SimpleMovingStrategy (1)

August 5, 2024

0.1 Simple Moving Average Strategy Backtesting

Objective The objective of this project is to implement and backtest a basic trading strategy based on simple moving averages using historical price data

0.1.1 Background

Moving averages of a stock is the average price of a security over a duration and is used to help smooth out price data by creating a constantly updated average price. ##### Moving average Crossover For this project, I will be using the Moving average Crossover strategy. This strategy is typically used by traders to identify changes in trend direction in financial markets and involves the use of two moving averages with different periods, where one is typically a shorter-term moving average and the other is a longer-term moving average. “golden cross”: buy signal. This occurs when the shorter-term price average is moving upwards “faster” than the long-term average. “death cross”: sell signal. short-term price is falling quicker than the average long-term price. ##### Summary Overall, the Moving Average Crossover strategy aims to capture trends in asset prices by identifying key points of trend reversal. This is a simple strategy that can be used when complemented with proper risk management and additional analysis techniques.

[5]:
```
import numpy as np
import pandas as pd
```

[6]:
```
df = pd.read_csv('MSFT (1).csv')
df.head(5)
```

[6]:
```
         Date        Open        High         Low       Close   Adj Close  \
0  2019-05-16  126.750000  129.380005  126.459999  128.929993  122.959991
1  2019-05-17  128.309998  130.460007  127.919998  128.070007  122.139816
2  2019-05-20  126.519997  127.589996  125.760002  126.220001  120.375465
3  2019-05-21  127.430000  127.529999  126.580002  126.900002  121.023979
4  2019-05-22  126.620003  128.240005  126.519997  127.669998  121.758331

     Volume
0  30112200
1  25770500
2  23706900
3  15293300
4  15396500
```

[7]:
```
#calculating short term 50 day moving avergae for shorter terms and 200 day for␣
↪longer term
short_window = 20
df['Short_MA'] = df['Close'].rolling(window = short_window, min_periods = 1).
↪mean()

long_window = 50
df['Long_MA'] = df['Close'].rolling(window = long_window, min_periods = 1).
↪mean()
df.tail()
```

[7]:
```
            Date        Open        High         Low       Close   Adj Close  \
1254  2024-05-09  410.570007  412.720001  409.100006  412.320007  411.577637
1255  2024-05-10  412.940002  415.380005  411.799988  414.739990  413.993256
1256  2024-05-13  418.010010  418.350006  410.820007  413.720001  412.975098
1257  2024-05-14  412.019989  417.489990  411.549988  416.559998  415.809998
1258  2024-05-15  417.899994  423.809998  417.269989  423.079987  423.079987

        Volume    Short_MA     Long_MA
1254  14689700  406.253000  413.728201
1255  13402300  405.895000  413.750200
1256  15440200  405.898999  413.714600
1257  15109300  405.998000  413.747400
1258  22217500  406.559999  414.156000
```

Now we will generate trade signals. the golden cross will be generated when the short-term sMA crosses above the long-term SMA, and the death cross will be generated when a short-term SMA crosses below the long-term SMA. Note that a golden cross occurs when (1) in the previous period when Short_MA was below Long_Ma (2) in the current period, Short_Ma is > Long_MA

[8]:
```
#generating a solumn with zeros
df['Signal'] = 0

#golden cross
df.loc[(df['Short_MA'] > df['Long_MA']) & (df['Short_MA'].shift(1) <=␣
↪df['Long_MA'].shift(1)), 'Signal'] = 1

#death cross
df.loc[(df['Short_MA'] < df['Long_MA']) & (df['Short_MA'].shift(1) >=␣
↪df['Long_MA'].shift(1)), 'Signal'] = -1
df
```

[8]:
```
            Date        Open        High         Low       Close   Adj Close  \
0     2019-05-16  126.750000  129.380005  126.459999  128.929993  122.959991
1     2019-05-17  128.309998  130.460007  127.919998  128.070007  122.139816
2     2019-05-20  126.519997  127.589996  125.760002  126.220001  120.375465
3     2019-05-21  127.430000  127.529999  126.580002  126.900002  121.023979
```

```
4     2019-05-22  126.620003  128.240005  126.519997  127.669998  121.758331
…         …           …           …           …           …           …
1254  2024-05-09  410.570007  412.720001  409.100006  412.320007  411.577637
1255  2024-05-10  412.940002  415.380005  411.799988  414.739990  413.993256
1256  2024-05-13  418.010010  418.350006  410.820007  413.720001  412.975098
1257  2024-05-14  412.019989  417.489990  411.549988  416.559998  415.809998
1258  2024-05-15  417.899994  423.809998  417.269989  423.079987  423.079987

        Volume    Short_MA     Long_MA  Signal
0     30112200  128.929993  128.929993       0
1     25770500  128.500000  128.500000       0
2     23706900  127.740000  127.740000       0
3     15293300  127.530001  127.530001       0
4     15396500  127.558000  127.558000       0
…          …           …           …      …
1254  14689700  406.253000  413.728201       0
1255  13402300  405.895000  413.750200       0
1256  15440200  405.898999  413.714600       0
1257  15109300  405.998000  413.747400       0
1258  22217500  406.559999  414.156000       0

[1259 rows x 10 columns]
```

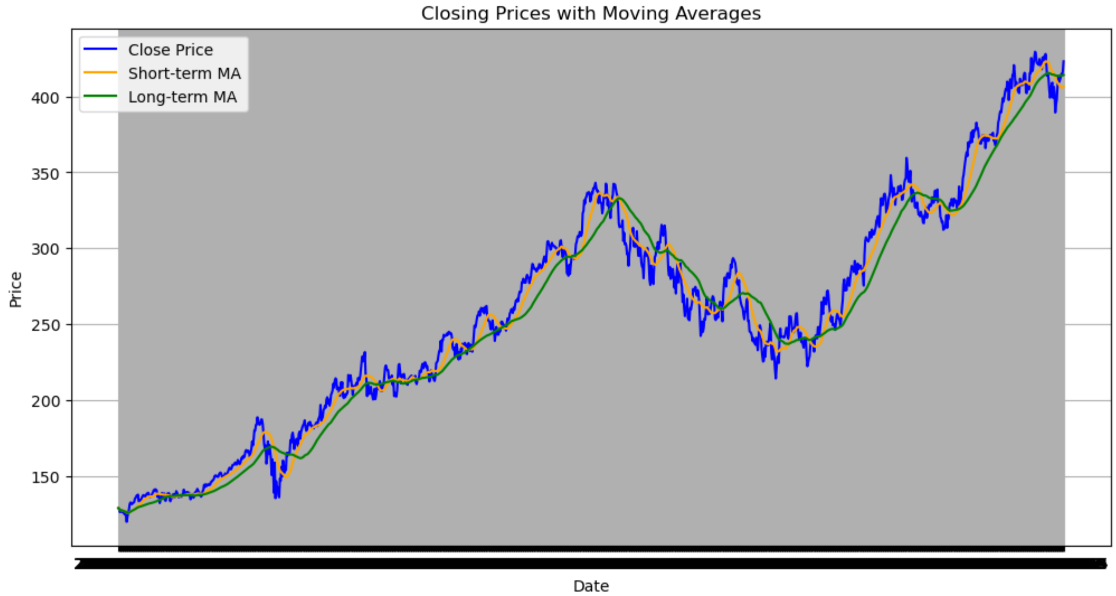
[9]:
```python
import matplotlib.pyplot as plt
```

[10]:
```python
plt.figure(figsize=(12, 6))
plt.plot(df['Date'], df['Close'], label='Close Price', color='blue')

# Plotting short-term moving average
plt.plot(df['Date'], df['Short_MA'], label='Short-term MA', color='orange')

# Plotting long-term moving average
plt.plot(df['Date'], df['Long_MA'], label='Long-term MA', color='green')

# Adding labels and title
plt.xlabel('Date')
plt.ylabel('Price')
plt.title('Closing Prices with Moving Averages')
plt.legend()
plt.grid(True)
plt.show()
```



We will now backtest and stimulate the strategy.

[11]:
```
#intializing trading variables
portfolio_value = 10000
position = 0 # 0 = no position , 1 = long, -1 = short
entry_price = 0 #storing entry price for the current positon
trade_log = []
for index, row in df.iterrows():
    #cross signal
    if row['Signal'] == 1 and position == 0:
        position = 1 #enter long posiition
        entry_price = row['Close']
        print(f" buy at {row['Date']} for ${entry_price}")
    #death signal
    elif row['Signal']== -1 and position == 1:
        position = 0 #exit long position
        exit_price = row['Close']
        trade_profit = (exit_price - entry_price)  #calculating trade profit/
 ↪loss
        portfolio_value += trade_profit
        trade_log.append({'entry_date': row['Date'], 'entry_price': entry_price,
                          'exit_date': row['Date'], 'exit_price': exit_price,
                          'position': 1})
        print(f" sell at {row['Date']} for ${exit_price}. Profit␣
 ↪${trade_profit}")

final_portfolio_val = portfolio_value
```

```
print(f" Final Portfolio Value: ${final_portfolio_val}")
```

```
buy at 2019-06-18 for $135.160004
sell at 2019-08-23 for $133.389999. Profit $-1.7700049999999976
buy at 2019-09-23 for $139.139999
sell at 2020-03-13 for $158.830002. Profit $19.69000300000002
buy at 2020-04-22 for $173.520004
sell at 2020-09-28 for $209.440002. Profit $35.91999799999999
buy at 2020-10-21 for $214.800003
sell at 2020-12-14 for $214.199997. Profit $-0.6000060000000076
buy at 2020-12-18 for $218.589996
sell at 2021-03-23 for $237.580002. Profit $18.990005999999994
buy at 2021-04-07 for $249.899994
sell at 2021-05-26 for $251.490005. Profit $1.590011000000004
buy at 2021-06-18 for $259.429993
sell at 2021-10-06 for $293.109985. Profit $33.67999199999997
buy at 2021-10-27 for $323.170013
sell at 2022-01-06 for $313.880005. Profit $-9.290008
buy at 2022-04-04 for $314.970001
sell at 2022-04-26 for $270.220001. Profit $-44.75
buy at 2022-07-21 for $264.839996
sell at 2022-07-25 for $258.829987. Profit $-6.010008999999968
buy at 2022-07-28 for $276.410004
sell at 2022-09-13 for $251.990005. Profit $-24.41999900000002
buy at 2022-11-30 for $255.139999
sell at 2023-01-10 for $228.850006. Profit $-26.28999299999998
buy at 2023-02-07 for $267.559998
sell at 2023-08-14 for $324.040009. Profit $56.48001099999999
buy at 2023-10-25 for $340.670013
sell at 2024-04-29 for $402.25. Profit $61.57998700000002
Final Portfolio Value: $10114.799987999997
```

We will now evaluate performance using metrics such as total return and average return per trade.

[12]:
```
#total return
total_return = ((final_portfolio_val- 10000)/10000)* 100
total_return
```

[12]: 1.1479998799999704

[13]:
```
#average return per trade
num_trade = len(trade_log)
avg_return_per_trade = (total_return /num_trade)*100
avg_return_per_trade
```

[13]: 8.199999142856932

Overall, both metrics indicate that the trading strategy produced positive results during the back-test period. However, it's essential to consider other performance metrics and conduct further analysis to assess the strategy's robustness, risk-adjusted return, and potential for future performance.