Coursera Capstone

IBM Data Science Professional Certificate

Opening a new shopping mall in Kualalumpur, Malaysia.

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Introduction

For many shoppers, visiting shopping malls is a great way to relax themselves on weekends and holidays. They can do grocery shopping, dine at restaurants, watch movies and perform many more activities. Shopping malls are like a one stop destination for all these activities. For retailers, the central location and the large number of crowds provides a great distribution channel for marketing their products and services. Property developers are also taking advantage of this trend and are trying to open a greater number of shopping malls to cater the increasing demand. As a result, there are many shopping malls in the city of Kualalumpur and many more are being built. Opening shopping malls provides a stable source of rental income for the property developers. Of course, opening a shopping mall is not as simple as it looks because of its numerous business considerations before opening it. Particularly, it is the location of the shopping mall that will play a major role in determining 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 Kualalumpur, Malaysia to open a 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 Kualalumpur, Malaysia, if a property developer is looking to open a new shopping mall, where should you recommend that they open it?

Target audience of this project

This is particularly useful for property developers and investors who are looking to open or invest in new shopping malls in the city of Malaysia i.e. Kualalumpur. This project is timely as the city is suffering from an oversupply of shopping malls.

Data

To solve the problem, we need the following data:

1.List of neighbourhoods in Kualalumpur. This defines the scope of the project which is confined to the city of Kualalumpur, Malaysia.

2.Latitude and longitude coordinates of neighbourhoods. This is required to plot the map and also get the venue data.

3.Venue data, particularly data related to the shopping malls. We will use this data to perform clustering on the neighbourhoods.

Sources of data and methods to extract them

This Wikipedia page consists of a list of neighbourhoods in Kualalumpur (https://en.wikipedia.org/wiki/Category:Suburbs_in_Kuala_Lumpur) with a total of 71 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 latitudes and longitudes of the neighbourhoods.

After that, we will use Foursquare API to get the venue data of these neighbourhoods. Foursquare has one of the largest databases of more than 105 million places and is used by over 125,000 developers. Foursquare will provide may categories of venue data, we are particularly interested in shopping mall category which will help us to solve our problem. This project will make use of many data science skills such as 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 of Kuala Lumpur. Fortunately, the list is available in the Wikipedia page (https://en.wikipedia.org/wiki/Category:Suburbs_in_Kuala_Lumpur). 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 Data Frame 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 analyzing 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

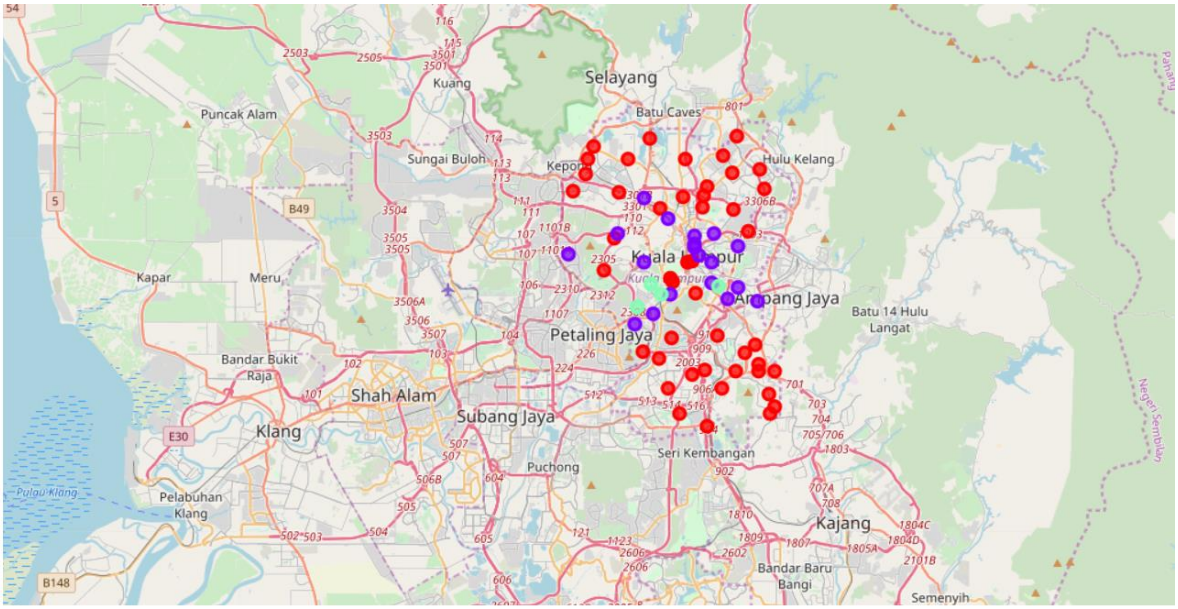
malls in different neighbourhoods, it will help us to answer the question as to which neighbourhoods are most suitable to open new shopping malls.

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 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 the central area of Kuala Lumpur 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 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 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.

References

1.Category: Suburbs in Kualalumpur. *Wikipedia.* Retrieved from, (https://en.wikipedia.org/wiki/Category:Suburbs_in_Kuala_Lumpur)

2.Foursquare Developers Documentation. *Foursquare*.

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