



Coursera Capstone Project

The Battle of Neighbourhoods

Submitted by:

Muhammad Bilal

Problem:

James is a very good cook and he specializes in Thai food. He wants to open a new Thai restaurant in Melbourne city. There are more than 300 suburbs (Neighbourhoods) in Melbourne city. James is in trouble; he does not know in which suburb he should open his new restaurant, so he has a profitable business.

Introduction of Melbourne:

Melbourne is one of the world's most liveable and multicultural cities. Almost 50 percent of Melbournians were either born overseas or have at least one parent who was born overseas.

Fig 1: The world's 10 most liveable cities

The World's 10 Most Liveable Cities

Melbourne is finally knocked off the top spot



Source: The Economist Intelligence Unit
Note: Toronto, Tokyo share 7th place.

Bloomberg

Reference: <https://www.bloomberg.com/news/articles/2018-08-14/vienna-takes-melbourne-s-crown-as-world-s-most-liveable-city>

Along with its liveability, Melbourne is also world-renowned for the quality of its food. People in Melbourne love dining outside, and food is a cause for celebration. A wide variety of high-quality foods are accessible to the people all-year-around.

Data acquisition and cleaning:

A database is acquired from the URL

https://www.matthewproctor.com/australian_postcodes. This database contains geographic information about all the suburbs in all the states of Australia.

Table 1: Geographic information of Australian states.

	id	postcode	locality	state	long	lat	dc	type		status	sa3	sa3name	sa4	sa4name	region
0	230	200	ANU	ACT	0.000000	0.000000	NaN	NaN		NaN	NaN	NaN	NaN	NaN	R1
1	21820	200	Australian National University	ACT	149.118900	-35.277700	NaN	NaN	Added 19-Jan-2020		NaN	NaN	NaN	NaN	R1
2	232	800	DARWIN	NT	130.836680	-12.458684	NaN	NaN	Updated 6-Feb-2020		70101.0	Darwin City	701.0	Darwin	R1
3	233	801	DARWIN	NT	130.836680	-12.458684	NaN	NaN	Updated 25-Mar-2020 SA3		70101.0	Darwin City	701.0	Darwin	R1
4	234	804	PARAP	NT	130.873315	-12.428017	NaN	NaN	Updated 25-Mar-2020 SA3		70102.0	Darwin Suburbs	701.0	Darwin	R1

The city of Melbourne exists in Victoria state, the above table is filtered for the state of Victoria and the information about the other states is dropped. The only information required from the above table after filtering is postcode, locality, longitude, latitude, and council area. Dropped all the unnecessary columns, renamed the sa3name column to the council, and reset the index. The cleaned data looks like the table below.

Table 2: Geographic data of Victoria.

	postcode	locality	long	lat	council
0	3000	MELBOURNE	144.956776	-37.817403	Melbourne City
1	3001	MELBOURNE	144.956776	-37.817403	Port Phillip
2	3002	EAST MELBOURNE	144.982207	-37.818517	Melbourne City
3	3003	WEST MELBOURNE	144.949592	-37.810871	Melbourne City
4	3004	MELBOURNE	144.970161	-37.844246	Port Phillip

In Victoria, some big suburbs have more than one postcode, which made the suburb to be duplicated in the table. The duplicated suburbs are dropped to keep one entry of each suburb.

Also, the above table contains information about all the suburbs in the state of Victoria. However, for this project, only the information about the suburbs in the greater Melbourne metropolitan area is required. To extract the information of Melbourne's suburbs, another table is built which contains the names of all the suburbs in Melbourne.

Table 3: List of Melbourne suburbs.

	Suburb
0	Abbotsford
1	Aberfeldie
2	Aintree
3	Airport West
4	Albanvale

Both tables are inner merged and finally, get a data-frame containing the geographic information about all the suburbs in Melbourne city.

Table 4: Geographic information about Melbourne suburbs.

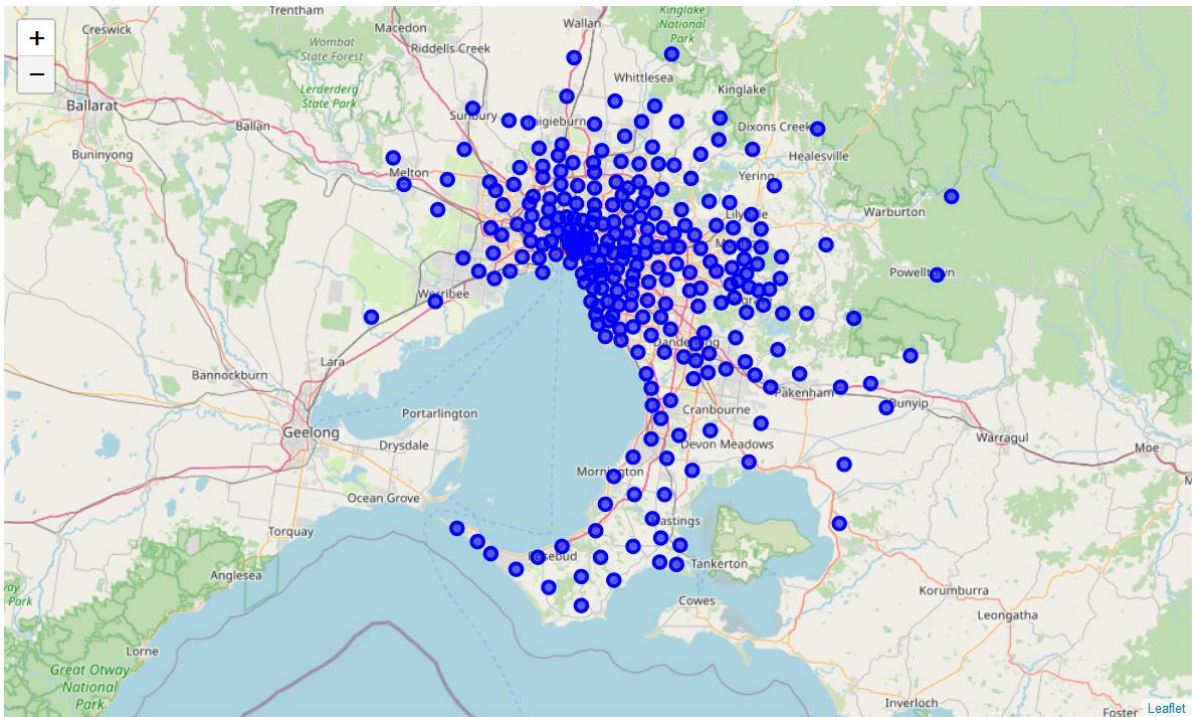
	postcode	suburb	council	lat	long
0	3000	MELBOURNE	Melbourne City	-37.817403	144.956776
1	3002	EAST MELBOURNE	Melbourne City	-37.818517	144.982207
2	3003	WEST MELBOURNE	Melbourne City	-37.810871	144.949592
3	3006	SOUTHBANK	Port Phillip	-37.823258	144.965926
4	3008	DOCKLANDS	Melbourne City	-37.814719	144.948039

Display the Data on Map:

Many small suburbs in Melbourne city have a similar postcode. All such suburbs are combined to condense the data.

Displayed all the suburbs of Melbourne on a map using the Folium library of Python. The purpose of displaying the suburbs on the map is to see the vicinity of the suburbs.

Fig 2: Location of Melbourne’s suburbs on the map.



The above map shows the distribution of suburbs around the city center. The suburbs are concentrating near the city center, which indicates that most of Melbourne's population lives near the city center. A business near the city center will have higher chances of success.

Top venues in Melbourne suburbs:

Using the Foursquare API, the list of venues in the suburbs are fetched and counted how many venues each suburb has.

Table 5: Venues in suburbs.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
2219	RYE, ST ANDREWS BEACH, TOOTGAROOK	-38.396077	144.827203	The Dunes	-38.400314	144.825927	Golf Course
2220	SORRENTO	-38.345527	144.739101	Sorento Beach Motel	-38.345351	144.740123	Motel
2221	SORRENTO	-38.345527	144.739101	St Paul's Road General Store	-38.347290	144.743008	Café
2222	SORRENTO	-38.345527	144.739101	Fusion Broadband	-38.345672	144.744219	Business Service
2223	HAMPTON PARK	-38.043995	145.264296	Club Teutonia - German-Australian Club	-38.043995	145.261979	German Restaurant

It found that there are almost 281 different venue categories in Melbourne city. However, all categories do not exist in each suburb. It is inspected that how many of these categories exist in each suburb.

Table 6: Number of Venues in each suburb.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
	ABBOTSFORD	21	21	21	21	21	21
	ABERFELDIE, ESSENDON, ESSENDON WEST	4	4	4	4	4	4
	AIRPORT WEST, KEILOR PARK, NIDDRIE	2	2	2	2	2	2
	ALBANVALE, KEALBA, KINGS PARK, ST ALBANS	7	7	7	7	7	7
	ALBERT PARK, MIDDLE PARK	24	24	24	24	24	24
	ALBION, SUNSHINE, SUNSHINE NORTH, SUNSHINE WEST	20	20	20	20	20	20
	ALPHINGTON, FAIRFIELD	4	4	4	4	4	4
	ALTONA MEADOWS, LAVERTON, SEABROOK	9	9	9	9	9	9
	ALTONA NORTH	2	2	2	2	2	2
	ALTONA, SEAHOLME	4	4	4	4	4	4
	ARDEER	2	2	2	2	2	2
	ARMADALE	12	12	12	12	12	12
	ASCOT VALE, MARIBYRNONG, TRAVANCORE	6	6	6	6	6	6
	ASHBURTON, ASHWOOD	15	15	15	15	15	15
	ASPENDALE, ASPENDALE GARDENS, BRAESIDE, MORDIALLOC, PARKDALE, WATERWAYS	3	3	3	3	3	3
	ATTWOOD, WESTMEADOWS	11	11	11	11	11	11
	AVONDALE HEIGHTS	2	2	2	2	2	2
	BALACLAVA, ST KILDA EAST	25	25	25	25	25	25
	BALWYN NORTH	2	2	2	2	2	2
	BALWYN, DEEPPENE	4	4	4	4	4	4

The frequency of venue category is grouped based on suburbs for cluster analysis.

Table 7: Frequency of venues in each suburb.

	Neighborhood	Adult Boutique	Afghan Restaurant	American Restaurant	Antique Shop	Aquarium	Arcade	Arepa Restaurant	Argentinian Restaurant	Art Gallery	...	Turkish Restaurant	Vegetarian / Vegan Restaurant
0	ABBOTSFORD	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.000000	0.00	...	0.000000	0.047619
1	ABERFELDIE, ESSENDON, ESSENDON WEST	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.000000	0.00	...	0.000000	0.000000
2	AIRPORT WEST, KEILOR PARK, NIDDRIE	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.000000	0.00	...	0.000000	0.000000
3	ALBANVALE, KEALBA, KINGS PARK, ST ALBANS	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.000000	0.00	...	0.000000	0.000000
4	ALBERT PARK, MIDDLE PARK	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.000000	0.00	...	0.000000	0.000000

Another data frame is created in which the ten most common venues in each suburb are listed. This data frame will be used to analyze which suburb and its venues are falling in which cluster.

Table 8: Ten most common venues in suburbs.

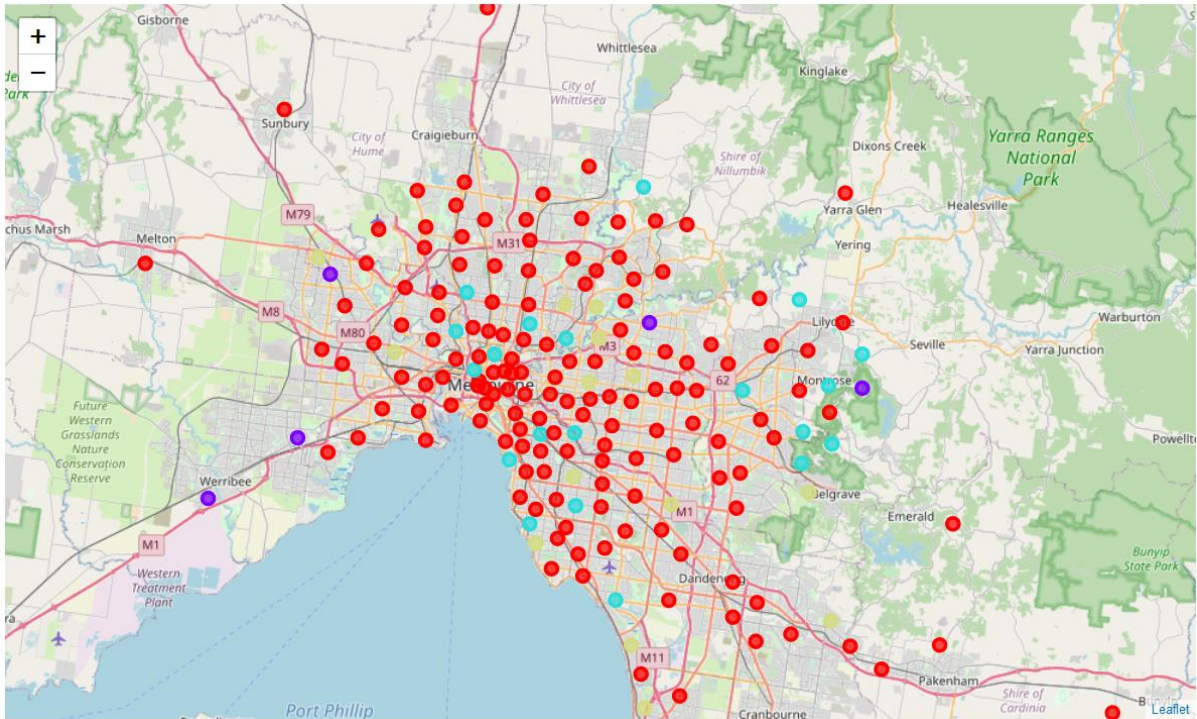
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	ABBOTSFORD	Café	Pub	Convenience Store	Japanese Restaurant	Park	Garden	Greek Restaurant	Grocery Store	Thrift / Vintage Store	Rock Climbing Spot
1	ABERFELDIE, ESSENDON, ESSENDON WEST	Food & Drink Shop	Café	Gym / Fitness Center	Coffee Shop	Flea Market	Fishing Spot	Fish Market	Fish & Chips Shop	Filipino Restaurant	Egyptian Restaurant
2	AIRPORT WEST, KEILOR PARK, NIDDRIE	Scenic Lookout	Gym / Fitness Center	Eastern European Restaurant	Electronics Store	Entertainment Service	Eye Doctor	Falafel Restaurant	Farmers Market	Fast Food Restaurant	Field
3	ALBANVALE, KEALBA, KINGS PARK, ST ALBANS	Pharmacy	Bus Station	Grocery Store	Asian Restaurant	Vietnamese Restaurant	Bakery	Portuguese Restaurant	Fishing Spot	Flea Market	Fish Market
4	ALBERT PARK, MIDDLE PARK	Café	Beach	Ice Cream Shop	Italian Restaurant	Pier	Fast Food Restaurant	Seafood Restaurant	Fishing Spot	Breakfast Spot	Supermarket

Cluster Analysis:

Using the package of KMeans in the scikit-learn library of Python the suburbs are clustered based on the venues. The different values of the “number of clusters” are used to see how the clusters are being developed. An optimum value of 4 is found after testing many different values.

Added the cluster labels and location information into Table No. 8 to display the different clusters on the map. A cluster map is built using the Folium library.

Fig 3: Clustering of suburbs.



The Next step is to analyze each cluster for the target value. Each cluster is individually analyzed for having Thai restaurants in the ten most common venues. It is found that all the suburbs having Thai restaurants are falling in cluster 1 and none of the other clusters have Thai restaurants in their ten most common venues.

Table 9: Suburbs having a Thai restaurant in their venues.

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	WONGA PARK	Thai Restaurant	Tennis Court	Park	Grocery Store	Shopping Mall	Eastern European Restaurant	Egyptian Restaurant	Electronics Store	Entertainment Service	Eye Doctor
1	ASHBURTON, ASHWOOD	Thai Restaurant	Pharmacy	Sandwich Place	Kebab Restaurant	Convenience Store	Liquor Store	Fish & Chips Shop	Fast Food Restaurant	Italian Restaurant	Park
2	MACLEOD, YALLAMBIE	Café	Thai Restaurant	Train Station	Burger Joint	Fish & Chips Shop	Basketball Court	Park	Gym	Athletics & Sports	Flower Shop
3	ALTONA, SEAHOLME	Convenience Store	Café	Train Station	Thai Restaurant	Fast Food Restaurant	Electronics Store	Entertainment Service	Eye Doctor	Falafel Restaurant	Farmers Market
4	COBURG, COBURG NORTH	Café	Supermarket	Bakery	Thai Restaurant	Coffee Shop	Grocery Store	Middle Eastern Restaurant	Shopping Mall	Food Truck	Fast Food Restaurant
5	BUNDOORA, KINGSBURY	Supermarket	Pizza Place	Paper / Office Supplies Store	Thai Restaurant	Portuguese Restaurant	Flea Market	Fishing Spot	Fish Market	Fish & Chips Shop	Flower Shop
6	KNOXFIELD	Bakery	Grocery Store	Skate Park	Thai Restaurant	Zoo Exhibit	Farmers Market	Electronics Store	Entertainment Service	Eye Doctor	Falafel Restaurant
7	DOCKLANDS	Café	Coffee Shop	Hotel	Restaurant	Thai Restaurant	Sandwich Place	Bar	Pizza Place	Middle Eastern Restaurant	Australian Restaurant

Finalize the Suburbs:

After getting the data of suburbs having Thai restaurants in their venues, the next step is to further summarize the data for a good suggestion to James for his restaurant.

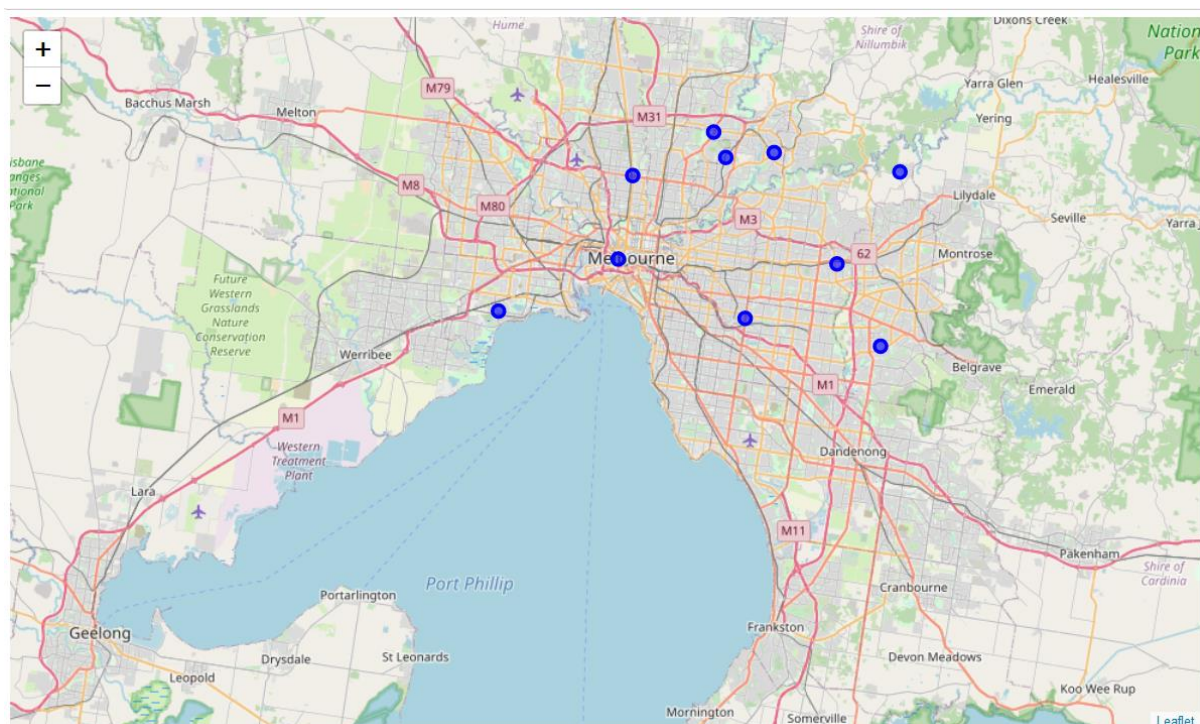
From the analysis, it is found that there are 19 suburbs in Melbourne that have a Thai restaurant in their ten most common venues. This information is further processed to find out the suburbs having a Thai restaurant in their five most common venues. Finally, 10 suburbs are shortlisted which have a Thai restaurant in their five most common venues.

Table 10: Suburb having a Thai restaurant in their five most common venues.

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	WONGA PARK	Thai Restaurant	Tennis Court	Park	Grocery Store	Shopping Mall
1	ASHBURTON, ASHWOOD	Thai Restaurant	Pharmacy	Sandwich Place	Kebab Restaurant	Convenience Store
2	MACLEOD, YALLAMBIE	Café	Thai Restaurant	Train Station	Burger Joint	Fish & Chips Shop
3	ALTONA, SEAHOLME	Convenience Store	Café	Train Station	Thai Restaurant	Fast Food Restaurant
4	COBURG, COBURG NORTH	Café	Supermarket	Bakery	Thai Restaurant	Coffee Shop
5	BUNDOORA, KINGSBURY	Supermarket	Pizza Place	Paper / Office Supplies Store	Thai Restaurant	Portuguese Restaurant
6	KNOXFIELD	Bakery	Grocery Store	Skate Park	Thai Restaurant	Zoo Exhibit
7	DOCKLANDS	Café	Coffee Shop	Hotel	Restaurant	Thai Restaurant
8	MONTMORENCY	Pub	Grocery Store	Burger Joint	Café	Thai Restaurant
9	MITCHAM	Pizza Place	Japanese Restaurant	Platform	Ice Cream Shop	Thai Restaurant

Before ranking these suburbs, they are displayed on the map to extract more information about these suburbs.

Fig 4: Suburb having a Thai restaurant in their five most common venues.



Conclusion:

The following suburbs are finalized and ranked for James to open his new Thai food restaurant.

Table 11: Ranking of Suburbs for the final suggestion.

Rank	Suburb
1.	DOCKLANDS
2.	ALTONA, SEAHOLME
3.	ASHBURTON, ASHWOOD
4.	MACLEOD, YALLAMBIE

1. Docklands is ranked first though it has a Thai restaurant a fifth most common venue because it is very near to city center and big businesses have their offices in the city center. People from the other suburbs of the city travel daily to their jobs in the city center. Also, the other most common venues in this suburb are food-related. All these references show that this place has higher customer obtainability.
2. Altona, Seaholme is ranked second because this place has a beach and a seashore. People love to spend their free time on the beach and during their time on the beach, they like to dine outside. This place will provide James a good opportunity to introduce fine dining to the people.
3. Ashburton, Ashwood is ranked third because this place has a Thai restaurant as the first most common venue. This indicates that people in these suburbs love Thai food and would give a try to a new Thai food place.
4. Macleod, Yallambie is ranked fourth because they are making another cluster with Bundoora, Kingsbury, and Montmorency. This indicates that the Thai population lives around these areas and they love to enjoy their traditional food.