



# **New Pharmacy Recommendation**

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# 1. Introduction

## 1.1 Background

If we were to consider only the number of pharmacies per inhabitant, opening a new business of this type in Brazil would not make sense. This is because, according to data from the Brazilian government, there is a pharmacy for every 3,300 inhabitants while the World Health Organization recommends one for every 8,000 people. Despite this, we know that there is a concentration of units in the city centers or places where there is a large circulation of people, which can create opportunities in other places if we consider the population density and its income level.

## 1.2 Problem

The Drogayl company wants to open one or more pharmacies in a city in the interior of southeastern Brazil. Due to logistical issues, the contractor requested a study to indicate in which neighborhood in the cities of Santo André (SP) or Uberlândia (MG) the new pharmacy should be opened, considering population factors and existing pharmacies in these locations.

## 1.3 Interest

Obviously the contractor or anyone interested in opening a pharmacy in these cities.

# 2. Data Description

The data used in this project will be obtained through a demographic census file carried out in 2010 with the population of all neighborhoods in Brazil ([here](#)) and [Foursquare API](#) for the location of pharmacies in Santo André e Uberlândia. In addition, we will use the 2016 per capita income and a population growth factor (2020) to be applied according to the table below.

City	Per Capita Income	Population Growth Factor
Santo André	26,035.49	5,37%
Uberlândia	48,585.36	15,74%

# 3. Methodology

The file containing all 14,227 neighborhoods in Brazil was imported and inserted into a dataframe, where I removed the unnecessary columns and excluded all neighborhoods that did not belong to

the cities of Santo André and Uberlândia. In addition, I also include the latitude and longitude data for each of the neighborhoods using the “geopy.geocoders”, the per capita income data and applied the population growth factor. This initial work pointed out the existence of 91 neighborhoods in Santo André and 51 in Uberlândia and my master data which has the main components City, Neighborhoods, Population, Income, Latitude and Longitude informations of the both cities.

Figure 1

I used python folium library to visualize geographic details of Santo André and Uberlândia to get the visual as below (Uberlândia):

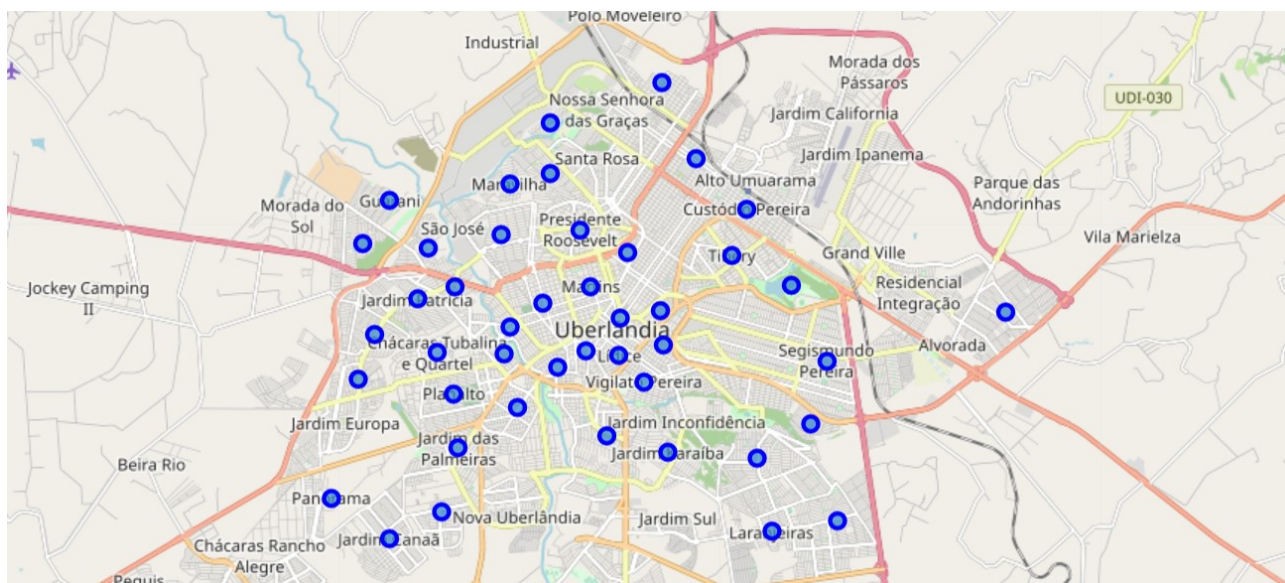


Figure 2

The next step was to verify, through the Foursquare API, the existence of venues with their respective geolocations and categories in each of the neighborhoods of the cities in the study, which demonstrated the existence of 1010 venues in Santo André and 531 in Uberlândia. After that, I applied a filter to get only places with the same category as the pharmacy, grouped the venues by neighborhood and inserted them into the dataframe.

To facilitate the analysis of the data, I also grouped the data from the ten neighborhoods with the largest number of people and the number of venues in each of them, as you see below.

	City	Neighborhood	Population	Income	Latitude	Longitude	Venue
0	Uberlândia (MG)	Santa Mônica	41362	48585.36	-18.909070	-48.235505	0.0
1	Uberlândia (MG)	São Jorge	30745	48585.36	-18.960517	-48.224862	0.0
2	Uberlândia (MG)	Presidente Roosevelt	23985	48585.36	-18.897078	-48.284198	0.0
3	Uberlândia (MG)	Laranjeiras	22457	48585.36	-18.962788	-48.240094	0.0
4	Uberlândia (MG)	Luizote de Freitas	22185	48585.36	-18.919949	-48.331647	1.0
5	Uberlândia (MG)	Tibery	21563	48585.36	-18.902763	-48.249193	1.0
6	Uberlândia (MG)	Osvaldo Rezende	21502	48585.36	-18.912946	-48.292700	0.0
7	Uberlândia (MG)	Segismundo Pereira	21454	48585.36	-18.925646	-48.227383	0.0
8	Uberlândia (MG)	Morumbi	20837	48585.36	-18.914956	-48.185952	0.0
9	Uberlândia (MG)	Planalto	18134	48585.36	-18.932957	-48.313303	1.0

Figure 3

## 4. Results

As a result of the data, I was able to observe that Santo André with 721,368 inhabitants has 27 pharmacies, with an average of one unit for every 26,717 people with income of R\$ 26,035.49. The map below shows the location of neighborhoods in blue and pharmacies in red.

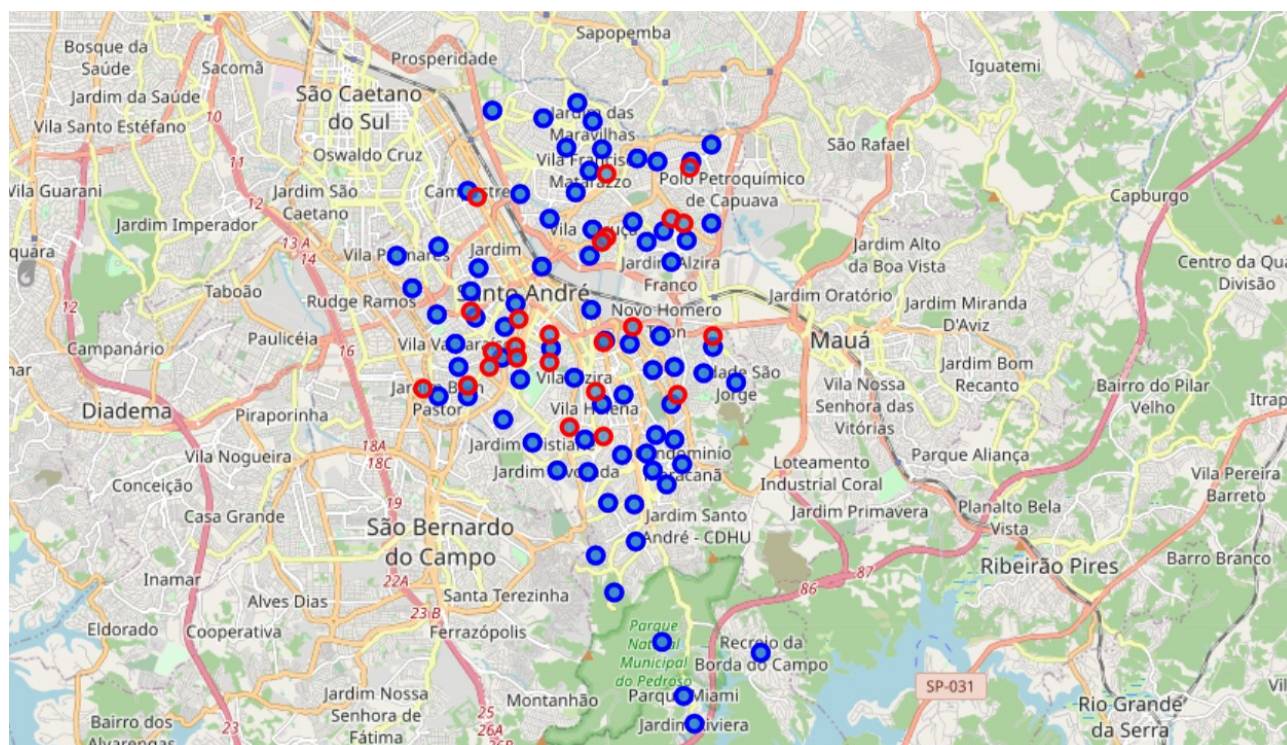




Figure 3

Another important data shown in the chart below is that of the ten most populous neighborhoods in Santo André, only two have pharmacies.

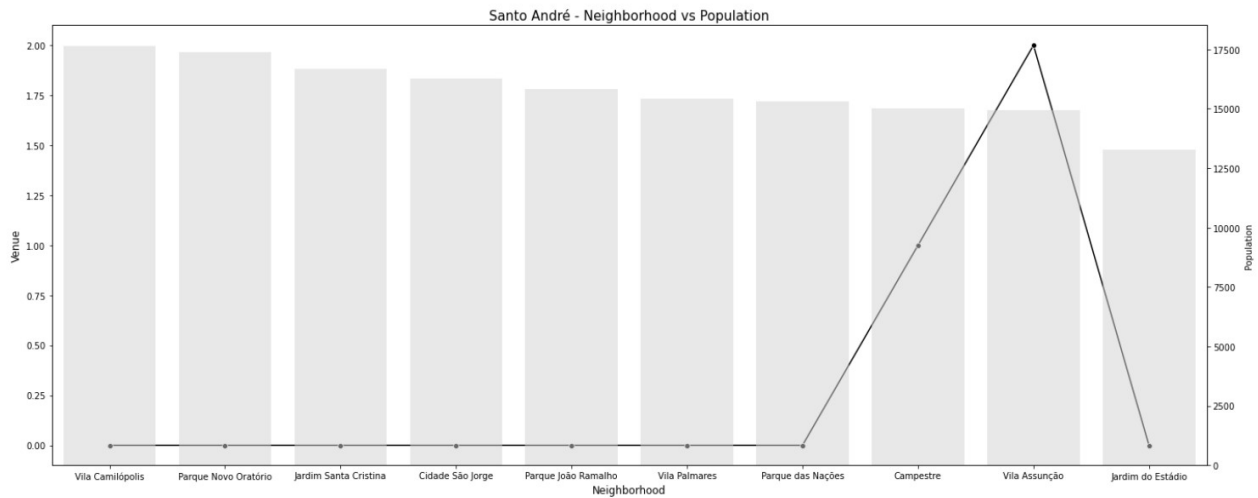


Figure 4

On the other hand in Uberlândia I noticed that the city has 699,097 inhabitants with 13 pharmacies, one unit for each 53,777 people with an income of R \$ 48,585.36. Below we can see on the map the neighborhoods in blue and the pharmacies in red.

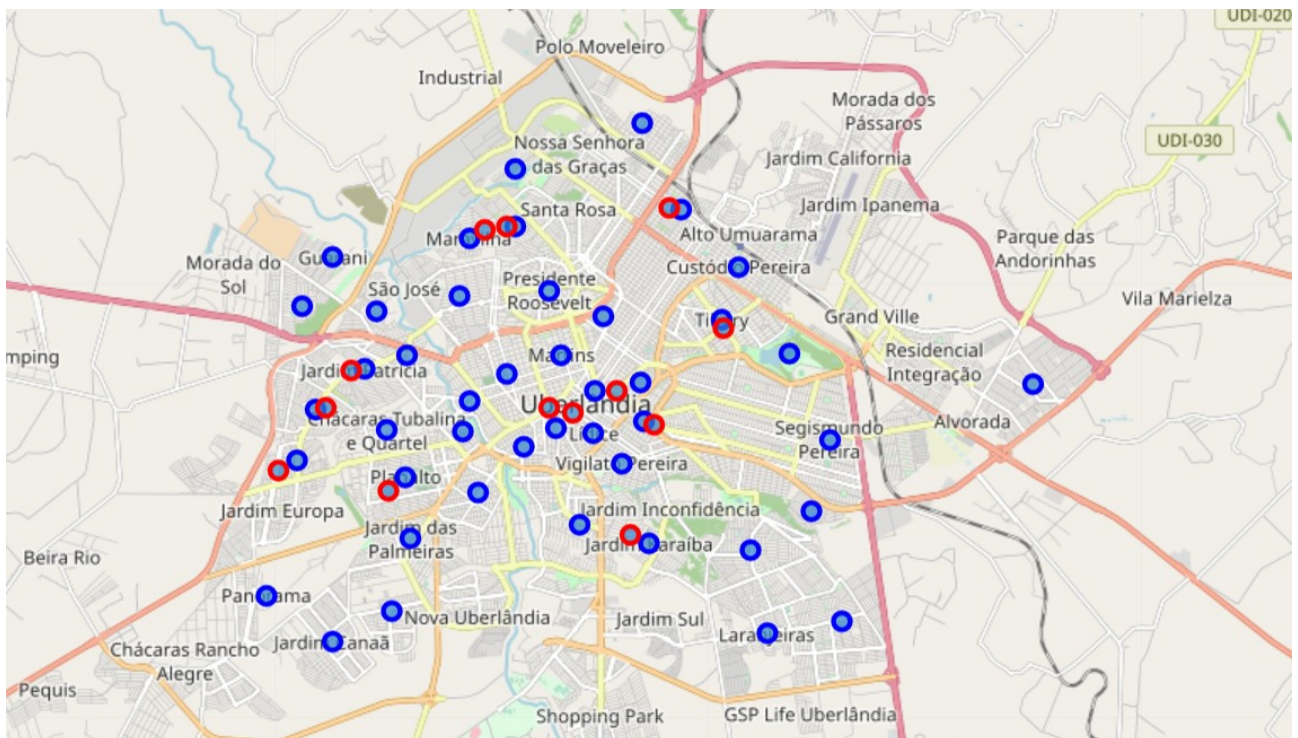


Figure 5

The graph below shows that in Uberlândia three neighborhoods, of the ten most populous, have 1 pharmacy, they are: Luizote de Freitas, Tibery and Planalto. It is important to note that the largest neighborhood, with more than 40,000 inhabitants, does not have any units.

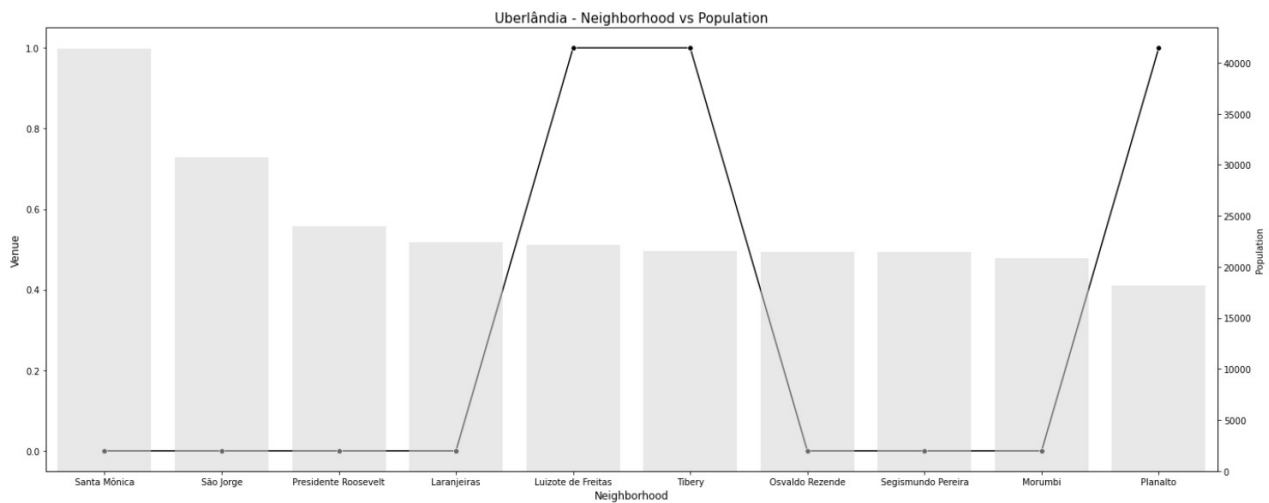


Figure 6

## 5. Discussion

Considering the recommendation of the World Health Organization of 1 unit for each 8000 inhabitants and analyzing the data obtained, Santo André and Uberlândia could have, respectively, 63 and 74 new pharmacies, but the objective of this work is to point out the best neighborhood in one of the two cities for this. So, considering that the Santa Mônica neighborhood has 40,000 inhabitants and has no pharmacy, that the income of a person in Uberlândia is almost twice that of Santo André and that our contractor had more opportunities to expand his business in this city, my recommendation is the new pharmacy is opened in this neighborhood.

## 6. Conclusion

In this work I demonstrated that, comparing the neighborhoods of the cities of Uberlândia and Santo André, the best neighborhood to open a new pharmacy is Santa Monica in Uberlândia. For that, I considered the population, income and number of pharmacies currently in operation. Another fact that I pointed out is that the average pharmacy per inhabitant in these locations is very far from the Brazilian national average, which is 1 to 3300, which generates several business opportunities. It is also important in the evolution of this study to consider, in addition to Foursquare, another tool for searching for venues (like Google).