portfolio-optimization

September 29, 2021

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

[2]:
```
directory = '../dataset/'
stocks = ['AMD.csv', 'FB.csv', 'TSLA.csv', 'TWTR.csv', 'MONDY.csv']
stocks = [directory + s for s in stocks]
stocks
```

[2]:
```
['../dataset/AMD.csv',
 '../dataset/FB.csv',
 '../dataset/TSLA.csv',
 '../dataset/TWTR.csv',
 '../dataset/MONDY.csv']
```

[3]:
```
dfs = [pd.read_csv(s)[['Date', 'Close']] for s in stocks]
```

[4]:
```
from functools import reduce
data = reduce(lambda left,right: pd.merge(left,right,on='Date'), dfs).iloc[:, 1:
 ↪]
data.head()
```

[4]:

	Close_x	Close_y	Close_x	Close_y	Close
0	16.270000	207.320007	318.869995	44.490002	56.889999
1	16.580000	207.229996	310.100006	44.259998	56.639999
2	16.870001	209.990005	322.690002	44.709999	57.730000
3	16.850000	209.360001	323.850006	43.340000	57.810001
4	16.709999	208.089996	320.230011	43.439999	52.380001

[6]:
```
returns = data.pct_change()
mean_daily_returns = returns.mean()
cov_matrix = returns.cov()
```

[8]:
```
cov_matrix
```

[8]:

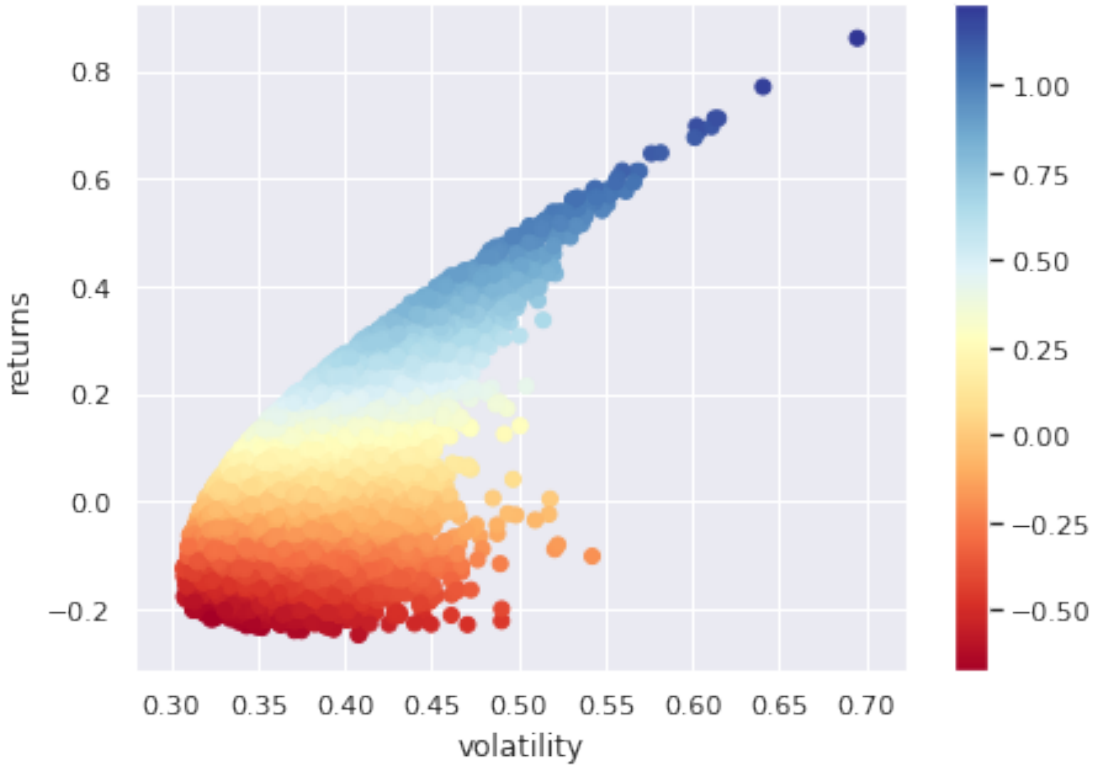
	Close_x	Close_y	Close_x	Close_y	Close
Close_x	0.002342	0.000316	0.000368	0.000387	0.000215
Close_y	0.000316	0.000694	0.000216	0.000463	0.000043
Close_x	0.000368	0.000216	0.001643	0.000516	0.000004
Close_y	0.000387	0.000463	0.000516	0.001240	0.000177
Close	0.000215	0.000043	0.000004	0.000177	0.000985

[9]:
```
num_portfolios = 25000
results = np.zeros((3,num_portfolios))
```

[11]:
```
for i in range(num_portfolios):
    weights = np.random.random(cov_matrix.shape[0])
    weights /= np.sum(weights)
    portfolio_return = np.sum(mean_daily_returns * weights) * 252
    portfolio_std_dev = np.sqrt(np.dot(weights.T,np.dot(cov_matrix, weights)))␣
 ↪* np.sqrt(252)
    results[0,i] = portfolio_return
    results[1,i] = portfolio_std_dev
    results[2,i] = results[0,i] / results[1,i]
```

[12]:
```
results_frame = pd.DataFrame(results.T,columns=['ret','stdev','sharpe'])
```

[18]:
```
plt.figure(figsize = (7, 5))
plt.scatter(results_frame.stdev,results_frame.ret,c=results_frame.
 ↪sharpe,cmap='RdYlBu')
plt.colorbar()
plt.xlabel('volatility')
plt.ylabel('returns')
plt.show()
```


returns
0.8
0.6
0.4
0.2
0.0
−0.2
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
volatility
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50

[ ]: