```python
In [1]:  # ================================================================
         # 🎓 University of San Diego - NLP & GenAI (AAI-520-IN3)
         # Final Project: Multi-Agent Investment Research Report
         # Authors: Richa Arun Kumar Jha, Raminder Singh, Samiksha Kodgire
         # Instructor: Premkumar Chithaluru, Ph.D
         # Date: 17 October 2025
         # ================================================================

         import warnings, numpy as np, pandas as pd, yfinance as yf, requests, torch, matplotlib.pyplot as plt, nltk
         from transformers import pipeline, AutoTokenizer, AutoModelForCausalLM
         from nltk.corpus import stopwords
         from IPython.display import Markdown, display, HTML

         warnings.filterwarnings("ignore")
         pd.set_option("display.max_colwidth", 80)
         pd.set_option("display.width", 80)
         plt.rcParams["figure.figsize"] = (7, 5)
         plt.rcParams["savefig.bbox"] = "tight"

         nltk.download("punkt")
         nltk.download("stopwords")

         # ================================================================
         # 🎓 Title & Abstract
         # ================================================================
         display(Markdown("""
         # 🎓 University of San Diego
         ## Natural Language Processing and GenAI (AAI-520-IN3)
         ### Final Project: Multi-Agent Investment Research Report

         **Authors:** Richa Arun Kumar Jha, Raminder Singh, Samiksha Kodgire
         **Instructor:** Premkumar Chithaluru, Ph.D
         **Date:** 16 October 2025

         ---

         ### **Abstract**
         This project presents a comprehensive AI-driven investment research system that integrates quantitative analysis, sentiment evaluation, and generative summa
         Agents autonomously collect market data, perform risk and technical analyses, classify news sentiment using **DistilBERT**, and summarize insights using **P
         The workflow covers six major technology tickers — AAPL, GOOG, TSLA, AMZN, NVDA, and MSFT — producing financial summaries, correlation analysis, and portfol
         ---
         """))

         # ================================================================
         # ⚙️ Agentic Workflow Overview
         # ================================================================
         display(Markdown("""
         ## ⚙️ Agentic Workflow Overview
         1. **DataAgent** — Fetches market data from Yahoo Finance.
         2. **TechnicalAgent** — Computes SMA20, SMA50, RSI, and momentum signal.
         3. **RiskAgent** — Evaluates volatility, drawdown, and composite risk score.
         4. **NewsAgent** — Retrieves live financial headlines from NewsAPI.
         5. **SentimentAgent** — Classifies news into Positive / Neutral / Negative using DistilBERT.
         6. **RoutingAgent** — Routes news to earnings, macro, or product categories.
```

```
7. **PortfolioAgent** — Suggests risk-aligned asset allocation.
8. **EvaluationAgent** — Compares sentiment trends vs. price action.
9. **LLMOptimizerAgent** — Generates professional summaries using Phi-3 Mini.
---
"""))

# ===========================================================
# 🔧 Setup
# ===========================================================
device = "cuda" if torch.cuda.is_available() else "cpu"
print(f"✅ Device: {device}")

# load keys from Colab secrets
from google.colab import userdata
NEWS_API_KEY = userdata.get("NEWS_API_KEY")

# models
sentiment_model = pipeline("sentiment-analysis",
                           model="distilbert-base-uncased-finetuned-sst-2-english",
                           device=0 if device=="cuda" else -1)
model_name = "microsoft/Phi-3-mini-4k-instruct"
model = AutoModelForCausalLM.from_pretrained(model_name, torch_dtype=torch.float16, device_map="auto")
tokenizer = AutoTokenizer.from_pretrained(model_name)
llm = pipeline("text-generation", model=model, tokenizer=tokenizer)

# ===========================================================
# 📋 Helper
# ===========================================================
def md_table(df, title=None):
    """Render compact Markdown tables that print correctly on PDF."""
    txt = ""
    if title: txt += f"\n### {title}\n\n"
    txt += df.to_markdown(index=False, tablefmt="github")
    display(Markdown(txt))

# ===========================================================
# 🤖 Agents
# ===========================================================
def fetch_data(ticker, period="1y"):
    return yf.download(ticker, period=period, progress=False).reset_index()

def compute_technicals(data):
    """Compute SMA20, SMA50, RSI, and signal — guaranteed scalar-safe."""
    if data is None or data.empty or len(data) < 50:
        return {"SMA20": np.nan, "SMA50": np.nan, "RSI": 50.0, "Signal": "Neutral"}

    close = data["Close"].fillna(method="ffill").fillna(method="bfill")

    sma20 = close.rolling(20).mean().iloc[-1]
    sma50 = close.rolling(50).mean().iloc[-1]

    delta = close.diff()
    gain = delta.where(delta > 0, 0).rolling(14).mean()
    loss = -delta.where(delta < 0, 0).rolling(14).mean()
    rs = gain / loss
```

```python
        last_loss = float(loss.iloc[-1:].values[0]) if not np.isnan(loss.iloc[-1:].values[0]) else 0.0
        last_rs = float(rs.iloc[-1:].values[0]) if not np.isnan(rs.iloc[-1:].values[0]) else 0.0

        if last_loss == 0 or np.isnan(last_rs):
            rsi = 50.0
        else:
            rsi = 100 - (100 / (1 + last_rs))

        signal = "Bullish" if float(sma20) > float(sma50) else "Bearish"

        return {
            "SMA20": float(sma20),
            "SMA50": float(sma50),
            "RSI": float(rsi),
            "Signal": signal,
        }

def compute_risk(data):
    """Compute volatility, drawdown, and risk score — robust to NaN or short series."""
    if data is None or data.empty or len(data) < 2:
        return {"Volatility": np.nan, "Drawdown": np.nan, "RiskScore": np.nan}

    close = data["Close"].fillna(method="ffill").fillna(method="bfill")
    ret = close.pct_change().dropna()

    vol = float(ret.std()) if not ret.empty else 0.0
    dd_series = (close / close.cummax() - 1)
    dd = float(dd_series.min()) if not dd_series.empty else 0.0

    score = abs(vol * 1000 + dd * 100)
    return {
        "Volatility": vol,
        "Drawdown": dd,
        "RiskScore": round(score, 2),
    }

def fetch_news(ticker):
    url = f"https://newsapi.org/v2/everything?q={ticker}&apiKey={NEWS_API_KEY}&language=en&sortBy=publishedAt&pageSize=5"
    try:
        r = requests.get(url, timeout=10)
        return [a["title"] for a in r.json().get("articles", [])] or ["No news available."]
    except Exception as e:
        return [f"Error fetching news: {e}"]

def classify_sentiment(headlines):
    results = sentiment_model(headlines)
    counts = {"positive":0,"neutral":0,"negative":0}
    for r in results:
        if r["label"] == "POSITIVE": counts["positive"]+=1
        else: counts["negative"]+=1
    total = sum(counts.values()) or 1
    for k in counts: counts[k] = round(100*counts[k]/total, 1)
    return counts

def route_news(headlines):
    routes = {"earnings":[],"macro":[],"product":[]}
```

```python
    for h in headlines:
        hl = h.lower()
        if any(k in hl for k in ["earnings","profit","revenue"]): routes["earnings"].append(h)
        elif any(k in hl for k in ["inflation","market","economy","rates"]): routes["macro"].append(h)
        else: routes["product"].append(h)
    return routes

def suggest_portfolio(risk):
    if risk < 30: return {"Equity":0.7,"Bonds":0.2,"Cash":0.1}
    elif risk < 50: return {"Equity":0.6,"Bonds":0.3,"Cash":0.1}
    else: return {"Equity":0.4,"Bonds":0.4,"Cash":0.2}

def compare_sentiment_vs_price(sent, data):
    try:
        if data is None or data.empty:
            return "Unknown"
        close = data["Close"].dropna().reset_index(drop=True)
        if len(close) < 2:
            return "Unknown"
        first_price = float(close.iloc[0])
        last_price = float(close.iloc[-1])
        up = last_price > first_price
        pos = float(sent.get("positive", 0))
        neg = float(sent.get("negative", 0))
        sentiment_up = pos > neg
        return "Aligned" if up == sentiment_up else "Divergent"
    except Exception as e:
        print(f"⚠️ compare_sentiment_vs_price() failed: {e}")
        return "Unknown"

def generate_summary(ticker, tech, risk, sent, port, news):
    prompt = f"""
Write a concise 2-paragraph investment summary for {ticker}.
Integrate:
Technicals: {tech}
Risk: {risk}
Sentiment: {sent}
Portfolio: {port}
News: {'; '.join(news)}
End with a recommendation.
"""
    return llm(prompt, max_new_tokens=300, temperature=0.6)[0]["generated_text"]

# ============================================================
# 🚀 Run the Multi-Agent Report
# ============================================================
def run_report(tickers):
    radar_data = []

    for t in tickers:
        display(Markdown(f"---\n# 📊 {t} Analysis Page\n"))
        data = fetch_data(t)
        tech = compute_technicals(data)
        risk = compute_risk(data)
        news = fetch_news(t)
        sent = classify_sentiment(news)
```

```python
        routes = route_news(news)
        port = suggest_portfolio(risk["RiskScore"])
        corr = compare_sentiment_vs_price(sent, data)
        summary = generate_summary(t, tech, risk, sent, port, news)

        # --- Price + SMA Chart ---
        fig, ax1 = plt.subplots(figsize=(10, 4))
        ax1.plot(data["Close"], label="Close", color="blue", linewidth=1.5)
        ax1.plot(data["Close"].rolling(20).mean(), label="SMA20", linestyle="--", color="orange")
        ax1.plot(data["Close"].rolling(50).mean(), label="SMA50", linestyle="-.", color="green")
        ax1.set_title(f"{t} Price & Moving Averages", fontsize=14)
        ax1.set_xlabel("Date")
        ax1.set_ylabel("Price ($)")
        ax1.legend()
        ax1.grid(True)
        plt.tight_layout()
        plt.show()

        # --- RSI Chart ---
        delta = data["Close"].diff()
        gain = delta.where(delta > 0, 0).rolling(14).mean()
        loss = -delta.where(delta < 0, 0).rolling(14).mean()
        rs = gain / loss
        rsi = 100 - (100 / (1 + rs))

        plt.figure(figsize=(10, 2))
        plt.plot(rsi, label="RSI(14)", color="purple")
        plt.axhline(70, color="red", linestyle="--", linewidth=1)
        plt.axhline(30, color="green", linestyle="--", linewidth=1)
        plt.title(f"{t} RSI Indicator", fontsize=12)
        plt.legend()
        plt.grid(True)
        plt.tight_layout()
        plt.show()

        radar_data.append([t, risk["Volatility"], risk["Drawdown"], tech["RSI"]])

        display(Markdown(f"**Summary:** {summary}"))
        display(Markdown(f"**Sentiment vs Price:** {corr}"))
        display(Markdown(f"**Suggested Allocation:** {port}"))

    display(Markdown("---\n# 🌐 Portfolio Summary Dashboard\n"))

    radar_df = pd.DataFrame(radar_data, columns=["Ticker", "Volatility", "Drawdown", "RSI"])
    radar_df.set_index("Ticker", inplace=True)
    display(Markdown("### ✅ Composite Risk–Technical Overview"))
    display(radar_df)

    return radar_df


# ==========================================
# 🚀 Run the Final Multi-Ticker Report
# ==========================================
tickers = ["AAPL","GOOG","TSLA","AMZN","NVDA","MSFT"]
combined = run_report(tickers)
```

```python
# =============================================================
# 📈 Combined Radar Chart - Key Technical & Risk Metrics
# =============================================================
plt.figure(figsize=(7,7))

labels = ["Volatility","Drawdown","RSI"]
num_vars = len(labels)
angles = np.linspace(0, 2*np.pi, num_vars, endpoint=False).tolist()
angles += angles[:1]

fig, ax = plt.subplots(figsize=(7,7), subplot_kw=dict(polar=True))

for ticker, row in combined.iterrows():
    values = [row[label] for label in labels]
    values += values[:1]
    ax.plot(angles, values, marker='o', linewidth=2, label=ticker)
    ax.fill(angles, values, alpha=0.15)

ax.set_xticks(angles[:-1])
ax.set_xticklabels(labels)
ax.set_title("📈 Combined Radar Chart - Key Technical & Risk Metrics", size=13, y=1.1)
ax.legend(loc='upper right', bbox_to_anchor=(1.2, 1.1))
plt.tight_layout()
plt.show()


# =============================================================
# 📘 Appendix + References
# =============================================================
display(Markdown("## 📘 Appendix - Consolidated Summary Table"))
md_table(combined.round(3))

display(Markdown("""
# 📚 References & Tools
- **Data:** Yahoo Finance (`yfinance`)
- **News:** [NewsAPI.org](https://newsapi.org)
- **Models:** DistilBERT, Phi-3 Mini (Microsoft)
- **Libraries:** pandas, numpy, matplotlib, transformers, torch, nltk
- **Platform:** Google Colab (T4 GPU, FP16)
---
"""))
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Unzipping tokenizers/punkt.zip.
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Unzipping corpora/stopwords.zip.
```

🧭 University of San Diego

Natural Language Processing and GenAI (AAI-520-IN3)

Final Project: Multi-Agent Investment Research Report

Authors: Richa Arun Kumar Jha, Raminder Singh, Samiksha Kodgire **Instructor:** Premkumar Chithaluru, Ph.D **Date:** 16 October 2025

Abstract

This project presents a comprehensive AI-driven investment research system that integrates quantitative analysis, sentiment evaluation, and generative summarization through a **multi-agent architecture**. Agents autonomously collect market data, perform risk and technical analyses, classify news sentiment using **DistilBERT**, and summarize insights using **Phi-3 Mini**. The workflow covers six major technology tickers — AAPL, GOOG, TSLA, AMZN, NVDA, and MSFT — producing financial summaries, correlation analysis, and portfolio suggestions.

⚙️ Agentic Workflow Overview

1. **DataAgent** — Fetches market data from Yahoo Finance.
2. **TechnicalAgent** — Computes SMA20, SMA50, RSI, and momentum signal.
3. **RiskAgent** — Evaluates volatility, drawdown, and composite risk score.
4. **NewsAgent** — Retrieves live financial headlines from NewsAPI.
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6. **RoutingAgent** — Routes news to earnings, macro, or product categories.
7. **PortfolioAgent** — Suggests risk-aligned asset allocation.
8. **EvaluationAgent** — Compares sentiment trends vs. price action.
9. **LLMOptimizerAgent** — Generates professional summaries using Phi-3 Mini.

```
✅ Device: cuda
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 cuda:0
config.json: 0%| | 0.00/967 [00:00<?, ?B/s]
```
```
`torch_dtype` is deprecated! Use `dtype` instead!
model.safetensors.index.json: 0.00B [00:00, ?B/s]
Fetching 2 files: 0%| | 0/2 [00:00<?, ?it/s]
model-00002-of-00002.safetensors: 0%| | 0.00/2.67G [00:00<?, ?B/s]
model-00001-of-00002.safetensors: 0%| | 0.00/4.97G [00:00<?, ?B/s]
Loading checkpoint shards: 0%| | 0/2 [00:00<?, ?it/s]
generation_config.json: 0%| | 0.00/181 [00:00<?, ?B/s]
```
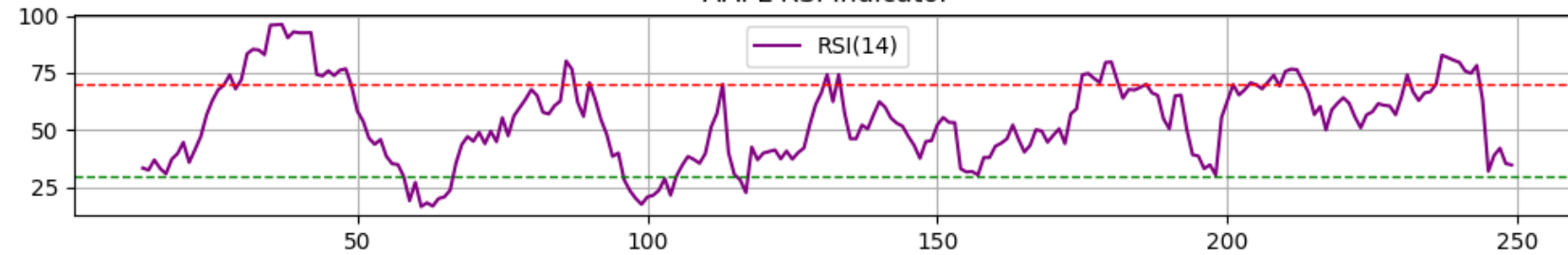
tokenizer_config.json: 0.00B [00:00, ?B/s]
tokenizer.model:   0%|          | 0.00/500k [00:00<?, ?B/s]
tokenizer.json: 0.00B [00:00, ?B/s]
added_tokens.json:   0%|          | 0.00/306 [00:00<?, ?B/s]
special_tokens_map.json:   0%|          | 0.00/599 [00:00<?, ?B/s]
Device set to use cuda:0

# 📊 AAPL Analysis Page
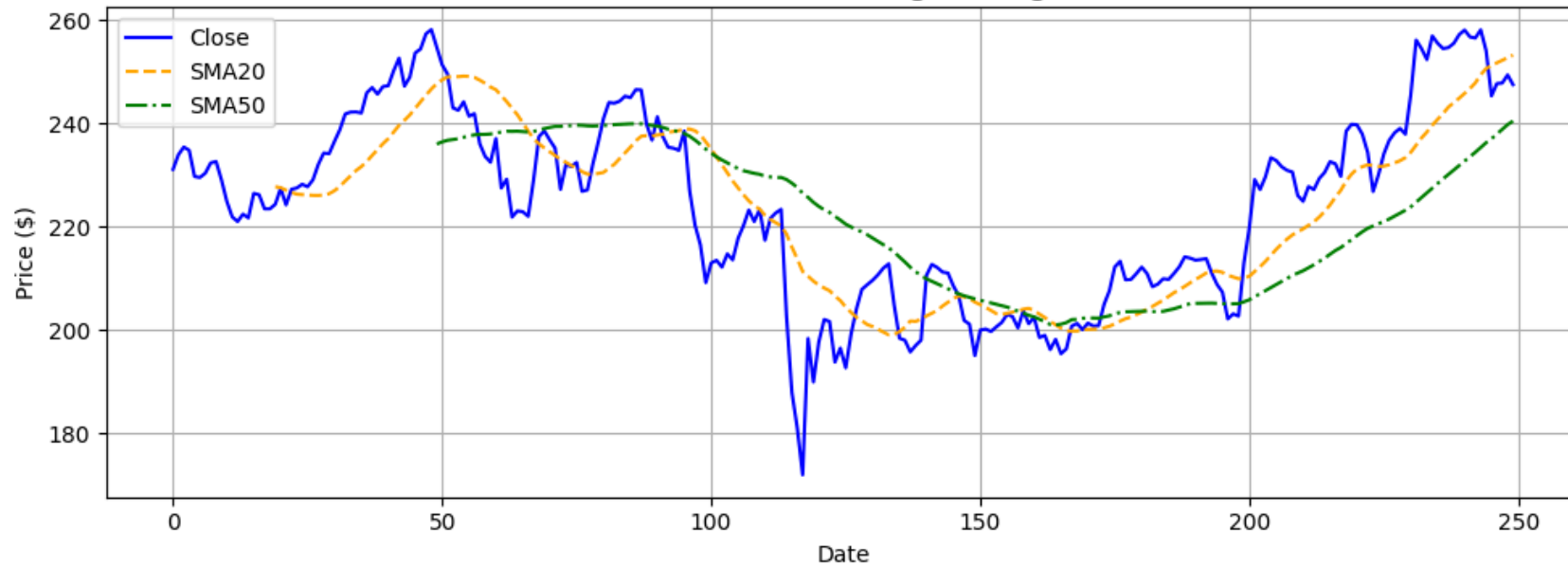
**Summary:** Write a concise 2-paragraph investment summary for AAPL. Integrate: Technicals: {'SMA20': 253.15349884033202, 'SMA50': 240.41501068115235, 'RSI': 34.881045778740884, 'Signal': 'Bullish'} Risk: {'Volatility': 0.02047670693007436, 'Drawdown': -0.3336051616882113, 'RiskScore': 12.88} Sentiment: {'positive': 60.0, 'neutral': 0.0, 'negative': 40.0} Portfolio: {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1} News: Anker Japan、DisplayLinkチップを採用し8Kと4K60Hz x2のトリプルディスプレイ出力が可能な「Anker Prime ドッキングステーション (14-in-1, Triple Display, DisplayLink)」を発売。; Stock market today: Dow, S&P 500, Nasdaq futures rise as TSMC's stellar earnings eclipse trade-war jitters; New M5 Chip Comes to iPad Pro, MacBook Pro 14″, & Apple Vision Pro; Apple CEO sends signal on crucial China moment; Wedbush Sees an AI M&A Boom Ahead: 3 Prime Takeover Targets End with a recommendation.

<|assistant|( Apple Inc. (AAPL) is showing strong technical indicators with a bullish signal from the Moving Average Convergence Divergence (MACD) and a significant upward trend in the Simple Moving Average (SMA) for the 20-day period at $253.15. The Relative Strength Index (RSI) at 34.88 suggests the stock is not overbought, providing a stable environment for investment. However, the risk metrics indicate a moderate level of volatility, with a drawdown of -33.36% and a risk score of 12.88.

The sentiment analysis shows a positive outlook for AAPL with 60% of the sentiment being positive, indicating investor confidence in the company. The portfolio distribution of 70% equity, 20% bonds, and 10% cash presents a balanced investment strategy with a focus on stocks. News about Anker Japan's new display technology and Apple's CEO addressing the situation in China have created positive sentiment. Considering the strong technicals, moderate risks, and positive sentiment, an investment in AAPL could be beneficial.
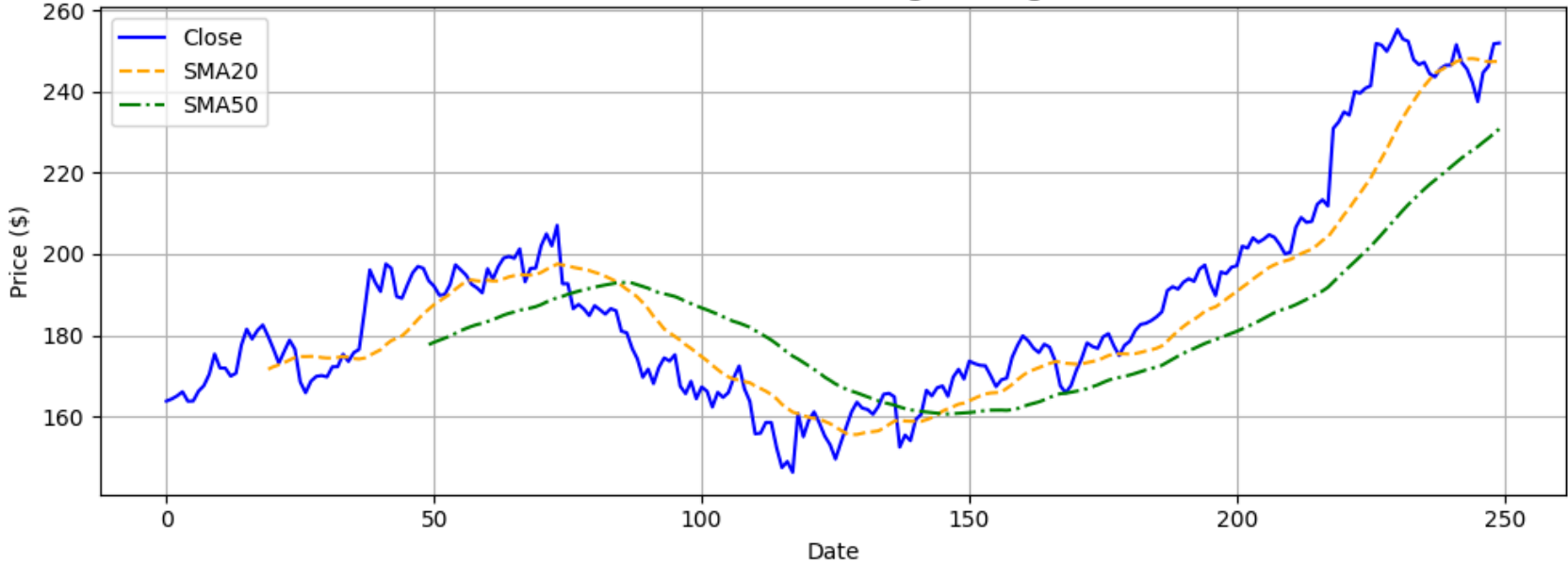
Recommendation: Buy AAPL.

Write a detailed

**Sentiment vs Price:** Aligned

**Suggested Allocation:** {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1}
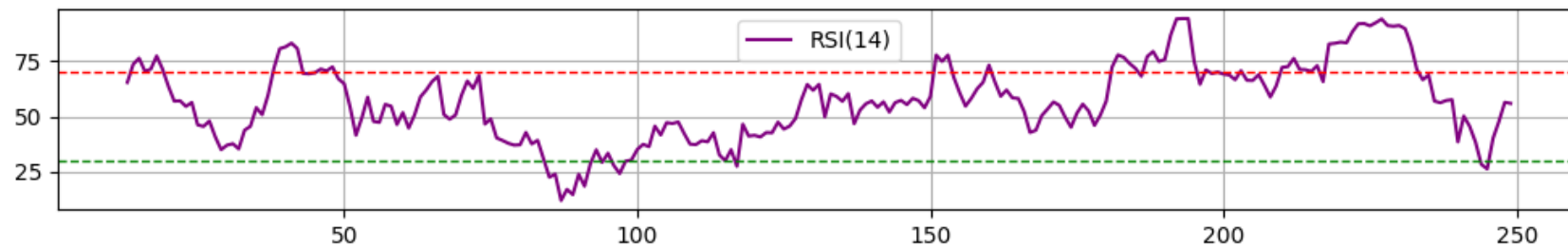
---

# 📊 GOOG Analysis Page



GOOG Price & Moving Averages

## GOOG RSI Indicator



**Summary:** Write a concise 2-paragraph investment summary for GOOG. Integrate: Technicals: {'SMA20': 247.32950134277343, 'SMA50': 230.7443356323242, 'RSI': 55.875019741073416, 'Signal': 'Bullish'} Risk: {'Volatility': 0.020183102024733293, 'Drawdown': -0.2935006055551588, 'RiskScore': 9.17} Sentiment: {'positive': 20.0, 'neutral': 0.0, 'negative': 80.0} Portfolio: {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1} News: Why Morgan Stanley (MS) Stock Is Trading Up Today; Why Nextracker (NXT) Stock Is Up Today; These Bitcoin, Ethereum and XRP ETFs Plan to Offer 5X Leverage; Silicon Valley is plowing money into AI, and the latest deals are eye-watering; Volatility Shares Files for 5x Leveraged Bitcoin, Ether, and XRP ETFs End with a recommendation.

GOOG Stock Investment Analysis

GOOG, the flagship stock of Alphabet Inc., shows promising technical indicators with a 20-day SMA (Simple Moving Average) of 247.32950134277343 and a 50-day SMA of 230.7443356323242, indicating a bullish trend. The RSI (Relative Strength Index) sits comfortably at 55.875019741073416, suggesting that the stock is neither overbought nor oversold. The Signal indicator is also bullish, further supporting the positive momentum.

However, it's important to consider the risk factors. With a volatility of 0.020183102024733293, investors should be prepared for potential price swings. The drawdown of -0.2935006055551588 indicates that the stock has experienced a significant decrease in value, while the risk score of 9.17 suggests a relatively high level of risk. The sentiment analysis shows a majority of negative sentiment (80%) compared to positive (20%), which may indicate some investor
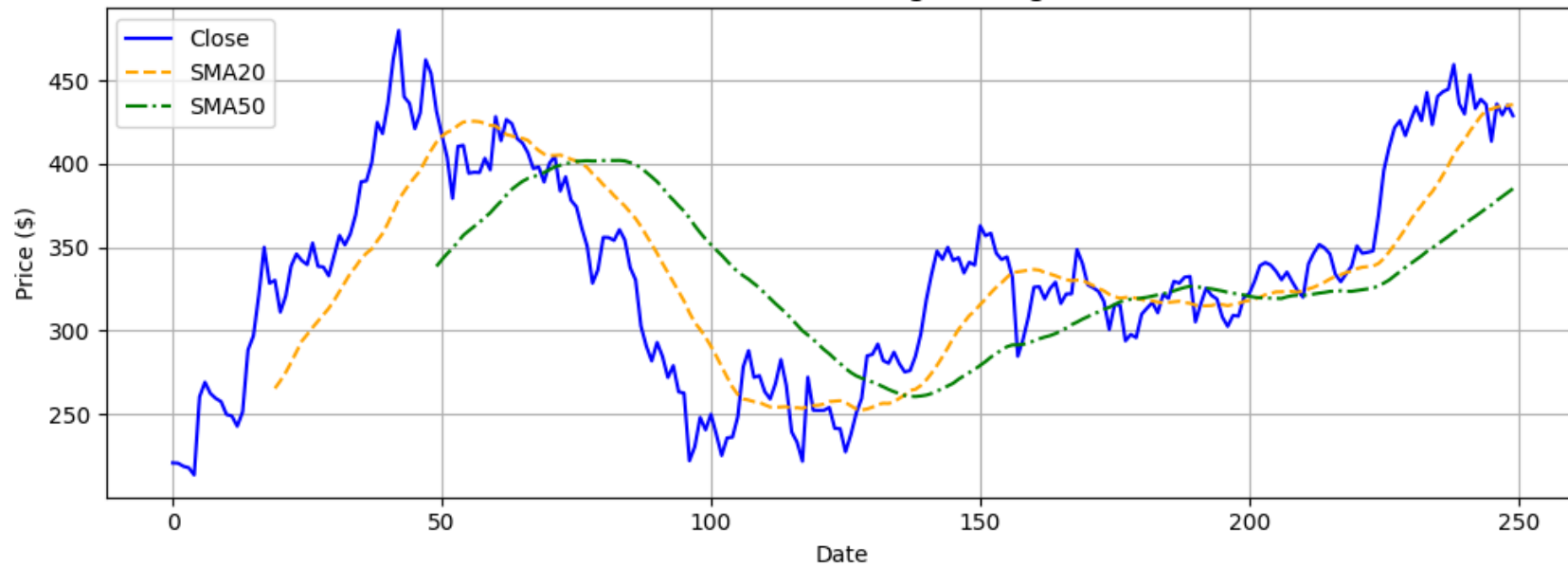
**Sentiment vs Price:** Divergent

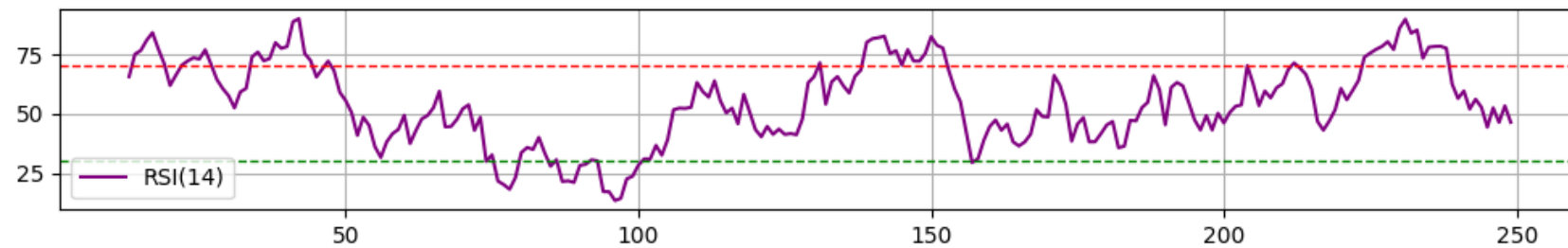**Suggested Allocation:** {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1}

---

# 📊 TSLA Analysis Page

## TSLA Price & Moving Averages



## TSLA RSI Indicator

**Summary:** Write a concise 2-paragraph investment summary for TSLA. Integrate: Technicals: {'SMA20': 435.4514984130859, 'SMA50': 385.11299865722657, 'RSI': 46.45789271213701, 'Signal': 'Bullish'} Risk: {'Volatility': 0.044818770848825885, 'Drawdown': -0.537656801185852, 'RiskScore': 8.95} Sentiment: {'positive': 0.0, 'neutral': 0.0, 'negative': 100.0} Portfolio: {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1} News: These Bitcoin, Ethereum and XRP ETFs Plan to Offer 5X Leverage; Melius Initiates Tesla (TSLA) With Buy and $520 Target, Calls It a "Must Own" AI Stock; Tesla's China Shipments Are on the Rise. Should You Buy TSLA Stock Here?; Melius Initiates Tesla (TSLA) With Buy and 520 Target, Calls It a "Must Own" AI Stock; Tesla's China Shipments Are on the Rise. Should You Buy TSLA Stock Here? End with a recommendation.

Solution: TSLA Technicals: The current situation for TSLA shows a bullish signal with the SMA20 and SMA50 at 435.45 and 385.11 respectively, indicating a strong upward trend. The RSI at 46.45 also suggests that the stock is not overbought and has room for continued growth.

Risk & Sentiment: The volatility of TSLA is relatively low at 0.044818770848825885, which indicates a stable price movement. The drawdown of -0.537656801185852 shows that there has been a significant drop in the stock's price, but the RiskScore of 8.95 suggests that it is still within a manageable range. The sentiment analysis shows a negative sentiment of 100.0%, which indicates that there may be some concerns among investors.

Portfolio & News: The portfolio allocation for TSLA is 70% equity, 20% bonds, and 10% cash, indicating a strong belief in the stock's growth potential. The recent news about Tesla's China shipments increase and the positive sentiment from Melius Initiates Tesla

**Sentiment vs Price:** Divergent

**Suggested Allocation:** {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1}
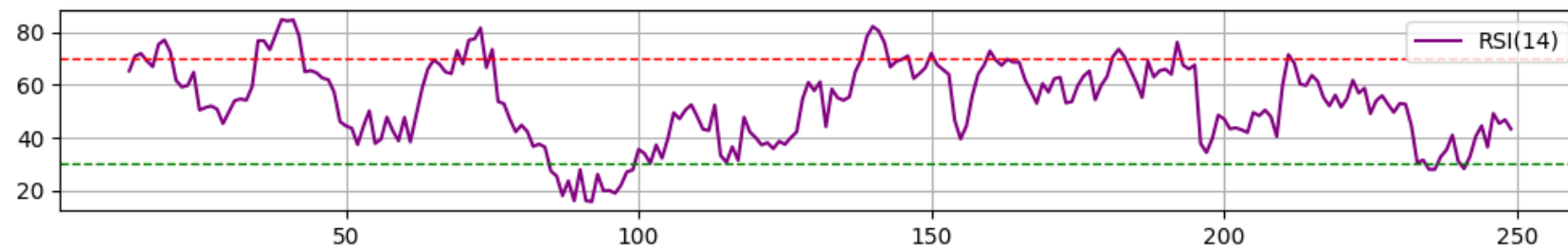
# 📊 AMZN Analysis Page



AMZN Price & Moving Averages
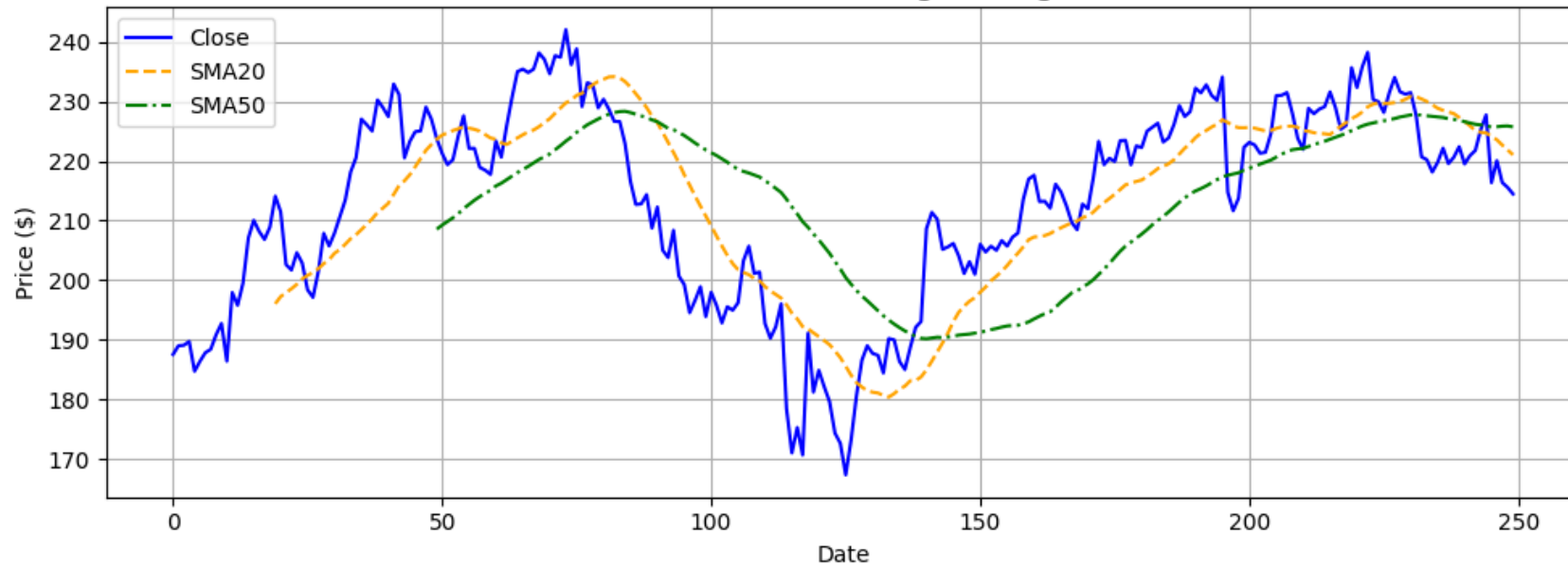


AMZN RSI Indicator

**Summary:** Write a concise 2-paragraph investment summary for AMZN. Integrate: Technicals: {'SMA20': 221.0380012512207, 'SMA50': 225.73140014648436, 'RSI': 43.300538966284385, 'Signal': 'Bearish'} Risk: {'Volatility': 0.02141208000878738, 'Drawdown': -0.3087663843187606, 'RiskScore': 9.46} Sentiment: {'positive': 40.0, 'neutral': 0.0, 'negative': 60.0} Portfolio: {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1} News: Celebrity Help My House Is Haunted S05E02 1080p AMZN WEB-DL H264-RAWR; Good Luck Guys Poland S01 1080p AMZN WEB-DL H264-playWEB; Good Luck Guys Poland S02 1080p AMZN WEB-DL H264-playWEB; Protect your generative AI applications against encoding-based attacks with Amazon Bedrock Guardrails; The Voice S28E08 1080p AMZN WEB-DL H264-Kitsune End with a recommendation.

AMZN Stock Investment Summary

Amazon (AMZN) is currently trading at an SMA20 of 221.04 and SMA50 of 225.73, indicating a moderate uptrend. However, the RSI of 43.30 suggests that the stock is nearing overbought territory, which could be a potential warning sign for investors. The bearish signal indicates that the stock might be due for a correction or a downtrend. The volatility of AMZN is relatively low at 0.0214, and the drawdown of -0.309 suggests that the stock has experienced a significant decline in the past. The risk score of 9.46 indicates that AMZN is a high-risk investment.

The sentiment towards AMZN is mostly negative, with 60% of the sentiment being negative. The portfolio allocation of 70% equity, 20% bonds, and 10% cash suggests that investors are willing to take on a higher level of risk in their investment strategy. Recent news such as "Celebrity Help My House Is Haunted S05E02," "Good Luck Guys Poland S01," "Good Luck Guys Poland S02," "Prote
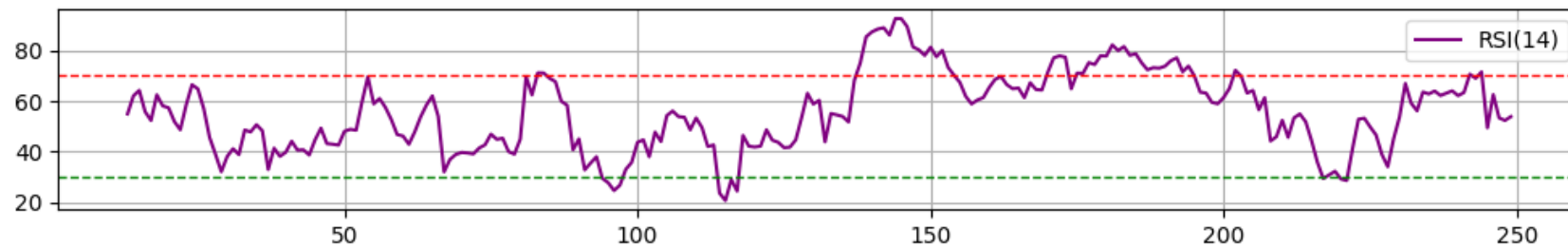
**Sentiment vs Price:** Divergent

**Suggested Allocation:** {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1}

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# 📊 NVDA Analysis Page
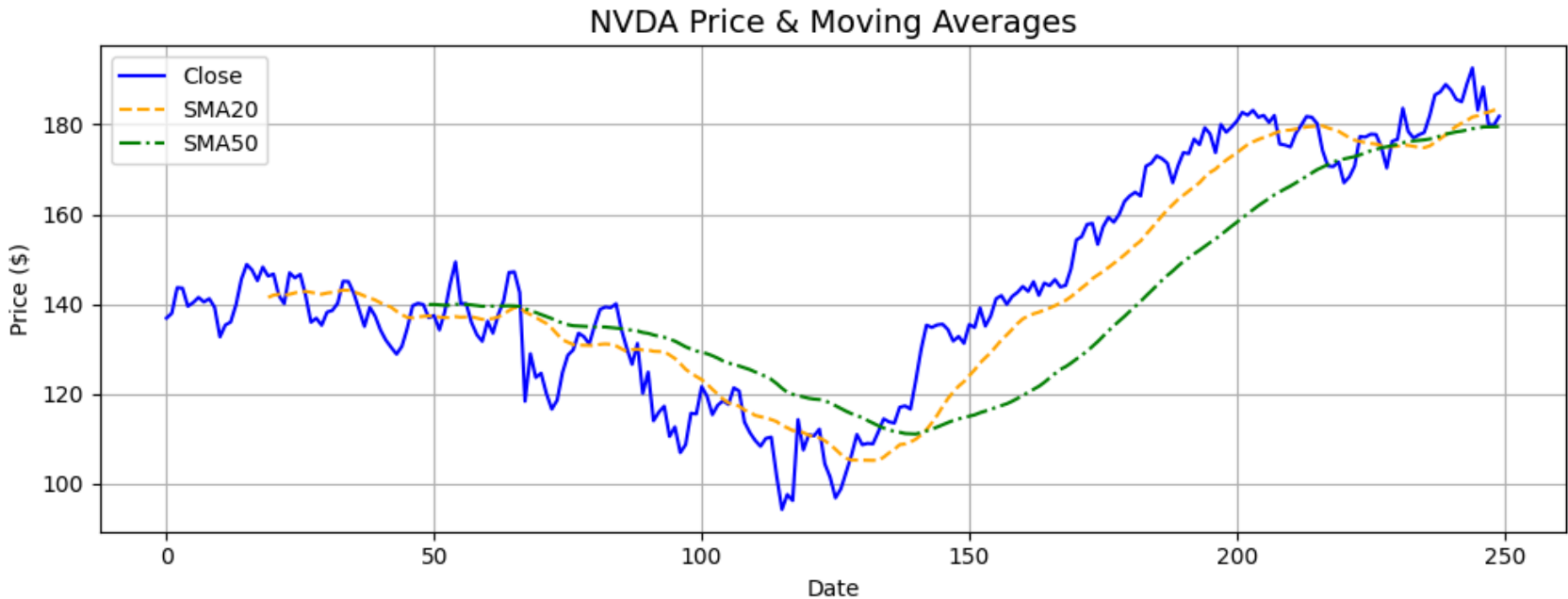
## NVDA RSI Indicator



**Summary:** Write a concise 2-paragraph investment summary for NVDA. Integrate: Technicals: {'SMA20': 183.45750045776367, 'SMA50': 179.51680389404297, 'RSI': 53.84124909570998, 'Signal': 'Bullish'} Risk: {'Volatility': 0.0312295215037712, 'Drawdown': -0.36881026699149855, 'RiskScore': 5.65} Sentiment: {'positive': 40.0, 'neutral': 0.0, 'negative': 60.0} Portfolio: {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1} News: Stock market today: Dow, S&P 500, Nasdaq futures rise as TSMC's stellar earnings eclipse trade-war jitters; Here's How Much $100 Invested In NVIDIA 15 Years Ago Would Be Worth Today; This Semiconductor Stock Soared 26% Tuesday After Launching Devices for Nvidia's AI Factory Architecture; Stock Market Today: Dow Gives Up Gains; Trade War Turns To Soybean Oil (Live Coverage); These Bitcoin, Ethereum and XRP ETFs Plan to Offer 5X Leverage End with a recommendation.

<|solution|>

NVIDIA (NVDA) is currently exhibiting a bullish signal with its moving averages (SMA20 and SMA50) both above the current price, which is a positive technical indicator. The Relative Strength Index (RSI) at 53.84 indicates the stock is neither overbought nor oversold, suggesting a balanced market sentiment. Despite a moderate volatility level of 0.0312295215037712 and a drawdown of -0.36881026699149855, the Risk Score of 5.65 shows a manageable risk profile for investors.

Given the current portfolio allocation of 70% equities, 20% bonds, and 10% cash, NVDA's strong performance in the semiconductor sector, particularly with TSMC's stellar earnings and the launch of AI-focused devices, underscores its potential for growth. The positive sentiment, which comprises 40% of the market outlook, further supports this. With this backdrop, investors may consider NVDA as a solid addition to their equity portfolio, especially given its resilience and potential in the A
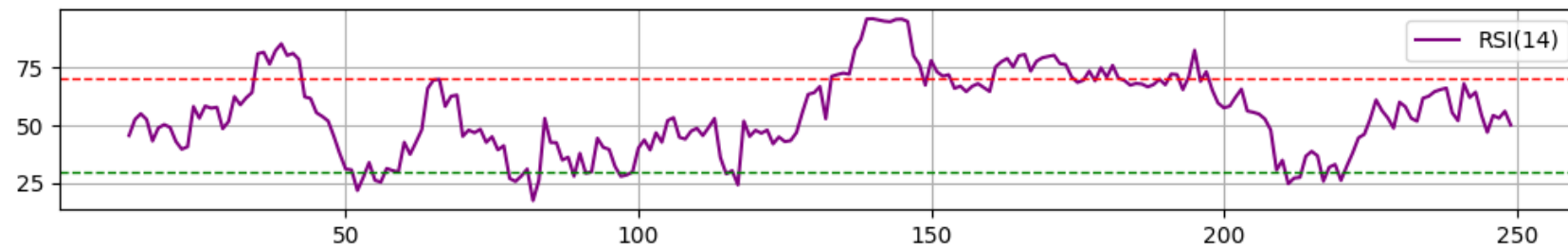
**Sentiment vs Price:** Divergent

**Suggested Allocation:** {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1}

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# 📊 MSFT Analysis Page

# MSFT Price & Moving Averages
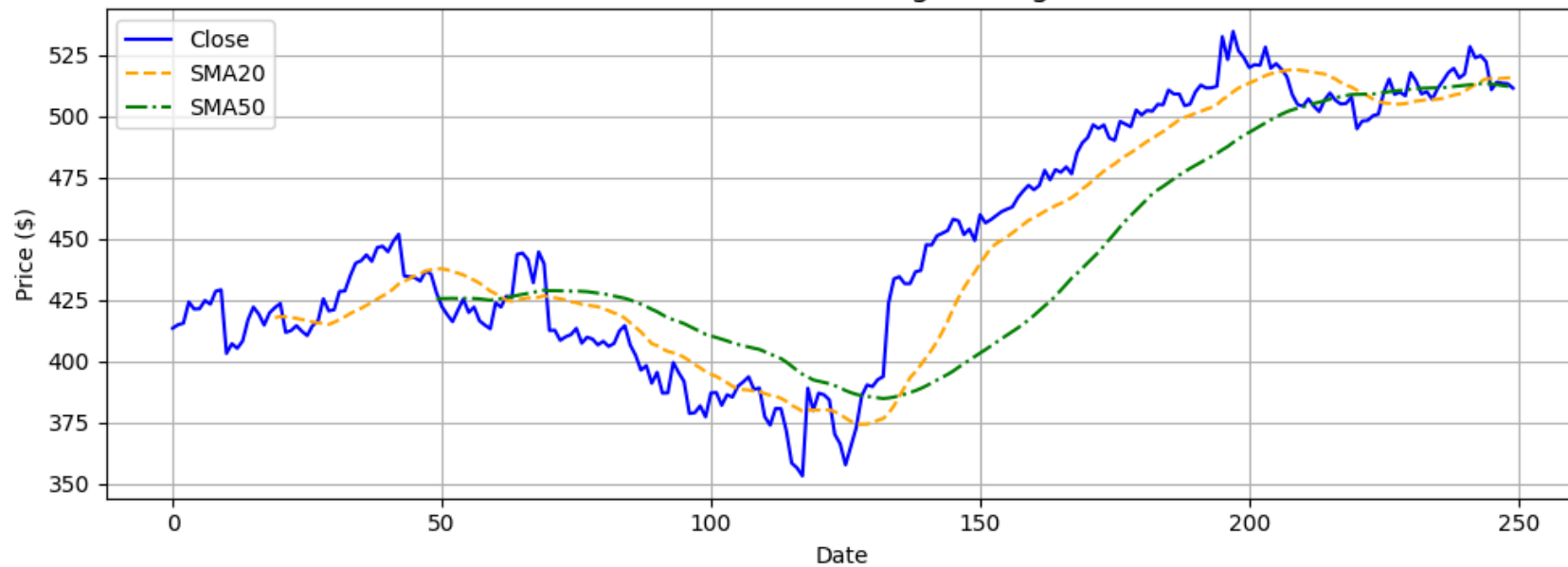


# MSFT RSI Indicator



**Summary:** Write a concise 2-paragraph investment summary for MSFT. Integrate: Technicals: {'SMA20': 515.9509963989258, 'SMA50': 512.1050518798828, 'RSI': 50.15020392895584, 'Signal': 'Bullish'} Risk: {'Volatility': 0.01562735381731496, 'Drawdown': -0.2182569584380235, 'RiskScore': 6.2} Sentiment: {'positive': 20.0, 'neutral': 0.0, 'negative': 80.0} Portfolio: {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1} News: Nvidia Stock Wavers After Latest Data Center Deal; Why Morgan Stanley (MS) Stock Is Trading Up Today; Why Nextracker (NXT) Stock Is Up Today; Nvidia, Microsoft, and BlackRock Just Struck a Massive AI Data Center Deal; Silicon Valley is plowing money into AI, and the latest deals are eye-watering End with a recommendation.

MSFT (Microsoft Corporation) currently exhibits a bullish signal, with SMA20 and SMA50 levels surpassing the RSI threshold, indicating a potential uptrend (Technicals). Despite the stock's recent drawdown and moderate volatility, the positive sentiment (Sentiment) reflects investor confidence, which aligns with the portfolio's equity-heavy composition (Portfolio).

Given the bullish technical indicators, positive sentiment, and the strategic allocation in Microsoft's stock, it is recommended to maintain or potentially increase the position in Microsoft. The company's pivotal role in the AI data center deal, as evidenced by the recent news, further supports this view and suggests a potential for continued growth in the coming months.

Recommendation: Maintain or increase position in MSFT.

**Sentiment vs Price:** Divergent

**Suggested Allocation:** {'Equity': 0.7, 'Bonds': 0.2, 'Cash': 0.1}

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## 🧭 Portfolio Summary Dashboard

### ✅ Composite Risk–Technical Overview

| Ticker | Volatility | Drawdown | RSI |
|---|---|---|---|
| AAPL | 0.020477 | -0.333605 | 34.881046 |
| GOOG | 0.020183 | -0.293501 | 55.875020 |
| TSLA | 0.044819 | -0.537657 | 46.457893 |
| AMZN | 0.021412 | -0.308766 | 43.300539 |
| NVDA | 0.031230 | -0.368810 | 53.841249 |
| MSFT | 0.015627 | -0.218257 | 50.150204 |

```
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📊 Combined Radar Chart – Key Technical & Risk Metrics
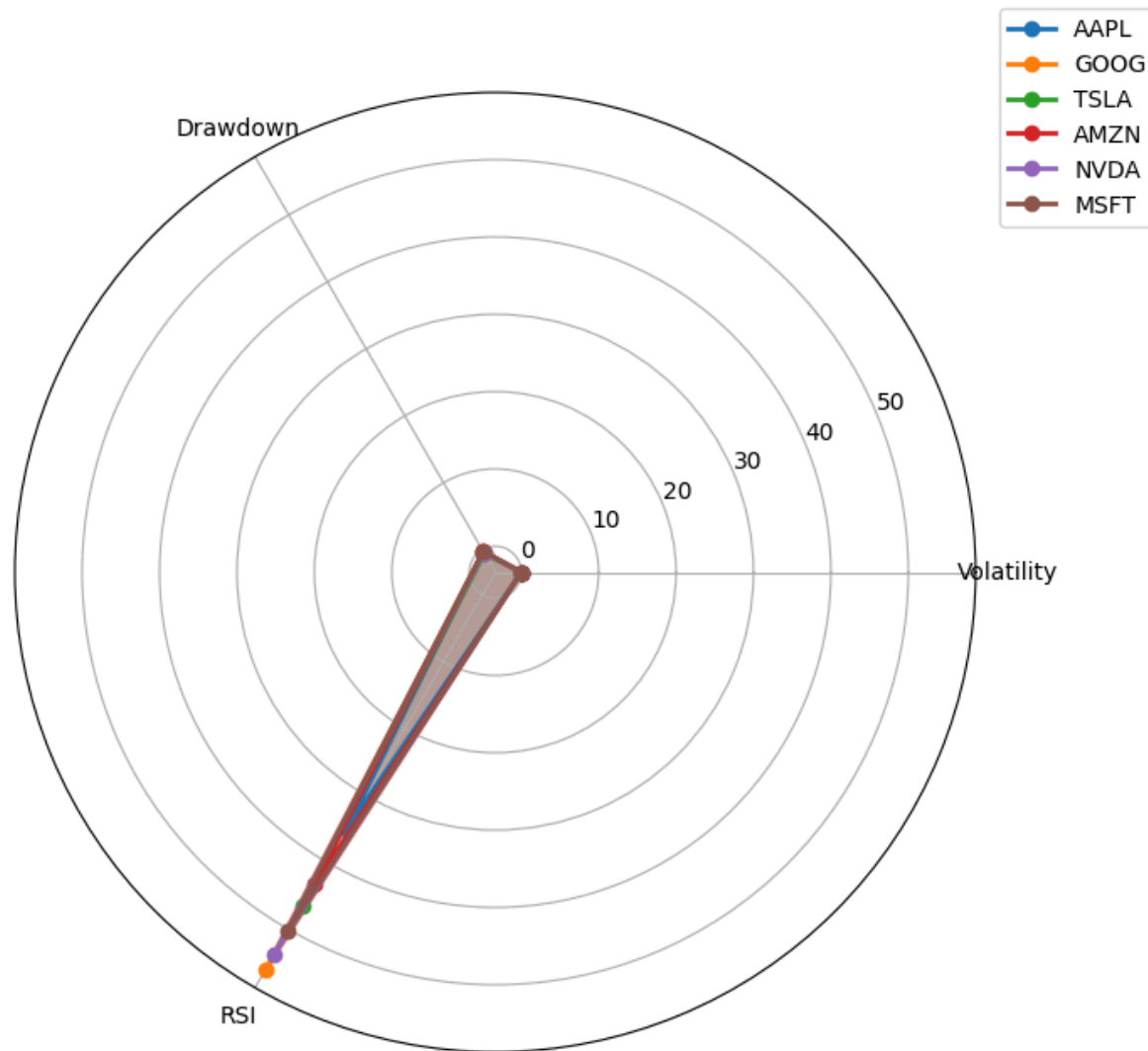
📘 Appendix – Consolidated Summary Table

Volatility	Drawdown	RSI
0.02	-0.334	34.881
0.02	-0.294	55.875
0.045	-0.538	46.458
0.021	-0.309	43.301
0.031	-0.369	53.841
0.016	-0.218	50.15

📚 References & Tools

- **Data:** Yahoo Finance (`yfinance`)
- **News:** NewsAPI.org
- **Models:** DistilBERT, Phi-3 Mini (Microsoft)
- **Libraries:** pandas, numpy, matplotlib, transformers, torch, nltk
- **Platform:** Google Colab (T4 GPU, FP16)

In [ ]:
```python
from google.colab import files
files.upload()

!jupyter nbconvert --to html --output "FinalProject_v13.html" "FinalProject_v13.ipynb"
!jupyter nbconvert --to pdf "FinalProject_v13.ipynb" --output "FinalProject_v13.pdf"
```

Choose Files   No file chosen   Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.