# Python - Data Processing by Patrick Flynn

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## 0.1 Import Necessary Libraries

[1]:
```
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
import seaborn as sns
import matplotlib.dates as mdates
import numpy as np
```

## 0.2 Read in DataFrame from Excel

[2]:
```
df = pd.read_excel(r'S:\Code\School\WGU_DataAnalyst_NanoDegree\05 - Data␣
↪Visualization\OISdata.xlsx', sheet_name='Data')
#Preview of First 10 Records
df.head(10)
```

[2]:

| | Number | DATETIME | INTERVAL | MONTH | DOW | YEAR | label | \ |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2014-01-28 19:55:00 | 46.000000 | Jan | Tuesday | 2014 | 2014 - 1 | |
| 1 | 2 | 2014-02-28 12:35:00 | 30.694444 | Feb | Friday | 2014 | 2014 - 2 | |
| 2 | 3 | 2014-03-01 20:33:00 | 1.331944 | Mar | Saturday | 2014 | 2014 - 3 | |
| 3 | 4 | 2014-03-13 06:13:00 | 11.402778 | Mar | Thursday | 2014 | 2014 - 4 | |
| 4 | 5 | 2014-03-18 18:19:00 | 5.504167 | Mar | Tuesday | 2014 | 2014 - 5 | |
| 5 | 6 | 2014-04-05 00:18:00 | 17.249306 | Apr | Saturday | 2014 | 2014 - 6 | |
| 6 | 7 | 2014-04-26 11:01:00 | 21.446528 | Apr | Saturday | 2014 | 2014 - 7 | |
| 7 | 8 | 2014-05-27 17:13:00 | 31.258333 | May | Tuesday | 2014 | 2014 - 8 | |
| 8 | 9 | 2014-06-05 08:20:00 | 8.629861 | Jun | Thursday | 2014 | 2014 - 9 | |
| 9 | 10 | 2014-06-21 21:06:00 | 16.531944 | Jun | Saturday | 2014 | 2014 - 10 | |

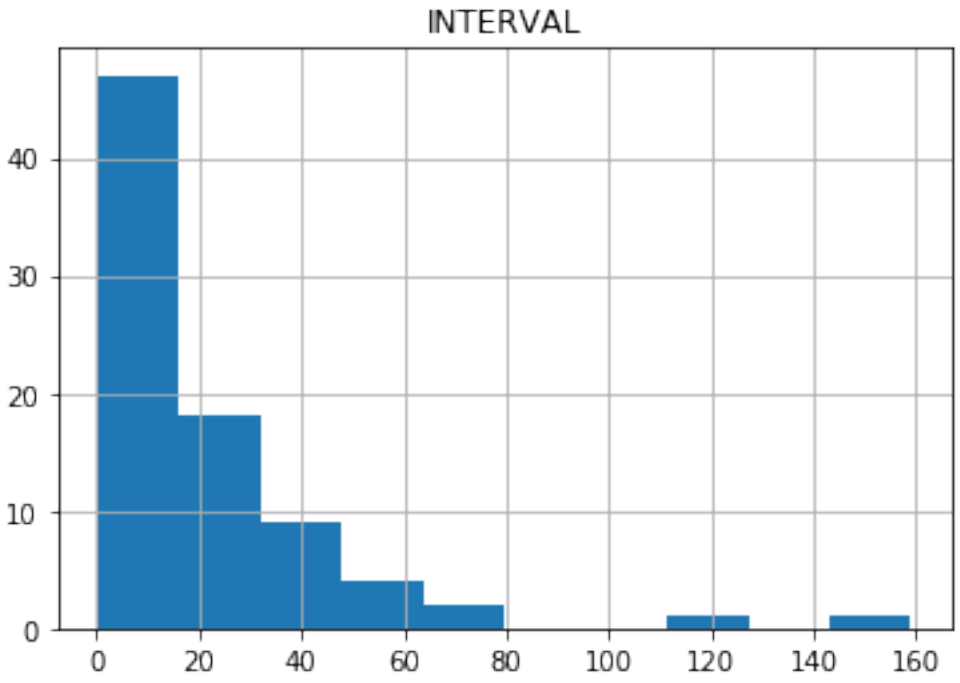
| | TIME | HOUR | Date |
|---|---|---|---|
| 0 | 2014-01-28 19:55:00 | 19 | 2014-01-28 19:55:00 |
| 1 | 2014-02-28 12:35:00 | 12 | 2014-02-28 12:35:00 |
| 2 | 2014-03-01 20:33:00 | 20 | 2014-03-01 20:33:00 |
| 3 | 2014-03-13 06:13:00 | 6 | 2014-03-13 06:13:00 |
| 4 | 2014-03-18 18:19:00 | 18 | 2014-03-18 18:19:00 |
| 5 | 2014-04-05 00:18:00 | 0 | 2014-04-05 00:18:00 |
| 6 | 2014-04-26 11:01:00 | 11 | 2014-04-26 11:01:00 |
| 7 | 2014-05-27 17:13:00 | 17 | 2014-05-27 17:13:00 |

```
8 2014-06-05 08:20:00     8 2014-06-05 08:20:00
9 2014-06-21 21:06:00    21 2014-06-21 21:06:00
```

### 0.3 Visualize the distribution of days between Officer Involved Shootings (interval column)

[3]:
```
#Histogram
df.hist(column='INTERVAL')
```

[3]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000002231101BFD0>]],
      dtype=object)
```




### 0.4 Convert 'DATE' column to a numeric EPOCH time

[4]:
```
test = df.groupby('Date').count()['Number']
test = test.reset_index()
test['Date'] = pd.to_numeric(test['Date'])
test.head()
```

[4]:

| | Date | Number |
|---|---|---|
| 0 | 1390938900000000000 | 1 |
| 1 | 1393590900000000000 | 1 |
| 2 | 1393705980000000000 | 1 |
| 3 | 1394691180000000000 | 1 |
| 4 | 1395166740000000000 | 1 |

### 0.5 Instantiate and Fit K-Means Model to Numeric Date Data

[5]:
```
#Create and Fit Model
mod = KMeans(n_clusters=15)
mod.fit(test)

#Create a labels (labs) column for kmeans category label
test['labs'] = mod.labels_
```

### 0.6 Convert Data Back to DateTime

[6]:
```
test['Date'] = pd.to_datetime(test['Date'])
test['year'] = test['Date'].dt.year
test.head()
```

[6]:

| | Date | Number | labs | year |
|---|---|---|---|---|
| 0 | 2014-01-28 19:55:00 | 1 | 6 | 2014 |
| 1 | 2014-02-28 12:35:00 | 1 | 6 | 2014 |
| 2 | 2014-03-01 20:33:00 | 1 | 6 | 2014 |
| 3 | 2014-03-13 06:13:00 | 1 | 6 | 2014 |
| 4 | 2014-03-18 18:19:00 | 1 | 6 | 2014 |

### 0.7 Create a Text Label for Each Unique Label Integer

[7]:
```
for lab in test['labs'].unique():
    temp_df = test.loc[test['labs'] == lab, :]
    first_date = temp_df.iloc[0]['Date'].strftime('%m/%d/%Y')
    last_date = temp_df.iloc[-1]['Date'].strftime('%m/%d/%Y')
    date_str = first_date + ' - ' + last_date
    test.loc[test['labs'] == lab, 'Text Range'] = date_str
test.head(15)
```

[7]:

| | Date | Number | labs | year | Text Range |
|---|---|---|---|---|---|
| 0 | 2014-01-28 19:55:00 | 1 | 6 | 2014 | 01/28/2014 - 04/26/2014 |
| 1 | 2014-02-28 12:35:00 | 1 | 6 | 2014 | 01/28/2014 - 04/26/2014 |
| 2 | 2014-03-01 20:33:00 | 1 | 6 | 2014 | 01/28/2014 - 04/26/2014 |
| 3 | 2014-03-13 06:13:00 | 1 | 6 | 2014 | 01/28/2014 - 04/26/2014 |
| 4 | 2014-03-18 18:19:00 | 1 | 6 | 2014 | 01/28/2014 - 04/26/2014 |
| 5 | 2014-04-05 00:18:00 | 1 | 6 | 2014 | 01/28/2014 - 04/26/2014 |
| 6 | 2014-04-26 11:01:00 | 1 | 6 | 2014 | 01/28/2014 - 04/26/2014 |
| 7 | 2014-05-27 17:13:00 | 1 | 2 | 2014 | 05/27/2014 - 08/08/2014 |
| 8 | 2014-06-05 08:20:00 | 1 | 2 | 2014 | 05/27/2014 - 08/08/2014 |
| 9 | 2014-06-21 21:06:00 | 1 | 2 | 2014 | 05/27/2014 - 08/08/2014 |
| 10 | 2014-06-23 19:43:00 | 1 | 2 | 2014 | 05/27/2014 - 08/08/2014 |
| 11 | 2014-07-26 03:42:00 | 1 | 2 | 2014 | 05/27/2014 - 08/08/2014 |
| 12 | 2014-07-31 06:52:00 | 1 | 2 | 2014 | 05/27/2014 - 08/08/2014 |
| 13 | 2014-08-08 09:58:00 | 1 | 2 | 2014 | 05/27/2014 - 08/08/2014 |
| 14 | 2014-12-03 02:03:00 | 1 | 14 | 2014 | 12/03/2014 - 12/18/2014 |

### 0.8 Create Helper Analysis File For Easier Labeling/Exploration of Data Vis

[8]:
```
analysis_data = pd.DataFrame()
for label in test['labs'].unique():
    p = test.loc[test['labs'] == label, :]
    td = (p.iloc[-1]['Date'] - p.iloc[0]['Date']).days
    cluster = p['labs'].max()
    length = len(p)
    day_delta = []
    for i in range(0, len(p)):
        if i != 0:
            day_delta.append((p.iloc[i]['Date'] - p.iloc[i-1]['Date']).days)
    day_delta_mean = np.mean(day_delta)
    row = pd.DataFrame([[cluster, length, p.iloc[0]['Date'], p.
 ↪iloc[-1]['Date'], td, day_delta_mean]])
    analysis_data = analysis_data.append(row)

analysis_data.columns = ['Label', 'Length', 'Start_Date', 'End_Date',␣
 ↪'time_delta', 'Mean']
```

### 0.9 Make Date Field Year 2016 for All Records to Trick Visualization

[9]:
```
test['Date'] = test.Date.apply(lambda dt: dt.replace(year=2016))
```

### 0.10 Export DataFrames to Excel

[11]:
```
test.to_excel(r'S:\Code\School\WGU_DataAnalyst_NanoDegree\05 - Data␣
 ↪Visualization\Visualization_Data.xlsx', index=False)
analysis_data.to_excel(r'S:\Code\School\WGU_DataAnalyst_NanoDegree\05 - Data␣
 ↪Visualization\OISdata_analysis.xlsx', index=False)
```