The Restaurant Battle of Neighborhoods in Mexico City

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1. Introduction/Business Problem

Mexico City is one of the top places to visit in the world [1]. It has many touristic places such as the historic center (designated a UNESCO World Heritage Site), colonial-era churches, El Templo Mayor (which preserves vestiges of the great Aztec empire), incredible museums, the Chapultepec Park, and many others [2].

Mexico City also possesses an extraordinary gastronomy, but for tourists locating the right place to eat can be complicated and challenging. Even for Mexicans in Mexico City, finding the right restaurant is a difficult task. Once, a friend of mine from India visited Mexico City for a conference. He asked me to show him the city, which I gladly did. Everything was going well until he told me he was a vegan, because I did not know where to find a restaurant for vegans! Mexican food is spicy, and the most delicious meals include beef or pork, which is a problem for many people around the world because of cultural, religious or health reasons.

Then, the purpose of this data science project is to help tourists in Mexico City to find restaurants of their preference. That is, in which neighborhoods of Mexico City they will find different options of restaurants (Fast food, Vegetarian food, Italian, Japanese and so on). Foreign tourists and also Mexicans are the target audience of this project.

2. Source and description of the data

Postal codes from all boroughs and neighborhoods in Mexico City were taken from https://micodigopostal.org/. For example, Figure 1 shows some of the postal codes from neighborhoods from the borough “Cuauhtémoc” in Mexico City.

MiCodigoPostal

Búsqueda de Códigos Postales de México

G+ Me gusta Compartir

Buscar por ciudad, colonia o poblado

Ciudad, colonia o poblado Buscar

Buscar por Código Postal

Código Postal Buscar

México » Ciudad de México » Cuauhtémoc

Listado de todos los Códigos Postales de Cuauhtémoc, Ciudad de México

Buscar en esta tabla (Opcional)

Asentamiento▼	Tipo de Asentamiento	Código Postal	Municipio	Ciudad	Zona	Mapa
Algarin	Colonia	06880	Cuauhtémoc	Ciudad de México	Urbana	Mapa
Ampliación Asturias	Colonia	06890	Cuauhtémoc	Ciudad de México	Urbana	Mapa
Asturias	Colonia	06850	Cuauhtémoc	Ciudad de México	Urbana	Mapa
Atlampa	Colonia	06450	Cuauhtémoc	Ciudad de México	Urbana	Mapa

Figure 1. Some postal codes from a borough in Mexico City called "Cuauhtémoc". Asentamiento, Código Postal, Municipio, Ciudad mean neighborhood, postal code, borough and city, respectively; Ciudad de Mexico means Mexico City).

Then, the postal codes from Mexico City were input in pgeocode, a python library that finds the GPS coordinates, region name, and municipality based on postal codes. After, the information from pgeocode was fed into Foursquare to search for different types of restaurants in the streets of Mexico-City neighborhoods. Figure 2 shows an example of a vegan/vegetarian restaurant in Mexico City: https://foursquare.com/explore?mode=url&near=Mexico%20City%2C%20DF%2C%20Mexico&nearGeoId=72057594041458533&q=Radha%20Krishna

Finally, the data of restaurants in Mexico City were analyzed with the k-means clustering technique to give tourists suggestions of neighborhoods where to find the right restaurant for their taste.

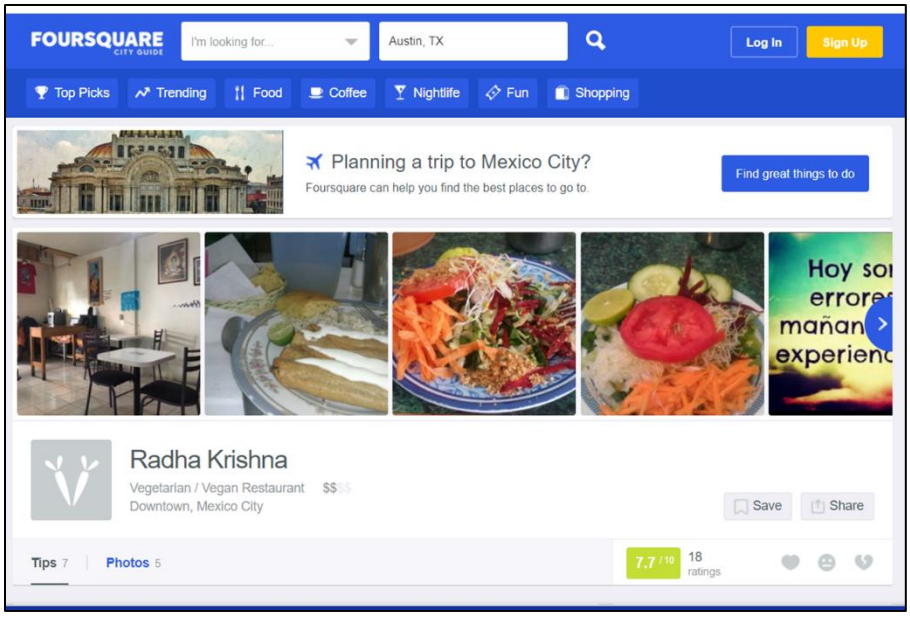


Figure 2. An example of a vegetarian/vegan restaurant in Mexico City shown in the website of Foursquare.

3. Methodology

Python was used in the IBM platform https://myibm.ibm.com/dashboard/ to perform this project. First, Tables with the names and postal codes of boroughs and neighborhoods in Mexico City were obtained from https://micodigopostal.org/. Information of the seven most important boroughs in Mexico City was taken from this website: Cuajimalpa, Cuauhtémoc, Coyoacán, Benito Juárez, Alvaro Obregón, Miguel Hidalgo and Xochimilco. The pandas read function was used to read the data from https://micodigopostal.org/, as shown in Figure 3.

```
In [60]: url1='https://micodigopostal.org/ciudad-de-mexico/cuajimalpa-de-morelos/'
         url2='https://micodigopostal.org/ciudad-de-mexico/cuauhtemoc/'
         url3='https://micodigopostal.org/ciudad-de-mexico/coyoacan/'
         url4='https://micodigopostal.org/ciudad-de-mexico/benito-juarez/'
         url5='https://micodigopostal.org/ciudad-de-mexico/alvaro-obregon/'
         url6='https://micodigopostal.org/ciudad-de-mexico/miguel-hidalgo/'
         url7='https://micodigopostal.org/ciudad-de-mexico/xochimilco/'

         df_cuajimalpa=pd.read_html(url1, header=0)[0]
         df_cuahtemoc=pd.read_html(url2, header=0)[0]
         df_coyoacan=pd.read_html(url3, header=0)[0]
         df_BenitoJuarez=pd.read_html(url4, header=0)[0]
         df_alvaroobregon=pd.read_html(url5, header=0)[0]
         df_MiguelHidalgo=pd.read_html(url6, header=0)[0]
         df_xochimilco=pd.read_html(url7, header=0)[0]

         df_xochimilco.head(5)
```

Out[60]:

	Asentamiento ▼	Tipo de Asentamiento	Código Postal	Municipio	Ciudad	Zona	Mapa
0	18	Barrio	16034	Xochimilco	Ciudad de México	Urbana	Mapa
1	3 de Mayo	Barrio	16606	Xochimilco	Ciudad de México	Urbana	Mapa
2	Ahualapa	Barrio	16533	Xochimilco	Ciudad de México	Urbana	Mapa
3	Ampliación La Noria	Colonia	16030	Xochimilco	Ciudad de México	Urbana	Mapa
4	(adsbygoogle = window.adsbygoogle || []).push(...	(adsbygoogle = window.adsbygoogle || []).push(...	(adsbygoogle = window.adsbygoogle || []).push(...	(adsbygoogle = window.adsbygoogle || []).push(...	(adsbygoogle = window.adsbygoogle || []).push(...	(adsbygoogle = window.adsbygoogle || []).push(...	(adsbygoogle = window.adsbygoogle || []).push(...

Figure 3. Use of a pandas read function to get data from a website

In Figure 3, the reader can see that the code of an image from the website was also store in in the row 4 of all data frames. To eliminate this row of all tables, the pandas drop function was used, as shown in **Figure 4**.

3. Removing the row #4 from all data frames that contains images from website

In [61]:
```
df_cuajimalpa=df_cuajimalpa.drop([4])
df_cuahtemoc=df_cuahtemoc.drop([4])
df_coyoacan=df_coyoacan.drop([4])
df_BenitoJuarez=df_BenitoJuarez.drop([4])
df_alvaroobregon=df_alvaroobregon.drop([4])
df_MiguelHidalgo=df_MiguelHidalgo.drop([4])
df_xochimilco=df_xochimilco.drop([4])

df_xochimilco
```

Out[61]:

	Asentamiento	Tipo de Asentamiento	Código Postal	Municipio	Ciudad	Zona	Mapa
0	18	Barrio	16034	Xochimilco	Ciudad de México	Urbana	Mapa
1	3 de Mayo	Barrio	16606	Xochimilco	Ciudad de México	Urbana	Mapa
2	Ahualapa	Barrio	16533	Xochimilco	Ciudad de México	Urbana	Mapa
3	Ampliación La Noria	Colonia	16030	Xochimilco	Ciudad de México	Urbana	Mapa
5	Ampliación Nativitas	Colonia	16459	Xochimilco	Ciudad de México	Urbana	Mapa
6	Ampliación San Marcos Norte	Colonia	16038	Xochimilco	Ciudad de México	Urbana	Mapa
7	Ampliación Tepepan	Colonia	16029	Xochimilco	Ciudad de México	Urbana	Mapa
8	Año de Juárez	Colonia	16440	Xochimilco	Ciudad de México	Urbana	Mapa
9	Apatlaco	Barrio	16513	Xochimilco	Ciudad de México	Urbana	Mapa
10	Belén	Barrio	16070	Xochimilco	Ciudad de México	Urbana	Mapa
11	Bosque Residencial del Sur	Colonia	16010	Xochimilco	Ciudad de México	Urbana	Mapa
12	Calpulco	Barrio	16514	Xochimilco	Ciudad de México	Urbana	Mapa

Figure 4. Use of pandas drop function to eliminate an image code imported from a website from data frames.

Then, the python library pgeocode was downloaded to get GPS coordinates, region name, and municipality through the postal codes of data frames shown in **Figure 3** (column called "código Postal"). After data cleaning and merging operations, new dataframes with relevant information of the boroughs and neighborhoods of Mexico City were created, as shown in **Figure 5** for Cuauhtémoc borough.

In [67]:
```
Cuajimalpa= Cuajimalpa.rename(columns = {"Código Postal":"Postal Code", "Municipio":"Borough", "place_name":"Neighborhood", "latitude":"Latitude", "longitude":"Longitude"})
Cuauhtemoc = Cuauhtemoc.rename(columns = {"Código Postal":"Postal Code", "Municipio":"Borough", "place_name":"Neighborhood", "latitude":"Latitude", "longitude":"Longitude"})
Coyoacan = Coyoacan.rename(columns = {"Código Postal":"Postal Code", "Municipio":"Borough", "place_name":"Neighborhood", "latitude":"Latitude", "longitude":"Longitude"})
BenitoJuarez = BenitoJuarez.rename(columns = {"Código Postal":"Postal Code", "Municipio":"Borough", "place_name":"Neighborhood", "latitude":"Latitude", "longitude":"Longitude"})
AlvaroObregon = AlvaroObregon.rename(columns = {"Código Postal":"Postal Code", "Municipio":"Borough", "place_name":"Neighborhood", "latitude":"Latitude", "longitude":"Longitude"})
MiguelHidalgo = MiguelHidalgo.rename(columns = {"Código Postal":"Postal Code", "Municipio":"Borough", "place_name":"Neighborhood", "latitude":"Latitude", "longitude":"Longitude"})
Xochimilco = Xochimilco.rename(columns = {"Código Postal":"Postal Code", "Municipio":"Borough", "place_name":"Neighborhood", "latitude":"Latitude", "longitude":"Longitude"})

Cuauhtemoc
```

Out[67]:

	Postal Code	Borough	Neighborhood	Latitude	Longitude
0	06880	Cuauhtémoc	Algarin	19.4053	-99.1408
1	06890	Cuauhtémoc	Ampliación Asturias	19.4070	-99.1313
2	06850	Cuauhtémoc	Asturias	19.4039	-99.1308
3	06450	Cuauhtémoc	Atlampa	19.4581	-99.1562
4	06350	Cuauhtémoc	Buenavista	19.4456	-99.1507
5	06780	Cuauhtémoc	Buenos Aires	19.4054	-99.1499
6	06000	Cuauhtémoc	Centro (Área 1)	19.4364	-99.1553
7	06010	Cuauhtémoc	Centro (Área 2)	19.4364	-99.1553
8	06020	Cuauhtémoc	Centro (Área 3)	19.4364	-99.1553
9	06040	Cuauhtémoc	Centro (Área 4)	19.4364	-99.1553

Figure 5. Clean pandas dataframe of Borough Cuauhtémoc and its neighborhoods in Mexico City.

Actually, during the project execution it was found that the most important and relevant borough for tourists in Mexico City is Cuauhtémoc. Therefore, from here, we are focused only on the different types of restaurants on the neighborhoods of the Cuauhtémoc borough.

Then, **Figure 6** shows a map of the neighborhoods of Cuauhtémoc borough in Mexico City obtained with the folium package and the dataframe of Cuauhtémoc borough. It should be mentioned that, because pgeocode was unable to find all the neighborhoods of Cuauhtémoc borough, some of them were found manually using Google.

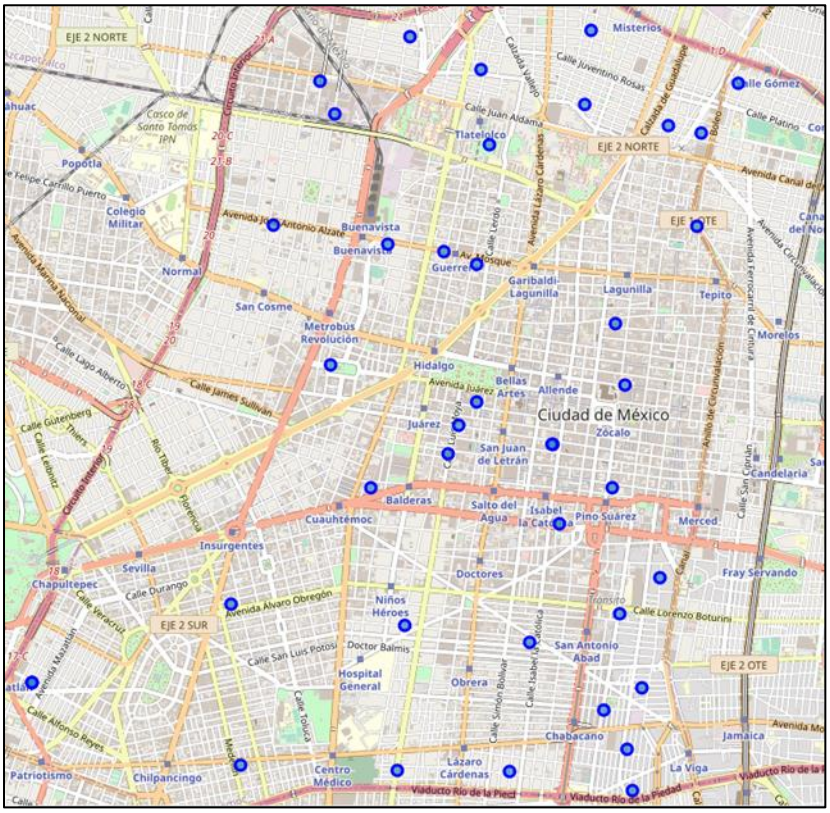


Figure 6. Map of Cuauhtémoc borough created with Folium package. Blue dots are the neighborhoods.

After, Foursquare was used to locate all the venues within a radius of less than 500 meters from the center of each neighborhood of Cuauhtémoc borough. 646 out of 2001 venues were restaurants. 31 types of restaurants were found, as shown in Figure 7. One of the first conclusions of this project was that Mexico City, and in particular the Cuauhtémoc borough, has too many Taco and Mexican restaurants, in comparison to other types of food. This is of course of common sense, but the proportion is disproportionate, in the opinion of the author of this project. 32% of restaurants are Mexican restaurants, and 19.6% are taco places, whereas, for example, Chinese restaurants only represent 0.46% of all restaurants. Therefore, Restaurants labeled as Mexican and Taco places were out of the data analysis since tourist can easily find them in the neighborhoods of Mexico City.

```
Mexican Restaurant                208
Taco Place                        127
Restaurant                         56
Seafood Restaurant                 55
Pizza Place                        27
Argentinian Restaurant             24
Italian Restaurant                 13
Tapas Restaurant                   13
Vegetarian / Vegan Restaurant      12
Sushi Restaurant                   12
Fast Food Restaurant               10
BBQ Joint                           8
Spanish Restaurant                  8
Japanese Restaurant                 8
Comfort Food Restaurant             7
Steakhouse                          7
Indian Restaurant                   6
Mediterranean Restaurant            6
German Restaurant                   5
Russian Restaurant                  4
Greek Restaurant                    4
Bistro                              4
Chinese Restaurant                  3
Southern / Soul Food Restaurant     3
New American Restaurant             3
Empanada Restaurant                 2
Paella Restaurant                   2
Asian Restaurant                    1
American Restaurant                 1
Middle Eastern Restaurant           1
Peruvian Restaurant                 1
Ramen Restaurant                    1
Name: Venue Category, dtype: int64
```

Figure 7. Categories of restaurants found by Foursquare in the neighborhoods of Cuauhtémoc borough.

Then, a bar chart with the ten most common types of restaurants in the Cuauhtémoc borough of Mexico City was created with seaborn/matplotlib packages, as shown in the Figure 8.

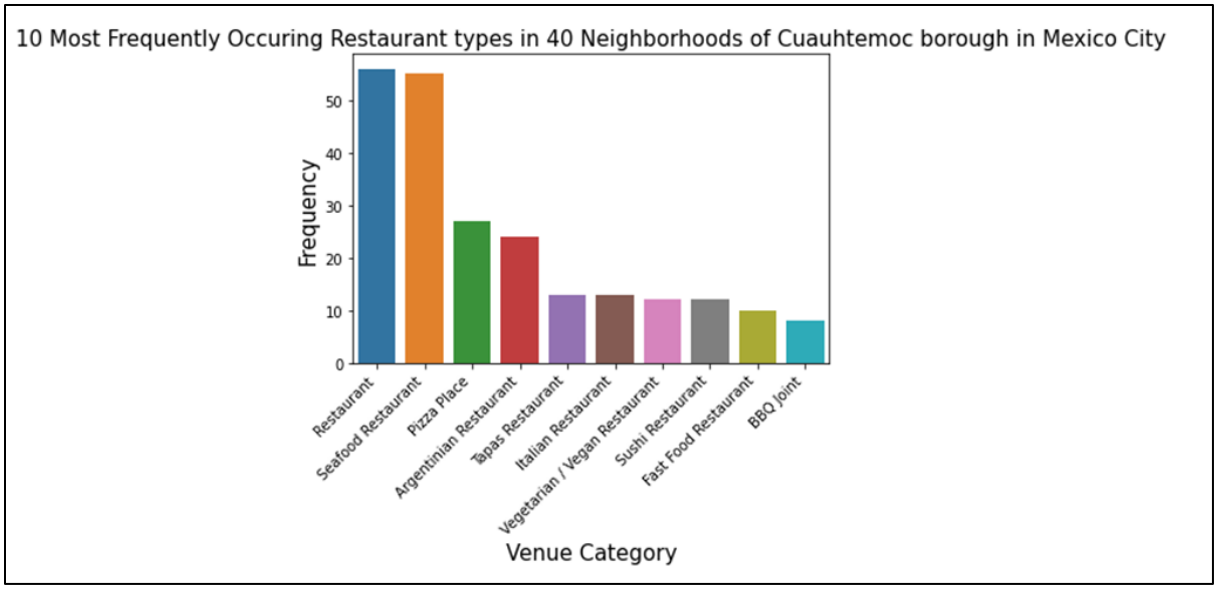


Figure 8. A plot chart with the ten most frequently occurring types of restaurants in the 40 neighborhoods of Cuauhtémoc borough in Mexico City.

It must be clarified here that first bar labeled as "Restaurant" in Figure 8 referred to small and cheap restaurants run by families in the street of the neighborhoods (commonly known as "Fondas"). They are family businesses. In this type of restaurant, you find a variety of delicious and cheap Mexican dishes. After these restaurants, Seafood and then Pizza places and Argentinian restaurants are the most frequently occurring restaurants in the Cuauhtémoc borough of Mexico City.

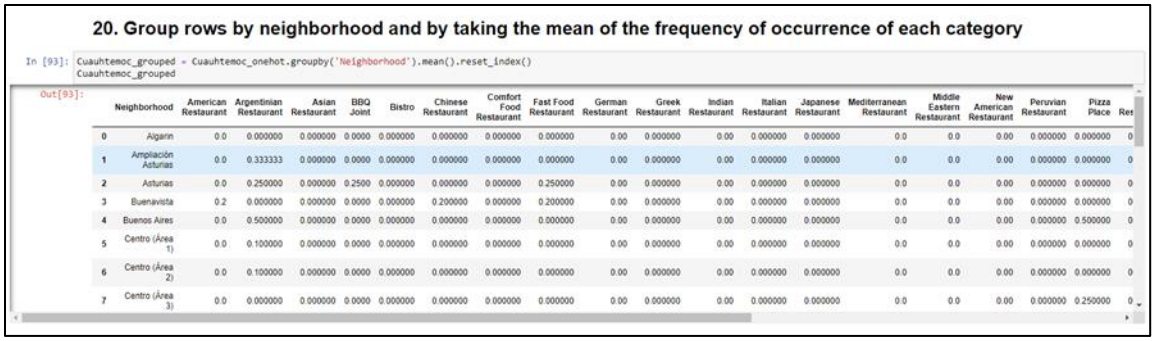
Next step is to find clusters of restaurants by using k-means technique. To do so, first each neighborhood of Cuauhtémoc borough is analyzed by one-hot encoding, as shown in the **Figure 9**.

Out[34]:

	Neighborhood	American Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant	Fast Food Restaurant	German Restaurant	Greek Restaurant	Indian Restaurant	Italian Restaurant	Japanese Restaurant	Mediterranean Restaurant	Middle Eastern Restaurant	Ame Resta
1	Algarin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	Ampliación Asturias	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	Ampliación Asturias	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	Ampliación Asturias	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	Ampliación Asturias	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	Asturias	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7	Asturias	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Figure 9. Analysis of the occurrence of each type of restaurants in the neighborhoods of Cuauhtémoc borough by one-hot encoding (0/1).

Then, the mean of the frequency of each category was determined for each neighborhood, as shown in the **Figure 10** for seven neighborhoods in the Cuauhtémoc borough.



	Neighborhood	American Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Fast Food Restaurant	German Restaurant	Greek Restaurant	Indian Restaurant	Italian Restaurant	Japanese Restaurant	Mediterranean Restaurant	Middle Eastern Restaurant	New American Restaurant	Peruvian Restaurant	Pizza Place	Res
0	Algarin	0.0	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.00	0.000000	0.000000	0.0	0.0	0.00	0.000000	0.000000	0
1	Ampliación Asturias	0.0	0.333333	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.00	0.000000	0.000000	0.0	0.0	0.00	0.000000	0.000000	0
2	Asturias	0.0	0.250000	0.000000	0.2500	0.000000	0.000000	0.000000	0.250000	0.00	0.000000	0.00	0.000000	0.000000	0.0	0.0	0.00	0.000000	0.000000	0
3	Buenavista	0.2	0.000000	0.000000	0.0000	0.000000	0.200000	0.000000	0.200000	0.00	0.000000	0.00	0.000000	0.000000	0.0	0.0	0.00	0.000000	0.000000	0
4	Buenos Aires	0.0	0.500000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.00	0.000000	0.000000	0.0	0.0	0.00	0.000000	0.500000	0
5	Centro (Área 1)	0.0	0.100000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.00	0.000000	0.000000	0.0	0.0	0.00	0.000000	0.000000	0
6	Centro (Área 2)	0.0	0.100000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.00	0.000000	0.000000	0.0	0.0	0.00	0.000000	0.000000	0
7	Centro (Área 3)	0.0	0.000000	0.000000	0.0000	0.000000	0.000000	0.000000	0.000000	0.00	0.000000	0.00	0.000000	0.000000	0.0	0.0	0.00	0.000000	0.250000	0

Figure 10. Frequency of each category of restaurants in each neighborhood of the Cuauhtémoc borough.

After, a new pandas dataframe was created with the ten most common types of restaurants in each neighborhoods of Cuauhtémoc borough. As an example, **Figure 11** shows the 10 most common types of restaurants for six neighborhoods of the Cuauhtémoc borough.

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Algarin	Steakhouse	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
1	Ampliación Asturias	Argentinian Restaurant	Vegetarian / Vegan Restaurant	Restaurant	Japanese Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
2	Asturias	Argentinian Restaurant	Vegetarian / Vegan Restaurant	Fast Food Restaurant	Tapas Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
3	Buenavista	Sushi Restaurant	American Restaurant	Chinese Restaurant	Restaurant	Fast Food Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro
4	Buenos Aires	Argentinian Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Japanese Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
5	Centro (Área 1)	Seafood Restaurant	Restaurant	Spanish Restaurant	Tapas Restaurant	Empanada Restaurant	Comfort Food Restaurant	Greek Restaurant	German Restaurant	Fast Food Restaurant	Vegetarian / Vegan Restaurant
6	Centro (Área 2)	Seafood Restaurant	Restaurant	Spanish Restaurant	Tapas Restaurant	Empanada Restaurant	Comfort Food Restaurant	Greek Restaurant	German Restaurant	Fast Food Restaurant	Vegetarian / Vegan Restaurant

Figure 11. The 10 most common types of restaurants in six neighborhoods of the Cuauhtémoc borough in Mexico City.

Finally, the k-means clustering algorithm was applied to the dataframe shown in Figure 11 to obtain the restaurant clusters that will help tourists to find restaurants of their preference. A k value of 5 was chosen for the k-means technique.

4. Results

Figure 12 shows a pandas dataframe with the clusters of neighborhoods of the Cuauhtémoc borough and their most common types of restaurants, labeled from 0 to 4.

	Postal Code	Borough	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Common V
0	06880	Cuauhtémoc	Algarin	19.4053	-99.1408	2	Steakhouse	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empa Rest
1	06890	Cuauhtémoc	Ampliación Asturias	19.4070	-99.1313	1	Argentinian Restaurant	Vegetarian / Vegan Restaurant	Restaurant	Japanese Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empa Rest
2	06850	Cuauhtémoc	Asturias	19.4039	-99.1308	1	Argentinian Restaurant	Vegetarian / Vegan Restaurant	Fast Food Restaurant	Tapas Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empa Rest
3	06450	Cuauhtémoc	Atlampa	19.4581	-99.1562	1	Vegetarian / Vegan Restaurant	Tapas Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant	Fast Rest
4	06350	Cuauhtémoc	Buenavista	19.4456	-99.1507	1	Sushi Restaurant	American Restaurant	Chinese Restaurant	Restaurant	Fast Food Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	
5	06780	Cuauhtémoc	Buenos Aires	19.4054	-99.1499	1	Argentinian Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Japanese Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empa Rest
6	06000	Cuauhtémoc	Centro (Área 1)	19.4303	-99.1373	0	Seafood Restaurant	Restaurant	Spanish Restaurant	Tapas Restaurant	Empanada Restaurant	Comfort Food Restaurant	Greek Restaurant	German Restaurant	Fast Food Restaurant	Vegetarian / Rest
7	06010	Cuauhtémoc	Centro (Área 2)	19.4303	-99.1374	0	Seafood Restaurant	Restaurant	Spanish Restaurant	Tapas Restaurant	Empanada Restaurant	Comfort Food Restaurant	Greek Restaurant	German Restaurant	Fast Food Restaurant	Vegetarian / Rest
8	06020	Cuauhtémoc	Centro (Área 3)	19.4396	-99.1322	4	Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Rest
9	06040	Cuauhtémoc	Centro (Área 4)	19.4270	-99.1520	1	German Restaurant	Italian Restaurant	Argentinian Restaurant	Seafood Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Japanese Restaurant	Asian Restaurant	BBQ Joint	
10	06050	Cuauhtémoc	Centro (Área 5)	19.4336	-99.1435	0	Restaurant	Seafood Restaurant	Spanish Restaurant	Comfort Food Restaurant	Vegetarian / Vegan Restaurant	Argentinian Restaurant	Japanese Restaurant	BBQ Joint	Asian Restaurant	
11	06060	Cuauhtémoc	Centro (Área 6)	19.4349	-99.1314	4	Restaurant	Pizza Place	Italian Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Rest
12	06070	Cuauhtémoc	Centro (Área 7)	19.4296	-99.1458	1	Vegetarian / Vegan Restaurant	Seafood Restaurant	Comfort Food Restaurant	Argentinian Restaurant	Restaurant	Tapas Restaurant	Pizza Place	Spanish Restaurant	Southern / Soul Food Restaurant	Jap Rest
13	06080	Cuauhtémoc	Centro (Área 8)	19.4243	-99.1368	1	Pizza Place	Steakhouse	Chinese Restaurant	Fast Food Restaurant	Tapas Restaurant	Vegetarian / Vegan Restaurant	Italian Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ
14	06090	Cuauhtémoc	Centro (Área 9)	19.4270	-99.1325	1	Seafood Restaurant	Pizza Place	Italian Restaurant	Argentinian Restaurant	Steakhouse	Tapas Restaurant	Middle Eastern Restaurant	Restaurant	Empanada Restaurant	German Rest

Figure 12. Clusters of neighborhoods of the Cuauhtémoc borough and their most common types of restaurants, labeled from 0 to 4.

Figure 13 shows in colored circles the clusters of restaurants in the neighborhoods of the Cuauhtémoc borough in Mexico City. This map was built using Folium package.

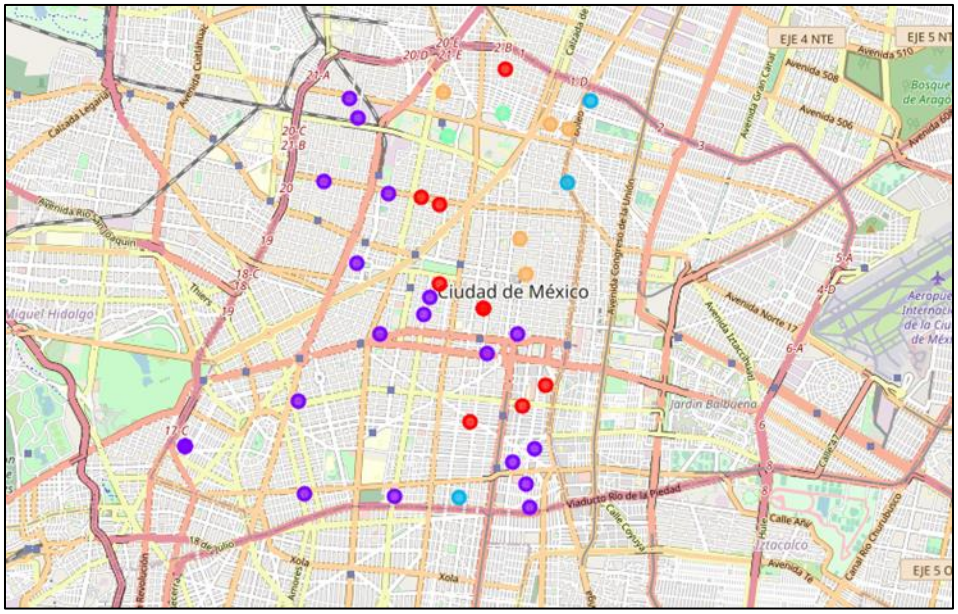
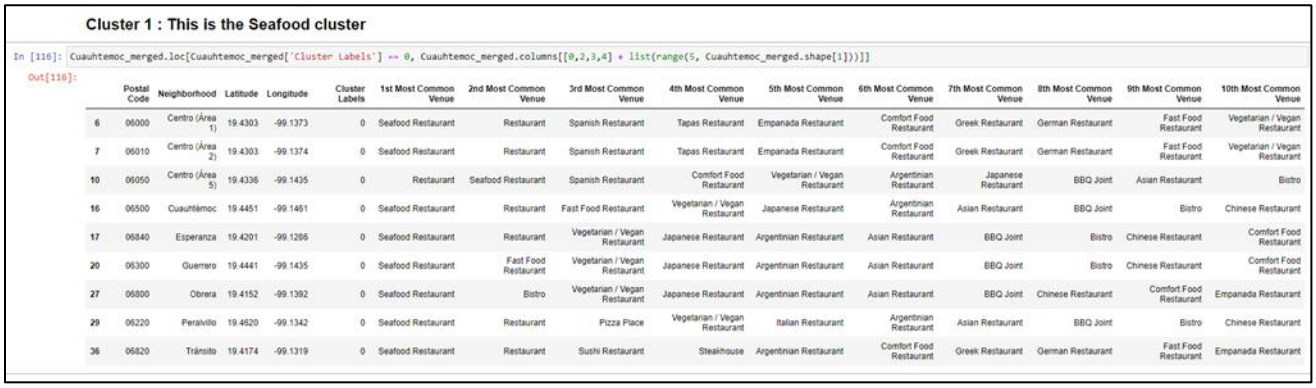


Figure 13. Restaurant clusters in the neighborhoods of the Cuauhtémoc borough in Mexico City.

Finally, **Figures 14 to 18** present the five clusters of restaurants located in the neighborhoods of the Cuauhtémoc borough in Mexico City. Cluster 2 is not fully visualized because of limited space in this report, but readers can find the whole cluster in the GitHub of the author: https://github.com/PereiraSostiene?tab=repositories



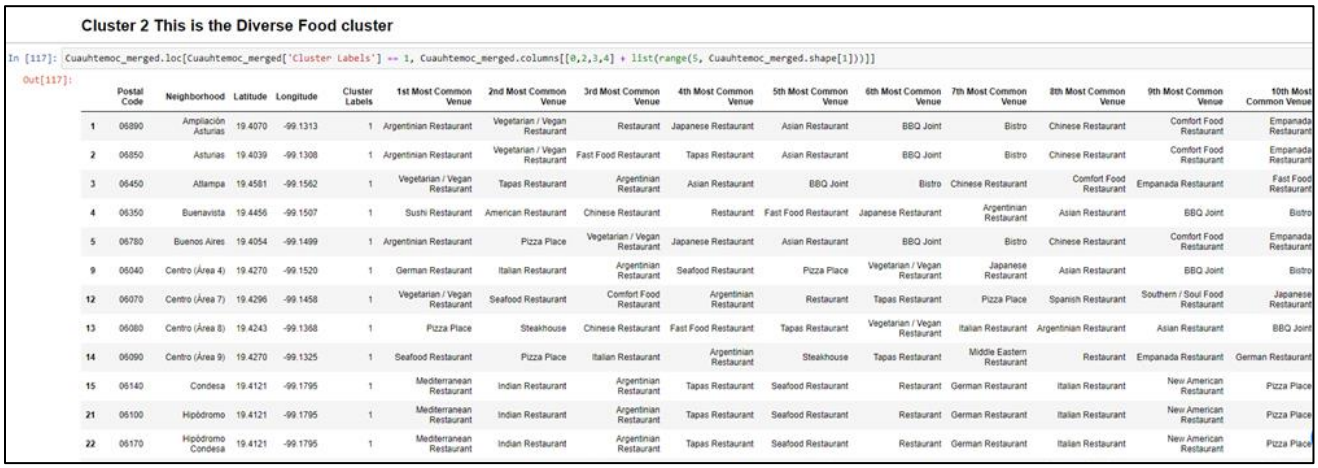
Cluster 1 : This is the Seafood cluster

```
In [116]: Cuauhtemoc_merged.loc[Cuauhtemoc_merged['Cluster Labels'] == 0, Cuauhtemoc_merged.columns[[0,2,3,4] + list(range(5, Cuauhtemoc_merged.shape[1]))]]
```

Out[116]:

	Postal Code	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
6	06000	Centro (Área 1)	19.4303	-99.1373	0	Seafood Restaurant	Restaurant	Spanish Restaurant	Tapas Restaurant	Empanada Restaurant	Comfort Food Restaurant	Greek Restaurant	German Restaurant	Fast Food Restaurant	Vegetarian / Vegan Restaurant
7	06010	Centro (Área 2)	19.4303	-99.1374	0	Seafood Restaurant	Restaurant	Spanish Restaurant	Tapas Restaurant	Empanada Restaurant	Comfort Food Restaurant	Greek Restaurant	German Restaurant	Fast Food Restaurant	Vegetarian / Vegan Restaurant
10	06050	Centro (Área 5)	19.4336	-99.1435	0	Restaurant	Seafood Restaurant	Spanish Restaurant	Comfort Food Restaurant	Vegetarian / Vegan Restaurant	Argentinian Restaurant	Japanese Restaurant	BBQ Joint	Asian Restaurant	Bistro
16	06500	Cuauhtémoc	19.4451	-99.1461	0	Seafood Restaurant	Restaurant	Fast Food Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant
17	06840	Esperanza	19.4201	-99.1286	0	Seafood Restaurant	Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant
20	06300	Guerrero	19.4441	-99.1435	0	Seafood Restaurant	Fast Food Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant
27	06800	Obrera	19.4152	-99.1392	0	Seafood Restaurant	Bistro	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
29	06220	Peralvillo	19.4620	-99.1342	0	Seafood Restaurant	Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Italian Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant
36	06820	Tránsito	19.4174	-99.1319	0	Seafood Restaurant	Restaurant	Sushi Restaurant	Steakhouse	Argentinian Restaurant	Comfort Food Restaurant	Greek Restaurant	German Restaurant	Fast Food Restaurant	Empanada Restaurant

Figure 14. The Seafood cluster.



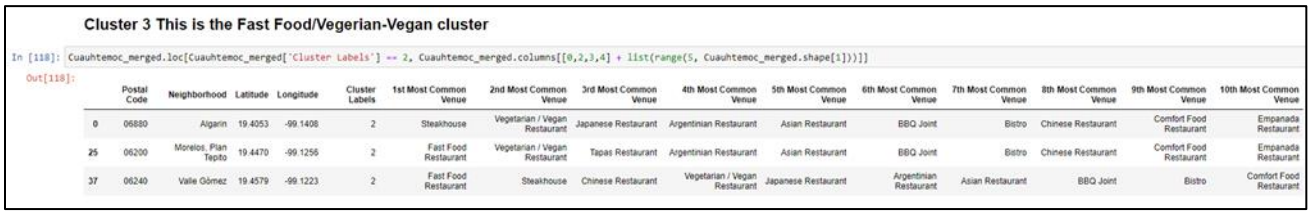
Cluster 2 This is the Diverse Food cluster

```
In [117]: Cuauhtemoc_merged.loc[Cuauhtemoc_merged['Cluster Labels'] == 1, Cuauhtemoc_merged.columns[[0,2,3,4] + list(range(5, Cuauhtemoc_merged.shape[1]))]]
```

Out[117]:

	Postal Code	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
1	06890	Ampliación Asturias	19.4070	-99.1313	1	Argentinian Restaurant	Vegetarian / Vegan Restaurant	Restaurant	Japanese Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
2	06850	Asturias	19.4039	-99.1308	1	Argentinian Restaurant	Vegetarian / Vegan Restaurant	Fast Food Restaurant	Tapas Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
3	06450	Atlampa	19.4581	-99.1562	1	Vegetarian / Vegan Restaurant	Tapas Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant	Fast Food Restaurant
4	06350	Buenavista	19.4456	-99.1507	1	Sushi Restaurant	American Restaurant	Chinese Restaurant	Restaurant	Fast Food Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro
5	06780	Buenos Aires	19.4054	-99.1499	1	Argentinian Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Japanese Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
9	06040	Centro (Área 4)	19.4270	-99.1520	1	German Restaurant	Italian Restaurant	Argentinian Restaurant	Seafood Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Japanese Restaurant	Asian Restaurant	BBQ Joint	Bistro
12	06070	Centro (Área 7)	19.4296	-99.1458	1	Vegetarian / Vegan Restaurant	Seafood Restaurant	Comfort Food Restaurant	Argentinian Restaurant	Restaurant	Tapas Restaurant	Pizza Place	Spanish Restaurant	Southern / Soul Food Restaurant	Japanese Restaurant
13	06080	Centro (Área 8)	19.4243	-99.1368	1	Pizza Place	Steakhouse	Chinese Restaurant	Fast Food Restaurant	Tapas Restaurant	Vegetarian / Vegan Restaurant	Italian Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint
14	06090	Centro (Área 9)	19.4270	-99.1325	1	Seafood Restaurant	Pizza Place	Italian Restaurant	Argentinian Restaurant	Steakhouse	Tapas Restaurant	Middle Eastern Restaurant	Restaurant	Empanada Restaurant	German Restaurant
15	06140	Condesa	19.4121	-99.1795	1	Mediterranean Restaurant	Indian Restaurant	Argentinian Restaurant	Tapas Restaurant	Seafood Restaurant	Restaurant	German Restaurant	Italian Restaurant	New American Restaurant	Pizza Place
21	06100	Hipódromo	19.4121	-99.1795	1	Mediterranean Restaurant	Indian Restaurant	Argentinian Restaurant	Tapas Restaurant	Seafood Restaurant	Restaurant	German Restaurant	Italian Restaurant	New American Restaurant	Pizza Place
22	06170	Hipódromo Condesa	19.4121	-99.1795	1	Mediterranean Restaurant	Indian Restaurant	Argentinian Restaurant	Tapas Restaurant	Seafood Restaurant	Restaurant	German Restaurant	Italian Restaurant	New American Restaurant	Pizza Place

Figure 15. The Diverse Food cluster.



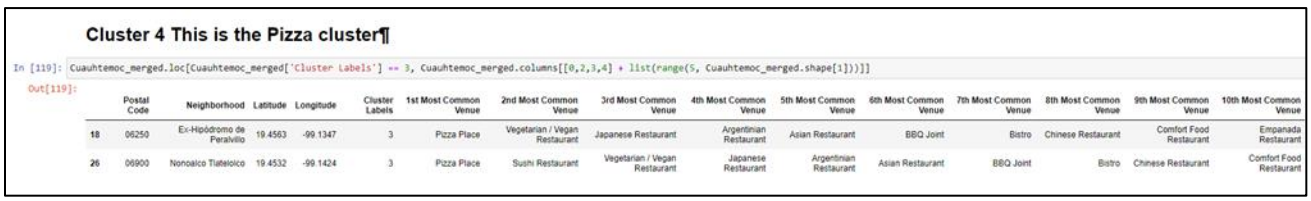
Cluster 3 This is the Fast Food/Vegerian-Vegan cluster

```
In [118]: Cuauhtemoc_merged.loc[Cuauhtemoc_merged['Cluster Labels'] == 2, Cuauhtemoc_merged.columns[[0,2,3,4] + list(range(5, Cuauhtemoc_merged.shape[1]))]]
```

Out[118]:

	Postal Code	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	06880	Algarín	19.4053	-99.1408	2	Steakhouse	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
25	06200	Morelos, Plan Tepito	19.4470	-99.1256	2	Fast Food Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
37	06240	Valle Gómez	19.4579	-99.1223	2	Fast Food Restaurant	Steakhouse	Chinese Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Comfort Food Restaurant

Figure 16. The Fast Food/Vegetarian-Vegan cluster.



Cluster 4 This is the Pizza cluster¶

```
In [119]: Cuauhtemoc_merged.loc[Cuauhtemoc_merged['Cluster Labels'] == 3, Cuauhtemoc_merged.columns[[0,2,3,4] + list(range(5, Cuauhtemoc_merged.shape[1]))]]
```

Out[119]:

	Postal Code	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
18	06250	Ex-Hipódromo de Peralvillo	19.4563	-99.1347	3	Pizza Place	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant	Empanada Restaurant
26	06900	Nonoalco Tlatelolco	19.4532	-99.1424	3	Pizza Place	Sushi Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant

Figure 17. The Pizza cluster.

Cluster 5: This is the Mexican Food Cluster¶

```
In [120]: Cuauhtemoc_merged.loc[Cuauhtemoc_merged['Cluster Labels'] == 4, Cuauhtemoc_merged.columns[[0,2,3,4] + list(range(5, Cuauhtemoc_merged.shape[1]))]]
```

Out[120]:

	Postal Code	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
8	06020	Centro (Área 3)	19.4396	-99.1322	4	Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant
11	06060	Centro (Área 6)	19.4349	-99.1314	4	Restaurant	Pizza Place	Italian Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant
19	06280	Felipe Pescador	19.4541	-99.1253	4	Restaurant	Seafood Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant
24	06270	Maza	19.4547	-99.1279	4	Restaurant	Seafood Restaurant	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant
33	06920	San Simón Tolnáhuac	19.4590	-99.1431	4	Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Japanese Restaurant	Argentinian Restaurant	Asian Restaurant	BBQ Joint	Bistro	Chinese Restaurant	Comfort Food Restaurant

Figure 18. The Mexican Food cluster.

4. Discussion (Discussion section where you discuss any observations you noted and any recommendations you can make based on the results)

As I mentioned above, the first observation I found was that in Mexico City is not easy to find diverse food because Mexican Food (Mexican dishes, Tacos and Fondas) is dominant in comparison to other types of Food. For example, Chinese restaurants represents only 0.46% of all restaurants in Mexico City, whereas Mexican Food represent 60%. In a way, this strengthens the development of this project, since we can tell tourists the specific street and neighborhoods where to find food other than Mexican one.

In this report I only proposed to form five food clusters, and one of them resulted as a "diverse food cluster", which means that many types foods, that are not abundant, are together located in specifics neighborhoods of the Cuauhtémoc borough in Mexico City. It is probable that trying with more clusters we can have an "Argentinian cluster" or a "Mediterranean cluster.

I would suggest to entrepreneurs to invest in the restaurant industry in Mexico City. It seems a business opportunity to invest in restaurants offering foreign dishes.

5. Conclusions

A data science project was developed to help tourists in Mexico City to locate restaurant of their taste. Five clusters were found in the Cuauhtémoc borough (the most important one for tourism): the seafood, the diverse-food, the Fast Food/Vegetarian-Vegan, the pizza, and the Mexican-food clusters. The code can be easily modified to find restaurants in other boroughs of Mexico City.

6. References

1. https://www.journeymexico.com/blog/mexico-city-rough-guides-2020

2. https://www.visitmexico.com/en/mexico-city