**USING MACHINE LEARNING TO FIND LOCATIONS TO OPEN AN INDIAN RESTAURANT IN MELBOURNE METROPOLITAN AREA**

**(IBM CAPSTONE PROJECT)**



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Contents

[Introduction 2](#_Toc12394324)

[Business Problem 3](#_Toc12394325)

[Target Audience 3](#_Toc12394326)

[Data 3](#_Toc12394327)

[Extracting the data 3](#_Toc12394328)

[Methodology 3](#_Toc12394329)

[Results 4](#_Toc12394330)

[Recommendations 5](#_Toc12394331)

[Limitations and Suggestions for Future Research 6](#_Toc12394332)

[Conclusion 6](#_Toc12394333)

[References 6](#_Toc12394334)

# Introduction

For the capstone project I am considering a scenario of selecting a suitable site for opening an Indian restaurants in Melbourne metropolitan area.

Melbourne has a vibrant Indian community with Indian-born migrants making up 3 per cent of Melbourne’s total population. Since 2001 the number of Indian-born migrants in Melbourne has more than tripled. There may not be enough Indian restaurants in Melbourne and it might present a great opportunity for an entrepreneur who is wants to open an Indian restaurant in Melbourne.

# Business Problem

The objective of this capstone project is to find the most suitable location for the entrepreneur to open a new Indian restaurant in Melbourne,Australia.

# Target Audience

The entrepreneur who wants to find the location to open authentic Indian restaurant

# Data

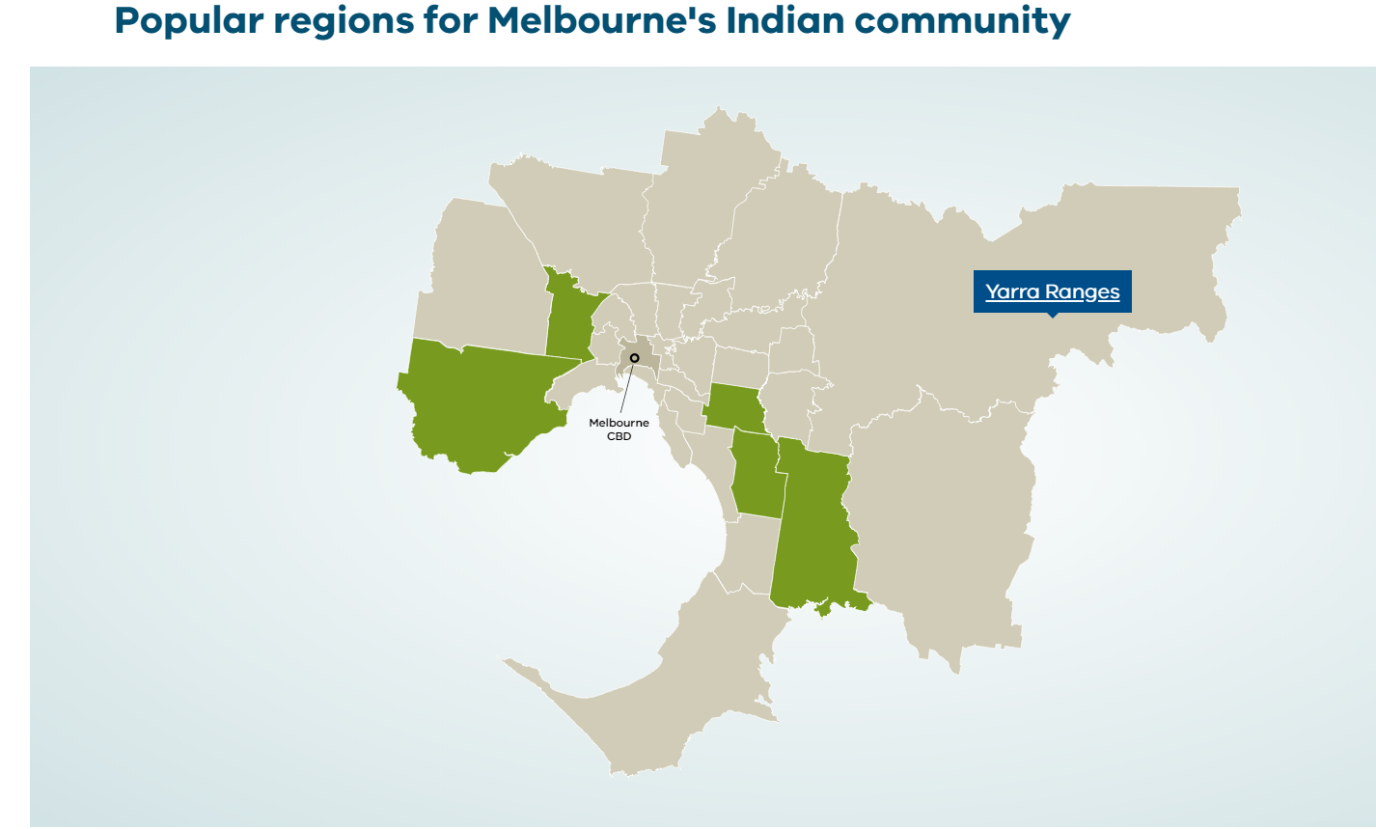
To solve this problem, I will need below data:

* List of suburbs where the Indian population is high.
* Latitude and Longitude of these suburbs.
* Venue data related to Indian restaurents.

# Methodology

As the first step to the project, I need to identify the suburbs where Indian community is high. This information is obtained from the following website <https://liveinmelbourne.vic.gov.au/discover/multicultural-communities/indian>

Cassy, Greater Dandenong, Monash, Brimbank and Wyndham are the major cities where Indian population is high.



The following suburbs of these five cities were considered for the analysis,

Endeavour Hills, Cranbourne, Berwick, Narre Warren, Tooradin, Springvale, Keysborough, Noble Park, Dandenong, Lyndhurst, Chadstone, Oakleigh, Glen Waverley, Mulgrave,Clayton, Point Cook, Werribee, Tarneit, Taylors Lakes, Deer Park, St Albans, Sunshine, and Keilor

The second step is to find the coordinates of these suburbs. Since Geocoder is not working, I prepared a csv file by manually extracting latitude and longitudes of these suburbs and read the file as pandas data frame.

I used folium package to visualize Melbourne and its suburbs.

Next, I use Foursquare API to pull the list of top 100 venues within 500 meters radius. From Foursquare, I am able to pull the names, categories, venues. With this data, I can also check how many unique categories that I can get from these venues. Then, I analyze each city by grouping the rows by city and taking the mean on the frequency of occurrence of each venue category. This is to prepare clustering to be done later.

Lastly, I performed the clustering method by using k-means clustering. I have clustered the cities into 5 clusters based on their similarity of venues. Then I looked for existent of Indian restaurant to assess the competition in those area. Then find the optimum location.

# Results

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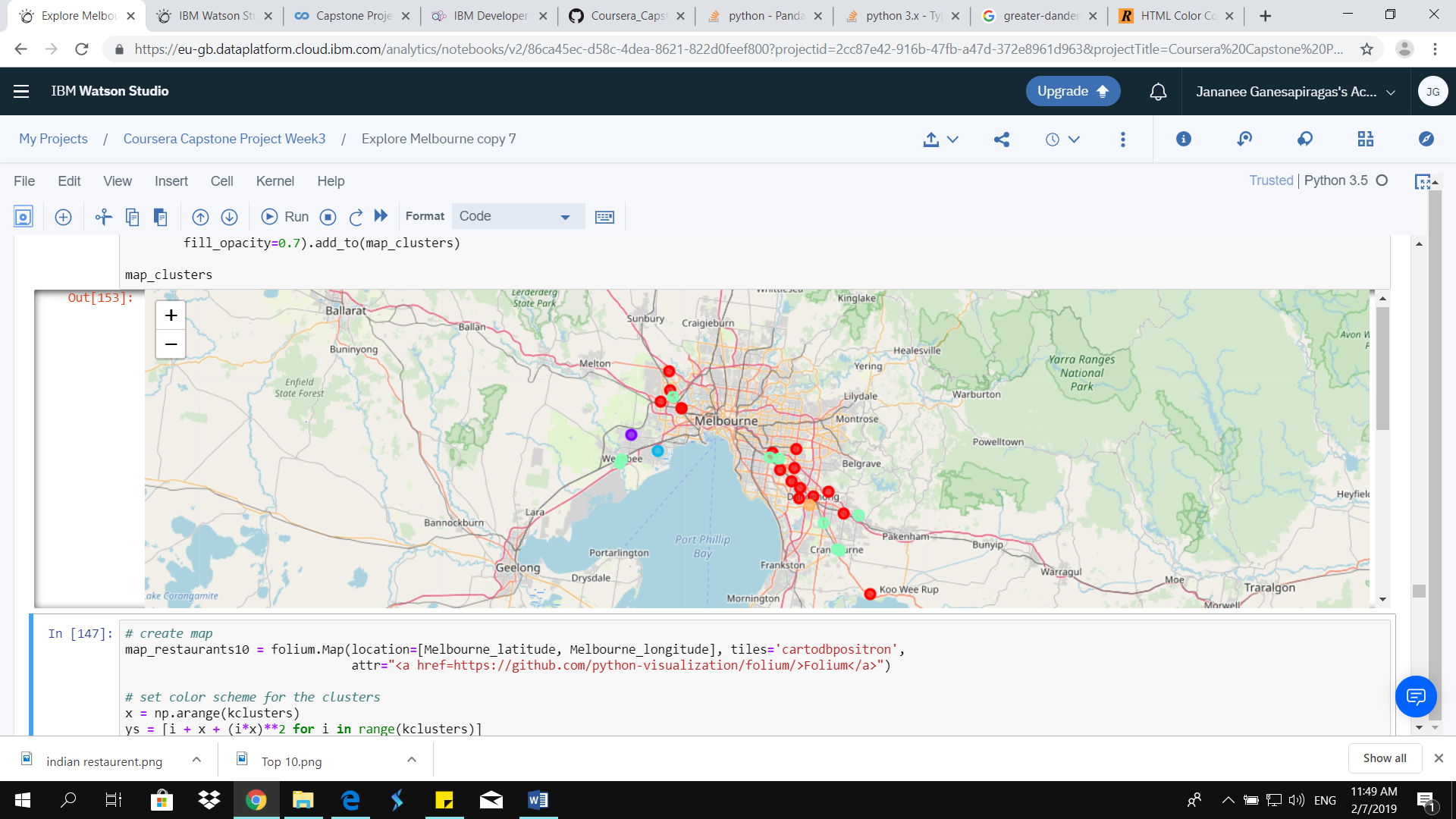
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**Clusters**

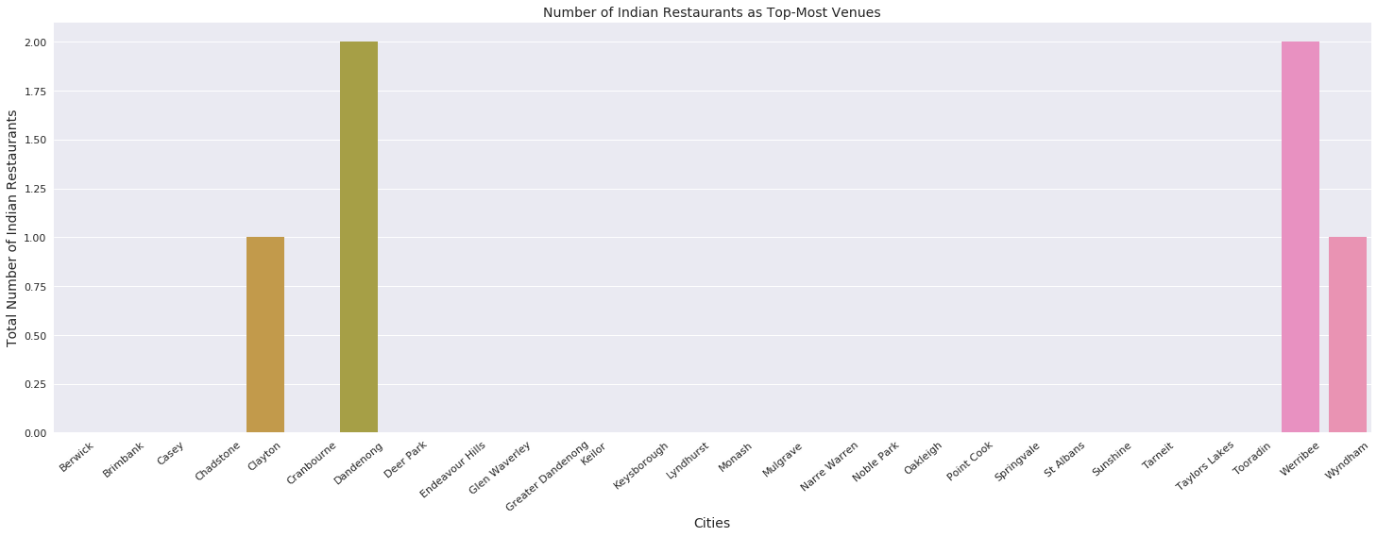
The results from k-means clustering show that we can categorize Melbourne into 5 clusters based on similar characteristics of the city.

* **Cluster 1**: Cities in this cluster exhibits highly urbanized areas where there are lots of food restaurant, café, supermarkets and shoping malls. 16 cities falls into this cluster namely Endeavour Hills, Narre Warren, Tooradin, Springvale, Keysborough, Noble Park, Dandenong, Chadstone, Glen Waverley, Mulgrave, Clayton, Taylors Lakes, Deer Park, St Albans, Sunshine, Keilor,
* **Cluster 2:** Tarneit falls in category 2 with features of electronic stores, gas station.
* **Cluster 3:**Point hookfalls in category 3 with unique features of plaza and flea market
* **Cluster 4**: Cities in this cluster exhibits less urbanized areas with café,fast food restaurents, grocery stalls. Threre are 9 cities in this cluster namely Cranbourne, Berwick,Lyndhust,Oakleigh,Werribee,Casey,Monash,Brimbank,Wyndham
* **Cluster 5:** Greater Dandenong falls in catergorey 5 with features of flea market, Farmers,post office, café.

The results are visualized in the above map with Cluster 1 in red color, Cluster 2 in light green color and Cluster 3 in yellow color Cluster 4 in blue and Cluster 5 in purple color.



There are six Indian restaurants in the study area, with two in Dandenong, two in Werribee and each in Wyndham and Clayton.



# Recommendations

# Cluster 1 contains many restaurants and café, this is unsuitable as there are highly urbanized and high competition 5 Indian restaurant out of 6 exist in this cluster therefore less likely to attract new customers.

# Cluster 4 contain one Indian restaurant and urbanized area therefore high land price therefore difficult to open a restaurent

# Cluster 2 and 3 are not urbanized therefore less profitable.

# Cluster 5 (Greater Dandenong) is moderately urbanized and land prices are affordable have potential to attract new customers,

# Therefore, this project recommends the entrepreneur to open an authentic Indian restaurant in Greater Dandenong.

# Limitations and Suggestions for Future Research

In this project, I considered the suitability of opening a restaurant based on the venues popular in the area and clustered them. And then used the existent of Indian Restaurant to assess the competition. But other factors like population desity,income level and land prices also should be considered.

# Conclusion

In this project, I learned how solve a real world problem and gained skills on data preparation analysis and machine learning tool like clustering.

# References

Melbourne’s Indian community available at [**https://liveinmelbourne.vic.gov.au/discover/multicultural-communities/indian**](https://liveinmelbourne.vic.gov.au/discover/multicultural-communities/indian)