Coursera Capstone

IBM Applied Data Science Capstone

Opening a New Shopping Mall in Mumbai, India

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Introduction

We all will accept that Shopping Malls are fun. Not only do they offer great discounts and a full shopping experience but they also allow people to relax and enjoy, especially on weekends . Due to these reasons, they have now become a quite important part of our live and thus a profitable business.
Therefore, many new shopping malls are now opening, but they all face a common challenge, that is to remain profitable. They may be the biggest, most beautiful, lavish or may be offering great discounts but then also they may not be profiting accordingly.
One of the main reasons for loss of shopping malls is the sever competition they face. Not only from other retail stores, but also from other shopping malls.

Therefore, this project will help new shopping malls to make profit by suggesting hem better locations to avoid competition.

Business Problem

The objective of this capstone project is to analyze and select the best locations in the city of **Mumbai, India** 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: In the city of Mumbai, India if a property developer is looking to open a new shopping mall, where would you recommend that they open it?

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 financial capital of India, Mumbai. This project is timely as the city is currently suffering from oversupply of shopping malls.

Data

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

- List of neighborhoods in Mumbai.
- Latitude and longitude coordinates of those neighborhoods. This is required in order to plot the map and to get the venue data.
- Venue data, particularly data related to shopping malls. We will use this data to perform clustering on the neighborhoods.

Sources of data and methods to extract them

This Wikipedia page (https://en.wikipedia.org/wiki/Category:Suburbs_of_Mumbai) contains a list of neighborhoods in Mumbai, with a total of 40 neighborhoods. We will use web-scraping techniques to extract the data from the Wikipedia page, with the help of Python requests and beautiful soup packages. Then we will get the geographical coordinates of the neighborhoods using Python Geocoder package which will give us the latitude and longitude coordinates of the neighborhoods.

After that, we will use Foursquare API to get the venue data for those neighborhoods. 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

Firstly, we need to get the list of neighborhoods in the city of Mumbai, India. Fortunately, the list is available in the Wikipedia page (https://en.wikipedia.org/wiki/Category:Suburbs_of_Mumbai). We will do web scraping using Python requests and beautiful soup packages to extract the list of neighborhoods data. However, this is just a list of names. We need to get the geographical coordinates in the form of latitude and longitude in order to be able to use Foursquare API. To do so, we will use the wonderful Geocoder package that will allow us to convert address into geographical coordinates in the form of latitude and longitude. After gathering the data, we will populate the data into a pandas Data Frame and then visualize the neighborhoods in a map using Folium package. This allows us to perform a sanity check to make sure that the geographical coordinates data returned by Geocoder are correctly plotted in the city of Mumbai. Next, we will use Foursquare API to get the top 100 venues that are within a radius of 2000 meters. We need to register a Foursquare Developer Account in order to obtain the Foursquare ID and Foursquare secret key. We then make API calls to Foursquare passing in the geographical coordinates of the neighborhoods in a Python loop. 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 neighborhood and examine how many unique categories can be curated from all the returned venues. Then, we will analyze each neighborhood by grouping the rows by neighborhood 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 analyzing the “Shopping Mall” data, we will filter the “Shopping Mall” as venue category for the neighborhoods. 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 neighborhoods into 3 clusters based on their frequency of occurrence for “Shopping Mall”. The results will allow us to identify which neighborhoods have higher concentration of shopping malls while which neighborhoods have fewer number of shopping malls. Based on the occurrence of shopping malls in different neighborhoods, it will help us to answer the question as to which neighborhoods are most suitable to open new shopping malls.

Results

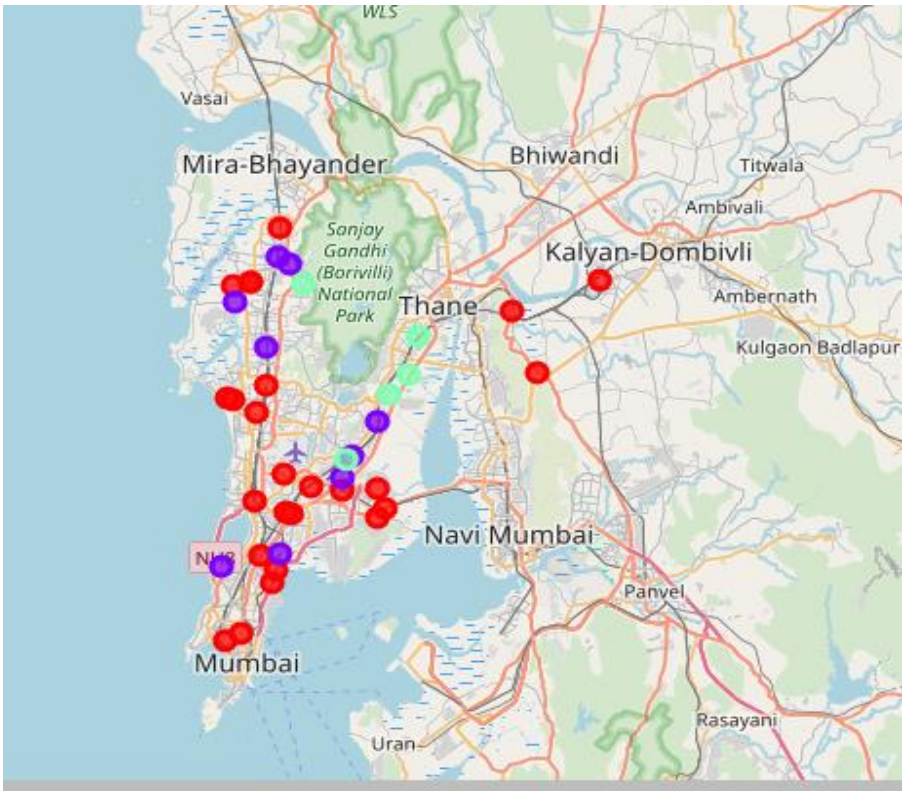
The results from the k-means clustering show that we can categorize the neighborhoods into 3 clusters based on the frequency of occurrence for “Shopping Mall”:

• Cluster 0: Neighborhoods with moderate number of shopping malls

• Cluster 1: Neighborhoods with low number to no existence of shopping malls

• Cluster 2: Neighborhoods with high concentration of shopping malls

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



Discussion

As observations noted from the map in the Results section, most of the shopping malls are concentrated in cluster 2 and moderate number in cluster 1. On the other hand, cluster 0 has very low number to no shopping mall in the neighborhoods. 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 2 are likely suffering from intense competition due to oversupply and high concentration of shopping malls.

Therefore, this project recommends property developers to capitalize on these findings to open new shopping malls in neighborhoods 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 neighborhoods in cluster 0 and cluster 1. Lastly, property developers are advised to avoid neighborhoods in cluster 2 which already have high concentration of shopping malls and suffering from intense competition.

Limitations and Suggestions for Future Research

In this project, we only consider one factor i.e. frequency of occurrence of shopping malls, there are other factors such as population and income of residents that could influence the location decision of a new shopping mall. However, to the best knowledge of this researcher such data are not available to the neighborhood level required by this project. Future research could devise a methodology to estimate such data to be used in the clustering algorithm to determine the preferred locations to open a new shopping mall.