# Fair Market Rents and Venues Data Analysis of Washington Metropolitan Area

## Introduction

For those who are suffering from kidney disease, there are plenty of other things to manage besides receiving hemodialysis treatment every week. About 37 million people in the United States are struggling with chronic kidney disease (CKD).

Mr. McDreamy who is currently living and working as a consultant in New York City, has also been suffering from CKD for two years. Having once weekly hemodialysis treatment combined with low-protein diet led him to live in a district where all his daily needs can be met easily. For example, the Fresenius Kidney Care Dialysis Center he visits, is situated only ten minutes‘ drive away from his house and very close to vegan restaurants as well as Tesla supercharger stations where he leaves his Tesla charging when dining at a vegan restaurant in the neighborhood.

Last month, he accepted a new job offer in Washington DC and decided to move from New York City to DC in two months. Fortunately, there are more than 70 Fresenius Dialysis Centers in Washington Metropolitan Area where he can receive his treatment without any change in his dialysis care plan.

Now, he desires to continue to live in a district where the Fresenius dialysis center, vegan restaurants and Tesla supercharger/Destination Charger Stations are located close to each other. This project would help Mr. McDreamy prioritize his „must-haves“ during his neighborhood search and find an apartment that he can afford. Exploring 196 Zip Code Areas in Washington Metropolitan Area with additional information on fair market rents would facilitate his decision process and make him confident in his choice.

We will create a map and information chart where each Zip Code is clustered according to Two-Bedroom Apartment average rent level and number of Fresenius Dialysis Center, Tesla Supercharger/Destination Charger Stations and Vegan Restaurants.

## Data Description

Washington Metropolitan Area has more than 250 neighborhoods. In order to explore them we will need a dataset that contains zip codes, latitude and longitude coordinates of each neighborhood. In this Analysis, I will be exploring only 196 zip codes in Washington Metropolitan Area.

I utilized Foursquare API to explore the neighborhoods with additional parameters in the API such as category_id and search_query to specify the Fresenius Dialysis Centers and Vegan Restaurants in the neighborhoods. https://developer.foursquare.com/docs/api-reference/venues/explore/

Using the NREL API from National Laboratory of the U.S. Department of Energy, I could fetch the details of a EV Charging station, such as Tesla Supercharger or Tesla Destination Charger and also find the nearest charging stations within a distance of a Zip Code Area in the Washington Metropolitan Area. https://developer.nrel.gov/docs/transportation/alt-fuel-stations-v1/nearest/

I downloaded the Washington Metropolitan Area Fair Market Rents Dataset from the The U.S. Department of Housing and Urban Development's (HUD's) Office of Policy Development and Research (PD&R) which contains the Zip Codes and the Fair Market Rents for 1-4 Bedroom Aparments. https://www.huduser.gov/portal/datasets/fmr.html#2020_query. Finally, I merged this dataset with the latitude and longitude coordinates of each zip code downloaded from United States Zip Code Database. https://www.unitedstateszipcodes.org/zip-code-database/

# Methodology

First of all, I imported the following libraries:

- Numpy - Library to handle data in a vectorized manner
- Pandas - Library for data analsysis
- Sklearn - Python Machine Learning Library
- Json - Library to handle JSON files
- Geopy- to retrieve Location Data
- Matplotlib – Python Plotting Module
- Folium - Map rendering library
- Requests - Library to handle requests

Secondly, I utilized Foursquare API to get the Fresenius Dialysis Centers and Vegan Restaurants that are in a Zip Code Area within a radius of 3000 meters. I used the NREL API from the U.S. Department of Energy to find the nearest Tesla Charging Stations (Tesla Supercharger and Tesla Destination Charger) that are in a Zip Code Area within a radius of 3 miles. After converting each API json data to a dataframe, I combined all dataframes into a single dataframe using „concat“ method.

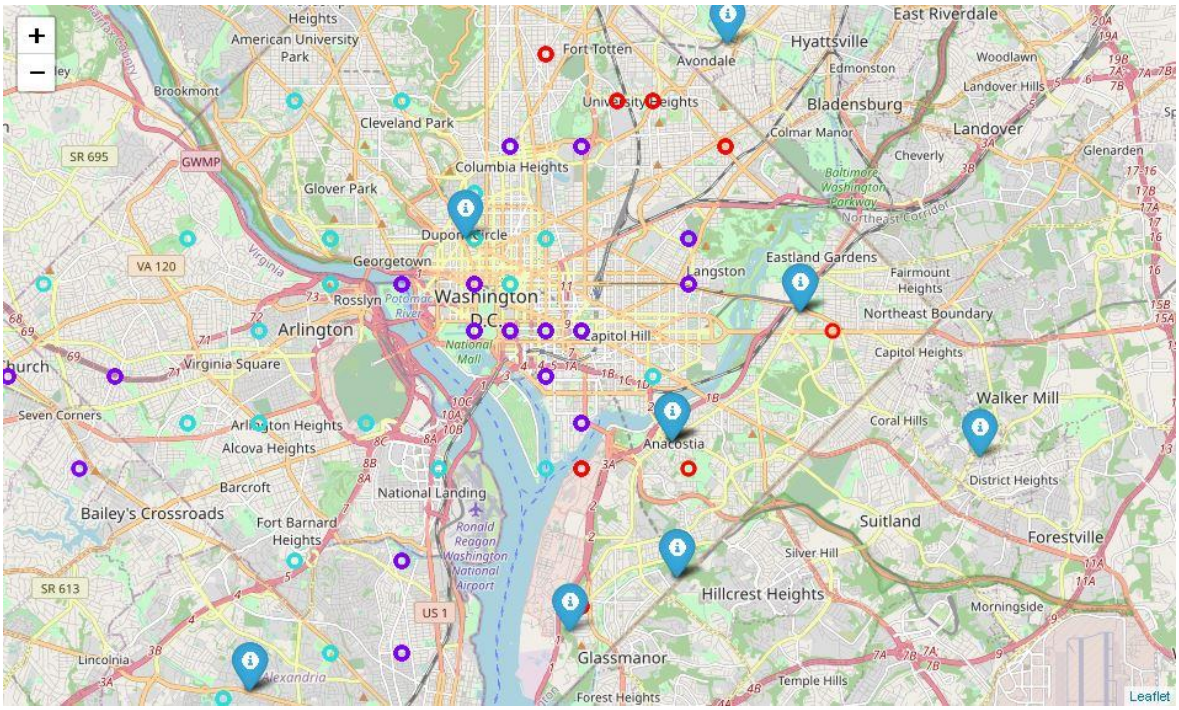
Thirdly, I analyzed the average Fair Market Rents for two bedroom apartments in the Washington Metropolitan Area and applied the describe() method to generate descriptive statistics. Then I drew a histogram to visualize the frequency of the Fair Market Rents in different price (USD) ranges.

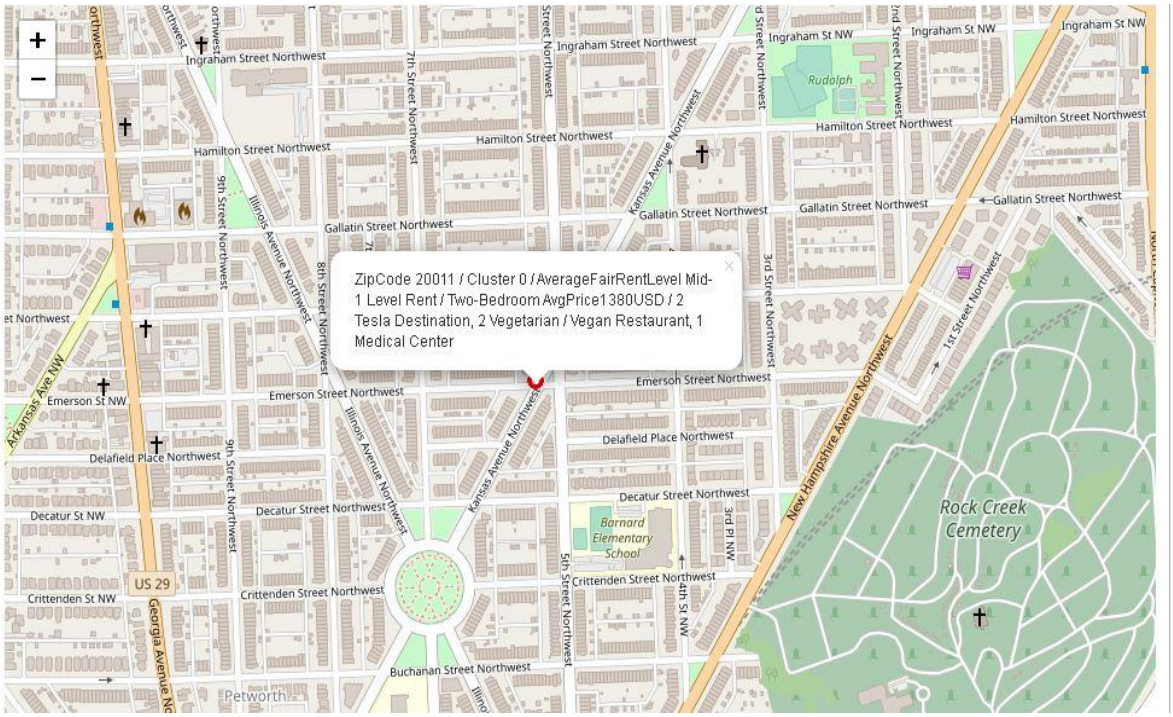
To analyse each Zip Code area, I applied the get_dummies method to convert the categorical variables into binary values. Then I grouped rows by Zip Code and by taking the mean of the frequency of occurrence of each category.

Finally, I applied the K-means clustering - unsupervised machine learning algorithm - to cluster the Zip Code Areas into 4 clusters and visualized the resulting clusters using amazing library of Folium.

# Conclusion

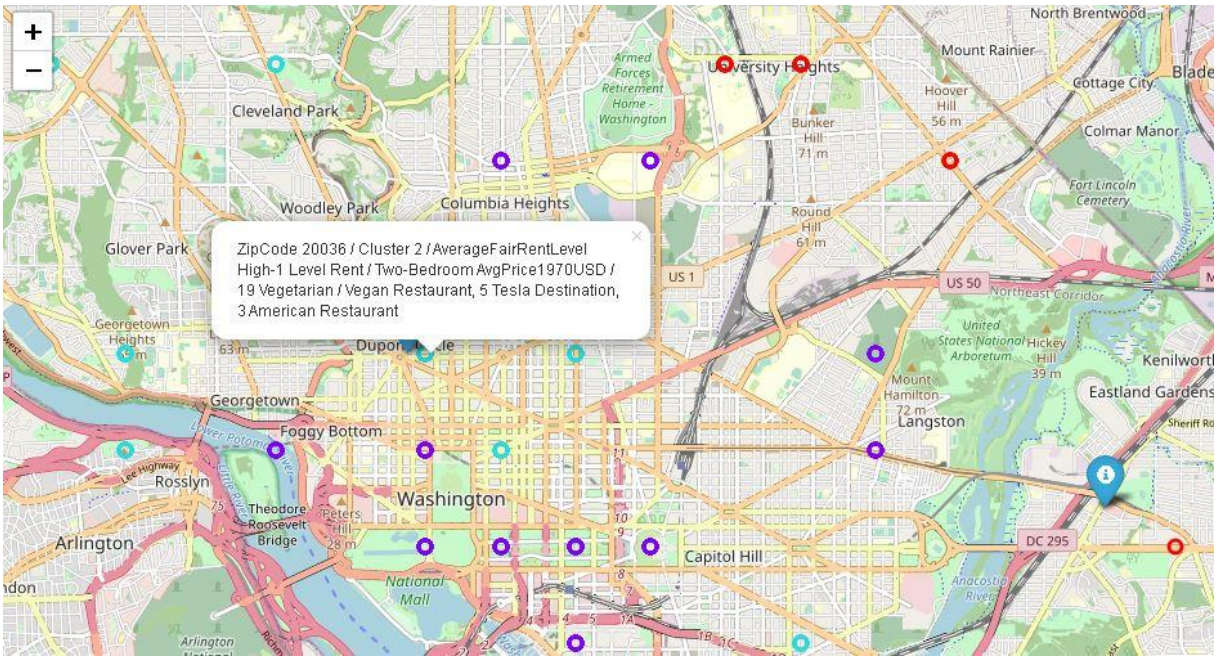
In this notebook, one can easily search for venues that are located close to each other in a zip code area within a specified radius. In Addition to venues, information on average Fair Market Rents of each zip code area will be provided. In our Example, Mr. McDreamy who is currently planning to move from New York City to Washington D.C., is looking for a neighborhood that is situated close to Fresenius Dialysis Centers, Vegan Restaurants and Tesla Charging Stations. Additionally, he wants to get information on Fair Market Rents of each neighborhood in Washington Metropolitan Area.




For example, when Mr. Mcdreamy clicks the (red) cluster of the Zip Code 20011 on the map, he would get the following information:

- ZipCode 20011
- Cluster 0
- Average Fair Rent Level: Mid-1 Level
- Two-Bedroom average rent 1380 USD
- 2 Tesla Destination Charging Stations
- 2 Vegetarian/Vegan Restaurant
- 1 Medical Center (Fresenius Dialysis Center)




Further examples:

- ZipCode 20036
- Cluster 2
- Average Fair Rent Level: High-1 Level
- Two-Bedroom average rent 1970 USD
- 5 Tesla Destination Charging Stations
- 19 Vegetarian/Vegan Restaurant

- ZipCode 20032
- Cluster 0
- Average Fair Rent Level: Mid-1 Level
- Two-Bedroom average rent 1280 USD
- 1 Tesla Destination Charging Stations
- 1 Vegetarian/Vegan Restaurant
- 2 Medical Center (Fresenius Dialysis Center)

# Discussion

This project can especially help those who are asking themselves „Where should I live?“ when planning to move to another place. One can prioritize „must-haves“ during exploring neighborhoods, add new venue categories, and compare rents or house prices in each neighborhood.

The crime rates of a neighborhood may also play a role in deciding where to live. If one wants to factor in crime statistics when making a decision, the crime dataset can be downloaded from Metropolitan Police Department and used when clustering neighborhoods in Washington Metropolitan Area. It’s up to user to add additional factors when applying k-means clustering algorithm.