Implementing a Trading Algorithm

Moving Average Crossover Strategy

```
#import modules
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import yfinance as yf

%precision 4
pd.options.display.float_format = '{:.4f}'.format
%config InlineBackend.figure_format = 'retina'
```

Preparing Data

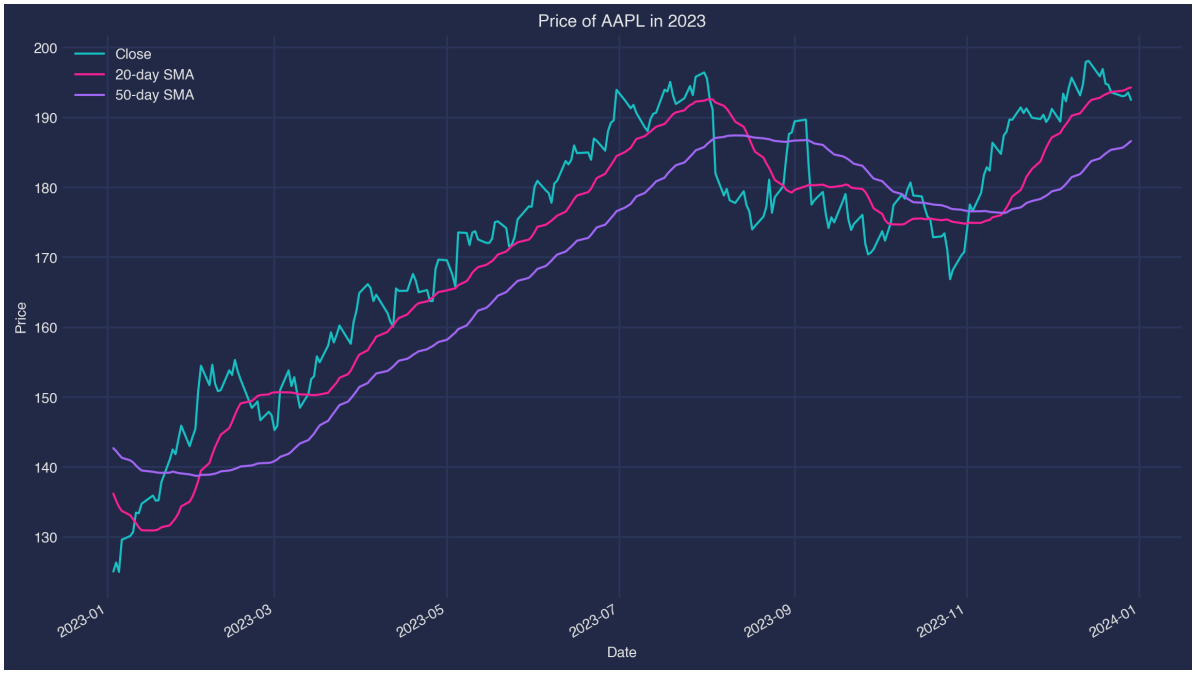
```
#import stock data from yfinance
def data_prep(symbol):
    df = yf.download(tickers=symbol).dropna()
    return df

df = data_prep('AAPL')
```

```
[**********************100%%**********************]  1 of 1 completed
```

```
#Caculate the fast and slow moving averages using the closing price
df["20-day SMA"] = df["Close"].rolling(20).mean()
df["50-day SMA"] = df["Close"].rolling(50).mean()
```

```
df[["Close", "20-day SMA", "50-day SMA"]].loc["2023"].plot(figsize=(14,8))
plt.legend()
plt.title('Price of AAPL in 2023')
plt.ylabel("Price")
plt.style.use('https://github.com/dhaitz/matplotlib-stylesheets/raw/master/'
              'pitayasmoothie-dark.mplstyle')
plt.grid(linewidth=1.5)
```



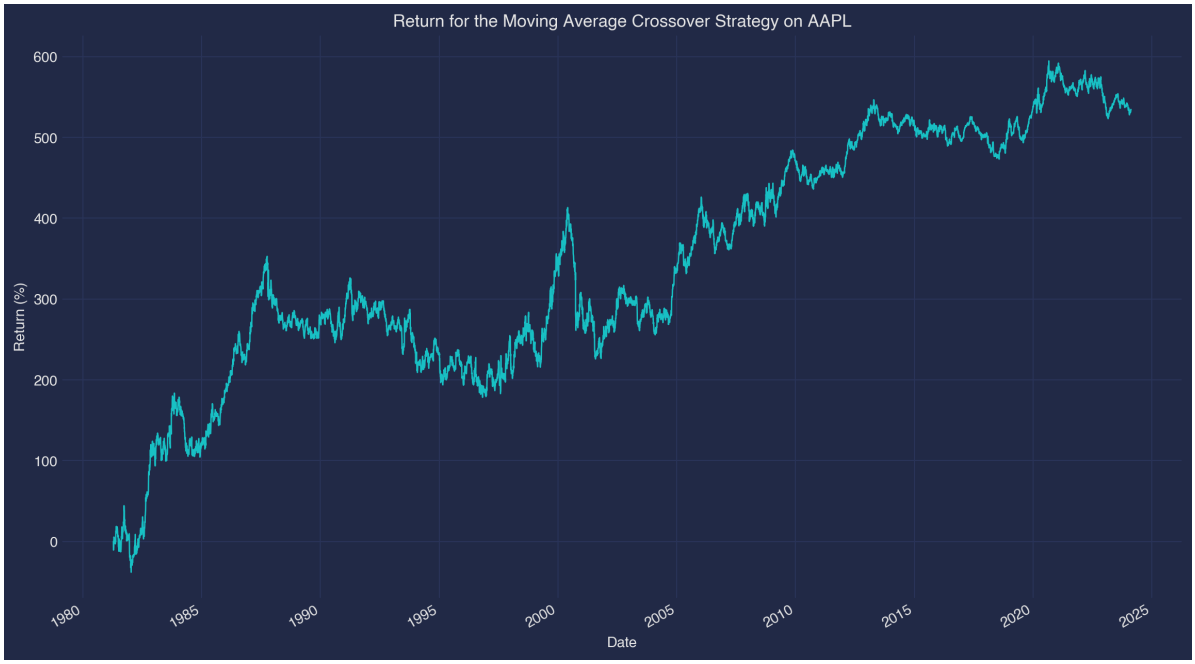
Creating Trading Signals

```
#Create signals to buy and sell the asset using moving average crossovers
df['signal'] = np.nan
df.loc[(df['20-day SMA'] > df['50-day SMA']) & (df['20-day SMA'].shift(1) <=
 ↪  df['50-day SMA'].shift(1)), 'signal'] = 1
df.loc[(df['20-day SMA'] < df['50-day SMA']) & (df['20-day SMA'].shift(1) >=
 ↪  df['50-day SMA'].shift(1)), 'signal'] = -1
idx_open = df.loc[df["signal"] == 1].loc["2023"].index
idx_close = df.loc[df["signal"] == -1].loc["2023"].index
```

```
plt.figure(figsize=(14,8))
plt.scatter(idx_open, df.loc[idx_open]["Close"].loc["2023"], color="green",
 ↪  marker="^")
plt.scatter(idx_close, df.loc[idx_close]["Close"].loc["2023"], color="red",
 ↪  marker="v")
plt.plot(df["Close"].loc["2023"].index, df["Close"].loc["2023"], alpha=0.35)
plt.plot(df["Close"].loc["2023"].index, df["20-day SMA"].loc["2023"], alpha=0.6)
plt.plot(df["Close"].loc["2023"].index, df["50-day SMA"].loc["2023"], alpha=0.6)
plt.legend(["Buy", "Sell", "MSFT"])
plt.title('Price of AAPL in 2023')
plt.ylabel('Price')
plt.xlabel('Date')
plt.show()
```

Computing Returns

```
#Computing the returns net of costs
df["position"] = df["signal"].ffill()
cost = 0.0001
df["cost"] = (np.abs(df["signal"]) * cost).fillna(value=0)
df["return"] = (df["Close"].pct_change(1) * df["position"].shift(1) - df["cost"]) *
 ↪  100
df["return"].cumsum().plot(figsize=(14,8), linewidth=1, title="Return for the Moving
 ↪  Average Crossover Strategy on AAPL")
plt.ylabel("Return (%)")
plt.show()
```



Automating the process

```
def SMA_strategy (input, fast_sma, slow_sma, cost):
    df = data_prep(input)
    df["fast_sma"] = df["Close"].rolling(fast_sma).mean()
    df["slow_sma"] = df["Close"].rolling(slow_sma).mean()
    df["signal"] = np.nan
    buy_condition = df.loc[(df['fast_sma'] > df['slow_sma']) &
 ↪  (df['fast_sma'].shift(1) <= df['slow_sma'].shift(1)), 'signal'] = 1
    sell_condition = df.loc[(df['fast_sma'] < df['slow_sma']) &
 ↪  (df['fast_sma'].shift(1) >= df['slow_sma'].shift(1)), 'signal'] = -1
    df["position"] = df["signal"].ffill()
    df["cost"] = (np.abs(df["signal"]) * cost).fillna(value=0)
    df["return"] = (df["Close"].pct_change() * df["position"].shift(1) - df["cost"])
 ↪  * 100
    return df["return"].cumsum().plot(figsize=(14,8), linewidth=1, title="Return for
     ↪  the Moving Average Crossover Strategy"), plt.ylabel("Return (%)")

SMA_strategy('AAPL',20,50,0.0001)
```

```
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(<Axes: title={'center': 'Return for the Moving Average Crossover Strategy'}, xlabel='Date', ylabel='
 Text(0, 0.5, 'Return (%)'))
```

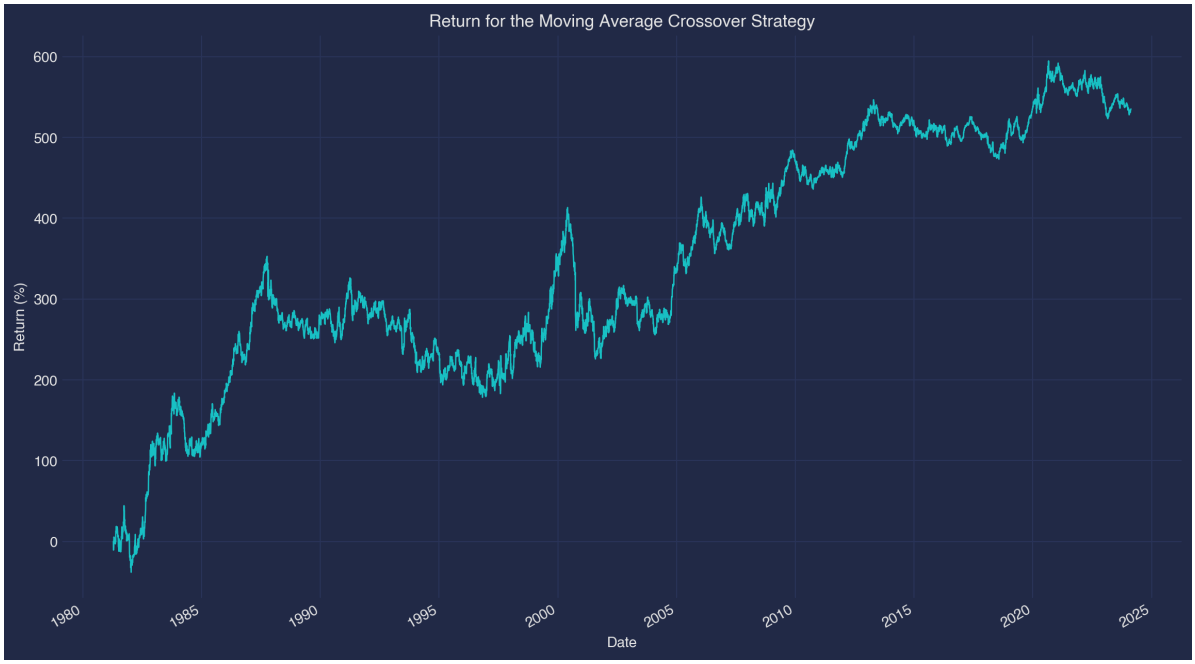
Return for the Moving Average Crossover Strategy
600
500
400
300
200
100
0
Return (%)
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Date