Applied Data Science Capstone Project

IBM Data Science Professional Certificate Program

Best Location in London, New York, and Melbourne for Goila Butter Chicken's Cloud Kitchen

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Introduction

Cloud kitchens are delivery-only kitchens which can be owned by a brand or third party working with various brands. Many brick-and-mortar restaurants are also now using separate cloud kitchen to provide more efficient delivery.

According to a study conducted by Grand View Research, the global kitchen market size was valued at $43.1 billion in 2019, and is expected to reach USD 139.37 billion by 2028, registering a CAGR of 12.4% from 2021 to 2028.

This rise of cloud kitchens can be attributed to many factors like -

- Increase in trend of ordering food online, offering convenience and comfort at doorstep
- Increase in demand for international cuisine.
- Rise in food delivery operators, which can now deliver food anywhere and everywhere
- Changing lifestyles, specially of millennials with increased disposable incomes.
- Increasing the demand for deliveries and takeaways due to frequent lockdowns in most countries

These virtual kitchens require minimal investment and operational costs to run as compared to opening full-fledged restaurants, which help the restaurants improve their profit margins. Due to the realization of these benefits of cloud kitchens, several entrepreneurs including food aggregators and restaurateurs investing in cloud kitchens.

One such entrepreneur and chef is ***Saransh Goila***, who founded ***Goila Butter Chicken*** as a cloud kitchen in 2015. GBC began as a viral food pop-up in Mumbai and by 2018, it had served 300,000 portions of its famous Butter Chicken.

Chef Saransh Goila rose to international acclaim in 2018, when he was invited to be a guest judge on MasterChef Australia, where contestants had to cook his version of Butter Chicken (adjudged as the best 'Butter Chicken' in the world by none other than the MasterChef Australia judges themselves)

Inspiration for this project came from this story - From Mumbai pop-up to London: How cloud kitchen Goila Butter Chicken took Indian food global. As per the story, GBC wants to go global, has already launched its operations in London and is now looking to open 25 kitchens by 2021-end, and 100 by 2023-end. It will launch in several new Indian cities, and in Dubai, New York, Melbourne as well.

Business Problem

The location of any restaurant is crucial to its success. A lot of thought and planning need to go into deciding the location, which is determined by many factors.

In the cloud kitchen model however, the location doesn't have to do anything with footfalls, customer service, parking space or high-end sites, but should be purely chosen based on the customer demography and where there is a high demand for the food being offered.

This project aims to address the problem of finding a suitable location in London, New York, and Melbourne to open a cloud kitchen by GBC or any other Indian Food Chain.

We will aim to –

- Analyze and cluster the neighborhoods in London, shortlist a few locations to open a cloud kitchen for GBC and see if our shortlisted locations include its actual location or any other nearby location.

- Take learnings from above analysis and then similarly analyze and cluster the neighborhoods in Melbourne and New York as well to recommend the best locations.

Target Audience

Target audience here is Goila Butter Chicken as we know that they are already planning to launch in New York and Melbourne, and this analysis can certainly help in finding a suitable location.

Our project can also help any new and upcoming cloud kitchen operators in India, who are looking to expand globally and scouting for suitable locations in cities of London, New York, and Melbourne to start operations.

Scope

Scope of the project is limited to finding locations in the cities of London, New York, and Melbourne, and will be purely based on location analysis we can perform on neighborhoods and nearby venues data extracted from Foursquare.

Data

To solve the business problem, we would need the following data

1) ***List of neighborhoods in London***
   London is very big city divided into many boroughs, which we can find on Wikipedia but there is no information on further division of these boroughs into neighborhoods.
   London also has a vast network of underground stations, which fall under different boroughs. So here, we will assume that these station names represent the neighborhoods more suitably, and extract the same from https://en.wikipedia.org/wiki/List_of_London_railway_stations
   Note that, all the stations are also divided into categories A-E. We will focus on stations in categories A and B only.

2) ***List of neighborhoods in New York City***
   We already have a JSON file with list of boroughs and neighborhoods in New York, provided as part of neighborhoods clustering exercise done earlier. We will use the same here.

3) ***List of neighborhoods in Melbourne City***
   Melbourne is divided into multiple municipalities, which are further divided into suburbs which will be the neighborhoods we are interested in. We will extract the suburbs of Melbourne City from https://en.wikipedia.org/wiki/List_of_Melbourne_suburbs

4) ***Geographical coordinates (Latitude and Longitude) of neighborhoods found above for 3 cities***
   New York JSON file already provides the coordinates. Wikipedia pages of London Stations and Melbourne Suburbs do not have coordinates, so we will get the coordinates for each neighborhood from https://nominatim.openstreetmap.org/ , by passing each neighborhood's name in the search query. (Note: Nominatim also provides an API to get coordinates of an address, but is not reliable and throws error most of the time, so extracting directly from its website is a better and much more reliable method)

Methodology

This project is divided into 3 parts –

1) Finding Best Locations in London to open Goila Butter Chicken's Cloud Kitchen and Compare with its Actual Location
2) Finding Best Locations in Melbourne to open Goila Butter Chicken's Cloud Kitchen
3) Finding Best Locations in New York to open Goila Butter Chicken's Cloud Kitchen

Same methodology and analysis has been performed for all 3 parts, so we will use Part 1 to walk through the methodology and analysis done in detail. But later, in Results and Conclusion sections, we look at all 3 cities.

Methodology followed is as below –

1. Extract London Neighborhoods and Get Location Coordinates

- Scrape the corresponding Wikipedia page to get the London Underground Station Names (which will be our Neighborhoods). The stations we get are divided into categories from A-E, with A being in innermost circle and E in outermost. We do not want to be far away from center, so we filter our scraped data to include only stations in A and B categories.

- Use Nominatim OpenStreet site to get latitude and longitude for London and all its neighborhoods found above. Data from Wikipedia also has coordinates, but these are map coordinates and not latitude-longitude. So, we then get the latitude-longitude from https://nominatim.openstreetmap.org/ by passing each station name to a search query.

- Create a map of London with its neighborhoods pointed on the map with the help of Folium library.

2. Explore and Cluster the Neighborhoods

- Use Foursquare API to get venues in the radius of 2 kms, around the neighborhood centers provided by their coordinates. GBC will be opening a cloud kitchen i.e. delivery only format. Generally, customers prefer food to be delivered in 30-40 min which also includes preparation, so quick delivery can be done in the radius of 2-3 kms.

- Cluster the neighborhoods based on venue categories, using K-means algorithm. Since number of neighborhoods is small, we will divide them into 3 clusters.

- Visualize the clustered neighborhoods using Folium.

- Get the top 10 most common venue categories in each neighborhood. This helps us to get an idea about type of venues in each cluster.

- Examine each cluster and determine how they are distinguished. Based on the top venues, we can try and determine the distinguishing features of each cluster. Based on observed clusters, their distance from each other, distances from city center, we can shortlist a cluster which looks good to open our new kitchen.

3. Recommend Locations to open Cloud Kitchen

- Find top 5 neighborhoods with Indian Restaurants.
- Find the neighborhoods with Indian Restaurants amongst Top 10 venues.

We look at those neighborhoods specifically, where there is a presence of Indian Restaurants. London has a considerable Indian population including working professionals and students. This is the demographic which will be our biggest customer base, so presence of other such Indian Restaurants would be a good indicator of the demand for Indian Food in these neighborhoods.

Results

For London -

- We found 369 London underground stations, which were reduced to 24 after filtering stations in categories A and B. These became our neighborhoods of interest.

- These neighborhoods have 2316 different venues, belonging to 233 unique venue categories.

- Based on cluster analysis, we find-

  Cluster 0 consists of Outer Neighborhoods (furthest from center) with pubs and cafes. Also, Italian Restaurants seem to be quite popular.

  Cluster 1 consists of Inner Neighborhoods (closer to center) with Hotels, Coffee Shops, Cocktail Bars plus a variety of Restaurants. This cluster seems to offer a lot of variety and lot of things to do attracting people from all walks of life.

  Cluster 2 consists of Innermost Neighborhoods (closest to center) with Theaters, Hotels and Art Galleries and Museums. This cluster seems to be the cultural and artistic center of London.

  Based on this analysis, we can say that Cluster 1 is a good choice to open our new cloud kitchen.

- Top 5 neighborhoods with Indian Restaurants are *Bromley South, East Croydon, Charing Cross, Marylebone, Victoria.*

- Neighborhoods with Indian Restaurants amongst Top 10 venues which are *Bromley South, East Croydon, Marylebone, Victoria.*

- Looking at the map, East Croydon and Bromley South are far down south, so we excluded these and were left with Victoria and Marylebone. Also, Marylebone falls under Cluster 1 (shortlisted earlier).

- Based on our observations, we could recommend either **Marylebone** or **Victoria** as the location for opening our new 'Goila Butter Chicken' Cloud Kitchen.

- As GBC has already been opened in London, if we check its location at https://goilabutterchicken.co.uk/, we see that it has been opened in **Marylebone.**

For Melbourne -

- We found 14 neighborhoods within main city of Melbourne

- These neighborhoods have 2423 venues, belonging to 244 unique venue categories.

- Based on cluster analysis, we find

  Cluster 0 consists of Neighborhoods to the west of center with Cafes and Fast-Food joints. Also, has additional variety in terms of markets, stores, gyms, parks.

  Cluster 1 consists of Neighborhoods to the east of center with Cafes, Coffee Shops, Bars and Restaurants. Seem to offer lots of wine and dine options. Also has City Centre in it, so sure to be buzzing with activity.

  Cluster 2 consists of Neighborhoods near to center with Cafes, Coffee Shops, and lots of Asian Restaurants.

  It was difficult to zero in on any one cluster as all seem to have great neighborhoods offering variety of options. But looking at the map, we could shortlist a few neighborhoods around city center which are not too far and not on the southern side. Neighborhoods - Kensington, Carlton, North Melbourne, East Melbourne, and Docklands seem to be good choices.

- Top 5 neighborhoods with Indian Restaurants were Carlton North, East Melbourne, Docklands, North Melbourne, Parkville.

- None of the neighborhoods had any Indian Restaurant in their top 10 venues.

- Looking at the map, we also noticed that Carlton lies almost at the middle of triangle formed by North Melbourne, East Melbourne, and Carlton North, and can service Carlton North and East

Melbourne areas. Similarly, North Melbourne and Docklands can service areas towards west and south.

- Based on these observations, we could recommend one of Carlton, North Melbourne, or Docklands as the locations for opening our new 'Goila Butter Chicken' Cloud Kitchen.

For New York –

- We found 5 boroughs with 306 neighborhoods.

- These neighborhoods have 20528 venues, with 485 unique venue categories. After filtering for neighborhoods with more than 100 venues, we were left with 98 neighborhoods with 9964 venues (which still accounted for ~50% of venues)

- Here, because of large number of neighborhoods to cluster, we used Elbow Plot to determine the best number of clusters to divide them in. This came to be 5 clusters.

  Based on cluster analysis, we found Clusters 0,1,2 having the most venues to be the most suitable. Also, these 3 top clusters have mostly venues from Manhattan, Queens, and Brooklyn.

- Top 10 neighborhoods with Indian Restaurants are Woodside, Jackson Heights, Sutton Place, Jamaica Center, Long Island City, Astoria, Yorkville, Queensbridge, Gramercy, Manhattan Valley.

- We also found that 8 places among above - above Yorkville, Manhattan Valley, Gramercy, Astoria, Woodside, Jackson Heights, Jamaica Center, Sutton Place also have Indian Restaurants amongst their top 10 venues, and these neighborhoods fall in either Manhattan or Queens.

- All these 8 locations seem pretty good, and based on information we have it's not feasible to filter them out further

- Based on these observations, we can recommend any of the 8 neighborhoods (Yorkville, Manhattan Valley, Gramercy, Astoria, Woodside, Jackson Heights, Jamaica Center, Sutton Place) in Manhattan or Queens for opening our new 'Goila Butter Chicken' Cloud Kitchen.

Discussion

If we were to open a regular restaurant, we would ideally think of avoiding neighborhoods which are already crowded with other similar restaurants, but we do not have to worry about this constraint with a cloud kitchen's delivery only format, as here we would ideally want to be in neighborhoods which have residential areas plus also have other restaurants serving similar food, which would tell us that the kind of food we want to serve is in good demand in that area.

Even with other similar restaurants in vicinity, a cloud kitchen like GBC with its specialized, quickly serviceable menu (like fast food), will have advantage to be able to deliver food quickly to multiple areas. Most dine-in restaurants also engage in food delivery, as delivery is taken care of by third party delivery partners nowadays, but they still need to cater to their own place and sitting in customers first, and so may not be equipped to service delivery requests quick enough.

So, in our case neighborhoods having Indian Restaurants featuring in Top 10 venues, would mean that these areas could have a good amount of Indian or Indian origin population, which will fit our target audience as well, and we want to be near such neighborhoods.

In real world, many other factors would need to be considered too before opening any kind of restaurant or kitchen in any neighborhood like demographic factors, real estate availability and prices, availability of labor, proximity to residential areas, licensing costs, kind of food in demand, social-economic factors etc.

Since, our entire analysis and recommendation is based only on location data gathered and based on certain assumptions, so our results do not imply that these recommended neighborhoods are perfect locations for the new shop.

Recommended areas can therefore be considered as starting point as well for more detailed analysis taking other factors into account, which might eventually result in a different location as well.

Conclusion

Purpose of this project was to identify neighborhoods in 3 major cities – London, Melbourne, New York to aid stakeholders in narrowing down their search for an optimal location for opening GBC's cloud kitchen, which has been highly successful in India.

For London -

Even though GBC has already opened its kitchen in London, we wanted to analyze location data ourselves to see how close we can come to the actual location.

This analysis of London Neighborhoods lead to satisfactory results, as one of the two locations we recommended, is also the actual location of cloud kitchen. And so, we performed similar analysis to identify neighborhoods in Melbourne and New York as well.

For Melbourne –

We only had few neighborhoods, but they were very close in comparison and we could not select any cluster. Also, none of the neighborhoods had any Indian Restaurant in their top 10 venues, and we could only find few areas with most Indian Restaurants but visualizing the clustered neighborhoods on map gave us some good insights and helped us to finally recommend three suitable neighborhoods.

For New York -

Here the challenge was large number of total neighborhoods to analyze, so but on numbers of venues we were able to filter out top ~30% neighborhoods. Here also, due to similarity of neighborhoods, we could not select any cluster, but we could see that most relevant venues are three boroughs, and on further analyzing these boroughs, we were able to recommend 8 neighborhoods from 2 boroughs most suitable for our purpose.