Coursera Capstone

IBM Applied Data Science Capstone

Opening a New Shopping Mall in Vadodara, Gujarat

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Introduction

Shopping malls are all at one place where they can do grocery shopping, dine at restaurants, shop at the various fashion outlets, watch movies and perform many more activities. For retailers, the central location and the large crowd at the shopping malls provides a great distribution channel to market their products and services. Property developers are also taking advantage of this trend to build more shopping malls to cater to the demand. As a result, there are many shopping malls in the city of Vadodara Gujarat and many more are being built. Opening shopping malls allows property developers to earn consistent rental income. Of course, as with any business decision, opening a new shopping mall requires serious consideration and is a lot more complicated than it seems. Particularly, the location of the shopping mall is one of the most important decisions that will determine whether the mall will be a success or a failure.

Business Problem

The objective of this capstone project is to analyse and select the best locations in the city of Vadodara , Gujarat to open a new shopping mall. Using data science methodology and machine learning techniques like clustering, this project aims to provide solutions to answer the business question.

Target Audience of this project

This project is particularly useful to property developers and investors looking to open or invest in new shopping malls in the Vadodara, Gujarat.

Data

To solve the problem, we will need the following data:

- List of neighbourhoods in Vadodara ,Gujarat. This defines the scope of this project which is confined to the city of in Vadodara ,Gujarat.
- Latitude and longitude coordinates of those neighbourhoods. This is required in order to plot the map and also to get the venue data.
- Venue data, particularly data related to shopping malls. We will use this data to perform clustering on the neighbourhoods.

Sources of data and methods to extract them

This Wikipedia page (https://en.wikipedia.org/wiki/Category:Urban_and_suburban_areas_of_Vadodara) contains a list of neighbourhoods in Vadodara, with a total of 13 neighbourhoods. We will use web scraping techniques to extract the data from the Wikipedia page, with the help of Python requests and beautifulsoup packages. Then we will get the geographical coordinates of the neighbourhoods using Python Geocoder package which will give us the latitude and longitude coordinates of the neighbourhoods.

After that, we will use Foursquare API to get the venue data for those neighbourhoods. Foursquare API will provide many categories of the venue data, we are particularly interested in the Shopping Mall category in order to help us to solve the business problem put forward. This is a project that will make use of many data science skills, from web scraping (Wikipedia), working with API (Foursquare), data cleaning, data wrangling, to machine learning (K-means clustering) and map visualization (Folium). In the next section, we will present the Methodology section where we will discuss the steps taken in this project, the data analysis that we did and the machine learning technique that was used.

Methodology

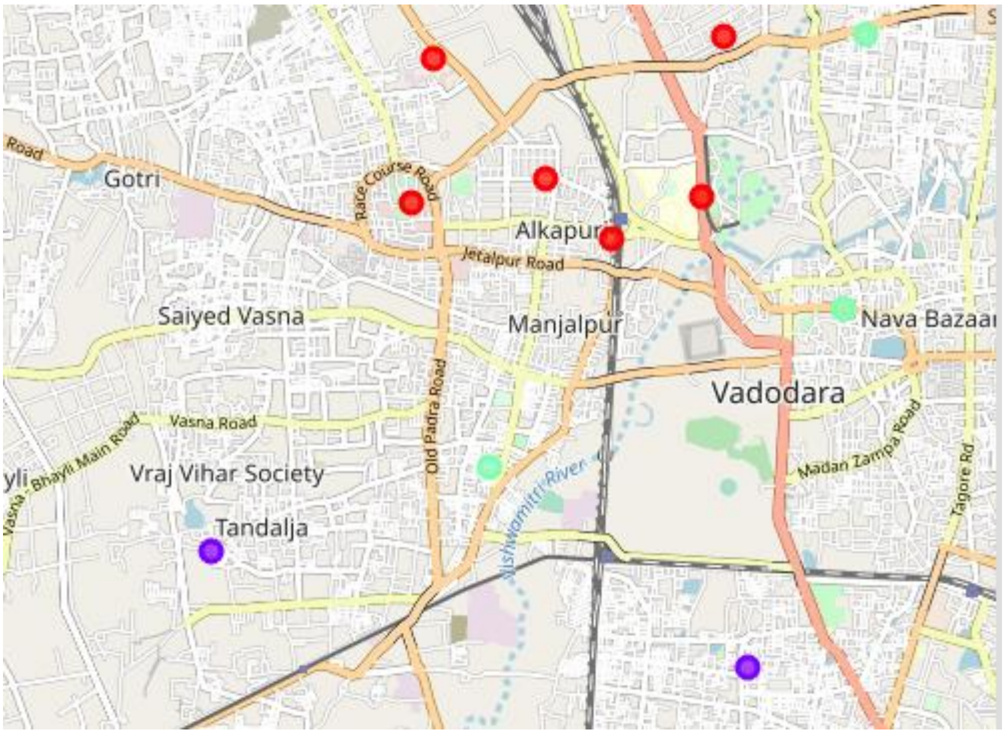
1. First getting the list of neighborhoods of the vadodara city and scraping from the Wikipedia page
2. Web scraping using Python requests and beautifulsoup packages to extract the list of neighbourhoods data.
3. We need to get the geographical coordinates in the form of latitude and longitude in order to be able to use Foursquare API. we will use the wonderful Geocoder package that will allow us to convert address into geographical coordinates in the form of latitude and longitude.
4. we will populate the data into a pandas DataFrame and then visualize the neighbourhoods in a map using Folium package.
5. Next, we will use Foursquare API to get the top 100 venues that are within a radius of 2000 meters.
6. We then make API calls to Foursquare passing in the geographical coordinates of the neighbourhoods in a Python loop.
7. Foursquare will return the venue data in JSON format and we will extract the venue name, venue category, venue latitude and longitude. With the data, we can check how many venues were returned for each neighbourhood and examine how many unique categories can be curated from all the returned venues. Then, we will analyse each neighbourhood by grouping the rows by neighbourhood and taking the mean of the frequency of occurrence of each venue category. By doing so, we are also preparing the data for use in clustering. Since we are analysing the “Shopping Mall” data, we will filter the “Shopping Mall” as venue category for the neighbourhoods.
8. Lastly, we will perform clustering on the data by using k-means clustering. K-means clustering algorithm identifies k number of centroids, and then allocates every data point to the nearest cluster, while keeping the centroids as small as possible. It is one of the simplest and popular unsupervised machine learning algorithms and is particularly suited to solve the problem for this project. We will cluster the neighbourhoods into 3 clusters based on their frequency of occurrence for “Shopping Mall”.
9. The results will allow us to identify which neighbourhoods have higher concentration of shopping malls while which neighbourhoods have fewer number of shopping malls. Based on the occurrence of shopping malls in different neighbourhoods, it will help us to answer the question as to which neighbourhoods are most suitable to open new shopping malls.

Results

The results from the k-means clustering show that we can categorize the neighbourhoods into 3 clusters based on the frequency of occurrence for “Shopping Mall”:

- Cluster 2: Neighbourhoods with moderate number of shopping malls
- Cluster 1: Neighbourhoods with low number of shopping malls
- Cluster 0: Neighbourhoods with high concentration of shopping malls

The results of the clustering are visualized in the map below with cluster 0 in red colour, cluster 1 in green colour, and cluster 2 in mint green colour



Observation

As observations noted from the map in the Results section, most of the shopping malls are concentrated in the central area of Vadodara city, with the highest number in cluster 0 and moderate number in cluster 1. On the other hand, cluster 1 has very low number to no shopping mall in the neighbourhoods. This represents a great opportunity and high potential areas to open new shopping malls as there is very little to no competition from existing malls. Meanwhile, shopping malls in cluster 0 are likely suffering from intense competition. Therefore this project recommends property developers to capitalize on these findings to open new shopping malls in neighbourhoods in cluster 1 with little to no competition. Property developers with unique selling propositions to stand out from the competition can also open new shopping malls in neighbourhoods in cluster 2 with moderate competition. Lastly, property developers are advised to avoid neighbourhoods in cluster 0 which already have high concentration of shopping malls and suffering from intense competition.