Recommending Locations for Opening a New Restaurant at Co. Galway in the Republic of Ireland

I. Introduction

In the modern business environment, spatial analytics plays a critical role in improving business values by elevating location-based insights to business problems. In this study, we focus primarily on analyzing the geospatial data of the Republic of Ireland and recommend a set of locations that could be fitting for starting a restaurant business. For the same, we employ the Foursquare API to retrieve neighborhood information to analyze and group areas that are similar.

II. Background

The Republic of Ireland has 32 counties and four provinces. Since the businesses are already well-established in the provinces Leinster, Ulster, and Munster, they wanted to expand the company to a county in the Connacht region. For simplification, we chose Co. Galway from Connacht for our study. Co. Galway is ranked 5th in the overall population of Ireland and 1st in the Connacht province. Therefore, setting up the restaurant in Co. Galway will improve the business.

	County	Population	Density	Rank	Province
0	Dublin	12,73,069	1380.8	1	Leinster
1	Antrim	6,18,108	202.9	2	Ulster
2	Down	5,31,665	215.6	3	Ulster
3	Cork	5,19,032	69.0	4	Munster
4	Galway	2,50,541	40.7	5	Connacht
5	Londonderry	2,47,132	119.1	6	Ulster

Figure 1: Counties of Ireland

III. Problem Statement

To analyze the neighborhoods of Co. Galway based on the popular venues and recommend a set of locations that suit well for setting up a new restaurant.

IV. Target Audience: The target audience may be a franchise like McDonald's looking to start a new restaurant in a new province.

V. Business Requirements

- The neighbourhood should be a busy area with plenty of foot traffic.
- The region should have enough bars and pubs nearby
- Should have relatively less number of restaurants opened in the same spot

VI. Data Understanding

a) Datasets Used

- **Dataset 1**: Ireland Counties Dataset | Available @ list-counties-ireland.csv

	County	Population	Density	Rank	Province
0	Dublin	12,73,069	1380.8	1	Leinster
1	Antrim	6,18,108	202.9	2	Ulster
2	Down	5,31,665	215.6	3	Ulster
3	Cork	5,19,032	69.0	4	Munster
4	Galway	2,50,541	40.7	5	Connacht
5	Londonderry	2,47,132	119.1	6	Ulster

Figure 2: Ireland Counties Data Sample

- **Dataset 2**: Neighborhoods in Co. Galway

  Since no public datasets are available for the neighborhood or town names in Co. Galway, we manually created a data frame with 67 neighborhoods. Given below is a snippet of the data frame.

	Neighborhood
0	Ahascragh
1	Ardrahan
2	Athenry
3	Ballinasloe
4	Ballinderreen
...	...
62	Tully
63	Tully Cross
64	Tuam
65	Turloughmore
66	Woodford

Figure 3: List of Neighborhoods in Co. Galway, Ireland

b) Data Pre-processing and Visualization

Initially, for improved understanding, we plot the 32 counties of Ireland on to a folium map using their latitude and longitude coordinates. Since the dataset has no spatial data, we make use of geopy python library to fetch the latitude and longitude coordinates using the name of the counties.

	County	Population	Density	Rank	Province	Latitude	Longitute
0	Dublin	12,73,069	1380.8	1	Leinster	53.349764	-6.260273
1	Antrim	6,18,108	202.9	2	Ulster	44.994737	-85.113319
2	Down	5,31,665	215.6	3	Ulster	53.597828	-7.351667
3	Cork	5,19,032	69.0	4	Munster	51.897928	-8.470581
4	Galway	2,50,541	40.7	5	Connacht	53.274412	-9.049063
5	Londonderry	2,47,132	119.1	6	Ulster	54.997868	-7.321306

Figure 4: Counties of Ireland with Latitude & Longitude coordinates

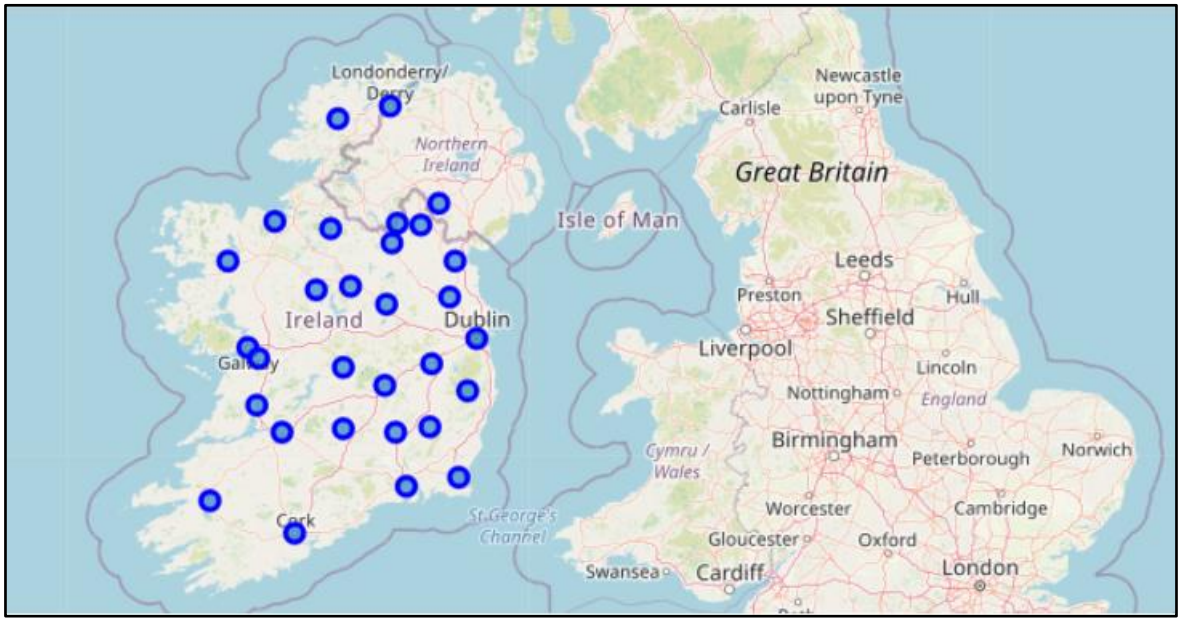

Figure 5: Counties of Ireland plotted on world map

Plotting Co. Galway

The primary objective of the project is to identify locations or neighborhoods in Co. Galway that might interest the stakeholders in starting a restaurant. Therefore, we filter only the coordinated of Co. Galway and plot it onto a folium map.

```
galway_lat=df_irish_counties.loc[df_irish_counties['County'] == 'Galway', 'Latitude'].iloc[0]
galway_lon=df_irish_counties.loc[df_irish_counties['County'] == 'Galway', 'Longitute'].iloc[0]
print('The geograpical coordinates of County Galway are {} and {}'.format(galway_lat,galway_lon))
```

```
The geograpical coordinates of County Galway are 53.2744122 and -9.0490632
```

Figure 6: Fetching only the coordinates of Co. Galway

Figure 7: Location of Co. Galway in the Republic of Ireland

Fetching Neighborhoods in Co. Galway

As the next step, we fetch the latitude and longitude coordinates of the cities in Co. Galway using the geopy library. It is to be noted that the neighborhoods or towns in Co. Galway is scraped manually from the web. Finally, we plot the regions onto a world map.

	Neighborhood	Latitude	Longitude
0	Ahascragh	53.397315	-8.332594
1	Ardrahan	53.156750	-8.805991
2	Athenry	53.299190	-8.746830
3	Ballinasloe	53.330272	-8.221376
4	Ballinderreen	53.186252	-8.908921
...	...	...	...
62	Tully	53.595796	-9.975448
63	Tully Cross	53.588201	-9.962930
64	Tuam	53.514792	-8.851287
65	Turloughmore	53.380699	-8.856270
66	Woodford	53.052181	-8.399454

Figure 8: Latitude & Longitude coordinates of Neighborhoods of Co. Galway

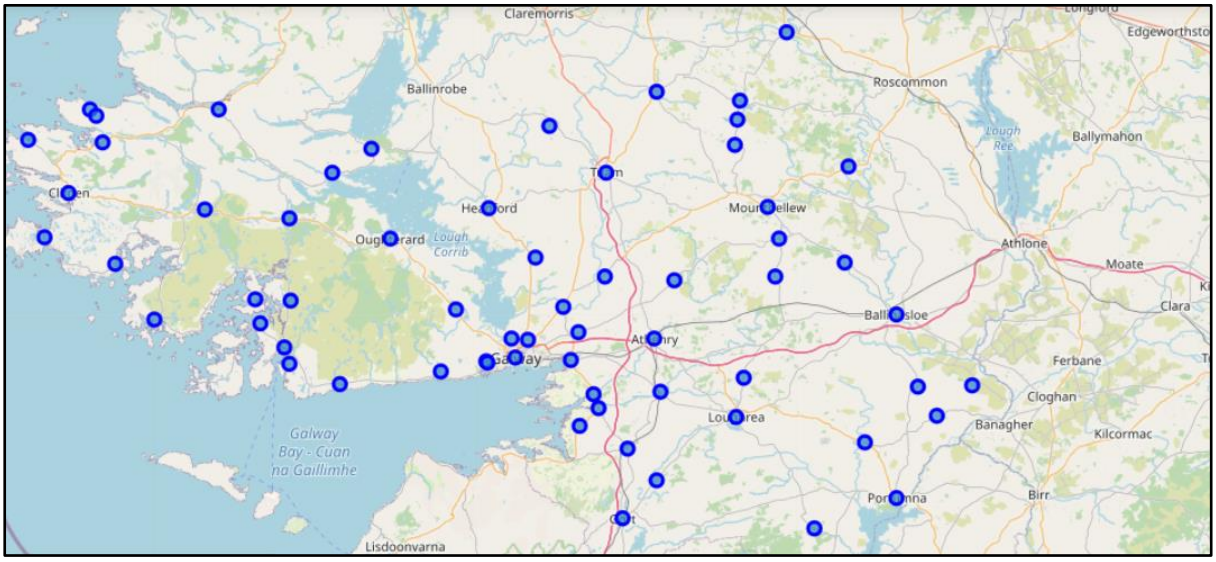

Figure 9: Neighborhoods of Co. Galway

Fetching Venues using Foursquare API

Using Foursquare API, we identify the venues at each of the neighborhood in Co. Galway. Further, we create data frame with information on the venues.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Ahascragh	53.397315	-8.332594	Cahill's	53.397293	-8.335465	Irish Pub
1	Ardrahan	53.156750	-8.805991	Ardrahan Bus Stop	53.156631	-8.806193	Bus Stop
2	Ardrahan	53.156750	-8.805991	Joyces	53.157442	-8.806357	Gastropub
3	Ardrahan	53.156750	-8.805991	Tarpeys	53.160487	-8.806054	Bar
4	Athenry	53.299190	-8.746830	Athenry Castle	53.299940	-8.745710	Castle

Figure 10: Venues fetched using Foursquare API

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Ahascragh	1	1	1	1	1	1
1	Ardrahan	3	3	3	3	3	3
2	Athenry	4	4	4	4	4	4
3	Ballinasloe	5	5	5	5	5	5
4	Ballinderreen	2	2	2	2	2	2
5	Ballyconneely	2	2	2	2	2	2
6	Ballygar	3	3	3	3	3	3
7	Barna	4	4	4	4	4	4
8	Carna	2	2	2	2	2	2
9	Casla	3	3	3	3	3	3
10	Castlegar	1	1	1	1	1	1

Figure 11: Venue Info grouped by Neighborhood

Assumptions:

- Venue Category (**Figure 11**) is directly proportional to Foot traffic
- Positive Venues Categories: Bars and Pubs (desired venues)
- Negative Venues Categories: Restaurant, Fast Food Restaurant, Seafood Restaurant, Vegan Restaurant, Middle Eastern Restaurant, Chinese Restaurant, Mexican Restaurant, Indian Restaurant, Asian Restaurant, French Restaurant, Japanese Restaurant and Italian Restaurant (the location should not have many restaurants)

Explanation

In the following sections, we will cluster neighborhoods based on the count of Venue Category (foot traffic), number of positive venues like bar and pubs, also on the number of negative venues like other restaurants. Finally, we compute an overall score based on the cluster values and categorize locations into low-value, mid-value and high-value neighborhoods.

In simple terms, we need a location that is busy, and has venues like bar and pubs. However, the number of restaurants in the same point should be less.

	Neighborhood	Latitude	Longitude	Venue Traffic Cluster	Negative Venues Cluster	Positive Venues Cluster	Overall Score	Segment
0	Ahascragh	53.397315	-8.332594	0	3	0	3	Low-Value
1	Ardrahan	53.156750	-8.805991	0	3	0	3	Low-Value
2	Athenry	53.299190	-8.746830	1	3	0	4	Mid-Value
3	Ballinasloe	53.330272	-8.221376	1	3	0	4	Mid-Value
4	Ballinderreen	53.186252	-8.908921	0	3	0	3	Low-Value
5	Ballyconneely	53.431491	-10.074751	0	3	0	3	Low-Value
6	Ballygar	53.522323	-8.326138	0	3	0	3	Low-Value
7	Barna	53.270434	-9.112482	1	3	0	4	Mid-Value
8	Carna	53.324842	-9.835653	0	3	0	3	Low-Value
9	Casla	53.288519	-9.552989	0	3	0	3	Low-Value
10	Castlegar	53.298620	-9.022817	0	3	0	3	Low-Value
11	Claregalway	53.340482	-8.946239	1	3	0	4	Mid-Value
12	Clarinbridge	53.228065	-8.880166	1	3	0	4	Mid-Value
13	Cleggan	53.556459	-10.110690	1	3	0	4	Mid-Value
14	Clifden	53.488492	-10.021067	2	3	0	5	High-Value
15	Clonbur	53.544594	-9.363610	1	3	0	4	Mid-Value

Figure 12: Final Cluster Output

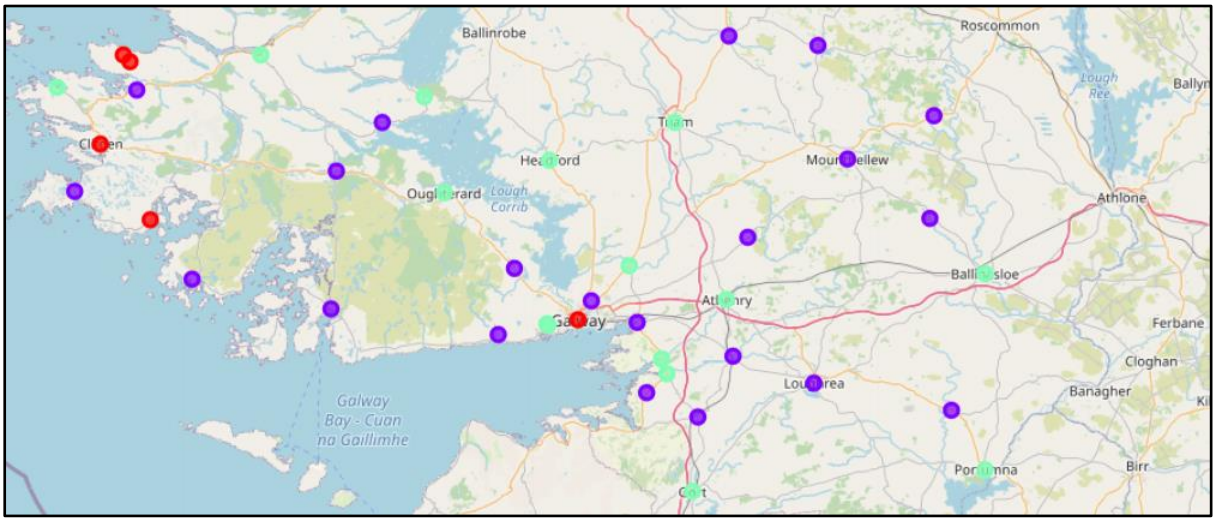

Figure 13: Cluster Output (**Red**: High-value, **Green**: Mid-value, **Purple**: Low-value)