clustering_moroccan_cities2

June 4, 2020

1 Morocco Cities Clustering

1.1 Introduction and description

The goal of this project it to **cluster** the cities of my country **Morocco**. The clustering algorithm will use **geographical** data such as *population*, *number of hotels* and *number and type of industries**. This clustering could serve for serveral purposes:

- Say I had to move from my current city, I would like to choose another city which is similar to my current city.
- For a foreign tourist, Say you visited a city A and you liked it but didn't like city B. In future visit to Morocco, you'll would like to avoid all the cities in the B cluster and try to discover more cities in the A cluster. Better application for this would be a **Recommender system** but can also use *clustering*.

1.2 Loading the data

The data was already prepared in the previous week. It is a list of Moroccan cities with a set of features

```
[11]: import pandas as pd
      import matplotlib.pyplot as plt
      import seaborn as sns
      %matplotlib inline
```

```
[97]: data = pd.read_csv("morocan_cities.csv" ,index_col=0)
      data.head()
```

```
[97]:             Population                  Region   latitude  longitude  Café  \
      City
      Casablanca     3359818         Casablanca-Settat  33.595063  -7.618777   4.0
      Fez            1112072                Fès-Meknès  34.034653  -5.016193   0.0
      Tangier         947952  Tanger-Tetouan-Al Hoceima  35.777103  -5.803792   4.0
      Marrakesh       928850             Marrakesh-Safi  31.625826  -7.989161   6.0
      Salé            890403         Rabat-Salé-Kénitra  34.044889  -6.814017   1.0

                  Hotel  Moroccan Restaurant  Coffee Shop  Diner
      City
```

```
Casablanca    6.0                  3.0          1.0    1.0
Fez           0.0                  1.0          1.0    0.0
Tangier       3.0                  1.0          0.0    5.0
Marrakesh    11.0                 12.0          0.0    0.0
Salé          0.0                  0.0          0.0    0.0
```

1.3 Exploratory data analysis

Let's plot some variables to see if there is a relation between the variables. But first I need to drop the `Region` field as it not a numeric variable.

[98]:

```
data.drop(['Region'], axis=1, inplace=True)
data.head()
```

[98]:

```
            Population   latitude  longitude  Café  Hotel  \
City
Casablanca     3359818  33.595063  -7.618777   4.0    6.0
Fez            1112072  34.034653  -5.016193   0.0    0.0
Tangier         947952  35.777103  -5.803792   4.0    3.0
Marrakesh       928850  31.625826  -7.989161   6.0   11.0
Salé            890403  34.044889  -6.814017   1.0    0.0

            Moroccan Restaurant  Coffee Shop  Diner
City
Casablanca                  3.0          1.0    1.0
Fez                         1.0          1.0    0.0
Tangier                     1.0          0.0    5.0
Marrakesh                  12.0          0.0    0.0
Salé                        0.0          0.0    0.0
```

1.4 Population

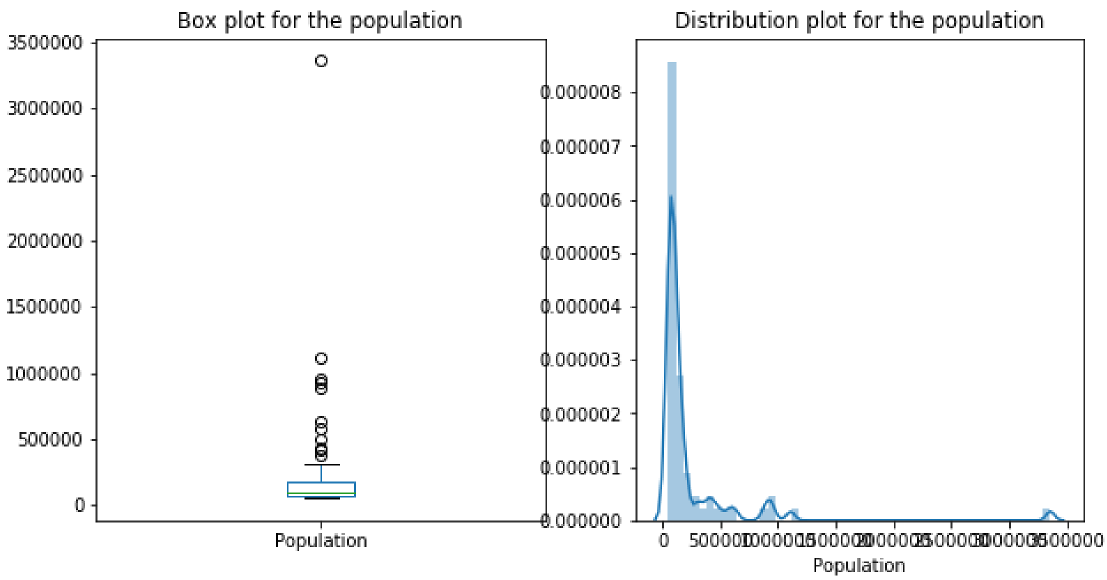
[26]:

```
fig, axs = plt.subplots(1,2,figsize=(10,5))

#box plot
data['Population'].plot(kind='box',ax=axs[0])
sns.distplot(data.Population, ax=axs[1])
axs[0].set_title("Box plot for the population")
axs[1].set_title("Distribution plot for the population")
```

[26]:

```
Text(0.5, 1.0, 'Distribution plot for the population')
```



```
We can see the data is not well distributed as the city of `Casablanca` has almost all the mass.
```

1.5 Features venues variables

Let's plot and see the values on the `venues` variables. This is data that was gathered for each town using the **foursquare** api

[42]:

```python
venues = ['Café','Hotel', 'Moroccan Restaurant', 'Coffee Shop', 'Diner']
```

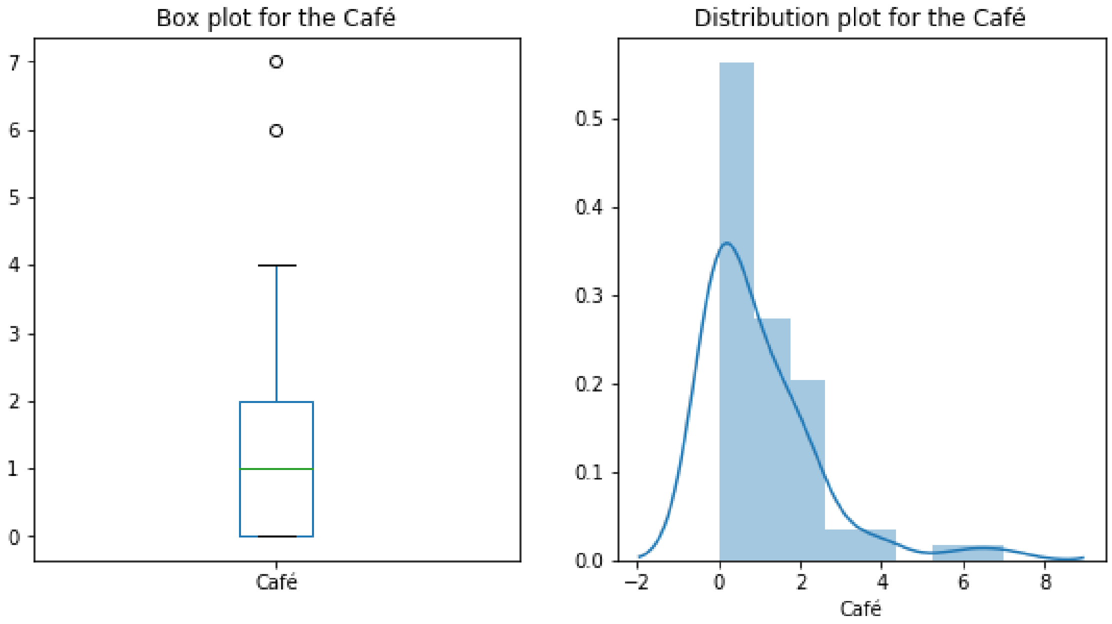
[51]:

```python
fig, axs = plt.subplots(1,2,figsize=(10,5))

#box plot
data['Café'].plot(kind='box',ax=axs[0])
sns.distplot(data['Café'], ax=axs[1])
axs[0].set_title("Box plot for the Café")
axs[1].set_title("Distribution plot for the Café")
```

[51]:

```
Text(0.5, 1.0, 'Distribution plot for the Café')
```



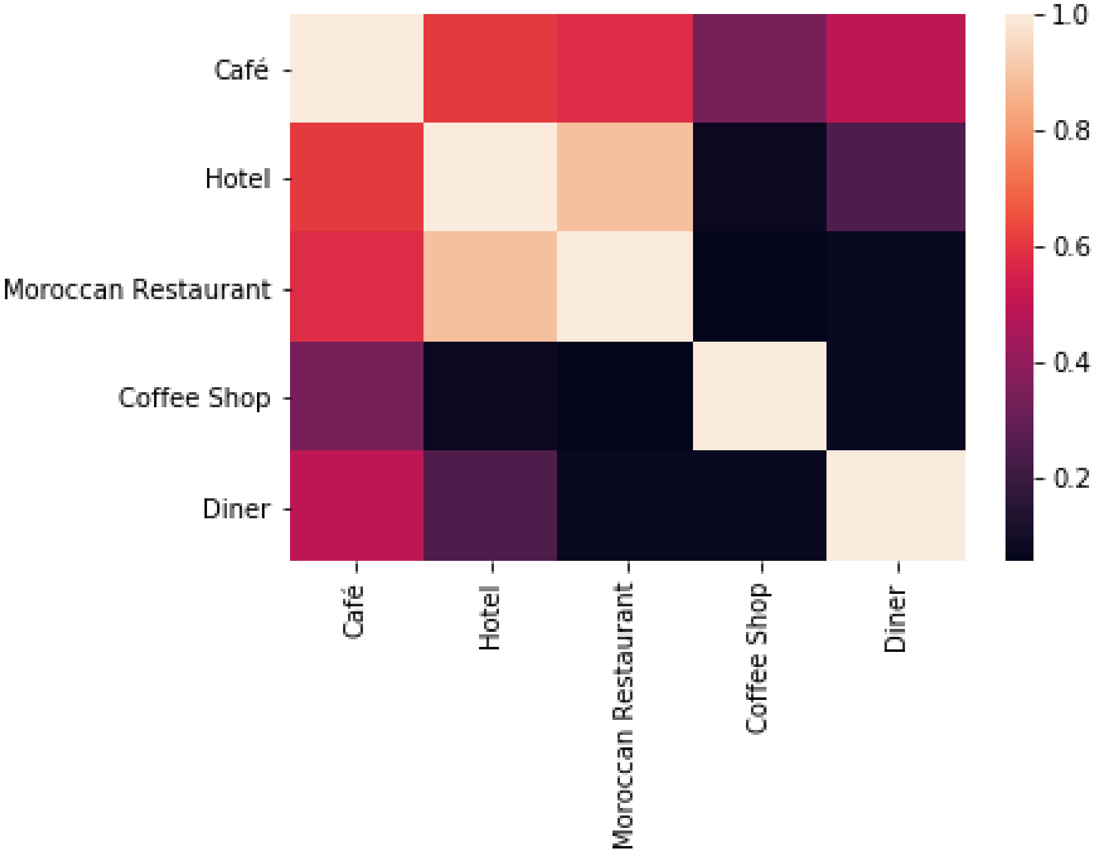
1.6 Correlation

Let plot and search if there is a correlation between the venues

```
[56]: corr = data[venues].corr()
```

```
[57]: sns.heatmap(corr)
```

```
[57]: <matplotlib.axes._subplots.AxesSubplot at 0x7f043ad02e10>
```

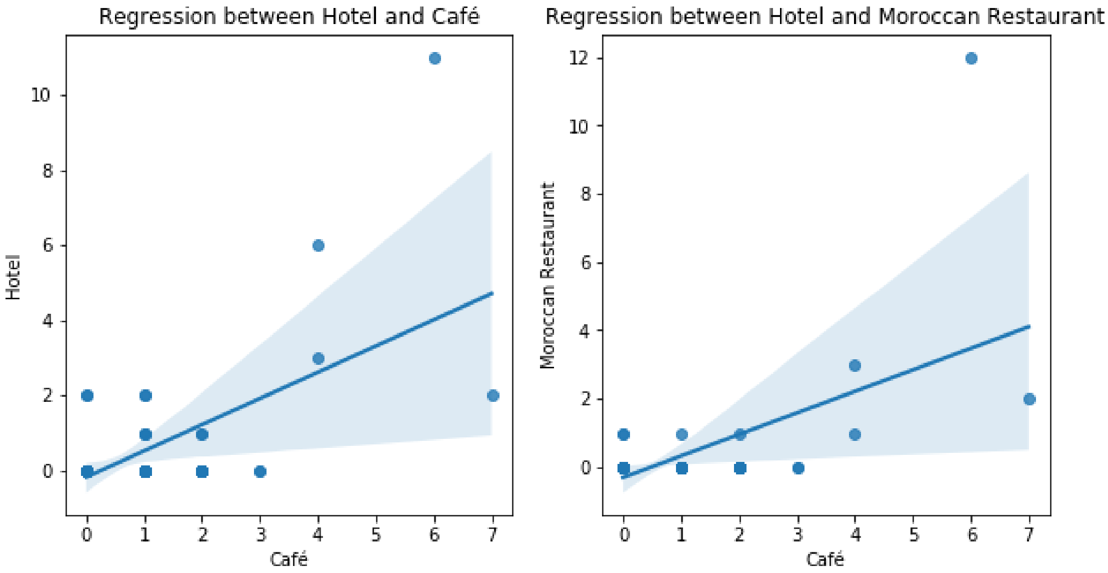


We can remark that there is a strong correlation between `Café` and `Hotel` and `Moroccan Restaurant`

to test that let's plot the the regression line between those two variables

[60]:
```
fig, axs = plt.subplots(1,2,figsize=(10,5))
sns.regplot(data['Café'], data['Hotel'],ax=axs[0])
axs[0].set_title('Regression between Hotel and Café')
sns.regplot(data['Café'], data['Moroccan Restaurant'],ax=axs[1])
axs[1].set_title('Regression between Hotel and Moroccan Restaurant')
```

[60]:
```
Text(0.5, 1.0, 'Regression between Hotel and Moroccan Restaurant')
```



1.7 Data preparation for clustering

The first step for the clustering is normalize the data

```
[90]: from sklearn.preprocessing import StandardScaler
```

```
[99]: normalizer = StandardScaler()
```

```
[100]: for col in data.columns:
           data[col] = normalizer.fit_transform(data[[col]])
```

```
[101]: data
```

```
[101]:              Population  latitude  longitude      Café     Hotel  \
       City
       Casablanca      6.950718 -0.035651  -0.196372  2.137331  3.411629
       Fez             1.941305  0.097944  -0.034972 -0.712444 -0.325360
       Tangier         1.575541  0.627486  -0.083815  2.137331  1.543135
       Marrakesh       1.532969 -0.634115  -0.219342  3.562218  6.525787
       Salé            1.447285  0.101055  -0.146465  0.000000 -0.325360
       ...                  ...       ...        ...       ...       ...
       M'diq          -0.411792  0.598997  -0.054012  1.424887 -0.325360
       Sidi Bennour   -0.412710 -0.322625  -0.246321  0.712444 -0.325360
       Midelt         -0.413849 -0.313639  -0.017837  0.000000  0.297472
       Azrou          -0.415975 -0.083955  -0.047730  0.000000  0.297472
       Drargua        -0.423561 -1.012113  -0.311575 -0.712444 -0.325360

                     Moroccan Restaurant  Coffee Shop     Diner
```

```
City
Casablanca              1.757776     1.125446  0.956183
Fez                     0.441899     1.125446 -0.378489
Tangier                 0.441899    -0.478913  6.294871
Marrakesh               7.679225    -0.478913 -0.378489
Salé                   -0.216040    -0.478913 -0.378489
...                          ...          ...       ...
M'diq                  -0.216040    -0.478913 -0.378489
Sidi Bennour           -0.216040     1.125446  0.956183
Midelt                 -0.216040     1.125446 -0.378489
Azrou                  -0.216040    -0.478913 -0.378489
Drargua                -0.216040    -0.478913 -0.378489

[67 rows x 8 columns]
```

Now it better, let's run the KMeans to cluster the data

[102]:

```python
from sklearn.cluster import KMeans
```

[103]:

```python
segmenter = KMeans(n_clusters=4)
```

[105]:

```python
segmenter.fit(data)
```

[105]:

```
KMeans(algorithm='auto', copy_x=True, init='k-means++', max_iter=300,
       n_clusters=4, n_init=10, n_jobs=None, precompute_distances='auto',
       random_state=None, tol=0.0001, verbose=0)
```

[106]:

```python
print(segmenter.labels_)
```

```
[2 1 0 2 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 3 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1]
```

1.7.1 Plotting the results

[108]:

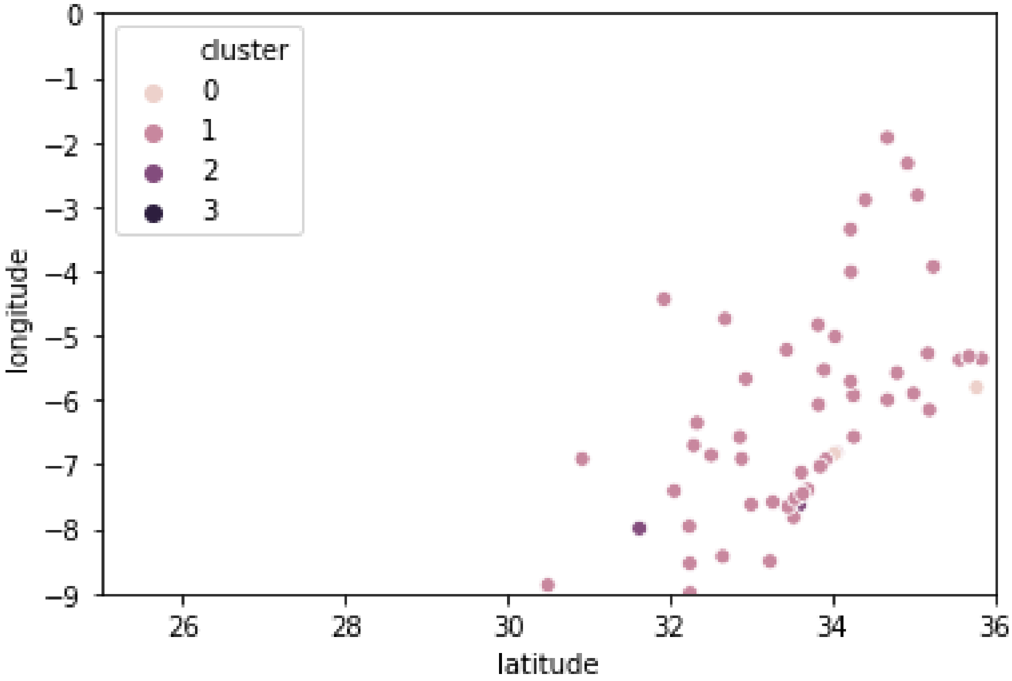
```python
import folium
```

[149]:

```python
position = [31.79, -7.02]
morocco = folium.Map(position, zoom_start=7)
sns.set_palette('muted')
data = pd.read_csv("morocan_cities.csv", index_col=0)  #normalizatin loose the␣
 ↪coordinates
data['cluster'] = segmenter.labels_.astype('int')
ax = sns.scatterplot(x='latitude', y = 'longitude', hue='cluster',data=data)
ax.set_xlim([25, 36])
ax.set_ylim([-9,0])
```

[149]:

```
(-9, 0)
```


cluster
0
1
2
3
0
−1
−2
−3
−4
−5
−6
−7
−8
−9
longitude
26
28
30
32
34
36
latitude