An analysis of potential theme park locations for the metropolitan Melbourne Area

Mario Andrés Muñoz

1 Introduction

Melbourne, Victoria is the second largest metropolitan area in Australia, with an estimated 5.191 million inhabitants as of 2019 [1]. Considered one of the cities with the highest quality of life in the world [2], Melbourne has one of the best education systems in the country [3], making it an attractive city for families. However, Melbourne lacks of large theme and attraction parks. The only two parks in the region are [4]:

- Luna Park located in the inner city suburb of St. Kilda, at 8 kilometres from the central business district, with an area of over 11 thousand square metres. It opened in 1912, contains 20 attractions and operates year round.
- Adventure Park located in the nearby city of Geelong, at 92 kilometres from the central business district, with an area of over 2 square kilometres. It opened in 1994, contains 20 attractions and operates from October to April, which correspond to the summer months in Australia.

Therefore, **the aim of this project is to identify the location of a new attraction park** closer to the central business district than Adventure Park, and an available area for expansion larger than Luna Park. The location should be within the metropolitan region, close to population growth corridors, with a high number of families nearby. Ideally, the location should be close to a suburban train station and but not close to amenities like shopping centres, museums or zoological parks. The project would not focus on the economical feasibility of the park, but the families in the vicinity should have a moderate income that would allow them visit the park often. Interested parties would be developers, government entities, and families.

This report is organised as follows: Section 2 describe the data used and its sources. Section 3 discusses the methodology employed. Section 4 presents the results, which are discussed in Section 5. The report concludes making some recommendations for further research in Section 6.

2 Data

For this project, four sources of data were used:

1. Geographical coordinates of the Victorian suburb boundaries, as defined by the Australian Bureau of Statistics in 2011 [5]. The data was provided by Stephen Muss [6] in GeoJSON format. Suburbs are sorted alphabetically. Figure 1 shows the first 10 rows of this dataset, as imported using the `pandas` package. The variable `'geometry'` contains a dictionary type, whose field `'coordinates'` corresponds to the latitude and longitude of each boundary point. The variable `'properties'` contains a dictionary type, whose field `'Suburb_Name'` is corresponds to the name.

Out[46]:

	geometry	type	properties
0	{'type': 'Polygon', 'coordinates': [[[145.0012...	Feature	{'SSC_NAME': 'Abbotsford (Vic.)', 'State': 'Vi...
1	{'type': 'Polygon', 'coordinates': [[[144.8894...	Feature	{'SSC_NAME': 'Aberfeldie', 'State': 'Victoria'...
2	{'type': 'Polygon', 'coordinates': [[[145.6416...	Feature	{'SSC_NAME': 'Acheron', 'State': 'Victoria', '...
3	{'type': 'Polygon', 'coordinates': [[[144.1021...	Feature	{'SSC_NAME': 'Aireys Inlet', 'State': 'Victori...
4	{'type': 'Polygon', 'coordinates': [[[144.8894...	Feature	{'SSC_NAME': 'Airport West', 'State': 'Victori...
5	{'type': 'Polygon', 'coordinates': [[[144.7569...	Feature	{'SSC_NAME': 'Albanvale', 'State': 'Victoria',...
6	{'type': 'Polygon', 'coordinates': [[[144.9701...	Feature	{'SSC_NAME': 'Albert Park (Vic.)', 'State': 'V...
7	{'type': 'Polygon', 'coordinates': [[[146.6472...	Feature	{'SSC_NAME': 'Alberton (Vic.)', 'State': 'Vict...
8	{'type': 'Polygon', 'coordinates': [[[144.8153...	Feature	{'SSC_NAME': 'Albion (Vic.)', 'State': 'Victor...
9	{'type': 'Polygon', 'coordinates': [[[145.8805...	Feature	{'SSC_NAME': 'Alexandra (Vic.)', 'State': 'Vic...

Figure 1: Postal codes for the State of Victoria. First 10 rows are shown.

Out[9]:

	Postcode	Suburb	Region
0	3000	MELBOURNE	MELBOURNE CITY
1	3001	MELBOURNE	MELBOURNE CITY
2	3002	EAST MELBOURNE	MELBOURNE CITY
3	3003	WEST MELBOURNE	MELBOURNE CITY
4	3004	MELBOURNE	MELBOURNE CITY
5	3006	SOUTH WHARF	MOORABBIN
6	3006	SOUTHBANK	MOORABBIN
7	3008	DOCKLANDS	MELBOURNE CITY
8	3010	UNIVERSITY OF MELBOURNE	MELBOURNE CITY
9	3011	FOOTSCRAY	FOOTSCRAY

Figure 2: Postal codes for the State of Victoria. First 10 rows are shown.

2. Postal codes for the State of Victoria, as provided by Zen10, a Search Engine Optimisation Consultancy based on Melbourne [7]. Figure 2 shows the first 10 rows of this dataset, which is in CSV format and was imported using the `pandas` package.

3. Population by age (in five year increments) and weekly income per postal code from the 2016 Australian Census Data, as provided by the Australian Bureau of Statistics [8], through the TableBuilder Application [9]. Figure 3 shows the first 10 rows for each one of these datasets, which are in CSV format and were imported using the `pandas` package.

4. Information about venues extracted using the Foursquare Places API v20180605 [10] accessed by Python directly using the `requests` package.

Out[8]:

	POA (UR)	0-4 years	5-9 years	10-14 years	15-19 years	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years	...	60-64 years	65-69 years	70-74 years	75-79 years	80-84 years	85-89 years	90-94 years	95-99 years	100 years and over	Total
0	3000, VIC	735	320	161	3561	11898	8697	5045	2325	1246	...	572	448	256	127	73	42	31	6	0	37979
1	3002, VIC	157	83	60	86	343	725	680	444	274	...	365	301	242	105	77	93	40	17	6	4957
2	3003, VIC	184	115	97	193	915	1252	933	488	355	...	112	91	74	45	12	13	4	0	0	5516
3	3004, VIC	284	177	106	257	819	1432	1365	907	600	...	482	507	349	214	124	131	70	41	8	9311
4	3005, VIC	32	16	6	14	56	90	96	62	29	...	11	16	6	7	0	0	0	0	0	523
5	3006, VIC	584	206	118	814	3211	4165	3436	1757	975	...	489	454	255	149	66	40	8	3	5	18811
6	3008, VIC	524	135	81	427	1513	2281	1696	891	561	...	333	289	139	61	32	11	7	0	0	10438
7	3010, VIC	3	0	6	756	658	80	28	14	4	...	11	7	10	0	0	0	0	0	0	1595
8	3011, VIC	1348	827	511	825	2287	3183	2847	2134	1465	...	723	584	385	381	295	242	112	34	5	21464
9	3012, VIC	1987	1470	996	1071	2118	3035	3093	2539	2061	...	997	734	532	482	423	288	141	33	4	26295

10 rows × 23 columns

(a)

Out[11]:

	POA (UR)	Negative income	Nil income	1–149 (1–7,799)	150–299 (7,800–15,599)	300–399 (15,600–20,799)	400–499 (20,800–25,999)	500–649 (26,000–33,799)	650–799 (33,800–41,599)	800–999 (41,600–51,999)	1,000–1,249 (52,000–64,999)	1,250–1,499 (65,000–77,999)	1,500–1,749 (78,000–90,999)	1,750–1,999 (91,000–103,999)	2,000–2,999 (104,000–155,999)	3,000*ormore*(156,000 or more)	Not stated	appli
0	3000, VIC	379	9718	1259	1878	2162	2051	2168	1913	2100	2231	1618	1321	890	1475	925	4687	
1	3002, VIC	23	231	96	154	125	168	198	209	296	383	382	372	272	529	615	607	
2	3003, VIC	36	586	150	242	252	247	258	273	336	456	331	310	202	351	223	865	
3	3004, VIC	32	777	170	248	263	315	333	405	608	798	698	650	485	935	787	1234	
4	3005, VIC	5	33	0	25	14	18	21	23	22	25	25	29	20	42	36	135	
5	3006, VIC	103	2404	386	585	644	690	799	914	1342	1625	1285	1099	856	1584	1145	2454	
6	3008, VIC	86	1574	217	322	347	313	408	450	622	791	736	640	456	867	636	1232	
7	3010, VIC	8	444	422	318	107	44	48	19	14	13	6	11	5	26	16	80	
8	3011, VIC	94	1685	655	1478	1518	1364	1278	1195	1498	1608	1218	960	661	1094	409	2074	
9	3012, VIC	110	2109	728	1621	1739	1651	1425	1549	1910	1919	1416	1186	816	1169	481	2013	

(b)

Figure 3: Population by (a) age and (b) weekly income per postal code for the State of Victoria. First 10 rows of each dataset are shown.

3 Methodology

3.1 Associating postcodes with suburbs

The first step was to associate the postcodes with its suburbs, as there are some suburbs with more than one post-code. Therefore, the data was pre-processed to group each postcode with a unique suburb name. Moreover, any suburb that does not correspond to the Melbourne metropolitan area (which are marked with the regions `'vic far country'` and `'vic country'`) were removed.

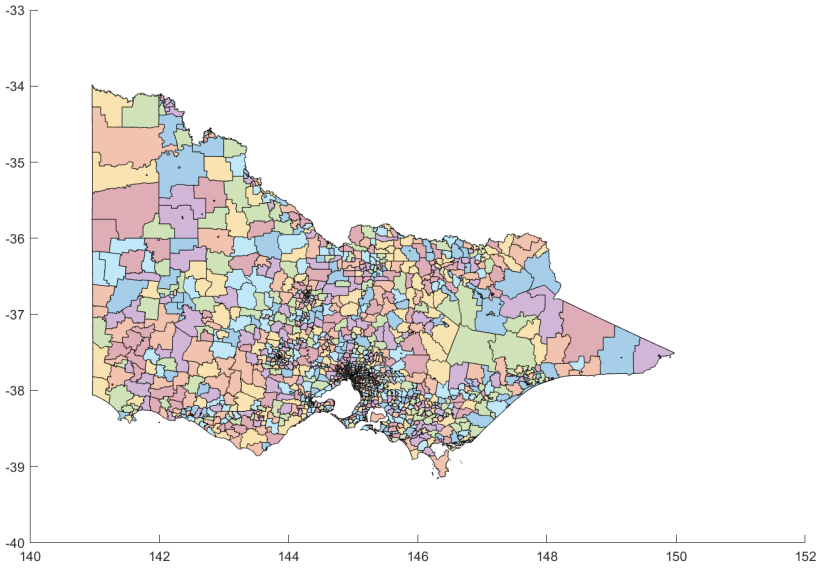

Figure 4: Postal codes for the State of Victoria. First 10 rows are shown.

3.2 Collecting geographical data

The next step was to obtain the area and centroid of the suburbs from the GeoJSON data. This proved to be very tricky to process in Jupyter Notebooks, as the variable `'geometry'` had a nested structure that was not uniform, i.e., while some suburbs had the data as a list of coordinate pairs, others had two or three levels before the pairs where available. This was very hard to identify in the Notebook environment, as it does not provide an easy way to explore the variables without re-running the whole cell.

Therefore, given the limited amount of time for this project, MATLAB was used to obtain the centroid and the area in squared kilometres. In a future iteration of this project, this part may be shifted to Python using the `'shapely'` package. The steps followed were: First, we detect the coordinates for the suburb and create two polygons out of them. The first polygon uses the coordinates as degrees as inputs, while the other one transforms the coordinate points into kilometres, using the geodesic transformation. The first polygon is used to obtain the coordinates of the centroid, while the second one is used to obtain the area. Figure 4 shows an image of the captured boundaries.

It is also important to know the distance of each suburb to Melbourne's Central Business District (CBD). Using the package `'geopy'`, we determined both the coordinates of the CBD, and the distance to the suburb centroids, using the geodesic function.

3.3 Demographic data

From the demographic information datasets, we are interested in calculating: (a) The population size of each suburb. (b) The population objective, which are children under the age of 15. (c) The density of each suburb, defined as the area in squared kilometres divided over the population. (d) The affluent population of each suburb, or those with an income in or above the national median of 66,000 dollars per year, or about 1,300 dollars per week before taxes. (e) The ratio of affluent density of each suburb, defined by the ratio between the affluent population and the total population. Note that we do not care about postcodes whose population is zero; hence, they are removed from the tables.

3.4 Obtaining venue data

The final set of data will be obtained from the Foursquare API. There are a few things that are of our interest:

1. The location of the nearest bus, train or tram station.
2. The location of other amenities such as shopping malls, museums, zoological parks.

The first step is to set up the API calls with the ID and SECRET, which have been stored in a separate file, not available in the repository for security reasons. Then, we defined two functions that would automatically issue the calls and process the required data. These calls are restricted to the unique Foursquare categories of shopping malls, museums, zoological parks. Given that this data is expensive to obtain, in terms of time and requests, once collected, they were stored in two csv files for further use: `'transportation_by_suburb.csv'` and `'landmarks_by_suburb.csv'`.

3.5 Rating the suburbs

We use a very simple procedure to filter the suburbs.

1. We add 10 Points for a nearby train station, 5 points for a tram station and 3 points for a bus station, and subtract 10 Points for each nearby amenity. We select those suburbs with more than 8 points.
2. We now select those suburbs with less than 1000 persons per square kilometres, as a reference for large empty areas of space.
3. We select those suburbs with more than 500 inhabitants with ages less than 15 years.
4. Next, we select the suburbs with distance to the CBD less of 60 kilometres
5. Finally, we sort them by affluent ratio.

4 Results

Figures 5 shows the final results of this process, where the top ranked suburb is Parwan, followed by Avonsleigh and Emerald. Figure 6 shows the location of the selected suburbs, where Parwan, VIC is the only suburb located on the western side of the city. In the northern area there is a cluster of two suburbs, composed of Kilmore and Kilmore East. The other five suburbs form a cluster in the Eastern side of the city.

5 Discussion

The three suburb groups correspond to growth areas in the Melbourne metropolitan region. Perhaps the best suburb for the park is Parwan, which is located about 45km west of Melbourne's CBD, within the Shire of Moorabool and the City of Melton. The Parwan valley lies between three geographical features: the Brisbane Ranges, Werribee Gorge State Park and the You Yangs. Formerly farmland, decades of abuse have made the soil extremely saline and erode. The Victorian Government compulsorily acquired the land and has been attempting to rescue the valley ever since.

The other two clusters are perhaps less desirable locations. Kilmore is located about 60km north of Melbourne CBD, and close to the cities of Ballarat and Bendigo, it is favoured by families due to the Kilmore International School, which offers an International Baccalaureate program. This may imply that the locals do not want a major distraction located nearby. The remaining suburbs, including Avonsleigh and

Out[195]:

	Suburb	Longitude	Latitude	Area	Postcodes	Distance to CBD	Population	Population under 15	Affluent Population	Density	...	Distance to Train Station	Closest Tram Station	Distance to Tram Station	Cl Sho
371	parwan	144.444221	-37.772680	120.913830	[3340]	45.939175	21123	4414.0	3492.0	174.695	...	9.445547	NaN	NaN	
22	avonsleigh	145.484745	-37.911650	9.289678	[3782]	47.153901	7824	1476.0	1453.0	842.225	...	3.048362	NaN	NaN	
172	emerald	145.436472	-37.946061	63.375671	[3782]	44.136234	7824	1476.0	1453.0	123.454	...	1.419608	NaN	NaN	
287	macclesfield	145.488903	-37.878529	36.512306	[3782]	46.820644	7824	1476.0	1453.0	214.284	...	6.325835	NaN	NaN	
258	kilmore	144.927489	-37.306109	116.470642	[3764]	56.482057	9161	1866.0	1367.0	78.655	...	5.157628	NaN	NaN	
259	kilmore east	145.011221	-37.278276	69.102919	[3764]	59.634445	9161	1866.0	1367.0	132.57	...	2.988418	NaN	NaN	
119	cockatoo	145.512777	-37.929879	44.737715	[3781]	50.032808	4471	1016.0	664.0	99.9381	...	3.815150	NaN	NaN	
316	monbulk	145.428493	-37.874150	24.356140	[3793]	41.494197	3575	726.0	511.0	146.78	...	5.572706	NaN	NaN	

8 rows × 24 columns

Figure 5: Postal codes for the State of Victoria. First 10 rows are shown.

Out[198]:

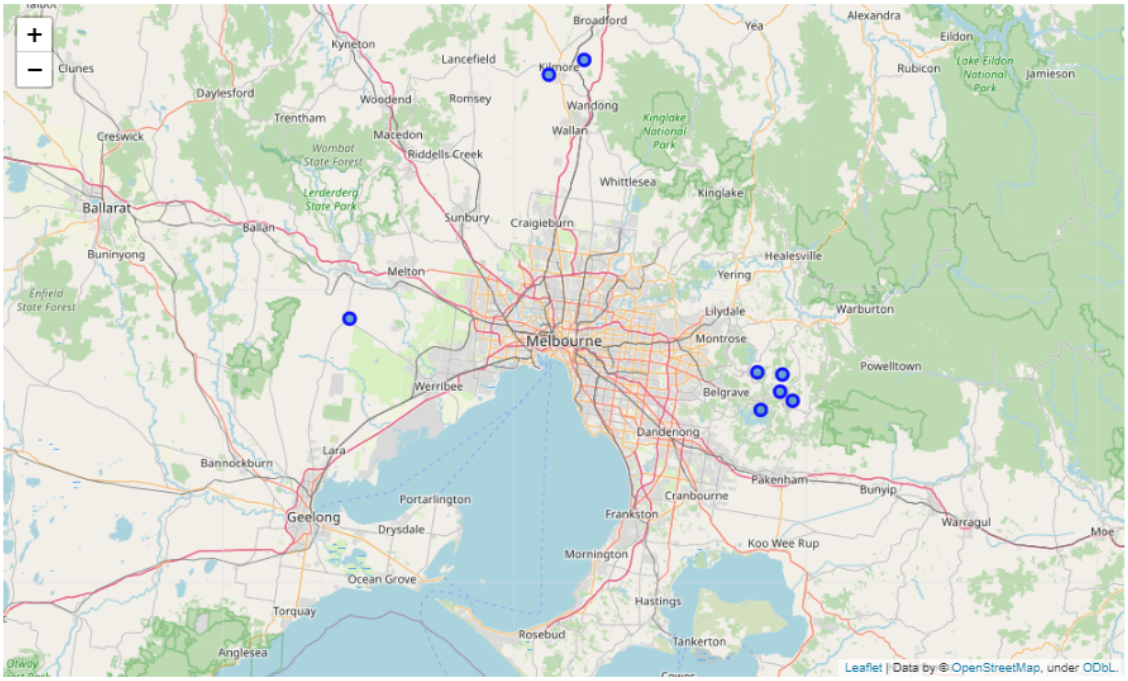

Figure 6: Postal codes for the State of Victoria. First 10 rows are shown.

Emerald are located about 44km south-east of Melbourne CBD, within the Shires of Cardinia and Yarra Ranges. Close to the Cardinia reservoir, it is a mountainous region which may difficult the construction of any major infrastructure.

6 Conclusion

Through this project, we identified a few reasonable locations for a theme park within the Melbourne metropolitan area, using several sources of data, such as demographic, geographical and venue data. The results where compiled in a clean database used to take decisions. Nevertheless, the analysis require some improvement. For example, a more comprehensive approach would consider the characteristics of the neighbouring suburbs, including the type of amenities existing, other than major attractions. Moreover, the whole

pipeline should be developed in Python, including the identification of centroids and areas.

References

[1] Australian Bureau of Statistics, "Regional population growth, australia, 2018-19," Mar. 2020. [Online]. Available: https://www.abs.gov.au/ausstats/abs@.nsf/mf/3218.0

[2] Mercer LLC, "Quality of living city ranking," 2019. [Online]. Available: https://mobilityexchange.mercer.com/Insights/quality-of-living-rankings

[3] Quacquarelli Symonds, "Best student cities," 2019. [Online]. Available: https://www.topuniversities.com/city-rankings/2018#sorting=rank+custom=rank+order=desc+search=

[4] Victoria State Government, "Things to do in Melbourne – children's activities," 2020. [Online]. Available: https://liveinmelbourne.vic.gov.au/discover/things-to-do-in-melbourne/childrens-activities-in-melbourne

[5] Australian Bureau of Statistics, "State suburbs ASGS non ABS structures ed 2011 digital boundaries," Jul. 2011. [Online]. Available: https://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/2C6132C0B332C336CA2578D40012CF76

[6] S. Muss, "Suburb boundaries geojson – victoria," Mar. 2016. [Online]. Available: https://github.com/stephenmuss/suburb-boundaries-geojson/blob/master/vic.json

[7] M. Thomas, "List of melbourne suburbs for melbourne web designs," 2020. [Online]. Available: https://zen10.com.au/melbourne-suburb-list/

[8] Australian Bureau of Statistics, "2016 census overview," 2016. [Online]. Available: https://www.abs.gov.au/websitedbs/D3310114.nsf/Home/Assuring%20Census%20Data%20Quality

[9] ——, "Census tablebuilder," 2020. [Online]. Available: https://www.abs.gov.au/websitedbs/censushome.nsf/home/tablebuilder

[10] Foursquare, "Places api documentation," 2020. [Online]. Available: https://developer.foursquare.com/docs/places-api/