02_vectorized_backtest

September 29, 2021

1 Vectorized Backtest

[1]:
```
import warnings
warnings.filterwarnings('ignore')
```

[2]:
```
from pathlib import Path
from time import time
import datetime

import numpy as np
import pandas as pd
import pandas_datareader.data as web

from scipy.stats import spearmanr

import matplotlib.pyplot as plt
from matplotlib.ticker import FuncFormatter
import seaborn as sns
```

[3]:
```
sns.set_style('whitegrid')
np.random.seed(42)
```

1.1 Load Data

1.1.1 Return Predictions

[4]:
```
DATA_DIR = Path('..', 'data')
```

[5]:
```
data = pd.read_hdf('00_data/backtest.h5', 'data')
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
MultiIndex: 190451 entries, ('AAL', Timestamp('2014-12-09 00:00:00')) to ('YUM',
Timestamp('2017-11-30 00:00:00'))
Data columns (total 6 columns):
 #   Column     Non-Null Count   Dtype
---  ------     --------------   -----
 0   predicted  74054 non-null   float64
```

```
 1   open       190451 non-null  float64
 2   high       190451 non-null  float64
 3   low        190451 non-null  float64
 4   close      190451 non-null  float64
 5   volume     190451 non-null  float64
dtypes: float64(6)
memory usage: 10.2+ MB
```

1.1.2 SP500 Benchmark

[6]:
```
sp500 = web.DataReader('SP500', 'fred', '2014', '2018').pct_change()
```

[7]:
```
sp500.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1044 entries, 2014-01-01 to 2018-01-01
Data columns (total 1 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   SP500   1042 non-null   float64
dtypes: float64(1)
memory usage: 16.3 KB
```

1.2 Compute Forward Returns

[8]:
```
daily_returns = data.open.unstack('ticker').sort_index().pct_change()
daily_returns.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 751 entries, 2014-12-09 to 2017-11-30
Columns: 257 entries, AAL to YUM
dtypes: float64(257)
memory usage: 1.5 MB
```

[9]:
```
fwd_returns = daily_returns.shift(-1)
```

1.3 Generate Signals

[10]:
```
predictions = data.predicted.unstack('ticker')
predictions.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 751 entries, 2014-12-09 to 2017-04-14
Columns: 257 entries, AAL to YUM
dtypes: float64(257)
memory usage: 1.5 MB
```

[11]:
```
N_LONG = N_SHORT = 15
```

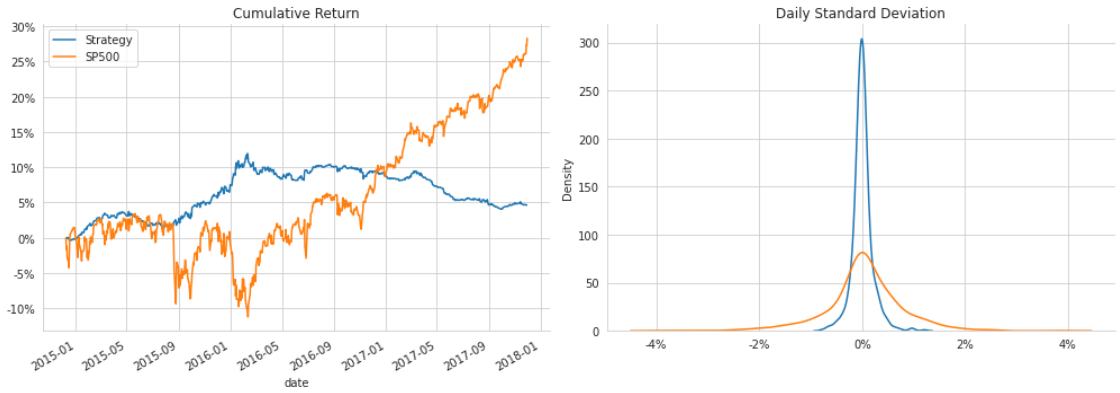
[12]:
```
long_signals = ((predictions
                 .where(predictions > 0)
                 .rank(axis=1, ascending=False) > N_LONG)
                 .astype(int))
short_signals = ((predictions
                  .where(predictions < 0)
                  .rank(axis=1) > N_SHORT)
                  .astype(int))
```

1.4 Compute Portfolio Returns

[13]:
```
long_returns = long_signals.mul(fwd_returns).mean(axis=1)
short_returns = short_signals.mul(-fwd_returns).mean(axis=1)
strategy = long_returns.add(short_returns).to_frame('Strategy')
```

1.5 Plot results

[14]:
```
fig, axes = plt.subplots(ncols=2, figsize=(14,5))
strategy.join(sp500).add(1).cumprod().sub(1).plot(ax=axes[0], title='Cumulative␣
 ↪Return')
sns.distplot(strategy.dropna(), ax=axes[1], hist=False, label='Strategy')
sns.distplot(sp500, ax=axes[1], hist=False, label='SP500')
axes[1].set_title('Daily Standard Deviation')
axes[0].yaxis.set_major_formatter(FuncFormatter(lambda y, _: '{:.0%}'.
 ↪format(y)))
axes[1].xaxis.set_major_formatter(FuncFormatter(lambda y, _: '{:.0%}'.
 ↪format(y)))
sns.despine()
fig.tight_layout();
```



[15]:
```
res = strategy.join(sp500).dropna()
```

[16]:
```
res.std()
```

[16]:
```
Strategy    0.001981
SP500       0.007923
dtype: float64
```

[17]:
```
res.corr()
```

[17]:

	Strategy	SP500
Strategy	1.0000	-0.1184
SP500	-0.1184	1.0000