coursera capstone

IBM Applied Data Science Capstone

Opening a New Shopping Mall in Hyderabad, India

By

Vennapusa Manjith Reddy

09-10-2020

Introduction:

The Shopping Malls has Unofficially became the heart and soul of communities, the foundation of retail economies and a social sanctuary for teenagers. Over the years Shopping Malls had changed by adapting to the recent trends. Shopping Malls are no longer primarly about shopping and when consumers visit the Shopping Malls they are looking for experiences. The modern Shopping Mallls Offer variety of entertainment alternatives, lifestyle products and services such as luxury shopping, game zones, beauty saloons, Cinemas and food Joints. Shopping Malls also became place of socialization as due to urbanization people living in smaller pleces and decreasing public space. Shopping Malls attract buyers, sellers and customers and providing enough time to make choices as well as a recreational means of shopping. For retailers, the central location and 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. Opening a shopping Mall allows property developers to earn consistent rental income. There are many factors to be considered before opening a New Shopping Mall but the location of the Shopping Mall is of prime importance and it has a great say in deciding wheter the Shopping Mall will succeed or Not?

Business Problem:

Hydeabad is the capital of south India’s Telangana state.A major center for Technology Industry with Amazon,Google’s largest campuses outside United States i.e a major hub for IT industry.It is home to many upscale Shopping Malls and restaurants.Due to High Youth population and Urbanization in India, Hyderabad became one of best city for relocation to Urban Areas and hence it is witnessing Major population growth in the city and hence the demand for New Shopping Malls. The Objective of this Capstone project is to analyze and suggest the best Neighborhoods to open a New Shopping Mall in Hyderabad.In this i have used data science Methodology and Machine learning Techniques like clustering.This project aims to provide solution to the business question: If a Property developer is going to Open a New shopping Mall what Neighborhood do you suggest to them.

Target Audience:

This project is particularly useful to propery developers and investors looking to open or invest in New Shopping Malls in Hyderabad City.This project is timely as the City is Witnessing Infastructure boom due to increasing population in the city with one of the Highest Youth Populated Cities in India.

Data:

- List of Neighborhoods in Hyderabad City
- Latitude and Longitude coordinates of the Neigborhoods in the city in order to get the venue data of those Neighborhoods and to plot those Neighborhoods on the map.
- Venue Data, particularly related to shopping Malls Which we will use to perform clustering on the Neighborhoods.

Sources of Data and Methods to extract them:

This Wikipedia page https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Hyderabad contains a list of neighbourhoods in Hyderabad city. 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 has one of the largest database of 105+ million places and is used by over 125,000 developers. 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:

Firstly, we need to get the list of neighbourhoods in the city Hyderabad and we can get it from wikipedia page.We will do web scraping using Python requests and beautifulsoup packages to extract the list of neighbourhoods 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 DataFrame and then visualize the neighbourhoods 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 Kuala Lumpur.

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 neighbourhoods 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 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.

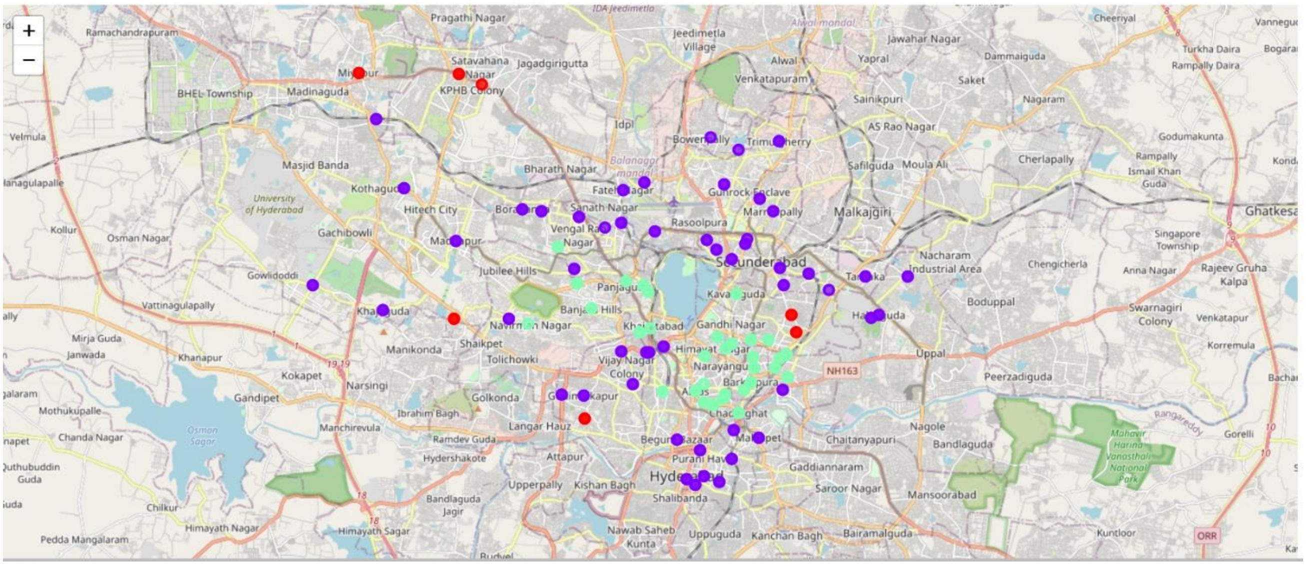
Lastly, we will perform clustering on the data by using k-means clustering. K-means clustering algorithm identifies k number of centroids, and then allocates every data point to the nearest cluster, while keeping the centroids as small as possible. It is one of the simplest and popular unsupervised machine 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”. 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 0: Neighbourhoods with moderate number of shopping malls
- Cluster 1: Neighbourhoods with low number to no existence of shopping malls
- Cluster 2: 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 purple colour, and cluster 2 in mint green colour.



Discussion:

As observations noted from the map in the Results section, most of the shopping malls are concentrated in the central area of Hyderabad city, with the highest number in cluster 2 and moderate number in cluster 0. 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 2 are likely suffering from intense competition due to oversupply and high concentration of shopping malls. From another perspective, the results also show that the oversupply of shopping malls mostly happened in the central area of the city, with the suburb area still have very few shopping malls. 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 0 with moderate competition. Lastly, property developers are advised to avoid neighbourhoods in cluster 2 which already have high concentration of shopping malls and suffering from intense competition.

Limitations and Suggetions 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 neighbourhood 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. In addition, this project made use of the free Sandbox Tier Account of Foursquare API that came with limitations as to the number of API calls and results returned. Future research could make use of paid account to bypass these limitations and obtain more results.

Conclusion:

In this project, we have gone through the process of identifying the business problem, specifying the data required, extracting and preparing the data, performing machine learning by clustering the data into 3 clusters based on their similarities, and lastly providing recommendations to the relevant stakeholders i.e. property developers and investors regarding the best locations to open a new shopping mall. To answer the business question that was raised in the introduction section, the answer proposed by this project is: The neighbourhoods in cluster 1 are the most preferred locations to open a new shopping mall. The findings of this project will help the relevant stakeholders to capitalize on the opportunities on high potential locations while avoiding overcrowded areas in their decisions to open a new shopping mall.