COURSERA CAPSTONE PROJECT

IBM Applied Data Science Capstone

Opening a new business near Tesla Superchargers!

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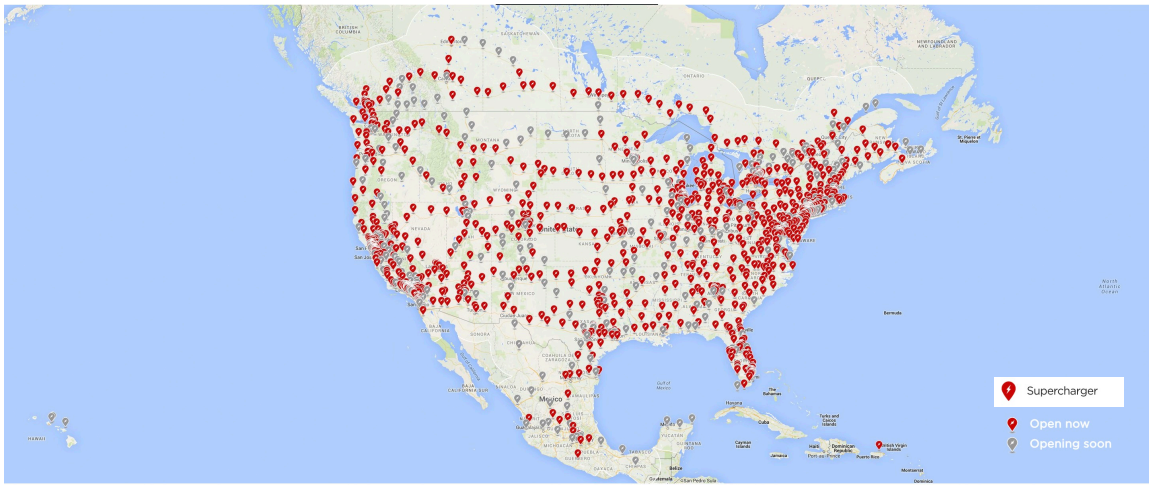
Introduction

Tesla Superchargers are a convenient way for Tesla car owners to charge their cars at over 70Kwh resulting in them spending about 15-20mins waiting for their cars to charge fully either during the long distance road trips on city driving. Most of the superchargers are located inside shopping complexes where there are three to four restaurants and other amenities like departmental stores. If on an average Tesla owners spend about 15-40 mins at a charger most likely they will also venture out to either pick up a coffee or grab a quick bite. Knowing what kind of restaurants are popular around these charging spots can be a factor on whether a new restaurants will be a success or a failure.

Problem

According to tesla.com/supercharger there are 1971 supercharges spread across USA where Tesla car owners can charge their cars at costs less than gasoline. The average wait times for the Tesla cars to charge varies from 15-40 mins. So the owners often hangout at restaurants or food courts that are nearby resulting in good turnout for thesebusinesses.



But if you are a business owner its really hard for you to predict what kind of restaurant you should open near a supercharger as most of the superchargers are conveniently located inside a mall or near a super store complex. Without this insight you may end up opening a restaurant of a similar cuisine to the one that already exists and your business may not get that much attraction.

Target Audience of this project

This project is particularly useful for future restaurant owners and investors in property management looking to open or invest in new restaurants at a nearby Tesla supercharger.

Data

Data Required to solve this problem

To analyze and help you with a right suggestion, we need the following datasets:

❖ Location and neighborhood of each Tesla Supercharger location in US

❖ Nearby food courts and restaurant within walking distance (500meters) of the Tesla Superchargers

Data Sources and methods of extraction

✤ supercharge.info keeps track of all the Tesla superchargers within United States along with the longitude and latitude of each location in a json format. We are going to filter out the results by country=USA only for this project.

✤ Foursquare Api for venue information

Methodology

Firstly through web scraping we extract the data from supercharge.info website. The data is available in json format. We need to scrape it out, filter out the superchargers only available within USA. Finally I convert the resulting json into a dataframe. The dimensions of this dataframe are (982,24). We have following columns in the data frame.

```
df.columns

Index(['id', 'locationId', 'name', 'status', 'dateOpened',
'stallCount','counted', 'elevationMeters', 'powerKilowatt',
'solarCanopy', 'battery', 'statusDays', 'urlDiscuss',
'address.street', 'address.city','address.state', 'address.zip',
'address.countryId', 'address.country', 'address.regionId',
'address.region', 'gps.latitude', 'gps.longitude','hours'],
dtype='object')
```

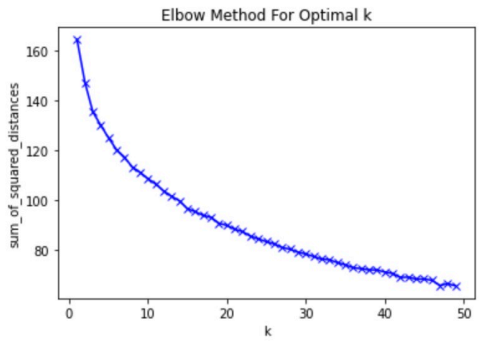
Out of all these columns the ones that interest me are the `name`, `gps.latitude` and `gps.longitude`. I'll use these to get the venue data and nearby restaurants data using the foursquare api.

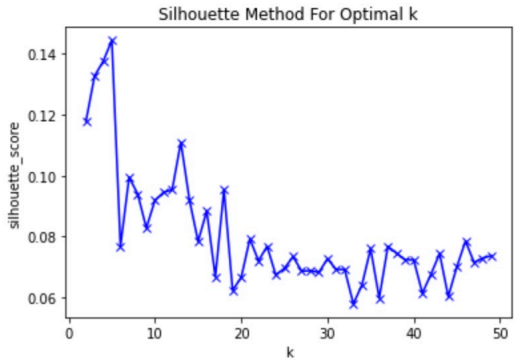
Using Foursquare Api `/v2/venues/explore?categoryId=4d4b7105d754a06374d81259` where `categoryId=4d4b7105d754a06374d81259` is filtering by `venue=Food Category` I get only the venues that are belonging to categories foursquare deems as food. These could be various kind of restaurants, delis, fast food chains, coffee shops etc. Then we will group the data based on each venue and by creating a one-hot over the resultant dataset we write a function that can compute top-5 most common venues at each venue. Now we can join this dataset with the supercharger location dataset performing the join on name column.

Lastly we will perform clustering on the data by using k-means clustering. K-means clustering algorithm identifies k number of centroids, and then allocates every data point to the nearest cluster, while keeping the centroids as small as possible.

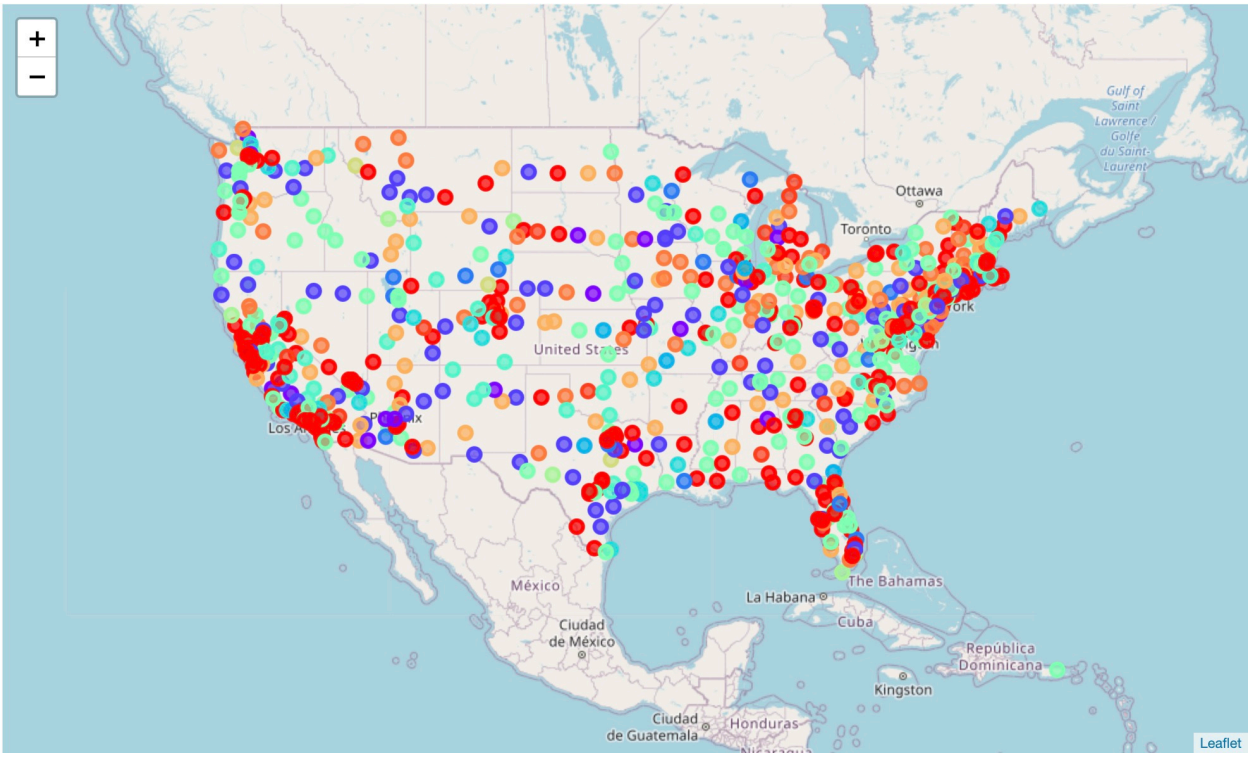
Results

To determine the optimal value of k we perform the Elbow Test and the Silhouette test. We see that Silhouette test performs best with values of k=2, k=3 and k=13.





Performing k-means clustering with k=14 and then plotting the map cluster yields the following distribution.



Clustering labels table

Cluster number	1st most common food venue	2nd most common food venue	Total superchargers
0	Steakhouse	American	13
1	Sandwich Place	Asian	21
2	Fast food	Mexican	97
3	Fast food	Asian	16
4	Breakfast spot	Ethiopian	9
5	Restaurant	BBQ	25
6	Mexican	American	44
7	Fast food	Pizza	205
8	Cafe	Asian	14
9	Diner	Food Court	4
10	American	Fast food	83
11	Pizza	Fast food	68
12	American	Asian	15
13	American	Pizza	349

Discussion

As observations noted from the map and the resulting clustering labels table above, it can be seen that Fast food and American restaurants are by far the most common venues near superchargers. Pizza joints are by far the most common second popular venue if people don't prefer fast food and American restaurants. Furthermore places like Diner and Cafe are not that common given that less 5 superchargers have them as most common venue.

Limitations and Suggestions for Future Research

We only took into consideration the location and frequency of occurrence of super chargers within a given area. There are other factors like demographics, income of the residents that could influence the popular food venues visited that could be Tesla owners.

Conclusion

American and Fast-food are by far the most common food venues located within walking distance of Tesla superchargers. Given that it takes about 15-20mins to charge an average Tesla car, it makes sense that people choose these cuisine over others as its easy to get in and get out with the choice of food and/or beverage in the time Tesla car owners have.

References

Supercharger location info : https://supercharge.info/service/supercharge/allSites

Foursquare Developers Documentation. Foursquare. Retrieved from https://developer.foursquare.com/docs