

Comparison of Places of Interest in Sydney and Melbourne

Coursera Applied Data Science Capstone Project

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1.0 Introduction

Australia is one of the most urbanised nations in the world, more than two-thirds of Australians live in a capital city and 40% of the population live in the two largest cities Sydney and Melbourne. According to the Australian Bureau of Statistics (ABS), in 2019, 533,500 people immigrated to Australia. Immigration in 2020 reduced significantly as Australia closed its borders as a result of Covid-19. Once Covid-19 vaccinations are widely available, immigration will increase again.

There are many factors that immigrants use when choosing where to live, such as where relatives or contacts are living, employment opportunities, cost of living, access to education etc. There are also lifestyle factors such as similar social and cultural opportunities. This report uses Foursquare data to compare Sydney and Melbourne in terms of places of interest and explore how each city might appeal to future immigrants.

2.0 Data

2.1 Foursquare

Foursquare data provides access to places of interest. Places of interest include food, nightlife, arts & entertainment, outdoors & recreation, shops:

<https://developer.foursquare.com/docs/build-with-foursquare/categories/>

2.2 Australian Postcodes and Regions

In order to visualise each city, we need to have geographical information in order to plot places of interest onto a map. Postcodes in Australia is provided by Australia Post, this data is combined with regional information, as defined by the Australian Bureau of Statistics (ABS), into a single data source that allows you to identify a city, it's suburbs, latitude and longitude coordinates from this site:

https://www.matthewproctor.com/australian_postcodes

The figure below provides definitions for the data fields in the Australian postcode file. The information of interest from this file includes:

- postcode – to be able to remove postcodes associated with PO boxes
- long – longitude to be able to map a region
- lat – latitude to be able to map a region
- SA4 name – this is the lowest level of region definition available in the file. In deciding between the regional definitions available, SA4 was selected the foursquare data has a limit of 100 API calls, selecting a larger number of small regions provides more places of interest in order to complete the comparison.

The files have eight fields in each:

Field	Description	Example	Updated
id	Primary Key from source database	1	Regularly
postcode	The postcode in numerical format - 0000 to 9999	3000	Regularly
locality	The locality of the postcode - typically the city/suburb or postal distribution centre	Melbourne	Regularly
state	The Australian state in which the locality is situated	VIC	Regularly
long	The longitude of the locality - defaults to 0 when not available	144.956776	Regularly
lat	The latitude of the locality - defaults to 0 when not available	-37.817403	Regularly
dc¹	The Australia Post distribution Centre servicing this postcode - defaults to blank when not available	MELBOURNE	Infrequently
type¹	The type of locality, such as a delivery area, post office or a "Large Volume Recipient" such as a GPO, defaults to blank when not available	LVR	Regularly
SA3	The SA3 Statistical Area code	215	Adhoc
SA3 Name	The name of the SA3 Statistical Area	North West	Adhoc
SA4	The SA4 Statistical Area code	21501	Adhoc
SA4 Name	The name of the SA4 Statistical Area	Grampians	Adhoc
Region	Designated Regional Area	R1	
status	A note indicating whether the data is new, removed or updated - new column Nov 2018	Updated	Regularly

¹ These fields are no longer being updated, as the data isn't overly relevant outside of AusPost.

Figure 1: Australian Postcode File Data Fields

3.0 Methodology

3.1 Exploratory Data Analysis and Data Cleaning

The Australian Postcodes file includes all post codes within Australia and information about each post code that was not relevant to the investigation. I removed the columns with information that I knew would not be needed and left SA3 Name and SA4 Name so that I could explore them further.

Initially I used the SA4 name to identify regions in Sydney and Melbourne, therefore I removed all rows where SA4 name was blank. I created separate dataframes for Sydney and Melbourne, and then filtered out post codes associated to a PO Box or LVR (large volume recipient, leaving post codes that were associated with a location.

Each region had multiple postcodes associated with it and each postcode had a latitude and longitude, each region had to have a single latitude and longitude to be able to map them, so I grouped each region by the mean of the latitude and longitude and merged that information into a new dataframe.

I started my analysis using the SA4 name to map Sydney regions, however, as I plotted the regions onto a map and remembered that the foursquare API was limited to 100 calls, I realised that the small number of SA4 regions, may not return enough information to make the comparison useful. I therefore returned back to the original data source and repeated the investigation using the lower level and more frequent SA3 name to identify regions. This would provide more places of interest with more regions being used to make 100 API calls.

Table 1: Comparison of unique SA3 and SA4 Names for Sydney and Melbourne

City	SA3 Name	SA4 Name
Sydney	43	14
Melbourne	38	8

3.2 Mapping Regions

To understand the geographical distribution of the regions, I created a map of Sydney and Melbourne with the centre of each city's regions marked. I observed that in the centre of each city the regions were closer together while at the periphery of the city, the regions were further apart. This spread was more noticeable in Sydney than Melbourne and using google maps, I could see that Sydney had a 195km distance between the city centre and the furthest regional centre, compared to 65km for Melbourne. Another difference was that in Sydney several of the outer regional centres appeared to be in heavily vegetated areas as indicated by the green shading.

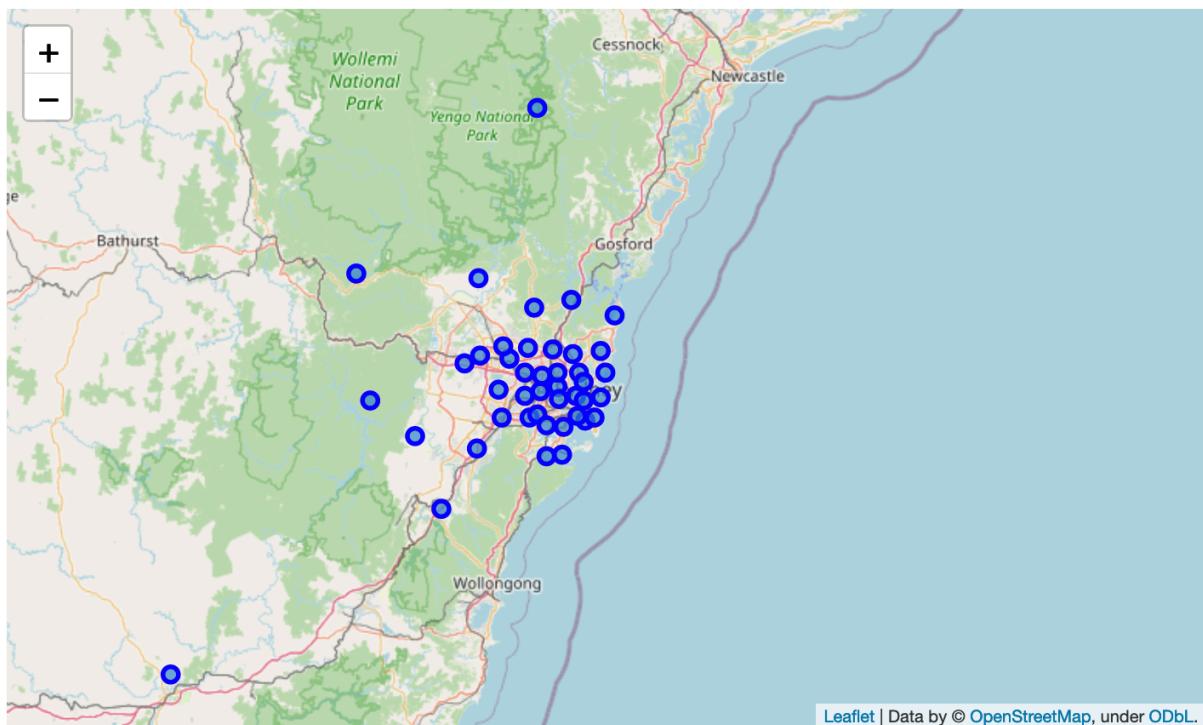


Figure 2: Map of Sydney Regions

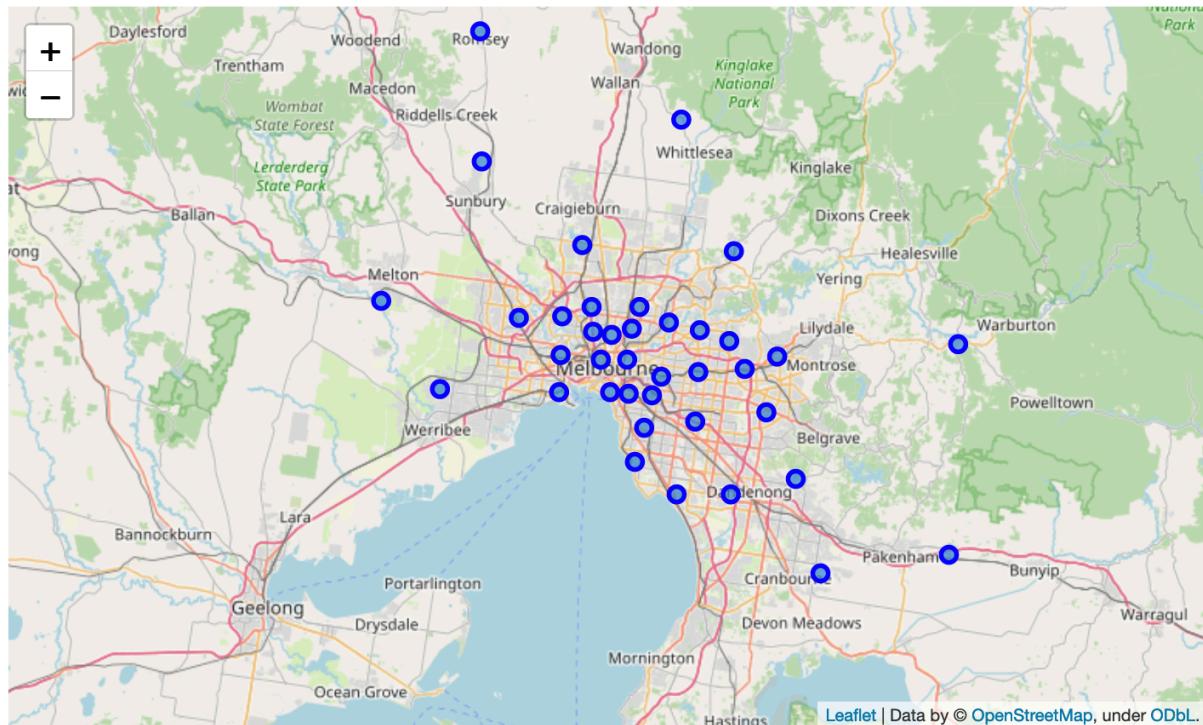


Figure 3: Map of Melbourne Regions

3.3 Identifying Places of Interest for each Region

In creating a function to access the Foursquare places of interest for each region, I had to set a radius. There were several factors that I used to determine the radius to use. It would be a compromise between knowing that I would be limited to 100 API calls for each region, minimising the risk of overlapping inner city regions that are close together by setting a radius too large and maximising how many places of interest would be included for outer city regions where places of interest are more spread out. Using google maps, I calculated the distance between inner city region centres for Sydney and Melbourne and decided to set the radius as 5km.

In exploring the dataset, I noticed that a reasonably large number of places of interest were returned for each city and a reasonable number of unique categories were captured and that the numbers for Sydney and Melbourne appeared to be relatively similar.

Table 2: Comparison of Regions, Places of Interest and Unique Categories

City	Adjusted Number of Regions	Number of Places of Interest	Number of Unique Categories
Sydney	41	3079	256
Melbourne	38	2776	232

Calculating the total places of interest by region highlighted that most of the regions reached the Foursquare limit of 100, while 2 outer Sydney regions returned no responses and were subsequently removed from the investigation and a number of outer regions returned less than 10 responses.

Region	Region Latitude	Region Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Auburn	100	100	100	100	100	100
Bankstown	100	100	100	100	100	100
Baulkham Hills	86	86	86	86	86	86
Blacktown	100	100	100	100	100	100
Blacktown - North	100	100	100	100	100	100
Blue Mountains	5	5	5	5	5	5
Blue Mountains - South	2	2	2	2	2	2
Botany	100	100	100	100	100	100
Bringelly - Green Valley	2	2	2	2	2	2

Figure 4: Total Places of Interest by Region for Sydney

Region	Latitude	Region Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Banyule	100	100	100	100	100	100
Bayside	100	100	100	100	100	100
Boroondara	100	100	100	100	100	100
Brimbank	50	50	50	50	50	50
Bruswick - Coburg	100	100	100	100	100	100
Cardinia	4	4	4	4	4	4
Casey - North	24	24	24	24	24	24
Casey - South	30	30	30	30	30	30
Dandenong	85	85	85	85	85	85

Figure 5: Total Places of Interest by Region for Melbourne

3.4 Identifying Most Common Places of Interest for each Region

To prepare the data for clustering, each place of interest was transformed using one hot encoding. The output of this transformation was a dataframe with columns for each place of interest category and a row for each unique place of interest, the cells in each row were given either a 1 or a 0 to identify which category they fell into. From there I grouped the data by region and calculated the mean of the frequency of each category. With the frequencies of each category, I could then calculate the top 10 most common categories for each region.

	Region	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	Auburn	Café	Vietnamese Restaurant	Park	Korean Restaurant	Indian Restaurant	Thai Restaurant	Supermarket	Lebanese Restaurant	Dessert Shop	Garden
1	Bankstown	Fast Food Restaurant	Café	Grocery Store	Vietnamese Restaurant	Sandwich Place	Pizza Place	Convenience Store	Train Station	Department Store	Coffee Shop
2	Baulkham Hills	Café	Gym	Shopping Mall	Supermarket	Pizza Place	Fast Food Restaurant	Convenience Store	Thai Restaurant	Burger Joint	Italian Restaurant
3	Blacktown	Fast Food Restaurant	Supermarket	Convenience Store	Café	Sandwich Place	Grocery Store	Pizza Place	Coffee Shop	Juice Bar	Shopping Mall
4	Blacktown - North	Supermarket	Fast Food Restaurant	Café	Coffee Shop	Grocery Store	Sandwich Place	Pizza Place	Thai Restaurant	Indian Restaurant	Shopping Mall

Figure 6: Top 10 Most Common Venue Categories by Region for Sydney

	Region	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	Banyule	Café	Supermarket	Grocery Store	Sandwich Place	Fast Food Restaurant	Park	Liquor Store	Electronics Store	Pharmacy	Coffee Shop
1	Bayside	Café	Beach	Bakery	Electronics Store	Park	Burger Joint	Indian Restaurant	Coffee Shop	Liquor Store	Brewery
2	Boroondara	Café	Park	Coffee Shop	Italian Restaurant	Bar	Gym / Fitness Center	Thai Restaurant	Vietnamese Restaurant	Brewery	Burger Joint
3	Brimbank	Fast Food Restaurant	Bakery	Supermarket	Vietnamese Restaurant	Pharmacy	Café	Grocery Store	Pub	Train Station	Chinese Restaurant
4	Bruswick - Coburg	Café	Bar	Bakery	Vietnamese Restaurant	Italian Restaurant	Coffee Shop	Vegetarian / Vegan Restaurant	Park	Wine Bar	Ice Cream Shop

Figure 7: Top 10 Most Common Venue Categories by Region for Melbourne

3.5 Clustering Similar Regions

To explore and compare each region within Sydney and Melbourne, I used the k-means clustering algorithm, an unsupervised machine learning to cluster similar regions. Prior to running the algorithm, I had to decide the number of clusters to set. Initially I ran the algorithm using 5 clusters and found that only one cluster was assigned to all of the inner city regions. In order to have more differentiation, I increased the clusters to 7 which resulted in two cluster for the inner city regions.

	Region	latitude	longitude	Cluster Labels	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	Auburn	-33.861337	151.046030	0	Café	Vietnamese Restaurant	Park	Korean Restaurant	Indian Restaurant	Thai Restaurant	Supermarket	Lebanese Restaurant	Middle Eastern Restaurant	Gym
1	Bankstown	-33.939347	151.007752	1	Fast Food Restaurant	Café	Grocery Store	Vietnamese Restaurant	Sandwich Place	Pizza Place	Convenience Store	Coffee Shop	Bar	Train Station
2	Baulkham Hills	-33.732380	151.000948	1	Café	Gym	Shopping Mall	Thai Restaurant	Supermarket	Convenience Store	Fast Food Restaurant	Pizza Place	Burger Joint	Italian Restaurant
3	Blacktown	-33.766075	150.935836	1	Fast Food Restaurant	Supermarket	Sandwich Place	Convenience Store	Café	Grocery Store	Pizza Place	Coffee Shop	Juice Bar	Indian Restaurant
4	Blacktown - North	-33.726999	150.915366	1	Fast Food Restaurant	Café	Supermarket	Grocery Store	Coffee Shop	Pizza Place	Sandwich Place	Thai Restaurant	Shopping Mall	Burger Joint

Figure 8: Output of k-Means Clustering for Sydney

	Region	latitude	longitude	Cluster Labels	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	Banyule	-37.750999	145.072143	1	Café	Supermarket	Grocery Store	Sandwich Place	Fast Food Restaurant	Park	Liquor Store	Electronics Store	Pharmacy	Coffee Shop
1	Bayside	-37.945692	145.012229	0	Café	Beach	Bakery	Electronics Store	Park	Burger Joint	Indian Restaurant	Coffee Shop	Liquor Store	Brewery
2	Boroondara	-37.826450	145.058341	0	Café	Park	Coffee Shop	Italian Restaurant	Bar	Gym / Fitness Center	Thai Restaurant	Vietnamese Restaurant	Brewery	Burger Joint
3	Brimbank	-37.744715	144.805248	5	Fast Food Restaurant	Bakery	Supermarket	Vietnamese Restaurant	Pharmacy	Café	Grocery Store	Pub	Train Station	Chinese Restaurant
4	Brunswick - Coburg	-37.768522	144.969204	1	Café	Bar	Bakery	Vietnamese Restaurant	Italian Restaurant	Coffee Shop	Vegetarian / Vegan Restaurant	Park	Wine Bar	Ice Cream Shop

Figure 9: Output of k-Means Clustering for Melbourne

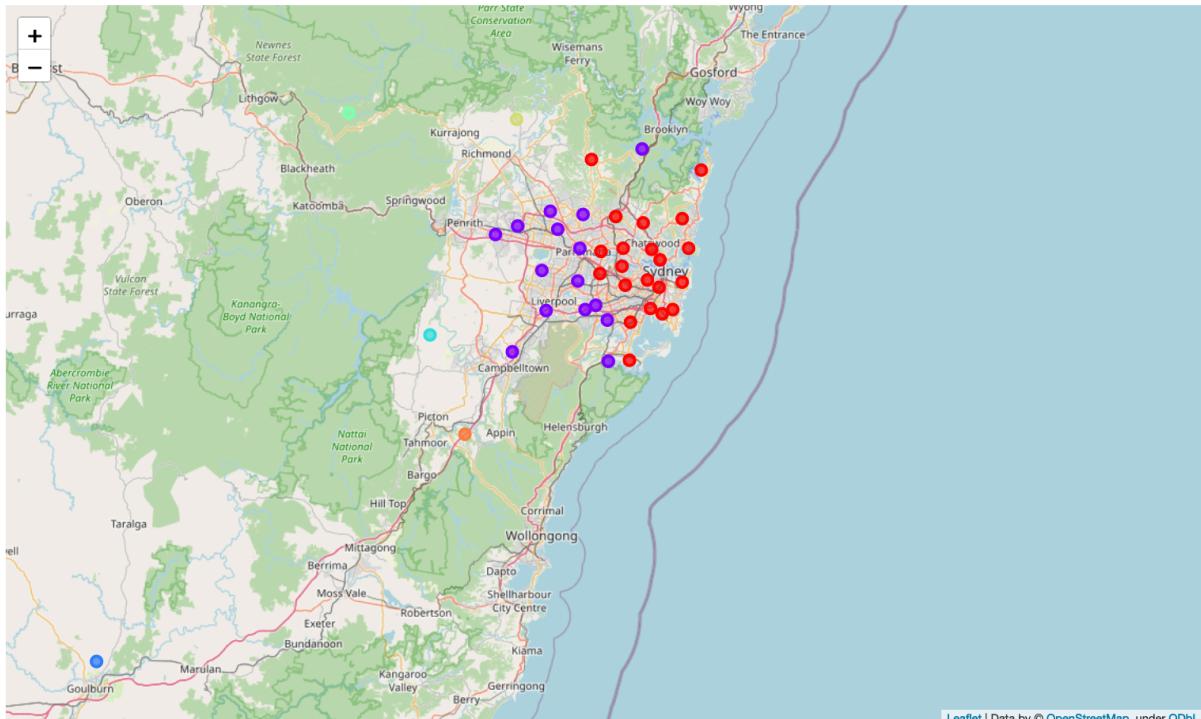


Figure 10: Map of Sydney Clustered using Places of Interest Categories

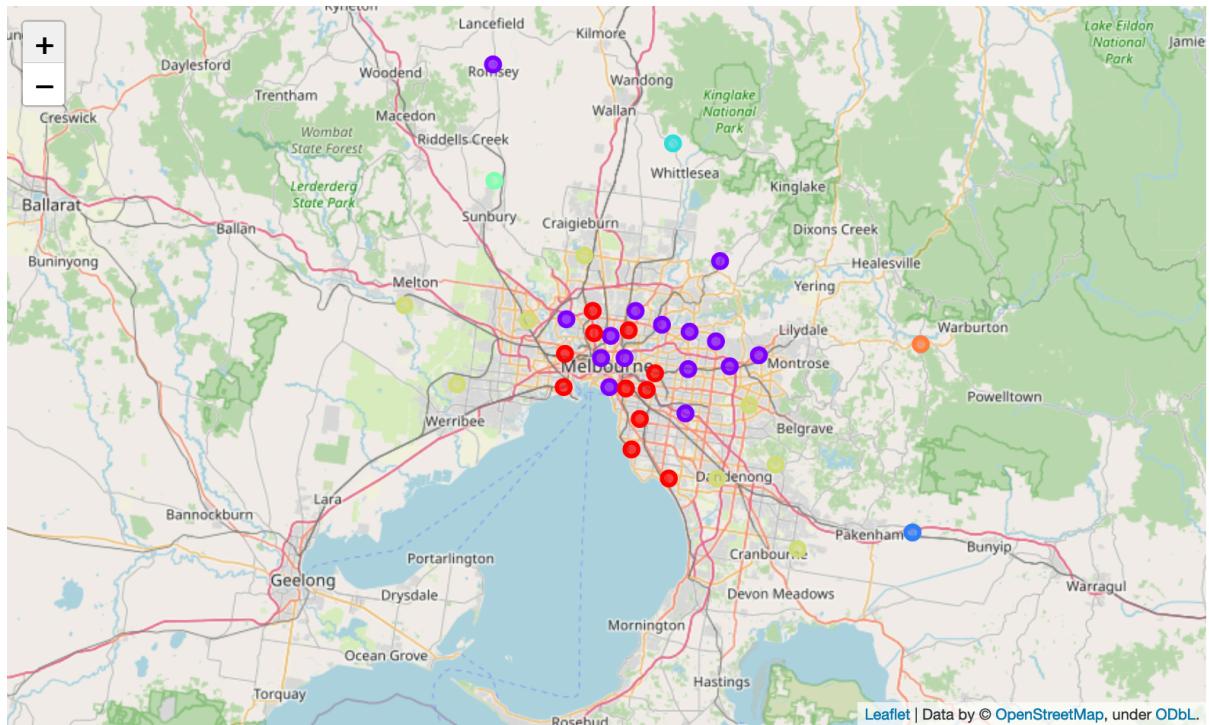


Figure 11: Map of Melbourne Clustered using Places of Interest Categories

3.6 Examining Each Cluster

I then examined each cluster to identify the venue categories that distinguished each cluster.

Sydney Clusters

	Region	Cluster Labels	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	Auburn	0	Café	Vietnamese Restaurant	Park	Korean Restaurant	Indian Restaurant	Thai Restaurant	Supermarket	Lebanese Restaurant	Middle Eastern Restaurant	Gym
7	Botany	0	Café	Bakery	Coffee Shop	Park	Supermarket	Beach	Gym	Burger Joint	Bar	Shopping Mall
10	Canada Bay	0	Café	Park	Korean Restaurant	Italian Restaurant	Thai Restaurant	Seafood Restaurant	Fast Food Restaurant	Chinese Restaurant	Supermarket	Coffee Shop
12	Carlingford	0	Café	Park	Lebanese Restaurant	Australian Restaurant	Burger Joint	Indian Restaurant	Vietnamese Restaurant	Thai Restaurant	Japanese Restaurant	Korean BBQ Restaurant
13	Chatswood - Lane Cove	0	Café	Japanese Restaurant	Coffee Shop	Park	Bakery	Thai Restaurant	Italian Restaurant	Gym	Shopping Mall	Chinese Restaurant
14	Cronulla - Miranda - Caringbah	0	Café	Beach	Electronics Store	Gym	Juice Bar	Bar	Park	Burger Joint	Tapas Restaurant	Tea Room
15	Dural - Wisemans Ferry	0	Café	Bakery	Supermarket	Event Space	Park	Liquor Store	Field	Fast Food Restaurant	Filipino Restaurant	Egyptian Restaurant
16	Eastern Suburbs - North	0	Park	Café	Beach	Australian Restaurant	Bakery	Mexican Restaurant	Burger Joint	Italian Restaurant	Wine Bar	Restaurant
17	Eastern Suburbs - South	0	Café	Bakery	Beach	Park	Supermarket	Coffee Shop	Thai Restaurant	Pizza Place	Burger Joint	Dessert Shop
21	Kogarah - Rockdale	0	Café	Supermarket	Greek Restaurant	Bakery	Gym	Thai Restaurant	Coffee Shop	Italian Restaurant	Sports Bar	Beach
22	Ku-ring-gai	0	Café	Grocery Store	Italian Restaurant	Bakery	Coffee Shop	Supermarket	Park	Clothing Store	Thai Restaurant	Pizza Place
23	Leichhardt	0	Café	Park	Ice Cream Shop	Thai Restaurant	Bar	Pizza Place	Bakery	Coffee Shop	Cocktail Bar	Brewery
25	Manly	0	Beach	Café	Park	Scenic Lookout	Seafood Restaurant	Brewery	Wine Bar	Bar	Australian Restaurant	Trail
26	Marrickville - Sydenham - Petersham	0	Café	Bakery	Bar	Pub	Ice Cream Shop	Coffee Shop	Brewery	Vietnamese Restaurant	Climbing Gym	Greek Restaurant
29	North Sydney - Mosman	0	Café	Park	Scenic Lookout	Japanese Restaurant	Theater	Cocktail Bar	Pub	Bar	Bakery	Australian Restaurant
31	Pennant Hills - Epping	0	Café	Park	Liquor Store	Fried Chicken Joint	Pizza Place	Golf Course	Supermarket	Thai Restaurant	Electronics Store	Shopping Mall
32	Pittwater	0	Café	Beach	Supermarket	Coffee Shop	Park	Pub	Bakery	Wine Shop	Sandwich Place	Harbor / Marina
34	Ryde - Hunters Hill	0	Café	Park	Supermarket	Thai Restaurant	Coffee Shop	Vietnamese Restaurant	Clothing Store	Department Store	Korean BBQ Restaurant	Malay Restaurant
36	Strathfield - Burwood - Ashfield	0	Café	Park	Coffee Shop	Korean Restaurant	Chinese Restaurant	Italian Restaurant	Bakery	Thai Restaurant	Indian Restaurant	Liquor Store
38	Sydney Inner City	0	Café	Coffee Shop	Bar	Thai Restaurant	Ice Cream Shop	Park	Bakery	Whisky Bar	Restaurant	Theater
39	Warringah	0	Café	Beach	Pizza Place	Bakery	Australian Restaurant	Coffee Shop	Supermarket	Sandwich Place	Bar	Italian Restaurant

Figure 12: Sydney Cluster Label 0 – Red Circles

	Region	Cluster Labels	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
1	Bankstown	1	Fast Food Restaurant	Café	Grocery Store	Vietnamese Restaurant	Sandwich Place	Pizza Place	Convenience Store	Coffee Shop	Bar	Train Station
2	Baulkham Hills	1	Café	Gym	Shopping Mall	Thai Restaurant	Supermarket	Convenience Store	Fast Food Restaurant	Pizza Place	Burger Joint	Italian Restaurant
3	Blacktown	1	Fast Food Restaurant	Supermarket	Sandwich Place	Convenience Store	Café	Grocery Store	Pizza Place	Coffee Shop	Juice Bar	Indian Restaurant
4	Blacktown - North	1	Fast Food Restaurant	Café	Supermarket	Grocery Store	Coffee Shop	Pizza Place	Sandwich Place	Thai Restaurant	Shopping Mall	Burger Joint
9	Campbelltown (NSW)	1	Fast Food Restaurant	Grocery Store	Sandwich Place	Shopping Mall	Supermarket	Convenience Store	Pizza Place	Department Store	Golf Course	Platform
11	Canterbury	1	Café	Grocery Store	Fast Food Restaurant	Sandwich Place	Vietnamese Restaurant	Pizza Place	Lebanese Restaurant	Electronics Store	Supermarket	Bar
18	Fairfield	1	Café	Park	Pizza Place	Italian Restaurant	Vietnamese Restaurant	Thai Restaurant	Grocery Store	Convenience Store	Burger Joint	Farm
19	Hornsby	1	Train Station	Platform	Trail	Sandwich Place	Café	Chinese Restaurant	Seafood Restaurant	Thai Restaurant	Bus Stop	Pub
20	Hurstville	1	Café	Grocery Store	Supermarket	Sandwich Place	Fast Food Restaurant	Pizza Place	Bakery	Middle Eastern Restaurant	Electronics Store	Park
24	Liverpool	1	Fast Food Restaurant	Supermarket	Italian Restaurant	Café	Lebanese Restaurant	Gym / Fitness Center	Bakery	Fried Chicken Joint	Pharmacy	Grocery Store
27	Merrylands - Guildford	1	Supermarket	Pizza Place	Café	Fast Food Restaurant	Vietnamese Restaurant	Italian Restaurant	Afghan Restaurant	Airport	Park	Garden
28	Mount Druitt	1	Grocery Store	Coffee Shop	Pizza Place	Zoo Exhibit	Fast Food Restaurant	Sandwich Place	Park	Burger Joint	Juice Bar	Gym
30	Parramatta	1	Café	Fast Food Restaurant	Lebanese Restaurant	Park	Australian Restaurant	Burger Joint	Supermarket	Thai Restaurant	Shopping Mall	Pub
35	St Marys	1	Fast Food Restaurant	Convenience Store	Supermarket	Grocery Store	Shopping Mall	Coffee Shop	Pizza Place	Pub	Fruit & Vegetable Store	Sandwich Place
37	Sutherland - Menai - Heathcote	1	Café	Thai Restaurant	Convenience Store	Bakery	Pub	Sandwich Place	Gym	Department Store	Train Station	Supermarket

Figure 13: Sydney Cluster Label 1 – Purple Circles

	Region	Cluster Labels	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
6	Blue Mountains - South	2	Soccer Field	Racetrack	Zoo Exhibit	Egyptian Restaurant	Electronics Store	Event Space	Exhibit	Falafel Restaurant	Farm	Farmers Market

Figure 14: Sydney Cluster Label 2 – Dark Blue Circles

	Region	Cluster Labels	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
8	Bringelly - Green Valley	3	Flower Shop	Music Venue	Food	Flea Market	Fish Market	Fish & Chips Shop	Filipino Restaurant	Field	Fast Food Restaurant	Farmers Market

Figure 15: Sydney Cluster Label 3 – Medium Blue Circles

Region	Cluster Labels	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	
5	Blue Mountains	4	Garden	Botanical Garden	Australian Restaurant	Restaurant	Zoo Exhibit	Farmers Market	Event Space	Exhibit	Falafel Restaurant	Farm

Figure 16: Sydney Cluster Label 4 – Green Circles

Region	Cluster Labels	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	
33	Richmond - Windsor	5	Food	Fast Food Restaurant	Park	Go Kart Track	Farmers Market	Paintball Field	Field	Filipino Restaurant	Farm	Dumpling Restaurant

Figure 17: Sydney Cluster Label 5 – Yellow Circles

Region	Cluster Labels	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	
40	Wollondilly	6	Home Service	Asian Restaurant	Skydiving Drop Zone	Gay Bar	Train Station	Platform	Airport	Harbor / Marina	Donut Shop	Filipino Restaurant

Figure 18: Sydney Cluster Label 6 – Orange Circles

Melbourne Clusters

Region	Cluster Labels	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	
1	Bayside	0	Café	Beach	Bakery	Electronics Store	Park	Burger Joint	Indian Restaurant	Coffee Shop	Liquor Store	Brewery
2	Boroondara	0	Café	Park	Coffee Shop	Italian Restaurant	Bar	Gym / Fitness Center	Thai Restaurant	Vietnamese Restaurant	Brewery	Burger Joint
10	Darebin - South	0	Café	Bar	Bakery	Park	Italian Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Gastropub	Vietnamese Restaurant	Music Venue
11	Essendon	0	Café	Bar	Zoo Exhibit	Bakery	Coffee Shop	Thai Restaurant	Park	Italian Restaurant	Department Store	Grocery Store
12	Glen Eira	0	Café	Coffee Shop	Bar	Park	Beach	Playground	Bagel Shop	Malay Restaurant	Movie Theater	Electronics Store
13	Hobsons Bay	0	Café	Park	Beach	Gym	Fish & Chips Shop	Grocery Store	Pub	Brewery	Pizza Place	Food Truck
15	Kingston	0	Café	Beach	Grocery Store	Italian Restaurant	Restaurant	Tea Room	Park	Lounge	Frozen Yogurt Shop	Brewery
20	Maribyrnong	0	Café	Vietnamese Restaurant	Bakery	Coffee Shop	Bar	Pub	Park	Grocery Store	Pizza Place	Indian Restaurant
25	Moreland - North	0	Café	Bar	Bakery	Middle Eastern Restaurant	Supermarket	Pizza Place	Breakfast Spot	Liquor Store	Gym	Coffee Shop
28	Stonnington - East	0	Café	Coffee Shop	Thai Restaurant	Bakery	Japanese Restaurant	Market	Indie Movie Theater	Multiplex	Liquor Store	Frozen Yogurt Shop
29	Stonnington - West	0	Café	Coffee Shop	Park	Pub	Australian Restaurant	Breakfast Spot	French Restaurant	Beach	Market	Burger Joint

Figure 19: Melbourne Cluster Label 0 – Red Circles

	Region	Cluster Labels	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	Banyule	1	Café	Supermarket	Grocery Store	Sandwich Place	Fast Food Restaurant	Park	Liquor Store	Electronics Store	Pharmacy	Coffee Shop
4	Brunswick - Coburg	1	Café	Bar	Bakery	Vietnamese Restaurant	Italian Restaurant	Coffee Shop	Vegetarian / Vegan Restaurant	Park	Wine Bar	Ice Cream Shop
9	Darebin - North	1	Café	Bar	Bakery	Electronics Store	Park	Italian Restaurant	Department Store	Vietnamese Restaurant	Pizza Place	Grocery Store
14	Keilor	1	Café	Gym / Fitness Center	Electronics Store	Coffee Shop	Pharmacy	Department Store	Supermarket	Thai Restaurant	Japanese Restaurant	Gym
17	Macedon Ranges	1	Grocery Store	Australian Restaurant	Bed & Breakfast	Bar	Burger Joint	Café	Restaurant	Roof Deck	Fast Food Restaurant	Field
18	Manningham - East	1	Café	Supermarket	Japanese Restaurant	Malay Restaurant	Grocery Store	Park	Sandwich Place	Department Store	Shopping Mall	Chinese Restaurant
19	Manningham - West	1	Café	Japanese Restaurant	Malay Restaurant	Dessert Shop	Chinese Restaurant	Pub	Supermarket	Department Store	Park	Sandwich Place
21	Maroondah	1	Café	Supermarket	Gym / Fitness Center	Coffee Shop	Fast Food Restaurant	Burger Joint	Convenience Store	Japanese Restaurant	Grocery Store	Dumpling Restaurant
22	Melbourne City	1	Café	Coffee Shop	Cocktail Bar	Bar	Wine Bar	Bookstore	Ice Cream Shop	Asian Restaurant	Italian Restaurant	Bakery
24	Monash	1	Café	Supermarket	Thai Restaurant	Greek Restaurant	Japanese Restaurant	Electronics Store	Sri Lankan Restaurant	Burger Joint	Coffee Shop	Gym
26	Nillumbik - Kinglake	1	Grocery Store	Café	Train Station	Basketball Court	Other Great Outdoors	Convenience Store	Fast Food Restaurant	Gym / Fitness Center	Australian Restaurant	Farm
27	Port Phillip	1	Café	Park	Pub	Breakfast Spot	Theater	Australian Restaurant	Japanese Restaurant	Beach	Hotel	Market
32	Whitehorse - East	1	Café	Grocery Store	Supermarket	Shopping Mall	Sandwich Place	Japanese Restaurant	Gym / Fitness Center	Convenience Store	Fast Food Restaurant	Electronics Store
33	Whitehorse - West	1	Café	Chinese Restaurant	Vietnamese Restaurant	Burger Joint	Shopping Mall	Park	Japanese Restaurant	Paper / Office Supplies Store	Dumpling Restaurant	Dessert Shop
36	Yarra	1	Café	Bakery	Coffee Shop	Park	Cocktail Bar	Wine Bar	Ice Cream Shop	Bar	Deli / Bodega	Tennis Stadium

Figure 20: Melbourne Cluster Label 1 – Purple Circles

	Region	Cluster Labels	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
5	Cardinia	2	Train Station	Gas Station	Zoo Exhibit	Falafel Restaurant	Food Court	Food & Drink Shop	Food	Flower Shop	Flea Market	Fish & Chips Shop

Figure 21: Melbourne Cluster Label 2 – Dark Blue Circles

	Region	Cluster Labels	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
34	Whittlesea - Wallan	3	Flower Shop	Café	Zoo Exhibit	Farm	Food Truck	Food Court	Food & Drink Shop	Food	Flea Market	Fish & Chips Shop

Figure 22: Melbourne Cluster Label 3 – Medium Blue Circles

	Region	Cluster Labels	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
30	Sunbury	4	Bar	Health & Beauty Service	Park	Train Station	Farm	Farmers Market	Fast Food Restaurant	Field	Zoo Exhibit	Falafel Restaurant

Figure 23: Melbourne Cluster Label 4 – Green Circles

	Region	Cluster Labels	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
3	Brimbank	5	Fast Food Restaurant	Bakery	Supermarket	Vietnamese Restaurant	Pharmacy	Café	Grocery Store	Pub	Train Station	Chinese Restaurant
6	Casey - North	5	Convenience Store	Grocery Store	Supermarket	Fast Food Restaurant	Park	Pub	Bike Shop	Fried Chicken Joint	Café	Shopping Mall
7	Casey - South	5	Fast Food Restaurant	Shopping Mall	Gas Station	Café	Pharmacy	Supermarket	Convenience Store	Restaurant	Field	Fried Chicken Joint
8	Dandenong	5	Fast Food Restaurant	Convenience Store	Supermarket	Café	Pharmacy	Portuguese Restaurant	Sandwich Place	Coffee Shop	Gas Station	Racetrack
16	Knox	5	Supermarket	Fast Food Restaurant	Café	Grocery Store	Sandwich Place	Malay Restaurant	Department Store	Shopping Mall	Gym	Portuguese Restaurant
23	Melton - Bacchus Marsh	5	Fast Food Restaurant	Convenience Store	Supermarket	Grocery Store	Department Store	Pub	Sandwich Place	Burger Joint	Bus Stop	Shopping Mall
31	Tullamarine - Broadmeadows	5	Fast Food Restaurant	Supermarket	Grocery Store	Café	Shopping Mall	Sandwich Place	Turkish Restaurant	Middle Eastern Restaurant	Department Store	Pharmacy
35	Wyndham	5	Fast Food Restaurant	Supermarket	Department Store	Pizza Place	Convenience Store	Coffee Shop	Café	Grocery Store	Sandwich Place	Food Court

Figure 24: Melbourne Cluster Label 5 – Yellow Circles

	Region	Cluster Labels	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
37	Yarra Ranges	6	Supermarket	Pizza Place	Garden	Gym	Café	Shopping Mall	Zoo Exhibit	Falafel Restaurant	Flower Shop	Flea Market

Figure 25: Melbourne Cluster Label 6 – Orange Circles

3.7 Cluster Analysis and Comparison

To help explore each cluster, I found it useful to compare the number of regions in a cluster, where the cluster was located in relation to other clusters and the most frequent places. The outer city regions tended to be more unique and occupied a cluster on their own. The inner city regions in Sydney were divided into two large clusters. While the inner city regions in Melbourne were divided into three clusters. For the inner city clusters, they tended to have similar places listed most frequently such as cafés, so I analysed what distinguished them from other clusters by looking at either places that were unique or that appeared more frequently than other clusters.

Table 3: Sydney Cluster Analysis

Cluster Label	Number of Regions	Geographic Description	Colour Marker	Most Frequent Places	Distinguishing Places (unique or more frequent)
0	21	Inner city coast	Red	Café, park, bakery, coffee shop	Beach, bar, Korean restaurant, Japanese restaurant, Thai restaurant
1	15	Inner city ring	Purple	Café, fast food, pizza place, supermarket	Grocery store, fast food restaurant, convenience store, train station & platform
2	1	Outer city limit	Dark blue	Soccer field, racetrack, zoo exhibit	Event space, exhibit
3	1	Outer city limit	Medium blue	Flower shop, music venue, food	Flea market, fish market
4	1	Outer city limit, mountains	Green	Garden, botanical garden, Australian restaurant	Garden, botanical garden
5	1	Outer city limit	Yellow	Food, Fast Food restaurant, park	Go Kart track, paintball field
6	1	Outer city limit	Orange	Home service, Asian restaurant, Skydiving drop zone	Gay bar, airport

Table 4: Melbourne Cluster Analysis

Cluster Label	Number of Regions	Geographic Description	Colour Marker	Most Frequent Places	Distinguishing Places (unique or more frequent)
0	11	Inner city coast	Red	Café, park, coffee shop, bar, bakery	Beach, brewery, pizza place
1	15	Inner city ring	Purple	Café, park, Japanese restaurant, coffee shop, grocery store, supermarket	Gym / fitness centre, wine bar, ice cream shop
2	1	Outer city limit	Dark blue	Train station, gas station, zoo exhibit	Flea market
3	1	Outer city limit	Medium blue	Flower shop, café, zoo exhibit	Food truck, food court, flea market
4	1	Outer city limit	Green	Bar, health & beauty service, park	Farmers market
5	8	Inner city outer ring	Yellow	Fast food restaurant, supermarket, café, grocery store	Convenience store, fried chicken joint, Portuguese restaurant, gas station
6	1	Outer city limit	Orange	Supermarket, pizza place, garden	Flea market

3.8 Combining Sydney and Melbourne Regions

Comparing the inner city regions for Sydney and Melbourne made me wonder if they were similar or distinct from one another. I decided that the best way to answer that question was to combine the data for both Sydney and Melbourne regions and run the clustering algorithm on it. I decided to maintain 7 clusters from the previous investigation.

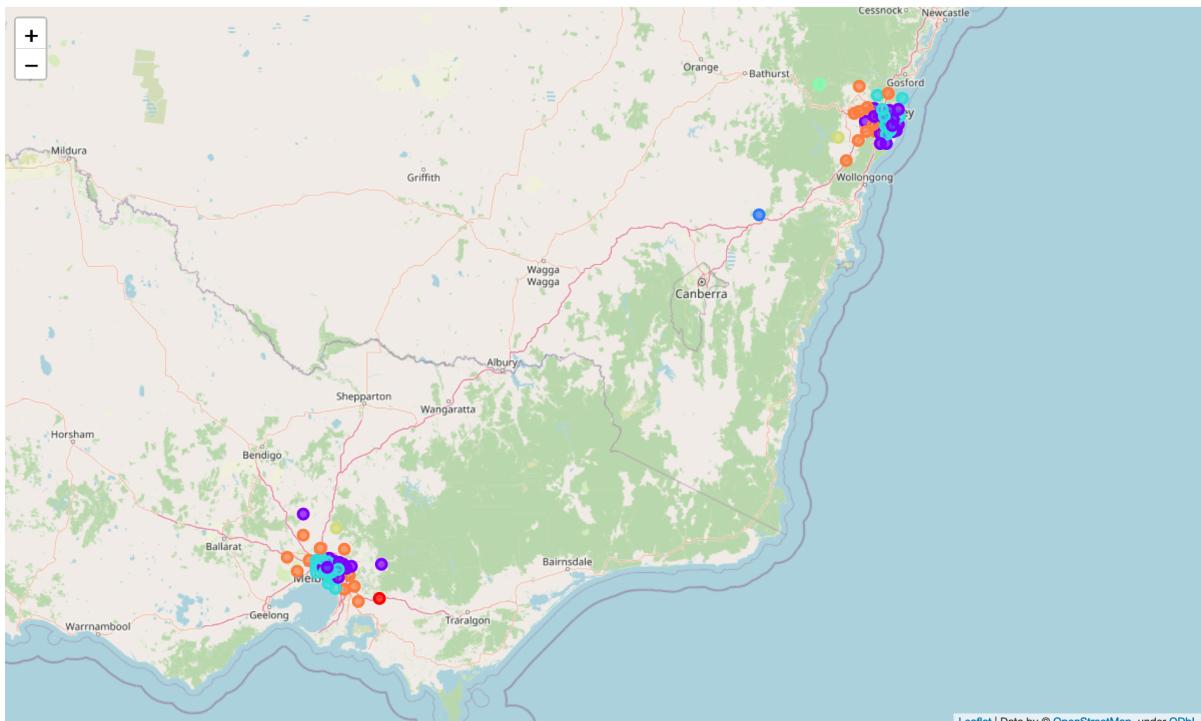


Figure 26: Map of Combined Sydney and Melbourne Clusters

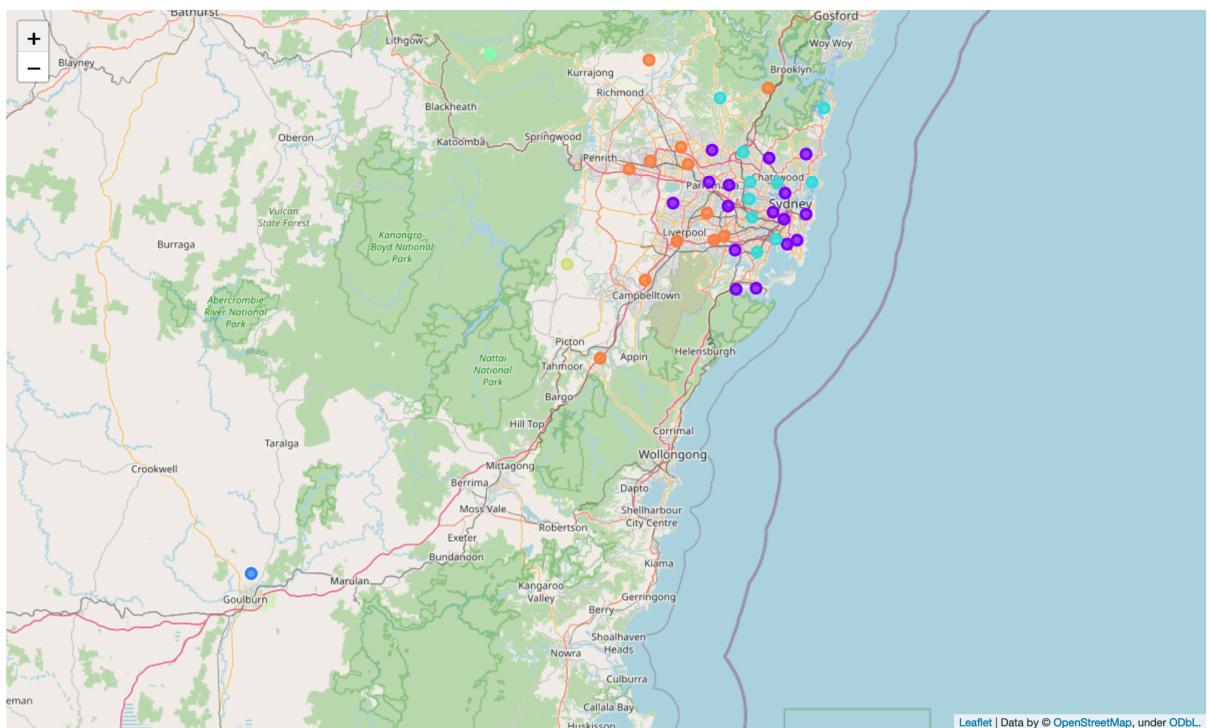


Figure 27: Map of Combined Sydney and Melbourne Clusters: Close up of Sydney

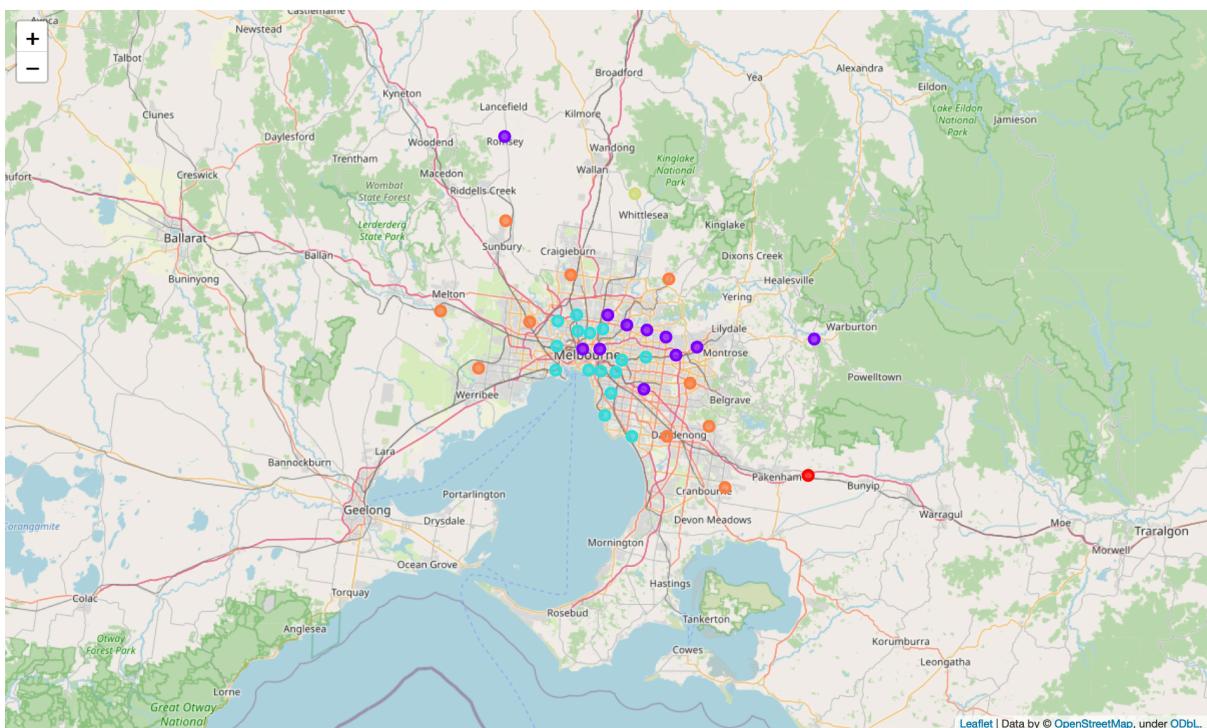


Figure 28: Map of Combined Sydney and Melbourne Clusters: Close up of Melbourne

Region	Cluster Labels	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	
46	Cardinia	0	Train Station	Gas Station	Zoo Exhibit	Exhibit	Dutch Restaurant	Eastern European Restaurant	Egyptian Restaurant	Electronics Store	Ethiopian Restaurant	Event Space

Figure 29: Sydney & Melbourne Cluster Label 0 – Red Circles

Region	Cluster Labels	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	Auburn	1	Café	Vietnamese Restaurant	Park	Korean Restaurant	Indian Restaurant	Supermarket	Thai Restaurant	Lebanese Restaurant	Football Stadium	BBQ Joint
2	Baulkham Hills	1	Café	Gym	Shopping Mall	Thai Restaurant	Fast Food Restaurant	Supermarket	Pizza Place	Convenience Store	Burger Joint	Italian Restaurant
7	Botany	1	Café	Bakery	Coffee Shop	Park	Supermarket	Gym	Beach	Golf Course	Souvlaki Shop	Hotel
12	Carlingford	1	Café	Park	Lebanese Restaurant	Indian Restaurant	Burger Joint	Thai Restaurant	Australian Restaurant	Vietnamese Restaurant	Japanese Restaurant	Dessert Shop
14	Cronulla - Miranda - Caringbah	1	Café	Beach	Gym	Electronics Store	Juice Bar	Bar	Burger Joint	Park	Liquor Store	Shopping Mall
16	Eastern Suburbs - North	1	Park	Café	Beach	Australian Restaurant	Bakery	Wine Bar	Burger Joint	Mexican Restaurant	Italian Restaurant	Trail
17	Eastern Suburbs - South	1	Café	Bakery	Beach	Park	Coffee Shop	Pizza Place	Burger Joint	Supermarket	Thai Restaurant	Golf Course
18	Fairfield	1	Park	Café	Italian Restaurant	Pizza Place	Convenience Store	Grocery Store	Vietnamese Restaurant	Thai Restaurant	Food Truck	Gastropub
20	Hurstville	1	Café	Grocery Store	Supermarket	Sandwich Place	Pizza Place	Fast Food Restaurant	Bakery	Middle Eastern Restaurant	Electronics Store	Park
22	Ku-ring-gai	1	Café	Grocery Store	Italian Restaurant	Bakery	Supermarket	Coffee Shop	Clothing Store	Pizza Place	Park	Thai Restaurant
23	Leichhardt	1	Café	Park	Ice Cream Shop	Thai Restaurant	Bar	Pizza Place	Bakery	Coffee Shop	Pub	Brewery
29	North Sydney - Mosman	1	Café	Park	Scenic Lookout	Japanese Restaurant	Theater	Australian Restaurant	Coffee Shop	Cocktail Bar	Bar	Bakery
30	Paramatta	1	Café	Fast Food Restaurant	Lebanese Restaurant	Park	Australian Restaurant	Burger Joint	Supermarket	Thai Restaurant	Shopping Mall	Bar
37	Sutherland - Menai - Heathcote	1	Café	Sandwich Place	Pub	Convenience Store	Bakery	Thai Restaurant	Train Station	Gym	Supermarket	Department Store
38	Sydney Inner City	1	Café	Coffee Shop	Thai Restaurant	Bar	Park	Ice Cream Shop	Bakery	Whisky Bar	Theater	Restaurant
39	Warringah	1	Café	Beach	Bakery	Pizza Place	Australian Restaurant	Bar	Supermarket	Gym	Sandwich Place	Coffee Shop
41	Bankstown	1	Café	Supermarket	Grocery Store	Sandwich Place	Fast Food Restaurant	Park	Liquor Store	Pharmacy	Japanese Restaurant	Gas Station
50	Darebin - North	1	Café	Bar	Electronics Store	Bakery	Park	Vietnamese Restaurant	Pizza Place	Italian Restaurant	Department Store	Sandwich Place
58	Macedon Ranges	1	Bar	Burger Joint	Café	Bed & Breakfast	Grocery Store	Australian Restaurant	Roof Deck	Restaurant	Farm	Falafel Restaurant
59	Manningham - East	1	Café	Supermarket	Japanese Restaurant	Malay Restaurant	Grocery Store	Park	Department Store	Shopping Mall	Sandwich Place	Portuguese Restaurant
60	Manningham - West	1	Café	Japanese Restaurant	Malay Restaurant	Chinese Restaurant	Department Store	Dessert Shop	Supermarket	Pub	Restaurant	Electronics Store
62	Maroondah	1	Café	Supermarket	Gym / Fitness Center	Fast Food Restaurant	Coffee Shop	Dumping Restaurant	Malay Restaurant	Grocery Store	Burger Joint	Shopping Mall
63	Melbourne City	1	Café	Coffee Shop	Bar	Cocktail Bar	Asian Restaurant	Bookstore	Ice Cream Shop	Wine Bar	Bakery	Italian Restaurant
65	Monash	1	Café	Supermarket	Thai Restaurant	Greek Restaurant	Japanese Restaurant	Electronics Store	Sri Lankan Restaurant	Gym	Burger Joint	Coffee Shop
73	Whitehorse - East	1	Café	Grocery Store	Shopping Mall	Supermarket	Sandwich Place	Gym / Fitness Center	Japanese Restaurant	Convenience Store	Fast Food Restaurant	Electronics Store
77	Yarra	1	Café	Bakery	Park	Coffee Shop	Ice Cream Shop	Wine Bar	Cocktail Bar	Bar	Hotel	Museum
78	Yarra Ranges	1	Shopping Mall	Pizza Place	Garden	Supermarket	Gym	Café	Zoo Exhibit	Ethiopian Restaurant	Dutch Restaurant	Eastern European Restaurant

Figure 30: Sydney & Melbourne Cluster Label 1 – Purple Circles

Region	Cluster Labels	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	
6	Blue Mountains - South	2	Soccer Field	Racetrack	Zoo Exhibit	Dutch Restaurant	Eastern European Restaurant	Egyptian Restaurant	Electronics Store	Ethiopian Restaurant	Event Space	Exhibit

Figure 31: Sydney & Melbourne Cluster Label 2 – Dark Blue Circles

Region	Cluster Labels	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	
10	Canada Bay	3	Café	Park	Korean Restaurant	Italian Restaurant	Supermarket	Fast Food Restaurant	Seafood Restaurant	Chinese Restaurant	Thai Restaurant	Coffee Shop
13	Chatswood - Lane Cove	3	Café	Japanese Restaurant	Coffee Shop	Thai Restaurant	Park	Bakery	Gym	Italian Restaurant	Shopping Mall	Chinese Restaurant
15	Dural - Wisemans Ferry	3	Café	Bakery	Liquor Store	Park	Supermarket	Event Space	Exhibit	Eastern European Restaurant	Egyptian Restaurant	Electronics Store
21	Kogarah - Rockdale	3	Café	Supermarket	Bakery	Greek Restaurant	Thai Restaurant	Gym	Coffee Shop	Burger Joint	Steakhouse	Italian Restaurant
25	Manly	3	Beach	Café	Park	Scenic Lookout	Seafood Restaurant	Wine Bar	Brewery	Australian Restaurant	Bar	Trail
26	Marrickville - Sydenham - Petersham	3	Café	Bakery	Brewery	Bar	Coffee Shop	Pub	Ice Cream Shop	Greek Restaurant	Gym	Climbing Gym
31	Pennant Hills - Epping	3	Café	Park	Electronics Store	Fried Chicken Joint	Pizza Place	Supermarket	Liquor Store	Thai Restaurant	Golf Course	Plaza
32	Pittwater	3	Café	Beach	Supermarket	Coffee Shop	Wine Shop	Convenience Store	Harbor / Marina	Park	Bakery	Sandwich Place
34	Ryde - Hunters Hill	3	Café	Park	Supermarket	Thai Restaurant	Coffee Shop	Vietnamese Restaurant	Clothing Store	Playground	Australian Restaurant	Multiplex
36	Strathfield - Burwood - Ashfield	3	Café	Park	Coffee Shop	Korean Restaurant	Italian Restaurant	Chinese Restaurant	Bakery	Indian Restaurant	Thai Restaurant	Liquor Store
42	Bayside	3	Café	Beach	Electronics Store	Bakery	Coffee Shop	Park	Burger Joint	Indian Restaurant	Restaurant	Movie Theater
43	Boroondara	3	Café	Park	Coffee Shop	Italian Restaurant	Thai Restaurant	Gym / Fitness Center	Bar	Vietnamese Restaurant	Brewery	Burger Joint
45	Brunswick - Coburg	3	Café	Bar	Bakery	Vietnamese Restaurant	Ice Cream Shop	Coffee Shop	Italian Restaurant	Vegetarian / Vegan Restaurant	Park	Wine Bar
51	Darebin - South	3	Café	Bar	Bakery	Park	Italian Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Vietnamese Restaurant	Brewery	Gastropub
52	Essendon	3	Café	Bar	Zoo Exhibit	Bakery	Thai Restaurant	Italian Restaurant	Coffee Shop	Park	Beer Garden	Japanese Restaurant
53	Glen Eira	3	Café	Coffee Shop	Bar	Beach	Park	Bagel Shop	Playground	Movie Theater	Malay Restaurant	Bakery
54	Hobsons Bay	3	Café	Park	Beach	Fish & Chips Shop	Gym	Grocery Store	Pub	Burger Joint	Sandwich Place	Italian Restaurant
55	Kelor	3	Café	Gym / Fitness Center	Electronics Store	Pharmacy	Gym	Supermarket	Thai Restaurant	Japanese Restaurant	Department Store	Coffee Shop
56	Kingston	3	Café	Grocery Store	Beach	Park	Tea Room	Italian Restaurant	Restaurant	Recreation Center	Frozen Yogurt Shop	Supermarket
61	Maribyrnong	3	Café	Vietnamese Restaurant	Coffee Shop	Bakery	Pub	Bar	Park	Grocery Store	Gym	Pizza Place
66	Moreland - North	3	Café	Bakery	Bar	Liquor Store	Supermarket	Middle Eastern Restaurant	Breakfast Spot	Japanese Restaurant	Thai Restaurant	Burger Joint
68	Port Phillip	3	Café	Park	Australian Restaurant	Breakfast Spot	Hotel	Beach	Pub	Japanese Restaurant	Theater	Ice Cream Shop
69	Stonnington - East	3	Café	Coffee Shop	Thai Restaurant	Japanese Restaurant	Bakery	Indie Movie Theater	Asian Restaurant	Multiplex	Bar	Market
70	Stonnington - West	3	Café	Park	Coffee Shop	Australian Restaurant	Beach	French Restaurant	Pub	Breakfast Spot	Ice Cream Shop	Japanese Restaurant
74	Whitehorse - West	3	Café	Chinese Restaurant	Burger Joint	Shopping Mall	Park	Vietnamese Restaurant	Japanese Restaurant	Gym	Bakery	Multiplex

Figure 32: Sydney & Melbourne Cluster Label 3 – Medium Blue Circles

Region	Cluster Labels	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	
5	Blue Mountains	4	Garden	Botanical Garden	Australian Restaurant	Restaurant	Falafel Restaurant	Eastern European Restaurant	Egyptian Restaurant	Electronics Store	Ethiopian Restaurant	Event Space

Figure 33: Sydney & Melbourne Cluster Label 4 – Green Circles

Region	Cluster Labels	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	
8	Brigalow - Green Valley	5	Music Venue	Flower Shop	Farm	Eastern European Restaurant	Egyptian Restaurant	Electronics Store	Ethiopian Restaurant	Event Space	Exhibit	Falafel Restaurant
75	Whittlesea - Wallan	5	Flower Shop	Café	Flea Market	Exhibit	Dutch Restaurant	Eastern European Restaurant	Egyptian Restaurant	Electronics Store	Ethiopian Restaurant	Event Space

Figure 34: Sydney & Melbourne Cluster Label 5 – Yellow Circles

Region	Cluster Labels	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	
1	Bankstown	6	Café	Fast Food Restaurant	Grocery Store	Vietnamese Restaurant	Sandwich Place	Pizza Place	Convenience Store	Gym	Coffee Shop	Train Station
3	Blacktown	6	Supermarket	Fast Food Restaurant	Café	Convenience Store	Sandwich Place	Grocery Store	Pizza Place	Coffee Shop	Juice Bar	Shopping Mall
4	Blacktown - North	6	Supermarket	Café	Fast Food Restaurant	Coffee Shop	Grocery Store	Sandwich Place	Pizza Place	Indian Restaurant	Thai Restaurant	Juice Bar
9	Campbelltown (NSW)	6	Fast Food Restaurant	Grocery Store	Shopping Mall	Sandwich Place	Convenience Store	Supermarket	Platform	Department Store	Pizza Place	Golf Course
11	Canterbury	6	Café	Grocery Store	Vietnamese Restaurant	Fast Food Restaurant	Sandwich Place	Pizza Place	Lebanese Restaurant	Middle Eastern Restaurant	Electronics Store	Supermarket
19	Hornsby	6	Train Station	Platform	Café	Liquor Store	Supermarket	Sandwich Place	Bus Stop	Soccer Field	Thai Restaurant	Chinese Restaurant
24	Liverpool	6	Italian Restaurant	Fast Food Restaurant	Supermarket	Lebanese Restaurant	Café	Pharmacy	Bakery	Fried Chicken Joint	Gym / Fitness Center	Grocery Store
27	Merrylands - Guildford	6	Supermarket	Pizza Place	Café	Vietnamese Restaurant	Fast Food Restaurant	Chinese Restaurant	Italian Restaurant	Garden	Airport	Park
28	Mount Druitt	6	Grocery Store	Pizza Place	Coffee Shop	Zoo Exhibit	Fast Food Restaurant	Park	Sandwich Place	Burger Joint	Juice Bar	Furniture / Home Store
33	Richmond - Windsor	6	Food	Park	Fast Food Restaurant	Farmers Market	Paintball Field	Go Kart Track	Cupcake Shop	Falafel Restaurant	Eastern European Restaurant	Egyptian Restaurant
35	St Marys	6	Fast Food Restaurant	Convenience Store	Supermarket	Grocery Store	Coffee Shop	Pizza Place	Shopping Mall	Sandwich Place	Pub	Train Station
40	Wollondilly	6	Asian Restaurant	Platform	Airport	Home Service	Gay Bar	Skydiving Drop Zone	Train Station	Zoo Exhibit	Dutch Restaurant	Eastern European Restaurant
44	Brimbank	6	Fast Food Restaurant	Vietnamese Restaurant	Supermarket	Bakery	Pharmacy	Train Station	Chinese Restaurant	Grocery Store	Café	Pub
47	Casey - North	6	Convenience Store	Grocery Store	Supermarket	Park	Fast Food Restaurant	Gas Station	Department Store	Fried Chicken Joint	Shopping Mall	Bike Shop
48	Casey - South	6	Fast Food Restaurant	Gas Station	Shopping Mall	Pharmacy	Café	Supermarket	Field	Sandwich Place	Donut Shop	Gastropub
49	Dandenong	6	Fast Food Restaurant	Convenience Store	Supermarket	Café	Pharmacy	Portuguese Restaurant	Sandwich Place	Gas Station	Movie Theater	Coffee Shop
57	Knox	6	Fast Food Restaurant	Supermarket	Sandwich Place	Grocery Store	Café	Malay Restaurant	Shopping Mall	Department Store	Portuguese Restaurant	Gym
64	Melton - Bacchus Marsh	6	Convenience Store	Supermarket	Fast Food Restaurant	Grocery Store	Sandwich Place	Department Store	Pub	Italian Restaurant	Shopping Mall	Electronics Store
67	Nillumbik - Kinglake	6	Café	Grocery Store	Train Station	Convenience Store	Other Great Outdoors	Australian Restaurant	Gym / Fitness Center	Basketball Court	Fast Food Restaurant	Falafel Restaurant
71	Sunbury	6	Park	Train Station	Health & Beauty Service	Bar	Event Space	Dumpling Restaurant	Dutch Restaurant	Eastern European Restaurant	Egyptian Restaurant	Electronics Store
72	Tullamarine - Broadmeadows	6	Fast Food Restaurant	Grocery Store	Supermarket	Café	Sandwich Place	Turkish Restaurant	Shopping Mall	Middle Eastern Restaurant	Department Store	Convenience Store
76	Wyndham	6	Fast Food Restaurant	Supermarket	Department Store	Pizza Place	Convenience Store	Café	Grocery Store	Coffee Shop	Dumpling Restaurant	Sandwich Place

Figure 35: Sydney & Melbourne Cluster Label 6 – Orange Circles

4.0 Results of Sydney and Melbourne Combined Cluster Analysis

4.1 Examining Cluster Maps

Comparing the maps created by clustering the Sydney and Melbourne regions combined, it reveals that three large inner city clusters were formed which included regions from both Sydney and Melbourne. This was a different result from when I had clustered the Sydney and Melbourne regions separately. Clustering the regions of Sydney and Melbourne together, differentiated the regions in new ways and many regions became more similar to other regions than they previously appeared to be.

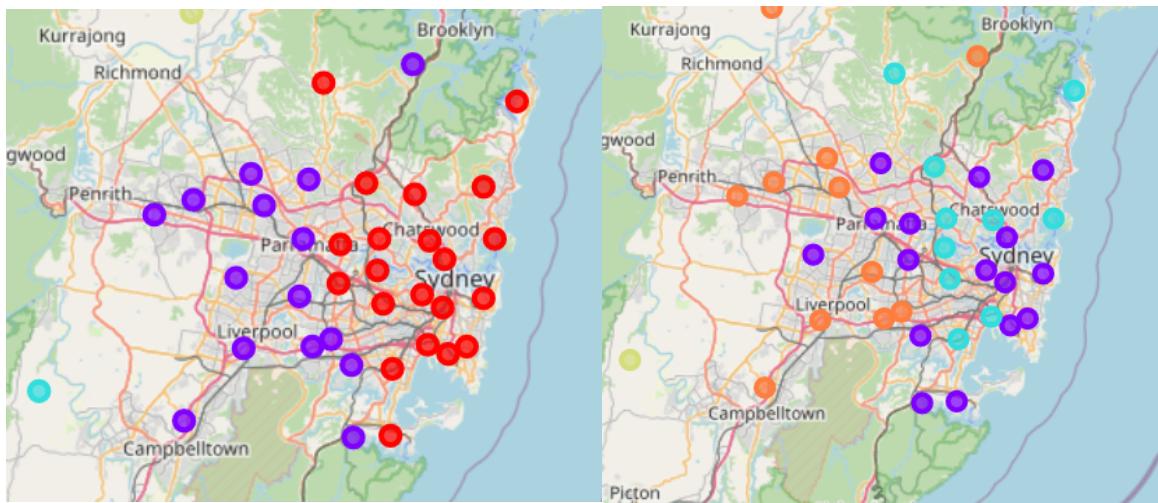


Figure 36: Close up of Sydney clusters: Sydney only clustering (image on left) and Sydney & Melbourne combined clustering (image on right)

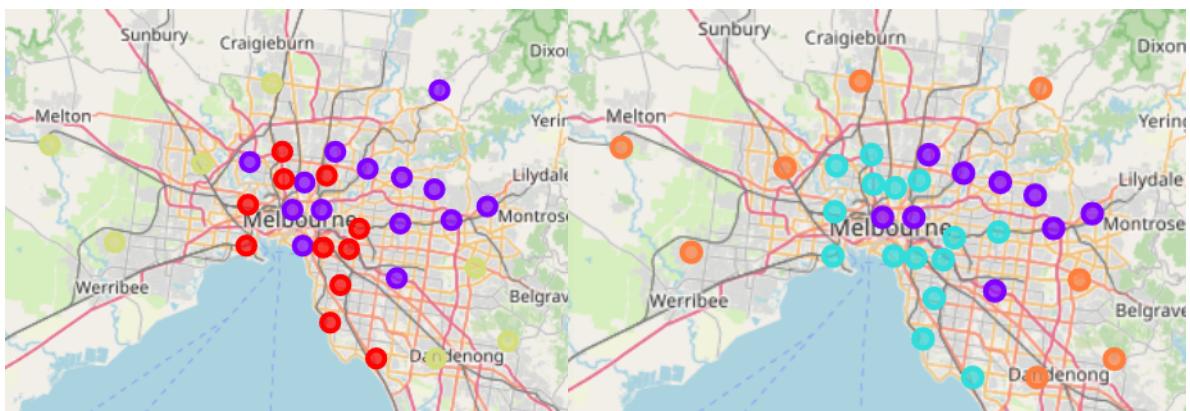


Figure 37: Close up of Melbourne clusters: Melbourne only clustering (image on left) and Sydney & Melbourne combined clustering (image on right)

4.2 Differentiating the Clusters

To explore each cluster in more detail, I compared the number of regions in a cluster, where the cluster was located in relation to other clusters and the most frequent places. The inner city clusters, tended to have similar places listed most frequently such as cafés, so I analysed what distinguished them from other clusters by looking at either places that were unique or that appeared more frequently than other clusters.

Table 5: Sydney and Melbourne Combined Cluster Analysis

Cluster Label	Number of Regions	Geographic Description	Colour Marker	Most Frequent Places	Distinguishing Places
0	1	Outer city limit	Red	Train station, gas station, zoo	

1	27	Inner city & coast	Purple	Café, park, supermarket, bakery	Similar to cluster 6 for supermarkets, grocery stores, shopping malls, department stores. Lebanese restaurants, cocktail bar
2	1	Outer city limit	Dark blue	Soccer field, racetrack, zoo	
3	25	Inner city & coast	Medium blue	Café, park, coffee shop, bakery	More parks & beaches, multiplex & cinema, Vegetarian / Vegan Restaurants, brewery
4	1	Outer city limit	Green	Garden, Australian Restaurant, Eastern European / Egyptian / Ethiopian Restaurants	
5	2	Outer city limit	Yellow	Flower shop, Eastern European / Egyptian / Ethiopian Restaurants, Exhibits	
6	22	Inner city outer ring	Orange	Fast food, supermarket, grocery store, café, sandwich place	Train station / Platform, Airport, more convenience stores

5.0 Discussion

Focussing on the results of the analysis where both Sydney and Melbourne regions were clustered together, there are three inner city clusters of between 22-27 regions and four outer city clusters of between 1-2 regions.

Examining the three inner city clusters and what distinguishes them:

- Cluster 1: Dominated by cafés, significant number of parks and beaches, significant number of shopping areas, more diverse spread of ethnic restaurants: Lebanese, Dutch, Ethiopian, Falafel, Malay, Mexican, Souvlaki, Sri Lankan.
- Cluster 3: Dominated by cafés, largest number of parks and beaches, focus on entertainment with cinemas, theatres, climbing gym
- Cluster 6: Dominated by fast food, supermarkets, convenience stores and sandwich places and access to transportation with train stations and airports. Geographically, this cluster is consistently forming an outer ring around the other two inner city clusters.

Examining the four outer city clusters in more detail, they are made up of 5 unique regions. Each of the 5 regions returned between 2-5 Foursquare venues when I first made the API call, I don't feel that there is enough data about these regions to draw any strong

conclusions about them. Ideally each region should include all places of interest so that there is enough data to draw reliable conclusions. A number of ways that this could be achieved are

1. Removing the API limit for Foursquare which was limited to 100 API calls
2. Calculating the unique radius for each region to ensure that regions that are larger are not disadvantaged when compared to regions that are smaller and more densely concentrated
3. Calculating the unique latitude and longitude for each region based on the geographical centre of the region, rather than the average of the centres of each postal code

6.0 Conclusion

For immigrants looking to move to Australia, the analysis indicates that Sydney and Melbourne are more similar than they are different in terms of places of interest. Each city has a number of regions that offer a lifestyle dominated by outdoor living with multiple cafés, parks and beaches. In both cities there are certain regions that offer more shopping opportunities, a more diverse selection of ethnic restaurants, or easier access to cinemas and theatres.

7.0 References

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