FinalCode

May 13, 2025

1 Mounting a drive

[1]:

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

[2]:

```
!pip install newsapi-python
```

```
Collecting newsapi-python
  Downloading newsapi_python-0.2.7-py2.py3-none-any.whl.metadata (1.2 kB)
Requirement already satisfied: requests<3.0.0 in /usr/local/lib/python3.11/dist-
packages (from newsapi-python) (2.32.3)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.11/dist-packages (from requests<3.0.0->newsapi-python)
(3.4.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-
packages (from requests<3.0.0->newsapi-python) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.11/dist-packages (from requests<3.0.0->newsapi-python)
(2.4.0)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.11/dist-packages (from requests<3.0.0->newsapi-python)
(2025.4.26)
Downloading newsapi_python-0.2.7-py2.py3-none-any.whl (7.9 kB)
Installing collected packages: newsapi-python
Successfully installed newsapi-python-0.2.7
```

2 Libraries

[3]:

```
import pandas as pd
import numpy as np
import datetime
import yfinance as yf
from newsapi import NewsApiClient
from transformers import pipeline
from collections import Counter
```

```
import matplotlib.pyplot as plt
```

3 loading a Fine-tuned FinBERT model

```
[4]: model_path = "/content/drive/MyDrive/my-finbert-finetuned"
     finbert = pipeline("sentiment-analysis", model=model_path)
```

```
Device set to use cuda:0
```

4 Fetching News Headlines using NewsAPI

```
[5]: newsapi = NewsApiClient(api_key='09458a27b33349439c94c2c7a302cfd0') #␣
       ↪'51802ca249bf426da64b9b1b1bdae59b' backup key

     def get_news_for_date(date='2025-05-05', query='stock market',␣
       ↪max_articles=100):
         articles = newsapi.get_everything(
             q=query,
             language='en',
             sort_by='publishedAt',
             from_param=date,
             to=date,
             page_size=100
         )['articles']

         news_df = pd.DataFrame([{
             'date': a['publishedAt'][:10],
             'headline': a['title']
         } for a in articles])

         return news_df.head(max_articles)

     news_df = get_news_for_date()
     print(news_df.head())
```

```
         date                                           headline
0  2025-05-05  Rupee strengthens at 84.25 amid falling oil pr…
1  2025-05-05  Companies Like Compugates Holdings Berhad (KLS…
2  2025-05-05  Can CE Technology Berhad's (KLSE:CETECH) Decen…
3  2025-05-05  Barbie Toymaker Mattel Warns Tariffs May Force…
4  2025-05-05       Asia markets live: Stocks set to trade mixed
```

5 Ticker Dictionary

[6]:

```
ticker_dict = {
    "Apple": "AAPL", "Microsoft": "MSFT", "Amazon": "AMZN",
    "Tesla": "TSLA", "Meta": "META", "Nvidia": "NVDA",
    "Google": "GOOGL", "Alphabet": "GOOGL", "Netflix": "NFLX", "Advanced Micro␣
 ↪Devices Inc": "AMD", "S&P 500": "SPY"
}
```

- In this dictionary as much as ticker can be added for further process and identify more tickers in the News headlines

6 Ticker Extraction and Sentiment analysing

[7]:

```
def extract_ticker(headline, ticker_dict):
    for company, ticker in ticker_dict.items():
        if company.lower() in headline.lower() or ticker.lower() in headline.
 ↪lower():
            return ticker, company
    return "SPY", "S&P 500"
```

[8]:

```
def analyze_sentiment(text):
    result = finbert(text)[0]
    return result["label"].lower(), result["score"]
```

7 RSI Indicator

[9]:

```
def calculate_rsi(data, period=14):
    delta = data['Close'].diff()
    gain = delta.clip(lower=0)
    loss = -delta.clip(upper=0)
    avg_gain = gain.rolling(period).mean()
    avg_loss = loss.rolling(period).mean()
    rs = avg_gain / avg_loss
    rsi = 100 - (100 / (1 + rs))
    return rsi.iloc[-1] if not rsi.empty else np.nan

def rsi_signal(rsi_value):
    if isinstance(rsi_value, pd.Series):
        rsi_value = rsi_value.iloc[0]

    if np.isnan(rsi_value):
        return 0
    if rsi_value < 30:
        return 1
    elif rsi_value > 70:
        return -1
    else:
        return 0
```

8 MACD Indicator

[10]:

```
def calculate_macd(data):
    ema12 = data['Close'].ewm(span=12).mean()
    ema26 = data['Close'].ewm(span=26).mean()
    macd_line = ema12 - ema26
    signal_line = macd_line.ewm(span=9).mean()

    macd = macd_line.iloc[-1] if not macd_line.empty else np.nan
    signal = signal_line.iloc[-1] if not signal_line.empty else np.nan

    if isinstance(macd, pd.Series):
        macd = macd.iloc[0]
    if isinstance(signal, pd.Series):
        signal = signal.iloc[0]

    return macd, signal

def macd_signal(macd_value, signal_value):
    if isinstance(macd_value, pd.Series):
        macd_value = macd_value.iloc[0]
    if isinstance(signal_value, pd.Series):
        signal_value = signal_value.iloc[0]

    if np.isnan(macd_value) or np.isnan(signal_value):
        return 0

    if macd_value > signal_value:
        return 1
    elif macd_value < signal_value:
        return -1
    else:
        return 0
```

9 Mapping

[11]:

```
decision_map = {"buy": 1, "hold": 0, "sell": -1}
sentiment_map = {"positive": 1, "neutral": 0, "negative": -1}
```

10 Main Block for Calling function and final dataframe building

[12]:

```
rows = []

for _, row in news_df.iterrows():
    date = row["date"]
    headline = row["headline"]

    # Extraction of company and its ticker
    ticker, company = extract_ticker(headline, ticker_dict)

    # sentiment and its score
    sentiment, sent_score = analyze_sentiment(headline)
    sentiment_action = sentiment_map.get(sentiment, 0)

    news_date = pd.to_datetime(date)
    start_date = (news_date - pd.Timedelta(days=60)).strftime('%Y-%m-%d')
    end_date = (news_date + pd.Timedelta(days=1)).strftime('%Y-%m-%d')

    price_data = yf.download(ticker, start=start_date, end=end_date,␣
 ↪progress=False)
    price_data.index = pd.to_datetime(price_data.index)

    # Ensuring we have OHLC data and news day are same
    if news_date not in price_data.index:
        print(f"No OHLC data found for {ticker} on {date}")
    else:
        same_day_ohlc = price_data.loc[news_date]

    if price_data.empty:
        continue

    # indicators call
    rsi_val = calculate_rsi(price_data)
    macd_val, macd_sig = calculate_macd(price_data)

    rsi_action = rsi_signal(rsi_val)
    macd_action = macd_signal(macd_val, macd_sig)

    # decision making by taking average of all scores
    final_score = np.mean([sentiment_action, rsi_action, macd_action])

    if final_score > 0.33:
        final_dec = "BUY"
    elif final_score < -0.33:
        final_dec = "SELL"
    else:
        final_dec = "HOLD"

    signal_components = {
        "Sentiment": sentiment_action,
        "RSI": rsi_action,
        "MACD": macd_action
    }

    # Find the strongest contributor (abs value)
    max_component = max(signal_components, key=lambda k:␣
 ↪abs(signal_components[k]))
    direction = "BUY" if signal_components[max_component] == 1 else "SELL" if␣
 ↪signal_components[max_component] == -1 else "HOLD"
    reason = f"{max_component} strongly suggested {direction}"

    rows.append({
        "date": date,
        "company": company,
        "ticker": ticker,
        "headline": headline,
        "sentiment": sentiment,
        "sentiment_score": round(sent_score, 4),
        "RSI": round(rsi_val, 2),
        "RSI_signal": rsi_action,
        "MACD": round(macd_val, 4),
        "MACD_signal": round(macd_sig, 4),
        "MACD_decision": macd_action,
        "final_score": round(final_score, 2),
        "final_decision": final_dec,
        "reason": reason
    })

# Final output DataFrame
final_df = pd.DataFrame(rows)
final_df.head()
```

```
YF.download() has changed argument auto_adjust default to True
```

```
You seem to be using the pipelines sequentially on GPU. In order to maximize
efficiency please use a dataset
```

[12]:

```
         date  company ticker  \
0  2025-05-05  S&P 500    SPY
1  2025-05-05  S&P 500    SPY
2  2025-05-05  S&P 500    SPY
3  2025-05-05  S&P 500    SPY
4  2025-05-05  S&P 500    SPY
```

```
                                            headline sentiment  \
0  Rupee strengthens at 84.25 amid falling oil pr…  positive
1  Companies Like Compugates Holdings Berhad (KLS…  positive
2  Can CE Technology Berhad's (KLSE:CETECH) Decen…  positive
3  Barbie Toymaker Mattel Warns Tariffs May Force…  negative
4       Asia markets live: Stocks set to trade mixed  negative

   sentiment_score                                                RSI  \
0           0.8046  Ticker
SPY    64.72
Name: 2025-05-05 00:00:00,…
1           0.9996  Ticker
SPY    64.72
Name: 2025-05-05 00:00:00,…
2           0.9577  Ticker
SPY    64.72
Name: 2025-05-05 00:00:00,…
3           0.9516  Ticker
SPY    64.72
Name: 2025-05-05 00:00:00,…
4           0.4354  Ticker
SPY    64.72
Name: 2025-05-05 00:00:00,…

   RSI_signal    MACD  MACD_signal  MACD_decision  final_score final_decision  \
0           0  4.2768       0.0634              1         0.67            BUY
1           0  4.2768       0.0634              1         0.67            BUY
2           0  4.2768       0.0634              1         0.67            BUY
3           0  4.2768       0.0634              1         0.00           HOLD
4           0  4.2768       0.0634              1         0.00           HOLD

                              reason
0   Sentiment strongly suggested BUY
1   Sentiment strongly suggested BUY
2   Sentiment strongly suggested BUY
3  Sentiment strongly suggested SELL
4  Sentiment strongly suggested SELL
```

11 Analysis of Ticker vise News

[13]:

```python
ticker = "AMZN"
filtered_rows = final_df[final_df["ticker"] == ticker]
print(filtered_rows)
```

```
Empty DataFrame
```

```
Columns: [date, company, ticker, headline, sentiment, sentiment_score, RSI,
RSI_signal, MACD, MACD_signal, MACD_decision, final_score, final_decision,
reason]
Index: []
```

12 Counting number of News per ticker

[14]:

```python
final_df["ticker"].value_counts()
```

[14]:

```
ticker
SPY     93
NVDA     1
AAPL     1
TSLA     1
NFLX     1
Name: count, dtype: int64
```

13 Combining multiple news of same ticker and averaging into single decision

[15]:

```python
def aggregate_ticker_signals(final_df):
    aggregated_rows = []

    grouped = final_df.groupby(['ticker', 'date'])

    for (ticker, date), group in grouped:
        decisions = group['final_decision'].values
        sentiment_scores = group['sentiment_score'].values
        decision_counts = Counter(decisions)
        if len(decision_counts) == 1:
            final_decision = list(decision_counts.keys())[0]
        else:
            avg_score = np.mean(sentiment_scores)
            if avg_score > 0.33:
                final_decision = 'BUY'
            elif avg_score < -0.33:
                final_decision = 'SELL'
            else:
                final_decision = 'HOLD'

        aggregated_rows.append({
            'ticker': ticker,
            'date': date,
            'final_decision': final_decision,
        })
    aggregated_df = pd.DataFrame(aggregated_rows)
    return aggregated_df

aggregated_df = aggregate_ticker_signals(final_df)

print("Aggregated Results:")
print(aggregated_df)
```

```
Aggregated Results:
  ticker       date final_decision
0   AAPL 2025-05-05            BUY
1   NFLX 2025-05-05           HOLD
2   NVDA 2025-05-05            BUY
3    SPY 2025-05-05            BUY
4   TSLA 2025-05-05           HOLD
```

14 Plotting Stock Price Chart with Aggregated BUY/SELL/HOLD Signals

[16]:

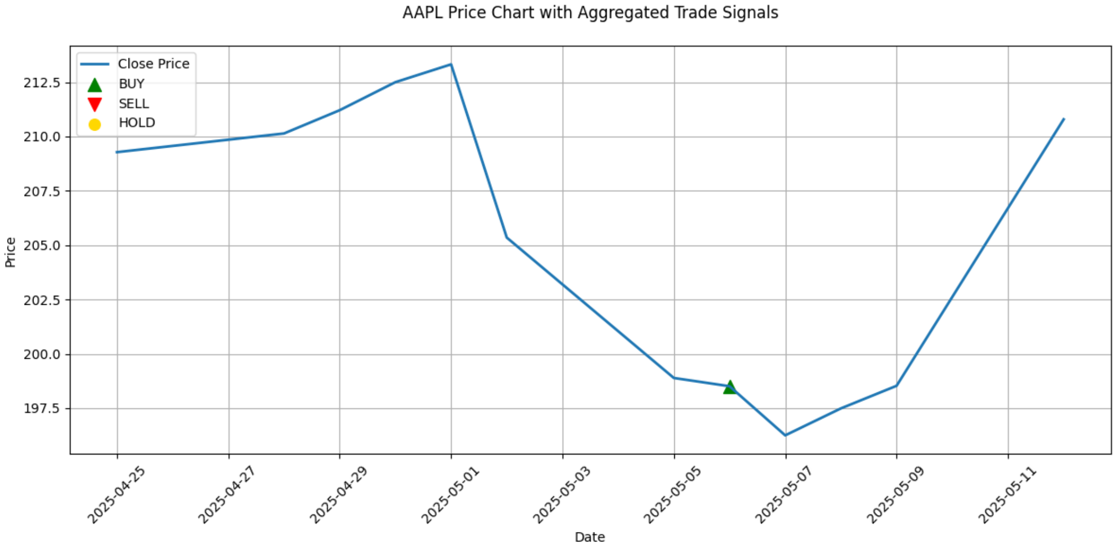
```
# checking next available trading day if it is a weekend or not
def get_next_trading_day(date):
    date = pd.to_datetime(date)
    if date.weekday() == 5:
        date = date + pd.Timedelta(days=2)
    elif date.weekday() == 6:
        date = date + pd.Timedelta(days=1)
    return date

def plot_signals(aggregated_df, ticker):
    aggregated_df["date"] = pd.to_datetime(aggregated_df["date"])
    ticker_decisions = aggregated_df[aggregated_df["ticker"] == ticker].copy()
    if ticker_decisions.empty:
        print(f"No aggregated decisions found for {ticker}")
        return

    ticker_decisions["action_date"] = ticker_decisions["date"] + pd.
 ↪Timedelta(days=1)

    ticker_decisions["adjusted_action_date"] = ticker_decisions["action_date"].
 ↪apply(get_next_trading_day)

    first_news_date = ticker_decisions["date"].min()

    # plot range: 10 days before trading date to 10 days after
    plot_start = (first_news_date - pd.Timedelta(days=10)).strftime('%Y-%m-%d')
    plot_end = (first_news_date + pd.Timedelta(days=10)).strftime('%Y-%m-%d')

    price_data = yf.download(ticker, start=plot_start, end=plot_end, progress=False)
    if price_data.empty:
        print(f"No price data available for {ticker}.")
        return

    price_data.index = pd.to_datetime(price_data.index)

    ticker_decisions = ticker_decisions[ticker_decisions["adjusted_action_date"].isin(price_data.index)]

    buy_dates = ticker_decisions[ticker_decisions["final_decision"] == "BUY"]["adjusted_action_date"]
    sell_dates = ticker_decisions[ticker_decisions["final_decision"] == "SELL"]["adjusted_action_date"]
    hold_dates = ticker_decisions[ticker_decisions["final_decision"] == "HOLD"]["adjusted_action_date"]

    plt.figure(figsize=(12, 6))
    plt.plot(price_data.index, price_data["Close"], label="Close Price", linewidth=2)

    # BUY signal - green
    plt.scatter(buy_dates, price_data.loc[buy_dates]["Close"], color="green", marker="^", s=100, label="BUY")

    # SELL signal - red
    plt.scatter(sell_dates, price_data.loc[sell_dates]["Close"], color="red", marker="v", s=100, label="SELL")

    # HOLD - yellow dot
    plt.scatter(hold_dates, price_data.loc[hold_dates]["Close"], color="gold", marker="o", s=70, label="HOLD")

    plt.title(f"{ticker} Price Chart with Aggregated Trade Signals\n")
    plt.xlabel("Date")
    plt.ylabel("Price")
    plt.xticks(rotation=45)
    plt.grid(True)
    plt.legend()
    plt.tight_layout()
    plt.show()
```

- Graph of each Ticker in Aggreated Dataframe and mapping decision to next day help investor to visulize direction of market on trading day

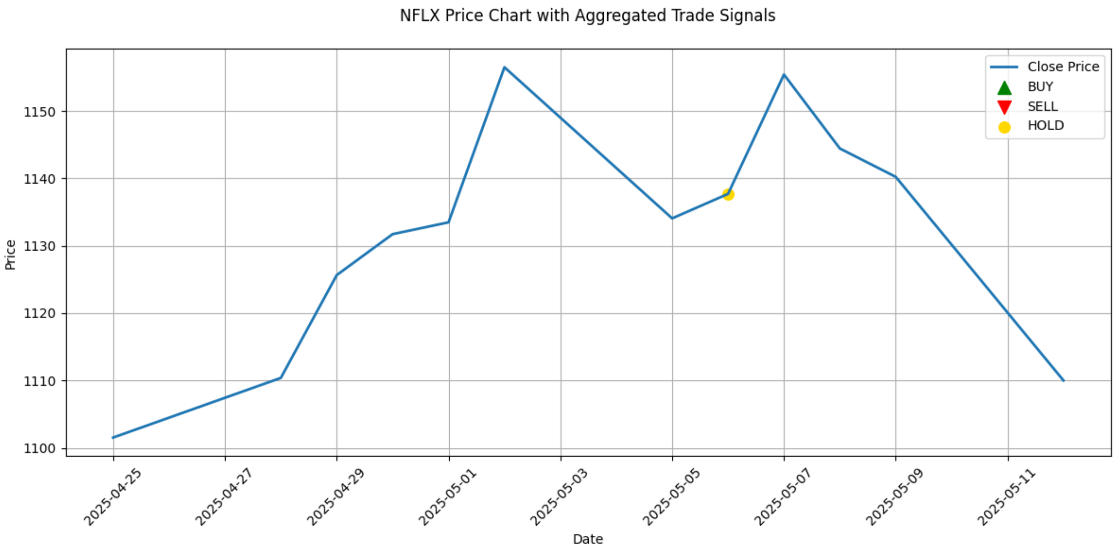
[17]:

```
def plot_all_tickers(aggregated_df):
    tickers = aggregated_df["ticker"].unique()

    for ticker in tickers:
        print(f"Plotting signal for {ticker}...")
        plot_signals(aggregated_df, ticker)

plot_all_tickers(aggregated_df)
```

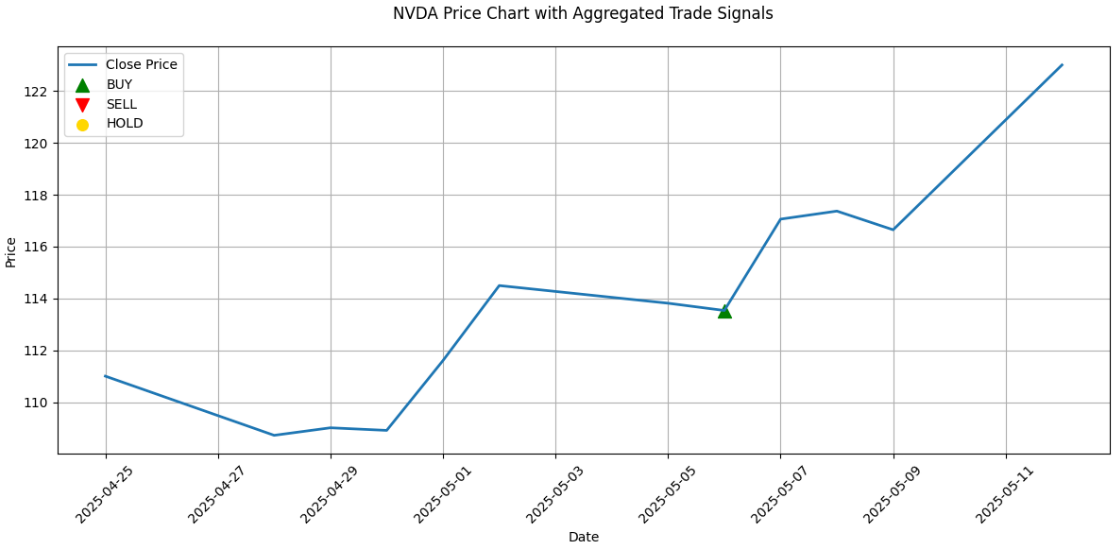
```
Plotting signal for AAPL…
```



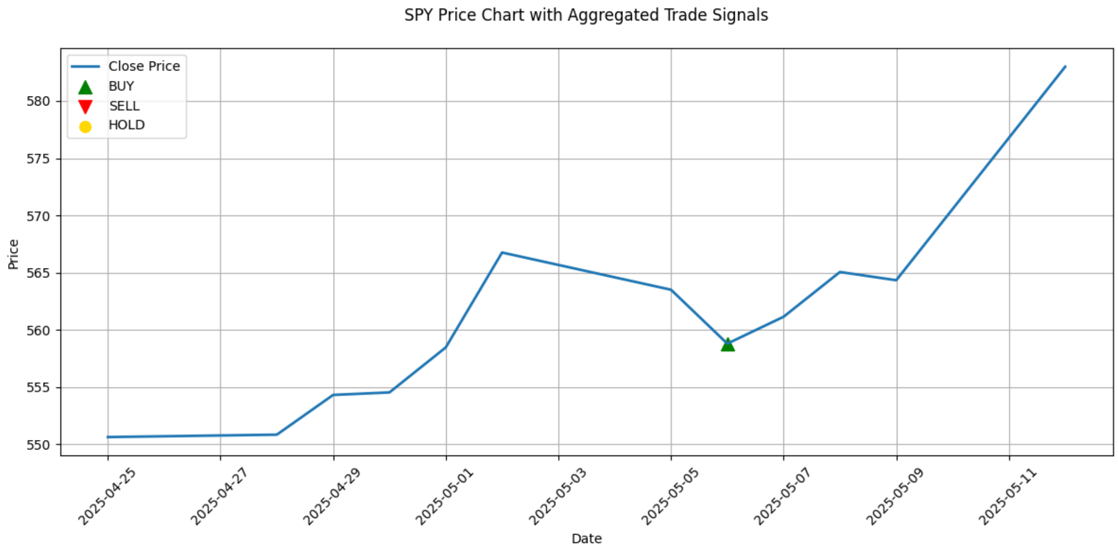
```
Plotting signal for NFLX…
```



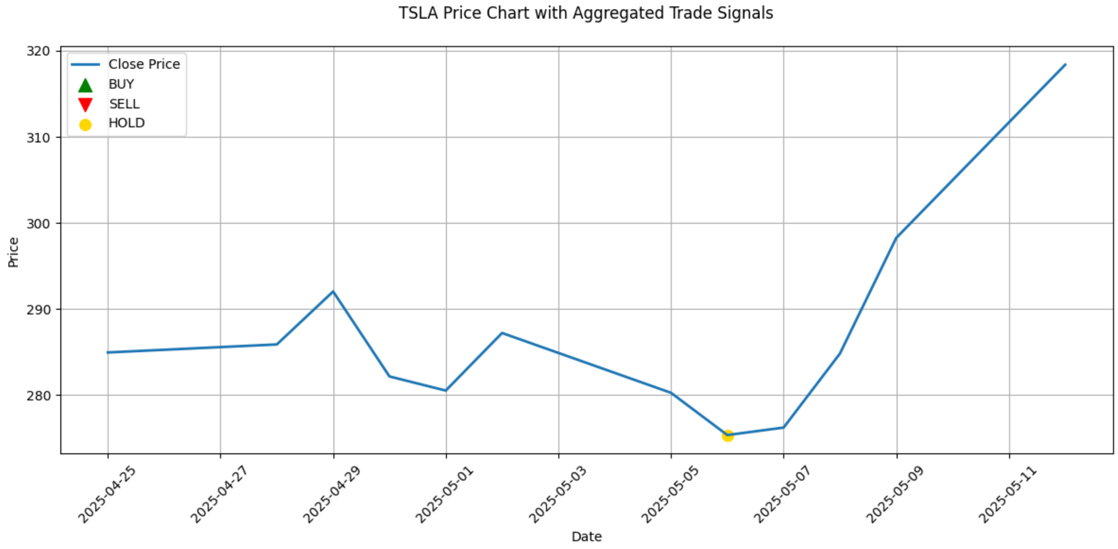
```
Plotting signal for NVDA…
```



```
Plotting signal for SPY…
```



```
Plotting signal for TSLA…
```



15 Backtesting

[18]:

```python
import datetime
import yfinance as yf
import pandas as pd

# Virtual Portfolio
```

```
initial_capital = 100000.0
portfolio_value = initial_capital
cash_balance = initial_capital
stock_holdings = 0
buy_date = None
buy_price = None
buy_ticker = None

trade_log = []

def is_weekend(date):
    return date.weekday() >= 5

def get_next_valid_date(date):
    while is_weekend(date):
        date += datetime.timedelta(days=1)
    return date.strftime("%Y-%m-%d")

def get_stock_data(ticker, target_date, search_range=5):
    target = pd.to_datetime(target_date)

    for offset in range(-search_range, search_range + 1):
        check_date = target + pd.Timedelta(days=offset)
        if is_weekend(check_date):
            continue

        start_date = check_date.strftime("%Y-%m-%d")
        end_date = (check_date + pd.Timedelta(days=1)).strftime("%Y-%m-%d")

        try:
            price_data = yf.download(ticker, start=start_date, end=end_date,␣
 ↪progress=False, interval="1d")
            if not price_data.empty:
                open_price = price_data['Open'].iloc[0]
                close_price = price_data['Close'].iloc[0]
                return open_price, close_price
        except Exception as e:
            print(f"Error fetching data for {ticker} on {check_date.date()}:␣
 ↪{e}")

    print(f"No price data found for {ticker} within ±{search_range} days of␣
 ↪{target_date}")
    return None, None



# backtesting loop
```

```
for i, row in aggregated_df.iterrows():
    trade_date = row['date']
    ticker = row['ticker']
    action = row['final_decision']

    if isinstance(trade_date, pd.Timestamp):
        trade_date = trade_date.strftime("%Y-%m-%d")

    next_date = datetime.datetime.strptime(trade_date, "%Y-%m-%d") + datetime.
 ↪timedelta(days=1)
    next_valid_date = get_next_valid_date(next_date)

    open_price, close_price = get_stock_data(ticker, next_valid_date,␣
 ↪search_range=5)

    if open_price is None or close_price is None:
        continue

    daily_profit = 0.0
    if action == "HOLD":
        pass
    elif action == "BUY" and stock_holdings == 0:
        buy_date = next_valid_date
        buy_price = open_price
        buy_ticker = ticker
        shares = cash_balance / buy_price
        if isinstance(shares, pd.Series):
            shares = shares.iloc[0]
        shares = float(shares)

        stock_holdings = shares

        stock_holdings = shares
        cash_balance -= shares * buy_price
    elif action == "SELL" and float(stock_holdings) > 0 and buy_date is not␣
 ↪None:
        hold_days = (datetime.datetime.strptime(next_valid_date, "%Y-%m-%d") -
                     datetime.datetime.strptime(buy_date, "%Y-%m-%d")).days
        if hold_days >= 2:
            value_from_sale = stock_holdings * close_price
            cash_balance += value_from_sale
            daily_profit = value_from_sale - (stock_holdings * buy_price)
            portfolio_value = cash_balance

            trade_log.append({
                "date": next_valid_date,
                "ticker": ticker,
                "action": "SELL",
                "open": round(open_price, 2),
                "close": round(close_price, 2),
                "daily_profit": round(daily_profit, 2),
                "portfolio_value": round(portfolio_value, 2),
                "cash_balance": round(cash_balance, 2),
                "stock_holdings": 0
            })

            stock_holdings = 0
            buy_date = buy_price = buy_ticker = None

if isinstance(stock_holdings, pd.Series):
    stock_holdings = stock_holdings.iloc[0]
stock_holdings = float(stock_holdings)

if stock_holdings > 0 and buy_date is not None:
  if isinstance(cash_balance, pd.Series):
      cash_balance = cash_balance.iloc[0]
  if isinstance(close_price, pd.Series):
      close_price = close_price.iloc[0]
  if isinstance(stock_holdings, pd.Series):
      stock_holdings = stock_holdings.iloc[0]

portfolio_value = float(cash_balance) + float(stock_holdings) *␣
 ↪float(close_price)


trade_log.append({
    "date": next_valid_date,
    "ticker": buy_ticker,
    "action": "HOLD",
    "open": round(open_price, 2),
    "close": round(close_price, 2),
    "daily_profit": round(daily_profit, 2),
    "portfolio_value": round(portfolio_value, 2),
    "cash_balance": round(cash_balance, 2),
    "stock_holdings": round(stock_holdings, 2)
})

trade_log_df = pd.DataFrame(trade_log)
trade_log_df.head()
```

[18]:

```
         date ticker action  \
0  2025-05-06   AAPL   HOLD

                                                open   close  daily_profit  \
0  Ticker
TSLA    280.01
Name: 2025-05-01 00:00:0…  280.52          0.0

   portfolio_value  cash_balance  stock_holdings
0        134168.73           0.0          478.29
```

16 Summary

[19]:

```python
# profit/loss
profit = portfolio_value - initial_capital
profit_percent = (profit / initial_capital) * 100

# summary
print("Backtest Summary")
print(f" Starting Capital:${initial_capital:,.2f}")
print(f" Final Portfolio Value:${portfolio_value:,.2f}")
print(f" Profit/Loss:${profit:,.2f} ({profit_percent:+.2f}%)")
print(f" Final Cash Balance:${cash_balance:,.2f}")
print(f" Final Stock Holdings:{stock_holdings:.2f} shares")
print(f" Total Trades Executed:{len(trade_log_df)}")
print(f" Last Trade Date:{trade_log_df['date'].iloc[-1] if not trade_log_df.
  ↪empty else 'N/A'}")
print(f" Last Action Taken:{trade_log_df['action'].iloc[-1] if not trade_log_df.
  ↪empty else 'N/A'}")
```

```
Backtest Summary
 Starting Capital:$100,000.00
 Final Portfolio Value:$134,168.73
 Profit/Loss:$34,168.73 (+34.17%)
 Final Cash Balance:$0.00
 Final Stock Holdings:478.29 shares
 Total Trades Executed:1
 Last Trade Date:2025-05-06
 Last Action Taken:HOLD
```