

Opportunity for Car Rental Business, Mississauga, CA



Detailed report on ●
Mississauga's Neighborhoods for car rental business,
using **data science and machine learning**.

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Submitted for IBM Data Science Professional Certificate
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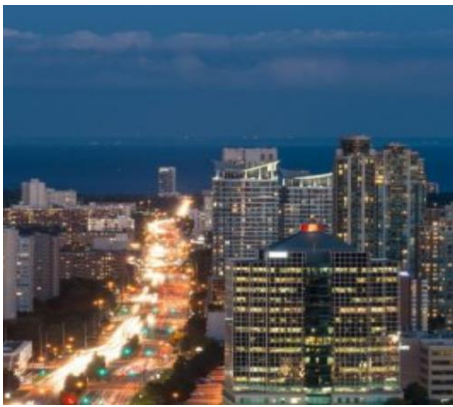
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EXECUTIVE SUMMARY

Mississauga is one of the lively cities of Canada enveloping a wide range of businesses. This report presents a model to initiate or expand an existing car rental business in Mississauga through a thorough analysis of Mississauga's neighborhoods. The analysis is two-fold covering the density of car rental companies and the occurrence of dominant car rental companies in different neighborhoods. The project involved an unsupervised machine learning clustering algorithm to group similar neighborhoods within Mississauga. The resulting cluster association helps to understand the infrastructure of the city, residential communities, and business centers which leads to highlight the opportunistic areas for car rental business in Mississauga. The report analyzed in detail the cluster association of neighborhoods with the highest density of car rental businesses and vice versa. Additionally, a comparison between the number of car rental companies and the occurrence of dominant companies in a cluster association is presented in the discussion.

The report concludes that neighborhoods with postal codes L5T, L4T, and L5P could be the prime location for car rental business due to proximity to the airport. L5R and L4Z could be good for business locations as these areas are sandwiched between two major highways. The neighborhood with postal code L5V has a relatively less number of rental companies therefore, this area can be a good start for a new car rental business. South and southwest neighborhoods of Mississauga have overall lower number of car rental companies as it is a residential area and therefore an existing company can open their branch in this area for extra coverage.



INTRODUCTION

Mississauga is one of the busiest cities, situated along the shores of Lake Ontario and neighboring the Toronto City of Canada. Mississauga has evolved as a multicultural and diversified city during the past few decades as a result of increased immigration in Canada. The city is also home to Toronto's busiest airport, named Pearson International Airport. With passing time, Mississauga has become the hub of many businesses and cultural centers. It has offered various opportunities to both large businesses and startup entrepreneurs to initiate and expand their businesses across different neighborhoods of the city.

1.1. The Hub of Businesses

Mississauga city envelops many headquarters of large businesses like GlaxoSmithKline, FedEx, Microsoft, PepsiCo, etc. Most of the giant businesses operate from the city center and their branches spread throughout the city depending upon the nature of their business and requirements.

1.1.1. Business design in a city

Any business needs to understand the demographics of a city and design their business functions accordingly. Businesses can have different requirements depending upon the nature of work. Some businesses like convenience or grocery stores require an understanding of residential communities and their needs. Similarly, a fashion entrepreneur will look for the ethnicity, culture, and diversity of the population in a neighborhood before starting a fashion business in a particular area. This report will focus on an analysis of the city for starting/ or expanding a car rental business in Mississauga.

1.1.2. Car Rental business



A car rental business has various operations. The two main domains of business are:

- 1) daily car rental business, and
- 2) accidental or insurance replacement car rental.

Major car rental companies in Mississauga like Enterprise operate in both domains while small companies can have either of the two domains.

Understanding the function of a car rental business requires a quantitative set of analysis including but not limited to:

- Geography of the area and the city,
- Number of major car rental companies operating in any neighborhood,
- Number of small car rental companies operating in any neighborhood,
- Areas in a neighborhood close to highways or major intersections,
- Understanding the spread of car rental companies across the city and the number of their branches in a different neighborhood, and
- Rate of an accident in any neighborhood.



1.2. Business Understanding

This report aims to provide insights into the distribution of car rental companies spread out in various neighborhoods. **This will assist any small company to decide its location of a business or any working company to expand its business.**

For this purpose, this analysis will provide:

- distribution of top 10 car rental companies in different neighborhoods of the city that mostly operate both for daily car rental and accidental car rental,
- a cluster of neighborhoods with a high density of car rental companies and vice versa





- the cluster of companies in different neighborhoods.

In addition to the analysis provided by this report, the results will provide a deep understanding of how car rental companies operate within the city of Mississauga. The results will help the entrepreneurs to underpin the reasons why

- some areas are densely populated with companies,
- while the others are less populated,
- also, if there are any areas reserved by the companies as their zone of business,
- or the population of companies is affected by the geographical location of the city or roads or highways.

Additionally, businesses would require qualifying other parameters like the location of the property, cost, fleet functions, etc. to finalize their decision to initiate or expand their business in any specific area based on this report.

LITERATURE REVIEW

2.1. Neighborhoods of Mississauga

Various authorities including governmental organizations, municipality reports, private businesses, academic researchers have divided the city of Mississauga into 22 Neighborhoods. Neighborhoods are subdivided into smaller neighborhoods and are associated with postal codes (Figure 1).

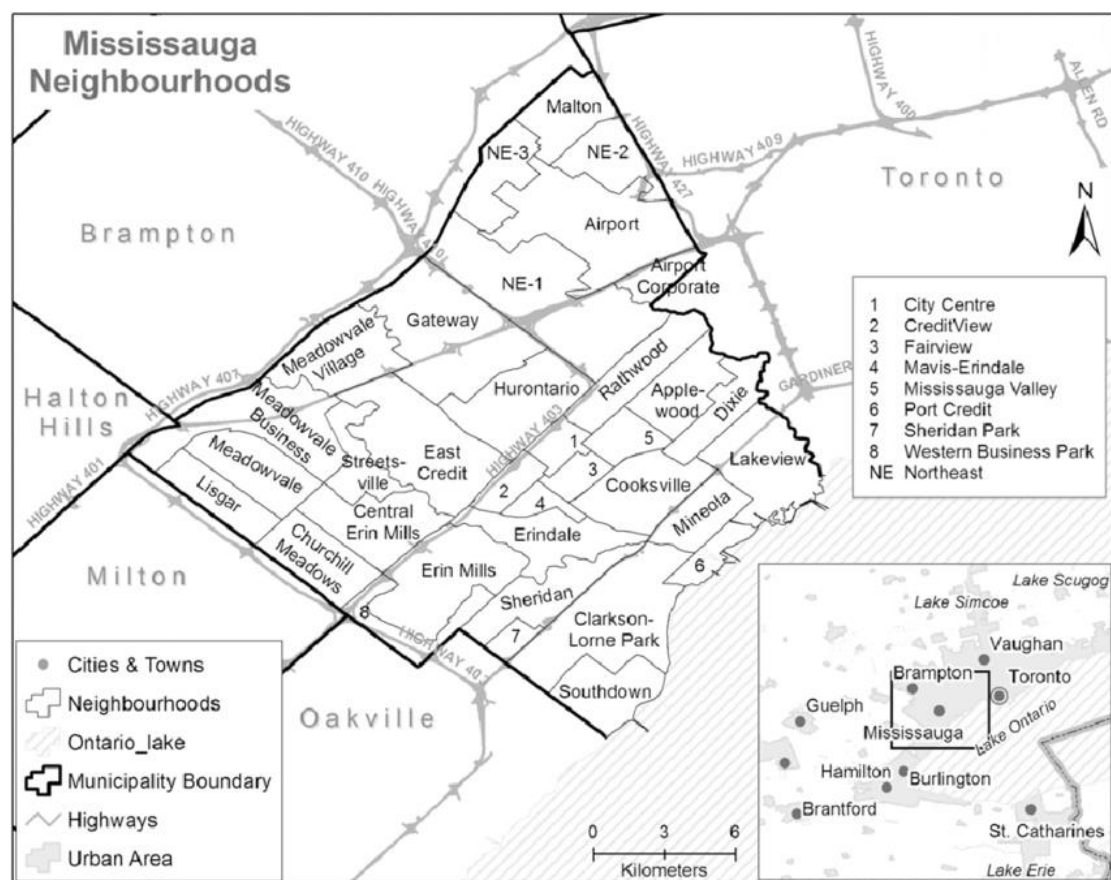


Figure 1. showing the map of Mississauga and the division of its neighborhoods. Boundaries of cities are marked with bold black outlines. Neighborhood boundaries are marked with black outlines. Major highways are shown in gray color. The map is sourced from Bissonnette *et al.* (2012).

2.2. Postal codes

Using postal codes to analyze a particular location in a city is one of the reliable ways as it is the standard division of a city. Each postal code comprises a neighborhood or a group of neighborhoods. Below is a map of Mississauga and its neighboring cities showing postal code division (Figure 2). It is also feasible to access the location data using the postal code of an area, therefore Mississauga's postal codes were used to extract location coordinates of neighborhoods.

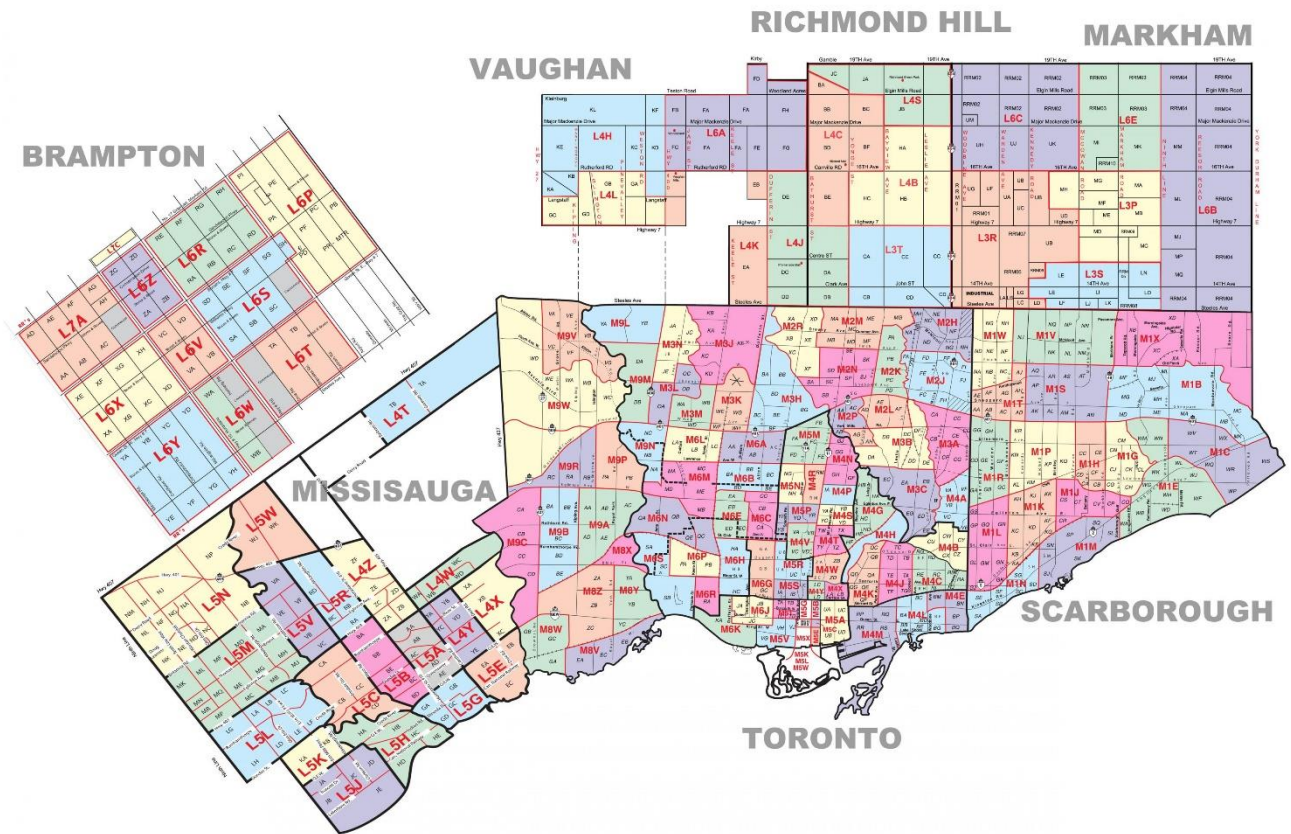


Figure 2. showing the map of Mississauga and neighboring cities with the postal code division. Each postal code is color-coded. The map is retrieved from <https://maps-mississauga.com/mississauga-postal-code-map>.



METHODOLOGY

Based on the project's business requirements, Mississauga city was examined according to its neighborhoods as defined by the postal code. Using postal code is the most reliable way to divide the city and it is also helpful in combining nearby neighborhoods provided that they have similarities.

3.1. Analytical Approach – Clustering Model

Considering the business problem as identified in business understanding and literature review, the unsupervised machine learning approach is used for the available data. Understanding Mississauga's neighborhoods according to the number of car rental companies requires clustering analysis. Clustering will identify associations among various neighborhoods resulting in distinguishing areas of the low and high number of rental companies.

3.2. Data Requirements and Collection

The following data was acquired for the analysis:

- 1) Postal code list of Mississauga city with associated neighborhoods, and
- 2) Coordinates of each postal code.

The data was required in a table format, however, there was various sort of postal code lists available on the internet with the inconsistent dataset. Therefore, this analysis collected the data from the website "<https://postal-codes.cybo.com/canada/mississauga/>" to gather the postal code numbers, associated neighborhoods, and their coordinates (Table 1). The coordinates were also confirmed by google maps.

The collected data was transferred to the excel sheet and saved as a comma-delimited file to use directly in a Jupiter notebook.

	Postal Code	Neighborhood	Latitude	Longitude
0	L4Y	West Applewood, West Dixie, NW Lakeview	43.607600	-79.59970
1	L5M	Churchill Meadows, Central Erin Mills, South S...	43.561800	-79.72320
2	L4X	East Applewood, East Dixie, NE Lakeview	43.618838	-79.58343
3	L5A	Mississauga Valleys, East Cooksville	43.589600	-79.61090
4	L5E	Central Lakeview	43.585500	-79.56600
5	L5B	West Cooksville, Fairview, City Centre, East C...	43.582100	-79.63340
6	L5G	SW Lakeview, Mineola, East Port Credit	43.567500	-79.57720
7	L4W	Matheson, East Rathwood	43.647600	-79.62210
8	L4Z	West Rathwood, East Hurontario, SE Gateway	43.622200	-79.65580
9	L5R	West Hurontario, SW Gateway	43.614800	-79.67830
10	L5C	West Creditview, Mavis, Erindale	43.564100	-79.64460
11	L5H	West Port Credit, Lorne Park, East Sheridan	43.542000	-79.61090
12	L5T	Courtney Park, East Gateway	43.651700	-79.66710
13	L5V	East Credit	43.596800	-79.68950
14	L5J	Clarkson	43.506000	-79.63340
15	L5N	Lisgar, Meadowvale	43.588100	-79.75120
16	L4T	Malton	43.716100	-79.64460
17	L5W	Meadowvale Village	43.636800	-79.71190
18	L5K	Clarkson, Erin Mills	43.525500	-79.66420
19	L5L	Erin Mills	43.543900	-79.68390
20	L5P	Toronto Pearson International Airport	43.690400	-79.62380
21	L5S	Etobicoke, Malton, Streetsville, Toronto Pears...	43.689700	-79.66710
22	L4V	Etobicoke, Malton, Toronto Pearson Internation...	43.689700	-79.66710

Table 1. showing postal codes, neighborhoods, and coordinates of Mississauga city.

3.3. Data Understanding and Preparation

To assess the data, various libraries including Pandas, NumPy, Folium, Matplotlib, and Geopy with Nominatim was imported. The following procedure was pursued:

- The data was loaded in a table format and columns of postal code, coordinates, and neighborhoods were sorted. Irrelevant data was dropped (Table 1).
- Using Nominatim, the location of Mississauga was retrieved.
- To assess the geographical boundaries and limits of the neighborhoods, the postal zones of Mississauga were displayed on a map using the Folium library (Figure 3).

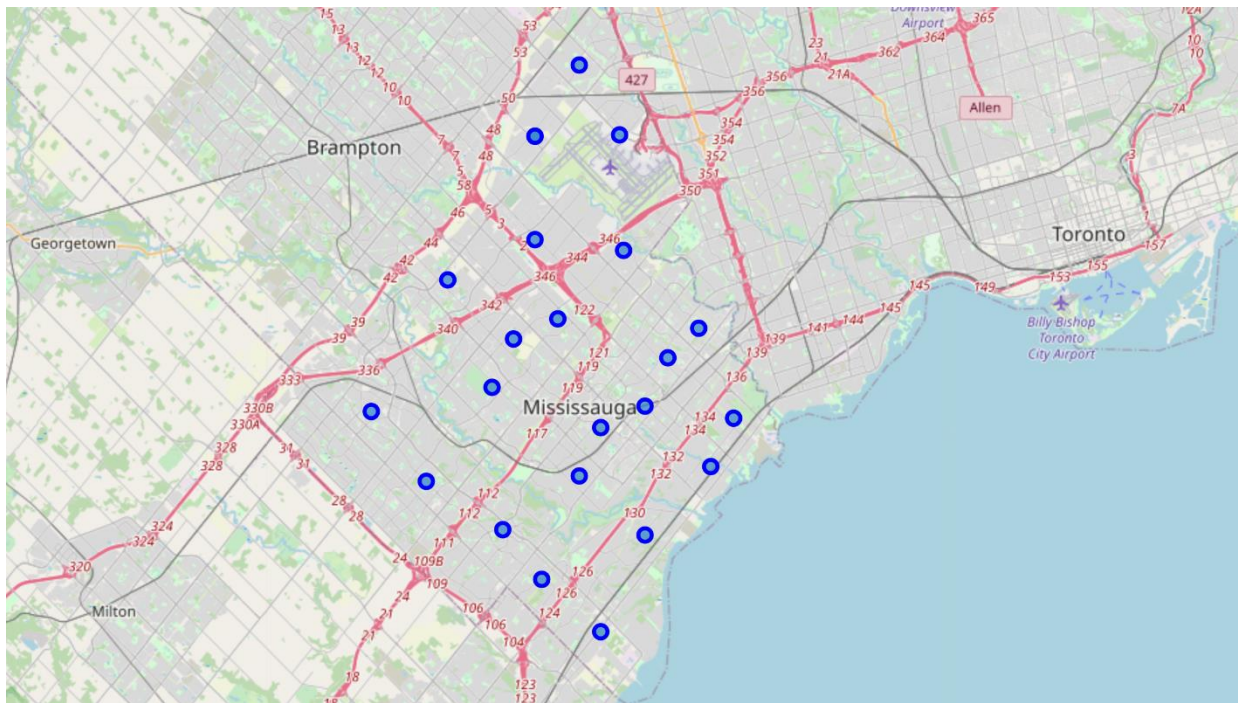


Figure 3. showing the map of Mississauga with superimposed postal code locations in blue circles.

- To find out the rental companies across Mississauga city, we required a location provider. For this purpose, this analysis used the Foursquare location provider. Foursquare requires the user to create an API id and password through which the users can retrieve data about nearby venues, specific venues by their name, provided that the user enters a specific location. In our analysis, we entered query for venue “rental car”, within the surrounding of 10km in each neighborhood.

The Foursquare API resulted in 881 rental car companies including automotive shops in Mississauga City. This dataset needs to be in groups according to the postal codes to examine the density of rental companies in each neighborhood area. Therefore, the data is sorted accordingly with a table showing the total number of rental companies in each neighborhood.

3.4. Modeling

Once the data is formatted to the desired format, it is ready for modeling. For this project, the unsupervised machine learning clustering technique is used. To analyze neighborhoods of similarity in a cluster association, where each cluster association is different from one another, the K-Means clustering approach is utilized.

3.4.1. K-Means Clustering

K-Means clustering is a type of partitioning clustering that divides the data into non-overlapping clusters without any internal cluster structure. Data within a cluster are similar while data across the cluster is different. For K-Means clustering, it is important to initialize the k-value that represents the number of clusters. K-Means clustering involves the following steps:

1. Setting k value to initialize cluster centroids randomly.
2. Perform distance calculation between data points and centroids.
3. Assign each data point to the closest centroid and then find the sum of squared differences between each data point and centroid.
4. This lets the computation of new centroids for each cluster.
5. Step 1 to 4 is repeated until no more changes in centroid location occur.

RESULTS

4.1. Cluster Association by the Number of Car Rental Companies

The K-Means clustering model results in 4 different cluster associations based on the density of rental car companies in different neighborhoods (Figure 4).

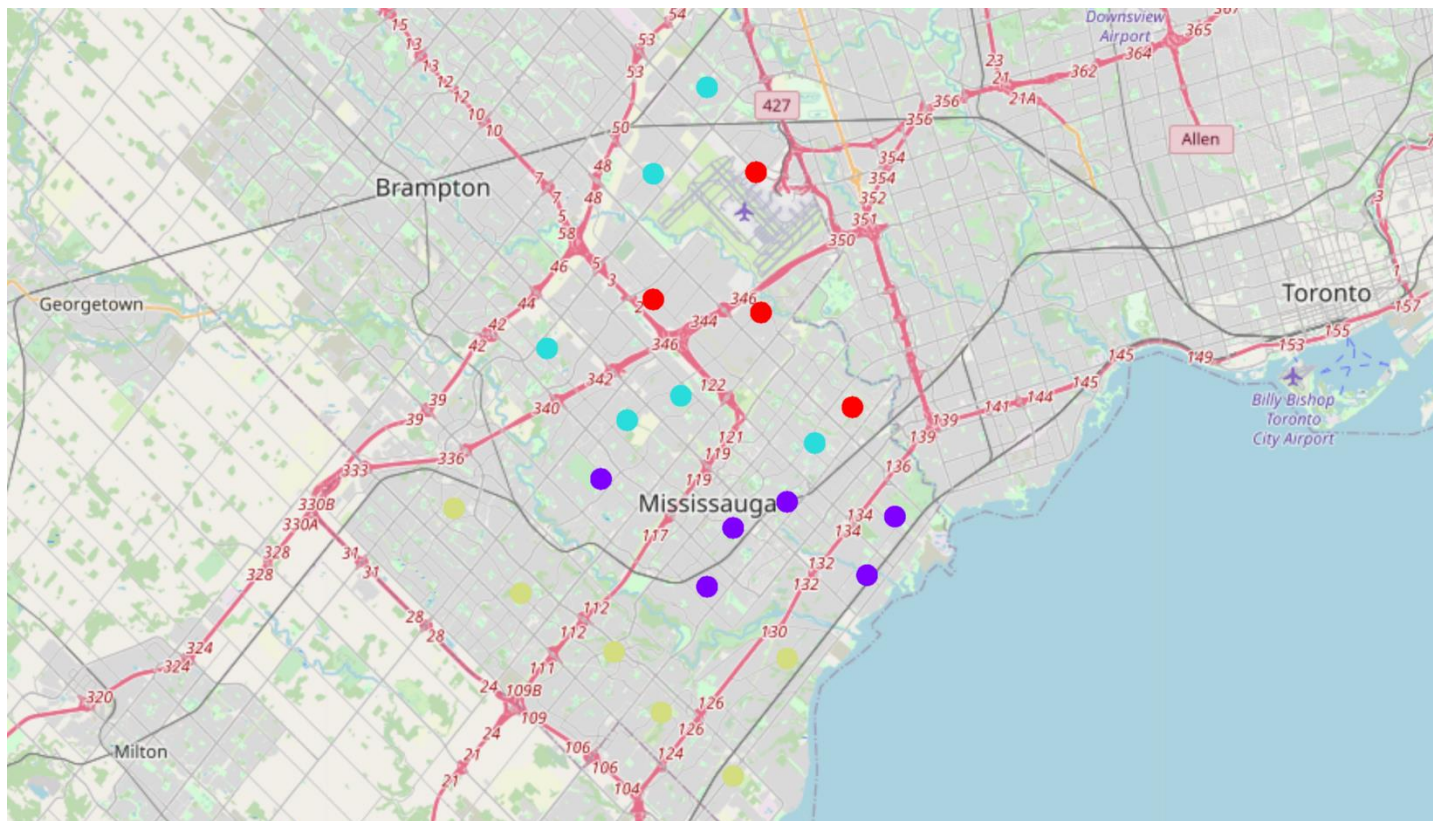


Figure 4. Map of Mississauga, showing a total number of car rental companies in each neighborhood through cluster association. Four clusters are shown with different colors. Cluster 1 is red where the number of car rental companies ranges from 53 to 61. Cluster 2 is purple where the number of car rental companies ranges from 29 to 37. Cluster 3 is blue where the number of car rental companies ranges from 43 to 49. Cluster 4 is yellow where the number of car rental companies ranges from 17 to 27.

4.1.1. Cluster 1

Cluster 1 is represented by a red color that envelops the neighborhoods of L5T (Courtney Park, East Gateway), L4X (East Applewood, East Dixie, NE Lakeview), L4W(Matheson, East Rathwood), and L5P (Toronto Pearson International Airport). This cluster represents the highest density of the rental companies throughout Mississauga (Table 2). This cluster association represents 26% of the rental companies of Mississauga spanning four neighborhoods.

	Neighborhood	Venue Latitude	Venue Longitude	Cluster Labels	Venue Category
0	Courtney Park, East Gateway	61	61	61	61
1	East Applewood, East Dixie, NE Lakeview	53	53	53	53
2	Matheson, East Rathwood	58	58	58	58
3	Toronto Pearson International Airport	55	55	55	55

Table 2. showing the neighborhoods of cluster 1, represented by the red color in figure 4. The columns of Venue Latitude, Venue Longitude, Cluster Labels, and Venue Category are showing the total number of car rental companies in each neighborhood. The total number of companies in this cluster are 227 spread across 4 neighborhoods.

4.1.2. Cluster 2

Cluster 2 is represented by a purple color that envelops the neighborhoods of L5E (Central Lakeview), L5V (East Credit), L5A (Mississauga Valleys, East Cooksville), L5G (SW Lakeview, Mineola, East Port Credit), L5B (West Cooksville, Fairview, City Centre, East Creditview), and L5C (West Creditview, Mavis, Erindale). This cluster represents the average to a low density of the rental companies within Mississauga. This cluster association represents 22.4% of the rental companies of Mississauga spanning across six neighborhoods (Table 3).

	Neighborhood	Venue Latitude	Venue Longitude	Cluster Labels	Venue Category
0	Central Lakeview	32	32	32	32
1	East Credit	29	29	29	29
2	Mississauga Valleys, East Cooksville	37	37	37	37
3	SW Lakeview, Mineola, East Port Credit	30	30	30	30
4	West Cooksville, Fairview, City Centre, East C...	37	37	37	37
5	West Creditview, Mavis, Erindale	33	33	33	33

Table 3. showing the neighborhoods of cluster 2, represented by a purple color in figure 4. The columns of Venue Latitude, Venue Longitude, Cluster Labels, and Venue Category are showing the total number of car rental companies in each neighborhood. The total number of companies in this cluster are 198 spread across 6 neighborhoods.

4.1.3. Cluster 3

Cluster 3 is represented by a blue color that envelops the neighborhoods of L5S (Etobicoke, Malton, Streetsville, Toronto Pearson International Airport), L4V (Etobicoke, Malton, Toronto Pearson International Airport), L4T (Malton), L5W (Meadowvale Village), L4Y (West Applewood, West Dixie, NW Lakeview), L5R (West Hurontario, SW Gateway), and L4Z (West Rathwood, East Hurontario, SE Gateway). This cluster represents a high density of the rental companies within Mississauga. This cluster association represents 36.3% of the rental companies of Mississauga spanning across seven neighborhoods (Table 4).

	Neighborhood	Venue Latitude	Venue Longitude	Cluster Labels	Venue Category
0	Etobicoke, Malton, Streetsville, Toronto Pears...	43	43	43	43
1	Etobicoke, Malton, Toronto Pearson Internation...	43	43	43	43
2	Malton	48	48	48	48
3	Meadowvale Village	46	46	46	46
4	West Applewood, West Dixie, NW Lakeview	49	49	49	49
5	West Hurontario, SW Gateway	44	44	44	44
6	West Rathwood, East Hurontario, SE Gateway	47	47	47	47

Table 4. showing the neighborhoods of cluster 3, represented by a blue color in figure 4. The columns of Venue Latitude, Venue Longitude, Cluster Labels, and Venue Category are showing the total number of car rental companies in each neighborhood. The total number of companies in this cluster are 320 spread across 7 neighborhoods.

4.1.4. Cluster 4

Cluster 4 is represented by a yellow color that envelops the neighborhoods of L5M (Churchill Meadows, Central Erin Mills, South Streetsville), L5J (Clarkson), L5K (Clarkson, Erin Mills), L5L (Erin Mills), L5N (Lisgar, Meadowvale), and L5H (West Port Credit, Lorne Park, East Sheridan). This cluster represents the lowest density of the rental companies throughout Mississauga. This cluster association represents 15.4% of the rental companies of Mississauga spanning across six neighborhoods (Table 5).

	Neighborhood	Venue Latitude	Venue Longitude	Cluster Labels	Venue Category
0	Churchill Meadows, Central Erin Mills, South S...	24	24	24	24
1	Clarkson	21	21	21	21
2	Clarkson, Erin Mills	26	26	26	26
3	Erin Mills	27	27	27	27
4	Lisgar, Meadowvale	17	17	17	17
5	West Port Credit, Lorne Park, East Sheridan	21	21	21	21

Table 5. showing the neighborhoods of cluster 4, represented by a yellow color in figure 4. The columns of Venue Latitude, Venue Longitude, Cluster Labels, and Venue Category are showing the total number of rental car companies in each neighborhood. The total number of companies in this cluster are 136 spread across 6 neighborhoods.

4.2. Cluster Association by the Dominant Car Rental Companies

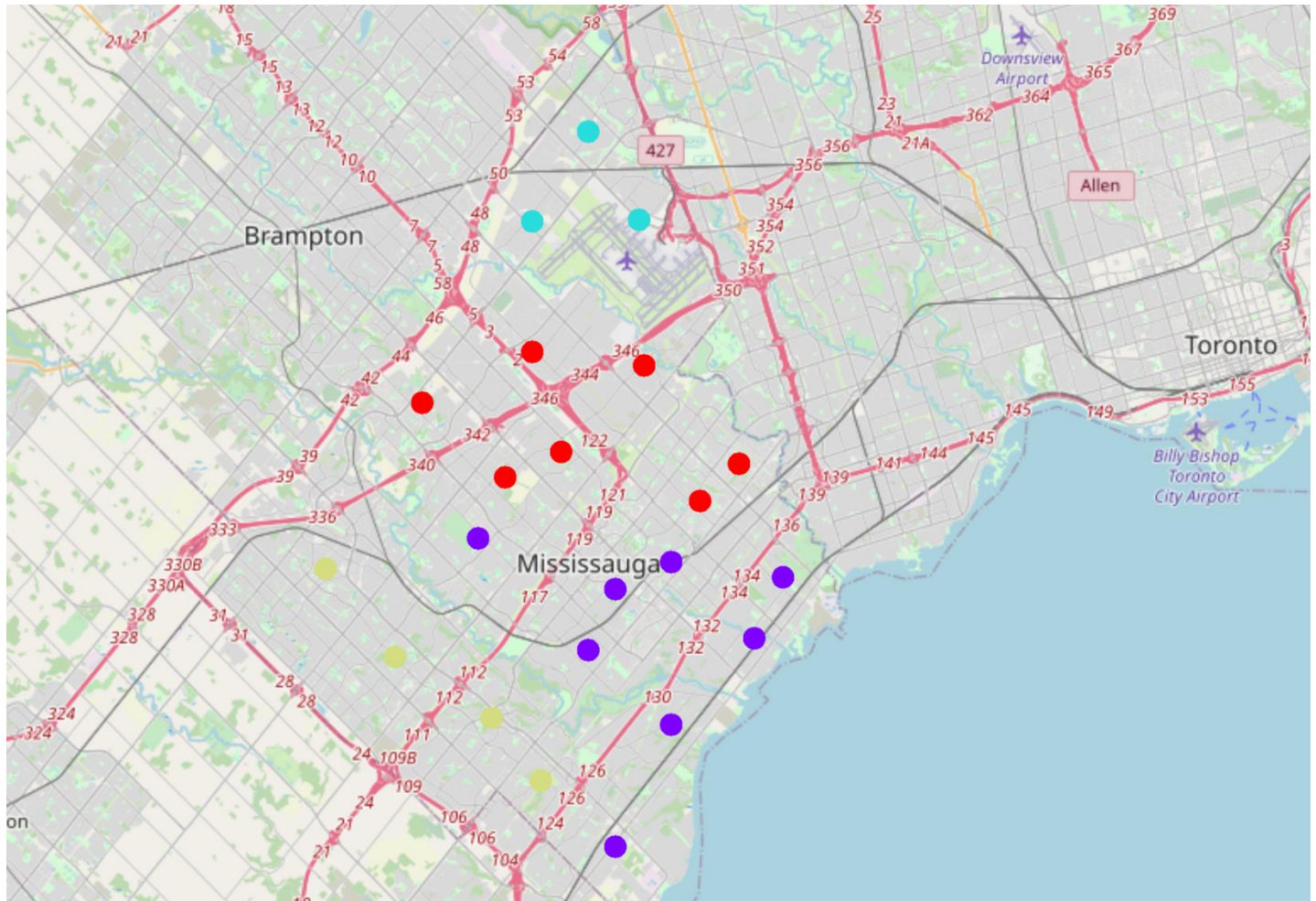


Figure 5. showing a map of Mississauga, showing cluster association based on the most commonly occurring car rental company in an area. Four clusters are shown with different colors and they vary in order of 1st to 10th most commonly occurring companies in an area.

4.2.1. Cluster 1

Cluster 1 neighborhoods have the following car rental companies in order of the first most common venue to the tenth most common venue (Table 6): Enterprise Rent-A-Car, Auto Loan Solutions, Avis Car Rental, Thrifty Car Rental, Budget Car Rental, Discount Car & Truck Rentals, Dollar Rent A Car, Payless Car Rental, Hertz and E-Z Rent-A-Car.

Neighborhood	Venue Latitude	Venue Longitude	Venue Category	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 West Applewood, West Dixie, NW Lakeview	43.683041	-79.611507	Rental Car Location	0	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Thrifty Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car & Truck Rentals	Dollar Rent A Car	Payless Car Rental	Hertz	E-Z Rent-A-Car
1 West Applewood, West Dixie, NW Lakeview	43.682373	-79.611094	Rental Car Location	0	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Thrifty Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car & Truck Rentals	Dollar Rent A Car	Payless Car Rental	Hertz	E-Z Rent-A-Car
2 West Applewood, West Dixie, NW Lakeview	43.683010	-79.612779	Rental Car Location	0	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Thrifty Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car & Truck Rentals	Dollar Rent A Car	Payless Car Rental	Hertz	E-Z Rent-A-Car
3 West Applewood, West Dixie, NW Lakeview	43.686466	-79.619245	Rental Car Location	0	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Thrifty Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car & Truck Rentals	Dollar Rent A Car	Payless Car Rental	Hertz	E-Z Rent-A-Car

Table 6. showing the neighborhoods of cluster 1 in red color with rental car companies in order of 1st most common to 10th most common venue.

4.2.2. Cluster 2

Cluster 2 neighborhoods have the following car rental companies in order of the first most common venue to the tenth most common venue (Table 7): Enterprise Rent-A-Car, Auto Loan Solutions, Avis Car Rental, Budget Car Rental, Discount Car & Truck Rentals, Thrifty Car Rental, Dollar Rent A Car, Hertz, Budget Truck Rental and Denny's.

	Neighborhood	Venue Latitude	Venue Longitude	Venue Category	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
126	Mississauga Valleys, East Cooksville	43.588777	-79.607382	Rental Car Location	1	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car & Truck Rentals	Thrifty Car Rental	Dollar Rent A Car	Hertz	Budget Truck Rental	Denny's
127	Mississauga Valleys, East Cooksville	43.586025	-79.608886	Rental Car Location	1	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car & Truck Rentals	Thrifty Car Rental	Dollar Rent A Car	Hertz	Budget Truck Rental	Denny's
128	Mississauga Valleys, East Cooksville	43.584694	-79.611418	Rental Car Location	1	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car & Truck Rentals	Thrifty Car Rental	Dollar Rent A Car	Hertz	Budget Truck Rental	Denny's
129	Mississauga Valleys, East Cooksville	43.592308	-79.633863	Rental Car Location	1	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car & Truck Rentals	Thrifty Car Rental	Dollar Rent A Car	Hertz	Budget Truck Rental	Denny's

Table 7. showing the neighborhoods of cluster 2 in purple color with rental car companies in order of 1st most common to 10th most common venue

4.2.3. Cluster 3

Cluster 3 neighborhoods have the following car rental companies in order of the first most common venue to the tenth most common venue (Table 8): Enterprise Rent-A-Car, Discount Car & Truck Rentals, Avis Car Rental, Budget Car Rental, Hertz, Payless Car Rental, Kal Tire, E-Z Rent-A-Car, Alamo Rent A Car, and Auto Loan Solutions.

Neighborhood	Venue Latitude	Venue Longitude	Venue Category	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	
593	Malton	43.683041	-79.611507	Rental Car Location	2	Enterprise Rent-A-Car	Discount Car & Truck Rentals	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Hertz	Payless Car Rental	Kal Tire	E-Z Rent-A-Car	Alamo Rent A Car	Auto Loan Solutions
594	Malton	43.682373	-79.611094	Rental Car Location	2	Enterprise Rent-A-Car	Discount Car & Truck Rentals	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Hertz	Payless Car Rental	Kal Tire	E-Z Rent-A-Car	Alamo Rent A Car	Auto Loan Solutions
595	Malton	43.683010	-79.612779	Rental Car Location	2	Enterprise Rent-A-Car	Discount Car & Truck Rentals	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Hertz	Payless Car Rental	Kal Tire	E-Z Rent-A-Car	Alamo Rent A Car	Auto Loan Solutions
596	Malton	43.686466	-79.619245	Rental Car Location	2	Enterprise Rent-A-Car	Discount Car & Truck Rentals	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Hertz	Payless Car Rental	Kal Tire	E-Z Rent-A-Car	Alamo Rent A Car	Auto Loan Solutions

Table 8. showing the neighborhoods of cluster 3 in blue color with car rental companies in order of 1st most common to 10th most common venue.

4.2.4. Cluster 4

Cluster 4 neighborhoods have the following car rental companies in order of the first most common venue to the tenth most common venue (Table 9): Enterprise Rent-A-Car, Auto Loan Solutions, Avis Car Rental, Budget Car Rental, Discount Car & Truck Rentals, Dollar Rent A Car, Thrifty Car Rental, Serena Motors Ltd., Budget Truck Rental, and Discount Car & Truck Rentals.

Neighborhood	Venue Latitude	Venue Longitude	Venue Category	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
49 Churchill Meadows, Central Erin Mills, South S...	43.585101	-79.741007	Rental Car Location	3	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car and Truck Rentals	Dollar Rent A Car	Thrifty Car Rental	Serena Motors Ltd	Budget Truck Rental	Discount Car & Truck Rentals
50 Churchill Meadows, Central Erin Mills, South S...	43.589062	-79.739822	Rental Car Location	3	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car and Truck Rentals	Dollar Rent A Car	Thrifty Car Rental	Serena Motors Ltd	Budget Truck Rental	Discount Car & Truck Rentals
51 Churchill Meadows, Central Erin Mills, South S...	43.592556	-79.727840	Rental Car Location	3	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Budget Car Rental (Budget Car & Truck Rental)	Discount Car and Truck Rentals	Dollar Rent A Car	Thrifty Car Rental	Serena Motors Ltd	Budget Truck Rental	Discount Car & Truck Rentals
52 Churchill Meadows, Central Erin Mills, South S...	43.591560	-79.741431	Rental Car Location	3	Enterprise Rent-A-Car	Auto Loan Solutions	Avis Car Rental	Budget Car Rental (Budget Car & Truck	Discount Car and Truck Rentals	Dollar Rent A Car	Thrifty Car Rental	Serena Motors Ltd	Budget Truck Rental	Discount Car & Truck Rentals

Table 9. showing the neighborhoods of cluster 4 in yellow color with car rental companies in order of 1st most common to 10th most common venue.



DISCUSSION

It is evident from the results that cluster 1 in red has the highest density of car rental companies (Table 2). While cluster 4 in yellow has the least density of car rental companies (Table 5). It is therefore important to understand the geography and location details of the city to underpin the distribution of the car rental companies, which will eventually assist a stakeholder to expand a current business or start a new one.

5.1. Areas with High Density of Rental Companies

The neighborhoods of Courtney Park, East Gateway, Matheson, East Rathwood, and Toronto Pearson Airport are surrounded by the major highways including highway 401 running NE and SW in the city, highway 410 running NW and SE, and highway 427 (Figure 6). The highways have a main junction near the airport where other highway connectors exist (Figure 6). **As it is one of the busiest highways with multiple junctions, it is the most vulnerable location for possible accidents.** Therefore, most of the car rental companies who provide accidental insurance or insurance replacement have their hubs in this location.

Additionally, **proximity to the airport is another reason why most of the car rental companies chose to sit in nearby areas.** People arriving at the airport find it feasible to rent a car from/ or a nearby airport. Airports are always the prime locations for a rental car company.

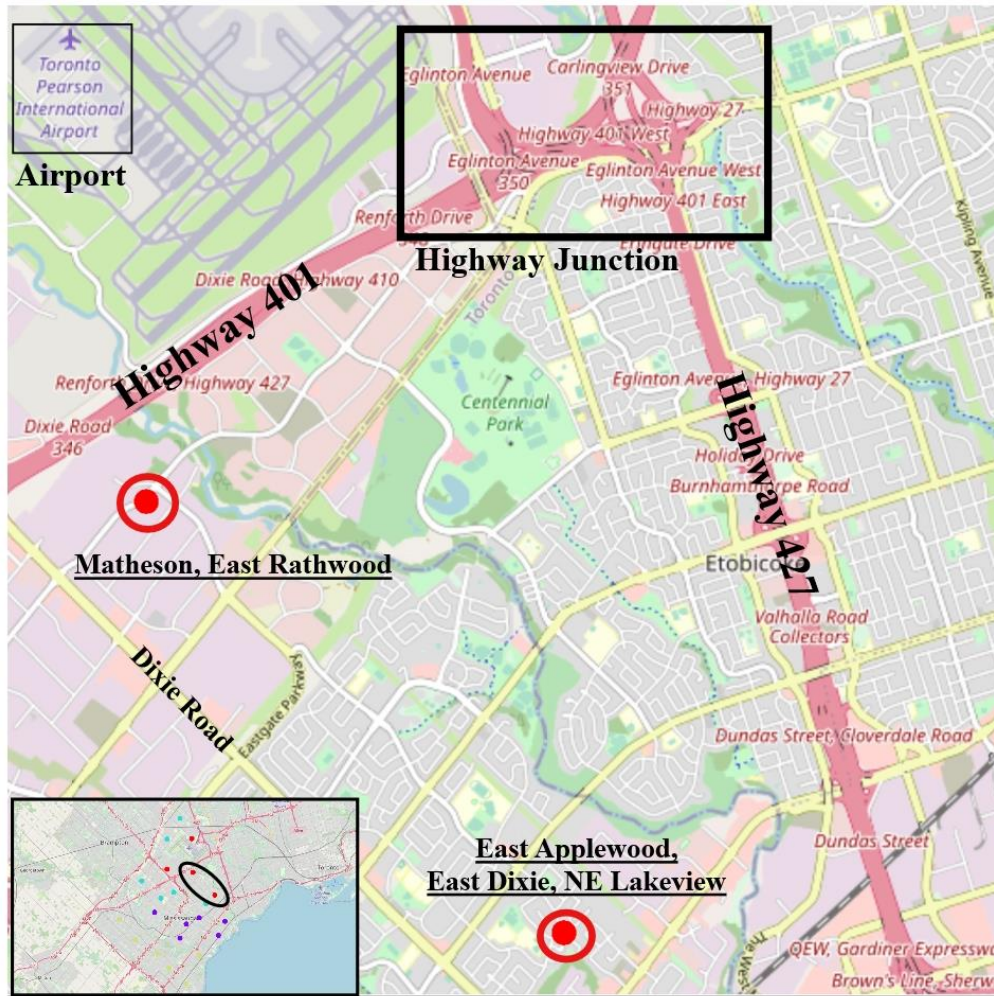


Figure 7. showing the two neighborhoods of cluster 1 in red circles. Highways and major roads are labeled. Highway junction is shown with a black outlined box. A small map in the bottom left corner shows the cluster position according to figure 4.

5.2. Areas with Moderate Density of Rental Companies

The neighborhoods of cluster 2 have a relatively low density of car rental companies (Table 3) than the neighborhoods of cluster 3 (Table 4).

Cluster 2 is mostly in the south and southeast of the city close to Lakeshore (Figure 8). Towards south in East Port Credit and Central Lakeview, the area is popular for tourism and is seasonally busy during the time of summer. Therefore, it is expected to have a relatively lesser number of car rental companies operating in this zone. Further north of the Lakeshore is the residential areas of Cooksville, Erindale, and Mississauga Valley which are relatively close to the highways and envelops the city center (Figure 8). This area is a hub of malls and plazas and probably a moderate number of 29 to 37 car rental companies (Table 3) suffice the need for this location.



Figure 9. showing two neighborhoods of cluster 3 in blue circles. Highways, city landmarks, and major roads are labeled. A small map in the bottom right corner shows the cluster position according to figure 4.

The second association of cluster 3 is near East and West Hurontario, SE and SW Gateway, Meadowvale Village, West Applewood, West Dixie, and NW Lakeview (Figure 10). These neighborhoods are close to the junction of highways 401 and 403. It is the hub of business plazas and business centers; therefore, it is the second-most populous association of rental car companies within Mississauga.

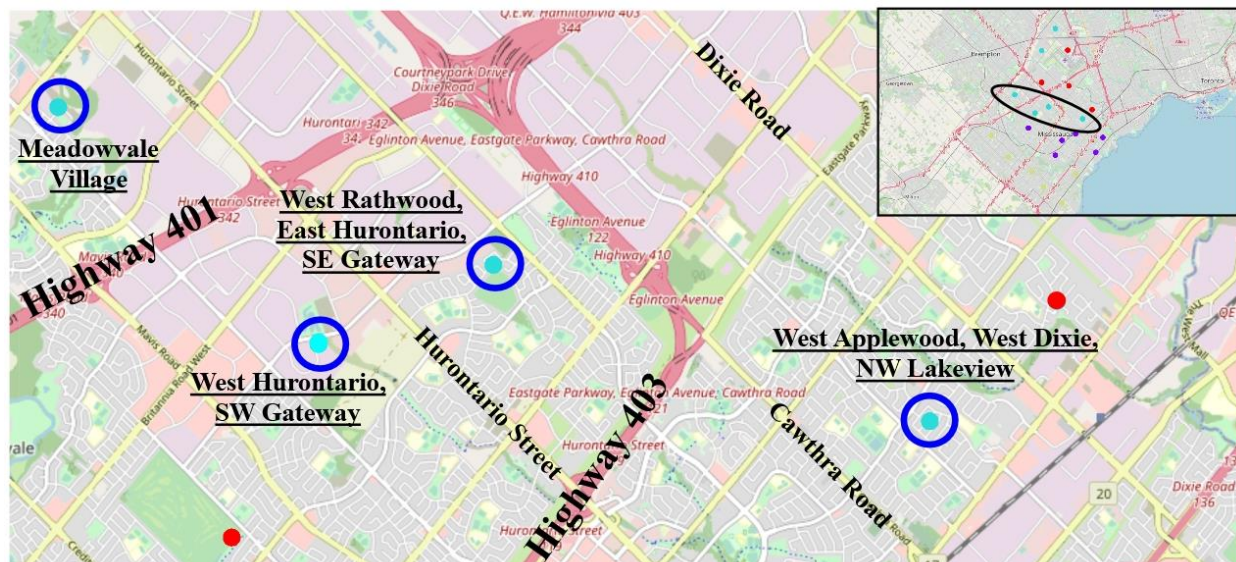


Figure 10. showing four neighborhoods of cluster 3 in blue circles. Highways and major roads are labeled. A small map on the top right corner shows the cluster position according to figure 4.

5.3. Areas with Least Density of Rental Companies

Cluster 4 is the south and southwest part of Mississauga city (Figure 11) that represents only 16% of the total rental car companies in the city (Table 5). These neighborhoods are mainly residential areas, calm and quiet locations. **Therefore, the rate of accidents is low and there are more chances for companies to operate as a daily car rental business.**

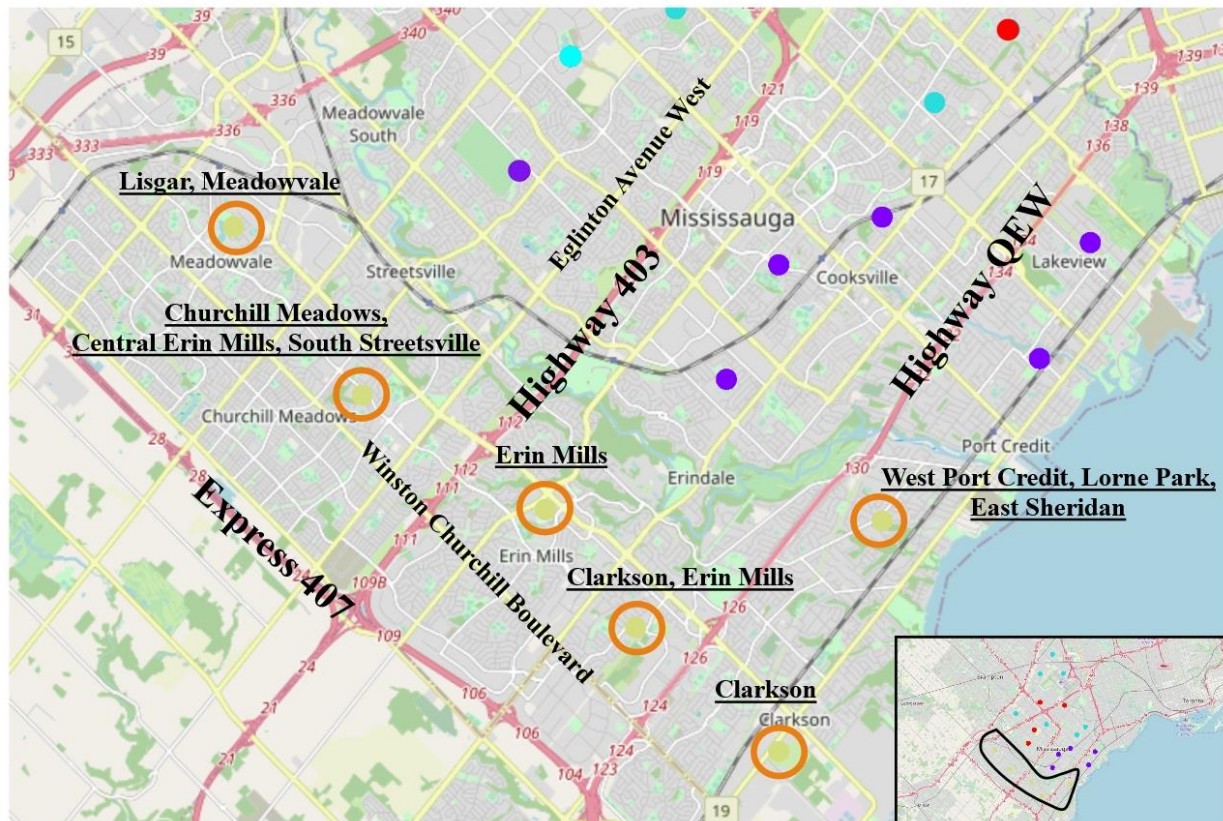


Figure 11. showing all the neighborhoods of cluster 4 in yellow circles. Highways and major roads are labeled. A small map in the bottom right corner shows the cluster position according to figure 4.

5.4. Dominant Car Rental Companies

Throughout Mississauga, the first common venue in all the neighborhoods is Enterprise Rent-A-Car, followed by Auto Loan Solutions. Third to fifth common venue among all neighborhoods vary between Avis Car Rental, Thrifty Car Rental, Budget Car Rental, and Discount Car & Truck Rentals. Cluster 3 has a relatively different set of venues, else most of the clusters have a similar range of venues (Table 8). Payless Car Rental, Hertz, Discount Car & Truck Rentals, and E-Z Rent-A-Car have been varying from seventh to the tenth commonplace in most of the neighborhoods.

5.5. Car Rental Business Opportunity in Mississauga

Figure 12 shows combined results from the cluster association by the density of car rental companies and cluster association by the dominant car rental companies.

5.5.1. Opportunity for an Existing Car Rental Business

5.5.1.1. Neighborhoods with Highest Density and Dominant Car Rental Companies

Only four neighborhoods (L5T, L5P, L4X, and L4W) have the highest density of car rental companies throughout Mississauga (Table 2) as they are proximal to the airport and the major highway junctions connecting Mississauga to other cities (Figure 6, 7). Enterprise Rent-A-Car, Auto Loan Solutions, and Avis Car Rental companies dominate in these areas, however, within this cluster L5T and L5P have a relatively lower frequency of car rental companies than the areas of L4X and L4W (Figure 12). **Therefore, L5T and L5P could be a possible area where a business expansion can take place specifically for car accidental/ or insurance replacement rental.** Though these areas are prime locations for a car rental company, a new company may face intense business competition as it is by the dominantly occurring companies.

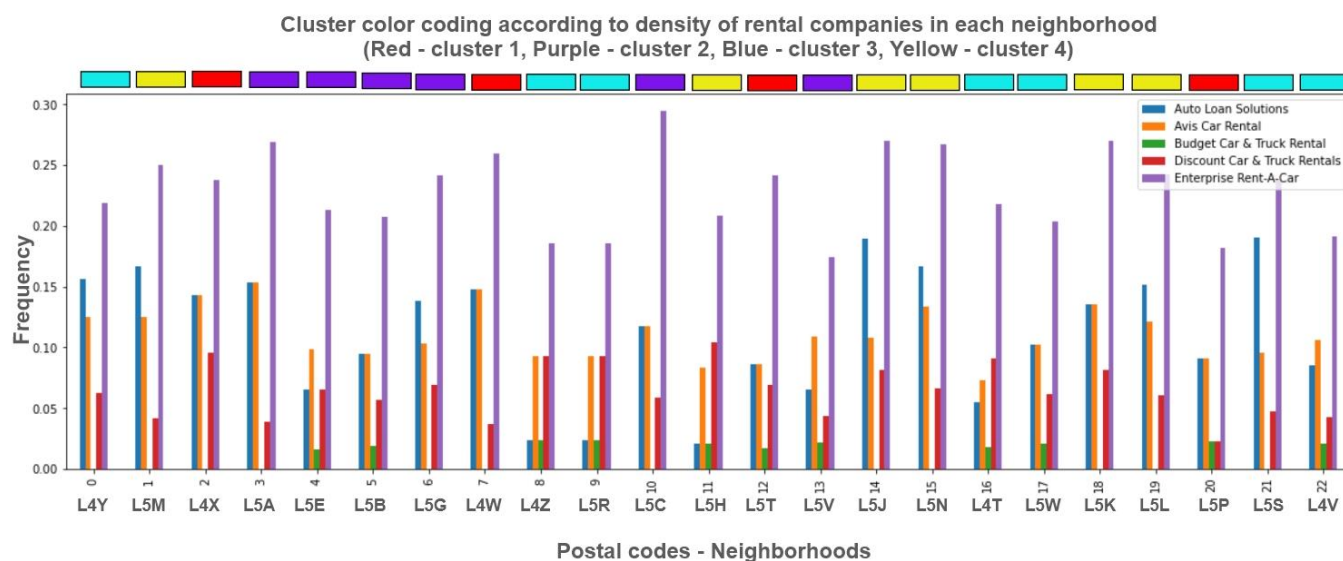


Figure 12. showing the bar graph of five major car rental companies and their frequency of occurrence in each neighborhood. The X-axis shows the neighborhoods, for which the postal codes are mentioned. Y-axis represents the frequency of car rental companies in each neighborhood. A color-coded legend is presented at the top of the graph according to the density of car rental companies in each neighborhood. Color coding is according to the cluster colors. Red represents the neighborhoods of the highest density of car rental companies followed by blue representing the average to a high density of car rental companies, purple with average to a low density of car rental companies, and yellow with the lowest density of car rental companies.

5.5.1.2. Neighborhoods with Lowest Density and Dominant Car Rental Companies

Neighborhoods in the yellow cluster (L5M, L5J, L5K, L5L, L5N, and L5H) have the least density of car rental companies (Table 5) and they are occupied by the dominant car rental companies: Enterprise Rent-A-Car, Auto Loan Solutions, Avis Car Rental, and Discount Car & Truck Rental. Budget Car Rental company appears to be in low frequency in this cluster (Figure 12). This cluster is mainly in residential areas (Figure 11) and it is expected that most of the dominant car rental companies have their branches in these neighborhoods. **Therefore, it appears that neighborhoods in this cluster could be an opportunity for the expansion of an existing car rental company rather than a new car rental venture.**

5.5.2. Opportunity to Expand an Existing Accidental Car Rental Business and/ or A New Daily Car Rental Business

5.5.2.1. Neighborhoods with Moderate to High Density and Dominant Car Rental Companies

Seven neighborhoods (L4Y, L4Z, L5R, L4T, L5W, L5S, and L4V) in the blue cluster have moderate to a high density of car rental companies (Table 4) as they are proximal to the Airport and the business centers (Figure 9, 10). Cluster blue occupies the busy part of Mississauga city where Enterprise Rent-A-Car, Auto Loan Solutions, and Avis Car Rental companies dominate in most of the neighborhoods except in areas of L4Z and L5R where Discount Car & Truck Rental has higher occurrence than Auto Loan Solutions (Figure 12). Similarly, in areas of L4T and L5W, the frequency of dominant rental companies other than Enterprise Rent-A-Car is 0.11 (Figure 12), which is quite low within the blue cluster. Additionally, the overall frequency of Enterprise Rent-A-Car company is low (0.23 – 0.24) in this cluster in comparison to other clusters (Figure 12).

This blue cluster shows a great variation with respect to the occurrence of car rental companies. **It is suggested that the areas of L4Z and L5R could be a possible opportunity to expand a car accidental rental company as these areas are sandwiched between highways. The area of L4T being close to the Airport (Figure 9) could be a possible opportunity for a new daily car rental business.** Though the new business may face competition from existing companies, the location is prime due to its proximity to the airport and may require some time to be in a running business.

5.5.2.2. Neighborhoods with Moderate to Low Density and Dominant Car Rental Companies

Six neighborhoods in the purple cluster (L5E, L5V, L5A, L5G, L5B, and L5C) are extremely dominated by the Enterprise Rent-A-Car company with maximum occurrence more than 0.25 throughout Mississauga (Figure 12). The other dominant car rental companies Auto Loan Solutions, Avis Car Rental, Discount Car & Truck Rental, and Budget Car Rental have occurrence no more than 0.16 frequency (Figure 12). It appears that Enterprise Rent-A-Car has greater coverage in these neighborhoods probably due to proximity to the City center and Lakeshore region. The only neighborhood with a low occurrence of rental companies within this cluster is L5V – the neighborhood of East Credit (Figure 12).

L5V could potentially be a good opportunity for any existing business or a new business to operate for both accidental car rental and daily rental.



CONCLUSION

The analysis presented in this report concludes the following results:

6.1. Prime Location to Expand an Existing Car Accidental Rental Business

- L5T - Courtney Park, East Gateway, and L5P - Toronto Pearson International Airport due to their proximity to the airport and major highway junctions.
- L5R - West Hurontario, SW Gateway, and L4Z - West Rathwood, East Hurontario, SE Gateway as these areas' neighborhoods are sandwiched between highways.

6.2. Possible Location to Expand an Existing Daily Car Rental Business

- L5M - Churchill Meadows, Central Erin Mills, South Streetsville, L5J – Clarkson, L5K - Clarkson, Erin Mills, L5L - Erin Mills, L5N - Lisgar, Meadowvale, and L5H - West Port Credit, Lorne Park, East Sheridan.

6.3. Prime Location for a New Daily Car Rental Business

- Area of L4T - Malton being close to the Airport could be a possible opportunity for a new daily car rental business.

6.4. Possible Location for a New or Existing Business of Daily Car Rental or Car Accidental Rental Business

- L5V – East Credit could potentially be a good opportunity for any existing business or a new business to operate for either car accidental rental or daily car rental or both.



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