1.turtle-agent

September 29, 2021

[1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
sns.set()
```

[2]:
```
df = pd.read_csv('../dataset/GOOG-year.csv')
df.head()
```

[2]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	2016-11-02	778.200012	781.650024	763.450012	768.700012	768.700012	1872400
1	2016-11-03	767.250000	769.950012	759.030029	762.130005	762.130005	1943200
2	2016-11-04	750.659973	770.359985	750.560974	762.020020	762.020020	2134800
3	2016-11-07	774.500000	785.190002	772.549988	782.520020	782.520020	1585100
4	2016-11-08	783.400024	795.632996	780.190002	790.510010	790.510010	1350800

[3]:
```
count = int(np.ceil(len(df) * 0.1))
signals = pd.DataFrame(index=df.index)
signals['signal'] = 0.0
signals['trend'] = df['Close']
signals['RollingMax'] = (signals.trend.shift(1).rolling(count).max())
signals['RollingMin'] = (signals.trend.shift(1).rolling(count).min())
signals.loc[signals['RollingMax'] < signals.trend, 'signal'] = -1
signals.loc[signals['RollingMin'] > signals.trend, 'signal'] = 1
signals
```

[3]:

	signal	trend	RollingMax	RollingMin
0	0.0	768.700012	NaN	NaN
1	0.0	762.130005	NaN	NaN
2	0.0	762.020020	NaN	NaN

3	0.0	782.520020	NaN	NaN
4	0.0	790.510010	NaN	NaN
5	0.0	785.309998	NaN	NaN
6	0.0	762.559998	NaN	NaN
7	0.0	754.020020	NaN	NaN
8	0.0	736.080017	NaN	NaN
9	0.0	758.489990	NaN	NaN
10	0.0	764.479980	NaN	NaN
11	0.0	771.229980	NaN	NaN
12	0.0	760.539978	NaN	NaN
13	0.0	769.200012	NaN	NaN
14	0.0	768.270020	NaN	NaN
15	0.0	760.989990	NaN	NaN
16	0.0	761.679993	NaN	NaN
17	0.0	768.239990	NaN	NaN
18	0.0	770.840027	NaN	NaN
19	0.0	758.039978	NaN	NaN
20	0.0	747.919983	NaN	NaN
21	0.0	750.500000	NaN	NaN
22	0.0	762.520020	NaN	NaN
23	0.0	759.109985	NaN	NaN
24	0.0	771.190002	NaN	NaN
25	0.0	776.419983	NaN	NaN
26	0.0	789.289978	790.510010	736.080017
27	0.0	789.270020	790.510010	736.080017
28	-1.0	796.099976	790.510010	736.080017
29	-1.0	797.070007	796.099976	736.080017
..	…	…	…	…
222	0.0	932.450012	939.330017	906.659973
223	0.0	928.530029	939.330017	906.659973
224	0.0	920.969971	939.330017	906.659973
225	0.0	924.859985	939.330017	906.659973
226	-1.0	944.489990	939.330017	906.659973
227	-1.0	949.500000	944.489990	913.809998
228	-1.0	959.109985	949.500000	913.809998
229	0.0	953.270020	959.109985	913.809998
230	0.0	957.789978	959.109985	913.809998
231	0.0	951.679993	959.109985	913.809998
232	-1.0	969.960022	959.109985	915.000000
233	-1.0	978.890015	969.960022	915.000000
234	0.0	977.000000	978.890015	915.000000
235	0.0	972.599976	978.890015	915.000000
236	-1.0	989.250000	978.890015	915.000000
237	0.0	987.830017	989.250000	915.000000
238	-1.0	989.679993	989.250000	915.000000
239	-1.0	992.000000	989.679993	915.000000
240	-1.0	992.179993	992.000000	915.000000

```
241    -1.0   992.809998   992.179993  915.000000
242     0.0   984.450012   992.809998  915.000000
243     0.0   988.200012   992.809998  915.000000
244     0.0   968.450012   992.809998  915.000000
245     0.0   970.539978   992.809998  915.000000
246     0.0   973.330017   992.809998  920.969971
247     0.0   972.559998   992.809998  920.969971
248    -1.0  1019.270020   992.809998  920.969971
249     0.0  1017.109985  1019.270020  920.969971
250     0.0  1016.640015  1019.270020  920.969971
251    -1.0  1025.500000  1019.270020  924.859985

[252 rows x 4 columns]
```

[4]:
```python
def buy_stock(
    real_movement,
    signal,
    initial_money = 10000,
    max_buy = 1,
    max_sell = 1,
):
    """
    real_movement = actual movement in the real world
    delay = how much interval you want to delay to change our decision from buy␣
↪to sell, vice versa
    initial_state = 1 is buy, 0 is sell
    initial_money = 1000, ignore what kind of currency
    max_buy = max quantity for share to buy
    max_sell = max quantity for share to sell
    """
    starting_money = initial_money
    states_sell = []
    states_buy = []
    current_inventory = 0

    def buy(i, initial_money, current_inventory):
        shares = initial_money // real_movement[i]
        if shares < 1:
            print(
                'day %d: total balances %f, not enough money to buy a unit␣
↪price %f'
                % (i, initial_money, real_movement[i])
            )
        else:
            if shares > max_buy:
                buy_units = max_buy
            else:
```

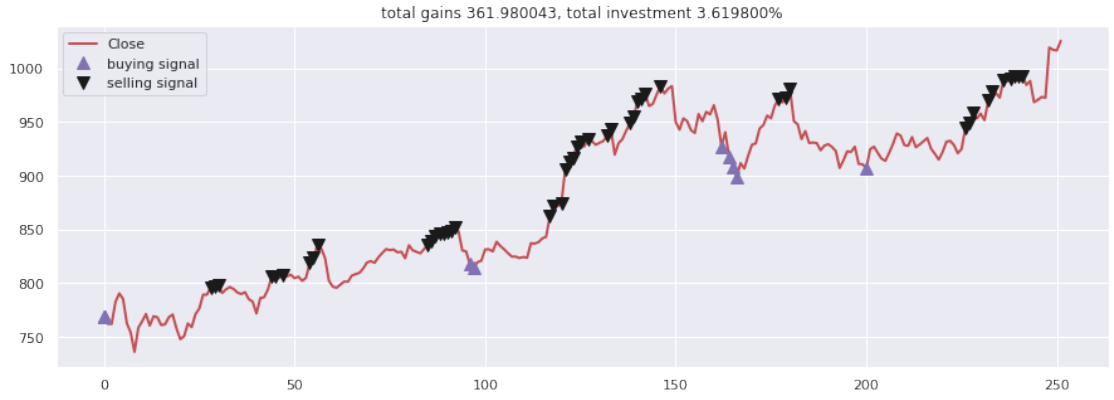
```
                buy_units = shares
            initial_money -= buy_units * real_movement[i]
            current_inventory += buy_units
            print(
                'day %d: buy %d units at price %f, total balance %f'
                % (i, buy_units, buy_units * real_movement[i], initial_money)
            )
            states_buy.append(0)
        return initial_money, current_inventory

    for i in range(real_movement.shape[0] - int(0.025 * len(df))):
        state = signal[i]
        if state == 1:
            initial_money, current_inventory = buy(
                i, initial_money, current_inventory
            )
            states_buy.append(i)
        elif state == -1:
            if current_inventory == 0:
                    print('day %d: cannot sell anything, inventory 0' % (i))
            else:
                if current_inventory > max_sell:
                    sell_units = max_sell
                else:
                    sell_units = current_inventory
                current_inventory -= sell_units
                total_sell = sell_units * real_movement[i]
                initial_money += total_sell
                try:
                    invest = (
                        (real_movement[i] - real_movement[states_buy[-1]])
                        / real_movement[states_buy[-1]]
                    ) * 100
                except:
                    invest = 0
                print(
                    'day %d, sell %d units at price %f, investment %f %%, total␣
↪balance %f,'
                    % (i, sell_units, total_sell, invest, initial_money)
                )
            states_sell.append(i)

    invest = ((initial_money - starting_money) / starting_money) * 100
    total_gains = initial_money - starting_money
    return states_buy, states_sell, total_gains, invest
```

[5]:
```
states_buy, states_sell, total_gains, invest = buy_stock(df.Close,␣
↪signals['signal'])
```

```
day 28: cannot sell anything, inventory 0
day 29: cannot sell anything, inventory 0
day 30: cannot sell anything, inventory 0
day 44: cannot sell anything, inventory 0
day 45: cannot sell anything, inventory 0
day 47: cannot sell anything, inventory 0
day 54: cannot sell anything, inventory 0
day 55: cannot sell anything, inventory 0
day 56: cannot sell anything, inventory 0
day 85: cannot sell anything, inventory 0
day 86: cannot sell anything, inventory 0
day 87: cannot sell anything, inventory 0
day 88: cannot sell anything, inventory 0
day 89: cannot sell anything, inventory 0
day 90: cannot sell anything, inventory 0
day 91: cannot sell anything, inventory 0
day 92: cannot sell anything, inventory 0
day 96: buy 1 units at price 817.580017, total balance 9182.419983
day 97: buy 1 units at price 814.429993, total balance 8367.989990
day 117, sell 1 units at price 862.760010, investment 5.934214 %, total balance
9230.750000,
day 118, sell 1 units at price 872.299988, investment 7.105582 %, total balance
10103.049988,
day 120: cannot sell anything, inventory 0
day 121: cannot sell anything, inventory 0
day 122: cannot sell anything, inventory 0
day 123: cannot sell anything, inventory 0
day 124: cannot sell anything, inventory 0
day 125: cannot sell anything, inventory 0
day 127: cannot sell anything, inventory 0
day 132: cannot sell anything, inventory 0
day 133: cannot sell anything, inventory 0
day 138: cannot sell anything, inventory 0
day 139: cannot sell anything, inventory 0
day 140: cannot sell anything, inventory 0
day 141: cannot sell anything, inventory 0
day 142: cannot sell anything, inventory 0
day 146: cannot sell anything, inventory 0
day 162: buy 1 units at price 927.330017, total balance 9175.719971
day 164: buy 1 units at price 917.789978, total balance 8257.929993
day 165: buy 1 units at price 908.729980, total balance 7349.200013
day 166: buy 1 units at price 898.700012, total balance 6450.500001
day 177, sell 1 units at price 970.890015, investment 8.032714 %, total balance
7421.390016,
```

```
day 179, sell 1 units at price 972.919983, investment 8.258592 %, total balance
8394.309999,
day 180, sell 1 units at price 980.340027, investment 9.084234 %, total balance
9374.650026,
day 200: buy 1 units at price 906.659973, total balance 8467.990053
day 226, sell 1 units at price 944.489990, investment 4.172459 %, total balance
9412.480043,
day 227, sell 1 units at price 949.500000, investment 4.725038 %, total balance
10361.980043,
day 228: cannot sell anything, inventory 0
day 232: cannot sell anything, inventory 0
day 233: cannot sell anything, inventory 0
day 236: cannot sell anything, inventory 0
day 238: cannot sell anything, inventory 0
day 239: cannot sell anything, inventory 0
day 240: cannot sell anything, inventory 0
day 241: cannot sell anything, inventory 0
```

[6]:
```
close = df['Close']
fig = plt.figure(figsize = (15,5))
plt.plot(close, color='r', lw=2.)
plt.plot(close, '^', markersize=10, color='m', label = 'buying signal',␣
 ↪markevery = states_buy)
plt.plot(close, 'v', markersize=10, color='k', label = 'selling signal',␣
 ↪markevery = states_sell)
plt.title('total gains %f, total investment %f%%'%(total_gains, invest))
plt.legend()
plt.show()
```



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