Iceland Day-in-Life Excursion

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1. Introduction

1.1 Background

LoadsOfFun is a travel company aim to deliver unforgettable short excursions to their customers. Their customers are usually people travel for business, they are in town for a short time either working or attending a conference, who usually have a day or half a day of free time to explore the country they are visiting, they want to make the most out of their limited free time.

1.2 Problem

The people travel for work usually have very busy schedules, they do not have time to do research or planning. They will not join a regular tour with fixed schedule. They want to see the major sights but after taking a memorable picture, they do not want to spend a full day there. They want to experience what locals enjoy and emerge in their culture briefly in their leisure time hoping to take back with them a memorable day-in-life of being a local.

1.3 Interest

LoadsOfFun decided to fill the gap by offering short excursions that delivers local cultural experience. The product development team will form a small team to work on a pilot tour package for customer trial. This team is composed of young IT professionals equipped with data science skills who are enthusiastic travelers themselves. The place they decided to work on is Iceland, it is a country filled with adventurous sites such as volcano, hot spring, and rugged mountains with extraordinary nature scenery.

1.4 Methodology

The key tools for the project are Jyputer Notebook and Python. Jyputer Notebook is a web-based application for software programming using a browser. Python is a programming language; it has a rich library for data analytics. The team will be using Python library such as geopy to locate the latitude and longitude of an address; folium for mapping and geospatial analysis and visualization; matplotlib for plotting; and scikit-learn for machine learning to understand data similarity.

The steps to do the project are outlined in Figure 1. Data is gathered for the project, it is cleaned and formatted to the stage that can be processed by Python. Data integration and transformation will take place if we need more information for analysis or build data models.

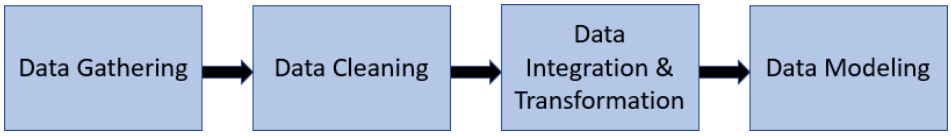

Figure 1 shows major steps in processing data for analysis.

In each steps of data handling, we gain a deeper understanding of the data used for the problem. Data modeling helps visualization of the data in addition to textual format.

This is not a waterfall approach, for example retrieved data will always be cleaned and visualized for problem solving. If more data is needed at a later stage, new data will be added, and it will go through the cleaning and visualization before integrated into the final data set for analysis.

2. Data acquisition and cleaning

2.1 Data sources

The team has not visited Iceland, so they rely on the internet to find all the information they need for the developing the excursion project. They browse the web for postal code with the understanding that from the postal code they will be able to find information on cities and towns.

The team decided to use the Iceland postal code link from Wikipedia https://en.m.wikipedia.org/wiki/List_of_postal_codes_in_Iceland , after reviewing the website they believed it contains trusted data. The postal code is divided into regions, It is contained in a table showing postal code, area using the postal code, and post office address. Figure 2 shows a snapshot of the postal code data from the web link.

1xx: Capital Region and Southern Peninsula

Code	Area served (district)	Post office address (place, if outside area served)
101	Reykjavík (Miðborg)	Hagatorg 1
102	Reykjavík (Vesturbær)	Hagatorg 1
103	Reykjavík (Háaleiti og Bústaðir)	Síðumúla 3-5, 108 Reykjavík
104	Reykjavík (Laugardalur)	Síðumúla 3-5, 108 Reykjavík
105	Reykjavík (Hlíðar)	Síðumúla 3-5, 108 Reykjavík
107	Reykjavík (Vesturbær)	Eiðistorgi 15, 170 Seltjarnarnes
108	Reykjavík (Háaleiti og Bústaðir)	Síðumúla 3-5
109	Reykjavík (Breiðholt)	Þönglabakka 4
110	Reykjavík (Árbær)	Hraunbæ 119
111	Reykjavík (Breiðholt)	Þönglabakka 4, 109 Reykjavík
112	Reykjavík (Grafarvogur)	Hverafold 1-3
113	Reykjavík (Grafarholt og Úlfarsárdalur)	Hraunbæ 119, 110 Reykjavík
116	Reykjavík (Kjalarnes)	*Surface mail*
121	Reykjavík *PO boxes*	Pósthússtræti 5, 101 Reykjavík

Figure 2. Iceland postal code in the Capital Region

2.2 Data cleaning

The data from the web was bring into Jyputer Notebook using Python library Beautiful Soup to read in the html table. It is put into Pandas data frame. Figure 3 shows the data frame containing the postal code data from the web link.

	Postal Code	City	PO address
0	101\n	Reykjavík (Miðborg)\n	Hagatorg 1\n
1	102\n	Reykjavík (Vesturbær)\n	Hagatorg 1\n
2	103\n	Reykjavík (Háaleiti og Bústaðir)\n	Síðumúla 3-5, 108 Reykjavík\n
3	104\n	Reykjavík (Laugardalur)\n	Síðumúla 3-5, 108 Reykjavík\n
4	105\n	Reykjavík (Hlíðar)\n	Síðumúla 3-5, 108 Reykjavík\n
5	107\n	Reykjavík (Vesturbær)\n	Eiðistorgi 15, 170 Seltjarnarnes\n
6	108\n	Reykjavík (Háaleiti og Bústaðir)\n	Síðumúla 3-5\n
7	109\n	Reykjavík (Breiðholt)\n	Þönglabakka 4\n
8	110\n	Reykjavík (Árbær)\n	Hraunbæ 119\n
9	111\n	Reykjavík (Breiðholt)\n	Þönglabakka 4, 109 Reykjavík\n
10	112\n	Reykjavík (Grafarvogur)\n	Hverafold 1-3\n
11	113\n	Reykjavík (Grafarholt og Úlfarsárdalur)\n	Hraunbæ 119, 110 Reykjavík\n
12	116\n	Reykjavík (Kjalarnes)\n	Surface mail\n
13	121\n	Reykjavík, PO boxes\n	Pósthússtræti 5, 101 Reykjavík\n
14	123\n	Reykjavík, PO boxes\n	Síðumúla 3-5, 108 Reykjavík\n
15	124\n	Reykjavík, PO boxes\n	Síðumúla 3-5, 108 Reykjavík\n
16	125\n	Reykjavík, PO boxes\n	Síðumúla 3-5, 108 Reykjavík\n
17	127\n	Reykjavík, PO boxes\n	Eiðistorgi 15, 170 Seltjarnarnes\n

Figure 3. Postal code data in pandas data frame before cleaning

As we can see, the data has unwanted characters and format. The team needs to clean the data to a stage that they can use for analysis. They need the city name and the neighborhood names only.

The City column contains the city and district in (), sometimes district also means PO Box. The team selected index 0 to 12, taking only the lines with unique district names and removing duplicate lines.

The City column is then separated into two columns City and Neighborhood. The City column is for the city names and the Neighborhood column is for the district names. The characters ‘(‘ and ‘)’ are removed.

The post code and the PO address column is not useful for analysis, so they are deleted. Figure 4 shows the new data frame after cleaning.

	City	Neighborhood
0	Reykjavík	Miðborg
1	Reykjavík	Vesturbær
2	Reykjavík	Háaleiti
3	Reykjavík	Laugardalur
4	Reykjavík	Hlíðar
5	Reykjavík	Breiðholt
6	Reykjavík	Árbær
7	Reykjavík	Grafarvogur
8	Reykjavík	Grafarholt

Figure 4 shows the data frame after data cleaning.

To know more about the city and its neighborhoods the team wants to see a map. They use Python geopy to get the latitude and longitude, this data is necessary for folium to create the map for visualization. Figure 5 shows the latitude and longitude of Reykjavik city and its neighborhoods.

The new data, latitude and longitude, give an idea to the team where the neighborhoods are located. They also noticed that Hlíðar's longitude is out of normal range and may be an issue.

	City	Neighborhood	Latitude	Longitude
0	Reykjavík	Miðborg	64.135984	-21.938189
1	Reykjavík	Vesturbær	64.145461	-21.958172
2	Reykjavík	Háaleiti	64.135067	-21.884649
3	Reykjavík	Laugardalur	64.142568	-21.867004
4	Reykjavík	Hlíðar	65.957517	-14.624533
5	Reykjavík	Breiðholt	64.102520	-21.832057
6	Reykjavík	Árbær	64.114373	-21.795208
7	Reykjavík	Grafarvogur	64.147253	-21.789674
8	Reykjavík	Grafarholt	64.126563	-21.755767

Figure 5. Shows latitude and longitude for every neighborhood in the city of Reykjavik.

Figure 6 shows a map of Reykjavik and its neighborhood. The map only shows eight dots, this reassures the team that Hlíðar is out of range and it will be a good idea to omit it for their project. The team regenerated the dataset. Figure 7 shows the final dataset.

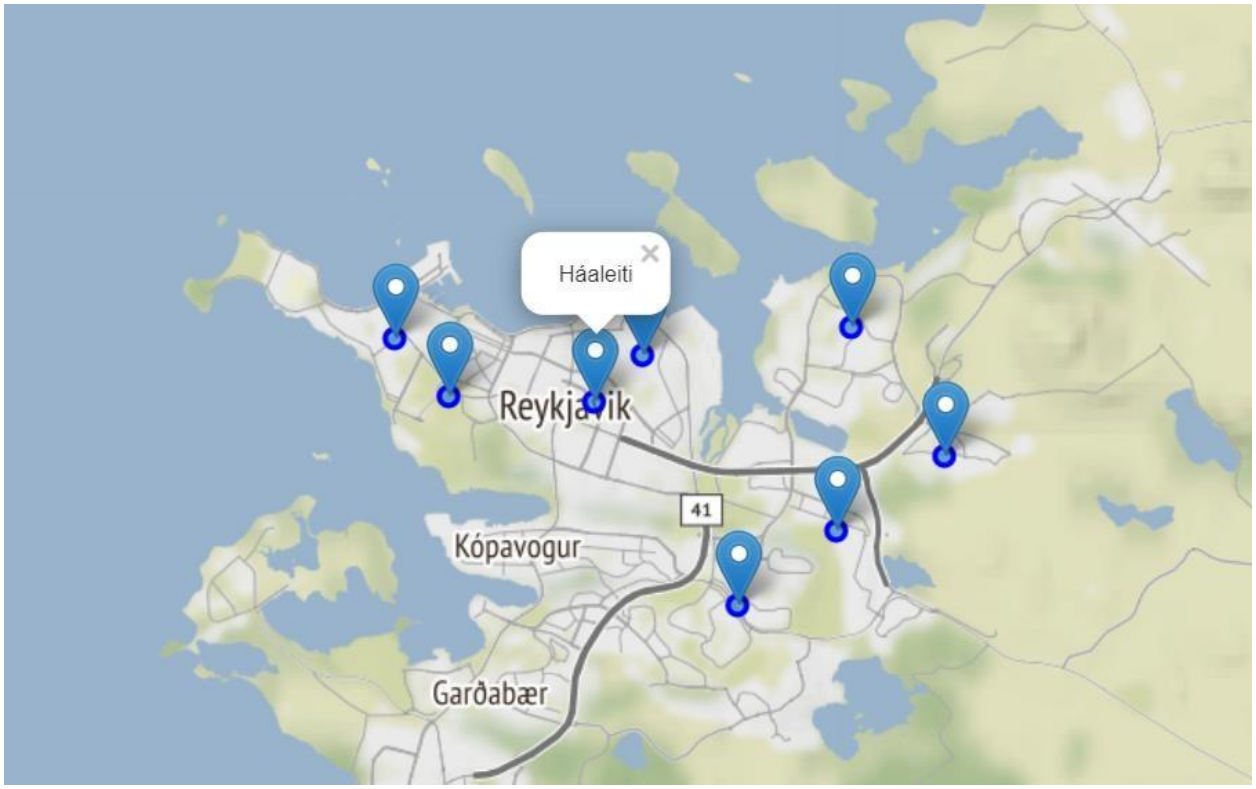

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Figure 7 shows the final dataset

2.2 Adding New Data

The map helps the team to visualize where the neighborhoods are location, which two neighborhoods are in close in proximity. To build an excursion package the development team needs to know in-depth what each neighborhood has to offer to the visitor. The best place for this

information is using Foursquare API to get data of popular places people visited and recommanded. Figure 8 shows the Json file from Foursquare and the data in it.

Figure 8 shows the Json file from Foursquare and the data in it

The team extracts the data out of the json file and stores it in a dataframe for analysis similar to rea ding in the html file for postal code. Figure 9 shows the datafame containing venues for neighborho od Miðborg.

	name	categories	lat	lng
0	Hljómskálagarðurinn	Park	64.140945	-21.940230
1	Norræna Húsið	Opera House	64.138162	-21.946746
2	AALTO Bistro	Scandinavian Restaurant	64.138363	-21.946862
3	Serrano (N1 Hringbraut)	Burrito Place	64.138683	-21.937948
4	Mýrin Mathús	Diner	64.137481	-21.934801
5	Galtafell Guesthouse	Bed & Breakfast	64.141343	-21.936922
6	Matstofa FÍ	Restaurant	64.132115	-21.944246
7	Hljómskálagarður	Garden	64.140792	-21.941457
8	Flugumsjón	Airport Terminal	64.132024	-21.945856

Figure 9 shows the datafame containing popular places for Miðborg

2.3 Explore Data in other neighborhoods

This is useful data for building excursion, so the team decided to get similar information for all the neighborhoods in Reykjavik. Figure 10 shows the popular venues in Reykjavik neighborhoods.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Miðborg	64.135984	-21.938189	Norræna Húsið	64.138162	-21.946746	Opera House
1	Miðborg	64.135984	-21.938189	AALTO Bistro	64.138363	-21.946862	Scandinavian Restaurant
2	Miðborg	64.135984	-21.938189	Serrano (N1 Hringbraut)	64.138683	-21.937948	Burrito Place
3	Miðborg	64.135984	-21.938189	Mýrin Mathús	64.137481	-21.934801	Diner
4	Vesturbær	64.145461	-21.958172	Melabúðin	64.144684	-21.960164	Grocery Store
5	Vesturbær	64.145461	-21.958172	Kaffihús Vesturbæjar	64.144237	-21.961138	Café
6	Vesturbær	64.145461	-21.958172	Vesturbæjarlaug	64.144549	-21.962506	Pool
7	Vesturbær	64.145461	-21.958172	Ísbúð Vesturbæjar	64.145884	-21.962309	Ice Cream Shop
8	Vesturbær	64.145461	-21.958172	Vesturbær	64.145248	-21.958570	Neighborhood
9	Vesturbær	64.145461	-21.958172	Björnsbakarí	64.143986	-21.950875	Bakery
10	Vesturbær	64.145461	-21.958172	Hagavagninn	64.144301	-21.961606	Burger Joint
11	Vesturbær	64.145461	-21.958172	Thai Grill	64.145896	-21.962165	Asian Restaurant
12	Vesturbær	64.145461	-21.958172	KR-Völlur	64.145964	-21.966838	Soccer Stadium
13	Vesturbær	64.145461	-21.958172	Brauð & Co	64.144228	-21.961057	Bakery
14	Vesturbær	64.145461	-21.958172	Kerno Apartments	64.146413	-21.955243	Vacation Rental
15	Vesturbær	64.145461	-21.958172	Kjötborg	64.145895	-21.951010	Convenience Store

Figure 10 shows the popular venues in Reykjavik neighborhoods.

The eight (8) neighborhood has a total of fifty-seven (57) venues, and twenty-nine (29) unique venue categories. The Venue Category column in Figure 11 shows Háaleiti and Vesturbær has the most variety venues to attracts visitors.

Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
Breiðholt	4	4	4	4	4	4
Grafarholt	4	4	4	4	4	4
Grafarvogur	4	4	4	4	4	4
Háaleiti	13	13	13	13	13	13
Laugardalur	5	5	5	5	5	5
Miðborg	4	4	4	4	4	4
Vesturbær	16	16	16	16	16	16
Árbær	7	7	7	7	7	7

Figure 11 Háaleiti and Vesturbær has the most variety venues.

3. Data Model

3.1 Data Discovery

To visualize the data, the team decided to build a machine leaning model to show cluster of data. To do that they use one hot encoding to represent each venue in the 9 neighborhood using 0 or 1. 0 means not available and 1 means it exists. Figure 12 shows neighborhood venues represented in one hot encoding. The venues are then grouped by neighborhood with the frequency of occurrence shown in each category in Figure 13.

	Neighborhood	Asian Restaurant	BBQ Joint	Bakery	Burger Joint	Burrito Place	Café	Convenience Store	Diner	Ele
0	Miðborg	0	0	0	0	0	0	0	0	
1	Miðborg	0	0	0	0	0	0	0	0	
2	Miðborg	0	0	0	0	1	0	0	0	
3	Miðborg	0	0	0	0	0	0	0	1	
4	Vesturbær	0	0	0	0	0	0	0	0	

Figure 12. shows neighborhood venues represented in one hot encoding.

	Neighborhood	Asian Restaurant	BBQ Joint	Bakery	Burger Joint	Burrito Place	Café	Convenience Store	Diner	El
0	Breiðholt	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	
1	Grafarholt	0.000000	0.000000	0.250000	0.000000	0.000000	0.000000	0.000000	0.00	
2	Grafarvogur	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	
3	Háaleiti	0.000000	0.076923	0.076923	0.000000	0.076923	0.000000	0.000000	0.00	
4	Laugardalur	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00	
5	Miðborg	0.000000	0.000000	0.000000	0.000000	0.250000	0.000000	0.000000	0.25	
6	Vesturbær	0.066667	0.000000	0.133333	0.066667	0.000000	0.066667	0.066667	0.00	
7	Árbær	0.000000	0.000000	0.142857	0.142857	0.000000	0.000000	0.000000	0.00	

Figure 13. shows venues frequency grouped by neighborhood.

Figure 14 shows a list of venues and frequency in Háaleiti and Vesturbær in a different format using the same data. This is good information for the development team to design the excursion trip based on on e neighborhood.

```
---- Háaleiti----
                venue  freq
0               Hotel  0.38
1     Ice Cream Shop  0.08
2          Restaurant  0.08
3   Mobile Phone Shop  0.08
4           BBQ Joint  0.08
5   Electronics Store  0.08
6       Burrito Place  0.08
7             Bakery  0.08
8        Pizza Place  0.08
9     Soccer Stadium  0.00
10      Skating Rink  0.00
11              Park  0.00
```

```
---- Vesturbær ----
                venue  freq
0             Bakery  0.13
1     Soccer Stadium  0.13
2      Grocery Store  0.13
3    Asian Restaurant  0.07
4        Flower Shop  0.07
5               Pool  0.07
6        Pizza Place  0.07
7     Ice Cream Shop  0.07
8              Café  0.07
9   Convenience Store  0.07
10      Burger Joint  0.07
11   Vacation Rental  0.07
```

Figure 14 shows a list of venues and frequency in Háaleiti and Vesturbær

By manipulating the data, one can visualize the top 10 most popular venues across the 9 neighborhoods in Figure 15. This data can make suggestion if one wants to stay in their neighborhood, what activities they can do there.

	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	Breiðholt	Grocery Store	Pizza Place	Fast Food Restaurant	Vacation Rental	BBQ Joint	Bakery	Burger Joint	Burrito Place	Café	Convenience Store
1	Grafarholt	Supermarket	Bakery	Fast Food Restaurant	Grocery Store	Vacation Rental	BBQ Joint	Burger Joint	Burrito Place	Café	Convenience Store
2	Grafarvogur	Sandwich Place	Pizza Place	Supermarket	Vacation Rental	Garden	BBQ Joint	Bakery	Burger Joint	Burrito Place	Café
3	Háaleiti	Hotel	BBQ Joint	Bakery	Burrito Place	Restaurant	Pizza Place	Electronics Store	Mobile Phone Shop	Ice Cream Shop	Garden
4	Laugardalur	Park	Garden	Skating Rink	Scandinavian Restaurant	Vacation Rental	BBQ Joint	Bakery	Burger Joint	Burrito Place	Café
5	Miðborg	Scandinavian Restaurant	Burrito Place	Diner	Opera House	Vacation Rental	Grocery Store	BBQ Joint	Bakery	Burger Joint	Café
6	Vesturbær	Bakery	Soccer Stadium	Grocery Store	Vacation Rental	Ice Cream Shop	Burger Joint	Café	Convenience Store	Flower Shop	Asian Restaurant
7	Árbær	Stadium	Soccer Stadium	Bakery	Burger Joint	Pool	Supermarket	Grocery Store	Vacation Rental	Flower Shop	BBQ Joint

Figure 15 to shows the 10 most common venue in each neighborhood.

The team uses K-means cluster data on the Reykjavik map to understand the similarities and difference venues offered in each neighborhood. Figure 16 shows the neighborhood similarities if we set K-mean cluster to 4. Figure 17 shows the neighborhood similarities if we set K-mean cluster to 2.

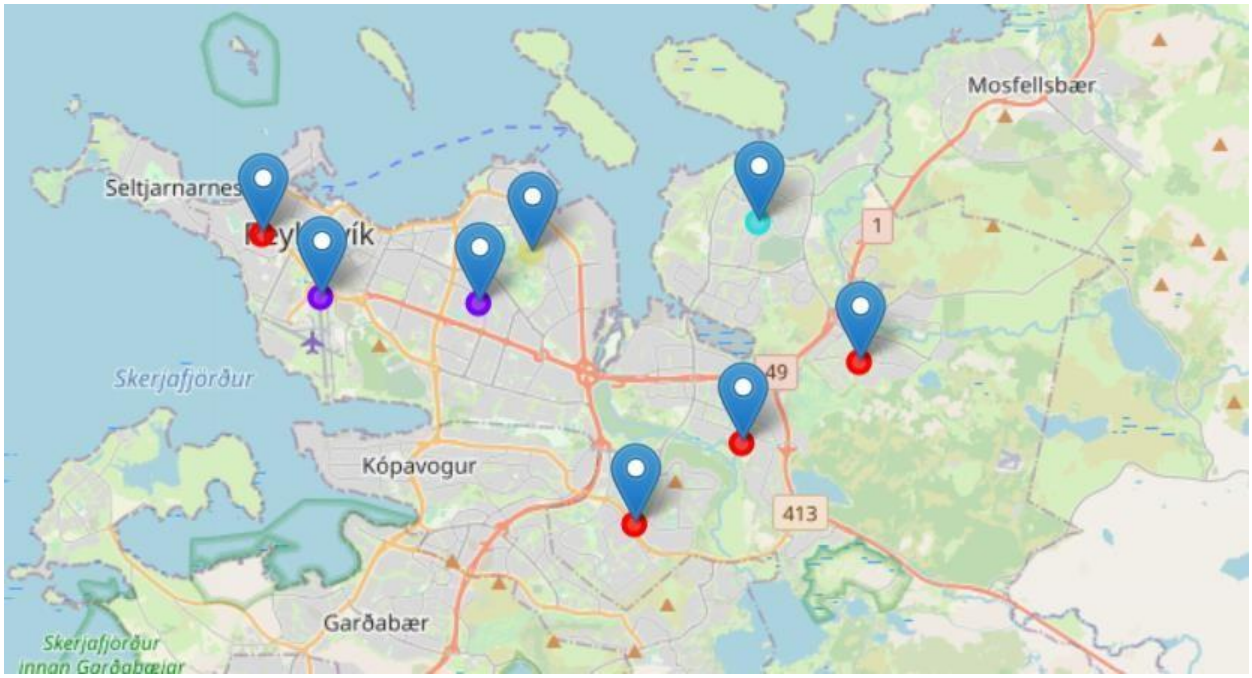

Figure 16 shows the neighborhood similarities if we set K-mean cluster to 4.

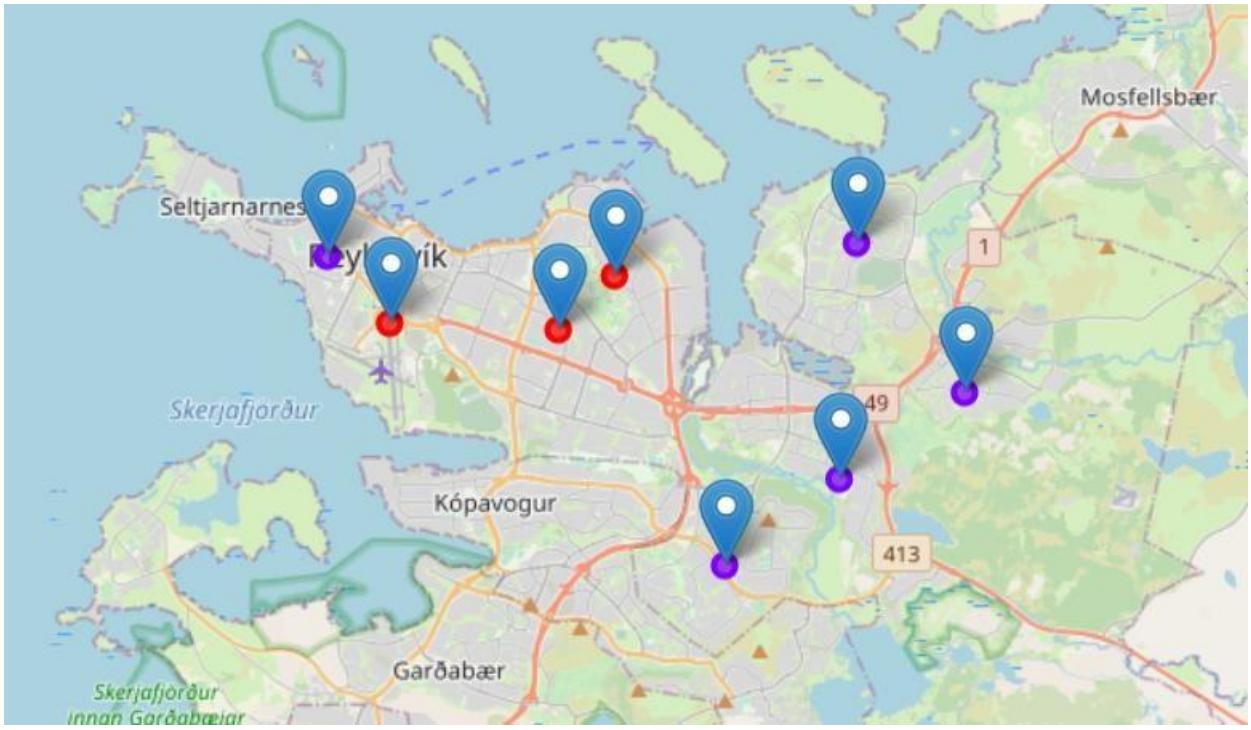

Figure 17 shows the neighborhood similarities if we set K-mean cluster to 2.

By changing the number of clusters in K-means, we learn the following:

When K is set to 2, two clusters are created from the data. The venues in the red neighborhoods, Miðborg, Háaleiti, and Laugardalur has similar venues and the purple neighborhoods, Vesturbær, Breiðholt, Árbær, Grafarvogur, and Grafarholt has similar venues. If compare the red and purple neighborhoods, they have different venues. The 2 cluster is a good indication that red neighborhoods are the tourist spot and purple neighborhood are residential area. This is further supported by the data such as opera house, hotels, and gardens are found in the red neighborhood.

When K is set to 4, we learned that Grafarvogur and Laugardalur may have something unique to offer while the Vesturbær, Árbær, Breiðholt, and Grafarholt remains in the same cluster as well as Miðborg and Háaleiti. It may be worth a trip for visitor to visit Grafarvogur and Laugardalur.

4. Development of excursion product

The excursion development team at LoadsOfFun had enough information to develop several excursion packages inviting anyone traveling to Iceland to try out

Excursions packages

Modborg Half Day Trip	1. Get a quick bite at AALTO Bistro in the morning

	2. Take the bus to explore Modborg's surroundings. 3. Have dinner at Myrin Mathus 4. Go to Opera House
Modborg Full Day Trip	1. Stay at Galtafell Guesthouse 2. Eat at Serrano. 3. Visit Hljómskálagarðurinn 4. Dinner at Matstofa FÍ 5. Go to Opera House 6. Go to airport
Háaleiti and Laugardalur Half Day Trip	1. Get bakery at Mosfellsbakarí in the morning. 2. Take a walk at the Laugardalurinn park. 3. Lunch at Dirty Burger & Ribs 4. Have some icecream at Ísbúð Háaleitis
Háaleiti and Laugardalur Full Day Trip	1. Get bakery at Mosfellsbakarí in the morning. 2. Take a walk at the Grasagarðurinn garden. 3. Go to Café Flóran for lunch 4. Try out skating at Skautahöllin Laugardal 5. Have some icecream at Ísbúð Háaleitis 6. Dinner at Mulakaffi
Breiðholt half day Trip	1. Stay in vacation rental. 2. Visit grocery store. 3. Go to Indian Restaurant

5. Conclusion

Data is crucial in understand everything around us. Using the right data and analytic tools can turn seemingly unimportant fact to useful information. In this project we use a simple postal code and latitude and longitude data to developed excursion package that delivers lifetime memorable experience for travelers are priceless. If the pilot trips are successful, one can build a business out of this concept and the possibilities to expand to other countries and cities is limitless.