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CAPSTONE PROJECT

THE BATTLE OF THE NEIGHBOURHOODS

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IBM DATA SCIENCE PROFESSIONAL CERTIFICATION

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Introduction

Background

The Lotus group of companies are a group of companies established in Malaysia in the 1980's, with businesses ranging from Indian F&B outlets, cinema chains and hospitality. They are also the main movie distributor of Tamil and Hindi movies in Malaysia. They found success by pairing the dine-in restaurant experience specializing in Indian cuisine, together with the Indian cinema experience in Malaysia where Indians make up the third largest cultural demographic group.

Problem Statement

They are now looking to use the same value proposition that won them success in Malaysia and expand in North America. Both New York and Toronto were considered as they both are the financial capitals of their respective countries and both are very diverse cities. However, Toronto was selected as it much more diverse with 51.5% of residents belonging to minority communities and 12.6% of the total residents that belong to the South Asian community.

The purpose of this project is:

- 1) To find a location/district/riding within Toronto that would be suitable to open an India F&B outlet together with a movie theatre specializing in Indian Cinema.
- 2) To assess the competitiveness of the local Indian cuisine scene at the selected location, as well as the local cinema scene.
- 3) To determine the uniqueness of their business model by determining if other businesses have a similar model or not.
- 4) To assess all the potential opportunities and risks from the data gathered and make a recommendation on the expansion plan by the Lotus group.

Data

The first set of data was gathered on the demographics of the residents on Toronto. The data on the last complete census gathered by Statics Canada in 2016 was investiaged. The data was sourced from Wikipedia which has tabulated and summarized all the relevant data and information that was required.

- The overall demographics for each cultural group of the residents in Toronto was gathered, to support the initial assumption of high concentration of East Indian & South Asian communities residing in Toronto.
- Next, data on the districts/ridings in Toronto was explored to determine where the highest concentrations of East Indian community were located.
- Once the district/riding was identified, exploratory data analysis was conducted around the location selected using the Foursquare API.
- All the data on restaurants around the location that served Indian cuisine was gathered then all irrelevant data was filtered out. The overall ratings and customer feedback information for each restaurant was the assessed.
- The same data analysis with Foursquare API was also carried out on the cinemas around the location selected. Data on the overall ratings and feedback information for all relevant cinemas were assessed as well.
- The coordinates of all points of interest (Indian restaurants and cinemas) were extracted and displayed on map for better visualization and understanding.

Once all the data was gathered, processed, cleaned, and visualized, all the potentials opportunities and risks were analysed, followed by a recommendation/conclusion on whether to proceed with the business plan specified in the problem statement.

Methodology

Web Scraping using BeautifulSoup

For this project, a Jupyter Notebook was used to collect and prepare the data required and Python was used as the programming language for the notebook.

First the required data from Wikipedia, regarding the demographics of Toronto from this link: https://en.wikipedia.org/wiki/Demographics_of_Toronto, needed to be web scraped. The BeautifulSoup library was imported into the Notebook and the HTML data was pulled from the specified URL. Python's 'html.parser' was then used to parse the HTML data and collect all the table information as demonstrated in the lines of code seen below:

```
url='https://en.wikipedia.org/wiki/Demographics_of_Toronto'
url_1 = requests.get(url).text
soup = BeautifulSoup(url_1, "html.parser")
#print(soup.prettify())

table = soup.find_all("table", attrs={"class": "wikitable sortable"})
```

Descriptive Statistical Testing on East Indian Population Data in Toronto

The first bit of data needed to be explored, was statistical data on the top 20 ethnic origins in the city of Toronto. The data was presented in a data frame using the Pandas library. A list is created containing the column headers of the data frame as strings. The row data was extracted using a loop function into another empty list to contain the extracted row data. A data frame with values from each list is then created as seen in the lines of code below:

```
td_data=[]
for data in table1.find_all('tr'):
    row=[]
    for td in data.find_all('td'):
        row.append(td.text.strip())
    td_data.append(row)

columns=['Top 20 Ethnic origins in the City of Toronto','Population(2016)','Pop. %',
        'Riding with Highest Concentration','Riding Conc. %']
df = pd.DataFrame(td_data, columns=columns)
df=df.drop(df.index[0])
df = df.reset_index(drop=True)
df = df.set_index('Top 20 Ethnic origins in the City of Toronto')
df['Pop. %'] = df['Pop. %'].astype(float)
df=df.drop(df.index[20])
df
```

- The results for the above code can be seen in the Results section under **Figure 1**

The relevant data in the data frame is then extracted and visualized using Matplotlib, on a horizontal bar plot for better understanding of the data, as seen in the lines of code below:

```
df_plot1=df['Pop. %']
df_plot1.plot(kind='barh', figsize=(10, 6), color='green')
plt.xlabel('% of Total Population in Toronto')
plt.ylabel('Ethnic Origins')
plt.title('Top 20 Ethnic Origins of Toronto Residents')
for index, value in enumerate(df_plot1):
    plt.text(value, index, str(value))

plt.show()
```

- The results for the above code can be seen in the Results section under **Figure 2**

From the data in the first data frame generated, it was observed that the highest concentration of the East Indian community is located in the Etobicoke North district/riding in Toronto. Etobicoke North is explored as a potential business location. A new data frame was generated on the demographic breakdown on ethnic groups residing in Etobicoke, similar to how the data frame on top 20 ethnic origins in the city of Toronto was generated, using the lines of code seen below:

```
table2 = table[8]
```

```
td_data2=[]
for data2 in table2.find_all('tr'):
    row2=[]
    for td in data2.find_all('td'):
        row2.append(td.text.strip())
    td_data2.append(row2)
```

```
columns2=['Riding','Population','Ethnic Group #1','Highest %','Ethnic Group #2','2nd Highest %',
          'Ethnic Group #3','3rd Highest %',
          'Ethnic Group #4','4th Highest %','Ethnic Group #5','5th Highest %']
df2 = pd.DataFrame(td_data2, columns=columns2)
df2 = df2.drop(df2.index[0])
df2 = df2.set_index('Riding')
df2
```

- The results for the above code can be seen in the Results section under **Figure 3**

From the data frame generated, only the data on the ethnic group breakdown in the Etobicoke North district/riding is extracted into another new data frame for ease of visualizing of the data on a vertical bar plot with Matplotlib, as seen in the lines of code listed below:

```
columns_plot=['Ethnic Group','%']
data_plot={'Ethnic Group':['South Asian','White','Black','Others'],
           '%':[28.9,23.8,23.4,23.9]}
df_plot=pd.DataFrame(data_plot,columns=columns_plot)
df_plot = df_plot.set_index('Ethnic Group')

ax = df_plot.plot(kind='bar', figsize=(10, 6), color=['#5bc0de'], fontsize=14)

ax.set_title("Demographics of Etobicoke North", fontsize=16)
ax.set_ylabel('% of Total Population = 116,960')
ax.set_facecolor('white')

for p in ax.patches:
    ax.annotate(str(p.get_height()), (p.get_x()+0.15, p.get_height()+0.15), fontsize=14)
```

- The results for the above code can be seen in the Results section under **Figure 4**

Exploratory Data Analysis on the Restaurants in Etobicoke North using the FourSquare API

Using a geocoder the central coordinates for Etobicoke North was determined. A search endpoint was then used to query the locations around the coordinates of Etobicoke North with a 5000m radius. Several search query terms were used such as Indian, South Asian, Indian restaurant, Indian cuisine but finally the search query was set as Indian as that yielded the most relevant set of data. The results are stored in JSON format before being converted into a data frame, as seen the lines of code below:

```
address = 'Etobicoke North, Toronto'
geolocator = Nominatim(user_agent="foursquare_agent")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print(latitude, longitude)

43.7410925 -79.5892249

search_query = 'indian'
radius = 5000
print(search_query + ' .... OK!')

indian .... OK!

url2 = 'https://api.foursquare.com/v2/venues/search?client_id={}&client_secret={}&ll={},{}&v={}&query={}&radius=5000'

results = requests.get(url2).json()

venues = results['response']['venues']
df3 = json_normalize(venues)
df3
```


The data frame containing the venue locations was then pre-processed and all irrelevant data are filtered out. A function is defined to extract the categories data for each venue. Along with the categories data, the final filtered data frame also includes the data on the name, latitude, longitude, city and ID for each venue, as seen by the lines of code below:

```
filtered_columns = ['name', 'categories'] + [col for col in df3.columns if col.startswith('location.')] + ['id']
dataframe_filtered = df3.loc[:, filtered_columns]

def get_category_type(row):
    try:
        categories_list = row['categories']
    except:
        categories_list = row['venue.categories']

    if len(categories_list) == 0:
        return None
    else:
        return categories_list[0]['name']

dataframe_filtered['categories'] = dataframe_filtered.apply(get_category_type, axis=1)
dataframe_filtered.columns = [column.split('.')[1] for column in dataframe_filtered.columns]
dataframe_filtered

df_filtered = dataframe_filtered[dataframe_filtered['categories'] == 'Indian Restaurant']

df_filtered = df_filtered.loc[:, ('name', 'categories', 'lat', 'lng', 'city', 'id')]
df_filtered = df_filtered.reset_index(drop=True)
df_filtered
```

- The results for the above code can be seen in the Results section under **Figure 5**

The filtered data frame contains data on 5 venues categories listed as Indian restaurants. Using the IDs for each restaurant, the overall ratings of each restaurant was extracted using the details endpoint of the venue. Each of the 5 different Indian restaurants has not been rated yet so no further exploratory data analysis was conducted. The following lines of code were used on all 5 restaurants however only 1 example is displayed below, as the same code is used for each of the 5 venues:

```
venue_id_0 = '515dfec1e4b0a90e62a40e7f' # ID of Large Indian Buffet
url_id_0 = 'https://api.foursquare.com/v2/venues/{}?client_id={} & client_secret={} & v={}'.format(venue_id_0, CLIENT_ID, CLIENT_SECRET, VERSION)
result_id_0 = requests.get(url_id_0).json()

try:
    print(result_id_0['response']['venue']['rating'])
except:
    print('This venue has not been rated yet.')

This venue has not been rated yet.
```

[Exploratory Data Analysis on the Cinemas in Etobicoke North using the FourSquare API](#)

Similar steps were taken to conduct exploratory data analysis on Cinemas within a 5000m radius of the coordinates of Etobicoke North as was done in the last section for the search of Indian restaurants. The data was extracted, pre-processed, and cleaned into a data frame as before. The resulting data frame yield the results for of 3 cinemas with data including the name, categories, latitude, longitude, city, and ID for each cinema as before, seen below:


```

search_query2 = 'Cinema'
radius = 5000
print(search_query2 + ' .... OK!')

Cinema .... OK!

url3 = 'https://api.foursquare.com/v2/venues/search?client_id={}&client_secret={}&ll={}&v={}&query={}&radius={}&limit={}'.format(CLIENT_ID, CL
<
results3 = requests.get(url3).json()

venues1 = results3['response']['venues']
df4 = json_normalize(venues1)
#df4

/home/jupyterlab/conda/envs/python/lib/python3.6/site-packages/ipykernel_launcher.py:2: FutureWarning: pandas.io.json.json_normalize is deprecate
d, use pandas.json_normalize instead

filtered_columns1 = ['name', 'categories'] + [col for col in df4.columns if col.startswith('location.')] + ['id']
dataframe_filtered1 = df4.loc[:, filtered_columns]
dataframe_filtered1['categories'] = dataframe_filtered1.apply(get_category_type, axis=1)
dataframe_filtered1.columns = [column.split('.')[0] for column in dataframe_filtered1.columns]
#dataframe_filtered1

df_filtered1 = dataframe_filtered1.loc[:, ('name', 'categories', 'lat', 'lng', 'city', 'id')]
df_filtered1 = df_filtered1.reset_index(drop=True)
df_filtered1

```

- The results for the above code can be seen in the Results section under **Figure 6**

Of the 3 cinemas, further exploration is conducted on Albion Cinemas, as Albion Cinemas is the most relevant data for this project. It is an independent multicultural cinema which mainly screens Indian movies, where else both Rainbow cinemas mainly screen English language films. As before using the ID for Albion Cinema, the overall rating of the cinema is queried and extracted using the details endpoint of the venue. Next the total number of tips and the detail of the tips are queried and extracted using the tips premium API endpoint. All relevant tip details are then filtered into a data frame as seen in the line of code seen below:

```

venue_id_c = '4ca8ae6e76d3a0935125186b' # Albion Cinemas
url_id_c = 'https://api.foursquare.com/v2/venues/{}/?client_id={}&client_secret={}&v={}'.format(venue_id_c, CLIENT_ID, CLIENT_SECRET, VERSION)
result_id_c = requests.get(url_id_c).json()

try:
    print(result_id_c['response']['venue']['rating'])
except:
    print('This venue has not been rated yet.')

5.1

result_id_c['response']['venue']['tips']['count']

4

limit_tip = 10
url_tip = 'https://api.foursquare.com/v2/venues/{}/tips?client_id={}&client_secret={}&v={}&limit={}'.format(venue_id_c, CLIENT_ID, CLIENT_SECRET,
results_tip = requests.get(url_tip).json()
#results_tip

tips = results_tip['response']['tips']['items']
tips_df = json_normalize(tips)
tips_df_filtered=tips_df[['id','text','agreeCount','likes.count']]
tips_df_filtered

```

- The results for the above code can be seen in the Results section under **Figure 7**

Venue Location Data Visualization using Folium

Once all the location data, for all points of interests are collected and processed into data frames, the locations are mapped on a map centred on Etobicoke North using the Folium library. An outer red circle is mapped to display the search radius of 5000m around the coordinates of Etobicoke North. Blue markers were mapped to display the locations of the Indian restaurants around the search radius, green markers were mapped to display the 2 Rainbow Cinemas around the search radius and a purple marker was mapped to display the location of the Albion Cinema. The Albion Cinema location was marked separately as it was the more relevant to the project, due to the similar nature of the cinema that Lotus group intends to set up. The lines of code used to generate the map can be seen below:

```
venues_map = folium.Map(location=[latitude, longitude], zoom_start=12.45) # generate map centred around Etobicoke North

# add a red circle to represent the search radius of Etobicoke North
folium.features.Circle(
    [latitude, longitude],
    radius=5000,
    color='red',
    popup='Etobicoke North',
    fill = True,
    fill_color = 'white',
    fill_opacity = 0.1
).add_to(venues_map)
```

```
for lat, lng, label in zip(df_filtered.lat, df_filtered.lng, df_filtered.name):
    folium.features.CircleMarker(
        [lat, lng],
        radius=5,
        color='blue',
        popup=label,
        fill = True,
        fill_color='blue',
        fill_opacity=0.6
    ).add_to(venues_map)
```

```
for lat, lng, label in zip(df_rainbow.lat, df_rainbow.lng, df_rainbow.name):
    folium.features.CircleMarker(
        [lat, lng],
        radius=5,
        color='green',
        popup=label,
        fill = True,
        fill_color='green',
        fill_opacity=0.6
    ).add_to(venues_map)
```

```
for lat, lng, label in zip(df_albion.lat, df_albion.lng, df_albion.name):
    folium.features.CircleMarker(
        [lat, lng],
        radius=5,
        color='purple',
        popup=label,
        fill = True,
        fill_color='purple',
        fill_opacity=0.6
    ).add_to(venues_map)
```

venues_map

- The results for the above code can be seen in the Results section under **Figure 8**

Results

	Population(2016)	Pop. %	Riding with Highest Concentration	Riding Conc. %
Top 20 Ethnic origins in the City of Toronto				
Chinese	332,830	12.5	Scarborough—Agincourt	47.0
English	331,890	12.3	Beaches—East York	24.2
Canadian	323,175	12.0	Beaches—East York	19.7
Irish	262,965	9.8	Parkdale—High Park	20.0
Scottish	256,250	9.5	Beaches—East York	18.9
East Indian	202,675	7.5	Etobicoke North	22.2
Italian	182,495	6.8	Etobicoke Centre	15.1
Filipino	162,605	6.0	York Centre	17.0
German	130,900	4.9	Parkdale—High Park	9.8
French	122,615	4.6	Parkdale—High Park	8.9
Polish	114,530	4.3	Eglinton—Lawrence	12.0
Portuguese	100,420	3.7	Davenport	22.7
Jamaican	90,065	3.3	Humber River—Black Creek	8.5
Russian	74,465	2.8	York Centre	9.5
Ukrainian	72,340	2.7	Etobicoke Centre	8.1
Sri Lankan	58,180	2.2	Scarborough—Rouge Park	11.1
Greek	57,425	2.1	Toronto—Danforth	7.3
Spanish	56,815	2.1		< 5.0
British Isles origins (other)	52,900	2.0		< 5.0
Iranian	45,540	1.7	Willowdale	12.1

Figure 1: Data Frame containing the 2016 census data on the top 20 ethnic origins in Toronto and the corresponding ridings with the highest concentration for each community

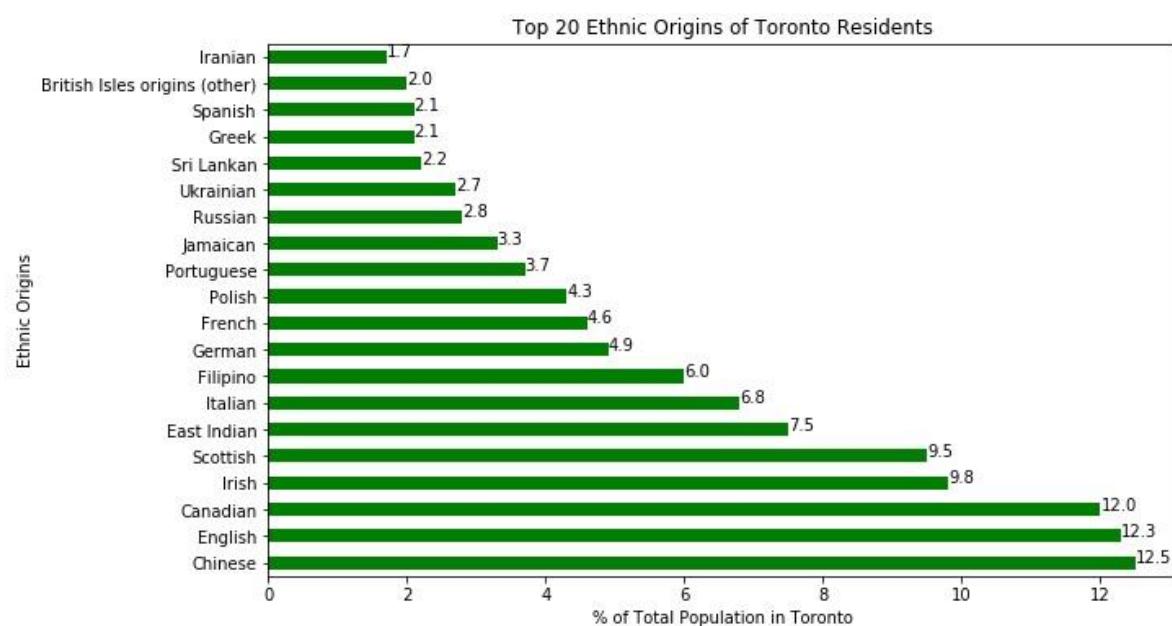


Figure 2: A Horizontal Bar Plot visualizing the data on the top 20 ethnic origins in Toronto

	Population	Ethnic Group #1	Highest %	Ethnic Group #2	2nd Highest %	Ethnic Group #3	3rd Highest %	Ethnic Group #4	4th Highest %	Ethnic Group #5	5th Highest %
Riding											
Etobicoke-Lakeshore	127,520	White	71.3	South Asian	5.5	Black	5.0		None	None	None
Etobicoke North	116,960	South Asian	28.9	White	23.8	Black	23.4		None	None	None
Etobicoke Centre	116,055	White	72.3	South Asian	5.9	Black	5.9		None	None	None
York South-Weston	115,130	White	44.2	Black	23.2	Latin American	8.5	Filipino	5.9	South Asian	5.7

Figure 3: Data Frame containing the demographic breakdown based on ethnic group in the Etobicoke district in Toronto

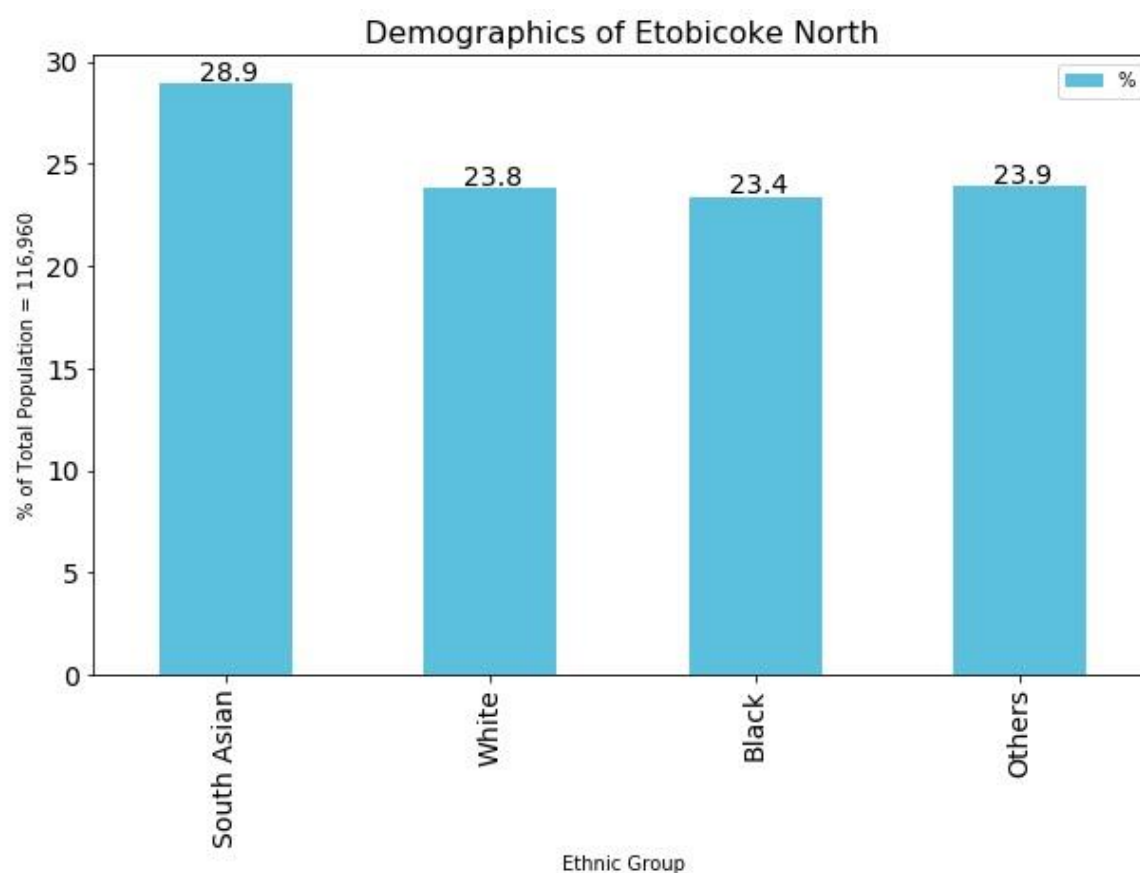


Figure 4: A Vertical Bar Plot visualizing the data the demographic breakdown based on ethnic group in Etobicoke North

	name	categories	lat	lng	city	id
0	Large Indian Buffet	Indian Restaurant	43.738283	-79.566449	NaN	515dfec1e4b0a90e62a40e7f
1	Great Indian Buffet	Indian Restaurant	43.738136	-79.566281	NaN	5160aaace4b05eefc1390a60
2	Exotic indian cuisine	Indian Restaurant	43.745956	-79.615838	Toronto	4df24f1b88772e1f814f40d3
3	Family Indian Cuisine	Indian Restaurant	43.716122	-79.555331	Etobicoke	4e6155c97d8b8540892c9de7
4	Bajra Fine Indian Cuisine	Indian Restaurant	43.751894	-79.535493	Toronto	5e0d270af1a09700089d3260

Figure 5: Data Frame containing data on the Indian restaurants in Etobicoke North

	name	categories	lat	lng	city	id
0	Albion Cinemas	Indie Movie Theater	43.741940	-79.584988	Toronto	4ca8ae6e76d3a0935125186b
1	Rainbow Cinema Woodbine	Movie Theater	43.720125	-79.600789	Etobicoke	4bd61bc96798ef3b519e648d
2	Rainbow Cinemas	Movie Theater	43.726361	-79.574516	Etobicoke	4c88437997828cfa56ec9aaa

Figure 6: Data Frame containing data on the Cinemas in Etobicoke North

	id	text	agreeCount	likes.count
0	4ef6a0896da1f7b6606ecc70	Expect an authentic Indian movie viewing exper...	1	1

Figure 7: Data Frame containing tip summary of the Albion Cinema in Etobicoke North

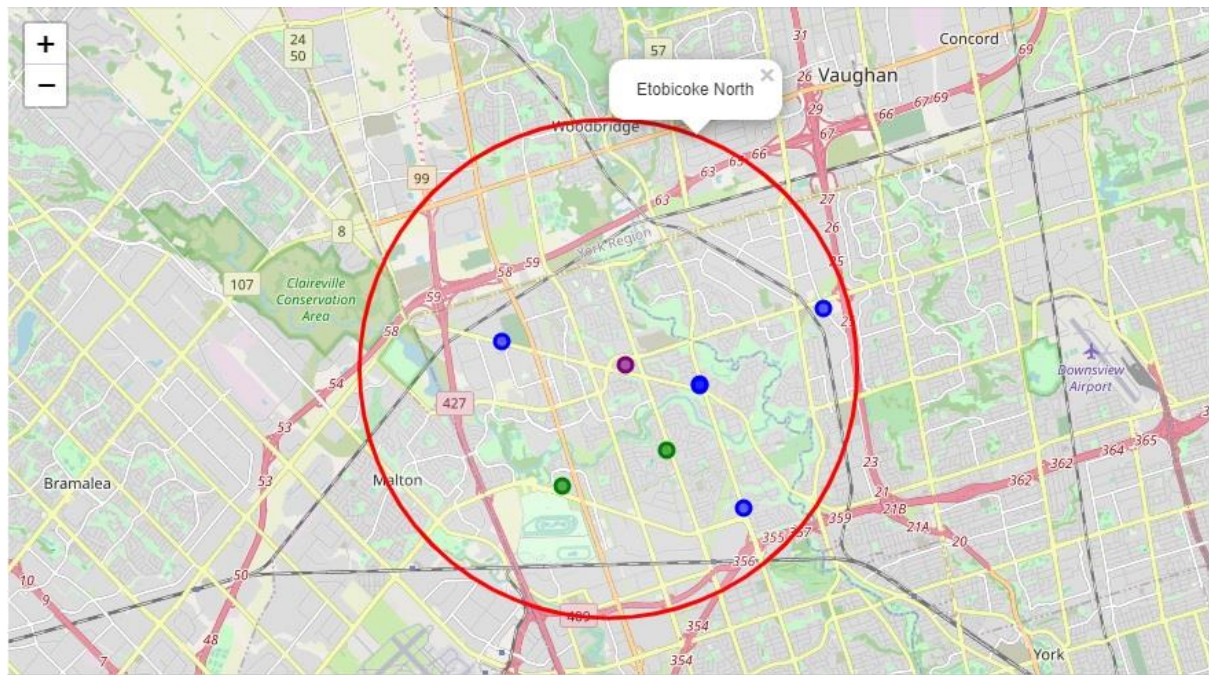


Figure 8: Map containing the locations of all points of interest within the boundary of the search radius in Etobicoke North

Discussion

In both figure 1 and 2, the top 20 ethnic origins among the residents was displayed. From the bar plot on figure 2, the East Indian community make up 7.5 % of the total residents of Toronto. A significant portion as it is the 6th highest portion among the Toronto residents. Now to narrow down a location within Toronto, the data from Figure 1 reveals that the highest concentration of East Indians reside in the Etobicoke North district/riding of Toronto, with over 1/5th of the population at 22.2% in that district/riding.

Looking closer at the demographic breakdown in Etobicoke North, it is shown in Figure 4 that the South Asian community makes up the largest group in Etobicoke North at 28.9% of the population. Of that fraction, 76.8% of the South Asian community are specifically East Indian. Looking further at the entire Etobicoke district, there is a signification size of South Asian residents residing at Etobicoke-Lakeside, Etobicoke-Centre and York South-Weston ridings with 5.5%, 5.9% and 5.7% of the total respective population coming from the South Asian community as seen in Figure 3.

From the data gathered, a recommendation is made to move forward and explore the Etobicoke North district/riding as a potential business location.

Using the FourSquare API, all the data on Indian restaurants within a 5000m radius on the coordinates of Etobicoke North, was gathered into a data frame as seen in Figure 5. Using the respective IDs for each of the 5 Indian restaurants, the overall rating for the restaurants were queried. All 5 of the restaurants however were unrated. Only taking into account the Indian restaurants registered on FourSquare, since all 5 of the restaurants have not been rated, it can be inferred based on the lack of rating data, that those restaurants are fairly new or not yet establish among the residents and there is room for the Lotus group open in that area.

Next, withing the same 5000m radius of Etobicoke North, data on the cinemas in the search area were gathered in a data frame as seen in Figure 6. Of the 3 cinemas in Etobicoke North, 2 of them are Rainbow Cinemas, a cinema chain that mainly screens English language films and limited foreign language films. The 3rd is Albion Cinema, an independent multi-language cinema that mainly screens Indian films. This data point is very signification, as there is an Indian movie cinema already set up in the district/riding. However, when the overal rating of the cinema is queried, it has an overall rating of 5.1/10, which is a very poor rating. The number of tips of the cinema was queried and the cinema has a total of 4, with one of the feedback from a customer reading “Expect an authentic Indian movie viewing experience. Complete with hecklers, sing along songs and even a mid-movie intermission” as seen in Figure 7.

From the data gathered on the cinemas specifically Albion Cinema, a few inferences are made. While there is the risk of an already existing Indian movie cinema in Etobicoke North, it has a very poor overall rating of 5.1 and with only 4 tips from users. The one tips that was queried while positive, speaks more towards the crowd during the movie viewing experience than actually about the quality of the cinema. The opportunity that was inferred from the data is that as there is already an established Indian movie cinema (Albian Cinemas) in Etobicoke North and that is prove that there is a market for an Indian movie cinema in Etobicoke North.

All the relevant location points in Etobicoke North are mapped out as seen in Figure 8. With the red circle being the boundary of the search radius, the blue markers indicating the location of the Indian restaurants, the green markers indication the location of the 2 Rainbow Cinemas and the purple marker indicating the location of the Albion Cinema. From Figure 8, there are only 4 blue markers but there were 5 Indian restaurants. This is because the location of the Large Indian Buffet and Great Indian Buffet have almost identical coordinates as seen in Figure 5. An assumption is made that the data is accurate, and both are separate restaurants with very close proximity to each other. When zooming in closer on the location points for both restaurants, the markers of both no longer overlap.

From Figure 8, none of the Indian restaurants and cinemas are very close in distance to each other, at least not within walking distance. From data it was inferred that there is a strong opportunity for success for the Lotus group’s value proposition of having an Indian restaurant attached together with an Indian movie cinema, to make for a unique dining and movie viewing experience.

Conclusion

From all the data accumulated on the demographics of the residents of Toronto, it was confirmed that there is a large percentage of the population made up of the East Indian community, specifically 7.5%. Within the districts/ridings of Toronto, Etobicoke North was selected for further exploratory data analysis as the East Indian community is the largest concentration in all of Toronto, in that district/riding at 22.2% of the total district/riding population. Within Etobicoke North there are 5 Indian restaurants but all with no user ratings, indicating those restaurants are new or not yet fully established among the residents. Etobicoke North also has 3 cinemas, with one that is mainly an Indian movie cinema. The cinema however has a very poor overall rating of 5.1/10 among FourSquare users. The proximity between the locations of the Indian restaurants and the cinemas particularly the Indian movie cinema was also distant from each other.

All the data gathered and summarized indicates that the Lotus group should proceed with their expansion plans in Etobicoke North, Toronto. The existence of an Indian movie cinema proves there is a market in the location for it, the number of Indian restaurants are limited and not fully established yet, as well as the concept of an Indian restaurant/cinema would be a unique appeal for the residents of Etobicoke North and the business model was already proven successful in the Malaysian market, which has overlapping similarity in terms of the demographics for the minority Indian communities in each country.

References

- 1) https://en.wikipedia.org/wiki/Demographics_of_Toronto
- 2) <http://www.albioncinema.com/>
- 3) <https://www.rainbowcinemas.ca/A/index.php?>