Location for a burger joint

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1. Introduction/Business Problem

Find a good location to start a business is a challenge problem. A young man wants start his first business. He makes very tasty hamburgers and decided to open a burger joint. He lives between two universities and thinks that locations where there are many students are good to sell hamburgers because students like it. He wants to know what is the best location to open his business, that is, near what university and in what region near the university.

In this project we will help this young choose a location to sell hamburgers in Campinas, State of São Paulo, Brazil. We will take into the number of burger joints that already exist in the neighborhood of universities, if necessary we will include other categories of restaurants to improve our analysis. We will use Foursquare api to find them.

We will make Exploratory Data Analysis and use a clustering algorithm to detect locations that are not already crowded with burger joints and we will choose a locations as close to university as possible.

2. Data

To solve our problem we need:

- University locations;
- Burger joint and others restaurants locations.

The university name's were provided by young that will start the business. And we use Google maps to get the address.

2.1 University Locations

2.1.1 Address

2.1.1.1 UNICAMP

Name: Universidade Estadual de Campinas

Address: Cidade Universitária Zeferino Vaz - Barão Geraldo, Campinas - SP, 13083-970

Site: https://www.unicamp.br/unicamp/mapas

2.1.1.2 MACKENZIE

Name: Universidade Presbiteriana Mackenzie, Campus Campinas

Address: Av. Brasil, 1220 - Jardim Guanabara, Campinas - SP, 13073-148

Site: https://www.mackenzie.br/universidade/campinas/

2.1.2 Google Maps url

We use the Google Maps url to take latitude and longitude values of Universities. The latitude and longitude are at the end of url.

2.1.2.1 Google Maps - UNICAMP

https://www.google.com.br/maps/place/UNICAMP+Universidade+Estadual+de+Campinas/@-22.8176241,-47.0681567,15z/data=!4m5!3m4!1s0x94c8c6b005d24db5:0xc6db750ecf04d796!8m2!3d-22.8184393!4d-47.0647206?hl=pt-BR

Latitude is equal to -22.8184393 and longitude is equal to -47.0647206.

2.1.2.2 Google Maps - Mackenzie

https://www.google.com.br/maps/place/Av.+Brasil,+1220+-+Jardim+Guanabara,+Campinas+-+SP,+13073-148/@-22.8854167,-47.0706735,17z/data=!3m1!4b1!4m5!3m4!1s0x94c8c61ad1cc9435:0x94dba75d07160912!8m2!3d-22.8854217!4d-47.0684848?hl=pt-BR

Latitude is equal to -22.8854217 and, longitude is equal to -47.0684848.

2.1.3 City of Campinas with the two universities

We use geopy [1] to get Campinas' geographical coordinates: latitude: -22.90556, longitude: -47.06083.

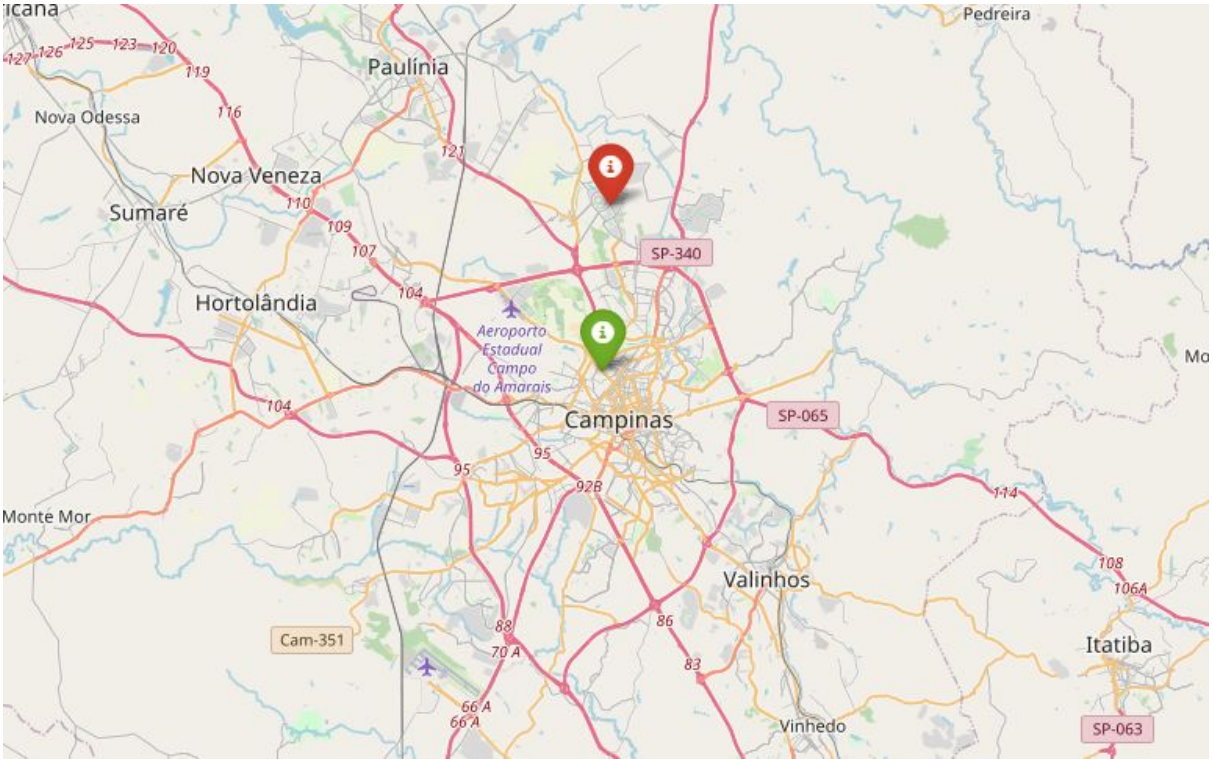


Fig 1. Map of Campinas, São Paulo, Brazil. In red Unicamp and in green Mackenzie.

2.2 Restaurant locations

In this section, we use Foursquare API [2] to get the burger joint locations.

2.2.2 Search for burger near universities

2.2.2.1 Unicamp

The parameters used in the request were

- ll=-22.8184393,-47.0647206
- v='20180605'
- query = 'burger',
- radius = 1000,limit = 50.

The search for burger returned zero results so we decided include other food categories (Burger Joint, Bakery, Fast Food Restaurant, Food Stand, Food Truck, Hot Dog Joint, Pastelaria, Pizza Place, Sandwich Place, Snack Place). We take the categories from Foursquare Documentation [3].

The categories included and their ids are shown in the table 1.

Table 1: Categories and id's from Foursquare

Category	Id

Burger Joint	4bf58dd8d48988d16c941735
Bakery	4bf58dd8d48988d16a941735
Fast Food Restaurant	4bf58dd8d48988d16e941735
Food Stand	56aa371be4b08b9a8d57350b
Food Truck	4bf58dd8d48988d1cb941735
Hot Dog Joint	4bf58dd8d48988d16f941735
Pastelaria	5294cbda3cf9994f4e043a63
Pizza Place	4bf58dd8d48988d1ca941735
Sandwich Place	4bf58dd8d48988d1c5941735
Snack Place	4bf58dd8d48988d1c7941735

2.2.3 Search for restaurants

Now we use categoryid parameter with a comma separated list of categories

2.2.3.1 Unicamp

The parameters used in the request were

- ll=-22.8184393,-47.0647206
- v='20180605'
- categoryid = a comma separated list of categories shown in section 2.2.2.1.
- radius = 1000,limit = 50.

The restaurants in Unicamp's neighborhood are in Table 2 and in fig 2.

Table 2: Restaurants in Unicamp's neighborhood

	name	categories	lat	lng	distance
0	Cantina da FEC	Snack Place	-22.816377	-47.062062	356
1	Rango Da Une	Food Stand	-22.817047	-47.069927	556
2	Delão Lanches	Food Truck	-22.815784	-47.073780	975
3	Pizzaria Piramide	Pizza Place	-22.824541	-47.072202	1025
4	Lanchonete do IEL	Snack Place	-22.815227	-47.070109	658
5	Espetos do Japa	Food Truck	-22.822791	-47.070209	742
6	CRIS CHURROS	Food Truck	-22.820718	-47.074268	1011
7	Porquetta Grill & Co.	Food Truck	-22.817267	-47.070708	628
8	Redi Lanches	Burger Joint	-22.824901	-47.067300	766

9	King Stoned	Smoke Shop	-22.826250	-47.072360	1170
10	Piadina	Sandwich Place	-22.817010	-47.070740	637
11	Pastelaria Ideal	Snack Place	-22.822477	-47.070224	721
12	Papelon	Food Truck	-22.814953	-47.066701	438
13	Burguer King Shopping Dom Pedro	Fast Food Restaurant	-22.813271	-47.062553	616
14	Sabor De Paris	Food Truck	-22.812378	-47.058673	916
15	De la rua Mexican Burritos	Food Truck	-22.826448	-47.072785	1216
16	Quiosque Do Açaí	Snack Place	-22.820020	-47.071950	762
17	Natortilha	Taco Place	-22.812383	-47.058756	910
18	Hoshi Japanese Food Truck	Food Truck	-22.811991	-47.058603	953
19	Lu Cupcakeria	Food Truck	-22.812355	-47.058678	918
20	Chefs Na Unicamp	Food Truck	-22.817307	-47.069977	553
21	Lanchonete Centro Médico	Snack Place	-22.809037	-47.065138	1047
22	Star Tresh (Auto lanches Guarujá)	Bar	-22.818930	-47.072800	830
23	Veg Wrap	Food Stand	-22.817171	-47.070477	607
24	Star Clean	Bar	-22.819026	-47.073024	854
25	Posto Ipiranga	Gas Station	-22.823057	-47.070623	794
26	Da Roça Food Truck	Food Truck	-22.824126	-47.071031	905

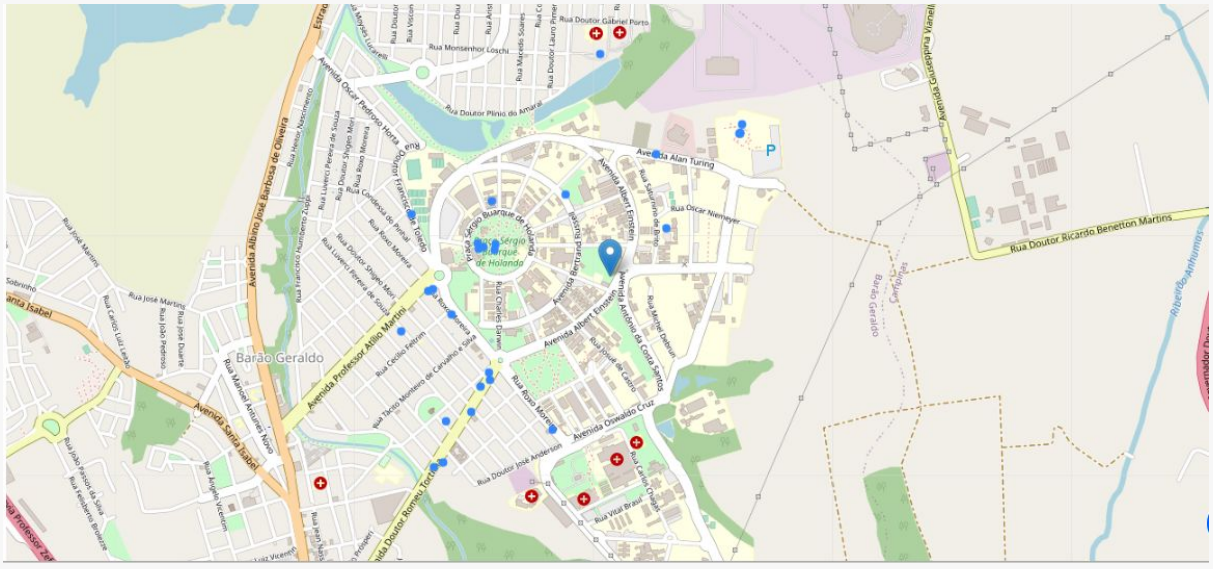


Fig. 2: Unicamp and restaurants in its neighborhood.

2.2.3.2 Mackenzie

The parameters used in the request were

- ll=-22.8854217,-47.0684848

- v='20180605'
- categoryid = a comma separated list of categories shown in section 2.2.2.1.
- radius = 1000,limit = 50.

The restaurants in Mackenzie's neighborhood are in Table 3 and fig 3.

Table 3: Restaurants in Mackenzie's neighborhood

	name	categories	lat	lng	distance
0	Panificadora Crisabel	Bakery	-22.883295	-47.068249	237
1	Todo Sabor - Café & Cia	Snack Place	-22.882803	-47.068577	291
2	Levain De Casa	Bakery	-22.884678	-47.059505	924
3	mega pizza	Pizza Place	-22.883836	-47.065429	359
4	Burger King	Fast Food Restaurant	-22.888760	-47.065729	466
5	Padaria Dolce Momento	Bakery	-22.887929	-47.063098	618
6	Subway	Sandwich Place	-22.890945	-47.076966	1065
7	Feira Livre do Castelo	Farmers Market	-22.888883	-47.073151	614
8	Nico Paneteria	Bakery	-22.889415	-47.076645	947
9	Pastelaria Da Vó Titi	Fast Food Restaurant	-22.874544	-47.069615	1216
10	Ki-Dog Brasil	Hot Dog Joint	-22.880988	-47.072124	618
11	Panetteria Corina	Bakery	-22.891410	-47.068695	666
12	Pastelaria e Lanchonete 3G	Pastelaria	-22.892599	-47.061225	1092
13	Auto Lanches Patropi	Fast Food Restaurant	-22.888776	-47.077603	1006
14	We Can Veg It	Food Truck	-22.890164	-47.067267	542
15	Barraca do Kartódromo	Food Truck	-22.879567	-47.063032	858
16	Quiosque Guanabara	Food Truck	-22.893252	-47.071145	913
17	quiosque taquaral	Food Truck	-22.878766	-47.060490	1105
18	Padaria Auxiliadora	Bakery	-22.876484	-47.066901	1008
19	Tastee	Sandwich Place	-22.889164	-47.061480	830
20	Pastel A Grande Familia	Snack Place	-22.889186	-47.072859	613
21	Barraquinha de Pastel	Food Truck	-22.888528	-47.073284	601
22	Padaria Rosa Do Castelo	Bakery	-22.883819	-47.073463	540
23	Casa Do Doce	Bakery	-22.883523	-47.063094	591
24	Cantina & Lanchonete Point da Galera	Snack Place	-22.889349	-47.059378	1031

25	Feline's Dog	Food Truck	-22.891051	-47.076350	1021
26	La Coxinha	Snack Place	-22.889193	-47.065263	534
27	Padaria São Bartolomeu	Bakery	-22.895352	-47.076126	1355
28	Espeto da Horta	Food Truck	-22.883894	-47.068188	172
29	Gastronomia Urbana, Entretenimento e Lazer	Food Truck	-22.880672	-47.068678	529
30	Panificadora Pão do Castelo	Bakery	-22.891321	-47.076053	1016
31	Pastel da Lagoa	Food Truck	-22.879343	-47.063104	873
32	Dog Brasil	Hot Dog Joint	-22.880959	-47.072361	636
33	Econtainer	Food Truck	-22.883300	-47.064135	504
34	econteiner	Food Truck	-22.880609	-47.063579	734
35	McDonald's	Fast Food Restaurant	-22.888311	-47.065693	430
36	Padaria Nossa Sra. das Graças	Bakery	-22.882134	-47.064185	573
37	Mag Dog	Hot Dog Joint	-22.889233	-47.065344	532
38	Lanchonete do Oba	Snack Place	-22.886021	-47.060737	797
39	Coguzzerie	Pizza Place	-22.886630	-47.079732	1161
40	Food Rock	Pizza Place	-22.888786	-47.073182	610
41	Habib's	Middle Eastern Restaurant	-22.890914	-47.063047	827
42	Pepperoni Pizza Bar	Pizza Place	-22.884231	-47.070560	250
43	Big Jack Hamburgueria	Burger Joint	-22.889849	-47.076352	945
44	Nova Casablanca Restaurante	Buffet	-22.891893	-47.063529	881
45	Lanche da tia	Food Truck	-22.890854	-47.063683	779
46	Quiosque Vila Nova	Food Truck	-22.876792	-47.066839	975
47	Scooby Dog	Snack Place	-22.882048	-47.069981	405
48	Edu Pizza Bar	Bar	-22.883402	-47.063511	557
49	Gordão Lanches	Burger Joint	-22.883724	-47.070633	290

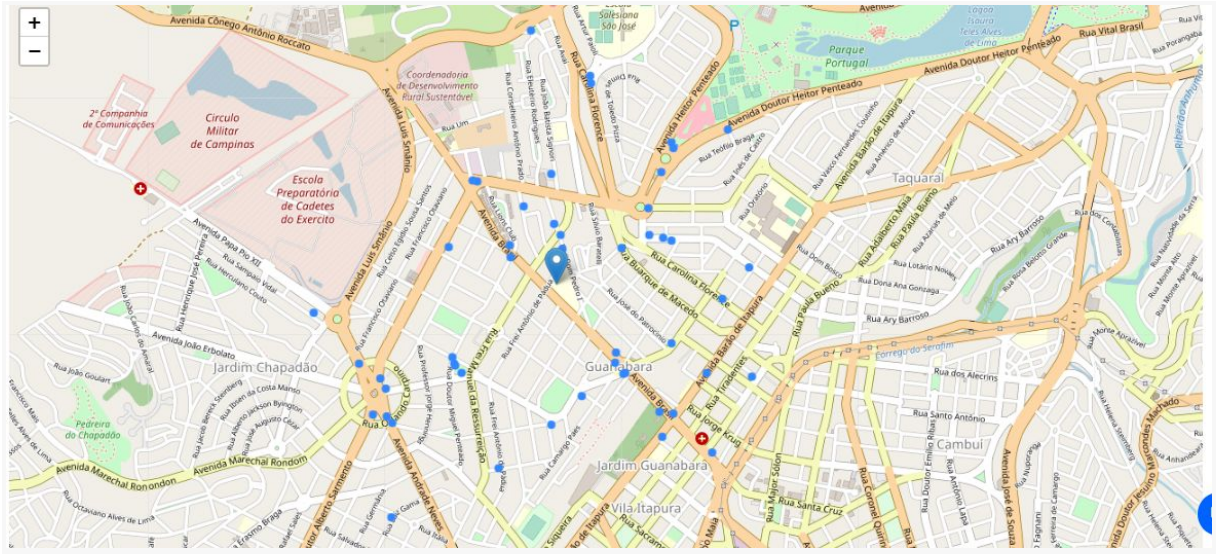


Fig. 3: Mackenzie and restaurants in its neighborhood

2.3 Final Data

In this section we get the location of two universities and locations of some categories of restaurants in their neighborhood. Our first attempt was search for 'burger' but the request in Unicamp's neighborhood return 0 venues. So we decided include other categories we think students like to. Now we have two dataframes, one to each university. Each row of data frames contains: name of restaurant, category(Burger Joint, Bakery, Fast Food Restaurant, Food Stand, Food Truck, Hot Dog Joint, Pastelaria, Pizza Place, Sandwich Place, Snack Place), geographical coordinates and distance to university.

3. Methodology

In this project we are helping a young man to choose a location start his first business, a burger joint. We will to decide between neighborhoods of two universities given by the young.

In the previous section we have collected the data. For each university and for each restaurant in selected categories (Burger Joint, Bakery, Fast Food Restaurant, Food Stand, Food Truck, Hot Dog Joint, Pastelaria, Pizza Place, Sandwich Place, Snack Place) we have **name**, **category**, **latitude**, **longitude** and **distance** to university. We use a radius of 1000 m in our foursquare api requests, so our analysis take account restaurants in a circle of radius ~1Km.

In this section we do an exploratory data analysis and after use a clustering algorithm to see how the restaurantes are grouped around universities.

3.1 Exploratory data analysis

In exploratory data analysis section we will answer the following questions:

- Number of restaurants in each neighborhood
- Number of burger joints in each neighborhood
- Percentage of burger joints
- Number of restaurants by category
- Density of restaurants in each neighborhood

- Mean distance to university
- Histogram of distances to university
- Heatmap

Number of restaurants in each neighborhood

Restaurants in Unicamp's neighborhood: 27
Restaurants in Mackenzie's neighborhood 50

There are more restaurants near Mackenzie than near Unicamp

Number of restaurants by category

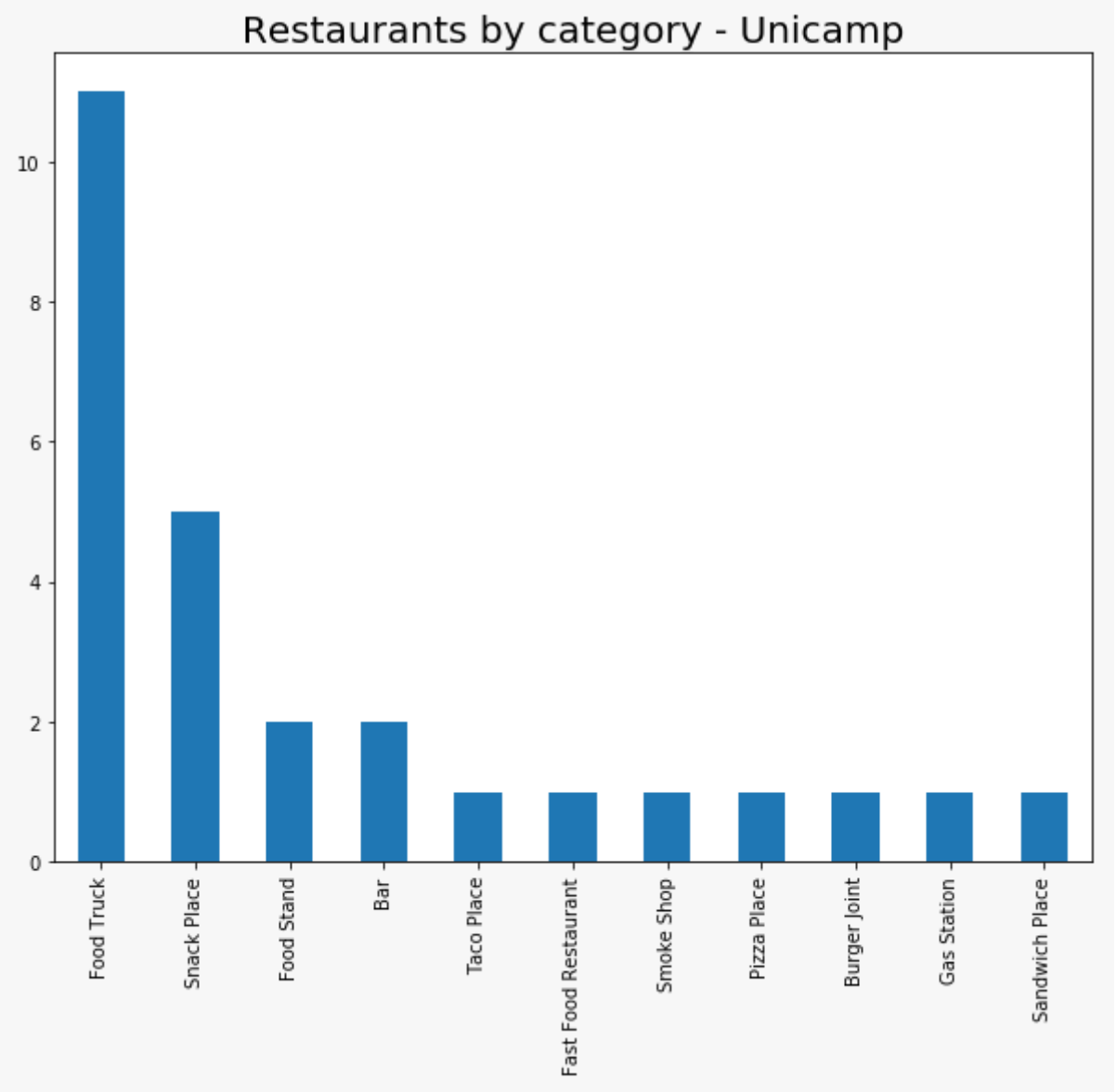


Fig. 4: Frequency of restaurants by category in Unicamp’s neighborhood.

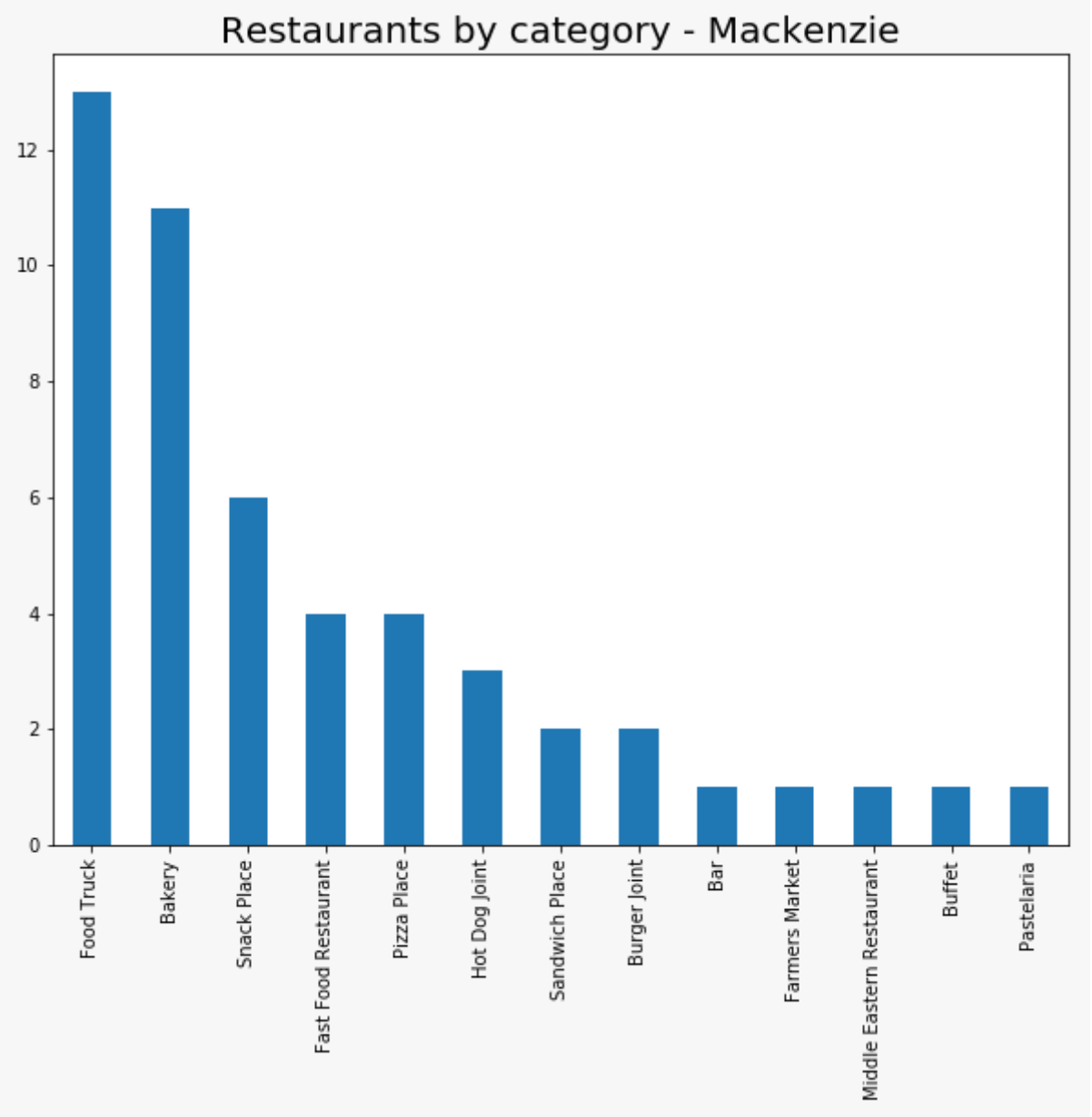


Fig. 5: Frequency of restaurants by category in Unicamp's neighborhood.

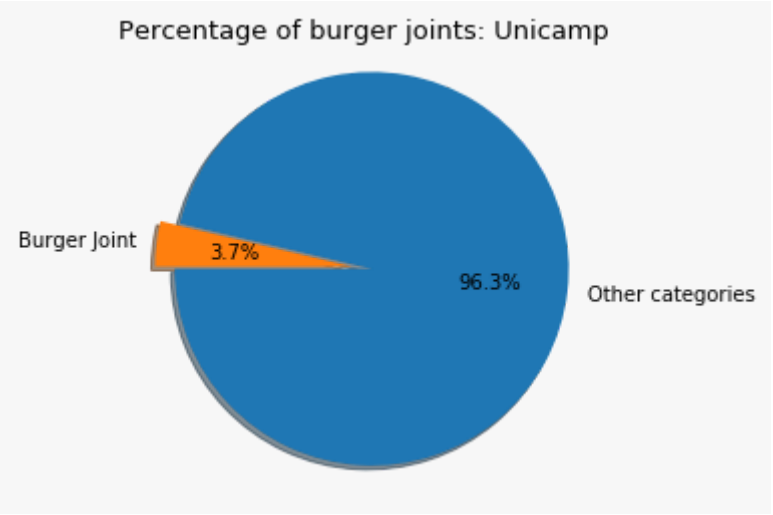
In booth neighborhoods the most popular category is Food Truck.

Number of burger joints in each neighborhood

Unicamp: 1
Mackenzie: 2

The number of burger joints is small for both neighborhoods. Near Unicamp there is only one.

Percentage of burger joints



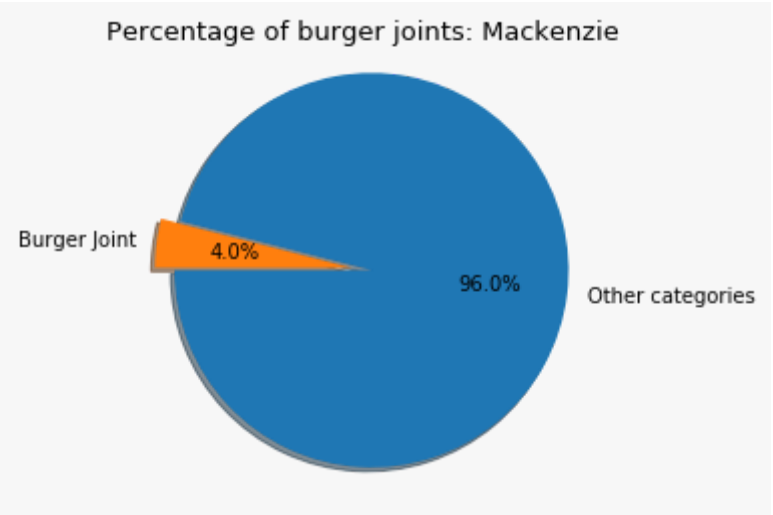


Fig 6: Percentage of burger joints in neighborhoods of two universities

Density of restaurants in each neighborhood

Density (d) is the number of restaurants divided by area.

Density of restaurants Unicamp: 5.81 Restaurants by square Km2
Density of restaurants Mackenzie: 8.67 Restaurants by square Km2

The density of restaurants is bigger in Mackenzie's Neighborhood

Mean distance to university

Mean distance from Unicamp: 798.67 m
Mean distance from Mackenzie: 722.74 m

The mean distance of restaurants from Unicamp is greater than mean distances from Mackenzie.

sd of distances from Unicamp: 209.30 m
sd of distances from Mackenzie: 279.27 m

Histogram of distances to university

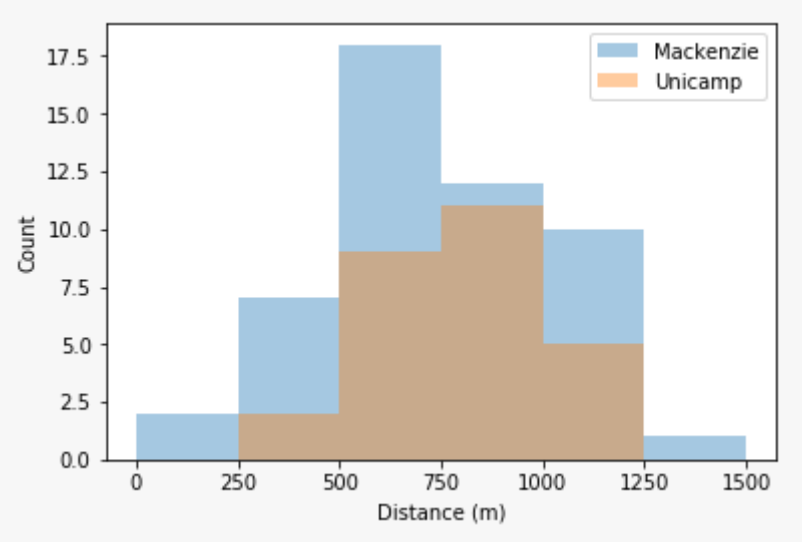


Fig. 7: Histogram of distances from universities to restaurants in theirs neighborhood

- Unicamp: The biggest number of restaurants between 500 and 1000 m. No restaurants between 0 and 250 m.
- Mackenzie: The biggest number of restaurants between 250 and 1000 m.

Heatmap

Fig. 8: Heatmap: restaurants in Unicamp's neighborhood

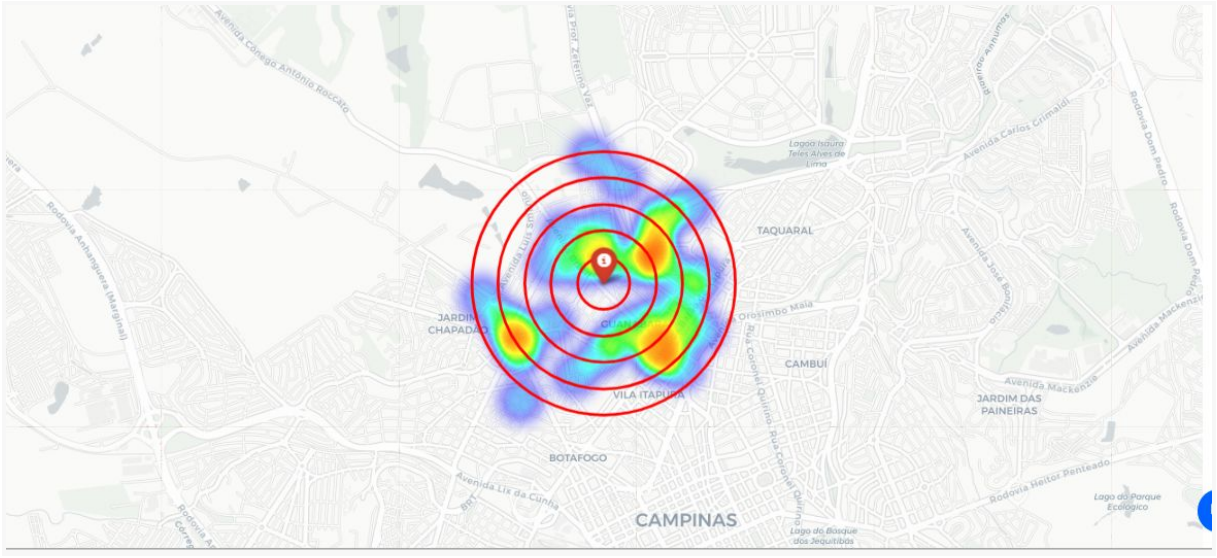


Fig. 9: Heatmap: restaurants in Unicamp's neighborhood

3.2 Clustering

We want see how we can group the restaurants in each neighborhood. We decided use DBSCAN because, according the course, Machine Learning with Python from Coursera [4] it does no require specification of the number of clusters, it is robust to outliers and can find arbitrarily shaped clusters.

We use only geographical coordinates, so it can help us to find areas with a low number of restaurants because it gives us the outliers, restaurants that were not associated with any cluster.

We use eps=0.5, min_samples=3.

For Unicamp we get number of clusters: 4 and number of noise points: 6. For Mackenzie we get number of clusters: 5 and number of noise points: 9. The results are shown in figures 11 and 12.

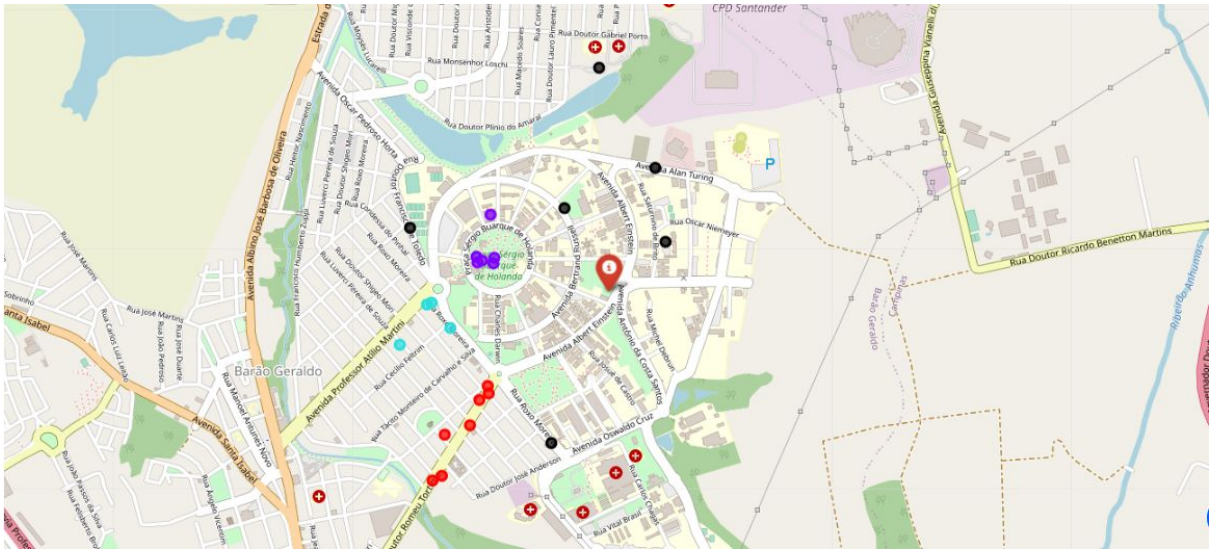


Fig. 11: Result of DBSCAN in Unicamp's neighborhood. Noise points in black.

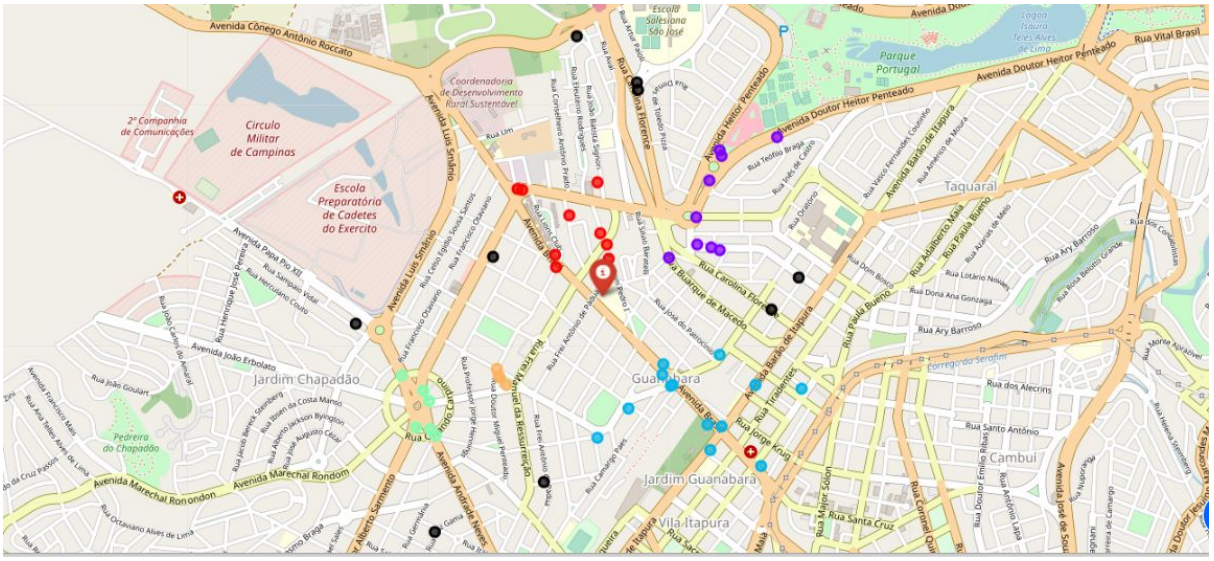


Fig. 12: Result of DBSCAN in Mackenzie's neighborhood. Noise points in black.

4 Results

There are more restaurants near Mackenzie (50) than near Unicamp (27).

In both neighborhoods the most popular category is Food Truck. But the second most popular category near Unicamp is Snack Place and near Mackenzie is Bakery. Some categories appears different from the categories we include in request (Burger Joint, Bakery, Fast Food Restaurant, Food Stand, Food Truck, Hot Dog Joint, Pastelaria, Pizza Place, Sandwich Place, Snack Place), examples are Gas Station and Middle Eastern Restaurant. But there are Snack Places in some Gas Stations and the Middle Eastern Restaurant that the request bring is a kind of Fast Food Restaurant.

The number of Burger Joints is surprising small. We have only one in Unicamp's neighborhood and two in Mackenzie's neighborhood. The percentage of Burger Joints is approximately 4 % in both neighborhood. These two informations shows it can be a good idea open a burger joint in these areas.

The density of restaurants near Mackenzie (8.67 restaurants/Km2) is bigger than the density of restaurants near Unicamp (5.61 restaurants/Km2). This result agree with the number of restaurants in each neighborhood.

The difference between the mean distance from restaurants in Unicamp neighborhood to Unicamp and mean distance from restaurants in Mackenzie's neighborhood to Mackenzie is small relatively to distances. We have 798.67 m and 722.74 m respectively. But we have large standard deviations, 209.30 m and 279.27 m.

Considering distances, other important information is the distribution of distances. In Unicamp's neighborhood the biggest number of restaurants are between 500 and 1000 m. There aren't restaurants in the interval 0 and 250 m. In Mackenzie's neighborhood the restaurants are concentrated between 250 m and 1000 m.

The heatmap shows that in Unicamp's neighborhood the restaurants are concentrated in two areas in the East of university. For Mackenzie we can see four areas, two near university at north and other two at East and West farther from university.

We also use a clustering algorithm DBSCAN. We want see how we can group the restaurants using geographical coordinates. For Unicamp we got 4 clusters and for Mackenzie 5 clusters. These results agree with heatmaps. We also note that this algorithm classifies some restaurants as outliers. We can see them in figures of section 3.2 as black points. They are in areas with a low density of restaurants.

The numerical results points Unicamp as the best neighborhood.

5. Discussion

It is important say that the size of two universities in our analysis is very different. Mackenzie is located in one block and Unicamp is huge, it has 3.5 Km. We can see in map of fig. 12 that there are many blocks this university.

We don't have information about the number of students but we can conclude Unicamp has more students because it is much bigger.

Unicamp is located at North of Campinas and Mackenzies is near the downtown area. Maybe in Mackenzie's neighborhood there are customer beyond students. It can influence the amount of customers during weekends, holidays and vacations.

It is important search for high schools, and other business in this neighborhoods.

Take into account the number of restaurants in each neighborhood, the number of burger joints in each neighborhood, the percentage of burger joints and the density of restaurants in each neighborhood we conclude Unicamp's neighborhood is the best area to open a burger joint.

Looking at the fig. 12 we can see that inside Unicamp there are some areas without restaurants and the business would be near students but the young man needs to obtain special permissions before start made hamburgers. Outside he needs to obtains permissions too but it is easier. We can also see that at East of university there are no streets.

After decide outside is the best, we indicate the following address: Rua Roxo Moreira, between streets Rua Doutor José Anderson and Avenida Doutor Romeu Tortima. It is near Unicamp and far from clusters of restaurants.

6. Conclusion

The objective of this project was to help a young man find a place to start his business. Starting with two universities provided by him, we use data from foursquare api to find the location of other restaurants that sell food that is very much consumed by students. We did an exploratory data analysis and used the dbscan algorithm and managed to indicate a possible place for the young man to open his burger joint.
More detailed studies on the type of food sold by food trucks may be necessary.

This kind of analysis can be used for other areas.

7. References

[1] https://pypi.org/project/geopy/

[2] https://developer.foursquare.com/

[3] https://developer.foursquare.com/docs/build-with-foursquare/categories/

[4] https://www.coursera.org/learn/machine-learning-with-python

[5] https://pt.wikipedia.org/wiki/Universidade_Estadual_de_Campinashttps://pt.wikipedia.org/wiki/Universidade_Estadual_de_Campinas