sgij_EDA_vertica

August 27, 2019

1 Exploratory data analysis (EDA) on the SGIJ Vertica Dataset

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

[4]:
```
import math
from datetime import date
from datetime import datetime
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 vertica_python
from sklearn.cluster import KMeans
from sklearn import metrics
from scipy.stats import linregress
from scipy import stats
from collections import Counter, OrderedDict
from IPython.display import display, Markdown
%matplotlib inline

register_matplotlib_converters()
```

Connect to Vertica databasef from credentials

NoteNook Year EDA Study

[5]:
```
YEAR = 2015
```

Vertica Database connection string

[7]:
```
config = {'host': '192.168.1.125',
              'port': 5433,
              'user': 'dbadmin',
              'password': 'password',
              'database': 'VMart',
              # default throw error on invalid UTF-8 results
```

```
            'unicode_error': 'strict',
            # SSL is disabled by default
            'ssl': False,
            # using server-side prepared statements is disabled by default
            'use_prepared_statements': False,
            # connection timeout is not enabled by default
            'connection_timeout': 5}

try:
  cnx = vertica_python.connect(**config)
except vertica.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

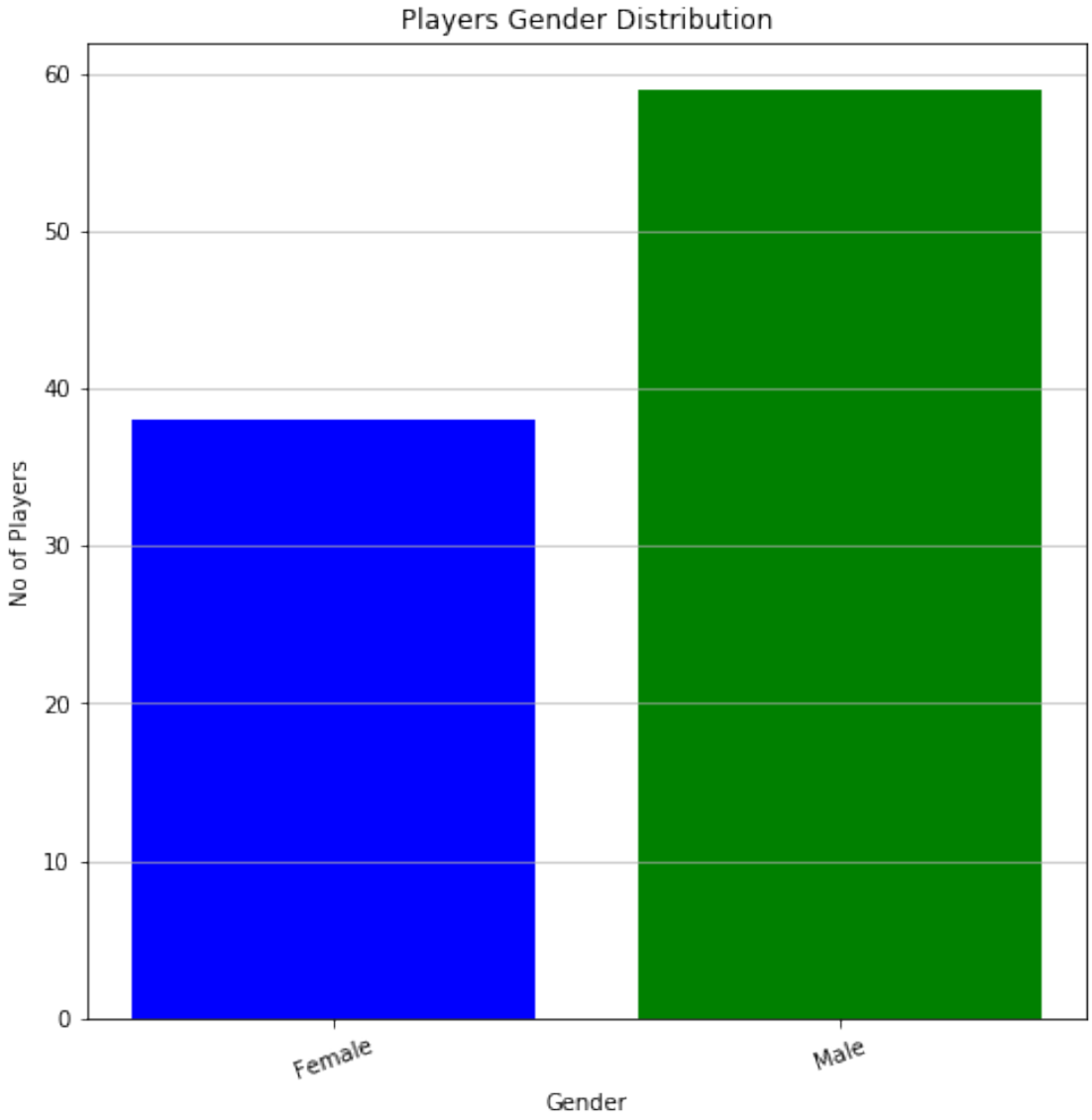
Get raw Dataset

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

query = ('SELECT pl.sex, COUNT(pl.sex) as total'
        ' FROM gaming.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

[8]:
```
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
```

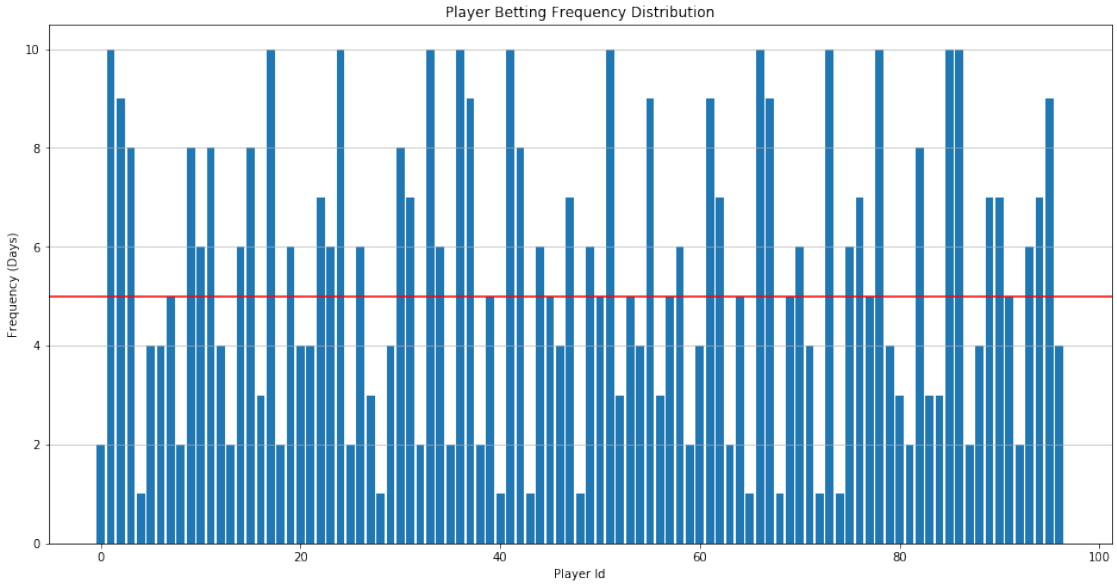
1.2 Betting Frequency

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

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

query = ("SELECT COUNT(*) AS total"
         " FROM gaming.player pl, gaming.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

[10]:
```
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

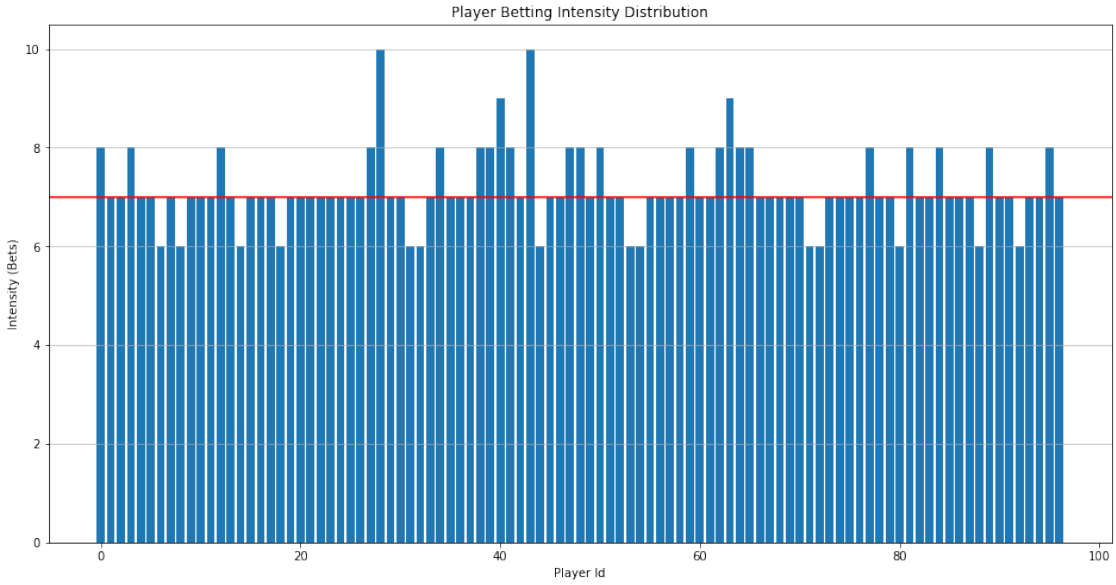
Get raw dataset for betting intensity, total number of live-action bets divided by frequency.

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

query = ("SELECT SUM(bettings) / COUNT(*) as total"
         " FROM gaming.player pl, gaming.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

[12]:
```
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

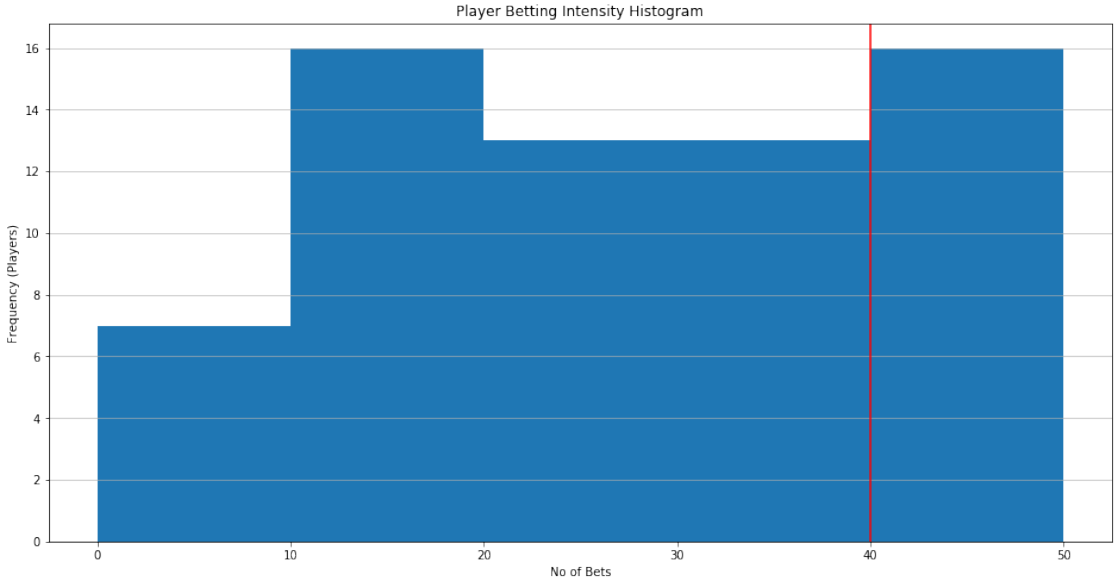
Get raw dataset for betting Intensity Histogram

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

query = ("SELECT SUM(bettings) as total"
         " FROM gaming.player pl, gaming.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

[14]:
```
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

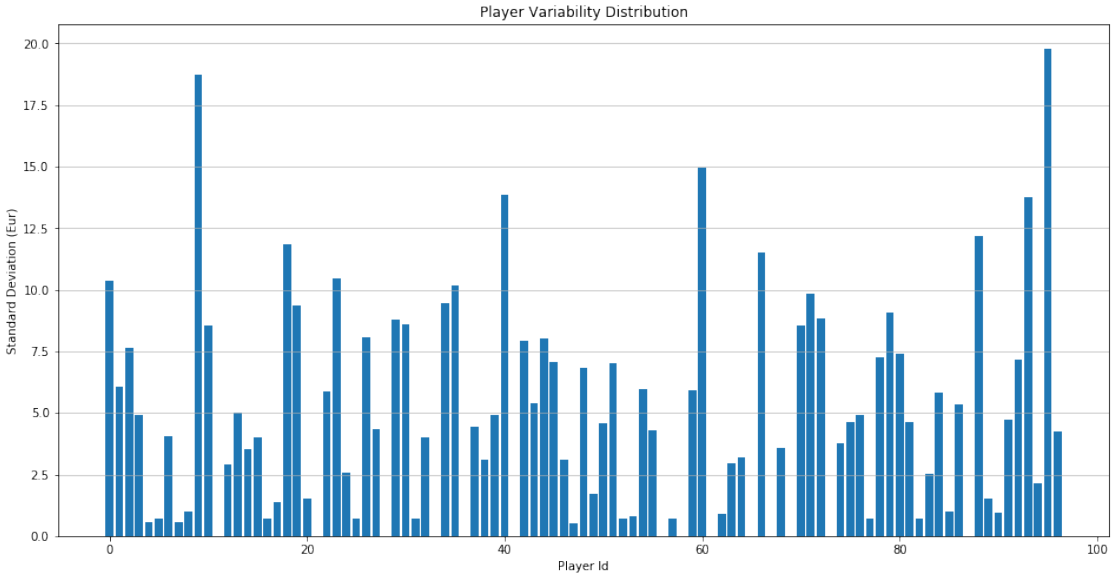
Get raw Dataset for Betting Variability. Standard Deviation of wagers

[16]:
```
cursor = cnx.cursor()

query = ("SELECT ac.operator_id as operator_id, ac.player_id as player_id,␣
 ↪SUM(ac.bettings) as total"
         " FROM gaming.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

[17]:
```
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

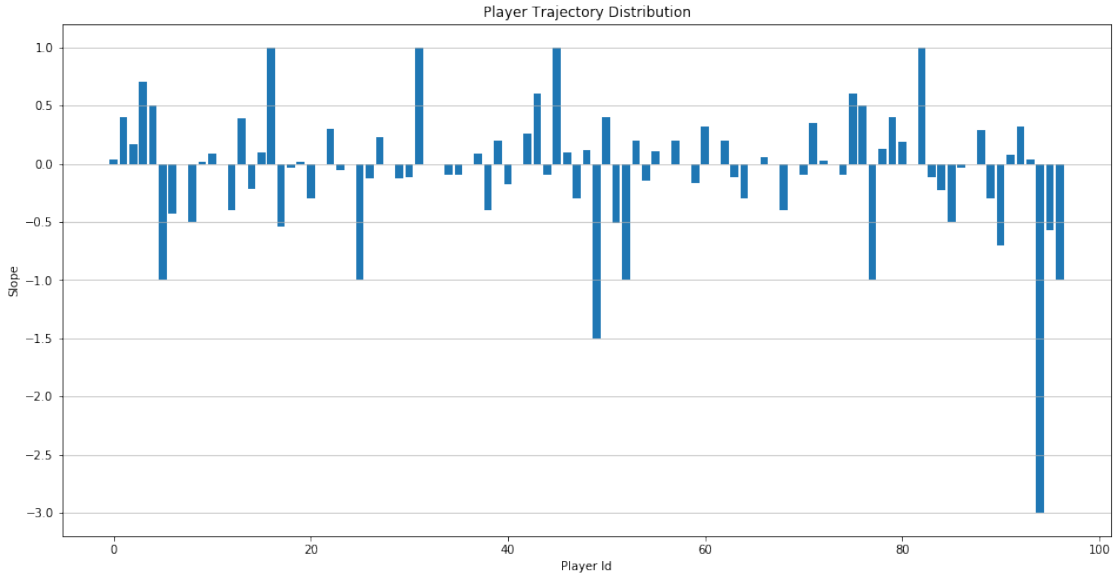
[18]:
```
cursor = cnx.cursor()

query = ("SELECT pl.operator_id, pl.player_id, bettings as total"
         " FROM gaming.player pl, gaming.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

[19]:
```
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

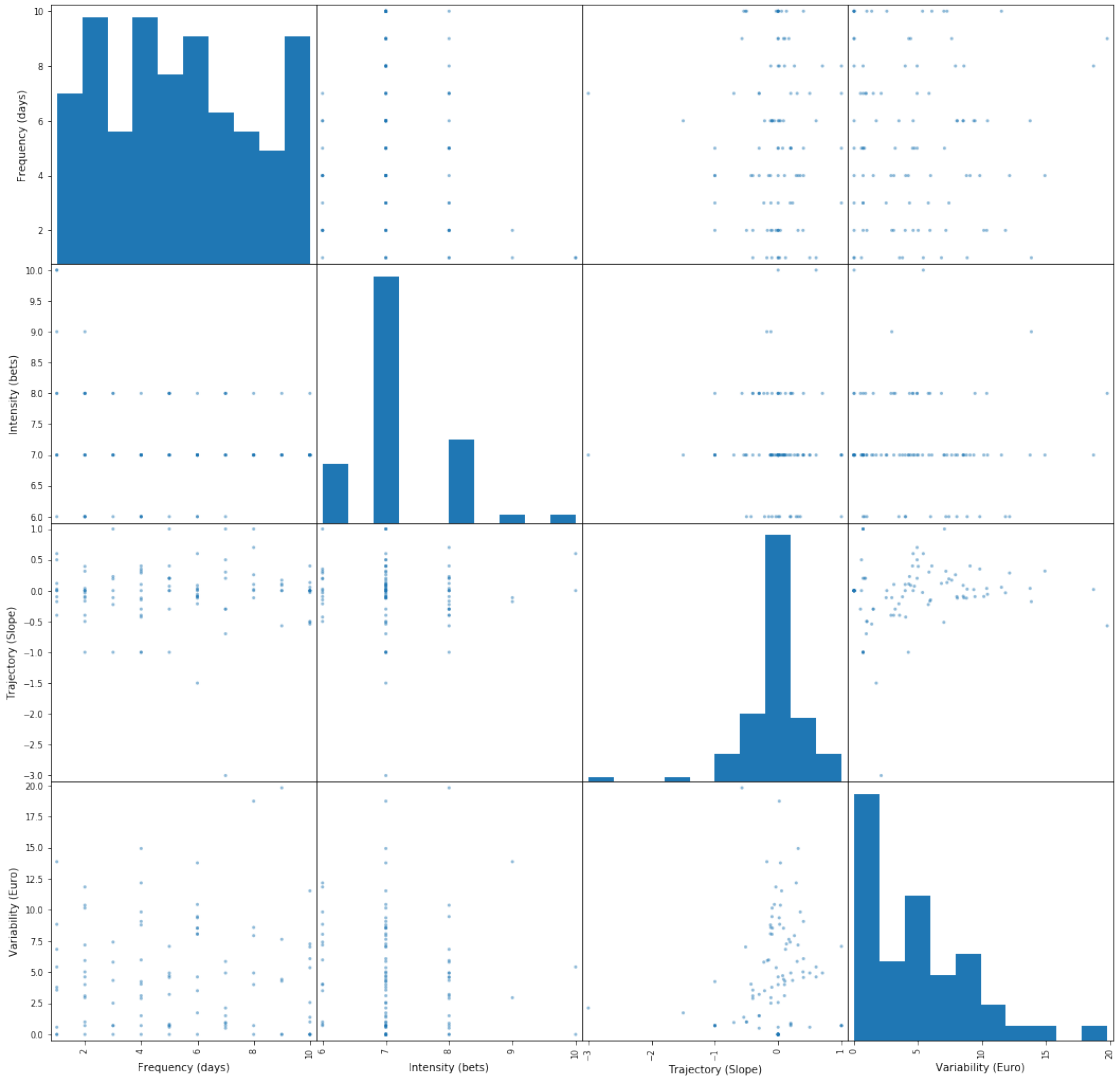
[20]:
```
predictors = pd.DataFrame({'Frequency (days)': betting_frequency_values,
                           'Intensity (bets)': betting_intensity_values,
                           'Variability (Euro)': betting_variability_values,
                           'Trajectory (Slope)': betting_trajectory_values})

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)	-1.019761	-0.084759	0.896303	-0.333897
Intensity(bets)	0.929856	-0.564608	-0.140191	-0.332718
Variability (Eur)	0.190396	0.232764	0.284727	-1.888840
Trajectory (Slope)	-0.194329	1.204053	-0.531906	-0.711858
N	25.000000	26.000000	35.000000	11.000000

Generate Predictors Correlative Scatter MAtrix

[21]:
```
scatter_matrix(predictors, figsize=(18, 18))
plt.show()
```



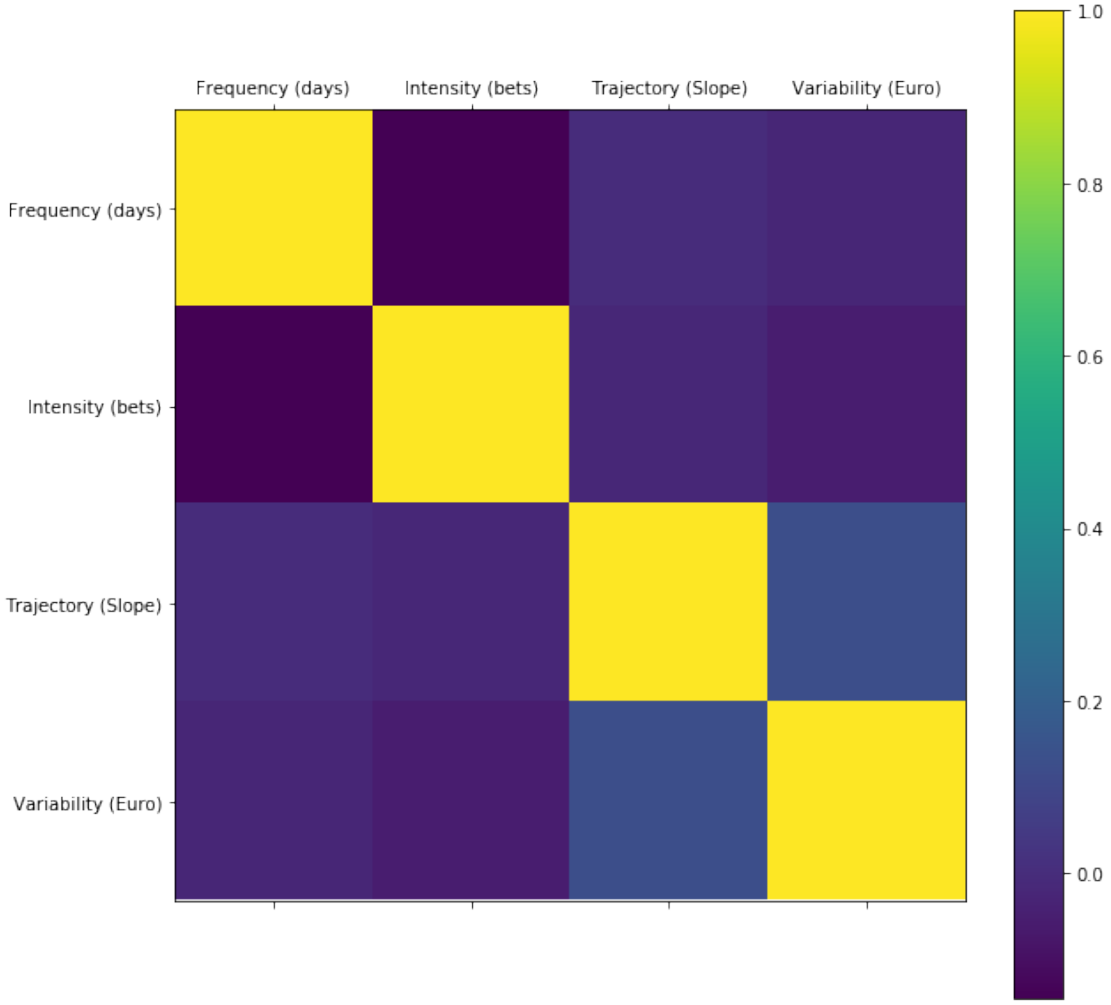
Generate Predictors Correlation Matrix Plot

[22]:
```
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           -0.000841
```

Intensity (bets)	-0.145690	1.000000	-0.019672
Trajectory (Slope)	-0.000841	-0.019672	1.000000
Variability (Euro)	-0.023985	-0.053654	0.131563

	Variability (Euro)
Frequency (days)	-0.023985
Intensity (bets)	-0.053654
Trajectory (Slope)	0.131563
Variability (Euro)	1.000000



1.8 Clustering Age vs Profit

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

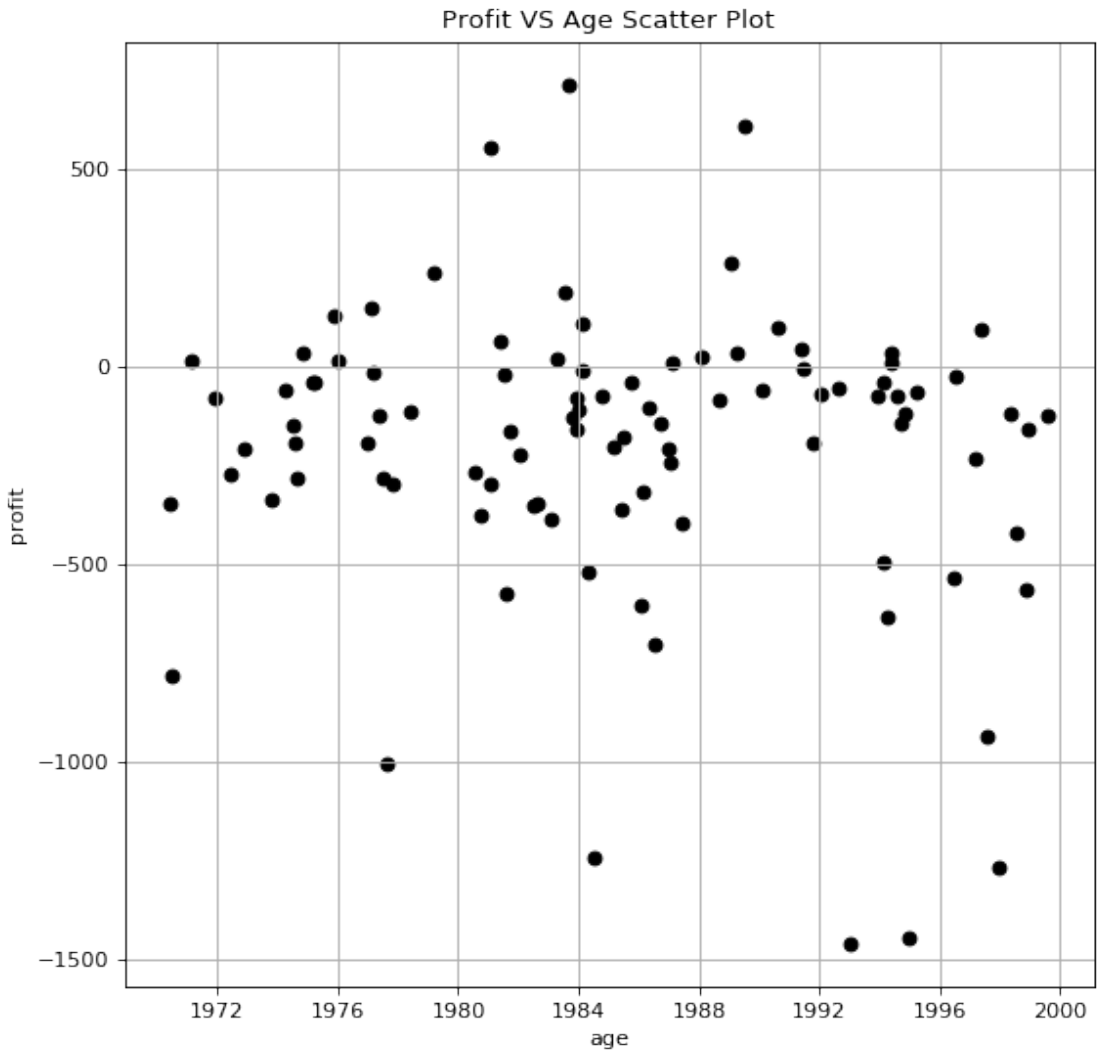
[25]:
```
# create dataset from database
cursor = cnx.cursor()

query = ("SELECT pl.birthdate, SUM(ac.profit) AS profit"
         " FROM gaming.player pl, gaming.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

[26]:
```
# 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

[27]:
```
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

[28]:
```
model = KMeans(n_clusters=2).fit(X)
```

Print k-means centroides

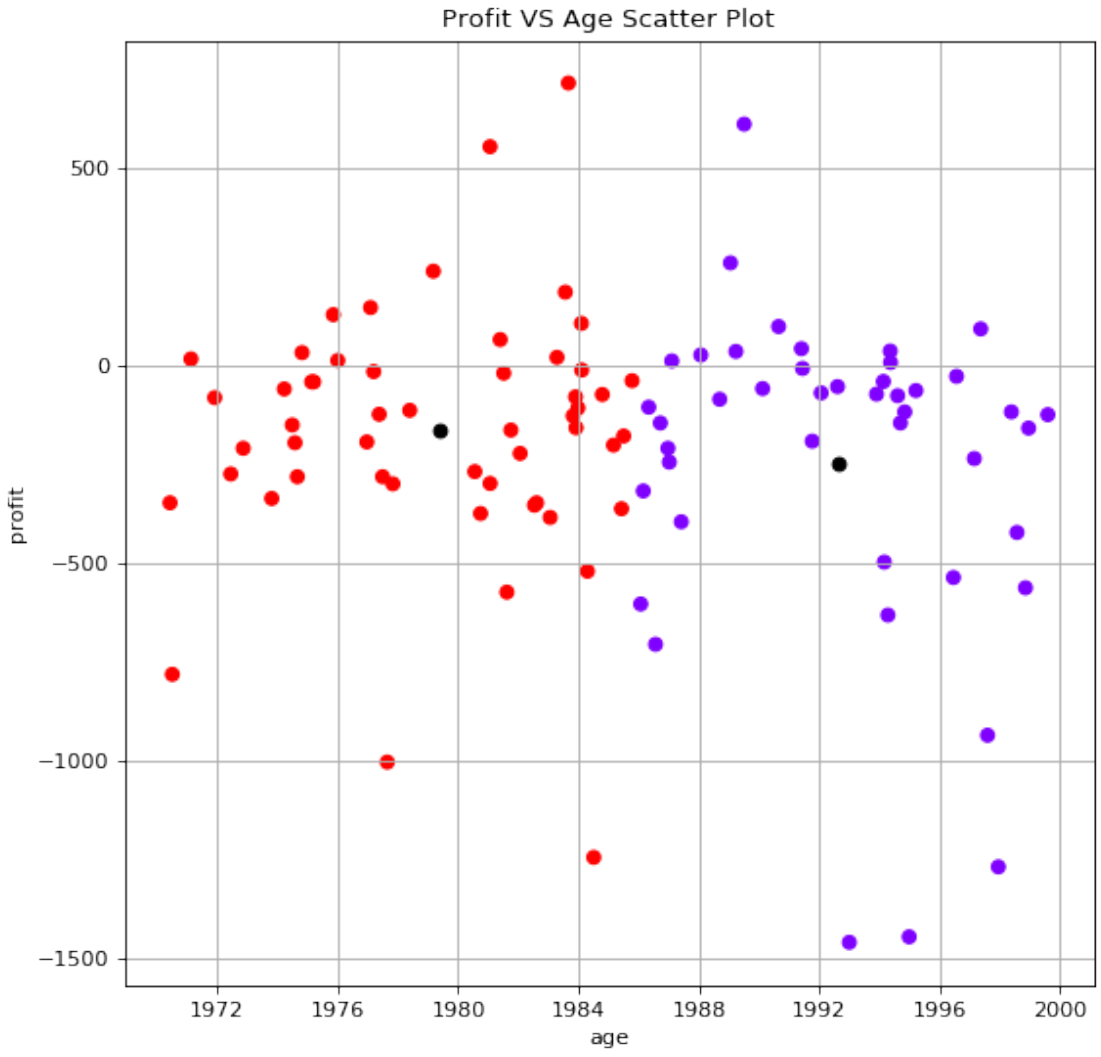
[29]:
```
centroides = []
for row in model.cluster_centers_:
    centroides.append((datetime.fromtimestamp(int(round(row[0]))), row[1]))

print(centroides)

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

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

```
(datetime.datetime(1979, 5, 18, 0, 10, 11), -164.0188679245283)]
```

Plot the scatter plot and the centroides for tha dataset

[30]:
```
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()
```



[ ]: