TA (1)

January 26, 2018

In [1]:
```
import vcf
import vcf.utils
import pandas
import os
import pandas as pd
import itertools
from itertools import groupby
from numpy import *
import operator
import seaborn as sns
import numpy as np
import matplotlib as mpl
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import matplotlib
%matplotlib inline
from scipy.special import logit
import datetime as DT
```

DAta Diamension and checking for null or NAN values

In [2]:
```
TA_log=pd.read_csv('TA_analysis.csv',sep=',',header=0,error_bad_lines = False)
TA_log['ts'] = pd.to_datetime(TA_log['ts'], errors='coerce')
print("Number of rows: ", TA_log.shape[0])

print("Number of rows with null: ",TA_log[TA_log.isnull().any(axis=1)].shape[0])
```

```
Number of rows:  669491
Number of rows with null:  18
```

Changing the Timestamp here for each user with date Week Business hours and Weekend

In [4]:
```
from datetime import datetime
import datetime
TA_log['day_of_week'] =TA_log['ts'].dt.weekday_name
TA_log['date'] = TA_log.ts.dt.floor('d')
TA_log['Busi_days'] = TA_log['ts'].dt.dayofweek < 5
TA_log['Busi_hours'] = TA_log['ts'].dt.time.between(datetime.time(9), datetime.time(18))
```

Adding the days for the days of week values

In [7]:
```
days=["Monday","Tuesday","Wednesday","Thursday","Friday"]
```

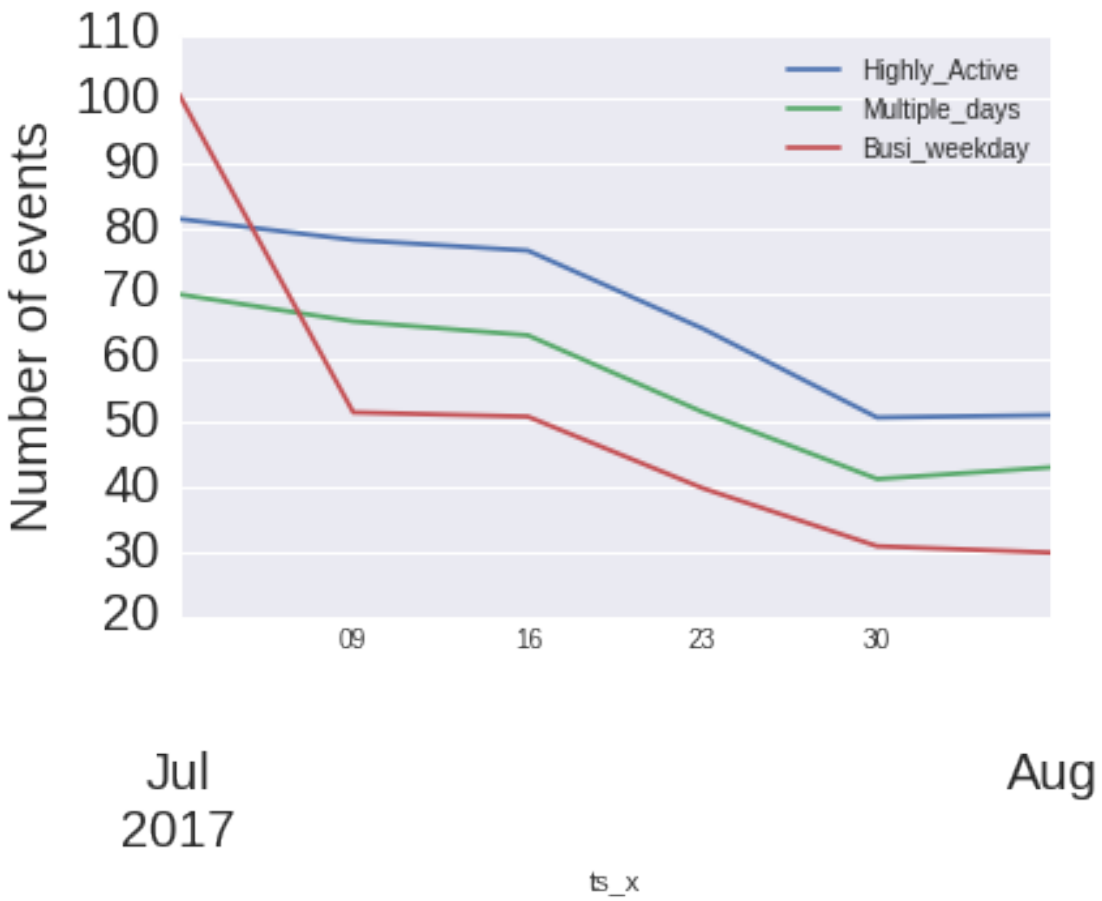
In [8]:
```
TA_log['DAYS']=np.where(TA_log['day_of_week'].isin(days), 'Busniess_weekday','Weekend')
```

Distribution of usersacross the month in between the Weekends and Weekdays

In [215]:
```
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.dates as mdates
fig, ax = plt.subplots()
ax.set_ylabel('Number of events', fontsize = 20.0)
plt.xticks(size = 20)
plt.yticks(size = 20)
import seaborn as sns

sns.set(rc={'figure.figsize':(15,5)})
for TA in New_melt_new_annon.Activity.unique():
    TA_df = New_melt_new_annon.loc[New_melt_new_annon.Activity == TA]
    TA_df.index = TA_df['ts_x']
    TA_df = TA_df.resample('1W')
    TA_df.plot(x=TA_df.index,
                    y='ts_y',
                    ax=ax,
                    label=TA)
```

```
/home/alva/Tools/anaconda3/lib/python3.4/site-packages/ipykernel/__main__.py:15: FutureWarning: .resample
use .resample(...).mean() instead of .resample(...)
/home/alva/Tools/anaconda3/lib/python3.4/site-packages/ipykernel/__main__.py:18: FutureWarning: .resample
use .resample(...).mean() instead of .resample(...)
```




```
In [9]: Counts=TA_log.groupby(by='uuid')['ts'].apply(lambda x: x.nunique())

In [10]: Counts=pd.DataFrame(Counts).reset_index()

In [214]: Counts_annon=pd.merge(TA_log,Counts,on='uuid')
          Counts_annon.sort('ts_x',inplace=True)

/home/alva/Tools/anaconda3/lib/python3.4/site-packages/ipykernel/__main__.py:2: FutureWarning: sort(colu
  from ipykernel import kernelapp as app
```

Counts For Busniess days, multiple days and Highly Active

```
In [206]: Business_active_list=TA_log[(TA_log.Busi_days==True)&(TA_log.Busi_hours==True)].uuid.unique()
          Business_active=TA_log[TA_log['uuid'].isin(Business_active_list)]
          Business_active_high=Business_active.groupby(['uuid']).count()
          Business_active_high.shape

Out[206]: (101290, 8)

In [ ]:

In [195]: New_melt_new[["variable","uuid"]].drop_duplicates().groupby('variable').count()
```

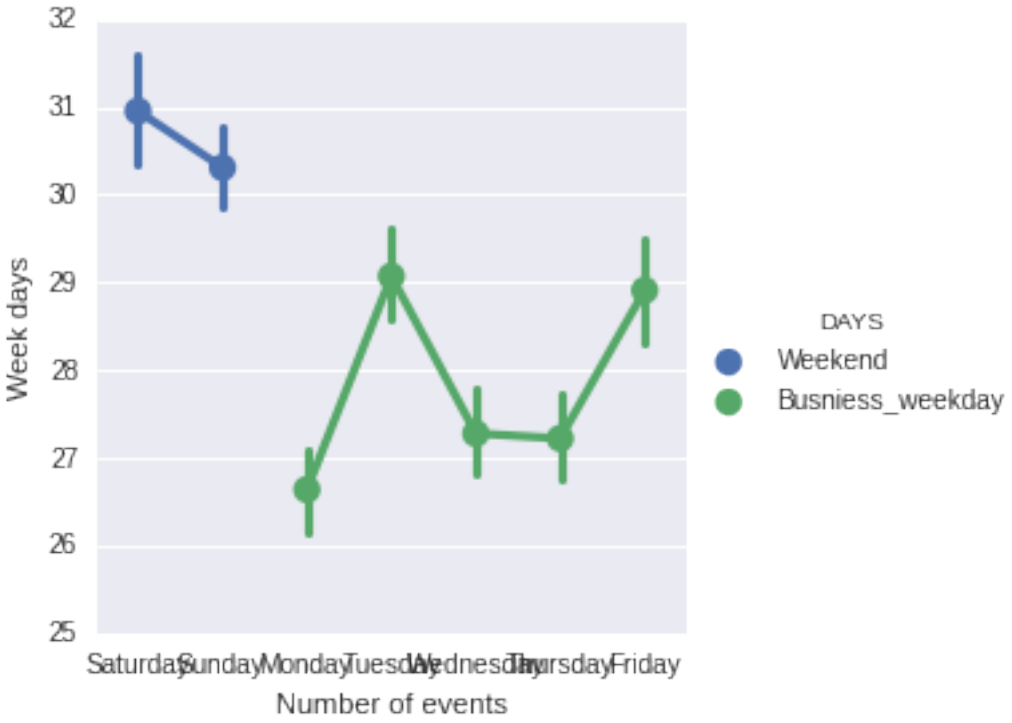
```
Out[195]:                   uuid
          variable
          Busi_weekday    101290
          Highly_Active    13185
          Multiple_days    21262
```

```
In [12]: sns.set_context(rc={"figure.figsize": (15, 13)})

         ax=sns.factorplot(x="day_of_week", y="ts_y", hue="DAYS", data=Counts_annon);
         ax.set(xlabel='Number of events', ylabel='Week days')
```

```
/home/alva/anaconda3/lib/python3.4/site-packages/matplotlib/collections.py:590: FutureWarning: elementwi
  if self._edgecolors == str('face'):
```

```
Out[12]: <seaborn.axisgrid.FacetGrid at 0xa91ef2ac>
```




```
In [199]:
```

```
Out[199]: 101290
```

Adding the features

```
In [53]: TA_log.ts = pd.to_datetime(TA_log.ts)

         TA_log['date'] = TA_log.ts.dt.floor('d')

         u = TA_log.uuid.unique()
         a = TA_log.groupby(['uuid', 'date']).size().reset_index(level=1, drop=True)
```

```
        a = a[a>5]
        New = a[~a.index.duplicated()].astype(bool).reindex(u, fill_value=False).to_frame(name='Highly_
        a = TA_log.groupby('uuid')['ts'].nunique()
        New['Multiple_days'] = a[a>5].astype(bool).reindex(u, fill_value=False)

        a = TA_log[(TA_log.Busi_days==True)&(TA_log.Busi_hours==True)].uuid.unique()
        New['Busi_weekday'] = New.index.isin(a)
        New.reset_index(inplace=True)
```

```
In [226]: def func(df):
              df.ts = pd.to_datetime(df.ts)

              df['date'] = df.ts.dt.floor('d')

              u = df.uuid.unique()
              a = df.groupby(['uuid', 'date']).size().reset_index(level=1, drop=True)
              a = a[a>1]
              target_df = (a[~a.index.duplicated()]
                             .astype(bool).reindex(u, fill_value=False).to_frame(name='Active'))

              a = df.groupby('uuid')['ts'].nunique()
              target_df['Multiple_days'] = a[a>1].astype(bool).reindex(u, fill_value=False)

              a = df.loc[(df.Busi_days==True)&(df.Busi_hours==True)].uuid.unique()
              target_df['Busi_weekday'] = target_df.index.isin(a)
              return target_df
```

0.1 Logististic Regression for fourth feature

```
In [228]: Count_ann_new=pd.merge(New,Counts_annon[["ts_y","uuid"]],on='uuid')
          Count_ann_new.columns[4:]
```

```
Out[228]: Index(['ts_y'], dtype='object')
```

```
In [182]: import statsmodels.api as sm

          train_cols = Count_ann_new.columns[4:]
          logit = sm.Logit(Count_ann_new['Highly_Active'], Count_ann_new['ts_y'])
          result = logit.fit()
          coeff = result.params

          # fit the model
          print (result.summary()) #result has more information
          Count_ann_new['My_feature'] = result.predict()
          Count_ann_new.head()
```

```
Optimization terminated successfully.
         Current function value: 0.572365
         Iterations 8
                           Logit Regression Results
==============================================================================
Dep. Variable:          Highly_Active   No. Observations:               669491
Model:                          Logit   Df Residuals:                   669490
Method:                           MLE   Df Model:                            0
```

```
Date:                Fri, 26 Jan 2018   Pseudo R-squ.:                  0.1479
Time:                        15:09:21   Log-Likelihood:            -3.8319e+05
converged:                       True   LL-Null:                   -4.4973e+05
                                        LLR p-value:                       nan
==============================================================================
                 coef    std err          z      P>|z|      [95.0% Conf. Int.]
------------------------------------------------------------------------------
ts_y           0.0525      0.000    244.574      0.000         0.052     0.053
==============================================================================
```

Out[182]:

	uuid	Highly_Active	Multiple_days	Busi_weekday
0	313908E1F6825D28ADF3FCE451E5B5E5	False	False	True
1	313908E1F6825D28ADF3FCE451E5B5E5	False	False	True
2	313908E1F6825D28ADF3FCE451E5B5E5	False	False	True
3	C7F60E6140A59120D9C9854CA87758DF	False	False	False
4	2DC20DA3585AEDFD846E8679AE5C14C7	True	True	True

	ts_y	My_feature
0	3	0.539278
1	3	0.539278
2	3	0.539278
3	1	0.513117
4	8	0.603443

In [183]:
```
Count_ann_new.query('My_feature ==1').shape ## When HA
```

Out[183]: (1804, 6)

In [179]:
```
Count_ann_new.query('My_feature ==1').shape ## When MD
```

Out[179]: (12705, 7)

In [49]:
```
Counts_annon.std()
```

Out[49]:
```
Busi_days      0.458661
Busi_hours     0.498866
ts_y          81.145601
dtype: float64
```

In [12]:
```
New_melt=pd.melt(New,id_vars='uuid')
New_melt['Activity']=New_melt['variable'].mask(~New_melt['value'], 'NO')

New_melt_new=New_melt.query('Activity !="NO"')
New_melt_new_annon=pd.merge(New_melt_new[["Activity","uuid"]],Counts_annon,on='uuid')
New_melt_new_annon.head()
```

Out[12]:

	Activity	uuid	ts_x	useragent	hashed_ip
0	Highly_Active	2DC20DA3585AEDFD846E8679AE5C14C7	2017-07-11 11:29:40	Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.3...	4F32D980A86D
1	Highly_Active	2DC20DA3585AEDFD846E8679AE5C14C7	2017-07-11 11:29:43	Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.3...	4F32D980A86D
2	Highly_Active	2DC20DA3585AEDFD846E8679AE5C14C7	2017-07-29 15:00:42		
3	Highly_Active	2DC20DA3585AEDFD846E8679AE5C14C7	2017-07-29 15:02:14		
4	Highly_Active	2DC20DA3585AEDFD846E8679AE5C14C7	2017-07-29 15:03:26		

```
2  Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.3...  0147187294E3
3  Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.3...  0147187294E3
4  Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.3...  0147187294E3
```

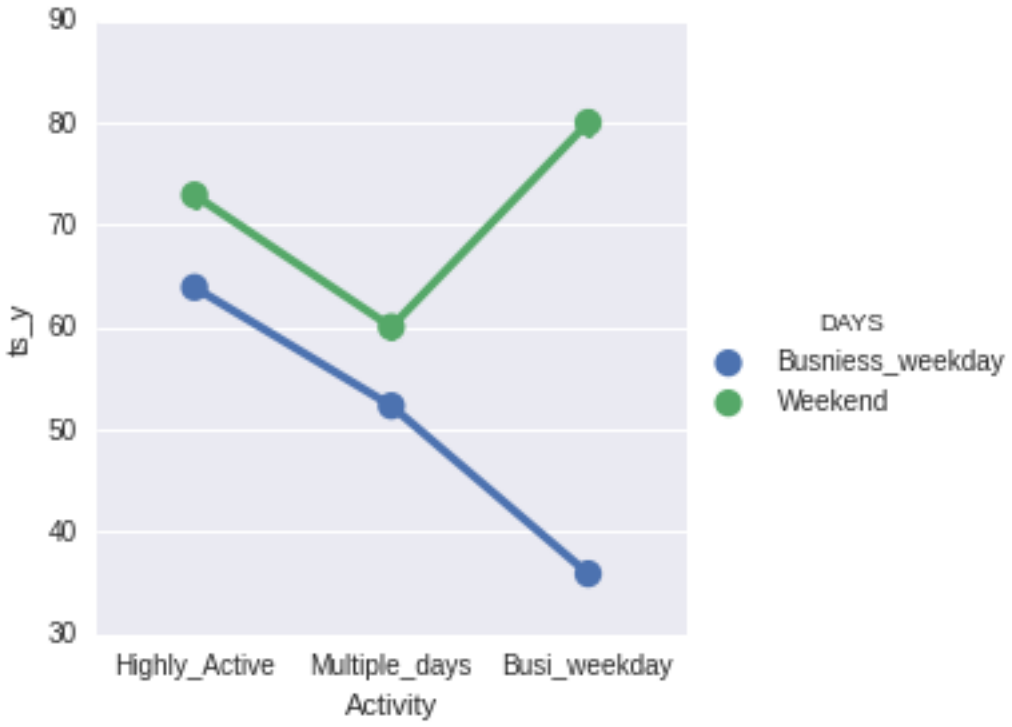
	day_of_week	date	Busi_days	Busi_hours	DAYS	ts_y
0	Tuesday	2017-07-11	True	True	Busniess_weekday	8
1	Tuesday	2017-07-11	True	True	Busniess_weekday	8
2	Saturday	2017-07-29	False	True	Weekend	8
3	Saturday	2017-07-29	False	True	Weekend	8
4	Saturday	2017-07-29	False	True	Weekend	8

In [68]:
```
import matplotlib.dates as mdates

import seaborn as sns

sns.set(rc={'figure.figsize':(15,5)})
sns.factorplot(x='Activity', y='ts_y', hue="DAYS", data=New_melt_new_annon);
```

```
/home/alva/anaconda3/lib/python3.4/site-packages/matplotlib/collections.py:590: FutureWarning: elementwi
  if self._edgecolors == str('face'):
```



In [54]:
```
Week_busi=TA_log[['DAYS','uuid','ts']].groupby(['uuid','DAYS']).count()
Week_busi.reset_index(inplace=True)
Week_busi_annon=pd.merge(Week_busi[["uuid","ts"]],TA_log,on='uuid')
Week_busi_annon.head()
```

Out[54]:

	uuid	ts_x	ts_y	\
0	0000AE02C6B52538D17DFAF66F2ACAF1	1	2017-07-26 23:41:34	

```
1  0000CD03517160EAEDB23A93A16489AE     1 2017-07-23 14:24:34
2  0000F516516CD22AC34384D65FE369B6     4 2017-07-26 21:20:45
3  0000F516516CD22AC34384D65FE369B6     4 2017-07-26 21:23:23
4  0000F516516CD22AC34384D65FE369B6     4 2017-07-26 21:12:51

                                          useragent     hashed_ip  \
0  Mozilla/5.0 (Macintosh; Intel Mac OS X 10_7_5)...  FD16201EBBBE
1  Mozilla/5.0 (Windows NT 6.1; WOW64; rv:54.0) G...  973F5B6D32ED
2  Mozilla/5.0 (Linux; Android 6.0.1; D5803 Build...  26FB5945C6EA
3  Mozilla/5.0 (Linux; Android 6.0.1; D5803 Build...  26FB5945C6EA
4  Mozilla/5.0 (Linux; Android 6.0.1; D5803 Build...  26FB5945C6EA

  day_of_week       date Busi_days Busi_hours              DAYS
0   Wednesday 2017-07-26      True      False  Busniess_weekday
1      Sunday 2017-07-23     False       True           Weekend
2   Wednesday 2017-07-26      True      False  Busniess_weekday
3   Wednesday 2017-07-26      True      False  Busniess_weekday
4   Wednesday 2017-07-26      True      False  Busniess_weekday
```

In [64]:
```
##Distributions of three features across the month
```

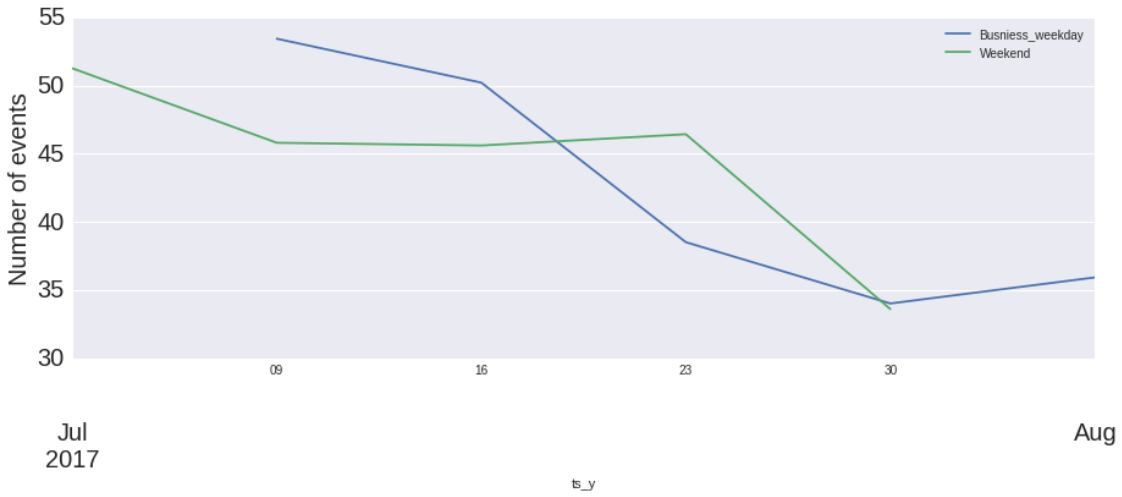
In [62]:
```
##Distributtaion in Highlyactive feature
```

In [63]:
```
Week_busi=TA_log[['DAYS','uuid','ts']].groupby(['uuid','DAYS']).count()
Week_busi.reset_index(inplace=True)
Week_busi_annon=pd.merge(Week_busi[["uuid","ts"]],TA_log,on='uuid')
High_week_busi=Week_busi_annon.query('ts_x>5')
Week_busi_annon.ts_x.max()
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.dates as mdates
fig, ax = plt.subplots()
ax.set_ylabel('Number of events', fontsize = 20.0)
plt.xticks(size = 20)
plt.yticks(size = 20)
import seaborn as sns

sns.set(rc={'figure.figsize':(15,5)})
for TA in High_week_busi.DAYS.unique():
    TA_df = High_week_busi.loc[High_week_busi.DAYS == TA]
    TA_df.index = TA_df['ts_y']
    TA_df = TA_df.resample('1W')
    TA_df.plot(x=TA_df.index,
                    y='ts_x',
                    ax=ax,
                    label=TA)


#plt.savefig('Groups.png')
plt.show()
```

```
/home/alva/anaconda3/lib/python3.4/site-packages/IPython/kernel/__main__.py:20: FutureWarning: .resample(
use .resample(...).mean() instead of .resample(...)
/home/alva/anaconda3/lib/python3.4/site-packages/IPython/kernel/__main__.py:23: FutureWarning: .resample(
use .resample(...).mean() instead of .resample(...)
```



In [185]:

Out[185]: (14320, 8)