Finding an Ideal Area for New Town Development in Seoul

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1. Introduction

1.1 Challenge Description

Seoul is already a mega-metropolis with one of the highest population densities in the world, claiming nearly over 10 million residents. However, the local municipal government wants to search for a relatively underdeveloped area in the city for the development plan of the new apartment community targeted for newly-wed family and family with young kids. As a research manager in the local municipal civil development research center, I am asked by the mayor of the city to look for an ideal area in Seoul that is the most feasible to carry out this plan.

The following is the result of my research on this assignment. The geographical conditions around the candidate area are taken into account for consideration of the living conditions for people that would live in the area. The most important factor is to avoid mountainous areas if possible, as the cost of construction could increase drastically for the leveling of the land foundation to build apartments on it. The secondary factor is to avoid public facilities such as airports, power plants, and nuclear development plants that may cause health issues for the local residents. The last factor is that there cannot be many pubs, motels, karaokes, or massage parlors that are considered inappropriate in Korean culture for the newly-wed people and those with young kids.

Considering the above factors Guemcheon District is selected as the ideal candidate area for the new town development, by locating it on the map to study the geographical conditions around it. Also, the top 10 venues of the area are searched to discover the most common types of business in the area.

1.2 Data Used

- The data of postal codes and neighborhoods in Seoul are taken from the Wikipedia page in the link presented in the reference section at the end of this page [1]
- The latitude and longitudes of each district of Seoul are found by typing on Google with the search keyword "OOOO-gu coordinates."("gu" means "District" in Korean). [2]
- The Foursquare API to get the venues in Geumcheon District [3]

2. Methodology

2.1 Data of Seoul

As the database, I formed a pandas dataframe with the information from my sources listed above. It has components of 'Code(Postal Code)', 'Neighborhood', 'Latitude', and 'Longitude.'

	Code	Neighborhood	Latitude	Longitude
0	010NN ~ 012NN	Gangbuk District	37.6396	127.0257
1	013NN ~ 015NN	Dobong District	37.6688	127.0471
2	015NN ~ 019NN	Nowon District	37.6542	127.0568
3	020NN ~ 023NN	Jungnang District	37.6066	127.0927
4	024NN ~ 026NN	Dongdaemun District	37.5744	127.0400
5	027NN ~ 029NN	Seongbuk District	37.5891	127.0182
6	030NN ~ 032NN	Jongno District	37.5730	126.9794
7	033NN ~ 035NN	Eunpyeong District	37.6027	126.9291
8	036NN ~ 038NN	Seodaemun District	37.5791	126.9368
9	039NN ~ 042NN	Mapo District	37.5638	126.9084
10	043NN ~ 044NN	Yongsan District	37.5384	126.9654
11	045NN ~ 046NN	Jung District	37.5641	126.9979
12	047NN ~ 048NN	Seongdong District	37.5633	127.0371
13	049NN ~ 051NN	Gwangjin District	37.5385	127.0823
14	052NN ~ 054NN	Gangdong District	37.5301	127.1238
15	055NN ~ 059NN	Songpa District	37.5145	127.1066
16	060NN ~ 064NN	Gangnam District	37.5172	127.0473
17	065NN ~ 068NN	Seocho District	37.4837	127.0324
18	069NN ~ 071NN	Dongjak District	37.5124	126.9393
19	072NN ~ 074NN	Yeongdeungpo District	37.5264	126.8962
20	075NN ~ 078NN	Gangseo District	37.5510	126.8495
21	079NN ~ 081NN	Yangcheon District	37.5169	126.8664
22	082NN ~ 084NN	Guro District	37.4954	126.8874
23	085NN ~ 086NN	Geumcheon District	37.4519	126.9020
24	087NN ~ 089NN	Gwanak District	37.4784	126.9516

2.2 Map of Seoul

The python **folium** library is used to visualize the geographical conditions of Seoul and its neighborhoods. The latitudes and longitudes information of coordinates are used to locate each District of Seoul on the map.
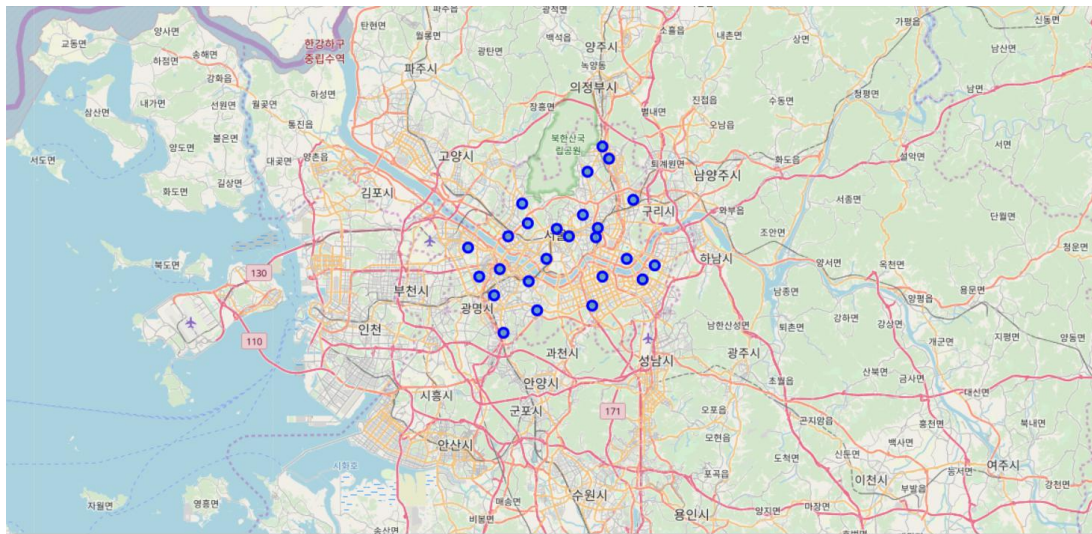

2.2.1 Analysis of the Map of Seoul

The analysis of this map is necessary to move further with this challenge. By looking at the map above, much of the conditions in each district of Seoul are apparent. The central parts of Seoul are already developed, and the western districts are close to the Gimpo International Airport that would cause significant noise for local residents. The northern districts are also not ideal as there is Korean North Mountain running along, which can result in a significant increase in construction cost for a new apartment community to come to. Goyang is the city bordering on the northwestern part of Seoul. The areas of Seoul close to here had already been much developed as it can be seen on the map. The eastern districts are also not favorable, as those near Guri, the city just east of Seoul, are also already much developed. Thus, there is not much space left for new development.

That leaves us southern parts of Seoul, but the southeastern part of Seoul would also be close to Seongnam National Airport. Then we are left with the southwestern parts of Seoul, which are the Gwanak District and the Guemcheon District. Let's first take a look at Gwanak District.
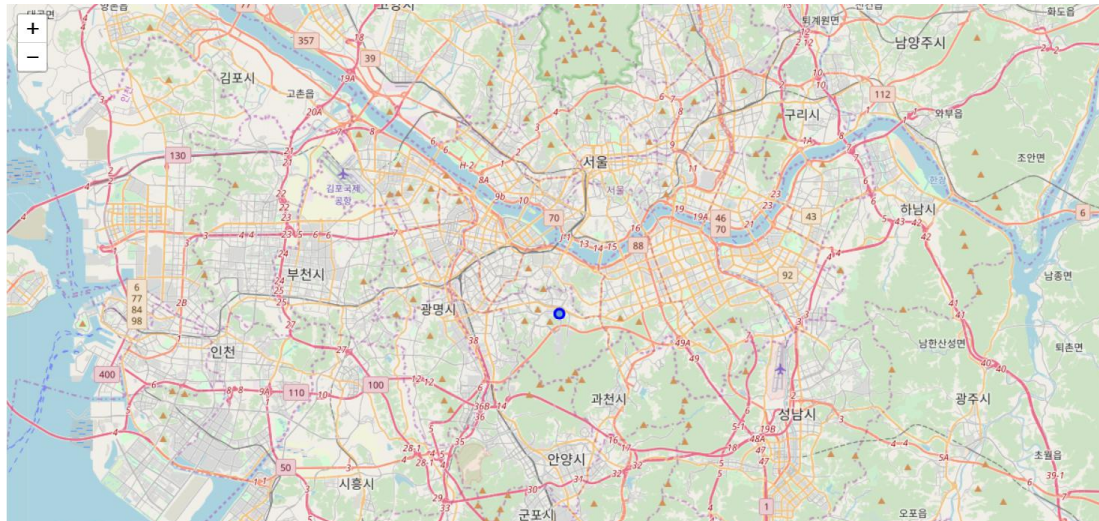
However, as it is visible on the map, there seem to be mountains around this area, these found to be 'Gwanak Mountains.' Thus, Gwanak District may not be an ideal candidate. Let's now take a look at Guemcheon District.
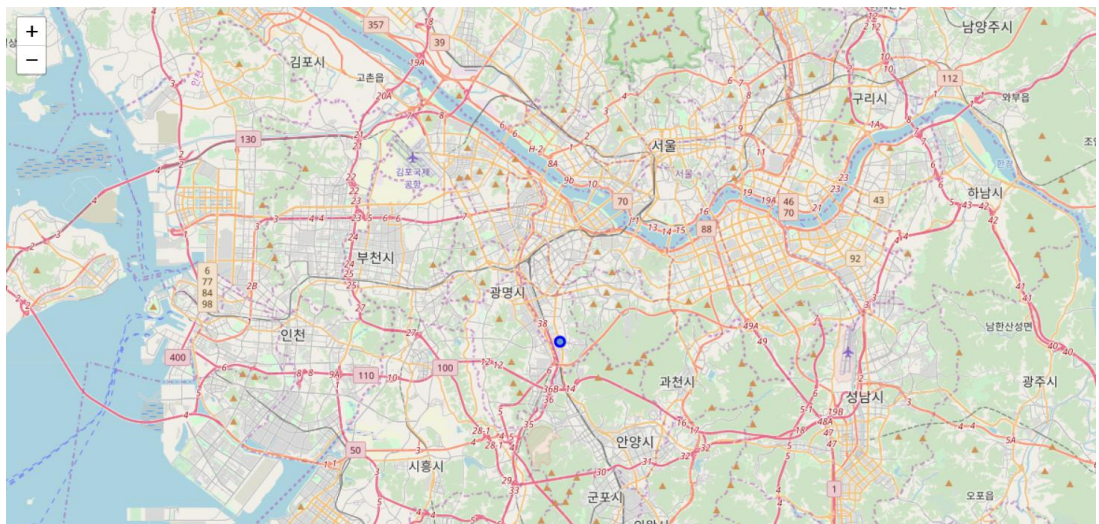
This area has no mountains closeby and seems to have no apparent public facilities to avoid. Guemcheon District also seems to have some undeveloped space around. This passes our first two factors. Let's explore this neighborhood to find out what the current local community is like.

3. Results

Foursqaure API is used to explore the venues in the neighborhood of Guemcheon District. The top 5 venues with the **limit of 100 venues** are shown below within **2km** of the District. Each district in Seoul is ranging from 2 to 3km in radius, as it is a mega-size city spread out widely in the heart of Korea. Each of their names, business types, latitude, and longitude are given in the form of a table.

	name	categories	lat	lng
0	강강술래	BBQ Joint	37.450880	126.901824
1	타요키즈카페	Recreation Center	37.449274	126.889540
2	Starbucks (스타벅스)	Coffee Shop	37.448713	126.903119
3	동흥관	Chinese Restaurant	37.455069	126.898628
4	Fitness Center	Gym	37.467370	126.897865

In total, **29 venues** are returned by Foursqaure. Then one-hot encoding is used to create a table showing the mean of the frequency of occurrence of each business category. The resulting size of the dataframe is found to be 19.

	Neighborhood	BBQ Joint	Bakery	Big Box Store	Buffet	Bus Stop	Café	Chinese Restaurant	Coffee Shop	Donut Shop	Fast Food Restaurant	Gym	Hotel	Ice Cream Shop	Metro Station	Multiplex	Recreation Center	Supermarket	Trail
0	Geumcheon District	0.034483	0.206897	0.034483	0.034483	0.034483	0.034483	0.034483	0.103448	0.068966	0.103448	0.034483	0.034483	0.034483	0.034483	0.034483	0.034483	0.068966	0.034483

The top 5 most common venues and the frequency are printed as below using the 'head()' command.

```
----Geumcheon District----
                 venue  freq
0               Bakery  0.21
1  Fast Food Restaurant  0.10
2          Coffee Shop  0.10
3          Supermarket  0.07
4           Donut Shop  0.07
```

The frequency of the venues is put into the dataframe in combination with the mean of the frequency of occurrence table presented beforehand resulting in the table below. This is done to rank which types of businesses are dominant in the area.

	Neighborhood	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	Geumcheon District	Bakery	Coffee Shop	Fast Food Restaurant	Donut Shop	Supermarket	Big Box Store	Buffet	Bus Stop	Café	Chinese Restaurant

4. Discussions & Conclusions

By referring to the resulting table above, the 8 out of the top 10 venues in the Guemcheon District area are found to be food service businesses such as bakery, coffee shops, fast food restaurants, donut shops, supermarkets, buffets, cafes, and Chinese restaurants. There seems to be no business that would be considered inappropriate such as motels, pubs, karaoke, and etc.

This satisfies our last requirement as these types of businesses are not apparent in this area, making it appropriate for newly-wed families and those with young kids. Furthermore, the 8th common element seems to be the bus stop, which makes the area an even more qualified candidate due to ease of access for transportation. I as the research manager, recommend Guemcheon District as the number 1 candidate for the new town development plan of a new apartment community.

References

[1] https://en.wikipedia.org/wiki/List_of_postal_codes_in_South_Korea

[2] https://www.google.com/search?q=Guemcheon-gu+coordinates&oq=Guemcheon-gu+coordinates&aqs=chrome..69i57j0.7391j0j4&sourceid=chrome&ie=UTF-8 (Typing "Geumcheon-gu coordinates" on Google, the coordinates of each District is found in this way.)

[3] https://developer.foursquare.com/