**Capstone Project - The Battle of Neighborhoods (Week 2)**

**1 Introduction**

Investment is in general a complex and challenging task.One of the most difficulty is to collect right data.Today there are certainly lots of data sources thanks to internet data centers developpement ,data processing technologies which make it possible to collect, process and store data in real time.Although these technologies are present in our day life and more often availables as open source tools,they still need to be carefully used in other to obtain right data.

# **1.1 Problem**

**T**he problem as set consists collecting ,porcessing and analyzing the cities **NEW YORK CITY, Toronto And Paris**. More precisely ,the problem is about Collecting informations about all the venues of different neighborhood of all borough in each of these cities in order to find the similarities between them base on data collected using data anlysis tools ,here is python and external API such as foursquar.The result obtained results will be use to suggest a suitable location for investment .

## **1.2 interest**

**Evidently,interested are either poeple interested in investing in one of these tree cities or somme one willing to know a litle bit about kaind of venues in these cities.**

## **1.3 Data socuces**

### 1.3.1 problem 1 Cities anlysis

**1.3.1.1-NYC(new york city) all data where provided**

**Link to the data set:** [<https://cocl.us/new_york_dataset>]

From this link data are downloaded using python api pandas ,process and transform into usable data format. The foursquare API is then used to generate the final data set including geografical coordinate of each neighbouhood.Thinal data set in the generated (Data frame including geographical coordinates of each neighborhood.

**1.3.1.2 -Toronto links To dataset:**  [<https://en.wikipedia.org/wiki/List_of_postal_codes_of_Canada:_M> -<http://cocl.us/Geospatial_data>]

From this link data are downloaded usind python api pandas ,process and transform into usable data format. The foursquare API is then used to generate the final data set including geografical coordinate of each neighbouhood.Thinal data set in the generated (Data frame including geographical coordinates of each neighborhood.

**1.3.1.3 Paris links to data sets:** [<https://fr.wikipedia.org/wiki/Liste_des_quartiers_administratifs_de_Paris> [<https://opendata.paris.fr/explore/dataset/quartier_paris/download/?format=csv&timezone=Europe/Berlin&use_labels_for_header=true&csv_separator=%3B>]

From this link data are download ,loded usind python api pandas ,process and transform into usable data format. The foursquare API is then used to generate the final data set including geografical coordinate of each neighbouhood.Thinal data set in the generated (Data frame including geographical coordinates of each neighborhood

### 1.3.2 Problem 2 (venue sugestion for ristaurant investment)

data set used here is the results of the data collected and transform (using python and foursquere api) into strutured and usable data format in the previous section.

# II-Data collection , processing and anlysis for each city

## II.1 New York City.

II.1.1 New york city data collection and tranformation

**New York City** (**NYC**), also known as the **City** of **New York** or simply **New York** (**NY**), is the most populous **city** in the United States with polpulation of 8398748 inhabitants.This is the first city on which ours first analisys wiil be focussed.

**AS** previously said,data are collected from links provided,the programming language used is python on IMD cloud,more precisely IBM service.Thanks to these tools we have colletted and tranformed data from unusable data forrmat to structured data frame.Below is the scrreshut of the final data structure where in the columns we have from left to right exactly :**Borough's name ,Neighborhood's name ,Latitude and Longitud**e of the overall newyork city.

*Newyork city data set with geogaphical coordinates*

*Une image contenant capture d’écran, intérieur, mur

Description générée automatiquement*

The total number of Neighborhood in newyork city is : **103**

Using External fousquare API and further processing data are transformed in the usable the final data structure wifhi can be seen in the following.

Une image contenant capture d’écran

Description générée automatiquementThe total number of venues in newyork city is : 1.22 per 100 inhabitants.

Table including venue categorie

In terms of venues diversity,there is 429 venues categories.

As we are interested in this analisys in investing on a Ristaurant ,we need to extract from the dataframe only rows coresponding to restaurant venues.final data in the folowwing is shown the first 5 element of the final table.

Une image contenant capture d’écran

Description générée automatiquementThe above data frame is the one we wiil be using for this project.

Top 25 restaurants NYC

Herlet plot the top 25 and the 25 last restaurants in terms of number of restaurant in newyork city .

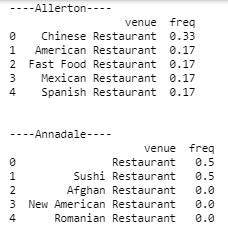
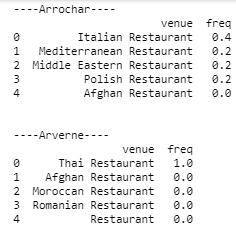
Une image contenant capture d’écran

Description générée automatiquementWith **315** restaurants in NYC,Italian restautrant in terms of number is the most respresented ,folowed Chinese,Mexican and American Restaurant with total number respectively 219,179,174and 113. Unexpectedly,the Italian restaurant comes first in USA .

Last 25 restaurants NYC

This last graph shows that,in NYC,they are lots of ristaurants categoris with only one building such as Indian chinese restaurant,South Indian Restaurant,and so on.

Let look a litle bit deeper into the data set .Here below are the top fives venues for 6 neighbohoods in Newyork city.



In this project,our anlysis will be totally decicated to Restaurant,thus they will be used in the first time to seek the similarity and dissimilarity between Newyork city ,Toronto and paris and secondely with deeper analisys will be used to sugest the most appropriate place if not an acceptable place to invest in restautant event which Restaurant category may the best choise according to our analisys.

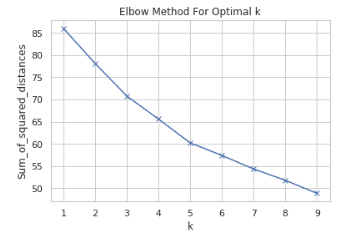
Let create a new data frame with the 10 most comon resturants as following.

In the next section,we are going to use this data to group the data set into différen into cluster.

II.1.2-Clustering (K-mean) :

**II**.1.2.1-Parameter turning (Best k parmater for kmeans).

The first step of our clustring is to choose the aproporiate value of k(number of cluster).



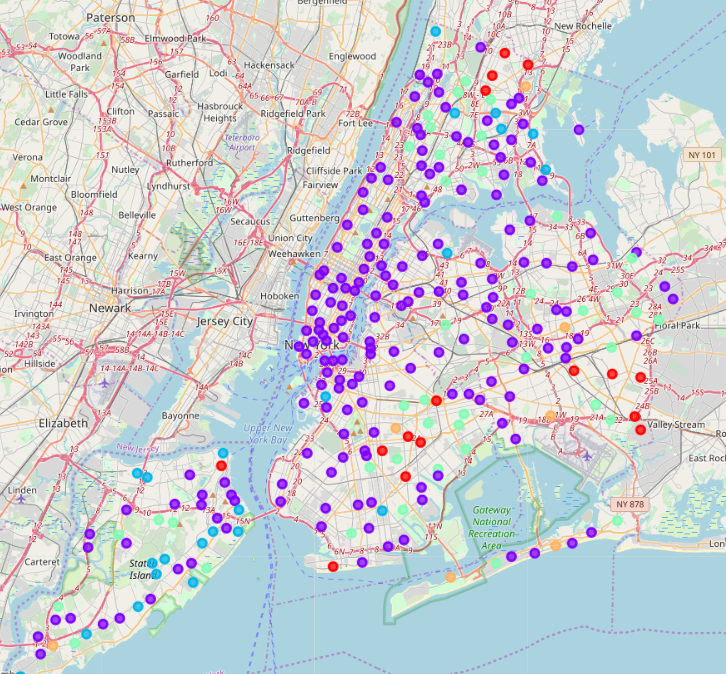
best k for the kmean cluster ,best k =5

In the plot above the elbow is at k=5 indicating the optimal k for this dataset is 5

II.1.2.2-Model fitting

This section consists in clustering the Newyork city data set using the best value of k obtained in the parameter turning section .In the below figure *:[ best k for the kmeans cluster in the Newyork City map*] are the differents neigborhoods clusters.

best k for the kmeans cluster in the Newyork City map



In the tables*(table cluster 1 NYC,table cluster 2 NYC,table cluster 3 NYC,table cluster 4 NYC,Table cluster 5 NYC*) are these obtained cluster with the overall information on them.

In the following table, the neighborhoods present in the same cluster are close to each other,thus they share most of the common restaurants.For instance,as the neigborhoods **Wakefield** and **Eastchester** it means the share lot of most common restaurants caterories.Similarly ,the neighborhoods present in différents clusters may share fewer most common restaurants of the most comon restaurants. Let print the fisrt rows of ours clusters.



Table cluster 1 NYC



Table cluster 2 NYC



Table cluster 3 NYC



Table cluster 5 NYC



Table cluster 4 NYC

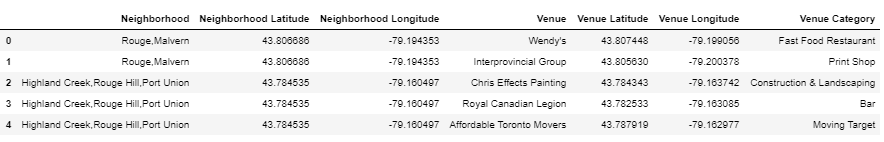
**II.2 Toronto**

**II.2.1-Toronto Data collection and transformation**

The City of **Toronto** **I**s the Canada's largest city, the fourth largest in North America with a population of 6196731 inhabitants.Data for this analysis where obtain using web crawling python API and secondely processed used the same processing méthodes decribed in the previous city analysis(NYC).For this new city ,making the same analysis as the one previously described in the section NYC DATA analisys produces the following results.

Final data structure including only the first rows :

Une image contenant capture d’écran

Description générée automatiquement

As shown by the above graphical representation,Italian Restaurant still the most represented restaurants,followed by Japanese,Fast food ,American.

Seafood Restautrant ect.. with respectively 64,48,37,30 and 26 restaurants in Toronto city.

Une image contenant capture d’écran

Description générée automatiquementLast 25 restaurants Toronto

Top 25 restaurants Toronto

For the last 25 restaurants category,they are 13 with only 1 restaurants,interesting for investment as they are few restaurants in these categories.

Let look a litle bit deeper into the data set .Here below are the top fives venues for 6 neighbohoods in Toronto city

**II.2.2-Clustering**

II.2.2.1-Parameter turning(Toronto)

Une image contenant texte, carte

Description générée automatiquement

II.2.2.1-Model fitting(kmeans)

Une image contenant texte, carte

Description générée automatiquementbest k for the kmeans cluster in the Toronto City m

Une image contenant texte

Description générée automatiquement

Table cluster 1 Toronto

Une image contenant capture d’écran

Description générée automatiquementUne image contenant capture d’écran

Description générée automatiquementUne image contenant capture d’écran

Description générée automatiquementUne image contenant capture d’écran, texte

Description générée automatiquement

Table cluster 5 Toronto

Table cluster 4 Toronto

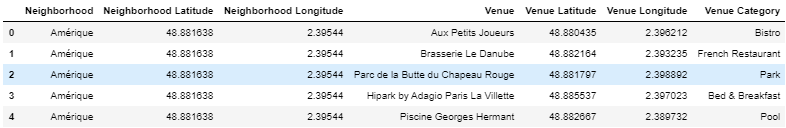
Table cluster3 Toronto

Table cluster 2 Toronto

**II.3 Paris**

II.3.1 Paris Data collection and transformation

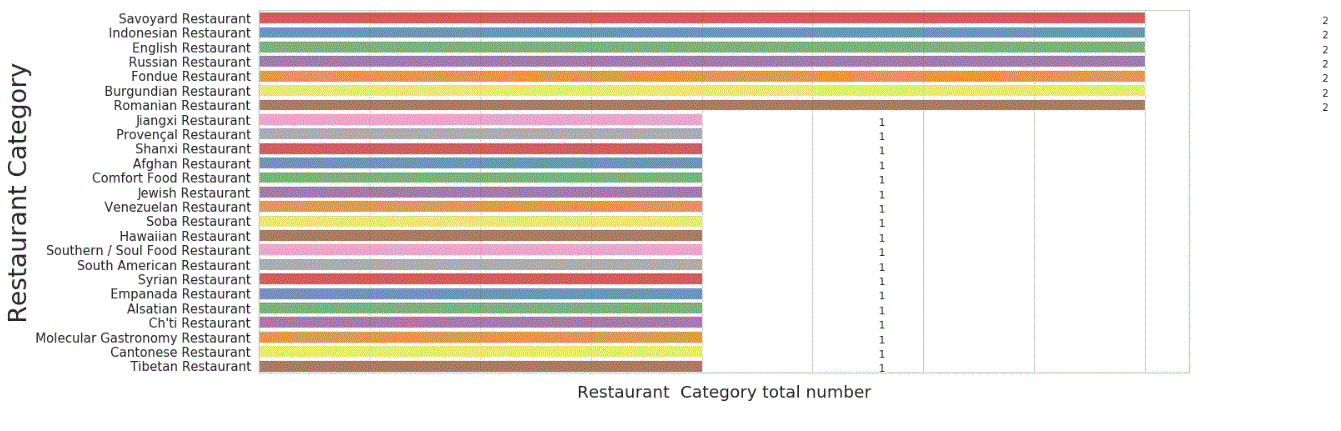
**Paris** is the [capital](https://en.wikipedia.org/wiki/Capital_city) and [most populous city](https://en.wikipedia.org/wiki/List_of_communes_in_France_with_over_20,000_inhabitants" \o "List of communes in France with over 20,000 inhabitants) of [France](https://en.wikipedia.org/wiki/France), with a [population](https://en.wikipedia.org/wiki/Population) of 2,148,271 residents (official estimate, 1 January 2020) in an area of 105 square kilometres (41 square miles).The data collection and transformation is done using the same techniques as previously describe for the two other cities(NYC and Toronto).The final data structure is :



Une image contenant capture d’écran

Description générée automatiquement

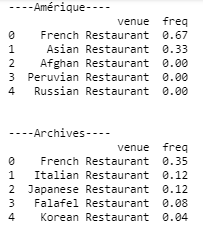
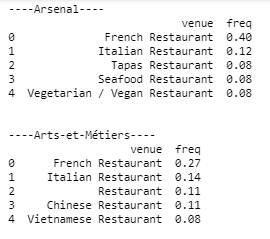
Top 25 restaurants Paris

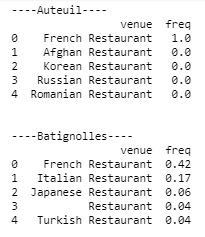
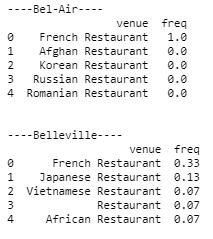
As shown by the above graphical representation,French Restaurant is the most represented restaurants,followed by Italian ,Japanese,Restaurant,Vietnamese ,Chinese etc… with respectively 702,206,129,92,49 restaurants in Paris city.

Last 25 restaurants Paris

For the last 25 restaurants category,they are 18 with only 1 restaurants,interesting for investment as they are few restaurants in these categories.

Let look a litle bit deeper into the data set .Here below are the top fives venues for 8 neighbohoods in Paris.





As for the NYC case we will cluster neighborhoods based on the 10 most common restaurants in each neigborhood in Paris.



**III.2.2- Clustering**

III.2.2.1-Parameter Turning(best k for clustering neighbohoods in Paris bas on the 10 most common restaurants category)

**Une image contenant texte, carte

Description générée automatiquement**

Here k= 3 may be the better choise ,thus grouping data set in 3 clusters.

**III.2.2 Model fitting and cluster generation**

Here,below are the cluster map for Paris and tables including neigborhood names for each clusters.

**Une image contenant texte, carte

Description générée automatiquement**

Cluster map for Paris

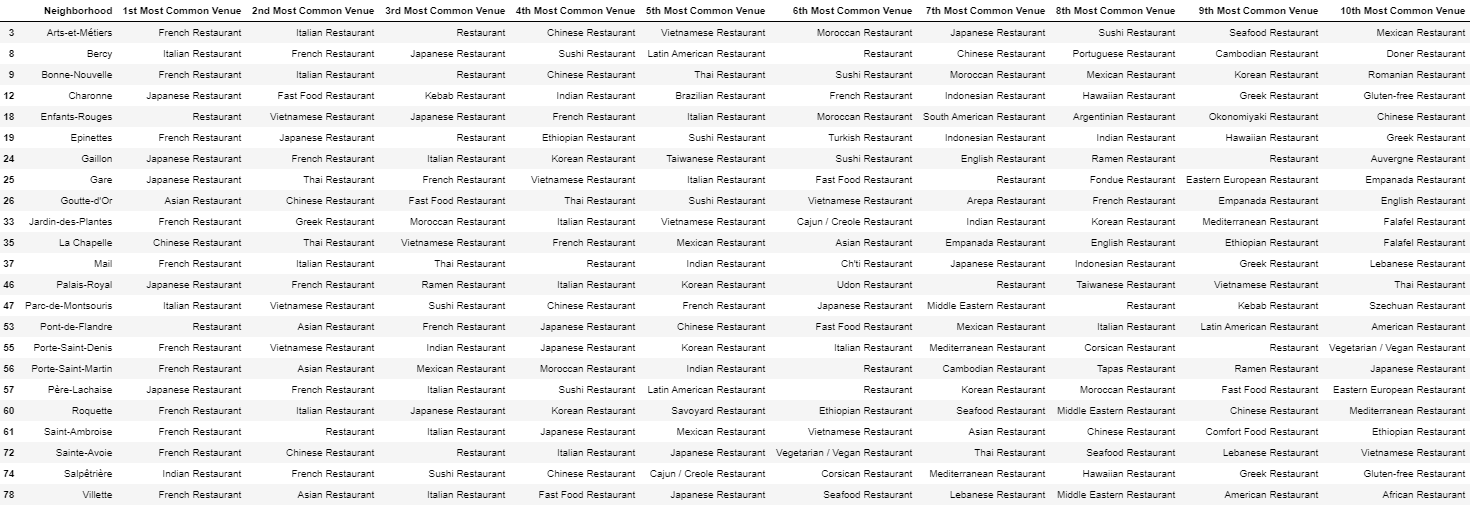
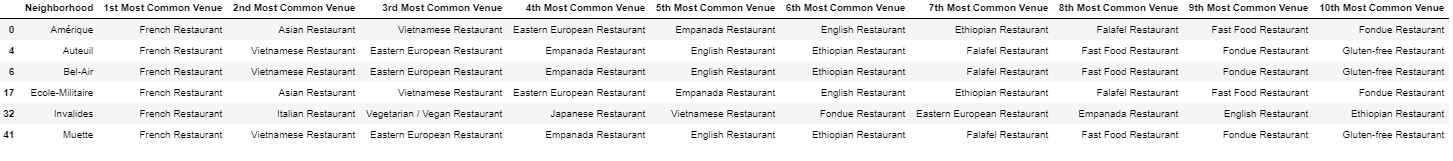


Table cluster 3 ¨Paris

Table cluster 2 Paris

Table cluster 1 Paris



**VI .Comparative of the tree cities(Paris,Tronto,NYC)**

The data collection ad processing describes in the previous section produce the following information .The analisys wil be base on Population(Total number of inhabitants in the city),Venues number,Venus number per 10000 inhabitants,unique Venus,Total number of restautant,Restaurants number per10000 inhabitants,unique restaurant number as shown in the following table



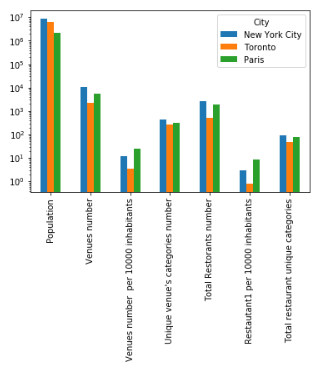


Table including informations on the on the tree cities analysed

Comparative analisis beetween the tree cities

To make things a litle bit more clear,let look at the following fiqure.To well understand what is in question here.

The most populated city here is NYC with 8398 748 inhabitants follwed by Toronto and Paris with respectively 6,196,731 and 2148271 inhabitants.

As our interest here is particularly restaurant we have respectively 2580, 503, 1866.Thus a restaurant density(Restaurants number for 10000 inhabitant )of respectively 3 ;0.8 and 8.5.In terms of restaurant diversity,the New york city is the best having 92 restaurant categories followed by Paris with 79 restaurants categories .

**V Conclusion .**

At the en of ours investigation,thanks to data we collected using data processing tools and IBM cloud,The totronto city being the less dense(0.8 restaurant for 10000 inhabitants) can be seen as the best place to invest if we tak into account only this criterion thus the restaurant demand compare to the city Paris ans newyork city heaving already lots of restaurants.From the Toronto city analisys,there are 13 restaurant category with only 1 restaurant and 7 with only two to those category may be interesting in the sens they are few.Investing in the restaurant such as German Restaurant,Taiwanese Restaurant,Modern European restaurant may be a good investment.