

Finding the Availability of Vegetarian/Vegan Restaurants within a US City

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1. Introduction

1.1 Background

Over the past decade, a growing number of Americans have adopted new eating habits to reflect a healthier, more ethical lifestyle. People have turned to vegan or vegetarian diets that eliminate meats, dairy, and other animal products from everyday consumption. Some fast-food companies have responded to this demand by providing plant-based alternatives; a good example is Burger King's 'Impossible Whopper,' a hamburger made with a soy protein meat substitute by the company Impossible Foods. Even with home name fast-food brands introducing plant-based alternatives, most restaurants in America are still very limited in their vegetarian/vegan menu options – and most struggle to prevent cross-contamination with other foods. This gave way to a rise in restaurants that only offer vegetarian/vegan meals, allowing consumers to enjoy a wide variety of alternative menu options without worrying if there are animal products in their food.

1.2 Problem

More and more Americans are seeking out restaurants who offer menu items that meet their dietary restrictions. This project aims to identify available vegetarian/vegan restaurants in selected major cities within the United States.

1.2 Interest

Those who are vegetarian, or vegan may be interested in eating options in the cities they are living in or visiting to get the most variety of restaurants.

2. Data

2.1 Data Sources

The data was taken from the Foursquare API and consists of all the vegetarian or vegan restaurants in the five pre-selected cities:

- New York, NY
- Chicago, IL
- Seattle, WA
- San Francisco, CA
- Boston, MA

2.2 Data Visualization

All vegetarian/vegan restaurants are stored for each city, with up to the top 100 identified on the city's map as a dot with the restaurant's name.

3. Methodology

I created a dataset that will identify vegetarian/vegan restaurants in a given city and gives the average distance to each one from a central point to represent which cities have the best access to these restaurants (i.e., the ones with the shortest average distance).

3.1 Code Program

```
!pip install folium
import numpy as np
import pandas as pd
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)
import requests
from pandas.io.json import json_normalize
import folium
```

The above tools are imported into the code file for creating data frames, arrays, and interactive maps.

```
CLIENT_ID = 'EKHNCZXJKWC5KBB5APJDTGRAVXODGM5FDUSR2H4ZZT24RNW'
CLIENT_SECRET = 'PXTZQ4FIVPUQKIK20F2NGDJRJJ3UHJVI4KQWSYW5FFGQB3P1'
VERSION = '20180605'
```

The above variables are set for the Client ID and Client Secret of my Foursquare Developers account to access the Foursquare API.

```
LIMIT = 500
cities = ["New York, NY", 'Chicago, IL', 'Seattle, WA', 'San Francisco, CA', 'Boston, MA']
results = {}
for city in cities:
    url = 'https://api.foursquare.com/v2/venues/explore?&client_id={}&client_secret={}&v={}&near={}&limit={}&categoryId={}'.format(
        CLIENT_ID,
        CLIENT_SECRET,
        VERSION,
        city,
        LIMIT,
        "4bf58dd8d48988d1d3941735")
    results[city] = requests.get(url).json()
```

The above code consists of a 'cities' list for the five selected major cities. Each city is looped through and all of the vegetarian and vegan restaurants from the Foursquare URL link are stored in the 'results' dictionary.

```
df_venues={}
for city in cities:
    venues = json_normalize(results[city]['response']['groups'][0]['items'])
    df_venues[city] = venues[['venue.name', 'venue.location.address', 'venue.location.lat', 'venue.location.lng']]
    df_venues[city].columns = ['Name', 'Address', 'Lat', 'Lng']
```

For each city, all of the restaurants' addresses along with their location coordinates are stored in the 'df_venues' data frame to be used when creating the maps.

```
maps = {}
for city in cities:
    city_lat = np.mean([results[city]['response']['geocode']['geometry']['bounds']['ne']['lat'],
                        results[city]['response']['geocode']['geometry']['bounds']['sw']['lat']])
    city_lng = np.mean([results[city]['response']['geocode']['geometry']['bounds']['ne']['lng'],
                        results[city]['response']['geocode']['geometry']['bounds']['sw']['lng']])
    maps[city] = folium.Map(location=[city_lat, city_lng], zoom_start=11)

    for lat, lng, label in zip(df_venues[city]['Lat'], df_venues[city]['Lng'], df_venues[city]['Name']):
        label = folium.Popup(label, parse_html=True)
        folium.CircleMarker(
            [lat, lng],
            radius=5,
            popup=label,
            color='blue',
            fill=True,
            fill_color='#3186cc',
            fill_opacity=0.7,
            parse_html=False).add_to(maps[city])
    print(f"Total number of vegetarian/vegan restaurants in {city} = ", results[city]['response']['totalResults'])
```

Using the folium tool, the top one hundred restaurants are indicated with blue dots within the selected city. The code then prints out the total number of vegetarian/vegan restaurants found in that area.

```
maps = {}
for city in cities:
    city_lat = np.mean([results[city]['response']['geocode']['geometry']['bounds']['ne']['lat'],
                        results[city]['response']['geocode']['geometry']['bounds']['sw']['lat']])
    city_lng = np.mean([results[city]['response']['geocode']['geometry']['bounds']['ne']['lng'],
                        results[city]['response']['geocode']['geometry']['bounds']['sw']['lng']])
    maps[city] = folium.Map(location=[city_lat, city_lng], zoom_start=11)
    venues_mean_coor = [df_venues[city]['Lat'].mean(), df_venues[city]['Lng'].mean()]
    # add markers to map
    for lat, lng, label in zip(df_venues[city]['Lat'], df_venues[city]['Lng'], df_venues[city]['Name']):
        label = folium.Popup(label, parse_html=True)
        folium.CircleMarker(
            [lat, lng],
            radius=5,
            popup=label,
            color='blue',
            fill=True,
            fill_color='#3186cc',
            fill_opacity=0.7,
            parse_html=False).add_to(maps[city])
        folium.PolyLine([venues_mean_coor, [lat, lng]], color="green", weight=1.5, opacity=0.5).add_to(maps[city])

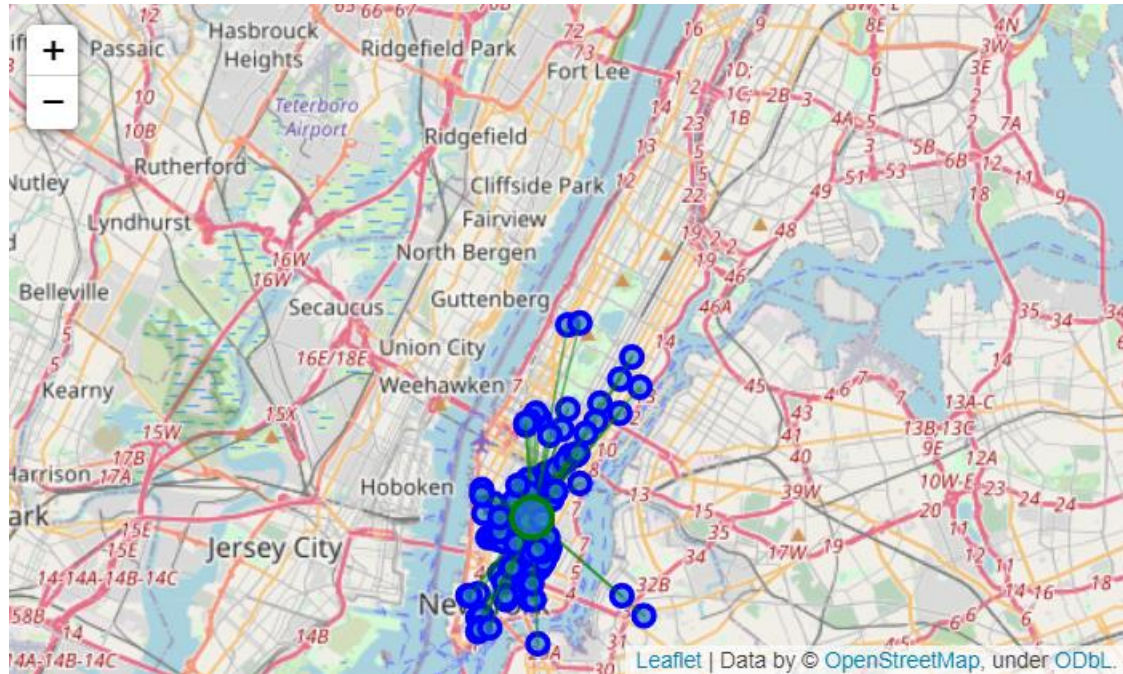
    label = folium.Popup("Mean Co-ordinate", parse_html=True)
    folium.CircleMarker(
        venues_mean_coor,
        radius=10,
        popup=label,
        color='green',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(maps[city])
```

The above code creates another set of maps that contains a center point within all the identified restaurants with green lines indicating the distance between the center point and a particular restaurant.

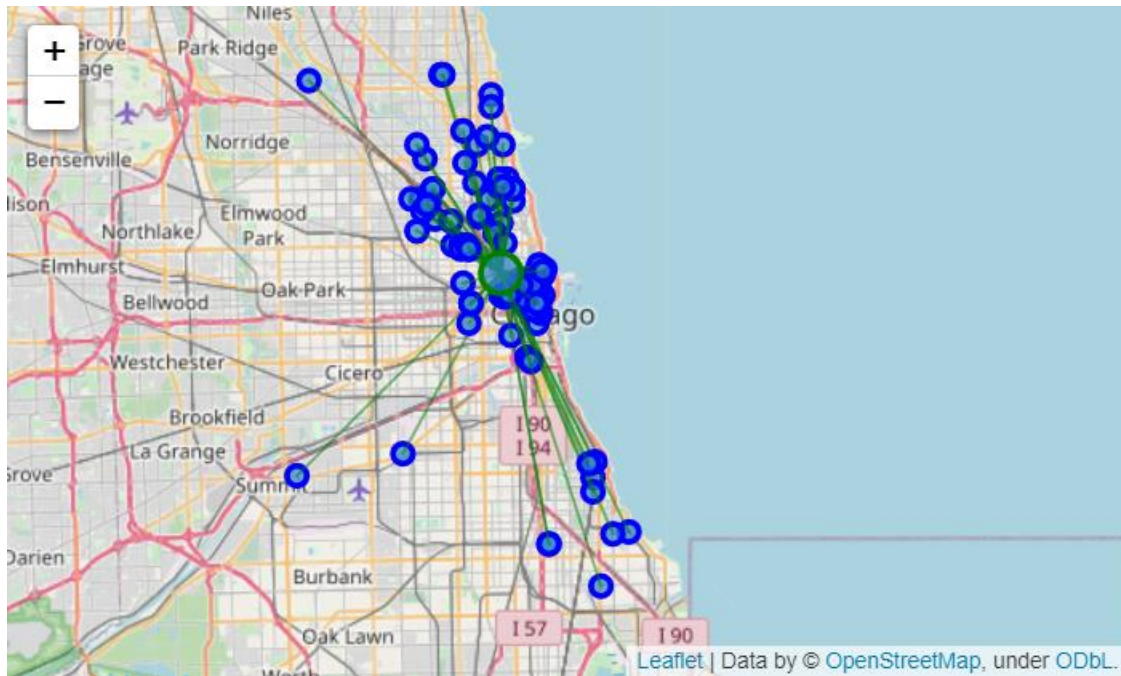
4. Results

The maps below are for each of the five cities. Every blue dot represents a vegetarian or vegan restaurant near the city with the singular green dot being the center location from all restaurants. Green lines connect the restaurant to the center location and represent the distance to a particular restaurant.

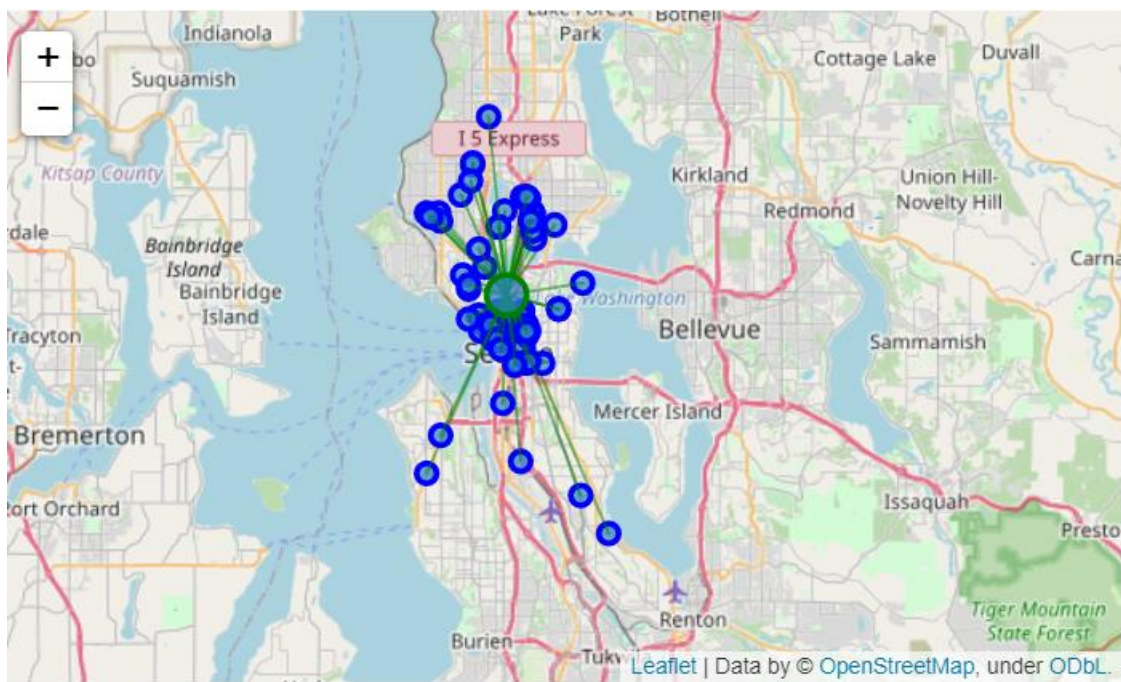
4.1 City maps



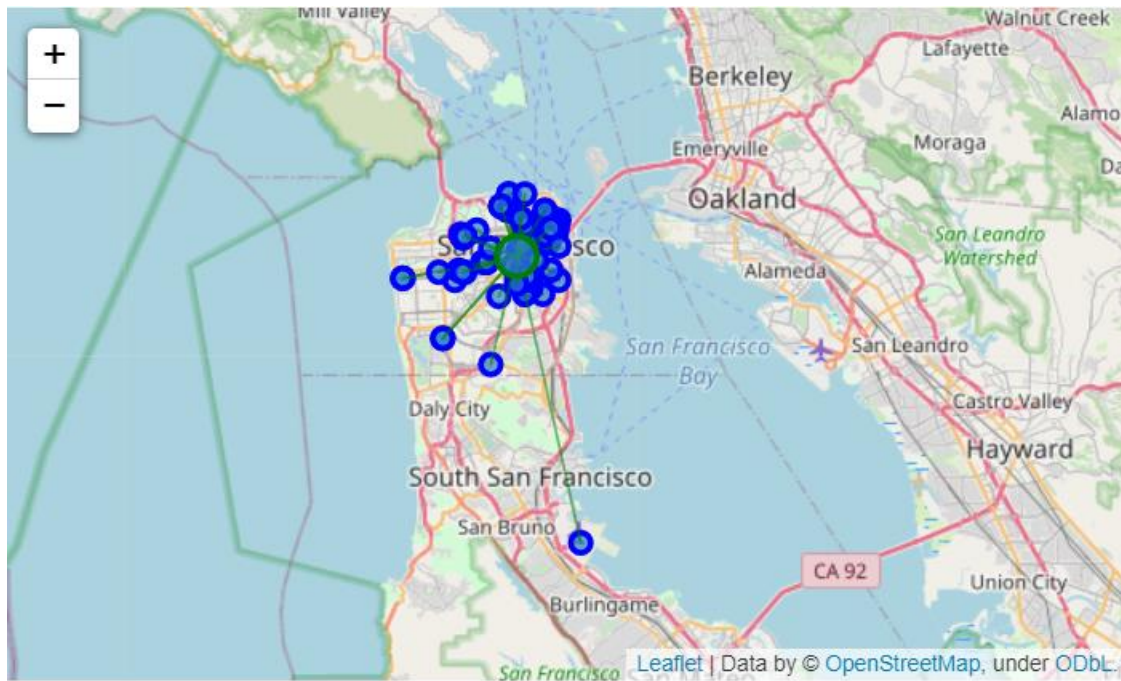
New York, NY



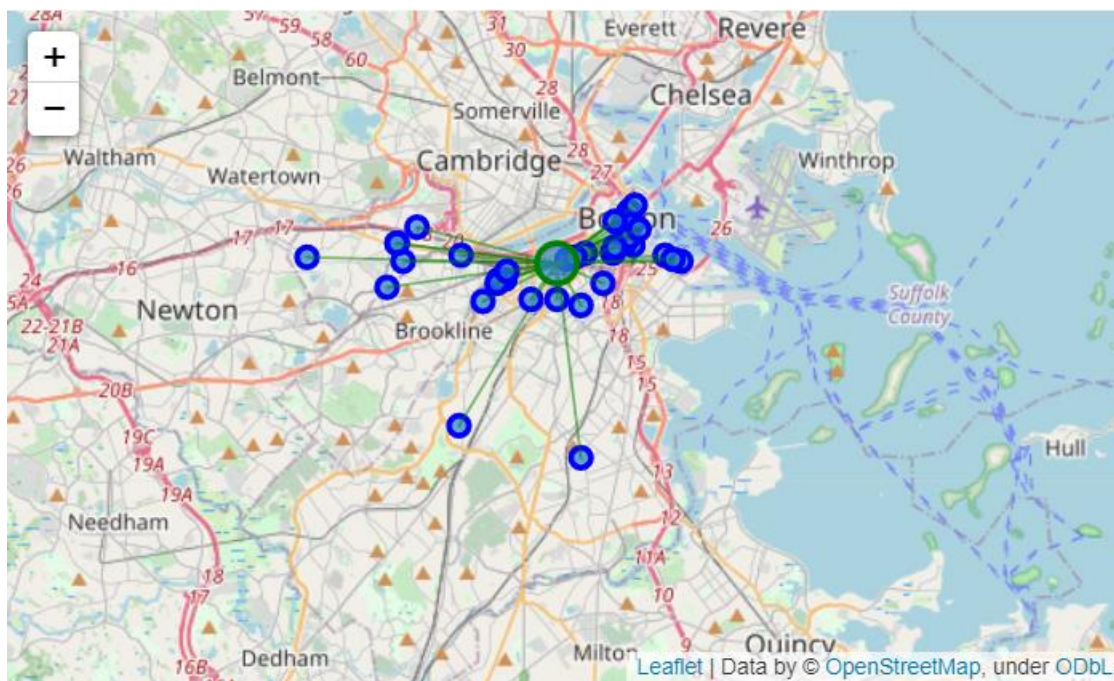
Chicago, IL



Seattle, WA



San Francisco, CA



Boston, MA

4.2 Average Restaurant Distances

Below is the mean distance from the central point to a vegetarian/vegan restaurant on average, in miles:

New York, NY
Mean Distance from Mean coordinates
0.01867679223504514
Chicago, IL
Mean Distance from Mean coordinates
0.050932744040259915
Seattle, WA
Mean Distance from Mean coordinates
0.03942519266378813
San Francisco, CA
Mean Distance from Mean coordinates
0.027534152008194007
Boston, MA
Mean Distance from Mean coordinates
0.029878045073234674

5. Discussion

Based on the five cities used, each city had a high number of vegetarian or vegan restaurants available – with the lowest city being Boston with 39 and New York being the highest with 235 restaurants. The resulting number of vegetarian/vegan restaurants generated using the Foursquare API for each city is listed below:

Total number of vegetarian/vegan restaurants in New York, NY = 235
Total number of vegetarian/vegan restaurants in Chicago, IL = 122
Total number of vegetarian/vegan restaurants in Seattle, WA = 67
Total number of vegetarian/vegan restaurants in San Francisco, CA = 82
Total number of vegetarian/vegan restaurants in Boston, MA = 39

The five selected cities are major cities within the US have high populations from various regions across the country with a wide range of demographics. However, not all places in the US are the same, and the people within each community are typically like-minded individuals with similar ideals and beliefs. And most people tend to correlate larger cities as more progressive thinking, with more individuals that may see the appeal of a vegetarian or vegan lifestyle. This most likely means that large cities will have many more vegetarian/vegan restaurants than smaller cities or towns. And the more options that are available the more people will be exposed to the lifestyle and more likely to follow it, raising demand and further increasing the number of restaurants, while places with a small number of vegetarians and vegans are less likely to get new restaurants.

6. Conclusion

In this study, I identified all of the known vegetarian and vegan restaurants surrounding a selected city by using the Foursquare API. I then created an interactive map of each city that

shows up to one hundred of the restaurants. I then determined a central point inside the city from all of the mapped restaurants and determined the average distance to a vegetarian/vegan restaurant from that point. This will help the user be aware of the number of possible eating options while living or visiting in the city and the ease of access they have to go to one.