Battle of Neighborhoods

Applied Data Science Capstone by IBM/Coursera

Venkatramanan Krishnasami

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Introduction

❖ Find the optimal location for opening a new Indian restaurant in Howard County, MD

❖ Find locations that are not already crowded with restaurants

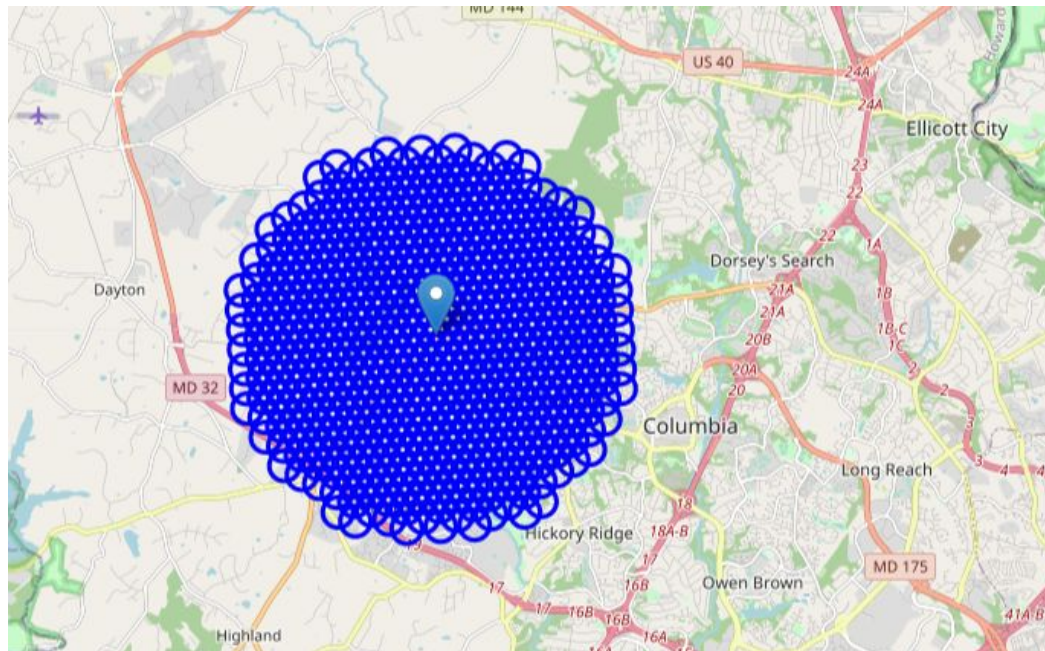❖ Find locations where there are no Indian restaurants in vicinity

Data

❖ Use **Foursquare API** to get the number of restaurants, their type and location in every neighborhood

❖ Use Google Maps API reverse geocoding, to fetch address

❖ Use Google Maps API geocoding, to get the latitude & longitude coordinates from a given address

Data deep-dive

Get the center of Howard county
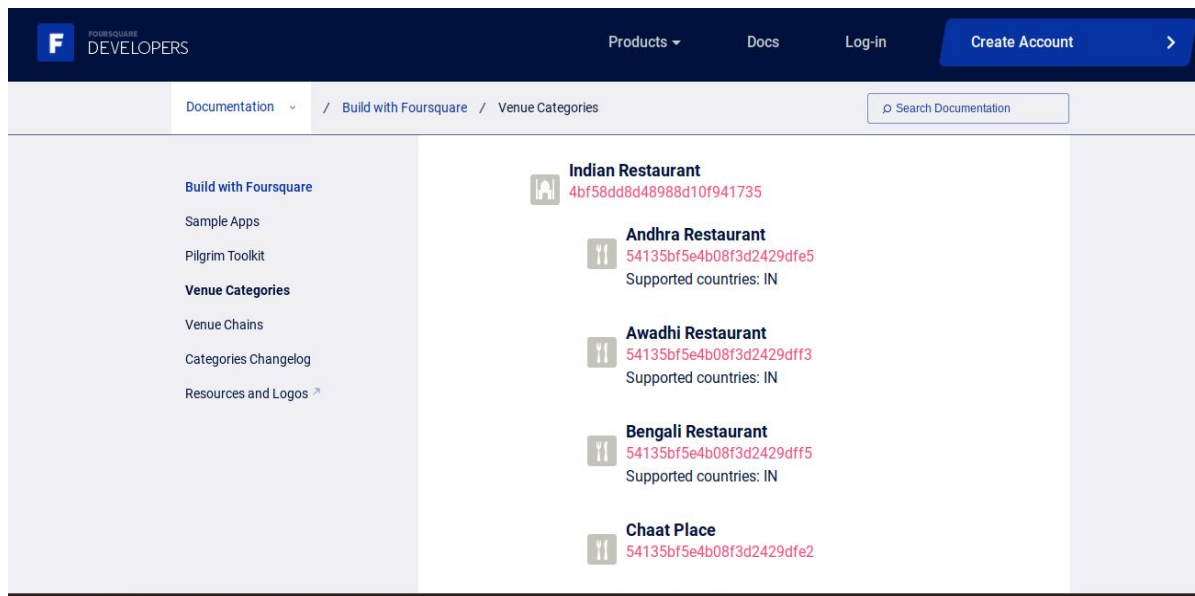
Create Neighborhood candidates with a radius of 300 m

Data deep-dive

Use **Foursquare API** to get the number of restaurants, their type and location in every neighborhood

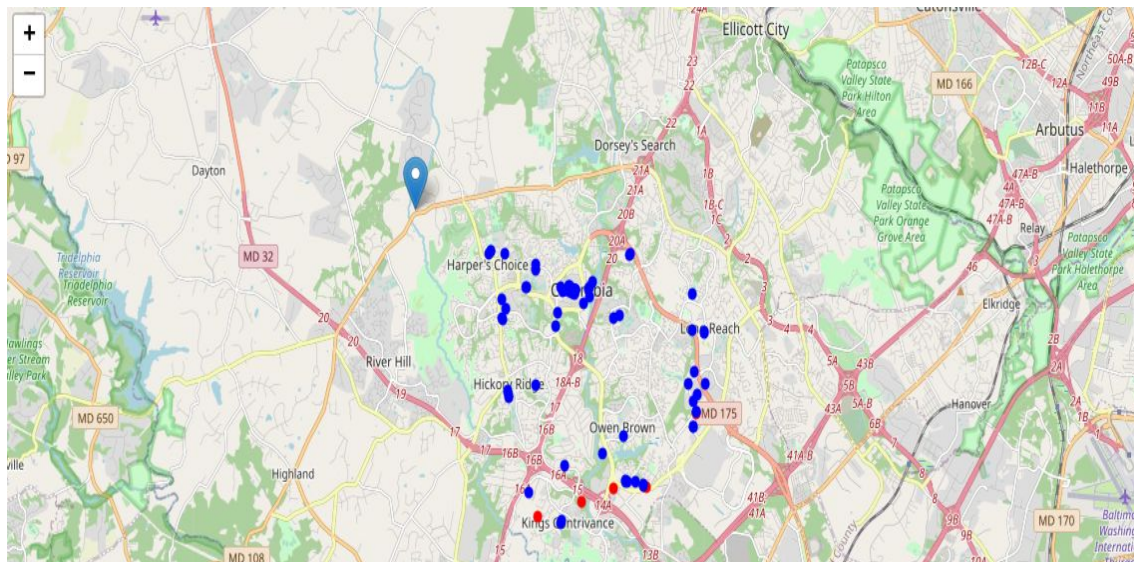Category ID to be taken from Foursquare website

Data deep-dive

Collect restaurants in the area of interest on map

Show Indian restaurants in different color

Methodology

❖ Calculate and Explore the 'restaurant density' across different areas of Howard County

❖ Identify a few promising areas close to center with low number of restaurants in general (and no Indian restaurants in vicinity)

❖ Create clusters of locations that meet requirements - no more than two restaurants in radius of 1000 meters and without Indian restaurants in radius of 1000 meters

Analysis

❖ Perform exploratory data analysis. Find Number of restaurants in every area candidate:

Average number of restaurants in every area with radius=300m: 0.43131868131868134

|	Address	Latitude	Longitude	X	Y	Distance from center	Restaurants in area
0	10388 Faulkner Ridge Cir, Columbia, MD 21044	39.221945	-76.873958	-6.074334e+06	1.025284e+07	5992.495307	3
1	10610 Fable Row, Columbia, MD 21044	39.225372	-76.874184	-6.073734e+06	1.025284e+07	5840.376700	1
2	5112 Durham Rd W, Columbia, MD 21044	39.228800	-76.874411	-6.073134e+06	1.025284e+07	5747.173218	0
3	5145 Hesperus Dr, Columbia, MD 21044	39.232228	-76.874638	-6.072534e+06	1.025284e+07	5715.767665	1
4	10475 Clarksville Pike, Columbia, MD 21044	39.235656	-76.874864	-6.071934e+06	1.025284e+07	5747.173218	1
5	10380 MD-108, Ellicott City, MD 21042	39.239084	-76.875091	-6.071334e+06	1.025284e+07	5840.376700	1
6	2, Ellicott City, MD	39.242512	-76.875318	-6.070734e+06	1.025284e+07	5992.495307	1
7	10840 Little Patuxent Pkwy, Columbia, MD 21044	39.216652	-76.877433	-6.075234e+06	1.025336e+07	5855.766389	3
8	10576 Cross Fox Ln, Columbia, MD 21044	39.220079	-76.877660	-6.074634e+06	1.025336e+07	5604.462508	1
9	10734 Faulkner Ridge Cir, Columbia, MD 21044	39.223506	-76.877887	-6.074034e+06	1.025336e+07	5408.326913	0

Analysis

❖ calculate the distance to nearest Indian restaurant from every area candidate center. Heat_Map with density of restaurants

Analysis

❖ calculate the distance to nearest Indian restaurant from every area candidate center. Heat_Map with density of Indian restaurants
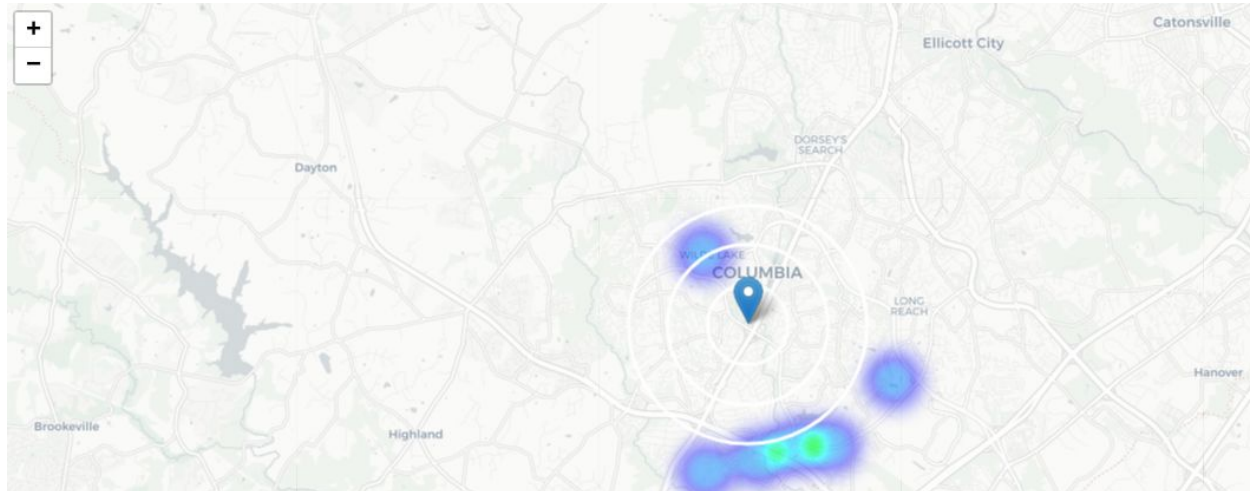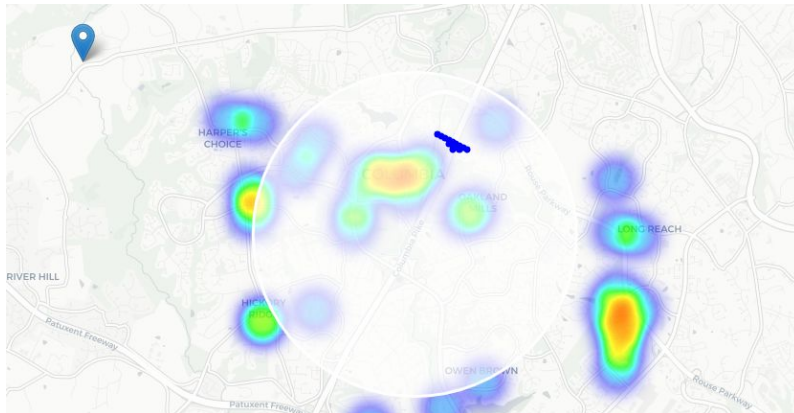
Analysis

❖ number of restaurants in vicinity (we'll use radius of 1000 meters) and distance to closest Indian restaurant.

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Locations with no more than two restaurants nearby: 14
Locations with no Indian restaurants within 1000m: 122
Locations with both conditions met: 14
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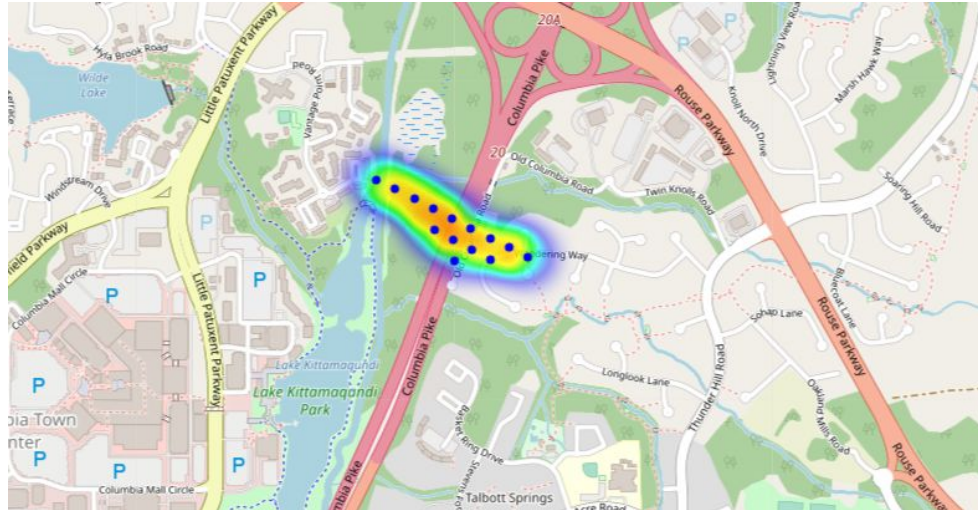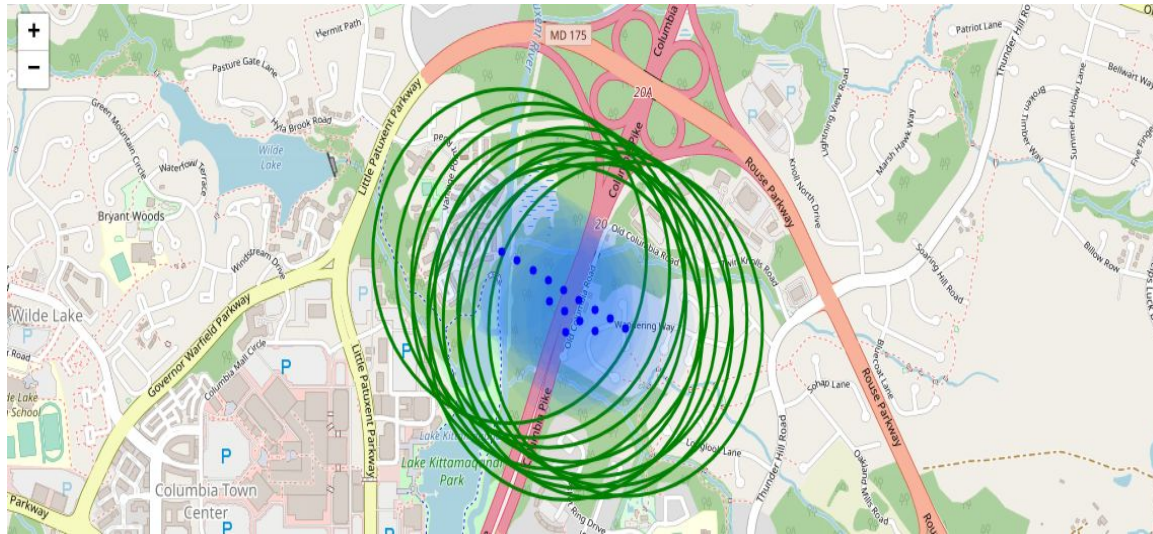
Analysis

❖ These are potential locations for opening the Indian Restaurant in the Howard County

Analysis

❖ Cluster the potential locations to create centers of zones containing good locations

Analysis

❖ Reverse geocode the candidate area centers to get the addresses

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Addresses of centers of areas recommended for further analysis
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5651 Vantage Point Rd, Columbia, MD 21044        => 9.0km from Columbia, MD
9512 Wandering Way, Columbia, MD 21045           => 9.5km from Columbia, MD
5509 Old Columbia Rd, Columbia, MD 21045         => 9.3km from Columbia, MD
9504 Wandering Way, Columbia, MD 21045           => 9.6km from Columbia, MD
5550 Columbia Pike, Columbia, MD 21045           => 9.2km from Columbia, MD
5550 Columbia Pike, Columbia, MD 21045           => 9.4km from Columbia, MD
9524 Wandering Way, Columbia, MD 21045           => 9.4km from Columbia, MD
5505 Old Columbia Rd, Columbia, MD 21045         => 9.2km from Columbia, MD
9485 Honeysalt Row, Columbia, MD 21045           => 9.7km from Columbia, MD
9520 Wandering Way, Columbia, MD 21045           => 9.4km from Columbia, MD
9511 Wandering Way, Columbia, MD 21045           => 9.5km from Columbia, MD
5618 US-29, Columbia, MD 21045                   => 9.1km from Columbia, MD
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Research

Our analysis shows that there are not a great number of restaurants in Howard (82 in our area of interest which was 6x6km around Howard center). There are multiple pockets of low restaurant density across the Howard county. Highest concentration of restaurants was detected west and south-east from Howard Center, so we focused our attention to areas south-west and north, corresponding to neighborhoods Hickory ridge and Oakland Mills. We continued with these 2 neighborhoods.

After directing our attention to this more narrow area of interest (covering approx. 5x5km south-west from Howard center) we first created a dense grid of location candidates (spaced 100m appart); those locations were then filtered so that those with more than two restaurants in radius of 1000m and those with an Indian restaurant closer than 1000m were removed.

Those location candidates were then clustered to create zones of interest which contain greatest number of location candidates. Addresses of centers of those zones were also generated using reverse geocoding to be used as markers/starting points for more detailed local analysis based on other factors.

Discussion

Result of all this is 12 zones containing largest number of potential new restaurant locations based on number of and distance to existing venues - both restaurants in general and Indian restaurants particularly. This, of course, does not imply that those zones are actually optimal locations for a new restaurant! Purpose of this analysis was to only provide info on areas close to Howard center but not crowded with existing restaurants (particularly Indian) - it is entirely possible that there is a very good reason for small number of restaurants in any of those areas, reasons which would make them unsuitable for a new restaurant regardless of lack of competition in the area. Recommended zones should therefore be considered only as a starting point for more detailed analysis which could eventually result in location which has not only no nearby competition but also other factors taken into account and all other relevant conditions met.

Conclusion

Purpose of this project was to identify areas near Howard County center with low number of restaurants (particularly Indian restaurants) in order to aid stakeholders in narrowing down the search for optimal location for a new Indian restaurant. By calculating restaurant density distribution from Foursquare data we have first identified general neighborhoods that justify further analysis (Hickory Ridge and Oakland Mills), and then generated extensive collection of locations which satisfy some basic requirements regarding existing nearby restaurants. Clustering of those locations was then performed in order to create major zones of interest (containing greatest number of potential locations) and addresses of those zone centers were created to be used as starting points for final exploration by stakeholders.

Final decision on optimal restaurant location will be made by stakeholders based on specific characteristics of neighborhoods and locations in every recommended zone, taking into consideration additional factors like attractiveness of each location (proximity to park or water), levels of noise / proximity to major roads, real estate availability, prices, social and economic dynamics of every neighborhood etc.

Thank You

Venkatramanan Krishnasami