

Which is the best neighbourhood in Bogota, Colombia for a new vegetarian restaurant?

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1. Introduction/Business Problem

Restaurants are tending to cater to vegetarians more and more every day. In the United Kingdom, a third of all meals are currently meatless (1). Likewise, more vegetarian products are being produced, such as the Beyond Meat patty. According to a recent Gallup survey, sales of plant-based food grew 8.1 percent in 2017 and exceeded 3.1 billion in sales last year.

In Bogota, in 2019, there were close to 200 restaurants with vegetarian options (2). However, truly vegetarian or vegan restaurants are limited; according to Happy Cow (3), a webpage which recommends these types of restaurants, there are currently only 91 exclusively vegan or vegetarian restaurants in the area. Most people who identify as vegetarians in Bogota, according to a Sodexo survey, are in their twenties or thirties (4). Bogota is gaining popularity amongst international tourists, which is one of the reasons why more vegetarian restaurants have been opening in the city. According to a study carried out by the Colombian Restaurant Association (Acodres) and the National Consulting Center (CNC), Bogota is one of the most popular destinations or restaurant owners to invest in. Here, they target their restaurants usually to upper-middle class citizens (5).

Taking into account the reasons previously stated, this project will focus on the best location for a vegetarian restaurant in Bogota, which meets the following requirements concerning the target audience: (a) A large population in the neighbourhood is in their twenties or thirties. (b) The neighbourhood's GDP per capita is amongst the highest in

the city. (c) People who visit that neighbourhood are interested in things which usually cluster well with vegetarianism.

2. Data

Data was collected from two main sources: the open source data portal for Bogota (6), and data from Foursquare, using the Foursquare API for developers (7). This included demographic data (information on number of people per age group, by borough), geographical data (longitude and latitude for each neighbourhood, within each borough), econometrical data (GDP per capita for each borough). Data from Foursquare included data about the venues found in Bogota, categorized by venue type.

3. Methodology

All of the following procedures may be via Github (8).

3.1 Data wrangling

Specific columns for each dataframe (location, wealth and demographic data), were selected, and translated into English. Numeric data was wrangled, removing periods in the number sequence. Demographic data before 2019 was discarded, as well as boroughs with no demographic data, and city-wide totals. All three dataframes were then merged, in order to carry out exploratory data analysis. Age groups were reclassified into millennials / non – millennials (millennials being between 25 and 39 years old) for better analysis of the target population.

3.2 Exploratory analysis

Exploratory data analysis was carried out to see which were the wealthiest boroughs. The point of this analysis was to select only boroughs where people could afford to go out to restaurants. Data was also analyzed to see whether there were any differences in the proportion of millennials to non-millennials in the richest boroughs.

3.3 Machine Learning

K-means clustering was used to cluster neighbourhoods within the richest boroughs, and those with the highest proportion of millenials, based on venue data from Foursquare. Data from the wealthiest borough, with the highest proportion of milenials was grouped by neighbourhood, scaled and converted into numerical data using the one-hot encoding from sklearn. Distances were calculated using the sum of squared distances. In order to determine the correct amount of clusters, the elbow method was used.

Clusters were then generated according to the number of clusters suggested by the elbow method. Data was then analyzed, selecting the cluster which had vegetarian or vegan restaurants among its top ten venues. Within this cluster, the neighborhood which had vegetarian restaurants in tenth place was then selected as the best neighbourhood to place the new restaurant.

4. Results

Chapinero is one of the four richest boroughs in Bogota (3.813.290 pesos, or 1000 USD, Figure 1). Out of those four boroughs, it is the one with the highest proportion of millenials (25% of the population, Figure 2).

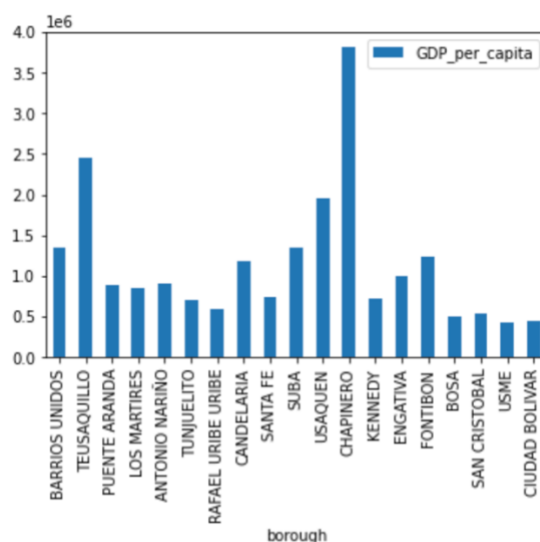


Figure 1: GDP per capita in Bogota's boroughs (*localidades*, in Spanish).

		total
borough	age_group	
ANTONIO NARIÑO	millenial	22.163257
	non-millennial	77.836743
BARRIOS UNIDOS	millenial	22.064332
	non-millennial	77.935668
BOSA	millenial	24.277947
	non-millennial	75.722053
CANDELARIA	millenial	24.363686
	non-millennial	75.636314
CHAPINERO	millenial	25.027435
	non-millennial	74.972565

Figure 2. Proportion of millennials to non-millennials within some boroughs in Bogota.

Within Chapinero, neighbourhoods can be optimally grouped into seven clusters (Figures 3, 4), according to the venues found within these neighbourhoods.

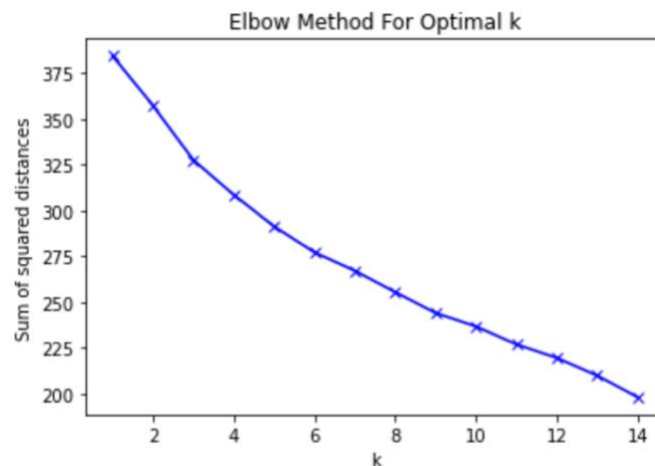


Figure 3. Optimal number of clusters within the Chapinero borough, according to venue data from FourSquare.

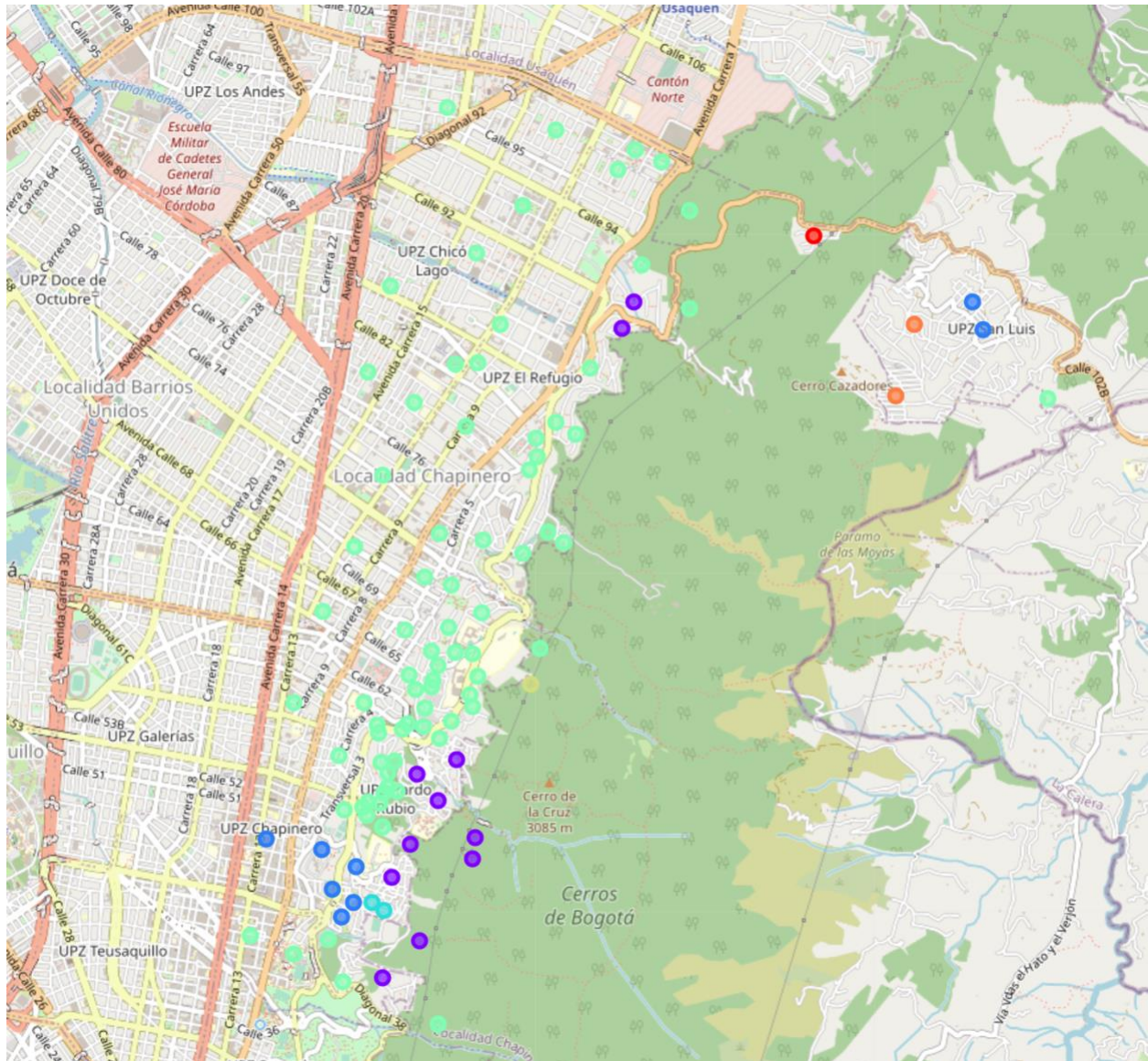


Figure 4. Cluster distribution within the Chapinero borough, according to venue data from FourSquare.

Out of these 7 clusters, only 1 cluster had vegan / vegetarian options: cluster 4 (Figure 5). Cluster 4 had 5 neighbourhoods with vegetarian /vegan restaurants among its top ten venues (Figure 6).

borough	neighbourhood_ID	neighbourhood	longitude	latitude	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	
4675	CHAPINERO	20009	Boques Calderón Tejada 1 Sector	-74.058127	4.643231	4	Restaurant	Italian Restaurant	Vegetarian / Vegan Restaurant	Beer Bar	Latin American Restaurant	Bakery	Japanese Restaurant	Mediterranean Restaurant	Burger Joint	Brewery
4743	CHAPINERO	20087	S.C. Quinta Camacho	-74.059584	4.654787	4	Coffee Shop	Restaurant	Latin American Restaurant	Burger Joint	Juice Bar	Sandwich Place	Hotel	Argentinian Restaurant	Vegetarian / Vegan Restaurant	Ice Cream Shop
5111	CHAPINERO	20115	Vista Hermosa - María Cristina	-74.055112	4.643116	4	Tea Room	Breakfast Spot	Mountain	Vegetarian / Vegan Restaurant	Trail	Pet Store	Café	Yoga Studio	Furniture / Home Store	Fried Chicken Joint
5161	CHAPINERO	20100	Siberia - Castillo Calderón Tejada	-74.056906	4.638949	4	Mediterranean Restaurant	Hot Dog Joint	Burger Joint	Beer Bar	Vegetarian / Vegan Restaurant	Latin American Restaurant	French Restaurant	Park	Food Court	Gaming Cafe
5168	CHAPINERO	20046	Los Olivos	-74.055019	4.644382	4	BBQ Joint	Japanese Restaurant	Trail	Pet Store	Café	Breakfast Spot	Tea Room	Theme Restaurant	Mountain	Vegetarian / Vegan Restaurant
5185	CHAPINERO	20002	Altos de la Salle	-74.055681	4.645510	4	Japanese Restaurant	BBQ Joint	Bakery	Café	Vegetarian / Vegan Restaurant	Herbs & Spices Store	Mexican Restaurant	Italian Restaurant	Ice Cream Shop	Hotel
5236	CHAPINERO	20099	Siberia - Boques Calderón Tejada	-74.055722	4.639848	4	Ice Cream Shop	Vegetarian / Vegan Restaurant	Burger Joint	Beer Bar	French Restaurant	Lounge	Latin American Restaurant	Mediterranean Restaurant	Hot Dog Joint	Electronics Store
5338	CHAPINERO	20077	S.C. La Salle	-74.059023	4.644736	4	Restaurant	Vegetarian / Vegan Restaurant	Latin American Restaurant	Arepas Restaurant	Caribbean Restaurant	Café	Italian Restaurant	Bakery	BBQ Joint	Brewery
5678	CHAPINERO	20062	S.C. Chapinero Norte	-74.061935	4.650635	4	Soccer Field	Italian Restaurant	Vegetarian / Vegan Restaurant	Restaurant	Vegetarian / Vegan Restaurant	Latin American Restaurant	Nightclub	Caribbean Restaurant	Bistro	Bed & Breakfast
7800	CHAPINERO	20101	Siberia - El Capricho (Predio)	-74.057459	4.639204	4	Mediterranean Restaurant	Burger Joint	Hot Dog Joint	Café	Vegetarian / Vegan Restaurant	Latin American Restaurant	Beer Bar	Lounge	French Restaurant	Food Court
8890	CHAPINERO	20080	S.C. María Cristina	-74.056066	4.646474	4	Bakery	Café	Hotel	Japanese Restaurant	Pet Store	Mexican Restaurant	BBQ Joint	Vegetarian / Vegan Restaurant	Italian Restaurant	Restaurant
9164	CHAPINERO	20007	Boques Calderón Tejada 2	-74.056557	4.642985	4	Japanese Restaurant	Tea Room	Brewery	Hot Dog Joint	Comfort Food Restaurant	Vegetarian / Vegan Restaurant	Lounge	Café	Gaming Cafe	Furniture / Home Store
9290	CHAPINERO	20043	La Portada...	-74.056158	4.643320	4	Japanese Restaurant	Tea Room	Brewery	Hot Dog Joint	Vegetarian / Vegan Restaurant	Café	Lounge	Gaming Cafe	Furniture / Home Store	Fried Chicken Joint
9341	CHAPINERO	20039	Ingemar - Urb. Nuevo Asia	-74.058817	4.637443	4	Mediterranean Restaurant	Ice Cream Shop	Buffet	Burger Joint	Beer Bar	Vegetarian / Vegan Restaurant	Latin American Restaurant	French Restaurant	Food Court	Gaming Cafe
9358	CHAPINERO	20035	Ingemar - Arbotum	-74.057982	4.638152	4	Mediterranean Restaurant	Ice Cream Shop	Burger Joint	Beer Bar	Vegetarian / Vegan Restaurant	Latin American Restaurant	French Restaurant	Food Court	Gastropub	Gaming Cafe
9375	CHAPINERO	20037	Ingemar - El Triángulo	-74.058025	4.642703	4	Restaurant	Café	Beer Bar	Vegetarian / Vegan Restaurant	Bakery	Bistro	Brewery	Breakfast Spot	French Restaurant	Comfort Food Restaurant



5. Discussion

People in the neighbourhoods in figure 5 are likely to be interested in vegetarian restaurants, as they have at least one vegetarian / vegan restaurant amongst their top 10 most common venues, so a new restaurant in any of these neighbourhoods would get noticed. As for supply and demand, the best option is a neighbourhood where there are fewer vegetarian restaurants. In this sense, out of the top neighbourhoods, Los Olivos is the place where a vegetarian / vegan restaurant is least common, so it would be the best place for a new restaurant of this type.

6. Conclusion

The best neighbourhood to place a vegetarian restaurant in Bogota, Colombia, is in the "Los Olivos" neighbourhood (-74.055019,4.644382), within the Chapinero borough. This is because Chapinero is the richest borough in Bogota, so people are more likely to go out to restaurants, because it has the highest proportion of millenials compared to other boroughs, and because vegetarian restaurants are popular in the cluster it is found. Additionally, though they are popular, they are in tenth place, among the most popular venues on FourSquare, so there is not a large offer of this type of restaurant.

7. Rerefences

- (1) <https://www.bbc.co.uk/news/uk-42973870>
- (2) <https://www.dinero.com/edicion-impresa/negocios/articulo/oferta-del-mercado-vegano-y-vegetariano-en-colombia/267318>
- (3) https://www.happycow.net/south_america/colombia/bogota/?filters=vegan-vegetarian
- (4) [https://www.rcnradio.com/estilo-de-vida/hay-mas-de-600-millones-de-vegetarianos-en-el-mundo#:~:text=En%20Colombia%20esta%20poblaci%C3%B3n%2C%20en,los%2020%20y%2030%20a%C3%B1os.&text=El%20estudio%20revel%C3%B3%20adem%C3%A1s%20que,carne\)%20y%209%20%25%20vegano](https://www.rcnradio.com/estilo-de-vida/hay-mas-de-600-millones-de-vegetarianos-en-el-mundo#:~:text=En%20Colombia%20esta%20poblaci%C3%B3n%2C%20en,los%2020%20y%2030%20a%C3%B1os.&text=El%20estudio%20revel%C3%B3%20adem%C3%A1s%20que,carne)%20y%209%20%25%20vegano)
- (5) <https://www.eltiempo.com/archivo/documento/CMS-3164528>

- (6) <https://datosabiertos.bogota.gov.co/>
- (7) <https://foursquare.com/>
- (8) [https://github.com/JulianaGomez/Coursera_Capstone/blob/master/.ipynb_checkp
oints/Vegetarian%20restaurants%20in%20Bogota-checkpoint.ipynb](https://github.com/JulianaGomez/Coursera_Capstone/blob/master/.ipynb_checkpoints/Vegetarian%20restaurants%20in%20Bogota-checkpoint.ipynb)