sgij_EDA_mysql

September 9, 2019

1 Exploratory data analysis (EDA) and Machine Learning on the SGIJ MySQL Dataset

Make a EDA Study for all players activate during a year selected

[23]:
```
import math
from datetime import date
from datetime import datetime
from collections import Counter, OrderedDict
import numpy as np
import pandas as pd
from pandas.plotting import scatter_matrix
from pandas.plotting import register_matplotlib_converters
import matplotlib
import matplotlib.pyplot as plt
import mysql.connector
from sklearn.cluster import KMeans
from sklearn import metrics
from scipy.stats import linregress
from scipy import stats
from scipy.spatial.distance import cdist
from IPython.display import display, Markdown
%matplotlib inline

register_matplotlib_converters()
```

Connect to MySQL databasef from credentials

NoteNook Year EDA Study

[3]:
```
YEAR = 2015
```

MySQL Database connection string

[4]:
```
config = {
  'user': 'root',
  'password': 'thingtrack',
  'host': '127.0.0.1',
```

```
  'database': 'gaming',
  'raise_on_warnings': True,
  'charset': 'utf8'
}

try:
  cnx = mysql.connector.connect(**config)
except mysql.connector.Error as err:
  if err.errno == errorcode.ER_ACCESS_DENIED_ERROR:
    print("Something is wrong with your user name or password")
  elif err.errno == errorcode.ER_BAD_DB_ERROR:
    print("Database does not exist")
  else:
    print(err)
```

1.1 Sex player distribution

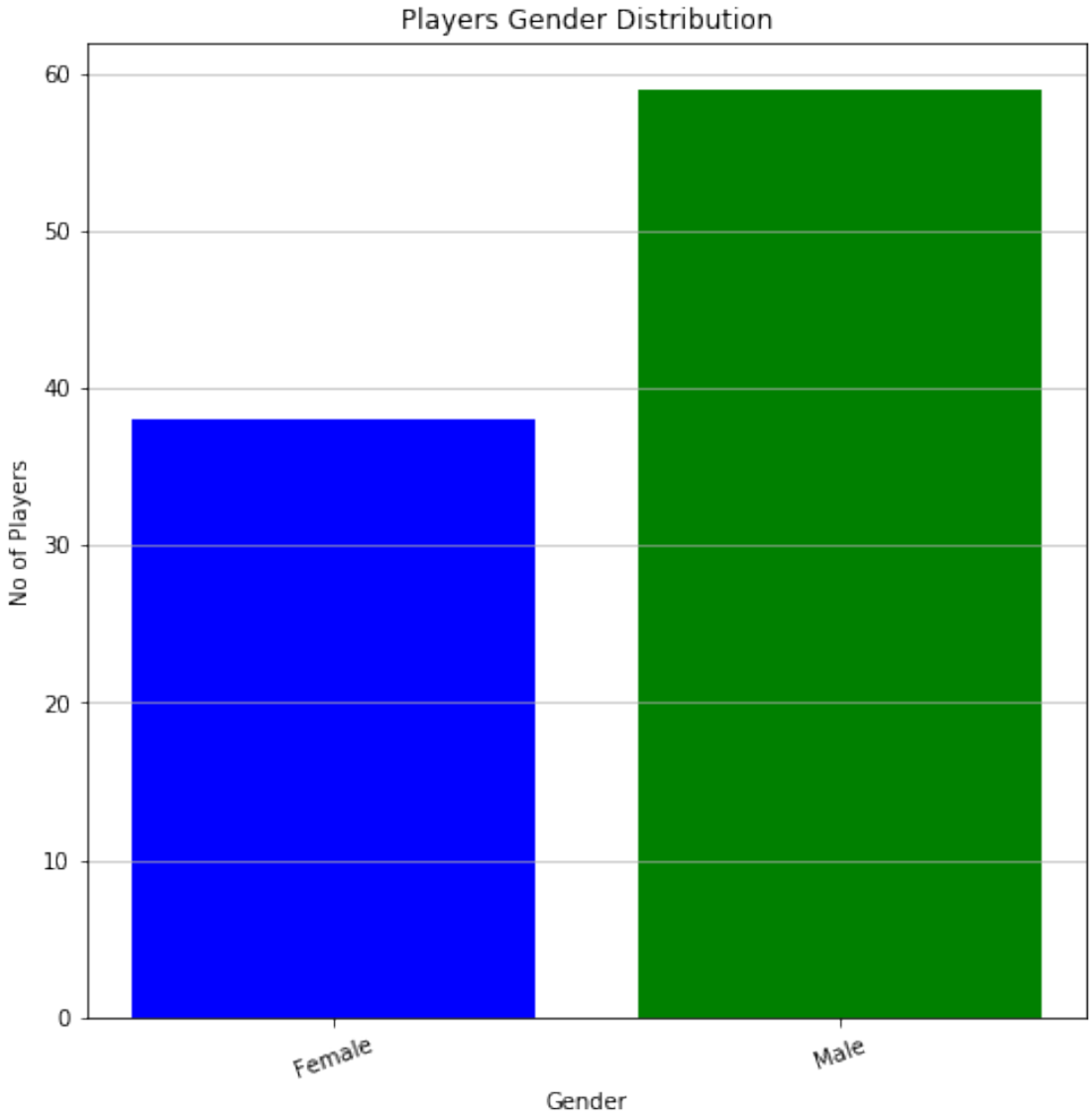
Get raw Dataset

[5]:
```
cursor = cnx.cursor()

query = ('SELECT pl.sex, COUNT(pl.sex) as total'
         ' FROM player pl'
         ' WHERE YEAR(pl.activation_date) = %s'
         ' GROUP BY pl.sex'
         ' ORDER BY pl.sex') %YEAR

cursor.execute(query)

# return a list of tuples
result_sex = list(cursor.fetchall())
```

Plot sex distribution Dataset

[6]:
```
data = np.array(result_sex) # numpy convert to string all values
labels = data[:, 0]
values = data[:, 1].astype(int)

plt.figure(figsize=(8, 8))
plt.bar(labels, values, color=('blue', 'green'))
plt.title('Players Gender Distribution')
plt.xlabel('Gender')
plt.ylabel('No of Players')
plt.xticks(np.arange(labels.size), ('Female', 'Male'), rotation=20)
plt.grid(axis='y', alpha=0.75)
plt.show()
```

```
print('Female Dataset Size: ' + str(values[0]))
print('Male Dataset Size: ' + str(values[1]))
print('------------------------')
print('Dataset Size: ' + str(sum(values)))
```




```
Female Dataset Size: 38
Male Dataset Size: 59
------------------------
Dataset Size: 97
```

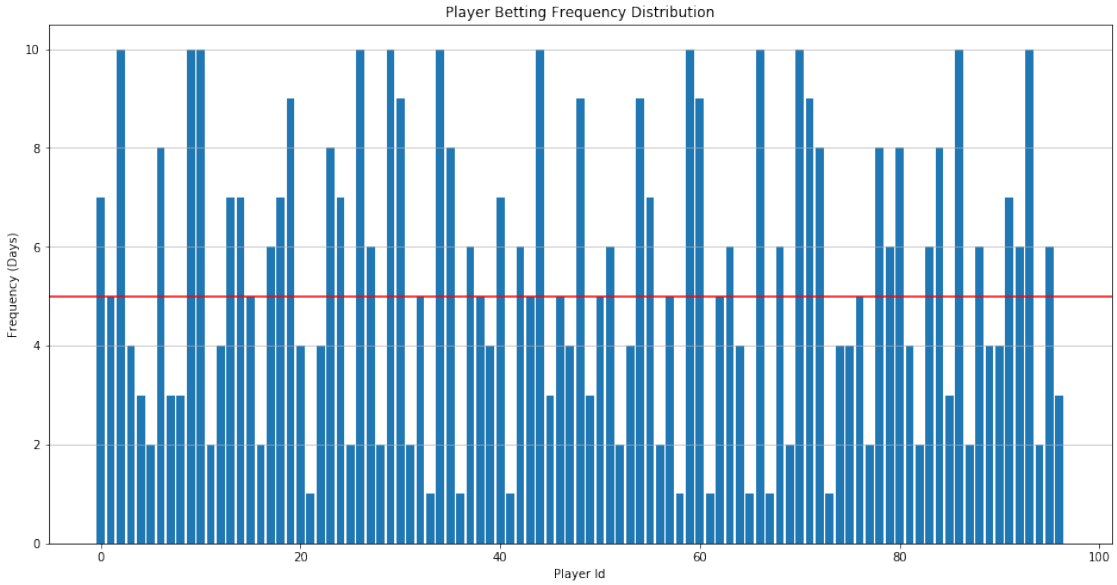
1.2 Betting Frequency

Get raw dataset for betting frequency, total number of activity days (days on witch a player placed at least one live-action bet))

[7]:
```
cursor = cnx.cursor()

query = ("SELECT COUNT(*) AS total"
         " FROM player pl, account ac"
         " WHERE pl.operator_id = ac.operator_id"
         "   AND pl.player_id = ac.player_id"
         "   AND YEAR(pl.activation_date) = %s"
         " GROUP BY ac.operator_id, ac.player_id") %YEAR

cursor.execute(query)

# return a list of tuples
result_betting_frequency = list(cursor.fetchall())
```

Plot betting frequency distribution per player

[8]:
```
data = np.array(result_betting_frequency) # numpy convert to string all values
data = data.astype(int)

betting_frequency_values = data[:, 0]

mean = round(betting_frequency_values.mean())

#print(betting_frequency_values.size)

plt.figure(figsize=(16, 8))
plt.bar(np.arange(betting_frequency_values.size), betting_frequency_values)
plt.title('Player Betting Frequency Distribution')
plt.xlabel('Player Id')
plt.ylabel('Frequency (Days)')
plt.axhline(y=mean, color='r', linestyle='-')
plt.grid(axis='y', alpha=0.75)
plt.show()

print('Mean bettings days: ' + str(mean))
```




```
Mean bettings days: 5.0
```

1.3 Betting Intensity

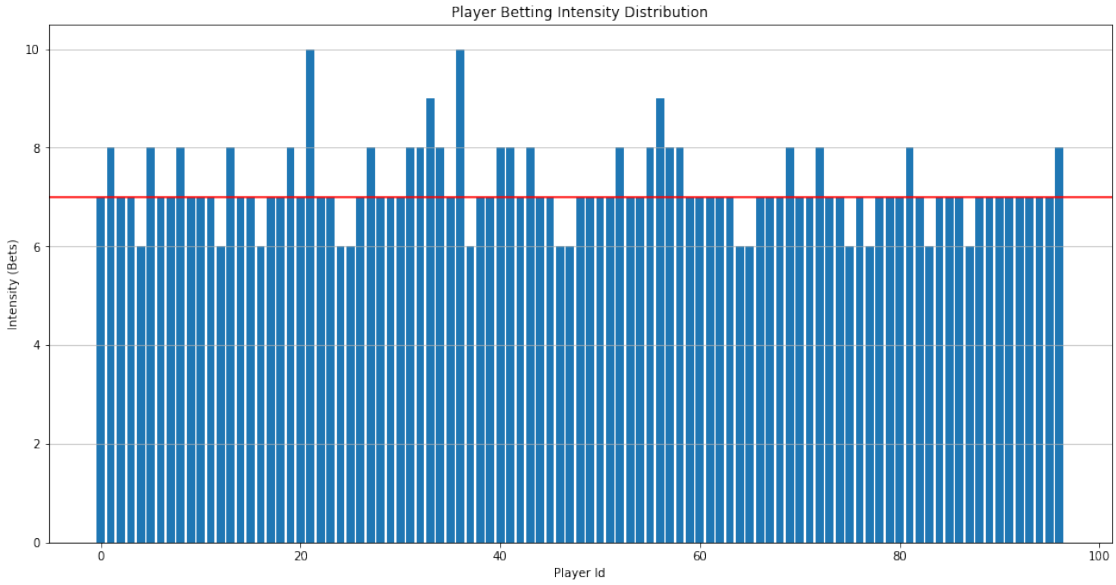
Get raw dataset for betting intensity, total number of live-action bets divided by frequency.

[9]:
```
cursor = cnx.cursor()

query = ("SELECT SUM(bettings) / COUNT(*) as total"
         " FROM player pl, account ac"
         " WHERE pl.operator_id = ac.operator_id"
         "   AND pl.player_id = ac.player_id"
         "   AND YEAR(pl.activation_date) = %s"
         " GROUP BY pl.operator_id, pl.player_id;") %YEAR

cursor.execute(query)

# return a list of tuples
result_betting_intensity = list(cursor.fetchall())
```

Plot betting intensity distribution per player

[10]:
```
data = np.array(result_betting_intensity) # numpy convert to string all values
data = data.astype(int)

betting_intensity_values = data[:, 0]

mean = round(betting_intensity_values.mean())
```

```
#print(betting_intensity_values.size)

plt.figure(figsize=(16, 8))
plt.bar(np.arange(betting_intensity_values.size), betting_intensity_values)
plt.title('Player Betting Intensity Distribution')
plt.xlabel('Player Id')
plt.ylabel('Intensity (Bets)')
plt.axhline(y=mean, color='r', linestyle='-')
plt.grid(axis='y', alpha=0.75)
plt.show()

print('Mean Betting Intensity : ' + str(mean))
```




```
Mean Betting Intensity : 7.0
```

1.4 Betting Intensity Histogram

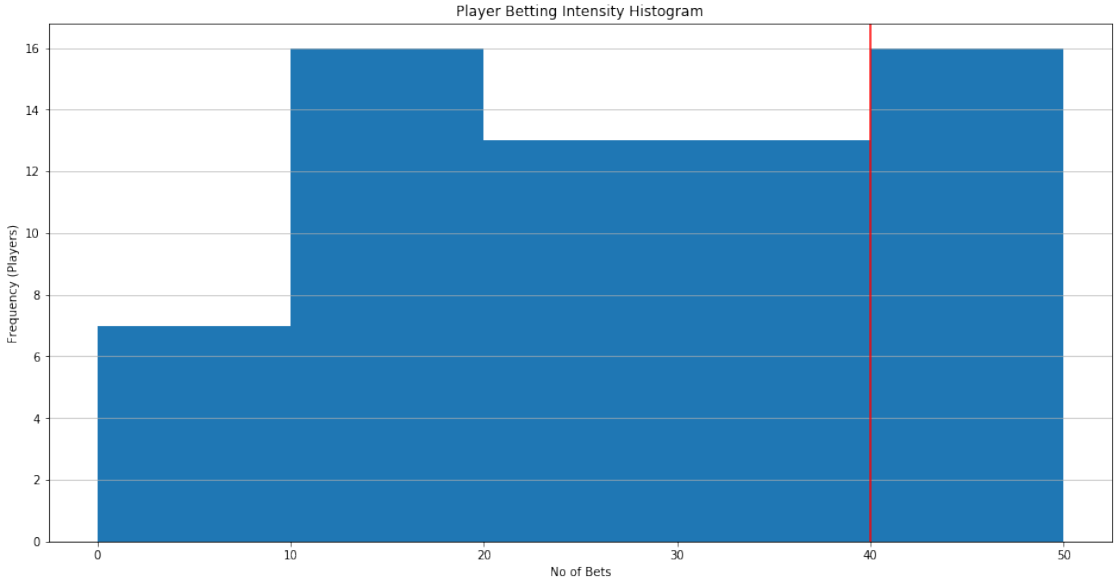
Get raw dataset for betting Intensity Histogram

[11]:
```
cursor = cnx.cursor()

query = ("SELECT SUM(bettings) as total"
         " FROM player pl, account ac"
         " WHERE pl.operator_id = ac.operator_id"
         "   AND pl.player_id = ac.player_id"
         "   AND YEAR(pl.activation_date) = %s"
```

```
        " GROUP BY pl.operator_id, pl.player_id;") %YEAR

cursor.execute(query)

# return a list of tuples
result_betting_histogram = list(cursor.fetchall())
```

Plot betting betting intesity histogram

[12]:
```
data = np.array(result_betting_histogram) # numpy convert to string all values
data = data.astype(int)

#labels = data[:, 0]
values = data[:, 0]

mean = round(values.mean())

plt.figure(figsize=(16, 8))
cuenta, cajas, ignorar = plt.hist(values, bins=np.arange(0, 60, 10))
plt.title('Player Betting Intensity Histogram')
plt.xlabel('No of Bets')
plt.ylabel('Frequency (Players)')
plt.axvline(x=mean, color='r', linestyle='-')
plt.grid(axis='y', alpha=0.75)
plt.show()

print('Mean Betting Intensity : ' + str(mean))
```



```
Mean Betting Intensity : 40.0
```

1.5 Betting Variability

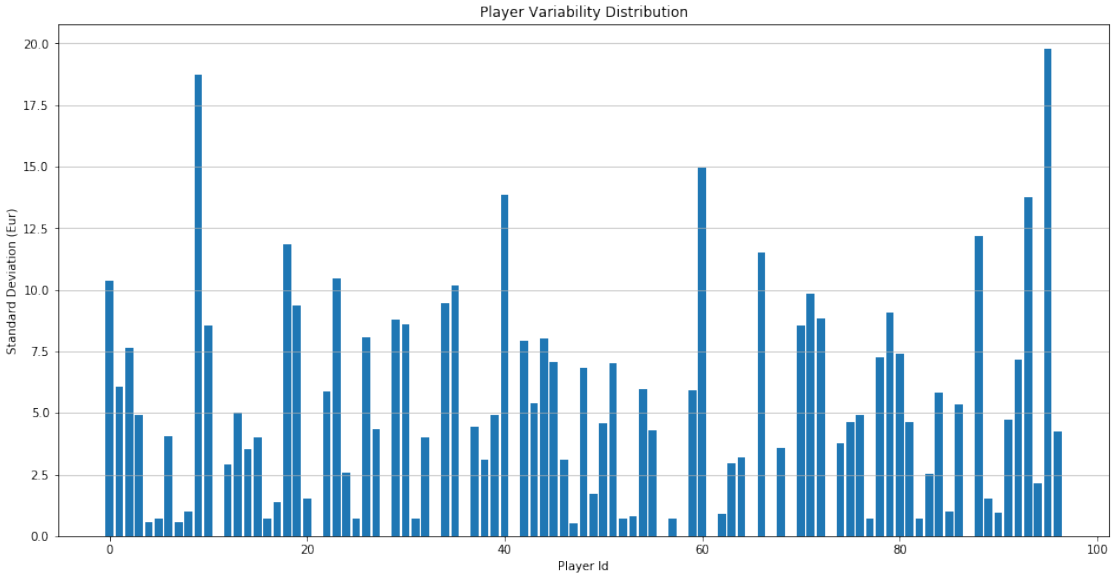
Get raw Dataset for Betting Variability. Standard Deviation of wagers

[13]:
```
cursor = cnx.cursor()

query = ("SELECT ac.operator_id as operator_id, ac.player_id as player_id,␣
 ↪SUM(ac.bettings) as total"
         " FROM player pl, gaming.account ac"
         " WHERE pl.operator_id = ac.operator_id"
         "   AND pl.player_id = ac.player_id"
         "  AND YEAR(pl.activation_date) = %d"
         " GROUP BY ac.operator_id, ac.player_id, DATE(ac.checkin_time)"
         " ORDER BY ac.operator_id, ac.player_id") %YEAR

cursor.execute(query)

# return a list of tuples
result_betting_variability = list(cursor.fetchall())
```

Plot betting betting variability distribution per player

[14]:
```
data = np.array(result_betting_variability) # numpy convert to string all␣
 ↪values()
data = data.astype(int)

df = pd.DataFrame({'operator_id': data[:,0],
                   'player_id': data[:,1],
                   'bettings': data[:,2]})

# calculate the standard deviation grouped by operator and player and replace␣
 ↪NaN to zero
df = df.groupby(['operator_id', 'player_id']).std().fillna(0)
#print(df.groupby(['operator_id', 'player_id']).head())

# convert pandas dataframe to numpy vector
betting_variability_values = df.values.flatten()

# plot player variance
plt.figure(figsize=(16, 8))
plt.bar(np.arange(betting_variability_values.size), betting_variability_values)
plt.title('Player Variability Distribution')
plt.xlabel('Player Id')
plt.ylabel('Standard Deviation (Eur)')
plt.grid(axis='y', alpha=0.75)
```

```
plt.show()
```



1.6 Betting Trajectory

Get raw Dataset for Betting Trajectory. The tendency to increse or decrease the amount of wagers money

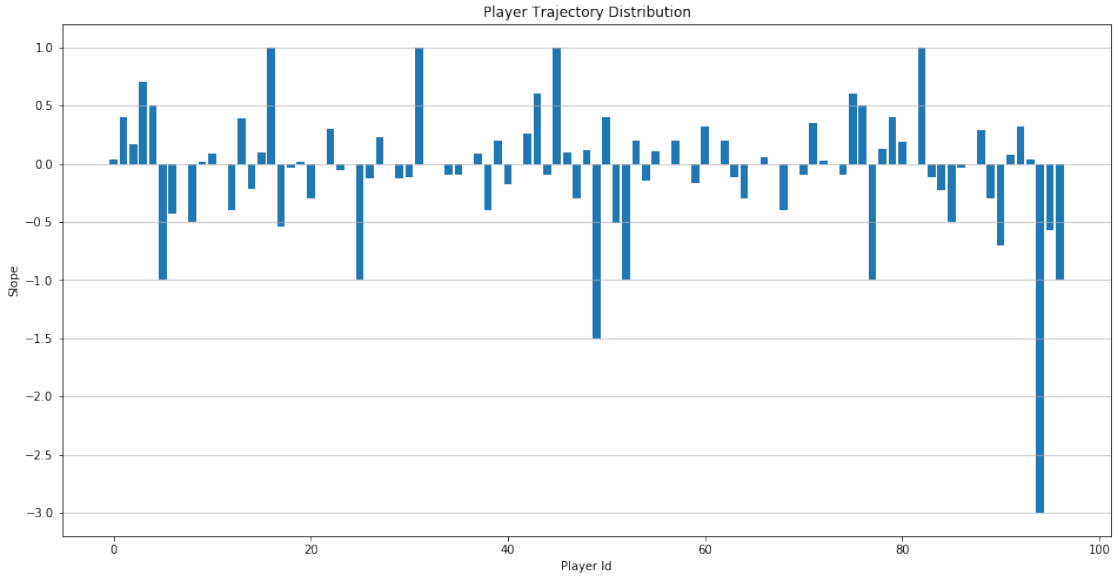
[15]:
```
cursor = cnx.cursor()

query = ("SELECT pl.operator_id, pl.player_id, bettings as total"
         " FROM player pl, account ac"
         " WHERE pl.operator_id = ac.operator_id"
         "   AND pl.player_id = ac.player_id"
         "   AND YEAR(pl.activation_date) = %s") %YEAR

cursor.execute(query)

# return a list of tuples
result_betting_trayectory = list(cursor.fetchall())
```

Plot betting trajectory distribution per player

[16]:
```
data = np.array(result_betting_trayectory) # numpy convert to string all values()
data = data.astype(int)

df = pd.DataFrame({'operator_id': data[:,0],
                   'player_id': data[:,1],
```

```
                    'bettings': data[:,2]})

# get bettings grouped by operator and player
result = df.groupby(['operator_id', 'player_id'])['bettings'].apply(list)

# calculate the slope for each bettings collection group by operator and player
betting_trajectory_values = [linregress(np.arange(len(x)), x).slope for x in␣
 ↪result]

# replace NaN to zero
betting_trajectory_values = np.nan_to_num(betting_trajectory_values)

# plot player trayectory
plt.figure(figsize=(16, 8))
plt.bar(np.arange(0, len(betting_trajectory_values)), betting_trajectory_values)
plt.title('Player Trajectory Distribution')
plt.xlabel('Player Id')
plt.ylabel('Slope')
plt.grid(axis='y', alpha=0.75)
plt.show()
```

```
/home/miguel/.local/lib/python3.5/site-
packages/scipy/stats/_stats_mstats_common.py:116: RuntimeWarning: invalid value
encountered in double_scalars
  slope = r_num / ssxm
/home/miguel/.local/lib/python3.5/site-
packages/scipy/stats/_stats_mstats_common.py:126: RuntimeWarning: invalid value
encountered in sqrt
  t = r * np.sqrt(df / ((1.0 - r + TINY)*(1.0 + r + TINY)))
/home/miguel/.local/lib/python3.5/site-
packages/scipy/stats/_stats_mstats_common.py:128: RuntimeWarning: invalid value
encountered in double_scalars
  sterrest = np.sqrt((1 - r**2) * ssym / ssxm / df)
```



1.7 Clustering Betting from predictors (independent characteristics)

Before clustering to assure comparatibility, we standardized all variables using z transformation

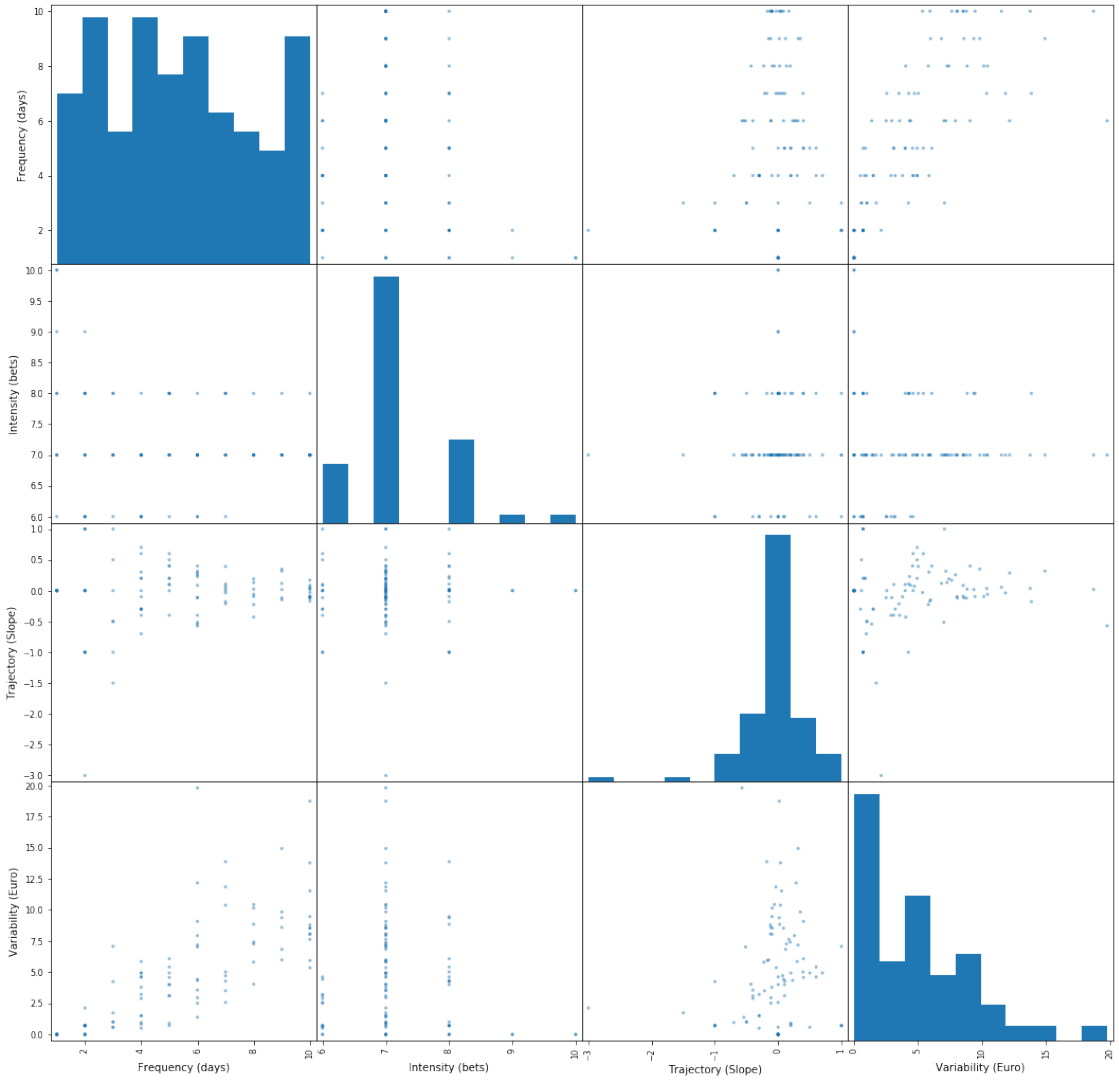
[17]:
```
predictors = pd.DataFrame({'Frequency (days)': betting_frequency_values,
                           'Intensity (bets)': betting_intensity_values,
                           'Variability (Euro)': betting_variability_values,
                           'Trajectory (Slope)': betting_trajectory_values})

X = stats.zscore(predictors)

# create k-means for the cluster
model = KMeans(n_clusters=4)
model.fit(X)

def ClusterIndicesNumpy(clustNum, labels_array):
    return np.where(labels_array == clustNum)[0]

labels = Counter(model.labels_)
centroids = model.cluster_centers_

columns = ['Cluster 1', 'Cluster 2', 'Cluster 3', 'Cluster 4']
index =['Frequency(days)', 'Intensity(bets)', 'Variability (Eur)', 'Trajectory␣
 ↪(Slope)', 'N']

centroides = centroids.T
centroides = np.vstack([centroides, [len(ClusterIndicesNumpy(0, model.labels_)),
```

```
                                    len(ClusterIndicesNumpy(1, model.labels_)),
                                    len(ClusterIndicesNumpy(2, model.labels_)),
                                   len(ClusterIndicesNumpy(3, model.labels_))]])

print(pd.DataFrame(centroides, index = index, columns = columns))


# recover all instances froma cluster label
#print(ClusterIndicesNumpy(3, model.labels_))

# to call the predict function with a single observation
#model.predict([ 5.1, 3.5, 1.4, 0.2 ])
```

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Frequency(days)	-0.984833	-0.498669	1.075934	-0.666369
Intensity(bets)	-0.051949	-0.636252	-0.065882	1.544870
Variability (Eur)	-2.340843	0.250808	0.088117	0.374281
Trajectory (Slope)	-0.755388	-0.558115	1.057824	-0.607677
N	8.000000	37.000000	35.000000	17.000000

Generate Predictors Correlative Scatter MAtrix

[18]:
```
scatter_matrix(predictors, figsize=(18, 18))
plt.show()
```



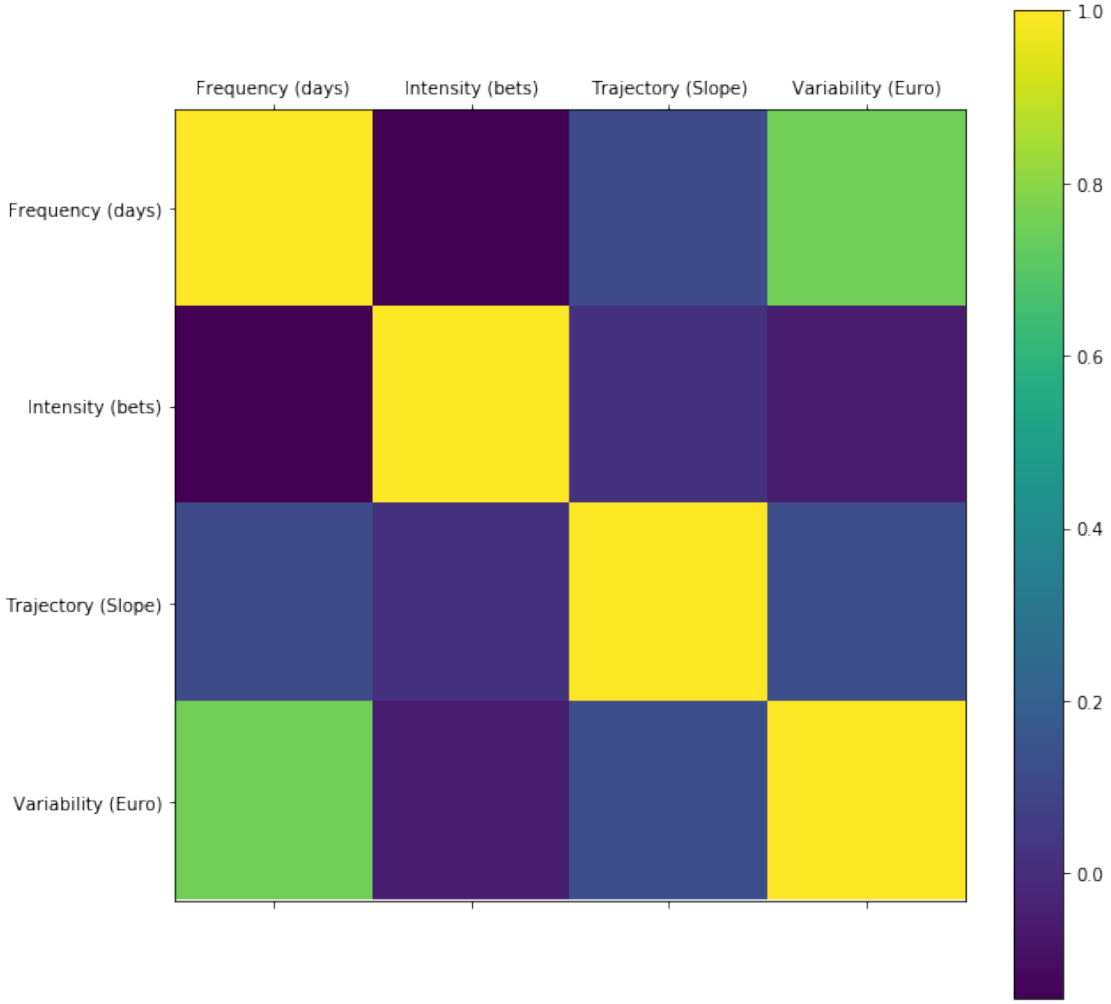
Generate Predictors Correlation Matrix Plot

[19]:
```
correlations = predictors.corr()
#display(Markdown('<font size="2">{}!</font>'.format(correlations)))
print(correlations)

plt.figure(figsize=(10, 10))
plt.matshow(correlations, fignum=1)
plt.xticks(range(len(predictors.columns)), predictors.columns)
plt.yticks(range(len(predictors.columns)), predictors.columns)
plt.colorbar()
plt.show()
```

```
                    Frequency (days)  Intensity (bets)  Trajectory (Slope)  \
Frequency (days)            1.000000         -0.145690            0.114631
```

```
Intensity (bets)          -0.145690          1.000000          0.022171
Trajectory (Slope)         0.114631          0.022171          1.000000
Variability (Euro)         0.753021         -0.060051          0.131563
```

```
                    Variability (Euro)
Frequency (days)                0.753021
Intensity (bets)               -0.060051
Trajectory (Slope)              0.131563
Variability (Euro)              1.000000
```



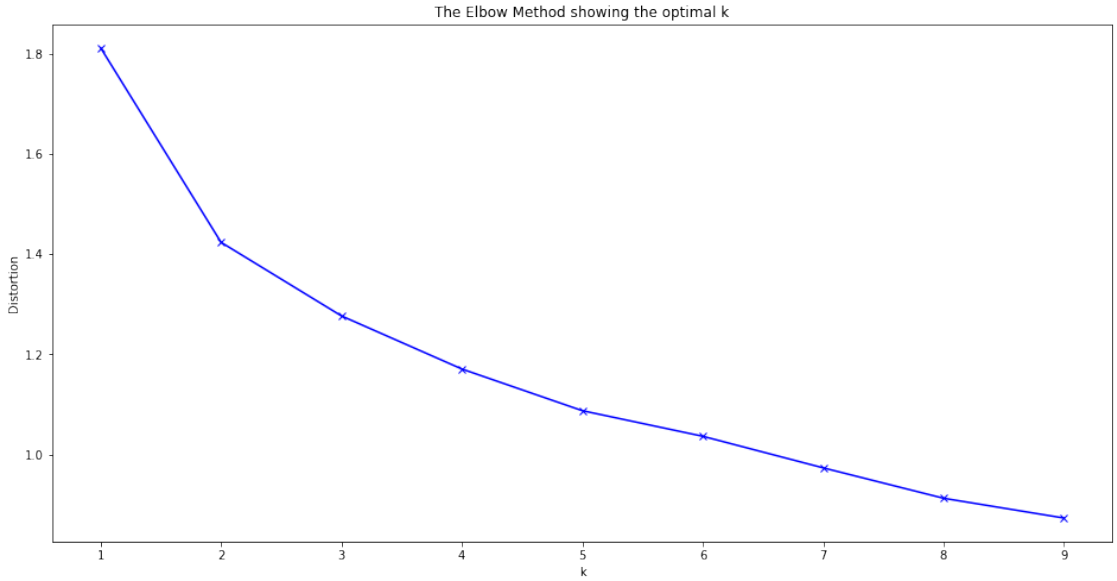
Find optimal K cluster value from Elbow method

[24]:
```
# k means determine k
distortions = []
K = range(1,10)
for k in K:
```

```
    model = KMeans(n_clusters=k)
    model.fit(X)
    distortions.append(sum(np.min(cdist(X, model.cluster_centers_,␣
↪'euclidean'), axis=1)) / X.shape[0])
```

Plot elbow method result

[25]:
```
# Plot the elbow
plt.figure(figsize=(16, 8))
plt.plot(K, distortions, 'bx-')
plt.xlabel('k')
plt.ylabel('Distortion')
plt.title('The Elbow Method showing the optimal k')
plt.show()
```



1.8 Clustering Age vs Profit

Study is exist any relation between the age and the profit in the period

[26]:
```
# create dataset from database
cursor = cnx.cursor()

query = ("SELECT pl.birthdate, SUM(ac.profit) AS profit"
         " FROM player pl, account ac"
         " WHERE pl.operator_id = ac.operator_id"
         " AND pl.player_id = ac.player_id"
         " AND YEAR(pl.activation_date) = %s"
```

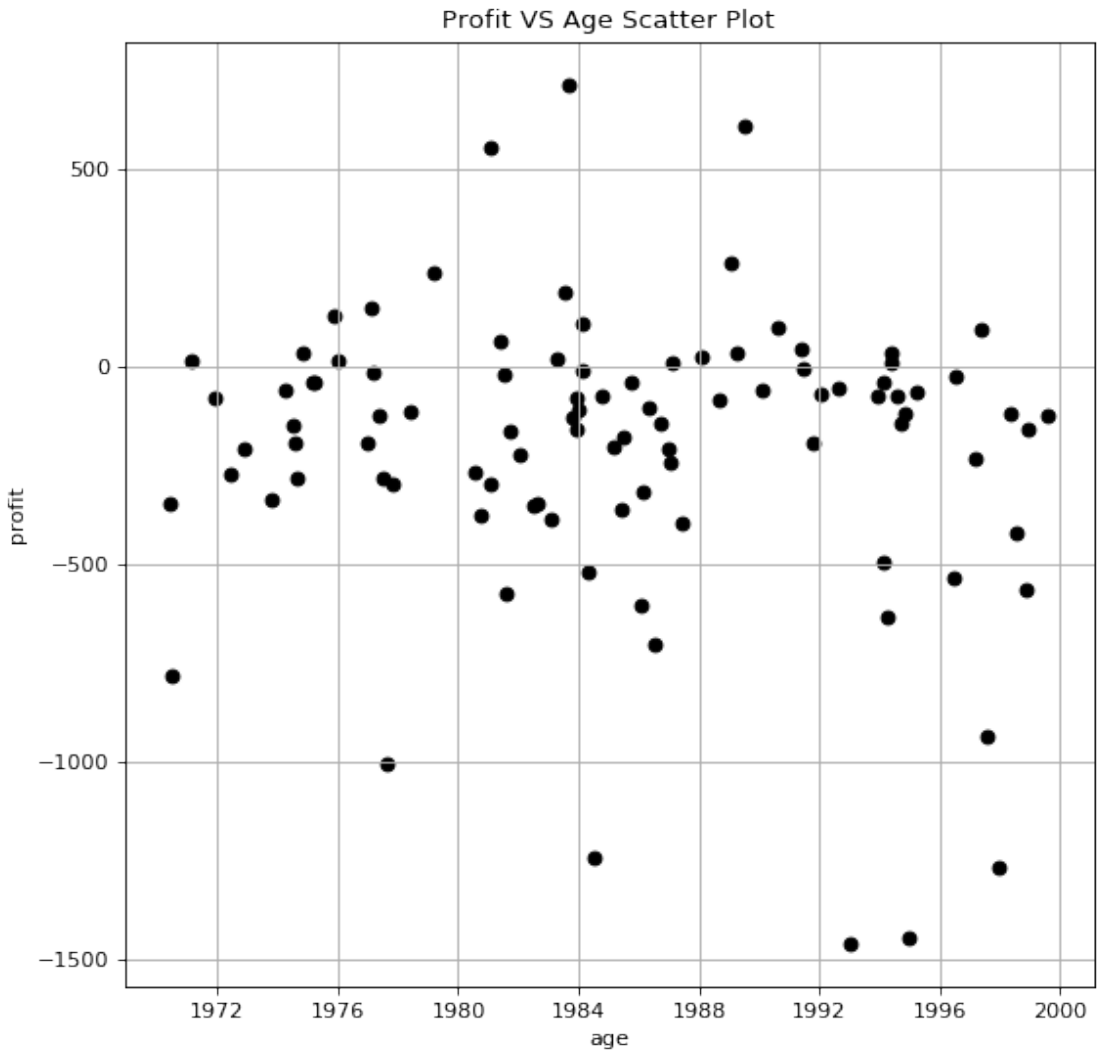
```
        " GROUP BY  pl.birthdate, ac.operator_id, ac. player_id") %YEAR

cursor.execute(query)

# return a list of tuples
result_km_players = list(cursor.fetchall())
```

Transform date characteristics and create tuples

[27]:
```
# separate tuples
dates, profits = zip(*result_km_players)

# convert string to date
#dates = [pd.to_datetime(d) for d in dates]

helper = np.vectorize(lambda x: datetime.combine(x, datetime.min.time()).
 ↪timestamp())

X = []
for row in result_km_players:
    X.append([helper(row[0]), row[1]])
```

Plot Age vs Profit Scatter Plot

[28]:
```
plt.figure(figsize=(8, 8), dpi=80)
plt.scatter(dates, profits, color='k')
plt.title("Profit VS Age Scatter Plot")
plt.xlabel("age")
plt.ylabel("profit")
plt.grid()
plt.show()
```



Design de k-means with 2 clusters model for dataset

[29]:
```
model = KMeans(n_clusters=2).fit(X)
```

Print k-means centroides

[30]:
```
centroides = []
for row in model.cluster_centers_:
    centroides.append((datetime.fromtimestamp(int(round(row[0]))), row[1]))

print(centroides)

centroides_dates, centroides_profits = zip(*centroides)
```

```
[(datetime.datetime(1979, 5, 18, 0, 10, 11), -164.01886792452834),
```

```
(datetime.datetime(1992, 8, 9, 11, 24, 33), -247.47727272727275)]
```

Plot the scatter plot and the centroides for tha dataset

[31]:
```
plt.figure(figsize=(8, 8), dpi=80)
plt.scatter(dates, profits, c=model.labels_, cmap='rainbow')
plt.scatter(centroides_dates ,centroides_profits, color='black')
plt.title("Profit VS Age Scatter Plot")
plt.xlabel("age")
plt.ylabel("profit")
plt.grid()
plt.show()
```