Timestemp structure3

May 25, 2016

In [1]:
```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import matplotlib.pyplot as plt
import os
%matplotlib inline

plt.rcParams['figure.figsize'] = (16,5)
os.chdir('E:\\Google Drive\\kaggle\\03-facebook\\data')

train = pd.read_csv('train.csv', index_col='row_id')
train.describe()


test = pd.read_csv('test.csv', index_col='row_id')
test['place_id'] = -1
test.head()
test.describe()
```

Out[1]:

	x	y	accuracy	time	place_id
count	8607230.000000	8607230.000000	8607230.000000	8607230.000000	8607230
mean	4.991417	5.006705	92.652076	890463.661617	-1
std	2.866409	2.886888	124.290613	64467.829800	0
min	0.000000	0.000000	1.000000	786242.000000	-1
25%	2.517000	2.502400	42.000000	833220.000000	-1
50%	4.988000	5.000900	64.000000	887462.000000	-1
75%	7.463600	7.505300	79.000000	945491.000000	-1
max	10.000000	10.000000	1026.000000	1006589.000000	-1

The same thing is for the test set, except: time is in the range of [786242, 1006589] The test and train are time splited. Let's combind two sets and so some analysis

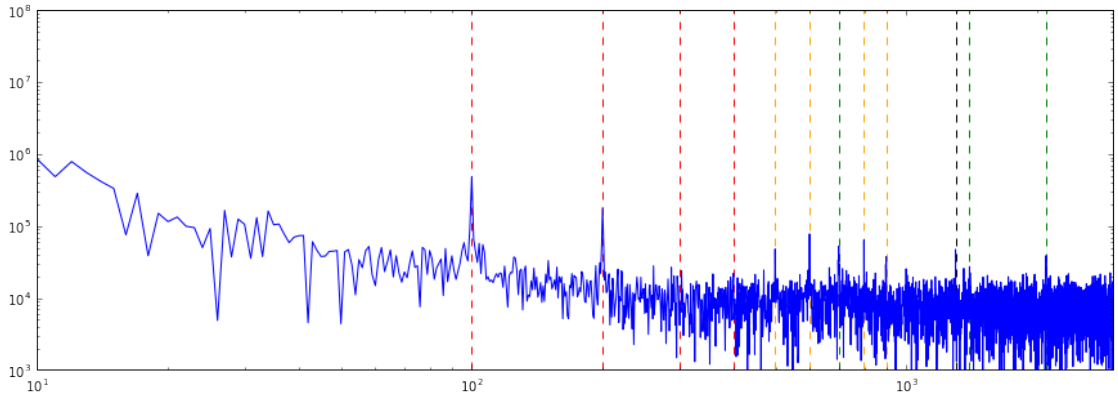
In [2]:
```
df = pd.concat([train, test])
idx_test = (df.place_id == -1)
print(df.head())
```

```
        print(df.tail())
        df.describe()
```

```
x       y  accuracy    time    place_id
row_id
0       0.7941  9.0809        54  470702  8523065625
1       5.9567  4.7968        13  186555  1757726713
2       8.3078  7.0407        74  322648  1137537235
3       7.3665  2.5165        65  704587  6567393236
4       4.0961  1.1307        31  472130  7440663949
              x       y  accuracy    time  place_id
row_id
8607225  4.1206  5.2443        58  882527        -1
8607226  5.1170  5.7695        60  984517        -1
8607227  6.6409  8.3626        19  814024        -1
8607228  6.4190  2.9985        68  862916        -1
8607229  8.1017  7.8736         1  845096        -1
```

```
In [16]: %matplotlib inline
         plt.rcParams['figure.figsize'] = (15, 5.0)
         checkins, bins = np.histogram(df.time, bins = range(0, df.time.max()+60, 60))
         fft = np.fft.fft(checkins)

         plt.xlim(10,3000)
         plt.ylim(10**3,10**8)
         for x in [100, 200, 300, 400]:
             plt.axvline(x,color='red', ls='--')
         for x in [699, 699*2, 699*3]:
             plt.axvline(x,color='green', ls='--')
         for x in [499, 599, 799, 899]:
             plt.axvline(x,color='orange', ls='--')
         for x in [1298]:
             plt.axvline(x,color='black', ls='--')
         plt.loglog(np.sqrt(fft * fft.conj()).real);
         plt.show()
```



The first peak at the lef (Dashed red line) shows 100 events.
The other redlines are its harmonics.
Interestingly, We do not have any harmonic at 300 and 400.

If we have 100 weeks, then we should have 700 days.
If we zoom in, we see that there is a peak at 699 and its harmonics at 1398 and 2097 (green lines).
Orange lines are modulations of the higher frequency event (days) with a lower frequency event (weeks), at 499, 599, 799, 899.

1 Simulation

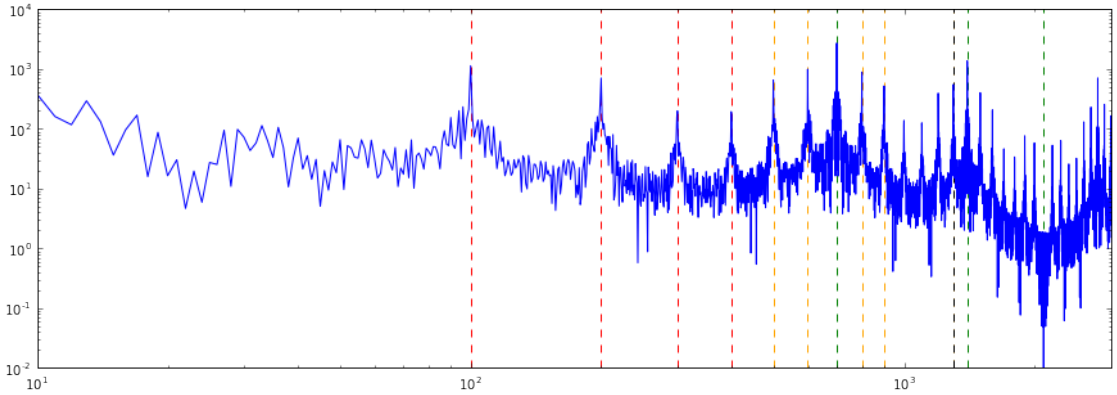
Now lets simulate. We assume a business that is open 8 hours a day, 5 days per week. This business has 1 hour of lunch break. We produce the data for about 100 weeks (699 days)

```
In [3]: rng = pd.date_range('1/1/2013', periods=(100*7-1)*24, freq='H')
        checkin_sim = pd.DataFrame(index = rng)
        checkin_sim['open'] = 0
        checkin_sim['dayofweek'] = rng.dayofweek
        checkin_sim['month'] = rng.month
        checkin_sim['day'] = rng.day
        checkin_sim['hour'] = rng.hour

        checkin_sim.ix[(checkin_sim.hour > 8) & (checkin_sim.hour < 17),'open'] = 1
        checkin_sim.ix[(checkin_sim.hour == 1),'open'] = 0
        checkin_sim.ix[checkin_sim.dayofweek > 4,'open'] = 0
        checkin_sim.ix[(checkin_sim.month == 8) & (checkin_sim.month < 15), 'open'] = 0
        checkin_sim.ix[(checkin_sim.month == 1) & (checkin_sim.month<7), 'open'] = 0
        checkin_sim.ix[(checkin_sim.month == 12) & (checkin_sim.month>24),'open'] = 0
```

```
In [17]: fft = np.fft.fft(checkin_sim.open)

         plt.xlim(10, 3000)
         plt.ylim(0.01, 10**4)
         for x in [100, 200, 300, 400]:
             plt.axvline(x,color='red', ls='--')
         for x in [699, 699*2, 699*3]:
             plt.axvline(x,color='green', ls='--')
         for x in [499, 599, 799, 899, 1298]:
             plt.axvline(x,color='orange', ls='--')
         for x in [1298]:
             plt.axvline(x,color='black', ls='--')
         plt.loglog(np.sqrt(fft * fft.conj()).real);
```



It is similar, isn't it?
My conclusion about time: 1. We have data for 699 days.
2. The time step is one minute.

```
In [5]: df.time.max()/(699*24*60)
```

```
Out[5]: 1
```

Almost there! Here we discovered the unit of time. This remind me of Oil drop experiment, in which Robert Andrews Millikan discovered the unit charge of electricity, the charge of an electron. Let's look at the pattern for 3rd business

```
In [6]: pid = train.place_id.value_counts().index[2]
        (df[df.place_id == pid].time%(24*60*7)).hist(bins=7*24)
        df.min()
```

```
Out[6]: x           0
        y           0
        accuracy    1
        time        1
        place_id   -1
        dtype: float64
```