Move to A Metropolis

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1. Introduction

New York City (NYC), Toronto, and Shanghai are all the financial centers of their respective countries, and are all among the top 10 financial centers around the world.[1] However, residents in the three cities are of different cultural backgrounds. Historically NYC and Toronto served as destinations for immigrants mostly from Europe, but there are mostly Chinese people living in Shanghai while it serves as an important trading port.[2-4] As a person from a less developed city, I am curious to learn more about lives in the three big cities.

The goal of this project is to find out the similarity and difference between the three big cities and hopefully the result can help people decide which one of the three is likely to be a better new home.

2. Data

In this project, we will be using the neighborhood information from the previous module for NYC and Toronto, together with the new information of neighborhoods in Shanghai from Wikipedia.[5] Foursquare location data will be used to obtain ventures around the neighborhoods.

We want all types of venues around each neighborhood to tell us about the types of food, transportation, and relaxation. These places contain hints of people's life styles. We want to see if it will be convenient to find things. As will be noticed later, the number of districts in Shanghai is intrinsically smaller than the other two cities. So the radius of search is increased from 500 to 1000 as compensation.

During preparation of data, I realized that some information such as the universities in Shanghai could not be aquired very precisely by Foursquare. It might be because of the translation of names or other language related reasons. I would like to use the distribution of universities in Shanghai as an example for discussion, so the list of univeristies is aquired seperately from Wikipedia.[6] Still, some names in the list have to be manually filtered out in order to avoid error.

3. Methodology

In this project, we first collected the names of neighborhoods in NYC, Toronto, and Shanghai by reading tables from the webpages or downloading a json file. The geographic coordinates are obtained with **Nominatim** and **geocoder** by providing the address strings. Some remote neighborhoods are excluded from the data sets since we are focusing on the main areas of the cities. We also marked the locations of the neighborhoods on the maps created with **folium**. A bar graph is created with **matplotlib.pyplot** to show the temperature distribution profile.

Foursquare API was used to acquire venue data 500 m around each neighborhood in NYC Manhattan and Toronto, and 1000 m for those in Shanghai. The name, location, and category information of the venuess are

stored in dataframes. The frequency of occurrence of each category in each neighborhood was found with the groupby function. Since we are looking for an ideal home, we specifically looked for some food and culture related key words in the venue types by building for loops.

Finally, the neighborhoods are divided into clusters with kmeans clustering. The best value of k is found by using the elbow method, although there is no very sharp turning point since the whole area is developed. Different clusters are marked on maps and we will try to find the common features among the neighborhoods in the same cluster. The locations of universities in Shanghai will be appended into the map of Shanghai to help us gain some understanding of the area.

4. Results and Discussion

Our analysis shows that even though NYC Manhattan area is the smallest among the three (87 km2 vs Toronto 630 km2 vs Shanghai 660 km2), it possesses the highest diversity of venues. 337 unique venue categories were found in NYC, while only 231 and 117 were found in Toronto and Shanghai separately.

As shown in Table 1, the food diversity in Manhattan is incredible. Cuisines from nearly every continent can be found there, such as North America (American, Cuban), South America (Brazilian, Argentinian), Europe (Scandinavian, Mediterranean), Africa (Ethiopian), Asia (Vietnamese, Israeli), and Oceania (Australian), without even mentioning the well-spreaded styles such as French and Japanese. There are even modern restaurants that sound more for the fun experience than for the food, such as molecular gastronomy restaurant and theme restaurant. In Toronto, the places of origin of the cuisines are more from North and South America, Europe, and Asia. Shanghai has the least number of food options, but one can find very specific types of Asian food there. For example, there are cuisines from many different provinces in China (Peking, Hunan, Xinjiang, Yunan, Cantonese) and different Asian countries (Thai, Malay, Indian).

The culture-related places found in the three cities are similar. There are art galleries, art and history museums, bookstores, and music venues. In NYC and Toronto, we also found antique shops and crafts stores. Again, NYC provides people with more casual places such as street art and used bookstores. Therefore, NYC might be a better place for people who are looking for a little bit of new experience of everything.

City	Food related venues	Culture related venues
NYC Manhattan	'Afghan Restaurant', 'African Restaurant', 'American Restaurant', 'Arepa Restaurant', 'Argentinian Restaurant', 'Asian Restaurant', 'Australian Restaurant', 'Austrian Restaurant', 'Brazilian Restaurant', 'Cajun / Creole Restaurant', 'Cambodian Restaurant', 'Caribbean Restaurant', 'Caucasian Restaurant', 'Chinese Restaurant', 'Cuban Restaurant', 'Czech Restaurant', 'Dim Sum Restaurant', 'Diner', 'Dumpling Restaurant', 'Eastern European Restaurant', 'Empanada Restaurant', 'English Restaurant', 'Ethiopian Restaurant', 'Falafel Restaurant', 'Fast Food Restaurant', 'Filipino Restaurant', 'French Restaurant', 'German Restaurant', 'Greek Restaurant', 'Hawaiian Restaurant', 'Himalayan Restaurant', 'Hotpot Restaurant', 'Indian Restaurant', 'Israeli Restaurant', 'Italian Restaurant', 'Japanese Curry Restaurant', 'Japanese Restaurant', 'Jewish Restaurant', 'Kebab Restaurant', 'Korean Restaurant', 'Kosher Restaurant', 'Latin American Restaurant', 'Lebanese Restaurant', 'Malay Restaurant', 'Mediterranean Restaurant', 'Mexican Restaurant', 'Middle Eastern Restaurant', 'Modern European Restaurant', 'Molecular Gastronomy Restaurant', 'Moroccan Restaurant', 'New American Restaurant', 'Paella Restaurant', 'Persian Restaurant', 'Peruvian Restaurant', 'Ramen Restaurant', 'Restaurant', 'Russian Restaurant', 'Scandinavian Restaurant', 'Seafood Restaurant', 'Shanghai Restaurant', 'Soba Restaurant', 'South American Restaurant', 'South Indian Restaurant', 'Southern / Soul Food Restaurant', 'Spanish Restaurant', 'Steakhouse', 'Sushi Restaurant', 'Swiss Restaurant', 'Szechuan Restaurant', 'Taiwanese Restaurant', 'Tapas Restaurant', 'Thai Restaurant', 'Theme Restaurant', 'Turkish Restaurant', 'Udon Restaurant', 'Vegetarian / Vegan Restaurant', 'Venezuelan Restaurant', 'Vietnamese Restaurant'	'Antique Shop', 'Art Gallery', 'Art Gallery', 'Art Museum', 'Art Museum', 'Arts & Crafts Store', 'Bookstore', 'College Arts Building', 'College Bookstore', 'History Museum', 'Martial Arts Dojo', 'Museum', 'Music School', 'Music Venue', 'Performing Arts Venue', 'Public Art', 'Street Art', 'Used Bookstore'
Toronto main area	'Afghan Restaurant', 'American Restaurant', 'Asian Restaurant', 'Belgian Restaurant', 'Brazilian Restaurant', 'Cajun / Creole Restaurant', 'Caribbean Restaurant', 'Chinese Restaurant', 'Colombian Restaurant', 'Comfort Food Restaurant', 'Cuban Restaurant', 'Dim Sum Restaurant', 'Diner', 'Doner Restaurant', 'Dumpling Restaurant', 'Eastern European Restaurant', 'Ethiopian Restaurant', 'Falafel Restaurant', 'Fast Food Restaurant', 'Filipino Restaurant', 'French Restaurant', 'German Restaurant', 'Gluten-free Restaurant', 'Greek Restaurant', 'Indian Restaurant', 'Italian Restaurant', 'Japanese Restaurant', 'Korean Restaurant', 'Latin American Restaurant', 'Mediterranean Restaurant', 'Mexican Restaurant', 'Middle Eastern Restaurant', 'Modern European Restaurant', 'Molecular Gastronomy Restaurant', 'New American Restaurant', 'Portuguese Restaurant', 'Ramen Restaurant', 'Restaurant', 'Seafood Restaurant', 'South American Restaurant', 'Southern / Soul Food Restaurant', 'Steakhouse', 'Sushi Restaurant', 'Taiwanese Restaurant', 'Thai Restaurant', 'Theme Restaurant', 'Vegetarian / Vegan Restaurant', 'Vietnamese Restaurant'	'Antique Shop', 'Art Gallery', 'Art Gallery', 'Arts & Crafts Store', 'Bookstore', 'College Arts Building', 'History Museum', 'Museum', 'Music Venue', 'Performing Arts Venue'
Shanghai main area	'American Restaurant', 'Brazilian Restaurant', 'Cantonese Restaurant', 'Chinese Restaurant', 'Dim Sum Restaurant', 'Dumpling Restaurant', 'English Restaurant', 'Fast Food Restaurant', 'French Restaurant', 'Hotpot Restaurant', 'Hunan Restaurant', 'Indian Restaurant', 'Italian Restaurant',	'Art Gallery', 'Art Gallery', 'Art Museum', 'Art Museum',

'Japanese Restaurant', 'Kebab Restaurant', 'Korean Restaurant', 'Malay Restaurant', 'Mexican Restaurant', 'Modern European Restaurant', 'New American Restaurant', 'Peking Duck Restaurant', 'Polish Restaurant', 'Ramen Restaurant', 'Restaurant', 'Seafood Restaurant', 'Shanghai Restaurant', 'Spanish Restaurant', 'Steakhouse', 'Sushi Restaurant', 'Szechuan Restaurant', 'Tapas Restaurant', 'Thai Restaurant', 'Vegetarian / Vegan Restaurant', 'Vietnamese Restaurant', 'Xinjiang Restaurant', 'Yunnan Restaurant', 'Zhejiang Restaurant'	'Bookstore', 'History Museum', 'Music Venue', 'Public Art'

Table 1. Food and culture related venues found in the three cities.

The smooth curves found with the elbow method inform that the whole area in the three cities are generally similar, which makes it hard to draw a line between neighborhoods. Taking a closer look at the detailed categories in each cluster, we could see that the clusters that dominate in the cities are all urban areas. This is not too surprising since the three cities are all modern metroplis. Those areas are convenient for people to get food and drinks, buy stuff, and commute to work. For people who come for short visits, there are many hotels around for them to stay in. In Manhattan, there are also neighborhoods featuring theaters, which contains the world-famous broadway. In NYC and Toronto, we could see neighborhoods mainly containing natural places such as parks, where people can enjoy themselves during weekends. Unfortunately, this is not the case for Shanghai.
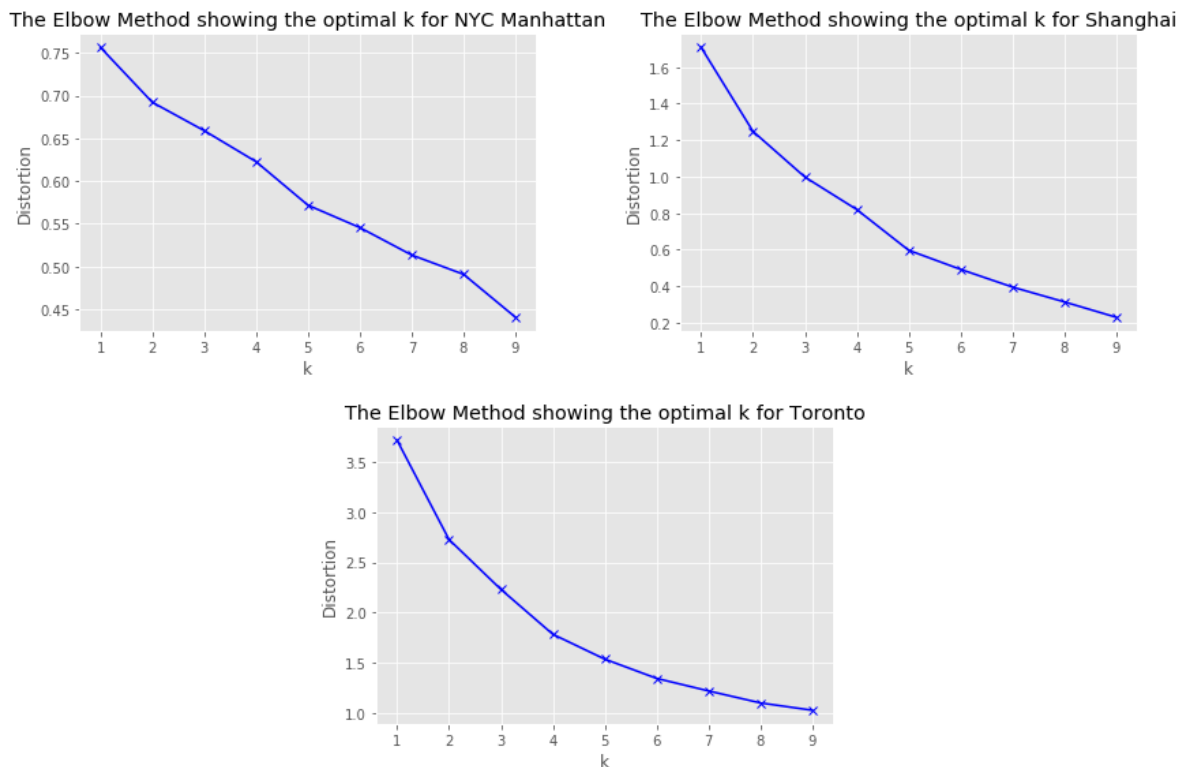

Figure 1. The elbow method curves for selecting k cluster nubmers.

From the map showing locations of universities in Shanghai, we could see that the density of higher education institutes is relatively high and the locations of the universities are nearly overlapped with the neighborhoods

included in the main cluster. This means that the food and store concentrated areas in Shanghai could also developed to meet the need of those students.

Figure 2. Clusters of neighborhoods in NYC (top left), Toronto (top right), and Shanghai (bottom). The locations of universities in Shanghai are marked with black circles.

Geographically, the three big cities all face water on at least one side. Shanghai and Toronto both have humid continental climate, while NYC locates in between the humid subtropical and the humid continental climate regions. The three cities all see four seasons and a temperature change over 40 °F throughout the year, with Toronto being the coldest. The average temperature in Toronto falls below freezing point of water in December through February, which might need to be undesirable for people come from warm area.
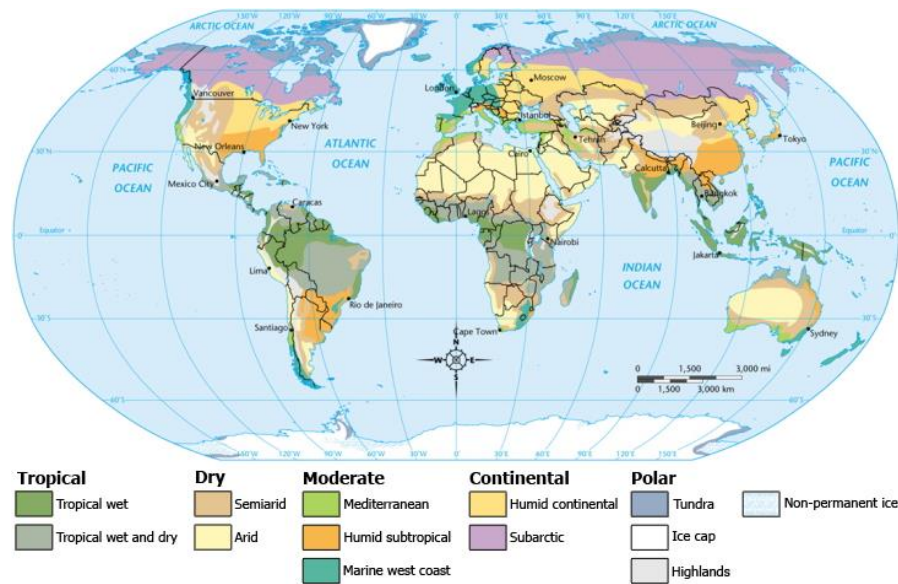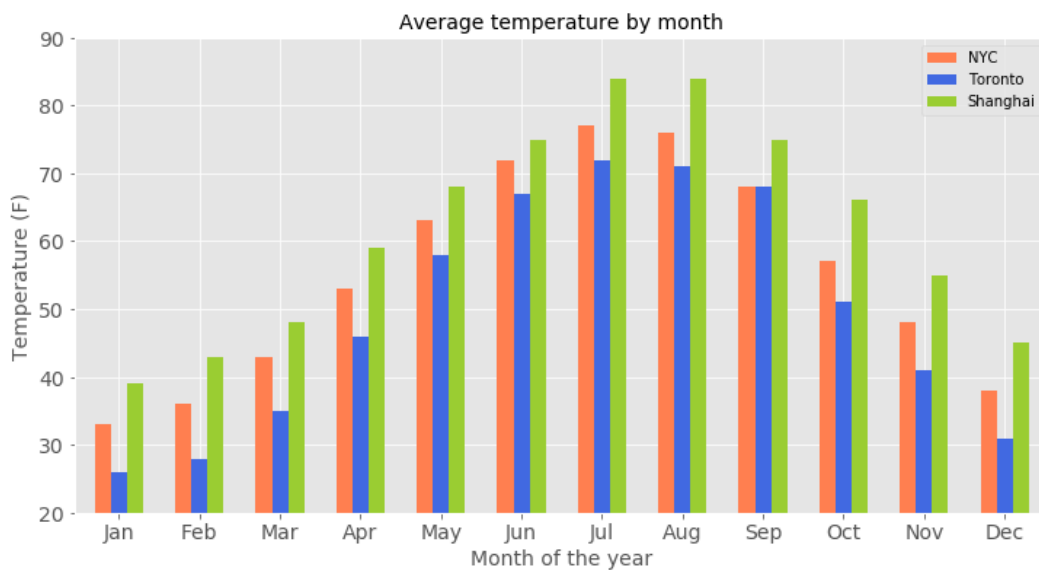
Figure 3. World climate map.

Figure 4. Average temperature by month of the three cities.

5. Conclusion

In this project, we were trying to compare the venues data of neighborhoods in the main areas of NYC, Toronto, and Shanghai to help people who are seeking for a new home in a metroplis decide which one of the three cities might be a better choice. Based on the clustering result of Foursquare data, we saw that the metropolitan cities are quite similar to each other.

NYC offers the most diverse choices for people from any background. For those who would like to try new things everyday, this might be the top choice among the three. Toronto is featured more for the balance

between urban and natural areas. Even though NYC and Toronto both have park rich areas, the density of venues is much lower in Toronto, which makes it less crowded there. For people who prefer warmer area or an extensive experience of asian culture, Shanghai is recommended.

There is a saying that people will vote for their dream home with their feet by walking there. The final decission is up to everybody. Considering the location, food, climate, activities, and education, people will certainly find their unique lives.

Reference

1. [Which Cities Are The World's Financial Centers?](#)
2. [Toronto - Wikipedia](#)
3. [New York City - Wikipedia](#)
4. [Shanghai - Wikipedia](#)
5. [List of administrative divisions of Shanghai](#)
6. [List of universities and colleges in Shanghai](#)
7. [New York City average temperature by month](#)
8. [Toronto average temperature by month](#)
9. [Shanghai average temperature by month](#)