Capstone project: Find the optimal location to start a restaurant in Toronto

1. Introduction

Dongjun is a new immigrant from Korea to the Toronto city, and he would like to start a Korean restaurant. According to South Korea's Ministry of Foreign Affairs and Trade, there were 240,942 ethnic Koreans or people of Korean descent in Canada as of 2017. With its diverse demographic of Toronto, we intend to help Dongjun find the optimal location to start a Korean restaurant in the city of Toronto.

2. Collecting and Processing Data

First, we need to obtain the neighborhood and its geospatial data of Toronto from a publicly available database, e.g., https://open.toronto.ca/dataset/neighbourhood-profiles/. We download the CSV file and uploaded to IBM cloud.
To open it, we have to use "project.get_file" The credential is hidden on purpose to protect my privacy.

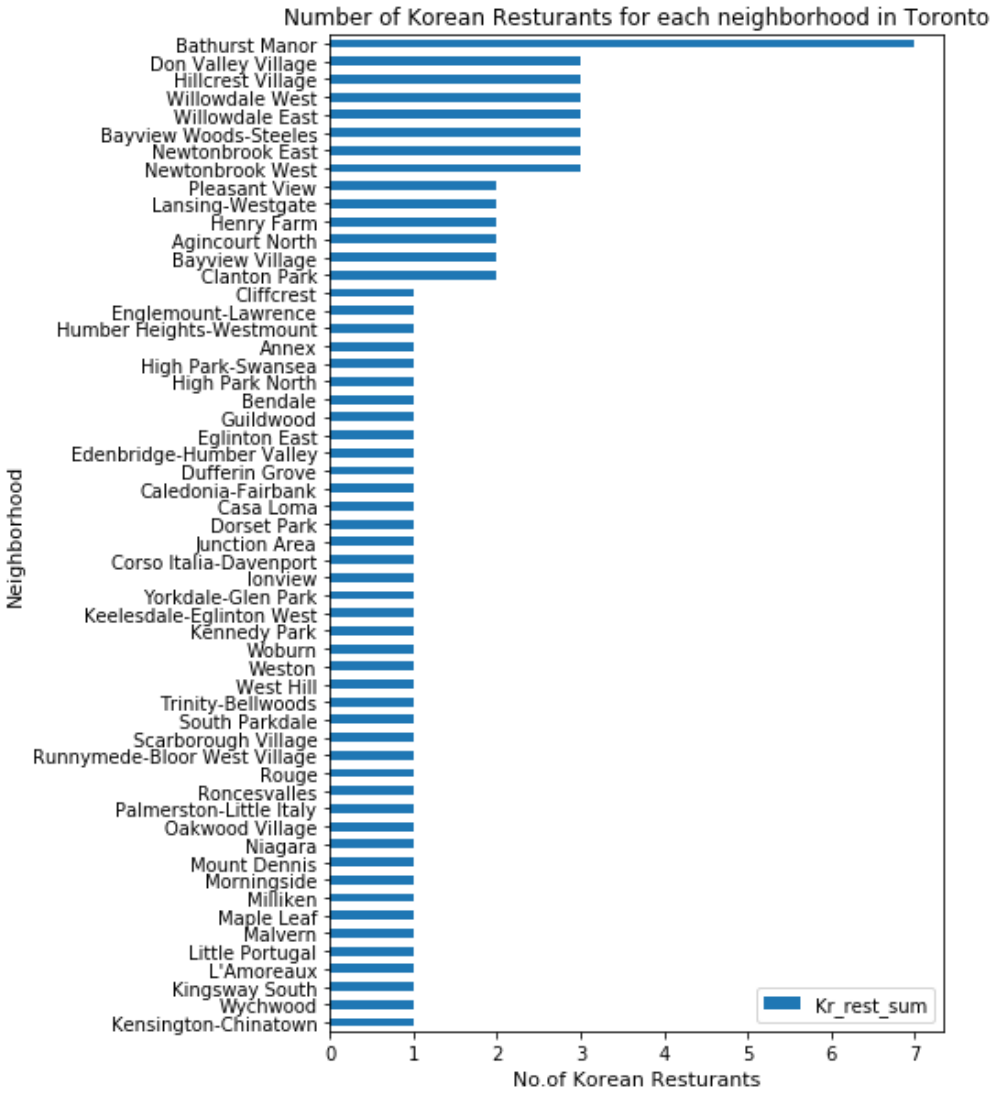
We would like to know our potential customers for Dongjun's business. Hence, we would focus on residents with Korean origin (who can speak Korean, or who characterized themselves of Korean ancestry) in a neighborhood. Since the size of dataframe is huge, only several key data were selected including average individual income and origin related to Korean based on the name of the column in the CSV file. We then cleaned the data, e.g. remove commas and change the datatype of number from object to integer for future analysis.

Here we propose an index to quantify how "Korean" related a neighborhood is. We give different weights to different column. We assume the weight represents "how many times a resident would like to visit a Korean restaurant per month". For example, Using Korean at work has a weight as 16, since it indicates the business need for Korean customers. (almost 4 times per week). Speaking Korean at home is assumed to have a weight of 8. (almost twice per week). Korean as mother tongue is assumed to have a weight of 8. (almost twice per week). Visible minority population, Ethnic origin as Korean all have a weight as 4. (almost once per week). Knowledge of Korean have weights as 1 (almost once per month). We then create a new column called "Korean index", the higher the index, the more Korean related residents in this neighborhood. We can also normalize this index with total population of the neighborhood and get "Normalized index". We then sort the table by normalized index, then found out the Newton brook East has the highest normalized index. The income of each neighborhood is also an important factor, we list average individual income of a neighborhood as a column in the Table.

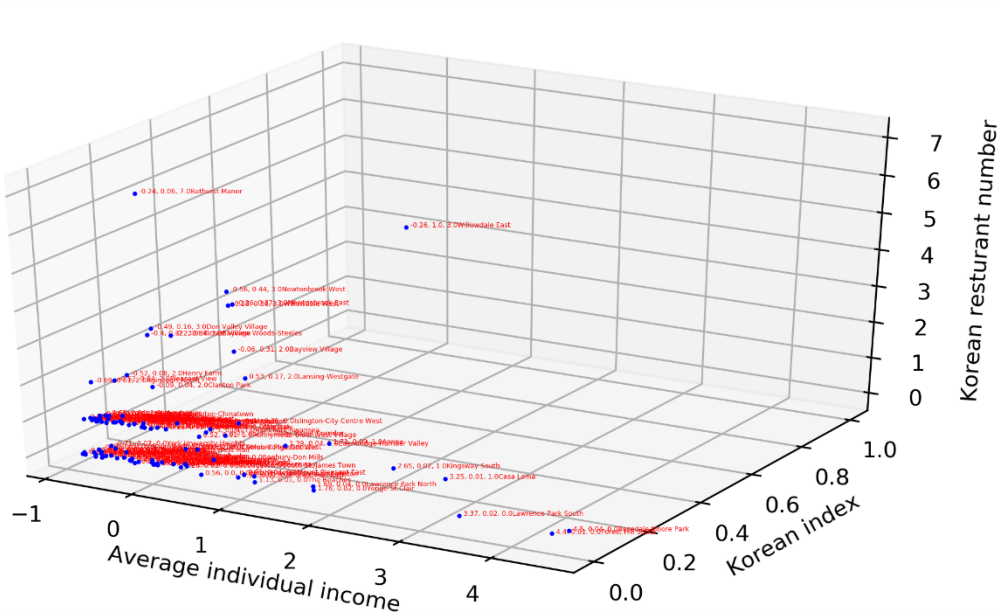
We then use Nominatim as geocoder, because geocoder.google keep returning None. Nominatim did a better job than google but coordinates for some neighborhood still cannot be obtained. 35 of 140 neighborhood do not have coordinate. We here just neglect those neighborhoods due to limitation of time to find the coordinate manually. We then use the Foursquare API to obtain detailed information on existing Korean restaurants in each neighborhood with known coordinates and find its competitors in each neighborhood. Lastly, we will combine data from foursquare with demographic data to find a solution to Dongjun's question.

3. Results and Discussion

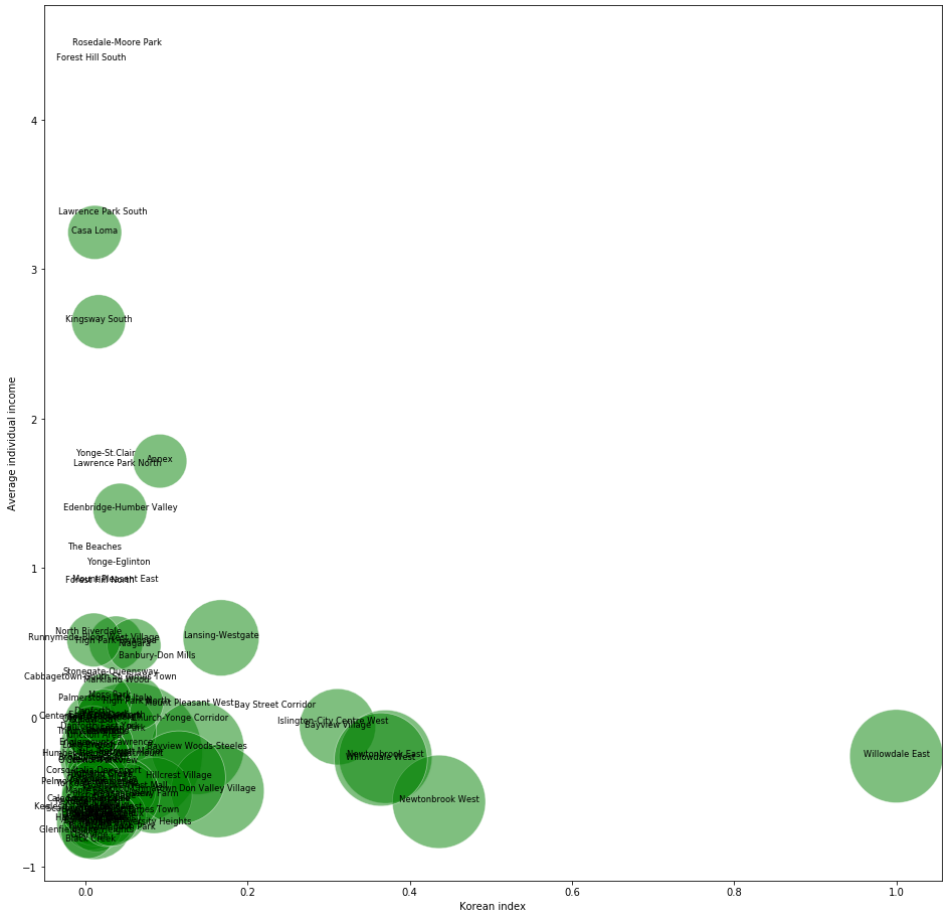
Based on the results return from Foursquare API, 56 neighborhoods at least have one Korean restaurant. Bathurst Manor has 7 Korean restaurants as shown in the bar charts.



We join it with previous demographic dataframe 'toronto_kr' obtained from City of Toronto by column "Neighbourhood". Now we can use Korean index, Kr_rest_sum and income to do the data analysis. Ideally, we want to find a neighborhood with high Korean_index, high income, but low Kr_rest_sum. But also, can accept a neighborhood with high Korean_index, high income, also high Kr_rest_sum. We would like to avoid a neighbourhood with low Korean_index, low income, also low Kr_rest_sum. Hence, we can plot all the neighborhood with these three values as coordinates in the 3D space. We normalize the data and visualize them using scatter plot in 3D as shown below. Here we found an apparent outlier, Willowdale East, which has very high Korean index, relatively good average income, but very low Korean restaurant number as 3. Hence it could be our option.



We can further verify the decision with the bubble plot. Again, Willowdale East will still stand out, which has very high Korean index, relatively good average income, but very low Korean restaurant number as 3. Hence, we would suggest Dongjun to start his restaurant there. Newtonbrook West, Newtonbrook East, and Willowdale West could be his second group choice, who also has a slight less Korean index, but similar level of average income and few competitors as 3.



4. Conclusions

In on our data analysis above, we first used publicly available data, and processed the data using Pandas. We then create a so called “Korean Index” to quantify the level of Korean-related of resident in each neighborhood. Besides, we also obtain the average individual income of each neighborhood. We then combine Nominatim and Foursquare API to summarize the number of Korean restaurants in each neighborhood of Toronto.

Finally, we obtain the data we need and visualize them in both bubble and scatter plot to obtain a few options for Dongjun to start his Korean restaurant in the city of Toronto. The first choice is Willowdale East, which has a few high Korean index and relatively good average individual income, the number of other Korean restaurants is 3 which is smaller than 7 in Bathurst Manor. And second-best group of location are Newtonbrook West, Newtonbrook East, and Willowdale West. who also have a slightly less Korean index, but similar level of average income and few competitors as 3.