
Comparing neighborhoods of Abidjan and Dakar

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1. Introduction(Business Problem)

The purpose of this project is to analyze the neighborhoods data of two western Africa cities namely Abidjan and Dakar with Data Science to see if there are any kind of similarities between them.

Abidjan is the capital city of Cote d'Ivoire (Ivory Coast) and Dakar is the capital city of Senegal. An insight of the similarities or dissimilarities can help basically tourists (to make a choice between the two cities) or those who would like to relocate in one of these cities.

2. The Data

In a structured format, it was difficult to find documented at one place, neighborhoods information about Abidjan and Dakar. Particularly the localization information such as Latitude and Longitude.

We proceeded from site to site in order to collect the data on the neighborhoods and put them together in csv files (Dakar_data.csv, Abidjan_data.csv).

For instance, to collect the coordinates info, we had to search on geo-localization web pages' neighborhoods per neighborhood. This imply that scraping the web via a code couldn't help.

2.1 Abidjan neighborhoods.

The data is comprised of the neighborhoods in Abidjan. In all they are thirteen (13) and below the columns description:

1. *Neighborhoods*: The name of the neighborhoods
2. *Latitude*: The latitude of the neighborhood
3. *Longitude*: The longitude of the neighborhood

Neighborhood	Latitude	Longitude
Abobo	5.432887	-4.038892
Adjamé	5.365073	-4.023572
Yopougon	5.365073	-4.023572
Le Plateau	5.323212	-4.023689
Attécoubé	5.3362	-4.0414
Cocody	5.35	-3.9833
Koumassi	5.303	-3.9419

Marcory	5.3027	-3.9827
Port-Bouët	5.2773	-3.8859
Treichville	5.2936	-4.0083
Anyama	5.5	-4.05
Bingerville	5.35	-3.9
Songon	5.2917	-4.2454

Table 1 : Abidjan neighborhoods.

2.2 Dakar neighborhoods.

Dakar neighborhoods are in all thirteen (18) The data list the neighborhoods with:

1. *Borough*: The names of the borough
2. *Neighborhoods*: The name of the neighborhoods
3. *Latitude*: The latitude of the neighborhood
4. *Longitude*: The longitude of the neighborhood

Borough	Neighborhood	Latitude	Longitude
Almadies	Mermoz-Sacré-Cœur	14.703417	-17.474614
Almadies	Ngor	14.744162	-17.512056
Almadies	Ouakam	14.723712	-17.494233
Almadies	Yoff	14.747126	-17.490256
Dakar Plateau	Dakar-Plateau	14.67183	-17.418832
Dakar Plateau	Fann-Point E-Amitié	14.697605	-17.456508
Dakar Plateau	Gorée	14.66683	-17.392332
Dakar Plateau	Gueule Tapée-Fass-Colobane	14.673452	-17.46325
Dakar Plateau	Médina	14.6822	-17.4494
Grand Dakar	Biscuiterie	15	-17.4542
Grand Dakar	Dieuppeul-Derklé	14.725	-17.4514
Grand Dakar	Grand Dakar	14.7042	-17.4533
Grand Dakar	Hann Bel-Air	14.7103	-17.435
Grand Dakar	HLM	14.7235	-17.4433
Grand Dakar	Sicap-Liberté	14.7109	-17.461
Parcelles Assainies	Cambérène	14.7708	-17.4308
Parcelles Assainies	Grand Yoff	14.7336	-17.4494
Parcelles Assainies	Les Parcelles Assainies	14.7569	-17.4347
Parcelles Assainies	Patte d'Oie	14.745	-17.4342

Table 2: Dakar neighborhoods

2.3 Venues data.

Foursquare is a technology company that built a dataset of accurate localization data. We use its API (free) to get information about venues located in a radius of 1500 m around each neighborhoods of interest (given their latitude and longitude). Next we build a data frame out of the Json we received from the API as shown below.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Category
0	Abobo (IC)	5.432887	-4.038892	Glacier NUMBER ONE	Gastropub
1	Adjame (IC)	5.365073	-4.023572	Black Market	Flea Market
2	Adjame (IC)	5.365073	-4.023572	Yopougon Autoroute Du Nord	Bus Station
3	Adjame (IC)	5.365073	-4.023572	Nouvelle Gare	Bus Station
4	Adjame (IC)	5.365073	-4.023572	Deport de Boisson	Brewery

3. Methodology

It was difficult though to find a complete structured data on the neighborhoods with their location data (geographical coordinates) at one place. What we did was to collect the information from web pages (eg: www.distancede.com) per neighborhood and initiated a csv file.

From the csv, we load the neighborhoods and their geographical coordinates data (latitude, longitude) and proceed to the analysis of their venues categories.

3.1 Step 1

The first thing we did was to group the venues per neighborhoods. This helped us to understand the areas with a higher numbers of venues known to Foursquare. It showed that:

- **Marcory and Plateau** have the highest number of venues declared and are probably the most prominent neighborhoods.
- **Cocody, Yopougan, Treichville and Adjame** are second in line in term of number of venues.
- **Abobo** (renowned for its violence), **Bingerville** and **Attecoube** have the lowest number of venues. Which would imply that these neighborhoods have less infrastructures built.

	Venue	Venue Category
Neighborhood		
Abobo (IC)	1	1
Adjame (IC)	8	8
Attecoube (IC)	1	1
Bingerville (IC)	1	1
Cocody (IC)	8	8
Koumassi (IC)	6	6
Le Plateau (IC)	16	16
Marcory (IC)	24	24
Treichville (IC)	8	8
Yopougon (IC)	9	9

Table 3: Number of venues per neighborhood

3.2 Step 2

The next step taken was to create a dummy data Frame from the neighborhoods venues categories. The process renders a numerical value in place of the venues categories names.

Neighborhood	African Restaurant	Art Gallery	BBQ Joint	Bakery	Bar	Basketball Stadium	Beer Bar	Bistro	Boutique	Brewery	Bus Station	Cafeteria	Café	Camera Store	Comedy Club	Conve
Marcory (IC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marcory (IC)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Marcory (IC)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marcory (IC)	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Treichville (IC)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Treichville (IC)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treichville (IC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treichville (IC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treichville (IC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treichville (IC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treichville (IC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Treichville (IC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treichville (IC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bingerville (IC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Dummy data: (0) when the category does not exist for the particular neighborhood, (1) when a category is identified for the neighborhood

Then we grouped the data per neighborhoods and calculated the mean per category. Which led to the following frame

	Neighborhood	African Restaurant	Art Gallery	BBQ Joint	Bakery	Bar	Basketball Stadium	Beer Bar	Bistro	Boutique	Bowling Alley	Brewery	Bus Station	Cafeteria	Café	Camer Stor
0	Abobo (IC)	0.000	0.000000	0.000	0.000000	0.0	0.000	0.0	0.000000	0.000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000
1	Adjame (IC)	0.000	0.000000	0.000	0.000000	0.0	0.000	0.0	0.000000	0.000	0.000000	0.142857	0.285714	0.000000	0.000000	0.14285
2	Attacoube (IC)	0.000	0.000000	0.000	0.000000	0.0	0.000	0.0	0.000000	0.000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000
3	Bingerville (IC)	0.000	0.000000	0.000	0.000000	0.0	0.000	0.0	0.000000	0.000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000
4	Cocody (IC)	0.125	0.000000	0.125	0.125000	0.0	0.000	0.0	0.000000	0.125	0.000000	0.000000	0.000000	0.000000	0.125000	0.00000
5	Koumassi (IC)	0.000	0.000000	0.000	0.200000	0.0	0.000	0.0	0.000000	0.000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000
6	Le Plateau (IC)	0.000	0.000000	0.000	0.000000	0.0	0.000	0.0	0.000000	0.000	0.000000	0.000000	0.000000	0.000000	0.062500	0.00000
7	Marcory (IC)	0.000	0.034483	0.000	0.034483	0.0	0.000	0.0	0.034483	0.000	0.034483	0.034483	0.000000	0.034483	0.034483	0.00000
8	Treichville (IC)	0.125	0.000000	0.000	0.000000	0.0	0.125	0.0	0.000000	0.000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000
9	Yopougon (IC)	0.000	0.000000	0.000	0.000000	0.4	0.000	0.1	0.100000	0.000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000

Categories means per neighborhood

Remark

- **Cocody** and **Treichville** only report the presence of “_African Restaurants_” which is quite meaningful. For it looks like these areas are frequented by Foreigners (Europeans mainly)
- **Marcory** also has many venue category names found in oversea.
- **Adjame** appears as an area flooded with Bus stations.
- **Yopougon** is identified by its Bars.

3.3 Step 3

The purpose of this step is to list the top venues per neighborhoods. To do so:

- We first display the top five (5) venues per neighborhoods given their calculated means.

But by proceeding in this way did not allow us to get the information about the category name.

For example: Abobo first venues has a mean of one (1) but we can't provide the name of the venue (see table below).

Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Abobo (IC)	1	0	0	0	0
Adjame (IC)	0.285714	0.142857	0.142857	0.142857	0.142857
Attécoube (IC)	0.666667	0.333333	0.142857	0.142857	0.142857
Bingerville (IC)	1	0.333333	0.142857	0.142857	0.142857
Cocody (IC)	0.125	0.125	0.125	0.125	0.125
Koumassi (IC)	0.166667	0.166667	0.166667	0.166667	0.166667
Le Plateau (IC)	0.4	0.066667	0.066667	0.066667	0.066667
Marcory (IC)	0.107143	0.0714286	0.0714286	0.0357143	0.0357143
Treichville (IC)	0.25	0.125	0.125	0.125	0.125
Yopougon (IC)	0.333333	0.111111	0.111111	0.111111	0.111111

This led us to go further and to list the category names corresponding to the calculated means values.

Example: Abobo first venues has a mean of 1 (table above) and its name is Gastropub

Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Abobo (IC)	Gastropub	Train Station	Cafeteria	Electronics Store	Diner
Adjame (IC)	Fast Food Restaurant	Train Station	Brewery	Camera Store	Bus Station
Attécoube (IC)	Pier	Department Store	Train Station	Bus Station	Electronics Store
Bingerville (IC)	Restaurant	Train Station	Bus Station	Electronics Store	Diner
Cocody (IC)	African Restaurant	Fast Food Restaurant	BBQ Joint	Bakery	Diner
Koumassi (IC)	Diner	Bakery	Cupcake Shop	Convenience Store	Hotel
Le Plateau (IC)	Hotel	French Restaurant	Grocery Store	Nightclub	Park
Marcory (IC)	Shopping Mall	Café	Nightclub	Food Court	Ice Cream Shop
Treichville (IC)	Harbor / Marina	African Restaurant	Basketball Stadium	Comedy Club	Mobile Phone Shop
Yopougon (IC)	Bar	Electronics Store	Restaurant	Playground	Beer Bar

- Now with these two outputs, we can consolidate the data and give a better description of the neighborhoods.
 - If the first column mean value is higher compared to the rest of the top columns, we choose the category name of the first column to describe the neighborhood.
 - Where the means has the same values for different categories, we combined the categories names to describe the neighborhood.

Neighborhoods	Characteristics	Description
Abobo	Gastropub	Gastropub
Adjame	Very busy place	Fast Food Restaurant, and Bus Stations
Attécoube	Pier	Pier
Bingerville	Restauration	Restauration

Cocody	Modern place with restaurants and boutiques	No enough distinctive characters. but it can be noticed that it is a wealthy environment
Koumassi	Restauration is dominant activity	No enough distinctive characters to describe this neighborhood
Le Plateau	Business area	Different type of Hotel should be easy to find
Marcory	Europeans life style	Shopping Mall , Nightclub
Treichville	Habor and Electronics shops	Harbor / Marina
Yopougon	Bars	Bars

3.4 Step 4

After listing the top venues per neighborhoods and described them, we wanted to know at this point about the similarities between these neighborhoods. Can we group them based on their venues?

To answer this question, we choose KMEAM Model to cluster these neighborhoods into seven (7) clusters (7 centroids seem to give a better result). The following is the result.

Cluster Labels	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
1	Abobo (IC)	Gastropub	Train Station	Cafeteria	Electronics Store	Diner
6	Adjame (IC)	Fast Food Restaurant	Train Station	Brewery	Camera Store	Bus Station
3	Attécoube (IC)	Pier	Department Store	Train Station	Bus Station	Electronics Store
2	Bingerville (IC)	Restaurant	Train Station	Bus Station	Electronics Store	Diner
0	Cocody (IC)	African Restaurant	Fast Food Restaurant	BBQ Joint	Bakery	Diner
5	Koumassi (IC)	Diner	Bakery	Cupcake Shop	Convenience Store	Hotel
5	Le Plateau (IC)	Hotel	French Restaurant	Grocery Store	Nightclub	Park
0	Marcory (IC)	Shopping Mall	Café	Nightclub	Food Court	Ice Cream Shop
0	Treichville (IC)	Harbor / Marina	African Restaurant	Basketball Stadium	Comedy Club	Mobile Phone Shop
4	Yopougon (IC)	Bar	Electronics Store	Restaurant	Playground	Beer Bar

- **Abobo** and **Bingerville** could go together in the same cluster
- **Yopougon** is on its own portray with bars and restaurants.
- **Koumassi** and **Cocody** being in the same cluster confirms the remark we reported in: "*Table 1: Abidjan neighborhoods distinctive characters*". both neighborhoods do not have a dominant characteristic.

Neighborhood	Cluster Label	Description
Abobo	2	Gastropub
Adjame	6	Popular and busy district
Attécoube	3	Pier

Bingerville	0	Restauration
Cocody, Koumassi	1	Supermarkets and Bakery?
Le Plateau, Marcory, Treichville	5	Business, shopping and entertainment
Yopougon	4	Bar

Table 4: Abidjan neighborhoods by cluster

3.5 Step 5

After studying the case of Abidjan, we use the same approach for Dakar the second city to come out with the following

a- Number of venues per neighborhood

Neighborhood	Venue	Venue Category
Camberene (SN)	3	3
Dakar Plateau (SN)	21	21
Dieuppeul Derkle (SN)	5	5
Fann Point E Amitie (SN)	11	11
Goree (SN)	4	4
Grand Dakar (SN)	7	7
Grand Yoff (SN)	8	8
Gueule Tapee Fass Colobane (SN)	10	10
HLM (SN)	4	4
Hann Bel Air (SN)	4	4
Les Parcelles Assainies (SN)	6	6
Medina (SN)	9	9
Mermoz Sacre Cœur (SN)	25	25
Ngor (SN)	59	59
Ouakam (SN)	8	8
Patte d'Oie (SN)	11	11
Sicap Liberte (SN)	13	13
Yoff (SN)	11	11

Table 5: Number of venues per neighborhood

In term of number of venues per neighborhoods, we have the following structure (descendant order):

- First: Ngor, Mermoz Sacre Coeur, Dakar Plateau have the highest number of venues
- Second: Sicap Liberte, Fann Point E Amitie, Yoff
- Third: Gueule Tapee Fass Colobane, Hann Bel Air, Medina ,Ouakam, Grand Dakar, Grand Yoff, Les Parcelles Assainies
- Fourth: Dieuppeul Derkle, Goree, HLM, Patte d'Oie, Camberene

b- Top venues per neighborhoods

Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Camberene (SN)	Accessories Store	Business Service	Bakery	Brazilian Restaurant	Buffet
Dakar Plateau (SN)	Hotel	French Restaurant	Pool	Seafood Restaurant	Lounge
Dieuppeul Derkle (SN)	Fast Food Restaurant	Electronics Store	Health & Beauty Service	Diner	Buffet
Fann Point E Amitie (SN)	Pizza Place	Asian Restaurant	Bakery	French Restaurant	Steakhouse
Goree (SN)	Boat or Ferry	History Museum	Art Museum	Restaurant	Zoo
Grand Dakar (SN)	Asian Restaurant	French Restaurant	Steakhouse	Soccer Stadium	Plaza
Grand Yoff (SN)	Supermarket	Fast Food Restaurant	Business Service	Soccer Stadium	Bakery
Gueule Tapee Fass Colobane (SN)	Restaurant	Hotel	Breakfast Spot	French Restaurant	Sports Club
HLM (SN)	Zoo	Farmers Market	Restaurant	Ice Cream Shop	Convenience Store
Hann Bel Air (SN)	Furniture / Home Store	Health & Beauty Service	Sporting Goods Shop	Diner	Creperie
Les Parcelles Assainies (SN)	Park	Pharmacy	Market	Art Gallery	Hostel
Medina (SN)	Shopping Mall	Flea Market	History Museum	Arts & Crafts Store	Hotel
Mermoz Sacre Cœur (SN)	Pizza Place	Restaurant	African Restaurant	Gym / Fitness Center	Bowling Alley
Ngor (SN)	Hotel	Restaurant	African Restaurant	Seafood Restaurant	Beach
Ouakam (SN)	Beach	Pastry Shop	Bakery	African Restaurant	Lighthouse
Patte d Oie (SN)	Supermarket	Park	Hostel	Market	Pharmacy
Sicap Liberte (SN)	Ice Cream Shop	Supermarket	Electronics Store	Kebab Restaurant	Shopping Mall
Yoff (SN)	Hotel	Airport Lounge	Airport	Supermarket	Arcade

Table 6: Top venues

The table below provides a description for each neighborhood based on their top venues.

Neighborhood	Characteristics	Description
Camberene	Bakery ,Business Service	Accessories Store, Business Service Bakery
Dakar Plateau	Hotel	Hotel, Pool, Seafood Restaurant
Dieuppeul Derkle	Fast Food Restaurant, Electronics Store, Health & Beauty Service	
Fann Point E Amitie	Pizza Place	Foreigners Restauration
Goree	Boat or Ferry, History Museum,Art Museum	Historical sites
Grand Dakar	No out standing characteristic	Asian Restaurant, French Restaurant, Steakhouse Soccer Stadium
Grand Yoff	Supermarket, Fast Food Restaurant	
Gueule Tapee Fass Colobane	Restaurant, Hotel	
HLM	Zoo,Farmers Market	
Hann Bel Air	Furniture / Home Store, Health & Beauty Service, Sporting Goods Shop	
Les Parcelles Assainies	No out standing characteristic	No out standing characteristic
Medina	Shopping Mall	
Mermoz Sacre Coeur	Pizza Place	
Ngor	Hotel	
Ouakam	Beach	
Patte d Oie	Supermarket	
Sicap Liberte	Ice Cream Shop, Supermarket	
Yoff	Hotel, Airport Lounge	

c- Clustering Dakar neighborhoods

KMean model is used to cluster the neighborhoods with seven centroids.

Cluster Labels	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
6	Camberene (SN)	Accessories Store	Business Service	Bakery	Brazilian Restaurant	Buffet
0	Dakar Plateau (SN)	Hotel	French Restaurant	Pool	Seafood Restaurant	Lounge
2	Dieuppeul Derkle (SN)	Fast Food Restaurant	Electronics Store	Health & Beauty Service	Diner	Buffet
0	Fann Point E Amitie (SN)	Pizza Place	Asian Restaurant	Bakery	French Restaurant	Steakhouse
1	Goree (SN)	Boat or Ferry	History Museum	Art Museum	Restaurant	Zoo
0	Grand Dakar (SN)	Asian Restaurant	French Restaurant	Steakhouse	Soccer Stadium	Plaza
5	Grand Yoff (SN)	Supermarket	Fast Food Restaurant	Business Service	Soccer Stadium	Bakery
0	Gueule Tapee Fass Colobane (SN)	Restaurant	Hotel	Breakfast Spot	French Restaurant	Sports Club
3	HLM (SN)	Zoo	Farmers Market	Restaurant	Ice Cream Shop	Convenience Store
4	Hann Bel Air (SN)	Furniture / Home Store	Health & Beauty Service	Sporting Goods Shop	Diner	Creperie
5	Les Parcelles Assainies (SN)	Park	Pharmacy	Market	Art Gallery	Hostel
0	Medina (SN)	Shopping Mall	Flea Market	History Museum	Arts & Crafts Store	Hotel
0	Mermoz Sacre Cœur (SN)	Pizza Place	Restaurant	African Restaurant	Gym / Fitness Center	Bowling Alley
0	Ngor (SN)	Hotel	Restaurant	African Restaurant	Seafood Restaurant	Beach
0	Ouakam (SN)	Beach	Pastry Shop	Bakery	African Restaurant	Lighthouse
5	Patte d'Oie (SN)	Supermarket	Park	Hostel	Market	Pharmacy
5	Sicap Liberte (SN)	Ice Cream Shop	Supermarket	Electronics Store	Kebab Restaurant	Shopping Mall
0	Yoff (SN)	Hotel	Airport Lounge	Airport	Supermarket	Arcade

Summary of the different cluster

Neighborhood	Cluster Label	Description
Camberene	3	Accessories Store, Business Service, Bakery
Dakar Plateau, Gueule Tapee Fass Colobane, Hann Bel Air, Medina, Ngor, Yoff	1	Hotel, Restaurant, Furniture / Home Store, Shopping Mall
Dieuppeul Derkle	6	Fast Food Restaurant, Electronics Store, Health & Beauty Service
Fann Point E Amitie, Grand Dakar, Grand Yoff, Les Parcelles Assainies, Mermoz Sacre Coeur, Ouakam, Sicap Liberte	0	Pizza Place, Supermarket, Fast Food Restaurant, Beach, Ice Cream Shop
Goree	4	Boat or Ferry, History Museum, Art Museum
HLM	5	Zoo, Farmers Market
Patte d'Oie	2	Supermarket

Table 7 : Dakar neighborhoods clusters

3.6 Comparing Abidjan and Dakar Neighborhoods

- We merge here Abidjan and Dakar data into one dataset called: *cities_neigh* and clean the it to keep only category names that are common to the cities.

	Neighborhood	Gastropub	Flea Market	Fast Food Restaurant	Bar	Electronics Store	Pharmacy	Restaurant	Playground	Café	Hotel	Soccer Field	Park	Ita Restau
0	Abobo (IC)	1.00	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
1	Adjame (IC)	0.00	0.142857	0.285714	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
2	Attécoubé (IC)	0.00	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
3	Bingerville (IC)	0.00	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
4	Cocody (IC)	0.00	0.000000	0.125000	0.000000	0.000000	0.000000	0.000000	0.000000	0.125000	0.000000	0.000000	0.000000	0.000
5	Koumassi (IC)	0.00	0.000000	0.000000	0.000000	0.000000	0.166667	0.000000	0.000000	0.000000	0.166667	0.000000	0.000000	0.000
6	Le Plateau (IC)	0.00	0.000000	0.000000	0.000000	0.000000	0.000000	0.066667	0.000000	0.066667	0.400000	0.066667	0.066667	0.066
7	Marcory (IC)	0.00	0.000000	0.035714	0.000000	0.035714	0.000000	0.035714	0.000000	0.071429	0.035714	0.000000	0.000000	0.000
8	Treichville (IC)	0.00	0.000000	0.000000	0.000000	0.125000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
9	Yopougon (IC)	0.00	0.000000	0.000000	0.333333	0.111111	0.111111	0.111111	0.111111	0.000000	0.000000	0.000000	0.000000	0.000
10	Camberène (SN)	0.00	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
11	Dakar Plateau (SN)	0.00	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.047619	0.142857	0.000000	0.000000	0.047
12	Dieuppeul Derkle (SN)	0.00	0.000000	0.600000	0.000000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
13	Fann Point E Amitié (SN)	0.00	0.090909	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
14	Goree (SN)	0.00	0.000000	0.000000	0.000000	0.000000	0.000000	0.250000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
15	Grand Dakar (SN)	0.00	0.000000	0.000000	0.000000	0.142857	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000
16	Grand Yoff (SN)	0.00	0.000000	0.250000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000

➤ The list of the top 10 categories per neighborhood.

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Abobo (IC)	Gastropub	Harbor / Marina	Flea Market	Fast Food Restaurant	Bar
1	Adjame (IC)	Fast Food Restaurant	Flea Market	Mobile Phone Shop	Harbor / Marina	Bar
2	Attécoubé (IC)	Pier	Harbor / Marina	Flea Market	Fast Food Restaurant	Bar
3	Bingerville (IC)	Restaurant	Mobile Phone Shop	Harbor / Marina	Flea Market	Fast Food Restaurant
4	Cocody (IC)	Café	Supermarket	Fast Food Restaurant	Bakery	Boutique
5	Koumassi (IC)	Convenience Store	Bakery	Hotel	Pharmacy	Diner
6	Le Plateau (IC)	Hotel	Restaurant	Café	Soccer Field	Park
7	Marcory (IC)	Shopping Mall	Café	Supermarket	Ice Cream Shop	Restaurant
8	Treichville (IC)	Harbor / Marina	Electronics Store	African Restaurant	Shopping Mall	Mobile Phone Shop
9	Yopougon (IC)	Bar	Electronics Store	Pharmacy	Restaurant	Playground
10	Camberène (SN)	Bakery	Mobile Phone Shop	Shopping Mall	Flea Market	Fast Food Restaurant
11	Dakar Plateau (SN)	Hotel	French Restaurant	Café	Italian Restaurant	BBQ Joint
12	Dieuppeul Derkle (SN)	Fast Food Restaurant	Electronics Store	Mobile Phone Shop	Harbor / Marina	Flea Market
13	Fann Point E Amitié (SN)	Pizza Place	French Restaurant	Flea Market	Bakery	Shopping Mall
14	Goree (SN)	Restaurant	Mobile Phone Shop	Harbor / Marina	Flea Market	Fast Food Restaurant
15	Grand Dakar (SN)	Electronics Store	French Restaurant	Mobile Phone Shop	Harbor / Marina	Flea Market
16	Grand Yoff (SN)	Fast Food Restaurant	Supermarket	Ice Cream Shop	Bakery	Playground
17	Gueule Tapee Fass Colobane (SN)	Restaurant	Hotel	Playground	French Restaurant	Mobile Phone Shop
18	HLM (SN)	Restaurant	Ice Cream Shop	Mobile Phone Shop	Shopping Mall	Flea Market
19	Hann Bel Air (SN)	Sporting Goods Shop	Furniture / Home Store	Diner	Mobile Phone Shop	Playground
20	Les Parcelles Assainies (SN)	Art Gallery	Bakery	Park	Pharmacy	Mobile Phone Shop
21	Medina (SN)	Shopping Mall	Flea Market	Movie Theater	Hotel	Mobile Phone Shop
22	Mermoz Sacré Cœur (SN)	Pizza Place	Restaurant	African Restaurant	Mobile Phone Shop	Supermarket
23	Ngor (SN)	Hotel	Restaurant	African Restaurant	French Restaurant	Bakery
24	Ouakam (SN)	Bakery	African Restaurant	Pizza Place	Mobile Phone Shop	Playground
25	Patte d'Oie (SN)	Supermarket	Ice Cream Shop	Park	African Restaurant	Pharmacy
26	Sicap Liberté (SN)	Ice Cream Shop	Supermarket	Shopping Mall	Fast Food Restaurant	Bakery
27	Yoff (SN)	Hotel	Restaurant	Supermarket	Mobile Phone Shop	Shopping Mall

- We clustered the neighborhoods into 8 clusters. And analyze their similarities.

a- First cluster (cluster_0)

```
cluster_0.head()
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
2	Attécoube (IC)	Pier	Harbor / Marina	Flea Market	Fast Food Restaurant	Bar

Attécoube of Ivory Coast is also a peculiar neighborhood unlike any of the neighborhoods in Dakar.

Neighborhood	City
Attécoube	Abidjan

b- Second cluster (cluster_1)

```
cluster_1.head(10)
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
5	Koumassi (IC)	Convenience Store	Bakery	Hotel	Pharmacy	Diner
6	Le Plateau (IC)	Hotel	Restaurant	Café	Soccer Field	Park
11	Dakar Plateau (SN)	Hotel	French Restaurant	Café	Italian Restaurant	BBQ Joint
17	Gueule Tapee Fass Colobane (SN)	Restaurant	Hotel	Playground	French Restaurant	Mobile Phone Shop
23	Ngor (SN)	Hotel	Restaurant	African Restaurant	French Restaurant	Bakery
27	Yoff (SN)	Hotel	Restaurant	Supermarket	Mobile Phone Shop	Shopping Mall

We could describe the cluster_0 to be an area where one can find easily and in variety **Hotels and Restaurants**

Neighborhood	City
Koumassi	Abidjan
Le Plateau	Abidjan
Dakar Plateau	Dakar
Gueule Tapee Fass Colobane	Dakar
Ngor	Dakar
Yoff	Dakar

c- Third cluster (cluster_2)

```
cluster_2.head()
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Abobo (IC)	Gastropub	Harbor / Marina	Flea Market	Fast Food Restaurant	Bar

Abobo of Ivory Coast known for its **Gastropub** has no similar neighborhoods in Dakar..

Neighborhood	City
Abobo	Abidjan

d- Fourth cluster (cluster_3)

```
cluster_3.head(15)
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
7	Marcory (IC)	Shopping Mall	Café	Supermarket	Ice Cream Shop	Restaurant
8	Treichville (IC)	Harbor / Marina	Electronics Store	African Restaurant	Shopping Mall	Mobile Phone Shop
9	Yopougon (IC)	Bar	Electronics Store	Pharmacy	Restaurant	Playground
13	Fann Point E Amitie (SN)	Pizza Place	French Restaurant	Flea Market	Bakery	Shopping Mall
14	Goree (SN)	Restaurant	Mobile Phone Shop	Harbor / Marina	Flea Market	Fast Food Restaurant
15	Grand Dakar (SN)	Electronics Store	French Restaurant	Mobile Phone Shop	Harbor / Marina	Flea Market
18	HLM (SN)	Restaurant	Ice Cream Shop	Mobile Phone Shop	Shopping Mall	Flea Market
20	Les Parcelles Assainies (SN)	Art Gallery	Bakery	Park	Pharmacy	Mobile Phone Shop
21	Medina (SN)	Shopping Mall	Flea Market	Movie Theater	Hotel	Mobile Phone Shop
22	Mermoz Sacre Cœur (SN)	Pizza Place	Restaurant	African Restaurant	Mobile Phone Shop	Supermarket
24	Ouakam (SN)	Bakery	African Restaurant	Pizza Place	Mobile Phone Shop	Playground

Neighborhood	City
Marcory	Abidjan
Treichville	Abidjan
Yopougon	Abidjan
Fann Point E Amitie	Dakar
Goree	Dakar
Grand Dakar	Dakar
HLM	Dakar
Les Parcelles Assainies	Dakar
Medina	Dakar
Mermoz Sacre Coeur	Dakar
Ouakam	Dakar

Shopping Mall, Pizza Place, Bar, Harbor / Marina, Restaurant, Art Gallery are found in these neighborhoods

Cluster 3 includes most of the neighborhoods both from Dakar (8) and Abidjan (3). We use the word cloud package to identify the most important themes for this cluster based on their venue category names.



From the word cloud, it appears that the top venues are of the types **Shopping malls, Electronics Store and Food restaurants**. Therefore we describe the cluster as the zone for shopping malls, electronics store and Restaurants.

e- Fifth cluster (cluster_4)

```
cluster_4.head()
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
1	Adjame (IC)	Fast Food Restaurant	Flea Market	Mobile Phone Shop	Harbor / Marina	Bar
12	Dieuppeul Derkle (SN)	Fast Food Restaurant	Electronics Store	Mobile Phone Shop	Harbor / Marina	Flea Market

This cluster shows that **Fast Food Restaurant** are highly present in these neighborhoods

Neighborhood	City
Adjame	Abidjan
Dieuppeul Derkle	Dakar

f- Sixth cluster (cluster_5)

```
cluster_5.head()
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
3	Bingerville (IC)	Restaurant	Mobile Phone Shop	Harbor / Marina	Flea Market	Fast Food Restaurant

Bingerville has no similar neighborhoods.

g- Seventh cluster (cluster_6)

```
cluster_6.head(10)
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
4	Cocody (IC)	Café	Supermarket	Fast Food Restaurant	Bakery	Boutique
10	Camberene (SN)	Bakery	Mobile Phone Shop	Shopping Mall	Flea Market	Fast Food Restaurant
16	Grand Yoff (SN)	Fast Food Restaurant	Supermarket	Ice Cream Shop	Bakery	Playground
25	Patte d Oie (SN)	Supermarket	Ice Cream Shop	Park	African Restaurant	Pharmacy
26	Sicap Liberte (SN)	Ice Cream Shop	Supermarket	Shopping Mall	Fast Food Restaurant	Bakery

Cluster 6 includes one (1) neighborhood from Abidjan and (4) from Dakar. These neighborhoods are therefore similar in their kinds: **Supermarket, Fast Food Restaurant, Ice Cream Shop**.

Neighborhood	City	Description
Cocody	Abidjan	
Camberene	Dakar	
Grand Yoff	Dakar	
Patte d Oie	Dakar	
Sicap Liberte	Dakar	

a- Height cluster (cluster_7)

```
cluster_7.head()
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
19	Hann Bel Air (SN)	Sporting Goods Shop	Furniture / Home Store	Diner	Mobile Phone Shop	Playground

Hann Bel Air has no similar neighborhoods in Ivory Coast.

4. Results and Discussion

During our analysis (based mainly on neighborhoods avenues categories) we were able to identify similarities between neighborhoods within the same cities and at a second stage similarities between neighborhoods of two different cities using Kmean model.

- We were able to identify for instance in Abidjan, neighborhoods which have high number of venues compared to Others. These neighborhoods are actually well equipped in infrastructures.
- We noticed that **restauration** is one of the common category found in almost every neighborhood.
- Some neighborhoods are mainly occupied by Europeans and beyond.

The venues analysis is not sufficient though, to show deeper insights on a neighborhood. Insights such as employment ratio, crime data can be exploit to improve the accuracy of the neighborhood description. But it is a starting point on revealing basic characteristics of a neighborhood.

5. Conclusion

The Battle of the Neighborhoods project helped us to have some information on Abidjan and Dakar neighborhoods. And identified the similarity between them.

Indeed, the results we obtained showed that a lot of Abidjan and Dakar neighborhoods are similar (7/10 from Abidjan and 10/18 from Dakar). Restauration is quite present at every corner. There are neighborhoods with plenty of known venues whereas some have almost none in the dataset of foursquare

Yopougon appeared to be a mark or particularity of Abidjan with a lot of Bar, bistro, and so forth. But we found out with the clustering that it has some similarities with Dakar.

Behavioral (or crime data) and the employment ratio data would help to provide much more insights on neighborhoods.