Time_Series_Hitch_Client_Project

January 24, 2017

1 Hitch Demand Prediction

1. This project is done in Python 2.7. I'll use a dataset of Hitch client logins and attemp to predict future demand based on historical data. Models that will be used include:

- statsmodels
- Scipy.stats

```
In [1]: import pandas as pd
        import numpy as np
        import statsmodels.api as sm
        from scipy import stats
        import matplotlib.pyplot as plt
        print pd.__version__
        %matplotlib inline
```

```
0.19.1
```

```
In [2]: # First, load the data.
        ts = pd.read_json('data/logins.json',typ='series')
        print ts.shape
        ts.head()
```

```
(22447,)
```

```
Out[2]: 0   2012-03-01 00:05:55
        1   2012-03-01 00:06:23
        2   2012-03-01 00:06:52
        3   2012-03-01 00:11:23
        4   2012-03-01 00:12:47
        dtype: datetime64[ns]
```

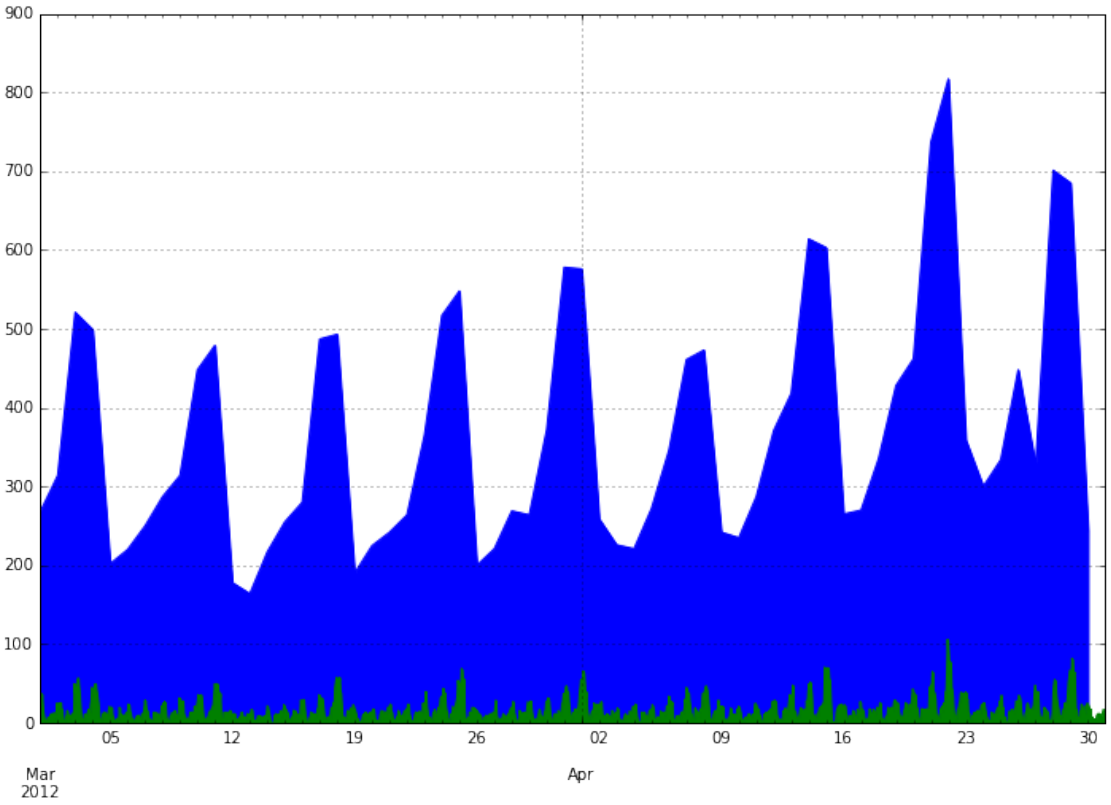
2. The indices is the timestamps. The values created should be a series of ones so that we can count them. I convert the data frame so that it looks like this (where the left column is the index):

```
In [3]: ts = pd.Series(1,ts)
```

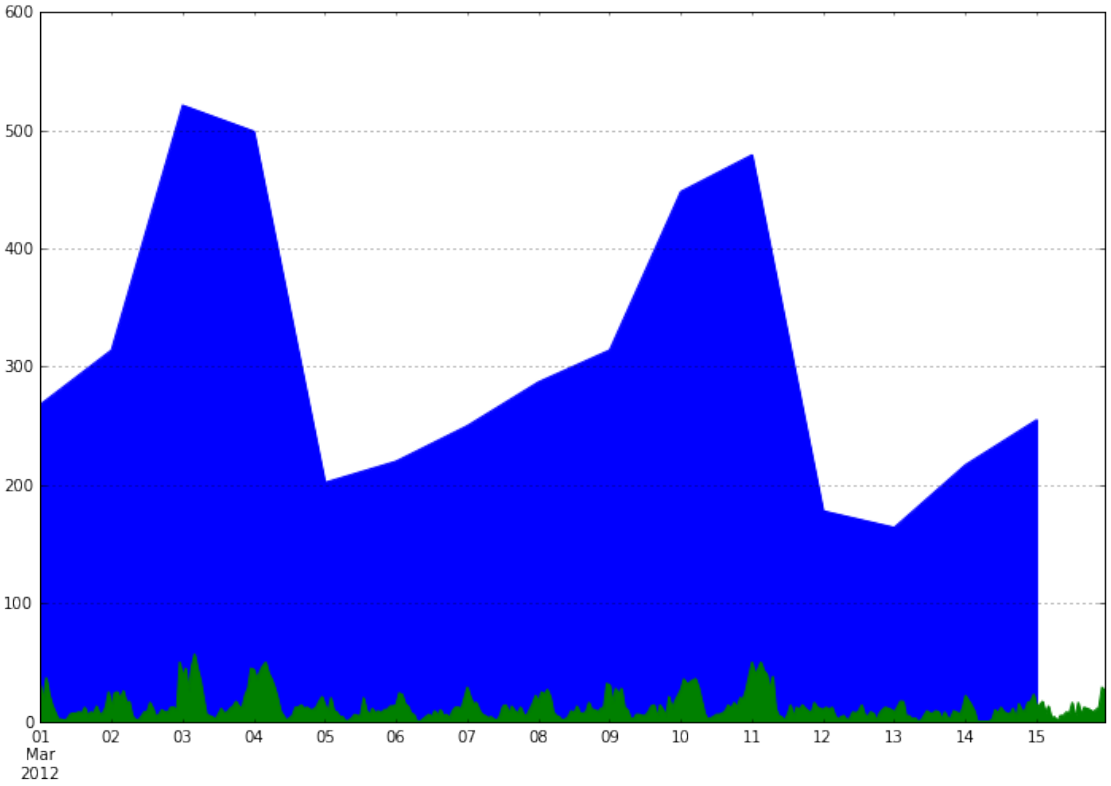
```
In [4]: ts.head()
```

```
Out[4]: 2012-03-01 00:05:55    1
        2012-03-01 00:06:23    1
        2012-03-01 00:06:52    1
        2012-03-01 00:11:23    1
        2012-03-01 00:12:47    1
        dtype: int64
```

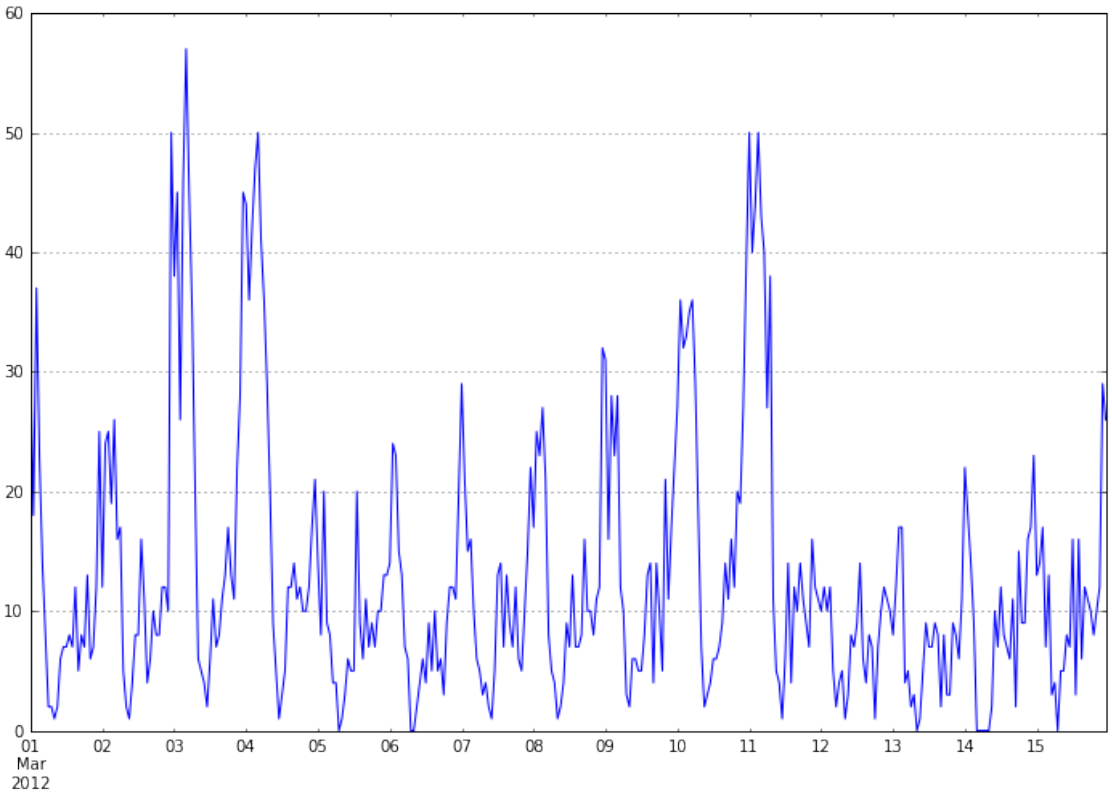
```
In [5]: ts_day = ts.resample(rule = 'D').count() #group by day
        ts_day.tail()

Out[5]: 2012-04-26    448
        2012-04-27    327
        2012-04-28    701
        2012-04-29    685
        2012-04-30    244
        Freq: D, dtype: int64

In [6]: ts_hour = ts.resample(rule = 'H').count()
        ts_hour.head()

Out[6]: 2012-03-01 00:00:00    31
        2012-03-01 01:00:00    18
        2012-03-01 02:00:00    37
        2012-03-01 03:00:00    23
        2012-03-01 04:00:00    14
        Freq: H, dtype: int64

In [7]: ts_day.plot(figsize = (12,8),kind = 'area');
        ts_hour.plot(kind = 'area', grid=True, figsize = (12,8));
```




```
In [8]: # Zoom in by slicing the index
        ts_day['2012-03-01':'2012-03-15'].plot(figsize = (12,8),kind = 'area');
        ts_hour['2012-03-01':'2012-03-15'].plot(kind = 'area', grid=True, figsize = (12,8));
```



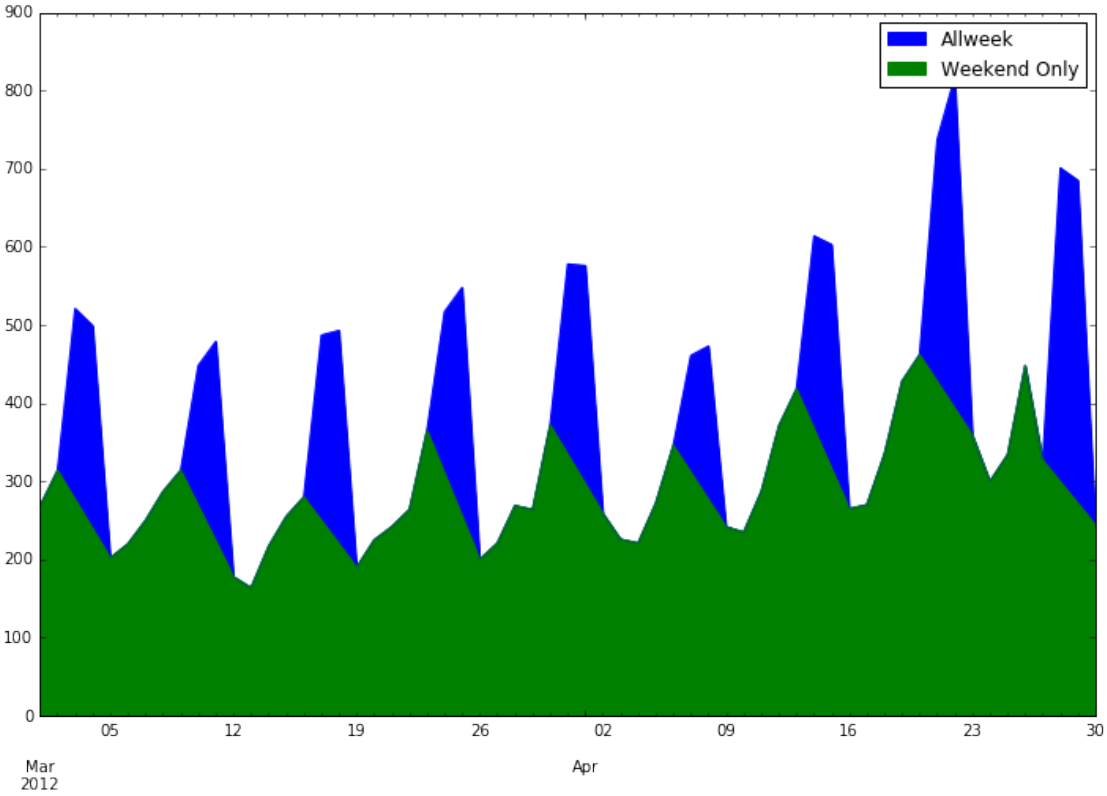

```
In [9]: ts_hour['2012-03-01':'2012-03-15'].plot(kind = 'line', grid=True, figsize = (12,8));
```



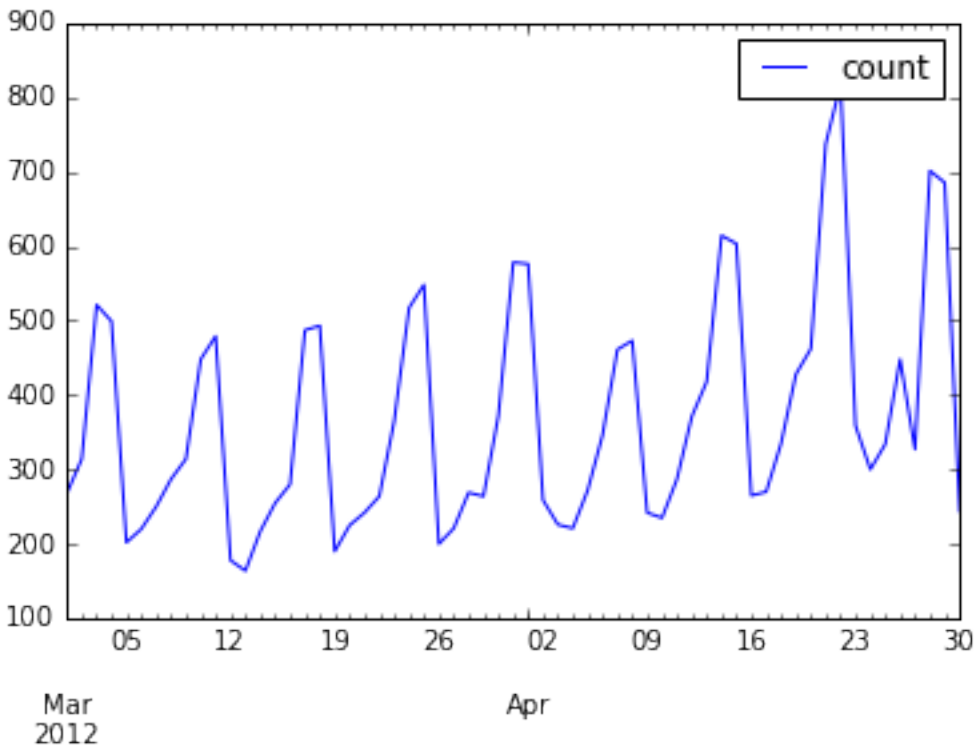
Create a dataframe that has count and dayofweek features.

```
In [10]: df = pd.DataFrame(ts_day)
         df.rename(columns = {0:'count'}, inplace=True)
         df.head()

Out[10]:             count
         2012-03-01    268
         2012-03-02    314
         2012-03-03    521
         2012-03-04    499
         2012-03-05    202

In [11]: df['weekofday'] = pd.DatetimeIndex(df.index).weekday
         # Or use the following
         #df['weekofday'] = pd.to_datetime(df.index).weekday

In [12]: df['weekend'] = df['weekofday']>=5
         df.head()

Out[12]:             count  weekofday weekend
         2012-03-01    268          3   False
         2012-03-02    314          4   False
         2012-03-03    521          5    True
         2012-03-04    499          6    True
         2012-03-05    202          0   False
```

```
In [13]: #filter or masking
         df[df['weekofday']>=5]['count'].sum()

Out[13]: 10237

In [14]: df[df['weekofday']<5]['count'].sum()

Out[14]: 12210

In [15]: df['count'].plot(figsize=(12,8),kind = 'area', label = 'Allweek')
         df[df['weekofday']<5]['count'].plot(kind='area',label = 'Weekend Only')
         plt.legend();
```

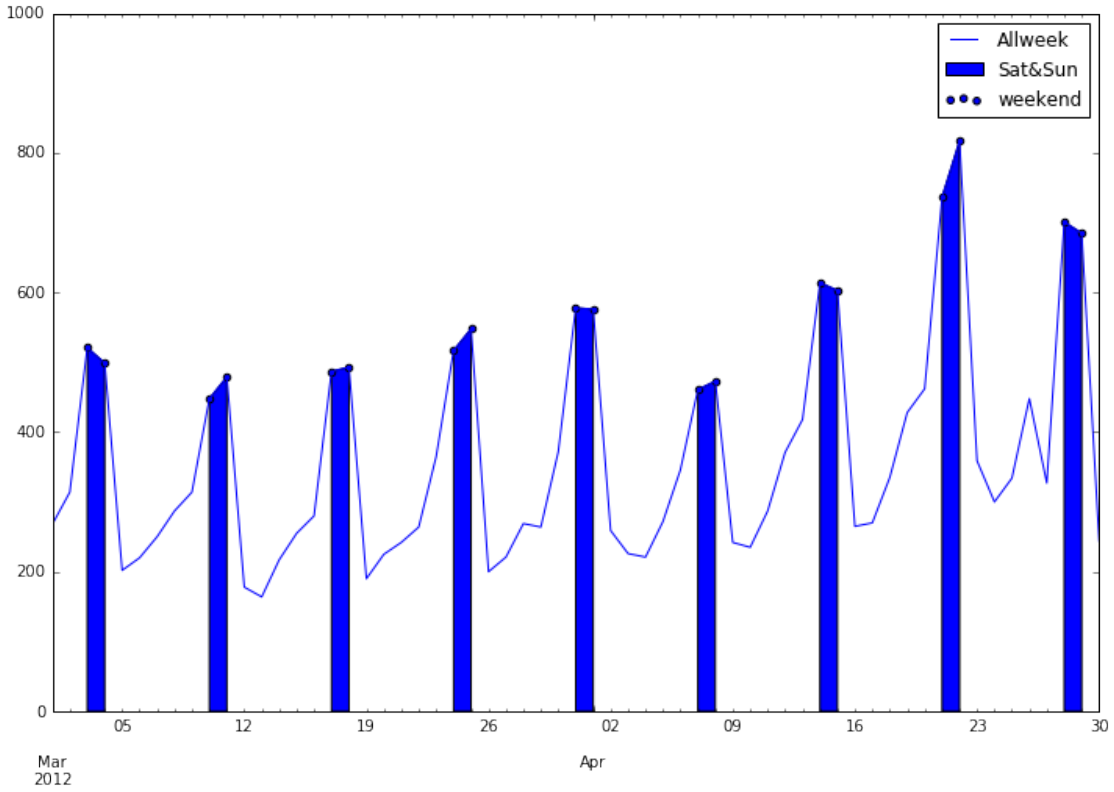



```
In [16]: df.plot(df.index, y = 'count')
         plt.legend();
```



Show strong seasonal component to the data. I'd be willing to bet that the peaks are weekend demand. Let's see if that's true by highlighting the weekends on our plot with fill_between weekend.

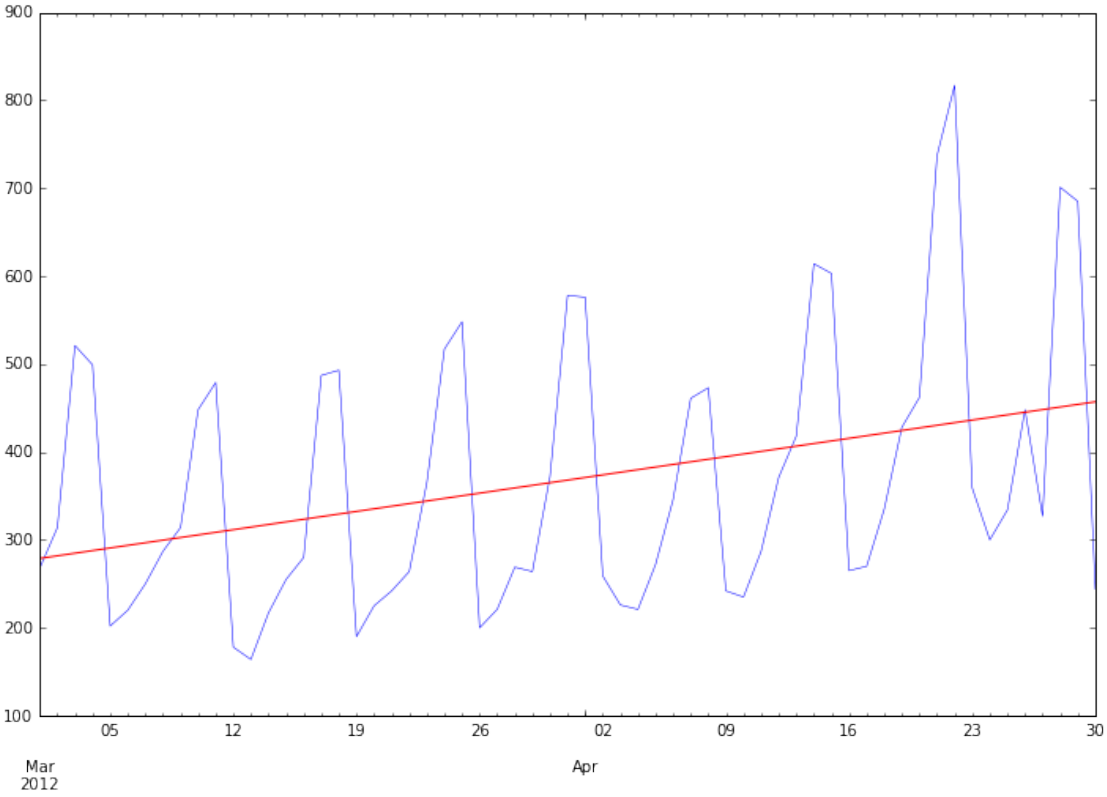
```
In [17]: df['count'].plot(figsize=(12,8),kind = 'line', label = 'Allweek')
         plt.fill_between(df.index, df['count'], where = df['weekend'], label = 'Sat&Sun')
         df1 = df[df['weekofday']>=5]
         plt.scatter(x = df1.index, y = df1['count'], label = 'weekend')
         # df1['count'].plot(kind = 'area')
         plt.ylim(0,1000)
         plt.legend();
```



1.0.1 Box-Jenkins Methodology

- determine if the data is stationary
- Plot the ACF/PACF with 28 lags (Approx. 4 weeks – See snippet of code below)

```
In [18]: y = ts_day.values
         X = range(1, ts_day.shape[0]+1)
         model = sm.OLS(y, sm.add_constant(X)).fit()

In [19]: ts_day.plot(figsize=(12,8), lw=0.5)
         pd.Series(model.fittedvalues, index=ts_day.index).plot(style='r')

Out[19]: <matplotlib.axes._subplots.AxesSubplot at 0x11b16dd10>
```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Apr