

IRS 990 e-File Data (part 3) – Load Index Files into PANDAS

Python PANDAS Code Bytes

This page contains brief (generally one-liner) blocks of code for working with Python and [PANDAS](#) for data analytics. I created it as a handy reference for PANDAS commands I tended to forget when I was learning. I hope it proves useful to you, too! I also have a page with longer [data analytics tutorials](#).

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Jupyter Notebook Settings

Set width of columns for display:

```
pd.set_option('display.max_columns', None)
```

Set cell width:

```
pd.set_option('max_colwidth', 150)
```

Working with Python Lists

Break list into chunks of 4 (needed for some APIs, for example)

```
mylist_chunked = [mylist[i:i+4] for i in xrange(0, len(mylist), 4)]
```

Finding duplicates in a list:

```
import collections
mylist = ['twitter', 'facebook', 'instagram', 'twitter']
[item for item, count in collections.Counter(mylist).items() if count > 1]
```

Remove list element:

```
mylist.remove('revenue')
```

Working with Python Dictionaries

Delete a key from a dictionary:

```
del dict[key]['key_to_delete']
```

Create sub-dictionary (from sub-set of keys):

```
subdict = {k: dict[k] for k in ('key1', 'key2')}
```

Analysis

Cross-tabulation:

```
pd.crosstab(df['var1'], df['var2'])
```

Generating New Variables, Arrays, etc.

Create list from dataframe column:

```
screen_names = df['screen_name'].tolist()
```

Create list of unique column values in DF:

```
tickers_in_df = pd.unique(df.ticker.ravel()).tolist()
```

Convert string variable to float:

```
df['count_V2'] =  
df['count'].convert_objects(convert_numeric=True)
```

Convert float column to int (only works if there are no missing values):

```
df_2014['rt_count'] = df_2014['rt_count'].astype(int)
```

Convert column to string:

```
df.index = df.index.astype(str)
```

Create new variable as a slice of an existing one:

```
df['cusip8'] = df['cusip'].apply(lambda x: x[:8])
```

Replace a word *within* a column with another word:

```
df['8-K'] = df['8-K'].str.replace('Item', 'Section')
```

Fill in missing values for one column with zero:

```
df_2014['rt_count'] = df_2014['rt_count'].fillna(0)
```

Get new list of unique items in a list:

```
screen_names_unique = list(set(screen_names))
```

Create dummy variable based on whether another column contains specific text (values will be 'True' and 'False'):

```
df['retweeted_status_dummy'] =  
df['retweeted_status'].str.contains('THIS', na=False)
```

Then convert to float (will convert 'True' and 'False' categories of above variable into '1' and '0', respectively):

```
df['retweeted_status_dummy'] =  
df['retweeted_status_dummy'].astype(float)
```

Replace values (here, replace 'None' with '0'):

```
df['reply_message'] =  
df['in_reply_to_screen_name'].replace([None], ['0'])
```

Replace values (here, replace np.nan values with '0'):

```
df.ix[df.Number_of_retweets.isnull(),  
      'Number_of_retweets'] = 0
```

Switch values of '0' and '1':

```
df['reply_message'] = df['reply_message'].replace([1],  
          [99]).replace([0],[1]).replace([99],[0])
```

Create binary variable from count variable (if old var=0, assign value of 0; otherwise 1):

```
df['urls'] = np.where(df['entities_urls_count']==0, 0, 1)
```

Change each unicode element in a list to string:

```
tickers_in_df = [x.encode('UTF8') for x in tickers_in_df]
```

Change column values to upper case:

```
df['Name'] = df['Name'].apply(lambda x: x.upper())
```

Change column values to upper case:

```
sec['8-K Item'] = sec['8-K Item'].str.upper()
```

Find number of unique values:

```
len(pd.unique(compustat_2013.cusip.ravel()))
```

Add leading zeros to string variable (as many as needed to reach 10 characters):

```
df['cik_x'] = df['cik_x'].apply(lambda x: x.zfill(10))
```

Convert column to string and add leading zeros:

```
df['CIK_10'] = df['CIK'].astype(str).apply(lambda x: x.zfill(10))
```

Get a list of values from a DF column:

```
values_list = df['8-K'].value_counts().keys().tolist()
```

Find number of cases with fewer than the mean value:

```
sum(df['followers_count'] < df['followers_count'].mean())
```

I/O

Read in a pickled dataframe:

```
ticker_master = pd.read_pickle('valid_tickers_317.pkl')
```

Read in JSON file:

```
f = open('valid_tickers_list_317.json', 'r')
valid_tickers = simplejson.load(f)
```

Read in JSON file -- method 2:

```
with open('my_list.json', 'r') as fp:
```

```
my_list = json.load(fp)
```

Save a list as JSON file:

```
f = open('all_valid_screen_names.json', 'w')
simplejson.dump(valid_twitter_accounts, f)
f.close()
```

Save a list as JSON file -- method 2:

```
with open('my_list.json', 'w') as fp:
    json.dump(my_list, fp)
```

Read in Excel file:

```
twitter_accounts = pd.read_excel('Twitter Account-level
Database – non-excluded tickers and accounts only.xlsx',
                                'accounts', header=0)
```

Write Excel file:

```
df.to_excel('df.xls', sheet_name='Sheet1')
```

Looping

Looping over rows (note how to select a slice of rows):

```
for index, row in df[:10].iterrows():
    print index, row['content']
```

Loop over rows and update existing variable:

```
for index, row in df.iterrows():
    df['count'] = count
```

Loop over rows and create new variable, method 1:

```
for index, row in df.iterrows():
    #df.ix[df.index==index, 'count'] = count #LONGER
    VERSION
    df.ix[index, 'count'] = count #SHORTER VERSION
```

Loop over rows and create new variable, method 2:

```
for index, row in df.iterrows():
    df.loc[index, 'count'] = count
```

Time Series

Weekdays:

```
weekdays_only = by_day2[by_day2['weekday'] < 5 ]
weekday_count = df.groupby(ts.index.weekday).apply(f)
by_day3['weekday'] = by_day['date'].apply(lambda x:
    x.weekday())
```

Add missing days (with zeros) for every day in a dataframe:

```
df_filled = df.unstack().fillna(0).stack()
```

Change specific columns

```
df_filled.loc[df_filled['Number of Firm Tweets'] == 0,
['Number of Firm Followers (start)', 'Number of Lists for
Firm (start)']] = np.nan
```

Set column to datetime:

```
df['created_at'] = pd.to_datetime(df['created_at'])
```

Convert datetime column to date:

```
df['date'] = [t.date() for t in df['datetime']]
```

Generate lagged variable with multi-index DF:

```
df['Mentions [t-1]'] =
df['Mentions'].unstack().shift(1).stack()
```

Generate variable aggregated over 3-day window lagged one day:

```
df['Mentions [sum of t-1:t-3]'] =
pd.rolling_sum(df['Mentions'].unstack().shift(),
    window=3).stack()
```

Select date range for DF:

```
df_2014 = df['2014-1-1':'2014-12-31']
```

Indexing and Sorting

Set the index:

```
df = df.set_index(['created_at'])
```

Reset Index:

```
df.reset_index(inplace=True)
```

Set Multi-Index:

```
df = df.set_index(['ticker', 'day'])
```

Sort dataframe:

```
df.sort(['ticker', 'day'], inplace=True)
```

Name Existing Multi-index columns:

```
df.index.names = ['day', 'ticker']
```

With multi-index df -- get unique items per index level:

```
len(firm_day_counts_firm_tweets.index.levels[0])  
len(firm_day_counts_firm_tweets.index.levels[1])
```

Swap levels on multi-index dataframe:

```
df_swapped = df.swaplevel('ticker', 'day')
```

Get minimum date in DF:

```
df.index.min()
```

Complex conditional row selection during loop:

```
if (row['Form Type'] == '8-K') and (row['8-K Item']=="")  
and (row['8-K Item - V2']=="") or (row['8-K Item']=="Item
```



```
that') or (row['8-K Item']=='Item fo')):
```

Missing Data

Interpolation with backfill and forward fill (n.b. - does not respect multi-index):

```
df['F_x')]=df['F'].interpolate(method='linear').bfill().ffill()
```

Find rows with empty column:

```
missing = df[df['ticker'].isnull()]
```

Fill missing values in one column with values from another column:

```
sec.loc[sec['8-K Item_v2'].isnull(), '8-K Item_v2'] = sec['8-K Item']
```

Custom Functions

Function for generating a series of new one-day lag variables in a dataframe:

```
def lag_one_day(df):
    #df_cols = df.columns
    df_cols = [u'Number of Firm Mentions', u'Number of Firm Tweets']
    for i in df_cols:
        col = str(i)+str('[t-1]')
        if '[t-1]' not in str(i):
            df[col] = df[i].unstack().shift(1).stack()
```

Function for generating a series of new dataframe variables that aggregate over a multi-day period:

```
def lag_one_day(df):
    #df_cols = df.columns
    df_cols = [u'Number of Firm Mentions', u'Number of
```

```

        Firm Tweets']
        for i in df_cols:
            col = str(i)+str('[sum t-1:t-3]')
            if '[t-1]' not in str(i):
                df[col] =
pd.rolling_sum(df[i].unstack().shift(),
                window=3).stack()

```

DataFrame Manipulations

Subset of DF -- based on a condition in a column:

```
df[df['reply_message'] == 1]
```

Subset of DF -- specific columns:

```
df[['in_reply_to_screen_name', 'in_reply_to_status_id',
    'reply_message']].head()
```

Drop a column:

```
df = df.drop('entities_urls',1)
```

Intersection of two lists:

```
pd.Series(np.intersect1d(pd.Series(tickers_in_df),
    pd.Series(valid_tickers)))
```

Difference between two lists (all different elements from either list):

```
set(tickers_in_df).symmetric_difference(valid_tickers_with
    _twitter)
```

Difference between two lists (elements from list1 missing from list2):

```
set(list1) - set(list2)
```

Create DF based on whether column value is in a list:

```
df = df[df.ticker.isin(mylist)]
```

Creat an empty dataframe:

```
columns = ['ticker', 'month', 'degree']
```

```
df = pd.DataFrame(columns=columns)
```

Add row (row 0) to empty dataframe:

```
df.loc[0] = pd.Series({'ticker': 'Z', 'month': '12',  
                      'degree': ''})
```

Change cell column values for a specific row (index=16458):

```
sec.ix[16458, "8-K Item - V2"] = 'Item 2.01'
```

Create dataframe from list/dictionary:

```
months = ['2014-1', '2014-2', '2104-3']
```

```
data = {'month': months}
```

```
df = pd.DataFrame(data, columns=['month', 'degree'])
```

Add rows to a dataframe:

```
df = df.append(df_month)
```

Create dataframe from list of column names:

```
d = {'Variable Name': list(df.columns.values)}  
variables = DataFrame(d)
```

Create dataframe by deleting all rows with null values in one column:

```
df2 = df[df['keep'].notnull()]
```

Rename a single column:

```
df.rename(columns={'cusip': 'cusip_COMPUSTAT'},  
         inplace=True)
```

Create dataframe based on column value appearing in a list:

```
missing = df[df['cusip'].isin(mylist)]
```

Look for duplicates in a dataframe:

```
counts = merged.groupby('cusip').size()
df2 = pd.DataFrame(counts, columns = ['size'])
df2 = df2[df2.size>1]
df2
```

Create version of dataframe with conditions on two variables
(for removing a duplicate firm):

```
merged = merged[~((merged['fyear']==2012) &
(merged['gvkey']=='176103'))]
```

Select partial dataframe -- complex conditions:

```
sec[(sec['Form Type'] == '8-K') & (sec['8-K Item']==") &
(sec['8-K Item - V2']==") | (sec['8-K Item']=='Item fo') &
(sec['8-K Item - V2']==") | (sec['8-K Item']=='Item that')
& (sec['8-K Item - V2']==")]
```

Merge two dataframes:

```
merged = pd.merge(fb, org_data, left_on='feed_id',
right_on='Org_ID')
```

Deep copy of DF:

```
df2 = df.copy(deep=True)
```

Get a slice of dataframe (here, the two rows with the given
indexes):

```
df.loc[11516:11517]
```

Custom Twitter Variables

Time on Twitter:

```
import datetime
df['start']=np.datetime64('2016-04-01')
df['created_at'] = pd.to_datetime(df['created_at'])
df['time_on_twitter'] = df['start'] - df['created_at']
```

```
df['time_on_twitter_days'] =  
df['time_on_twitter'].astype('timedelta64[D]')  
df['time_on_twitter_days'] =  
df.time_on_twitter_days.astype('int')
```

Working with MongoDB in PANDAS

Show first 2 documents:

```
for user in users.find()[:2]:  
    print user, '\n'
```

Get frequency counts:

```
from bson.son import SON  
pipeline = [ {"$group": {"_id": "$FormType", "count":  
                        {"$sum": 1}}} ]  
list(file_list.aggregate(pipeline))
```

I hope you have found this helpful. If so, please spread the word, and happy coding!

Python Data Analytics Tutorials

The bulk of my research involves some degree of 'Big Data' – such as datasets with a million or more tweets. Getting these data prepped for analysis can involve massive amounts of data manipulation – anything from aggregating data to the daily or organizational level, to merging in additional variables, to generating data required for social network analysis. For all such steps I now almost exclusively use Python's [PANDAS](#) library ('Python Data Analysis Library'). In conjunction with the [Jupyter Notebook](#) interactive computing framework and

packages such as [NetworkX](#), you will have a powerful set of analysis tools at your disposal. This page contains links to the tutorials I have created to help you learn data analytics in Python. I also have a page with shorter (typically one-liner) [data analytic code bytes](#).

Data Collection

- [Python: Where to Start?](#)
- [Running your first code](#)
- [Four ways to run your code](#)
- [Setting up Your Computer to Use My Python Code](#)
 - [Setting up Access to the Twitter API](#)
 - [Using Your Twitter API Key](#)
- [Using Python to Grab Twitter User Data](#)