ALWAYS include a timestamp of the run near the top of the report.
- Use at least 4 different tools for each analysis
- Cross-reference information from multiple sources
- If a tool fails, try alternative tools for the same data
- Always explain your reasoning between tool calls

3. Self-Reflection:

- Evaluate your output's completeness, correctness, and coherence at each stage. If key data (e.g., P/E, recent filings, or market indicators) appears missing or uncertain, perform iterative refinement using another reasoning pass or additional tool calls.

4. Memory/Learning:

- Retain useful context from prior analyses (observations, missing data, errors, patterns in company performance). Use this "brief memory" to improve future research quality and efficiency.

Workflow Logic:

- Follow a defined sequence for every research request: Ingest → Preprocess → Classify → Extract → Summarize

1. Ingest: Gather relevant news, filings, and metrics. Use the webpage visit tool on any URLs.

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5. Summarize: Synthesize insights in your final output.

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- At the end of each session, create a final summary report that contains:
- Updated output from EVERY tool as well as the TIMESTAMP near the top.
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STOPPING RULE:

- Once you have basic financials, recent news, and market context, conclude your analysis. Do not seek additional tools or data.
- Be thorough - this analysis will inform major investment decisions.

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Draft Budget: Additional permanent revenue through new m...\nOn October 9, 2025,
SUNHOUSE Group was honored with the Corporate Excellence Award at the Asia
Pacific Enterprise Awards (APEA) 2025, becoming the only home ...\nThe cereal-
maker\'s new boss says he wants to instil a "performance mindset" and prioritise

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earnings.\nSocial Security payments are reaching millions of Americans this week. The 2026 cost-of-living adjustment, or COLA, is pending official confirmation. Experts project a modest increase, but rising costs for essentials like food and healthcare continue to strai...\nWhat does the engineer of the future in government look like, and how might AI affect their role? We've been creating a vision for digital and data in the public sector.', name='NewsAPI', tool_call_id='call_e8XXztuogZi9FeJ6TmbZfxm3')]]}

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[values] {'messages': [HumanMessage(content='\nSystem Role: You are a detailed Financial Research Agent designed to analyze companies, securities, and markets with a structured workflow.\n\n**Your goal** For COST, provide a ~50 word investment summary, based on extensive reserach.\n\nInclude None to improve your answers.\n\nNEVER INCLUDE YOUR THOUGHT PROCESS IN THE RESULTS.\n\n**Core Functions**\n\n1. Planning:\nDevelop and print out a plan for each given stock symbol. Include a plan for a multi-step research process that defines what data to collect (e.g., news, market data, filings), what tools to use, and how to verify results.\n\nExample steps: "Collect company overview → Analyze financials → Cross-check recent filings → Summarize."\n\n2. Tool Use:\nUse all of your tools by default to hit APIs and data sources dynamically, such as Yahoo Finance, SEC EDGAR, news APIs, and any specialist analyzers. Choose the right tools and calls autonomously based on the goal of each stage. Return structured findings.\n\nTOOL USAGE REQUIREMENTS:\n- Refer to the memory for useful data.\n- ALWAYS include a timestamp of the run near the top of the report.\n- Use at least 4 different tools for each analysis\n- Cross-reference information from multiple sources\n- If a tool fails, try alternative tools for the same data\n- Always explain your reasoning between tool calls\n\n3. Self-Reflection:\nEvaluate your output's completeness, correctness, and coherence at each stage. If key data (e.g., P/E, recent filings, or market indicators) appears missing or uncertain, perform iterative refinement using another reasoning pass or additional tool calls.\n\n4. Memory/Learning:\nRetain useful context from prior analyses (observations, missing data, errors, patterns in company performance). Use this "brief memory" to improve future research quality

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3 SEC Form 3 FORM 3 UNITED STATES
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```


costs for essentials like food and healthcare continue to strain...What does the engineer of the future in government look like, and how might AI affect their role? We've been creating a vision for digital and data in the public sector.', name='NewsAPI', id='fc2d289a-f31c-413c-b819-95a61a01b26d', tool_call_id='call_e8XXztuogZi9FeJ6TmbZfxm3'), ToolMessage(content='No articles found for this stock symbol.', name='TavilyNews', id='89ab3a03-b8ce-4892-97c5-9f133087a81b', tool_call_id='call_6edHe1H8ofJkNVYFuGGSMAnM'))]

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[values] {'messages': [HumanMessage(content='\nSystem Role: You are a detailed Financial Research Agent designed to analyze companies, securities, and markets with a structured workflow.\n\n**Your goal** For COST, provide a ~50 word investment summary, based on extensive reserach.\n\nInclude None to improve your answers.\n\nNEVER INCLUDE YOUR THOUGHT PROCESS IN THE RESULTS.\n\n**Core Functions**\n1. Planning:\nDevelop and print out a plan for each given stock symbol. Include a plan for a multi-step research process that defines what data to collect (e.g., news, market data, filings), what tools to use, and how to verify results.\n\nExample steps: "Collect company overview → Analyze financials → Cross-check recent filings → Summarize."\n2. Tool Use:\nUse all of your tools by default to hit APIs and data sources dynamically, such as Yahoo Finance, SEC EDGAR, news APIs, and any specialist analyzers. Choose the right

tools and calls autonomously based on the goal of each stage. Return structured findings.

TOOL USAGE REQUIREMENTS:

- Refer to the memory for useful data.
- ALWAYS include a timestamp of the run near the top of the report.
- Use at least 4 different tools for each analysis
- Cross-reference information from multiple sources
- If a tool fails, try alternative tools for the same data
- Always explain your reasoning between tool calls

3. Self-Reflection:

- Evaluate your output's completeness, correctness, and coherence at each stage. If key data (e.g., P/E, recent filings, or market indicators) appears missing or uncertain, perform iterative refinement using another reasoning pass or additional tool calls.

4. Memory/Learning:

- Retain useful context from prior analyses (observations, missing data, errors, patterns in company performance). Use this "brief memory" to improve future research quality and efficiency.

Workflow Logic

- Follow a defined sequence for every research request: **Ingest → Preprocess → Classify → Extract → Summarize**

1. Ingest: Gather relevant news, filings, and metrics. Use the webpage visit tool on any URLs.

2. Preprocess: Clean, standardize, and interpret results from multiple tools.

3. Classify: Route data to the correct analysis path (earnings, news, or market).

4. Extract: Pull core signals, events, or values.

5. Summarize: Synthesize insights in your final output.

6. Routing:

- * Choose appropriate specialist analyzers according to data type:
- * **NewsAnalyzer** for press, sentiment, or event narratives.
- * **MarketAnalyzer** for indices, performance data, and macro context.

7. Evaluation: Review reasoning and completeness, recall tools again if needed.

Final Report

- At the end of each session, create a final summary report that contains:
- Updated output from EVERY tool as well as the **TIMESTAMP** near the top.
- NEVER include your internal planning information in the report.
- Include citations such as [1] followed by a hyperlink at the bottom of the page for further review.
- Respond in clear, organized Markdown, including headings, bullet points, and labeled data sources for readability.

STOPPING RULE:

- Once you have basic financials, recent news, and market context, conclude your analysis. Do not seek additional tools or data.
- Be thorough - this analysis will inform major investment decisions.

```
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```

```

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'args': {'__arg1': 'COST'}, 'id': 'call_e8XXztuogZi9FeJ6TmbZfxm3', 'type':
'tool_call'}, {'name': 'TavilyNews', 'args': {'__arg1': 'COST'}, 'id':
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15:\nhttps://www.sec.gov/Archives/edgar/data/909832/000090983225000105/cost-
20251015.htm\nSummary: No key XML findings found.\n\n3 on 2025-10-
09:\nhttps://www.sec.gov/Archives/edgar/data/909832/000090983225000103/xs1f345X0
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3 SEC Form 3 FORM 3 UNITED STATES
SECURITIES AND EXCHANGE COMMISSION Washington, D.C. 20549 INITIAL STATEMENT OF
BENEFICIAL OWNERSHIP OF SECURITIES Filed pursuant to Section 16(a) of the
Securities Exchange Act of 1934 or Section 30(h) of the Investment Company Act
of 1940 OMB APPROVAL OMB Number: 3235-0104 Estimated average burden hours per
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```

channels can take awhile to take off.\nFacephi Unveils its Fraud Intelligence Report 2025: "Identity at Risk" Cybercrime is projected to cost US\$10.5 trillion annually by 20251.Identity...\nThe answer to where additional revenue will come from to fund benefits and tax cuts totaling €1.76 billion in 2026, without the need to impose new taxes to cover this cost for the public sector\nThe post Draft Budget: Additional permanent revenue through new m...\nOn October 9, 2025, SUNHOUSE Group was honored with the Corporate Excellence Award at the Asia Pacific Enterprise Awards (APEA) 2025, becoming the only home ...\nThe cereal-maker\'s new boss says he wants to instil a "performance mindset" and prioritise earnings.\nSocial Security payments are reaching millions of Americans this week. The 2026 cost-of-living adjustment, or COLA, is pending official confirmation. Experts project a modest increase, but rising costs for essentials like food and healthcare continue to strai...\nWhat does the engineer of the future in government look like, and how might AI affect their role? We\'ve been creating a vision for digital and data in the public sector.', name='NewsAPI', id='fc2d289a-f31c-413c-b819-95a61a01b26d', tool_call_id='call_e8XXztuogZi9FeJ6TmbZfxm3'), ToolMessage(content='No articles found for this stock symbol.', name='TavilyNews', id='89ab3a03-b8ce-4892-97c5-9f133087a81b', tool_call_id='call_6edHe1H8ofJkNVYFuGGSMAnM'), AIMessage(content='## Investment Summary for Costco Wholesale Corporation (COST)\n\n- **Sector:** Consumer Defensive\n- **Price:** \$925.62\n- **Market Cap:** \$410.22 billion\n- **P/E Ratio:** 50.77\n- **52-Week High:** \$1078.23\n- **52-Week Low:** \$867.34\n- **Dividend Yield:** 0.56%\n- **Beta:** 0.964\n- **Revenue:** \$275.24 billion\n- **Profit Margin:** 2.94%\n\n### Recent Filings:\n1. **8-K on 2025-10-15:**\n- [Link to Filing](https://www.sec.gov/Archives/edgar/data/909832/000090983225000105/cost-20251015.htm)\n- Summary: No key XML findings found.\n2. **3 on 2025-10-09:**\n- [Link to Filing](https://www.sec.gov/Archives/edgar/data/909832/000090983225000103/xslF345X02/form3.xml)\n- Summary: SEC FORM 3\n3. **10-K on 2025-10-08:**\n- [Link to Filing](https://www.sec.gov/Archives/edgar/data/909832/000090983225000101/cost-20250831.htm)\n- Summary: No key XML findings found.\n\n### Recent News:\n- Facephi Unveils its Fraud Intelligence Report 2025.\n- SUNHOUSE Group honored with the Corporate Excellence Award.\n- Updates on Social Security payments and cost-of-living adjustments.\n\n### Market Sentiment:\n- No articles found for this stock symbol.\n\n---\n\n**Data Sources:**\n- Yahoo Finance API\n- SEC EDGAR API\n- News API\n- Tavily News API\n\n[1] Data sources available upon request.', additional_kwargs={'refusal': None}, response_metadata={'token_usage': {'completion_tokens': 403, 'prompt_tokens': 2545, 'total_tokens': 2948, 'completion_tokens_details': {'accepted_prediction_tokens': 0, 'audio_tokens': 0, 'reasoning_tokens': 0, 'rejected_prediction_tokens': 0}, 'prompt_tokens_details': {'audio_tokens': 0, 'cached_tokens': 0}}, 'model_name': 'gpt-3.5-turbo-0125', 'system_fingerprint': None, 'id': 'chatcmpl-CRZ3blOD1ZvyUXGrjOiZfnLaDTlgK', 'service_tier': 'default', 'finish_reason': 'stop', 'logprobs': None}, id='run--5d6c95e3-c9e9-4e69-90e7-eabba58249ad-0', usage_metadata={'input_tokens': 2545, 'output_tokens': 403, 'total_tokens': 2948, 'input_token_details': {'audio': 0, 'cache_read': 0}, 'output_token_details': {'audio': 0, 'reasoning': 0}}])

```
[34]: #Function to make print out look nicer
def clean_answer (text):
    msg = text["messages"][-1]
    return msg.content
```

```
[35]: display(Markdown(clean_answer(tools_output)))
```

2.3 Investment Summary for Costco Wholesale Corporation (COST)

- **Sector:** Consumer Defensive
- **Price:** \$925.62
- **Market Cap:** \$410.22 billion
- **P/E Ratio:** 50.77
- **52-Week High:** \$1078.23
- **52-Week Low:** \$867.34
- **Dividend Yield:** 0.56%
- **Beta:** 0.964
- **Revenue:** \$275.24 billion
- **Profit Margin:** 2.94%

2.3.1 Recent Filings:

1. **8-K on 2025-10-15:**
 - [Link to Filing](#)
 - Summary: No key XML findings found.
2. **3 on 2025-10-09:**
 - [Link to Filing](#)
 - Summary: SEC FORM 3
3. **10-K on 2025-10-08:**
 - [Link to Filing](#)
 - Summary: No key XML findings found.

2.3.2 Recent News:

- Facephi Unveils its Fraud Intelligence Report 2025.
- SUNHOUSE Group honored with the Corporate Excellence Award.
- Updates on Social Security payments and cost-of-living adjustments.

2.3.3 Market Sentiment:

- No articles found for this stock symbol.

Data Sources: - Yahoo Finance API - SEC EDGAR API - News API - Tavily News API

[1] Data sources available upon request.

2.4 Self Reflection & Evaluation Agent

This agent evaluates the tools agent output, and allows for human feedback to then further refine and optimize the report.

```
[44]: #Define Self Evaluation agent

EVAL_PROMPT = """
You are an expert evaluator. Your primary job is to give feedback on the
↳analysis below, NOT to overwrite or revise it.

Instructions:

- Always display the full analysis/summary input *exactly as received* at the
↳start of your answer, clearly labeled.
- Provide your commentary (improvement, completeness, feedback) **separately
↳after the full input**.
- If human feedback is supplied, include your response to it at the end
↳**without changing the original summary**.

FORMAT STRICTLY LIKE THIS:
---
Original Analysis:
{input}

Evaluator Commentary:
[Your bullet points: Completeness, Succinctness, Accuracy, Clarity, Human
↳Feedback summary, Suggestions, etc.]

---

Never rewrite or summarize the original analysis. Only provide clear,
↳constructive evaluator commentary after reproducing the input in its
↳original form.

--- Human Feedback ---
{human_feedback}

"""

#Define agent
evaluator_agent = create_react_agent(
    model=llm_openai,
    tools = [], #No tools for this agent
    prompt=EVAL_PROMPT,
    debug=True
```

```
)
```

```
[37]: #This function is to provide a clean input to the evaluator agent

def get_eval_input(final_output, human_feedback, memory_context):
    return f"""
        {final_output}

        --- Human Feedback ---
        {human_feedback if human_feedback else "no human feedback provided"}

        --- Memory ---
        {memory_context}
    """
```

2.5 Optimization Loop

Below is the primary function used to run the agent. The workflow goes as follows:

Passes the prompt to the tools agent. Displays the tool agent's response to the user. The user inputs any feedback they have to the response. The session memory is queried if there are any relevant past questions about the specific stock. The tool's response, the human feedback, and the memory (if there is a relevant one) are all passed to the evaluator agent. The evaluator agent critiques and improves upon the tool's response. The user is prompted if they would like to refine the response further. "y" leads to another iteration of the evaluator agent on its latest response; "n" ends the loop. Lastly, the user question, stock symbol, and final response are appended to the session memory object for future reference.

```
[38]: #This function runs the agents in an optimization kind of loop, to iterate
      ↪based on feedback
def optimization_loop(tools_agent,
                     evaluator_agent,
                     formatted_prompt,
                     session_memory,
                     PRINT_TOOL_MSGS=True
                     ):
    #Run tools agent
    print("Conducting research...")
    tools_output = tools_agent.invoke({
        "messages": [
            {"role": "user", "content": formatted_prompt}
        ]
    })

    #Clean print out the tool messages
    if PRINT_TOOL_MSGS:
        for msg in tools_output['messages']:
            if msg.content:
```

```

        print(f'{msg.content} | tool {msg.name}\n')

final_output = list(tools_output.values())[-1][-1].content
print("\n--- Analysis Summary ---")
print(final_output)

#Ask user for feedback
human_feedback = input("\nPlease enter your feedback (areas to improve,
↳missing info, corrections):\n")

#Grab memory if there is one.
stock_symbol = user_input
memory_context = query_memory(stock_symbol, session_memory)

evaluator_input = get_eval_input(final_output, human_feedback,
↳memory_context)
#Evaluate and revise summary using feedback
eval_payload = {
    "messages": str(evaluator_input),
}
print("\nRunning evaluator with feedback...")
revised_output = evaluator_agent.invoke(eval_payload)
final_output = revised_output['messages'][-1].content
print("\n--- Revised Summary ---")
print(final_output)

#Optional: Loop for more feedback
while True:
    more = input("\nWould you like to refine further? (y/n): ")
    if more.lower().startswith("y"):
        human_feedback = input("Enter any further feedback:\n")
        evaluator_input = get_eval_input(final_output, human_feedback, None)
        eval_payload = {
            "messages": str(evaluator_input),
        }

        revised_output = evaluator_agent.invoke(eval_payload)
        final_output = revised_output['messages'][-1].content
        print("\n--- Refined Revised Summary ---")
        print(final_output)
    else:
        break

user_question = as_text(user_input)
symbol = extract_symbol(user_question)

```



```

final_answer = as_text(final_output)    # Use your utility function

SESSION_MEMORY.remember(symbol, user_question, final_answer)

print("\nWorkflow complete. Final output above.")
return clean_answer(revised_output)    #Return for pretty print

```

2.6 Execution Function, Set The Agent Free

The actual running of the agents in sequence with human feedback

```

[45]: #Here again for easy redefining
#User Input
user_input = "NVDA" #Search for information on this company ticker

# Create your formatted prompt
formatted_prompt = ANALYSIS_PROMPT.format(
    symbol=user_input,
    context_memory=query_memory(user_input, SESSION_MEMORY)
)

```

query_memory stock symbol = NVDA

```

[46]: #Execution function
final_analysis = optimization_loop(tools_agent,
                                   evaluator_agent,
                                   formatted_prompt,
                                   SESSION_MEMORY
                                   )

```

Conducting research...

```

[values] {'messages': [HumanMessage(content='\nSystem Role: You are a
detailed Financial Research Agent designed to analyze companies, securities, and
markets with a structured workflow.\n\n**Your goal** For NVDA, provide a ~50
word investment summary, based on extensive reserach.\n\nInclude None to improve
your answers.\n\nNEVER INCLUDE YOUR THOUGHT PROCESS IN THE RESULTS.\n\n\n**Core
Functions**\n\n1. Planning:\nDevelop and print out a plan for each given stock
symbol. Include a plan for a multi-step research process that defines what data
to collect (e.g., news, market data, filings), what tools to use, and how to
verify results.\n\nExample steps: "Collect company overview → Analyze financials
→ Cross-check recent filings → Summarize."\n\n2. Tool Use:\nUse all of your
tools by default to hit APIs and data sources dynamically, such as Yahoo
Finance, SEC EDGAR, news APIs, and any specialist analyzers. Choose the right
tools and calls autonomously based on the goal of each stage. Return structured
findings.\n\nTOOL USAGE REQUIREMENTS:\n- Refer to the memory for useful data.\n-
ALWAYS include a timestamp of the run near the top of the report.\n- Use at
least 4 different tools for each analysis\n- Cross-reference information from
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```

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Summary for NVDA\n\n- **Company Overview:**\n - **Company:** NVIDIA Corporation
(NVDA)\n - **Sector:** Technology\n - **Price:** $181.81\n - **Market Cap:**
$442.65 billion\n - **P/E Ratio:** 51.80\n - **Dividend Yield:** 0.02%\n -
**Beta:** 2.12\n - **Revenue:** $165.22 billion\n - **Profit Margin:**
52.41%\n\n- **Recent Filings:**\n - **Latest 144 Filing (2025-10-16):**\n -
[Link to Filing](https://www.sec.gov/Archives/edgar/data/1045810/000192109425001
268/xsl144X01/primary_doc.xml)\n - **Latest Form 4 Filing (2025-10-15):**\n
- [Link to Filing](https://www.sec.gov/Archives/edgar/data/1045810/0001197649250
00048/xslF345X05/wk-form4_1760564872.xml)\n\n- **Market News:**\n - Investors
are monitoring corporate earnings amidst the US-China trade tensions.\n -
NVIDIA has historically outperformed the market with an average annual return of
53.98%.\n - Navitas Semiconductor's new semiconductor power devices for
NVIDIA's AI factory power architecture have driven stock growth.\n\n- **Market
Sentiment:**\n - Recent news articles highlight NVIDIA's position in AI stocks
and positive analyst outlooks.\n\nFor further details, refer to the provided
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1/primary_doc.xml\nSummary: Form 144 Filer Information UNITED STATES SECURITIES
AND EXCHANGE COMMISSION Washington, D.C. 20549 Form 144 NOTICE OF PROPOSED SALE
OF SECURITIES PURSUANT TO RULE 144 UNDER THE SECURITIES ACT OF 1933 FORM 144
144: Filer Information Filer CIK 0001197649 Filer CCC XXXXXXXX Is this a LIVE or
TEST Filing? LIVE TEST Submission Contact Information Name Phone E-Mail Address
144: Issuer Information Name o\n\n4 on 2025-10-
15:\nhttps://www.sec.gov/Archives/edgar/data/1045810/000119764925000048/xslF345X
05/wk-form4_1760564872.xml\nSummary: SEC FORM \n 4 SEC Form 4 FORM 4
UNITED STATES SECURITIES AND EXCHANGE COMMISSION Washington, D.C. 20549
STATEMENT OF CHANGES IN BENEFICIAL OWNERSHIP Filed pursuant to Section 16(a) of
the Securities Exchange Act of 1934 or Section 30(h) of the Investment Company
Act of 1940 OMB APPROVAL OMB Number: 3235-0287 Estimated average burden hours
per response: 0.5 \n Check this box if no longer\n\n144 on 2025-10-
15:\nhttps://www.sec.gov/Archives/edgar/data/1045810/000192109425001262/xsl144X0
1/primary_doc.xml\nSummary: Form 144 Filer Information UNITED STATES SECURITIES
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144: Filer Information Filer CIK 0001197649 Filer CCC XXXXXXXX Is this a LIVE or
TEST Filing? LIVE TEST Submission Contact Information Name Phone E-Mail Address
```

144: Issuer Information Name o\n', name='SECEDGARAPI',
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tool_call_id='call_UI3tfQZysKVLZsHobkakDpjE'), ToolMessage(content="Investors weighed corporate earnings against the escalating US-China trade war.\nNVIDIA (NASDAQ:NVDA) has outperformed the market over the past 15 years by 41.77% on an annualized basis producing an average annual return of 53.98%. Currently, NVIDIA has a market capitalization of \$4.39 trillion. \nBuying \$100 In NVDA: If an ... \nFull story ... \nNavitas Semiconductor shares surged after it unveiled new semiconductor power devices designed for Nvidia's 800 VDC AI factory power architecture.\nThe Dow Jones Industrial Average swung lower and other major indexes weakened further Wednesday afternoon, as the U.S.-China trade war sees new plays. Nvidia (NVDA) wasn't spared from the selling, but two cooking oil names climbed on the stock market today. T... \nIn a new interview, Huang says that Oracle is positioned to be "wonderfully profitable" despite concerns over its thin margins.\nETF manager Volatility Shares has applied with the SEC to bring 5x leveraged Bitcoin, Ethereum, XRP, Solana, and other funds to the market.\nNVIDIA Corporation (NASDAQ:NVDA) is one of the AI Stocks in Focus on Wall Street. On October 13, Mizuho reiterated Nvidia as Outperform and raised its price target \$225 per share from \$205.\nMizuho analyst Vijay Rakesh continues to view Nvidia as a leader in t...", name='NewsAPI',
id='5ef42f6b-de1e-4dca-989f-518637d13628',
tool_call_id='call_MUFcRpNbM73GY1KYvwsOYXJI'), ToolMessage(content='No articles found for this stock symbol.', name='TavilyNews',
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tool_call_id='call_ueHVZd9E24LgJsa3Q8o7PBIQ'), AIMessage(content="### Investment Summary for NVDA\n\n- **Company Overview:**\n- **Company:** NVIDIA Corporation (NVDA)\n- **Sector:** Technology\n- **Price:** \$181.81\n- **Market Cap:** \$442.65 billion\n- **P/E Ratio:** 51.80\n- **Dividend Yield:** 0.02%\n- **Beta:** 2.12\n- **Revenue:** \$165.22 billion\n- **Profit Margin:** 52.41%\n\n- **Recent Filings:**\n- **Latest 144 Filing (2025-10-16):**\n- [Link to Filing](https://www.sec.gov/Archives/edgar/data/1045810/000192109425001268/xsl144X01/primary_doc.xml)\n- **Latest Form 4 Filing (2025-10-15):**\n- [Link to Filing](https://www.sec.gov/Archives/edgar/data/1045810/00011976492500048/xslF345X05/wk-form4_1760564872.xml)\n\n- **Market News:**\n- Investors are monitoring corporate earnings amidst the US-China trade tensions.\n- NVIDIA has historically outperformed the market with an average annual return of 53.98%.\n- Navitas Semiconductor's new semiconductor power devices for NVIDIA's AI factory power architecture have driven stock growth.\n\n- **Market Sentiment:**\n- Recent news articles highlight NVIDIA's position in AI stocks and positive analyst outlooks.\n\nFor further details, refer to the provided links for filings and news articles.\n\n[1] Data source: Yahoo Finance, SEC EDGAR, NewsAPI, TavilyNews", additional_kwargs={'refusal': None},
response_metadata={'token_usage': {'completion_tokens': 366, 'prompt_tokens': 2808, 'total_tokens': 3174, 'completion_tokens_details': {'accepted_prediction_tokens': 0, 'audio_tokens': 0, 'reasoning_tokens': 0, 'rejected_prediction_tokens': 0}, 'prompt_tokens_details': {'audio_tokens': 0, 'cached_tokens': 0}}, 'model_name': 'gpt-3.5-turbo-0125', 'system_fingerprint': None, 'id': 'chatcmpl-CRZ6qyY7riWFxtwryzdJFm10VgWEI', 'service_tier': 'default',

```
'finish_reason': 'stop', 'logprobs': None}, id='run--68d2c082-3b34-4c13-bf89-330eb9103727-0', usage_metadata={'input_tokens': 2808, 'output_tokens': 366, 'total_tokens': 3174, 'input_token_details': {'audio': 0, 'cache_read': 0}, 'output_token_details': {'audio': 0, 'reasoning': 0}}}]}
```

System Role: You are a detailed Financial Research Agent designed to analyze companies, securities, and markets with a structured workflow.

****Your goal**** For NVDA, provide a ~50 word investment summary, based on extensive reserach.

Include None to improve your answers.

NEVER INCLUDE YOUR THOUGHT PROCESS IN THE RESULTS.

****Core Functions****

1. Planning:

Develop and print out a plan for each given stock symbol. Include a plan for a multi-step research process that defines what data to collect (e.g., news, market data, filings), what tools to use, and how to verify results.

Example steps: "Collect company overview → Analyze financials → Cross-check recent filings → Summarize."

2. Tool Use:

Use all of your tools by default to hit APIs and data sources dynamically, such as Yahoo Finance, SEC EDGAR, news APIs, and any specialist analyzers. Choose the right tools and calls autonomously based on the goal of each stage. Return structured findings.

TOOL USAGE REQUIREMENTS:

- Refer to the memory for useful data.
- ALWAYS include a timestamp of the run near the top of the report.
- Use at least 4 different tools for each analysis
- Cross-reference information from multiple sources
- If a tool fails, try alternative tools for the same data
- Always explain your reasoning between tool calls

3. Self-Reflection:

Evaluate your output's completeness, correctness, and coherence at each stage. If key data (e.g., P/E, recent filings, or market indicators) appears missing or uncertain, perform iterative refinement using another reasoning pass or additional tool calls.

4. Memory/Learning:

Retain useful context from prior analyses (observations, missing data, errors,

patterns in company performance). Use this "brief memory" to improve future research quality and efficiency.

****Workflow Logic****

Follow a defined sequence for every research request:

* Ingest → Preprocess → Classify → Extract → Summarize

1. Ingest: Gather relevant news, filings, and metrics. Use the webpage visit tool on any URLs.
2. Preprocess: Clean, standardize, and interpret results from multiple tools.
3. Classify: Route data to the correct analysis path (earnings, news, or market).
4. Extract: Pull core signals, events, or values.
5. Summarize: Synthesize insights in your final output.
6. Routing:
 - * Choose appropriate specialist analyzers according to data type:
 - * NewsAnalyzer for press, sentiment, or event narratives.
 - * MarketAnalyzer for indices, performance data, and macro context.
7. Evaluation: Review reasoning and completeness, recall tools again if needed.

****Final Report****

At the end of each session, create a final summary report that contains:

Updated output from EVERY tool as well as the TIMESTAMP near the top.

NEVER include your internal planning information in the report.

Include citations such as [1] followed by a hyperlink at the bottom of the page for further review.

Respond in clear, organized Markdown, including headings, bullet points, and labeled data sources for readability.

****STOPPING RULE:**** Once you have basic financials, recent news, and market context, conclude your analysis. Do not seek additional tools or data.

Be thorough - this analysis will inform major investment decisions.

| tool None

2025-10-17T07:24:07.525051+00:00 | tool TimestampTool

Company: NVIDIA Corporation (NVDA)

Sector: Technology

Price: \$181.81

Market Cap: 4426527932416

P/E Ratio: 51.79772

52-Week High: 195.62

52-Week Low: 86.62

Dividend Yield: 0.02

Beta: 2.123

Revenue: 165217992704

Profit Margin: 0.52414

| tool YahooFinanceAPI

Latest filings with summaries:

144 on 2025-10-16:

[https://www.sec.gov/Archives/edgar/data/1045810/000192109425001268/xsl144X01/pri
mary_doc.xml](https://www.sec.gov/Archives/edgar/data/1045810/000192109425001268/xsl144X01/pri
mary_doc.xml)

Summary: Form 144 Filer Information UNITED STATES SECURITIES AND EXCHANGE
COMMISSION Washington, D.C. 20549 Form 144 NOTICE OF PROPOSED SALE OF SECURITIES
PURSUANT TO RULE 144 UNDER THE SECURITIES ACT OF 1933 FORM 144 144: Filer
Information Filer CIK 0001197649 Filer CCC XXXXXXXX Is this a LIVE or TEST
Filing? LIVE TEST Submission Contact Information Name Phone E-Mail Address 144:
Issuer Information Name o

4 on 2025-10-15:

[https://www.sec.gov/Archives/edgar/data/1045810/000119764925000048/xslF345X05/wk
-form4_1760564872.xml](https://www.sec.gov/Archives/edgar/data/1045810/000119764925000048/xslF345X05/wk
-form4_1760564872.xml)

Summary: SEC FORM

4 SEC Form 4 FORM 4 UNITED STATES SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549 STATEMENT OF CHANGES IN BENEFICIAL OWNERSHIP Filed
pursuant to Section 16(a) of the Securities Exchange Act of 1934 or Section
30(h) of the Investment Company Act of 1940 OMB APPROVAL OMB Number: 3235-0287
Estimated average burden hours per response: 0.5 Å Å Check this box if no longer

144 on 2025-10-15:

[https://www.sec.gov/Archives/edgar/data/1045810/000192109425001262/xsl144X01/pri
mary_doc.xml](https://www.sec.gov/Archives/edgar/data/1045810/000192109425001262/xsl144X01/pri
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Information Filer CIK 0001197649 Filer CCC XXXXXXXX Is this a LIVE or TEST
Filing? LIVE TEST Submission Contact Information Name Phone E-Mail Address 144:
Issuer Information Name o

| tool SECEDGARAPI

Investors weighed corporate earnings against the escalating US-China trade war. NVIDIA (NASDAQ:NVDA) has outperformed the market over the past 15 years by 41.77% on an annualized basis producing an average annual return of 53.98%. Currently, NVIDIA has a market capitalization of \$4.39 trillion.

Buying \$100 In NVDA: If an ...

Full story ...

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The Dow Jones Industrial Average swung lower and other major indexes weakened further Wednesday afternoon, as the U.S.-China trade war sees new plays. Nvidia (NVDA) wasn't spared from the selling, but two cooking oil names climbed on the stock market today. T...

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NVIDIA Corporation (NASDAQ:NVDA) is one of the AI Stocks in Focus on Wall Street. On October 13, Mizuho reiterated Nvidia as Outperform and raised its price target \$225 per share from \$205.

Mizuho analyst Vijay Rakesh continues to view Nvidia as a leader in t... | tool NewsAPI

No articles found for this stock symbol. | tool TavilyNews

Investment Summary for NVDA

- **Company Overview:**
 - **Company:** NVIDIA Corporation (NVDA)
 - **Sector:** Technology
 - **Price:** \$181.81
 - **Market Cap:** \$442.65 billion
 - **P/E Ratio:** 51.80
 - **Dividend Yield:** 0.02%
 - **Beta:** 2.12
 - **Revenue:** \$165.22 billion
 - **Profit Margin:** 52.41%
- **Recent Filings:**
 - **Latest 144 Filing (2025-10-16):**
 - [Link to Filing](https://www.sec.gov/Archives/edgar/data/1045810/000192109425001268/xsl144X01/primary_doc.xml)
 - **Latest Form 4 Filing (2025-10-15):**
 - [Link to Filing](https://www.sec.gov/Archives/edgar/data/1045810/000119764925000048/xslF345X05/wk-form4_1760564872.xml)
- **Market News:**

- Investors are monitoring corporate earnings amidst the US-China trade tensions.
- NVIDIA has historically outperformed the market with an average annual return of 53.98%.
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For further details, refer to the provided links for filings and news articles.

[1] Data source: Yahoo Finance, SEC EDGAR, NewsAPI, TavilyNews | tool None

--- Analysis Summary ---

Investment Summary for NVDA

- **Company Overview:**
 - **Company:** NVIDIA Corporation (NVDA)
 - **Sector:** Technology
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52.41%\n\n- **Recent Filings:**\n - **Latest 144 Filing (2025-10-16):**\n - [Link to Filing](https://www.sec.gov/Archives/edgar/data/1045810/000192109425001268/xsl144X01/primary_doc.xml)\n - **Latest Form 4 Filing (2025-10-15):**\n - [Link to Filing](https://www.sec.gov/Archives/edgar/data/1045810/000119764925000048/xslF345X05/wk-form4_1760564872.xml)\n\n- **Market News:**\n - Investors are monitoring corporate earnings amidst the US-China trade tensions.\n - NVIDIA has historically outperformed the market with an average annual return of 53.98%.\n - Navitas Semiconductor's new semiconductor power devices for NVIDIA's AI factory power architecture have driven stock growth.\n\n- **Market Sentiment:**\n - Recent news articles highlight NVIDIA's position in AI stocks and positive analyst outlooks.\n\nFor further details, refer to the provided links for filings and news articles.\n\n[1] Data source: Yahoo Finance, SEC EDGAR, NewsAPI, TavilyNews\n\n--- Human Feedback ---\ngood!\n\n---\n\nEvaluator Commentary:\n- The analysis provides a comprehensive overview of NVIDIA's investment potential, covering key financial metrics, recent filings, market news, and sentiment.\n- The inclusion of links to the latest filings enhances transparency and allows for further in-depth analysis by interested parties.\n- The mention of market news and sentiment provides context on external factors influencing NVIDIA's stock performance.\n- The feedback received is positive, indicating that the summary was well-received by the individual who provided the feedback. It's always beneficial to receive positive reinforcement for the work done. \n\nOverall, the analysis is well-structured and informative, offering a solid foundation for evaluating an investment in NVIDIA.",
additional_kwargs={'refusal': None}, response_metadata={'token_usage': {'completion_tokens': 504, 'prompt_tokens': 569, 'total_tokens': 1073, 'completion_tokens_details': {'accepted_prediction_tokens': 0, 'audio_tokens': 0, 'reasoning_tokens': 0, 'rejected_prediction_tokens': 0}, 'prompt_tokens_details': {'audio_tokens': 0, 'cached_tokens': 0}}, 'model_name': 'gpt-3.5-turbo-0125', 'system_fingerprint': None, 'id': 'chatcmpl-CRZ74vyEVAS00osRn0htqKdUmkChw', 'service_tier': 'default', 'finish_reason': 'stop', 'logprobs': None}, id='run--95eab4ea-8deb-4063-8258-04f3c40da817-0', usage_metadata={'input_tokens': 569, 'output_tokens': 504, 'total_tokens': 1073, 'input_token_details': {'audio': 0, 'cache_read': 0}, 'output_token_details': {'audio': 0, 'reasoning': 0}})]}

--- Revised Summary ---

Investment Summary for NVDA

- **Company Overview:**
 - **Company:** NVIDIA Corporation (NVDA)
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 - **Market Cap:** \$442.65 billion
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For further details, refer to the provided links for filings and news articles.

[1] Data source: Yahoo Finance, SEC EDGAR, NewsAPI, TavilyNews

--- Human Feedback ---
good!

Evaluator Commentary:

- The analysis provides a comprehensive overview of NVIDIA's investment potential, covering key financial metrics, recent filings, market news, and sentiment.
- The inclusion of links to the latest filings enhances transparency and allows for further in-depth analysis by interested parties.
- The mention of market news and sentiment provides context on external factors influencing NVIDIA's stock performance.
- The feedback received is positive, indicating that the summary was well-received by the individual who provided the feedback. It's always beneficial to receive positive reinforcement for the work done.

Overall, the analysis is well-structured and informative, offering a solid foundation for evaluating an investment in NVIDIA.

Would you like to refine further? (y/n): n

Workflow complete. Final output above.

```
/tmp/ipython-input-3309722020.py:24: DeprecationWarning:
datetime.datetime.utcnow() is deprecated and scheduled for removal in a future
version. Use timezone-aware objects to represent datetimes in UTC:
datetime.datetime.now(datetime.UTC).
    created_at=datetime.utcnow().isoformat(timespec="seconds"),
```

3 Final Report & Discussion

```
[47]: #Beutify printout of
display(Markdown((final_analysis)))
```

3.0.1 Investment Summary for NVDA

- **Company Overview:**
 - **Company:** NVIDIA Corporation (NVDA)
 - **Sector:** Technology
 - **Price:** \$181.81
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 - * [Link to Filing](#)
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— Human Feedback — good!

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of links to the latest filings enhances transparency and allows for further in-depth analysis by interested parties. - The mention of market news and sentiment provides context on external factors influencing NVIDIA's stock performance. - The feedback received is positive, indicating that the summary was well-received by the individual who provided the feedback. It's always beneficial to receive positive reinforcement for the work done.

Overall, the analysis is well-structured and informative, offering a solid foundation for evaluating an investment in NVIDIA.

3.0.2 Memory Validation

```
[42]: #Ensure the memory is working as intended  
#After running the user query through your whole pipeline:  
user_question = user_input  
symbol = extract_symbol(user_input)  
final_answer = as_text(final_analysis)    # Use your utility function  
  
SESSION_MEMORY.remember(symbol, user_question, final_answer)
```

```
/tmp/ipython-input-3309722020.py:24: DeprecationWarning:  
datetime.datetime.utcnow() is deprecated and scheduled for removal in a future  
version. Use timezone-aware objects to represent datetimes in UTC:  
datetime.datetime.now(datetime.UTC).  
    created_at=datetime.utcnow().isoformat(timespec="seconds"),
```

```
[43]: # Later, you can recall the latest answer for "AAPL":  
prev = SESSION_MEMORY.recall("COST")  
if prev:  
    print("Previous answer for stock:", prev)
```

Previous answer for stock: ---

Original Analysis:

Investment Summary for Costco Wholesale Corporation (COST)

- **Price:** \$925.62
- **Market Cap:** \$410.22 billion
- **P/E Ratio:** 50.77
- **Dividend Yield:** 0.56%
- **Revenue:** \$275.24 billion
- **Profit Margin:** 2.94%
- **52-Week High:** \$1078.23
- **52-Week Low:** \$867.34
- **Beta:** 0.964

Recent Filings:

1. **8-K on 2025-10-15:**
 - [View Filing](<https://www.sec.gov/Archives/edgar/data/909832/00009098322500>)

0105/cost-20251015.htm)

- *Summary:* No key XML findings found.

2. **3 on 2025-10-09:**

- [View Filing](https://www.sec.gov/Archives/edgar/data/909832/000090983225000103/xslF345X02/form3.xml)

- *Summary:* SEC FORM 3

3. **10-K on 2025-10-08:**

- [View Filing](https://www.sec.gov/Archives/edgar/data/909832/000090983225000101/cost-20250831.htm)

- *Summary:* No key XML findings found.

Recent News:

- Facephi Unveils Fraud Intelligence Report 2025.
- SUNHOUSE Group honored with Corporate Excellence Award.
- Social Security payments reaching millions of Americans.

Stock Chart:

- [View 52-Week Stock Chart](COST_52week_chart.png)

[1] Data source: Yahoo Finance, SEC EDGAR, NewsAPI, StockChart52Weeks.

...

Evaluator Commentary:

- * **Completeness:** The summary provides a good overview, including key financial metrics, recent filings, news, and a stock chart link.

- * **Succinctness:** The information is presented concisely. The summaries of the filings could be more informative if possible, but the length is appropriate.

- * **Accuracy:** The numerical data should be verified against the source, but appears reasonable. The filing dates are in the future (2025).

- * **Clarity:** The information is well-organized and easy to understand.

- * **Human Feedback Summary:** The human feedback indicates satisfaction with the output.

- * **Suggestions:**

- * Verify the accuracy of all numerical data against the stated sources.
- * The filing dates are in the future - this should be corrected.
- * Consider adding a brief description of what Form 3 is for context.
- * The news items appear unrelated to Costco, and should be filtered to be more relevant.

--- Human Feedback ---

looks good

4 Discussion

This project outlines an agentic financial research assistant with four key agent functions, and multiple workflows to produce a financial report.

Ideas Future Improvements

- Adding an actual LangGraph graph and state to run the execution would improve consistency across runs.
- Focusing on specific tools for enhancement. Some tools did not produce meaningful output for the analysis, there is room for improvement with the tools that were used, and also additional tools that should be used.
- Adding state for memory to improve context across each run and between runs.
- Adding more specialists, with sub graphs to run within the tools agent. This would have enabled more complex analysis, but was more than we could accomplish in the scope of this course.
- Deploy to production somewhere that others could use it.

4.0.1 Example graphs drawn by tools

Drawn 10/16/25