Capstone Project Report : The Battle of Neighborhoods (week 2)

Mingkai Liu
Jan - 2020

Report Abstract

★ Aim to find locations for a new Chinese restaurant in Melbourne, targeting mid/high level customers

★ Narrow down the locations using the geo-social-economic data of Melbourne suburbs and machine learning

★ Suggest locations in the suburb based on information of nearby competitors, parking spots and business environment

Content

★ Background and Business Problem

★ Data Acquisition and Cleaning

★ Data Analysis and Findings

★ Suggested Locations

Background

★ Melbourne is an international city and the capital of Victoria State, Australia. It has a population around 5 million and attracts over 10 million tourists in 2019.

★ A large number of the new immigrants and tourists have Asian backgrounds, with Chinese being the dominant contributor.

Business Problem

★ Find potential places for the stakeholders to start a *Chinese restaurant* targeting *mid/high-end customers* in Melbourne

★ Prefer suburbs with large population, high income, low crime rate, and few competitors.
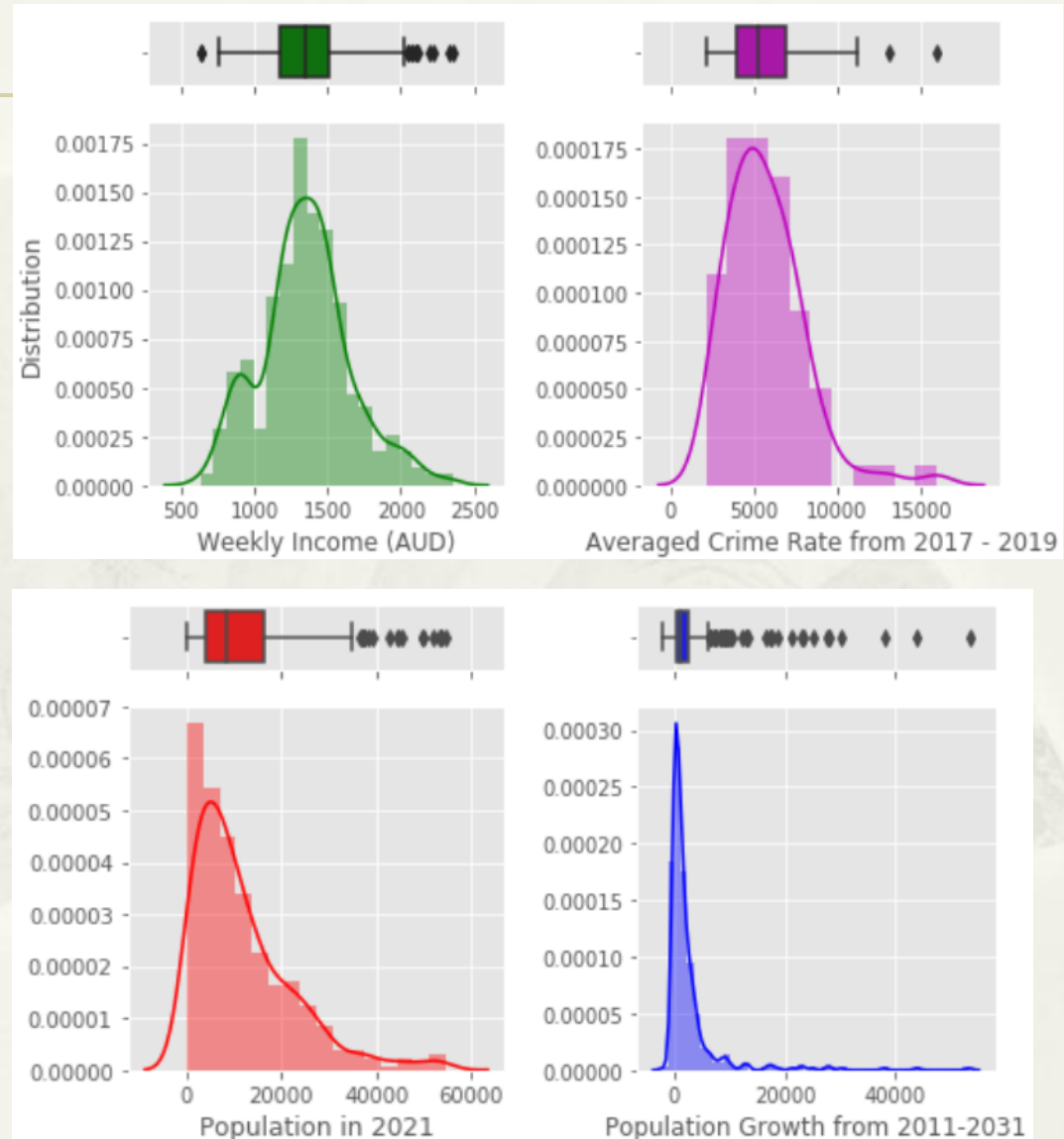
Data Acquisition

★ Population by suburbs: http://data.id.com.au/idforecasts/

★ Income by suburbs:

http://house.speakingsame.com/suburbtop.php?sta=vic&cat=Median%20household%20income&name=Weekly%20income&page=1

★ Crime rate by local administration areas: https://www.crimestatistics.vic.gov.au/explore-crime-by-location

★ Local venues: Foursquare API

★ Local parking areas: Folium map

Data Cleaning and Preprocessing

★ Population and income data are merged by suburbs

★ Crime rate data are re-arranged chronologically in different columns

★ geocoder.arcgis are used to extract locations of suburbs and local admistration areas, geopy.distance.vincenty are used to calculate their distances from the Melbourne center

★ Suburbs and local administration areas are cross-referenced by [https://www.greaterdandenong.com/document/32220/statistics-suburbs-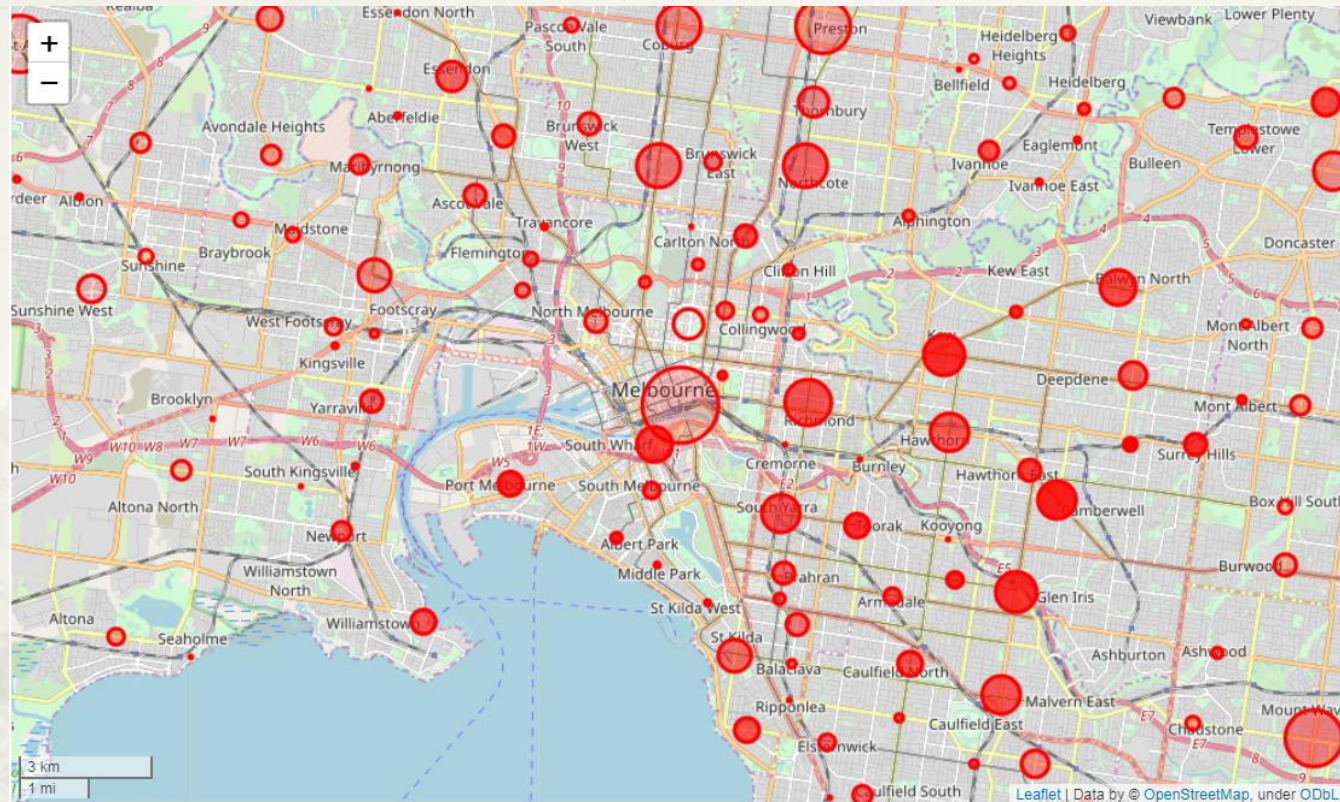postcodes-electorates-within-each-municipality](https://www.greaterdandenong.com/document/32220/statistics-suburbs-postcodes-electorates-within-each-municipality)

Data Analysis and Findings

★ The statistic distribution of **weekly income** and **crime rate** is more symmetric and close to normal distribution

★ The statistic distribution of **population** and **population growth** are highly skewed, meaning several suburbs have significantly larger population and population growth
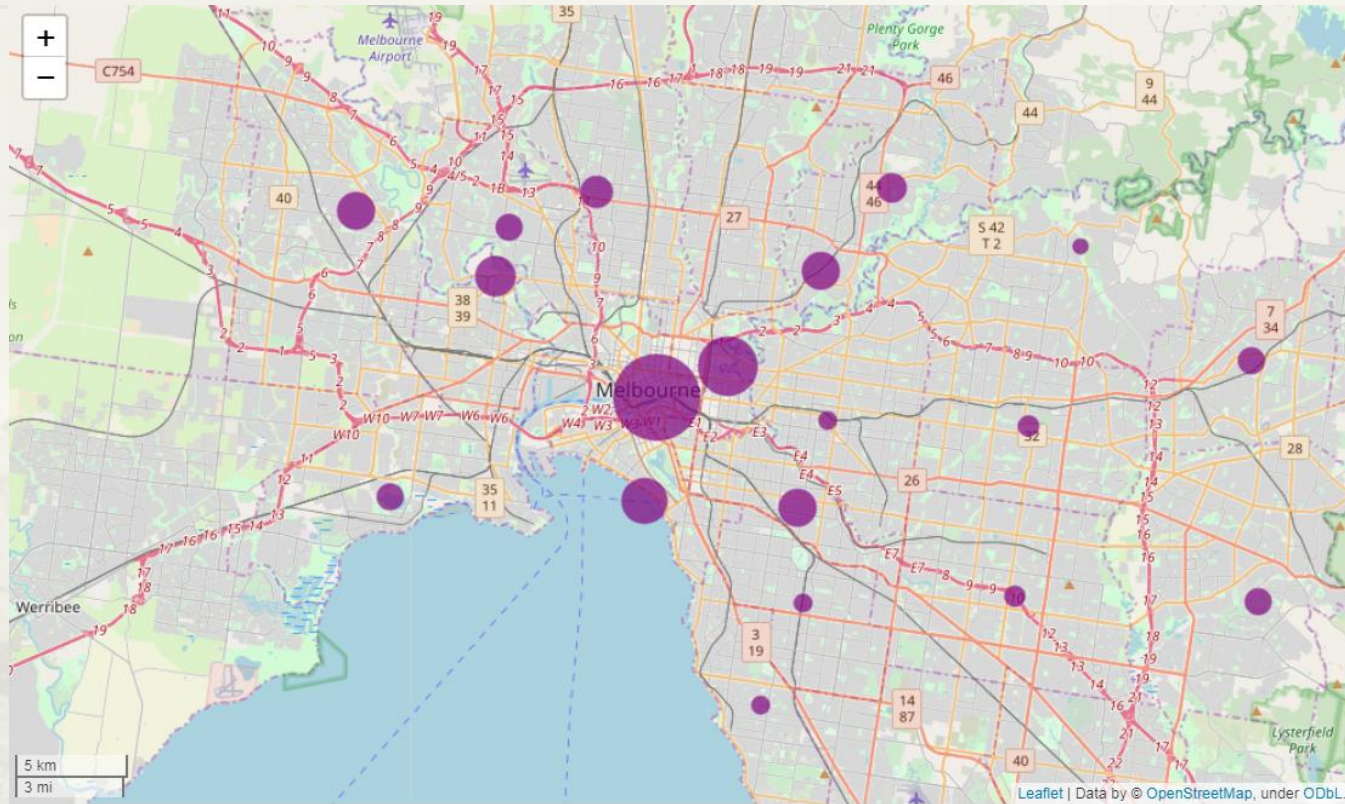
Data Analysis and Findings

Geographic distribution of population and income

★ East suburbs have larger population (larger circle size) and higher income (more opaque red color) compared to west suburbs

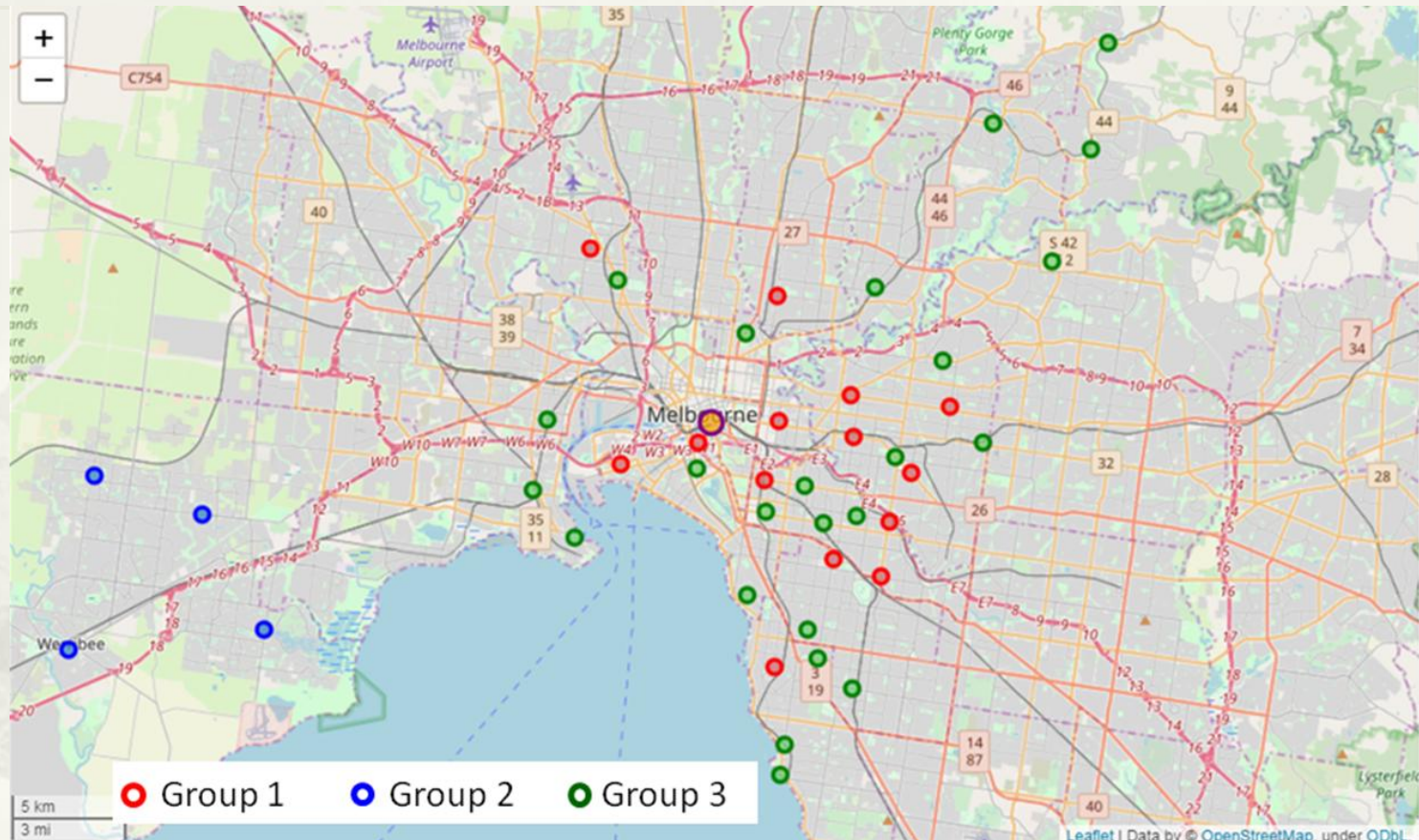# Data Analysis and Findings

Geographic distribution of crime rate

★ Melbourne center has the highest crime rate, followed by Yarra (northeast of Melbourne).
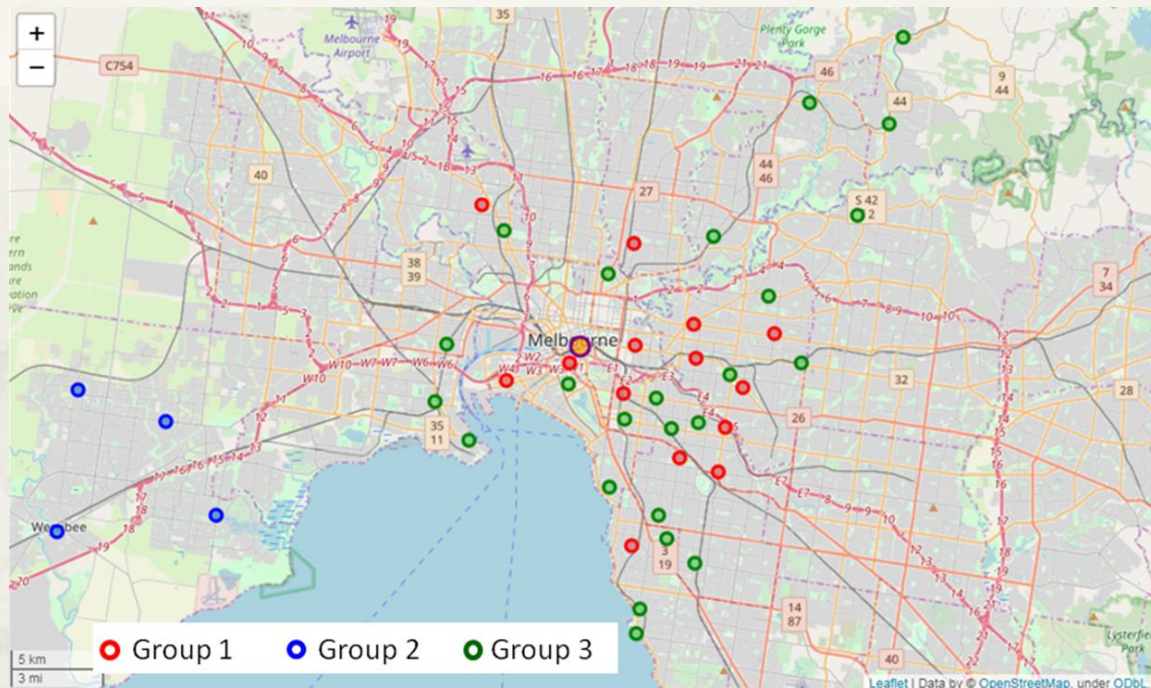
Data Analysis and Findings

Groups of suburbs with population and income above the medium level

- Group 1: large population (>75%), high population growth (>75%) and high income (>75%)
- Group 2: large population (>75%), high population growth (>75%) and medium income (>50%)
- Group 3: medium population (>50%), medium population growth (>50%) and high income (>75%)
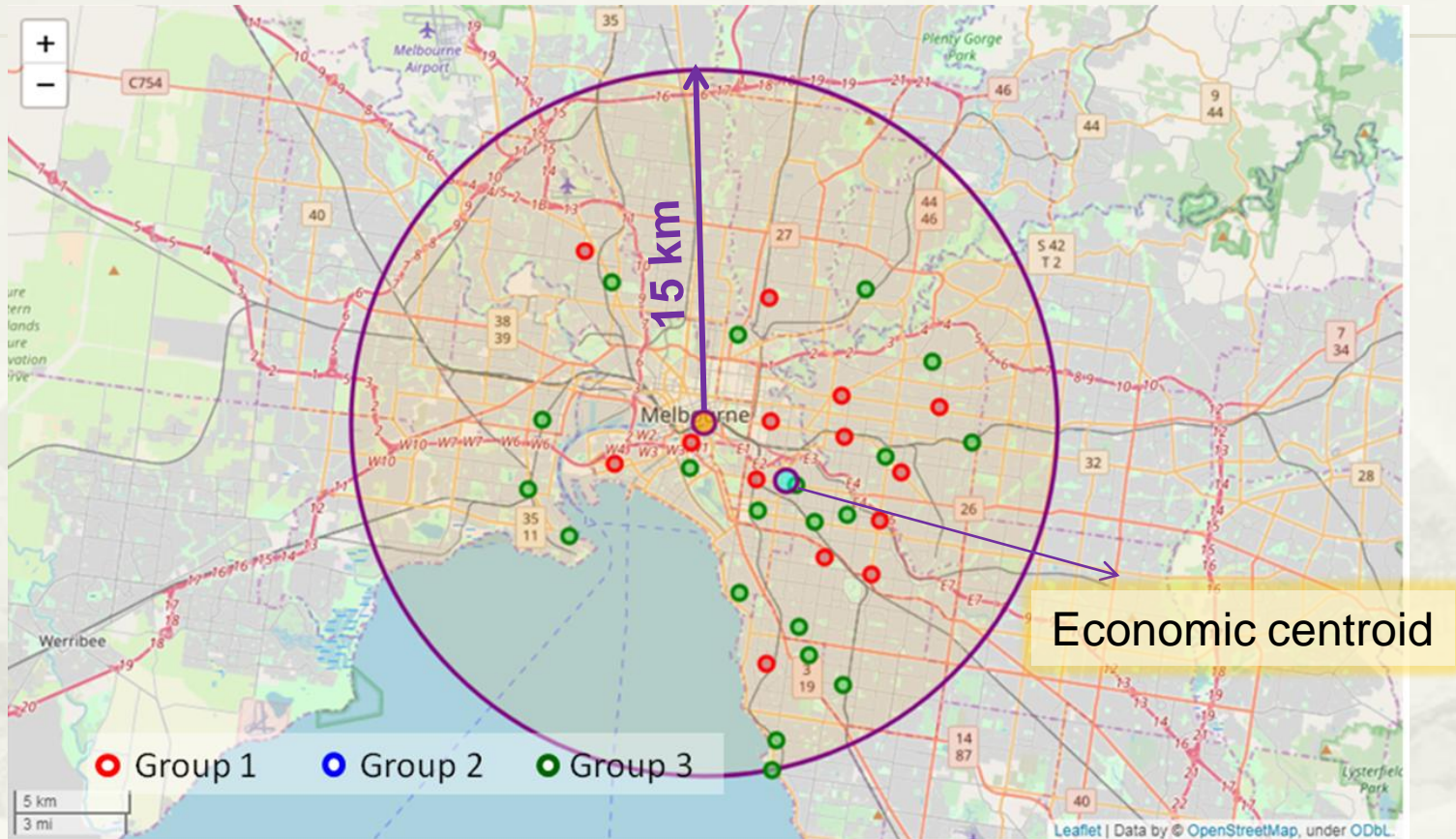
Data Analysis and Findings

★ Group 1 suburbs are mostly on the east side of Melbourne, close to CBD

★ Group 2 are mostly on the west side of Melbourne CBD, quite far away from the CBD

★ Group 3 are mostly on the east, northeast and southeast sides of Melbourne CBD

◆ Group 1: large population (>75%), high population growth (>75%) and high income (>75%)

◆ Group 2: large population (>75%), high population growth (>75%) and medium income (>50%)

◆ Group 3: medium population (>50%), medium population growth (>50%) and high income (>75%)

Data Analysis and Findings

Economic centroid of the suburbs that are within 15 km from CBD

Economic centroid

Group 1   Group 2   Group 3

15 km

★ To maximize the potential business income, we choose a location around the centroid of the suburb cluster (economic centroid)

★ The cluster centroid is found using weighted K-mean algorithm

★ Weight = income x population

Data Analysis and Findings

Restaurants within 2 km from the economic centroid
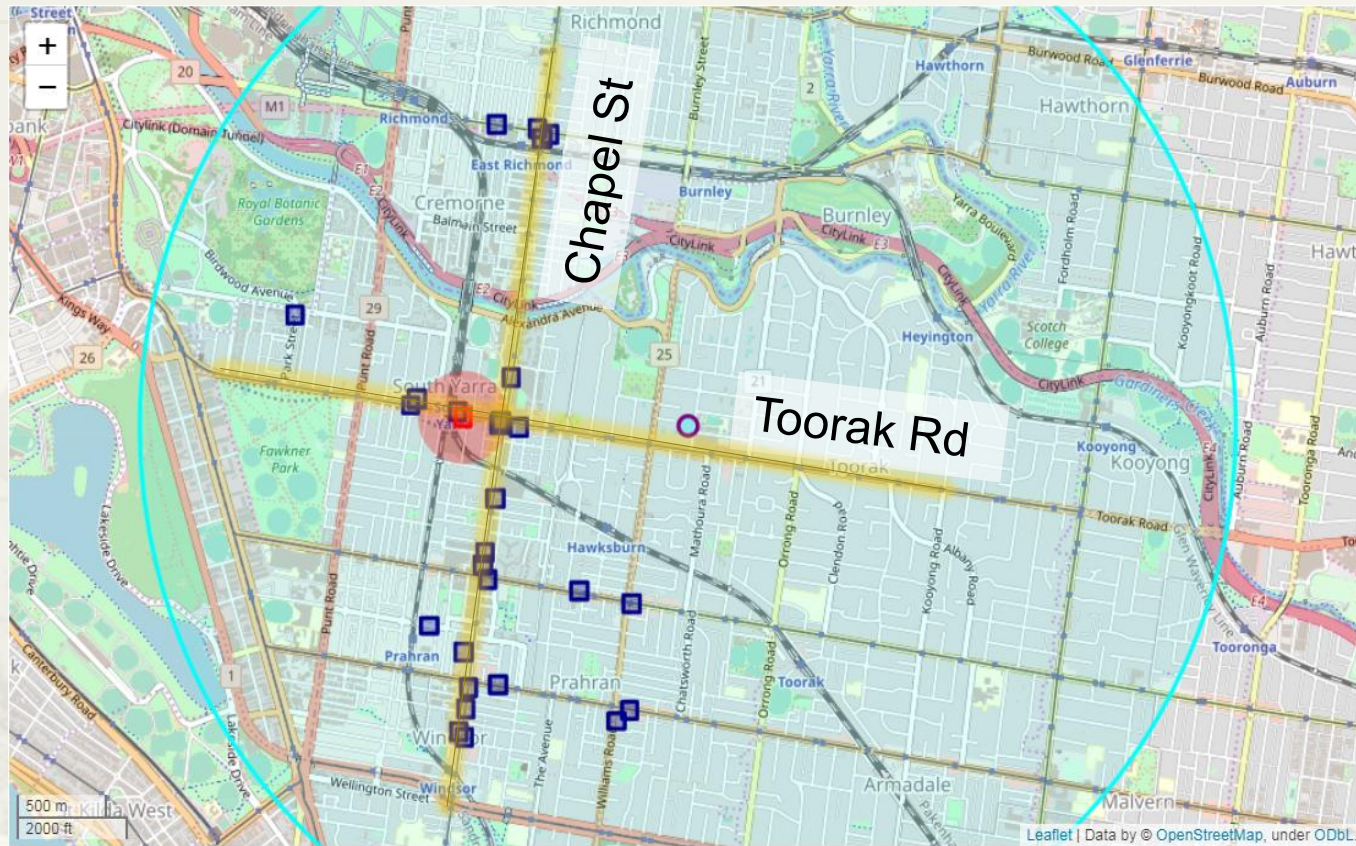
★ Using Foursquare API, 28 restaurants are found within 2 km distance from the centroid

★ The most popular ones are Greek restaurants and Italian restaurants

★ Only one Chinese restaurant: *Dainty Sichuan Restaurant*

	name	categories	lat	lng	postalCode	address
0	Hawker Hall	Asian Restaurant	-37.854527	144.993067	3181	98 Chapel St
1	The Smith	Australian Restaurant	-37.852035	144.995138	3181	213 High St
2	Bistro Thierry	French Restaurant	-37.848141	145.003454	3142	511 Malvern Rd
3	Chez Olivier	French Restaurant	-37.849200	144.990889	3181	121 Greville St
4	Jimmy Grants	Greek Restaurant	-37.825965	144.997876	NaN	427 Church Street
5	Bahari	Greek Restaurant	-37.825490	144.997590	3121	179 Swan Street
6	Lambs on Spit	Greek Restaurant	-37.847021	144.994518	NaN	245 Malvern Rd
7	Lemnos Tavern	Greek Restaurant	-37.853237	145.003340	NaN	445 High St
8	Two Forty Eight	Halal Restaurant	-37.839620	144.995220	3141	248 Toorak Rd
9	Cucinetta	Italian Restaurant	-37.838380	144.990080	3141	4/3 Murphy St
10	La Lucciola	Italian Restaurant	-37.843143	144.994969	NaN	478 Chapel St
11	Da Noi	Italian Restaurant	-37.838694	144.989701	3141	95 Toorak Rd
12	Mr. Miyagi	Japanese Restaurant	-37.854229	144.992694	3181	99 Chapel St
13	Ichi Ichi Ku Izakaya	Japanese Restaurant	-37.834413	144.982481	3141	119 Park St
14	Subi Q	Korean Restaurant	-37.847520	145.000240	3141	407 Malvern rd
15	Fonda Mexican	Mexican Restaurant	-37.825782	144.998363	3121	248 Swan St
16	Fonda Mexican	Mexican Restaurant	-37.853157	144.993141	3181	144 Chapel St
17	Persian Room 248	Middle Eastern Restaurant	-37.839459	144.995309	NaN	South Yarra
18	Woodland House	Modern European Restaurant	-37.853750	145.002530	3181	78 Williams Rd
19	Borsch, Vodka & Tears	Polish Restaurant	-37.852154	144.993322	3181	173 Chapel St
20	abacus.	Restaurant	-37.845723	144.994343	NaN	383 Chapel Street
21	Feast of Merit	Restaurant	-37.825326	144.995048	3121	117 Swan Street
22	Hunky Dory	Seafood Restaurant	-37.837395	144.995963	3141	670 Chapel St.
23	Dainty Sichuan Restaurant	Szechuan Restaurant	-37.839282	144.992979	3141	176 Toorak Rd
24	Colonel Tan's	Thai Restaurant	-37.850482	144.993022	3181	229 Chapel St
25	Veg Out Time	Vegetarian / Vegan Restaurant	-37.846323	144.994222	3141	366 Chapel St.
26	Misschu	Vietnamese Restaurant	-37.839760	144.996440	NaN	276 Toorak Road
27	Master Roll Vietnam	Vietnamese Restaurant	-37.839016	144.992614	3141	169 Toorak Rd

Data Analysis and Findings

Restaurants within 2 km from the economic centroid

★ Most restaurants are located along Toorak Road and Chapel Street
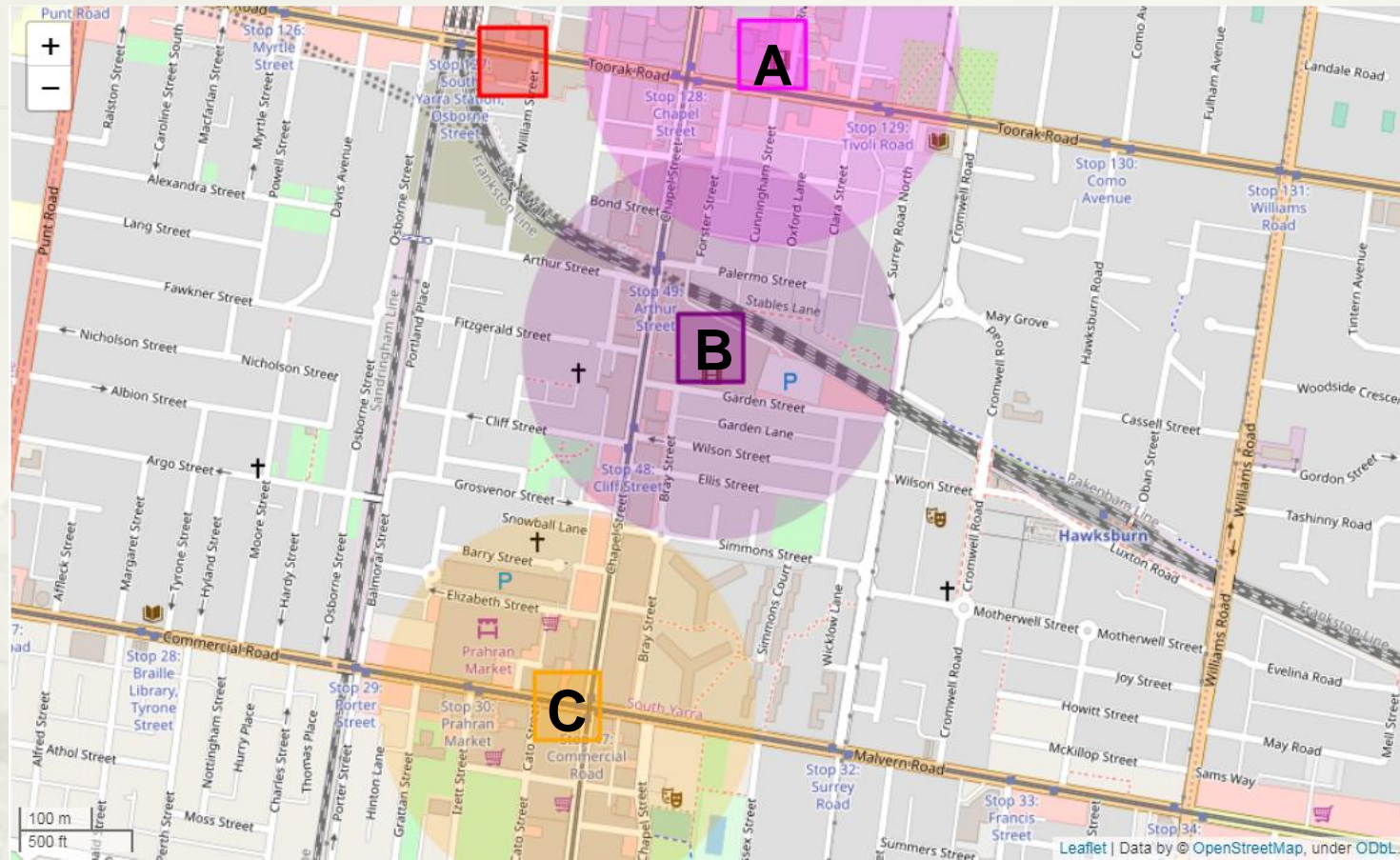★ Areas within 250 m from the existing Chinese restaurant (red circle) should be avoided

Data Analysis and Findings

Crime rate of the suburb

	Local Government Area	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean rate over the past 3 years	Latitude	Longitude	Distance to CBD
0	MELBOURNE	26613.6	24126.1	22588.3	20718.4	18581	18033.6	18691.8	16724.2	16129	14820.7	15891	-37.81739	144.96751	0.000000
1	YARRA	11737.9	11068	11411.6	10640.5	11528.4	10881.5	11982.5	11154.9	11513.3	10905.6	11191	-37.80491	145.00338	3.448998
2	PORT PHILLIP	8923.5	8501.6	8439	8954	8500.6	8935.8	9532.6	8964.7	8778.3	8364.7	8702	-37.85874	144.96150	4.619967
3	MARIBYRNONG	8684.6	9314.2	9739.7	8775.2	8155.2	7832.9	8427.5	7310.7	7632.4	7149.3	7364	-37.76920	144.88635	8.928000
4	STONNINGTON	7979.5	6880.9	7185.7	7124.6	6791.7	6989.9	8090.8	7101.9	7091.7	7442.3	7211	-37.86130	145.03776	7.873430
5	DAREBIN	6251.9	6537.6	6834.5	6269.4	7598.1	7259.1	8371.9	7525	7120.9	6968.4	7204	-37.76667	145.05000	9.191426
6	MORELAND	5269.2	5686.3	6165	5671.3	6153.6	6447.8	7057.7	6107.7	6348.6	5805.6	6087	-37.73557	144.93745	9.459637
7	MOONEE VALLEY	5247.7	5341.4	5983.8	5489.2	5443.1	5645.8	6230.9	5493.1	5351.8	4885.4	5243	-37.74941	144.89325	9.986149
8	BOROONDARA	3270.7	3128.8	3444.3	3509.4	3407.3	3233.1	3822.3	3482.9	3058.7	3208.4	3250	-37.82640	145.05299	7.592192

★ The economic centroid is within the suburb of *South Yarra*, which is governed by the Local Administration Area *STONNINGTON*

★ The crime rate is ranked 5th in the 9 Local Administration Areas that are within 10 km from the Melbourne CBD.
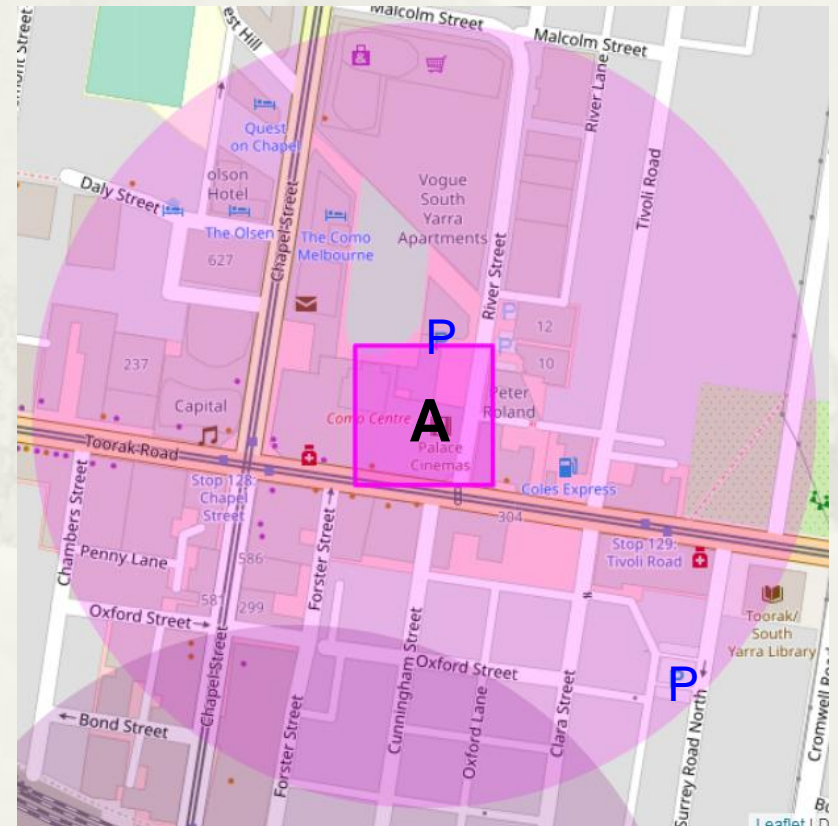
Suggested Locations

★ The three suggested locations are along or crossing Chapel St, at least 250 m away from the existing competitor

★ All have car park area within 250 m, around 5-min walking

★ All close to or within shopping centers to ensure a large flow of people

Suggested Location A

Candidate A: locations around **Como Center**, Toorak Rd, South Yarra

★ Como Center is a landmark retail space of South Yarra (https://www.comocentre.com.au), showcasing an extensive mix of local and international designer stores.

★ Large number of customers, visitors and close by car parks

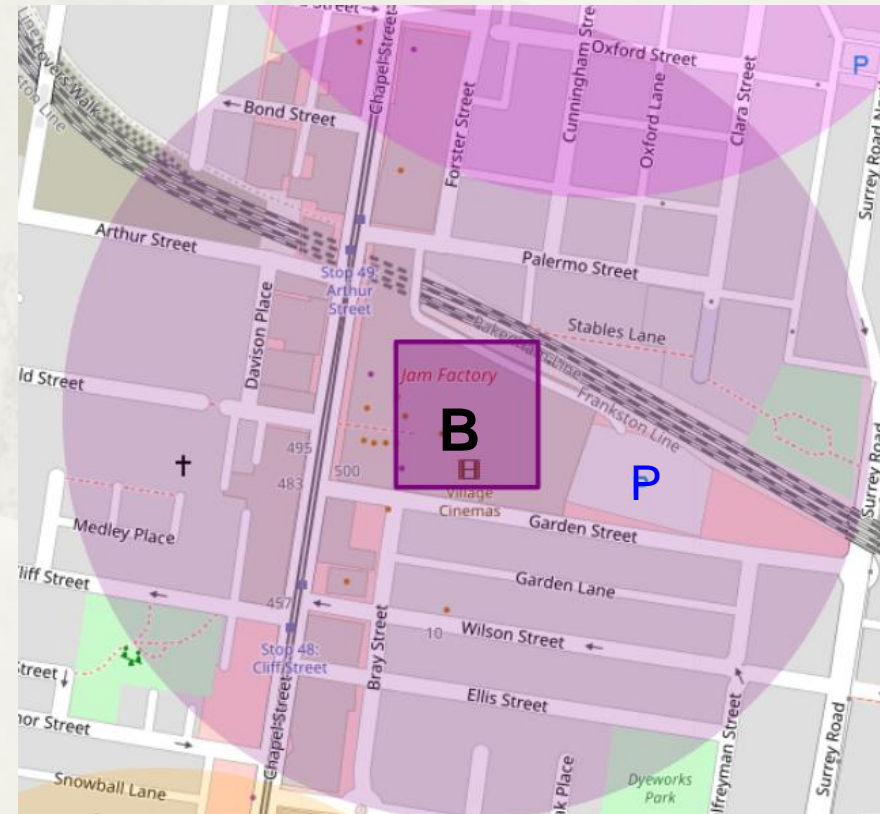★ Sufficiently far away (>250 m) from the existing Chinese restaurant

Suggested Location B

Candidate B: locations around **Jam Factory**, Chapel St, South Yarra

★ Jam Factory is a Mall in an old jam production facility featuring a multiscreen movie theatre, eateries & shops (https://thejamfactory.com.au).

★ Large number of movie viewers and close by car parks make it another attractive candidate location for the new Chinese Restaurant.

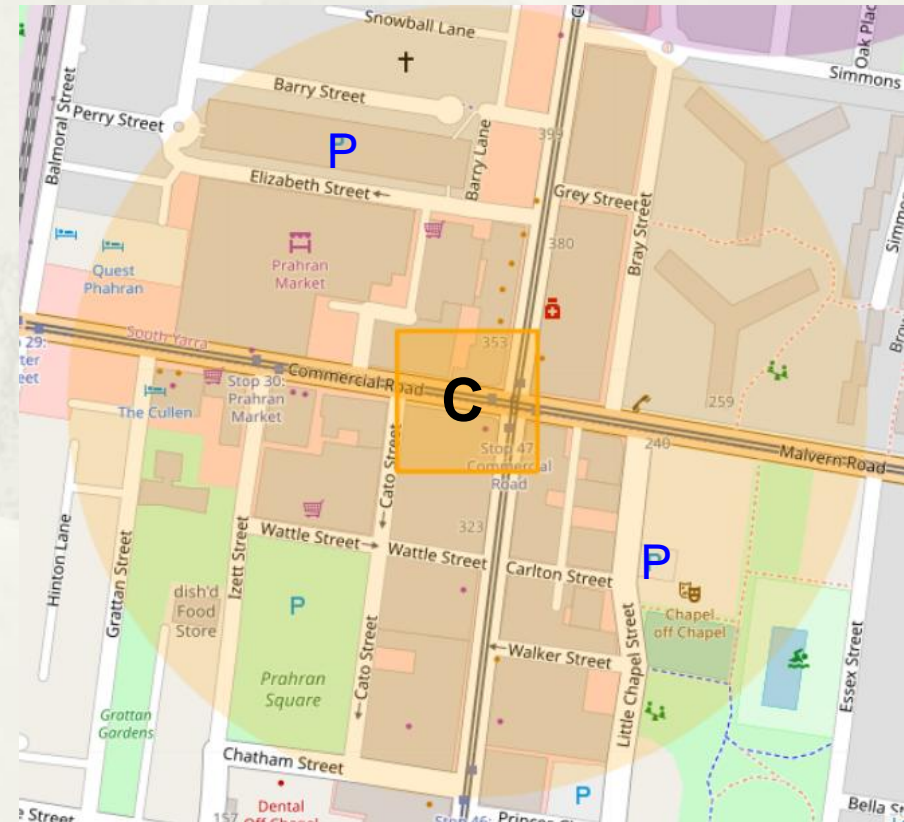★ Sufficiently far away (>300 m) from the existing Chinese restaurant

Suggested Location C

Candidate C: locations around **Pran Central Shopping Centre**, Commercial Rd, South Yarra

★ Pran Central is a heritage-listed seven-storey Edwardian baroque architectural style former department store (https://www.prancentral.com.au), with shopping center and department above.

★ Large supermarkets and fresh market near by, easy access to car parks.

★ Sufficiently far away (>750 m) from the existing Chinese restaurant

Summary

★ This report provided an analysis of the potential locations for a new Chinese restaurant in Melbourne, targeting mid to high-level customers.

★ The location is narrowed down by filtering the suburbs using the geo-social-economical data, only suburbs with above-the-medium level of population and income are considered.

★ To maximize the potential business income, the economic centroid of the suburb cluster is found using weighted K-mean algorithm.

★ Three locations around the economic centroid are suggested after a comprehensive analysis of the competitors, business environment, parking availability, etc.