intra_sp_features

December 11, 2019

https://github.com/QuantCS109/TrumpTweets/blob/master/notebooks_features/intra_sp_features.ipynb

[1]:

```
import sys
sys.path.append('..') #to add top-level to path

from modules.project_helper import TweetData, IntradayData, FuturesCloseData
import pandas as pd
import numpy as np
from pytz import timezone
import datetime
from datetime import timedelta
from tqdm import tqdm
import copy
import matplotlib.pyplot as plt

import warnings
warnings.simplefilter(action='ignore', category=FutureWarning)
```

1 Intraday S&P500 futures features

This notebook creates features derived from Trump's tweets, where we observe short term returns in S&P500 futures after each tweet. We look at 1 minute, 5 minute, and 15 minute returns after every tweet

A project from this class, two years ago, found that 5 minute returns was the most predictive out of short term returns: https://pdfs.semanticscholar.org/af67/ae4c3ac357679c10ddc394df52d392432f63.pdf.

It's normal to see an overreaction to a tweet the market thinks relevant, and then see a portion of the move fade. Instead of focusing on the most predictive return, we will look at the difference between 15 minute returns and 5 minute returns, as well as an average of 1, 5, and 15 mnute returns.

From here we have three features:

- **intra_ret_1**: The 1 minute return for the tweet with the largest absolute 1 minute return for the day
- **intra_ret_5**: The 5 minute return for the tweet with the largest absolute 5 minute return for the day

- **intra_ret_15**: The 15 minute return for the tweet with the largest absolute 15 minute return for the day
- **intra_blend**: Average of the last 3 features
- **intra_diff_15_5**: Difference between 15 minute and 5 minute return, same tweet used for intra_ret_5. If it's positive, the move kept going in the same direction of the 5 minute return, if negative, the move faded.

```
[2]: tweet_data = TweetData()
     tweet_data.raw_tweets.head()
```

```
[2]:                                                                      tweets
     timestamp
     2019-11-17 19:57:12-06:00  "Tell Jennifer Williams whoever that is to rea…
     2019-11-17 19:56:02-06:00                         "https://t.co/I31O117SVh
     2019-11-17 19:49:47-06:00  "Paul Krugman of @nytimes has been wrong about…
     2019-11-17 19:47:32-06:00  "Schiff is a Corrupt Politician! https://t.co/…
     2019-11-17 19:30:09-06:00  ".@SteveScalise blew the nasty &amp; obnoxious…
```

```
[3]: md = IntradayData()
     fin_data = md.get_data()
```

```
[4]: # Number of tweets with exactly the same timestamp
     len(tweet_data.raw_tweets.index) - len(set(tweet_data.raw_tweets.index))
```

```
[4]: 321
```

```
[5]: print(fin_data.shape)
     fin_data.head()
```

```
     (1040156, 2)
```

```
[5]:                               Open    Close
     timestamp
     2016-11-13 17:01:00-06:00  2183.00  2183.25
     2016-11-13 17:02:00-06:00  2183.25  2182.00
     2016-11-13 17:03:00-06:00  2182.00  2182.75
     2016-11-13 17:04:00-06:00  2182.50  2182.50
     2016-11-13 17:05:00-06:00  2182.75  2183.00
```

```
[6]: subset = (tweet_data.raw_tweets.index > fin_data.index[0]) & (tweet_data.
      ↪raw_tweets.index < fin_data.index[-1])
     sub_data = tweet_data.raw_tweets[subset]
```

```
[7]: sub_data.head()
```

```
[7]:                                                                      tweets
     timestamp
     2019-11-08 03:08:53-06:00                         "https://t.co/z0I7wBsgTP
```

```
2019-11-08 00:08:15-06:00  "STATEMENT FROM PRESIDENT DONALD J. TRUMP http…
2019-11-07 15:43:29-06:00   "Stock Market up big today. A New Record. Enjoy!
2019-11-07 15:41:53-06:00  "The Radical Left Dems and LameStream Media ar…
2019-11-07 15:27:57-06:00  "The Amazon Washington Post and three lowlife …
```

Getting indices for the tweets found in the different timeframes we're looking at

[8]:

```
ts_pre = [ time + datetime.timedelta(seconds = - time.second) for i, time in␣
 ↪enumerate(sub_data.index)]
ts_post = [ time + datetime.timedelta(seconds = 60*1 - time.second) for i, time␣
 ↪in enumerate(sub_data.index)]
ts_1min = [ time + datetime.timedelta(seconds = 60*2 - time.second) for i, time␣
 ↪in enumerate(sub_data.index)]
ts_5min = [ time + datetime.timedelta(seconds = 60*6 - time.second) for i, time␣
 ↪in enumerate(sub_data.index)]
ts_15min = [ time + datetime.timedelta(seconds = 60*16 - time.second) for i,␣
 ↪time in enumerate(sub_data.index)]
```

[9]:

```
min_dict = {}
for i, ts in enumerate(ts_post):
    try:
        min_dict[ts] = min_dict[ts] + sub_data.tweets.iloc[i]
    except KeyError:
        min_dict[ts] = sub_data.tweets.iloc[i]

data_min = pd.DataFrame(data = min_dict.values(), index = min_dict.keys())
data_min.columns = ['tweets']
data_min.index.name = 'timestamp'
data_min.head()
```

[9]:

```
                                                                    tweets
timestamp
2019-11-08 03:09:00-06:00                          "https://t.co/z0I7wBsgTP
2019-11-08 00:09:00-06:00  "STATEMENT FROM PRESIDENT DONALD J. TRUMP http…
2019-11-07 15:44:00-06:00   "Stock Market up big today. A New Record. Enjoy!
2019-11-07 15:42:00-06:00  "The Radical Left Dems and LameStream Media ar…
2019-11-07 15:28:00-06:00  "The Amazon Washington Post and three lowlife …
```

[10]:

```
ts_dict = {a:b for a, b in zip(ts_post, sub_data.index)}
```

[11]:

```
for ret, ts in zip(['ret_1', 'ret_5', 'ret_15'],[ts_1min,ts_5min,ts_15min] ):
    imp_open = fin_data.loc[ts_post]['Open']
    imp_close = fin_data.loc[ts]['Close']
    hl = (imp_open - imp_close.values)/imp_open
    hl = hl.loc[~hl.index.duplicated(keep='first')]
    data_min[ret] = hl.values
```

```python
data_min = data_min.dropna()
```

[12]:
```python
data_min.head()
```

[12]:
```
                                                                tweets  \
timestamp
2019-11-08 03:09:00-06:00                           "https://t.co/z0I7wBsgTP
2019-11-08 00:09:00-06:00  "STATEMENT FROM PRESIDENT DONALD J. TRUMP http…
2019-11-07 15:44:00-06:00   "Stock Market up big today. A New Record. Enjoy!
2019-11-07 15:42:00-06:00  "The Radical Left Dems and LameStream Media ar…
2019-11-07 14:52:00-06:00  "What did Hunter Biden do for the money? @SenJ…

                              ret_1     ret_5    ret_15
timestamp
2019-11-08 03:09:00-06:00  0.000162  0.000406  0.000406
2019-11-08 00:09:00-06:00  0.000162  0.000244  0.000244
2019-11-07 15:44:00-06:00 -0.000081  0.000000  0.000000
2019-11-07 15:42:00-06:00  0.000000  0.000000  0.000000
2019-11-07 14:52:00-06:00  0.000730  0.000730 -0.000081
```

[13]:
```python
after_4_tweets = data_min.index.hour >= 15
data_min['after4_date'] = data_min.index
data_min.after4_date[after_4_tweets] +=  timedelta(days=1)
data_min.after4_date =data_min.after4_date.dt.date
```

```
/Users/lalopey/opt/anaconda3/lib/python3.7/site-
packages/ipykernel_launcher.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  This is separate from the ipykernel package so we can avoid doing imports
until
```

Difference between 15 minute and 5 minute return, same tweet used for intra_ret_5. If it's positive, the move kept going in the same direction of the 5 minute return, if negative, the move faded.

[14]:
```python
mini = data_min.groupby('after4_date').min()
mini_15 = data_min.loc[data_min.groupby('after4_date').idxmin().
 ↪ret_5][['ret_15','after4_date']]
mini_15 = mini_15.set_index('after4_date')
mini['diff_15_5'] = mini_15
# notice different sides for the diff_15_5 in mini and maxi calculations
mini['diff_15_5'] = mini['ret_5'] - mini['diff_15_5']
maxi = data_min.groupby('after4_date').max()
maxi_15 = data_min.loc[data_min.groupby('after4_date').idxmax().
 ↪ret_5][['ret_15','after4_date']]
maxi_15 = maxi_15.set_index('after4_date')
```

```
maxi['diff_15_5'] = maxi_15
maxi['diff_15_5'] = maxi['diff_15_5'] - maxi['ret_5']
features = pd.DataFrame(index = mini.index, columns=['intra_ret_1',␣
 ↪'intra_ret_5', 'intra_ret_15', 'intra_diff_15_5'] )
```

[15]:
```
maxi.head()
```

[15]:
```
                                                           tweets     ret_1  \
after4_date
2016-11-14   "The debates especially the second and third p… -0.000114
2016-11-15   "The Electoral College is actually genius in t…  0.000000
2016-11-16   "Very organized process taking place as I deci…  0.000228
2016-11-17   "My transition team which is working long hour… -0.000114
2016-11-18   "Just got a call from my friend Bill Ford Chai…  0.000454

                ret_5    ret_15  diff_15_5
after4_date
2016-11-14  -0.000343 -0.000685  -0.000343
2016-11-15  -0.000456 -0.000685  -0.000684
2016-11-16   0.000683  0.000455  -0.000228
2016-11-17  -0.000114  0.000795   0.000908
2016-11-18   0.001022  0.000908  -0.000114
```

[16]:
```
for ind in mini.index:
    for ret in ['ret_1', 'ret_5', 'ret_15']:
        if abs(mini[ret].loc[ind]) > abs(maxi[ret].loc[ind]):
            features['intra_' + ret].loc[ind] = mini[ret].loc[ind]
            if ret == 'ret_5':
                features['intra_diff_15_5'].loc[ind] = mini['diff_15_5'].
 ↪loc[ind]
        else:
            features['intra_' + ret].loc[ind] = maxi['diff_15_5'].loc[ind]
            if ret == 'ret_5':
                features['intra_diff_15_5'].loc[ind] = maxi['diff_15_5'].
 ↪loc[ind]
```

[17]:
```
features.head()
```

[17]:
```
             intra_ret_1  intra_ret_5 intra_ret_15 intra_diff_15_5
after4_date
2016-11-14   -0.00034274  -0.00034274  -0.00034274     -0.00034274
2016-11-15  -0.000114129 -0.000570646  -0.00114064     0.000114129
2016-11-16  -0.000456934 -0.000227635 -0.000799543    -0.000227635
2016-11-17   0.000908265  0.000908265  0.000908265     0.000908265
2016-11-18   -0.00011352  -0.00011352  -0.00011352     -0.00011352
```

[18]:

```
features.index.name = 'date'
features['intra_blend'] = features[['intra_ret_1','intra_ret_5','intra_ret_15'␣
 ↪]].mean(axis=1)
features.to_csv('../data/features/intra_sp_features.csv')
```

[19]:

```
features
```

[19]:

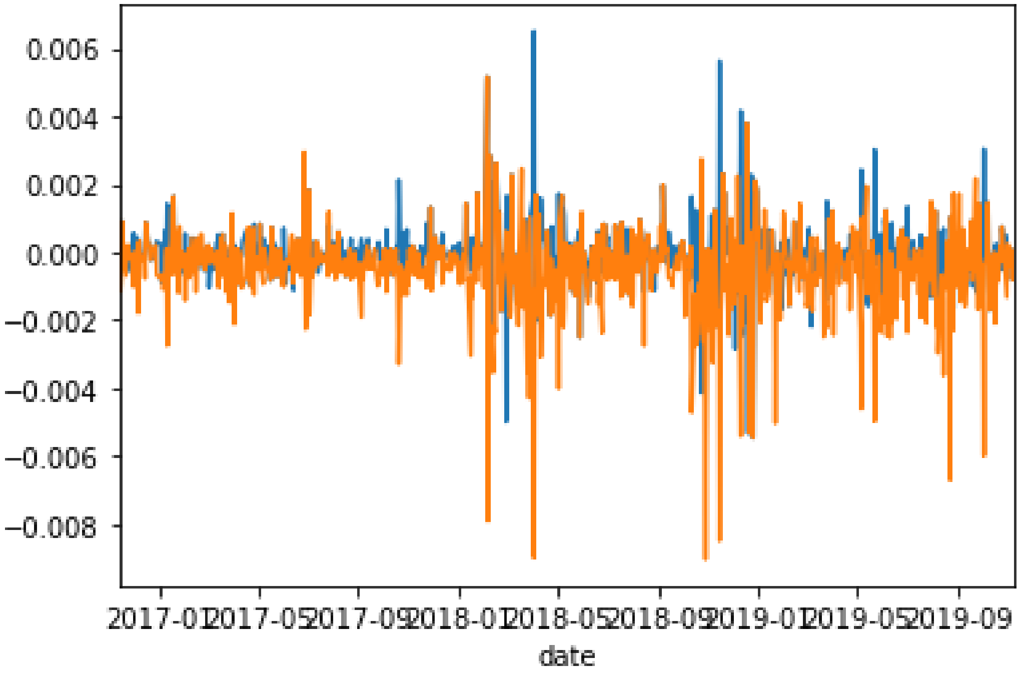
```
            intra_ret_1  intra_ret_5 intra_ret_15 intra_diff_15_5  intra_blend
date
2016-11-14  -0.00034274  -0.00034274  -0.00034274     -0.00034274    -0.000343
2016-11-15 -0.000114129 -0.000570646  -0.00114064     0.000114129    -0.000608
2016-11-16 -0.000456934 -0.000227635 -0.000799543    -0.000227635    -0.000495
2016-11-17  0.000908265  0.000908265  0.000908265     0.000908265     0.000908
2016-11-18  -0.00011352  -0.00011352  -0.00011352     -0.00011352    -0.000114
…                    …            …            …               …          …
2019-11-04 -0.000568921 -0.000406108 -8.14266e-05    -0.000162443    -0.000352
2019-11-05 -0.000405383 -0.000569152 -0.000405383    -0.000162615    -0.000460
2019-11-06  8.13736e-05  8.13736e-05  8.13736e-05     8.13736e-05     0.000081
2019-11-07  -0.00081057  -0.00081057  -0.00081057     -0.00081057    -0.000811
2019-11-08            0            0            0               0     0.000000

[768 rows x 5 columns]
```

[20]:

```
features['intra_diff_15_5'].plot()
features['intra_ret_15'].plot()
```

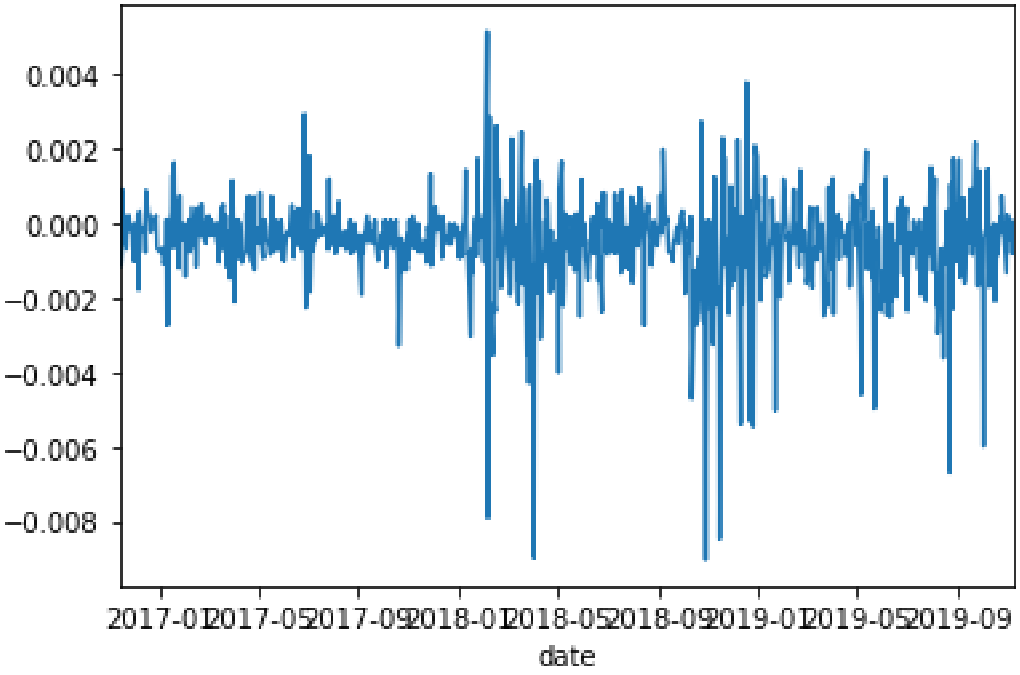
[20]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fe85a62b210>
```



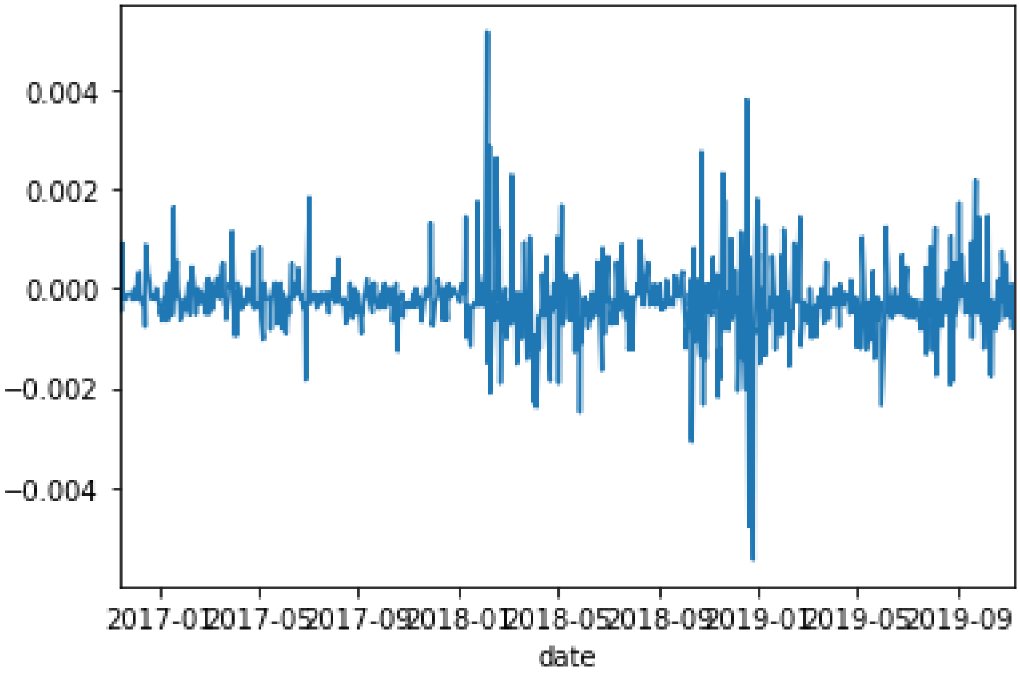
```
[21]: features['intra_ret_15'].plot()
```

```
[21]: <matplotlib.axes._subplots.AxesSubplot at 0x7fe85a410210>
```



```
[23]: features['intra_ret_1'].plot()
```

```
[23]: <matplotlib.axes._subplots.AxesSubplot at 0x7fe85a6456d0>
```



[ ]:
```
data_min
```

[ ]:
```
data_min_sort = data_min.dropna().sort_values(by = 'ret_5')
print(data_min_sort.shape)
data_min_sort.head()
```

[ ]:
```
data_min_sort.to_csv('../data/result_analysis/sorted_trump.csv')
```

[ ]:
```
tweet_data.clean_tweets
```