Ideal Locations for Opening a New Restaurant in Denver

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1. Introduction

1.1. Background

Denver is the capital and most populous municipality of the U.S. state of Colorado. With an estimated population of 716,492 in 2018, Denver has been one of the fastest-growing major cities in the United States. So opening a restaurant in Denver is promising and profitable because of the large local population. What's more, Denver is also a jumping-off point for ski resorts in the nearby Rocky Mountains. Every winter there are a huge amount of people coming to Denver for vacation, meaning that tourists also need restaurants.

1.2. Business Problem

In this project I will try to find an ideal location for opening a new restaurant for stakeholders interested in Denver, United States. In addition, we will identify the best kind of restaurant to open in different neighborhoods.

1.3. Goal

Regarding the locations for the restaurant, we will try to find areas that are not already crowded with restaurants. We also prefer locations that are either close to downtown or ski resorts. We will utilize data science analysis to generate neighborhoods that are promising based on our criteria. Results and advantages will be clearly stated after the data analysis.

2. Data Source and Workflow

2.1. Data Source

- Google Maps API reverse geocoding: obtain approximate addresses of centers of candidate areas
- Foursquare API: obtain detailed information of restaurants in every neighborhoods

2.2. Key Factors

- number of existing restaurants in the neighborhood
- number of distance to other restaurants in the neighborhood
- distance of neighborhood from city center

3. Methodology and Workflow

3.1. Methodology

To find the ideal place for opening a new restaurant, we first gathered information on Denver city center and divided the city into a hexagonal grid of cells. After getting the neighborhood candidate, we extracted data on nearby restaurants including name, type, likes, location, etc.

We defined the quality of the restaurants based on the number of likes they had. We also binned this data into quality categorical variables so that we would cluster appropriately.

Finally we would create a K-means clustering that grouped restaurants into 4 clusters so that businesses can see what kind of restaurants are popular in a specific cluster neighborhood.

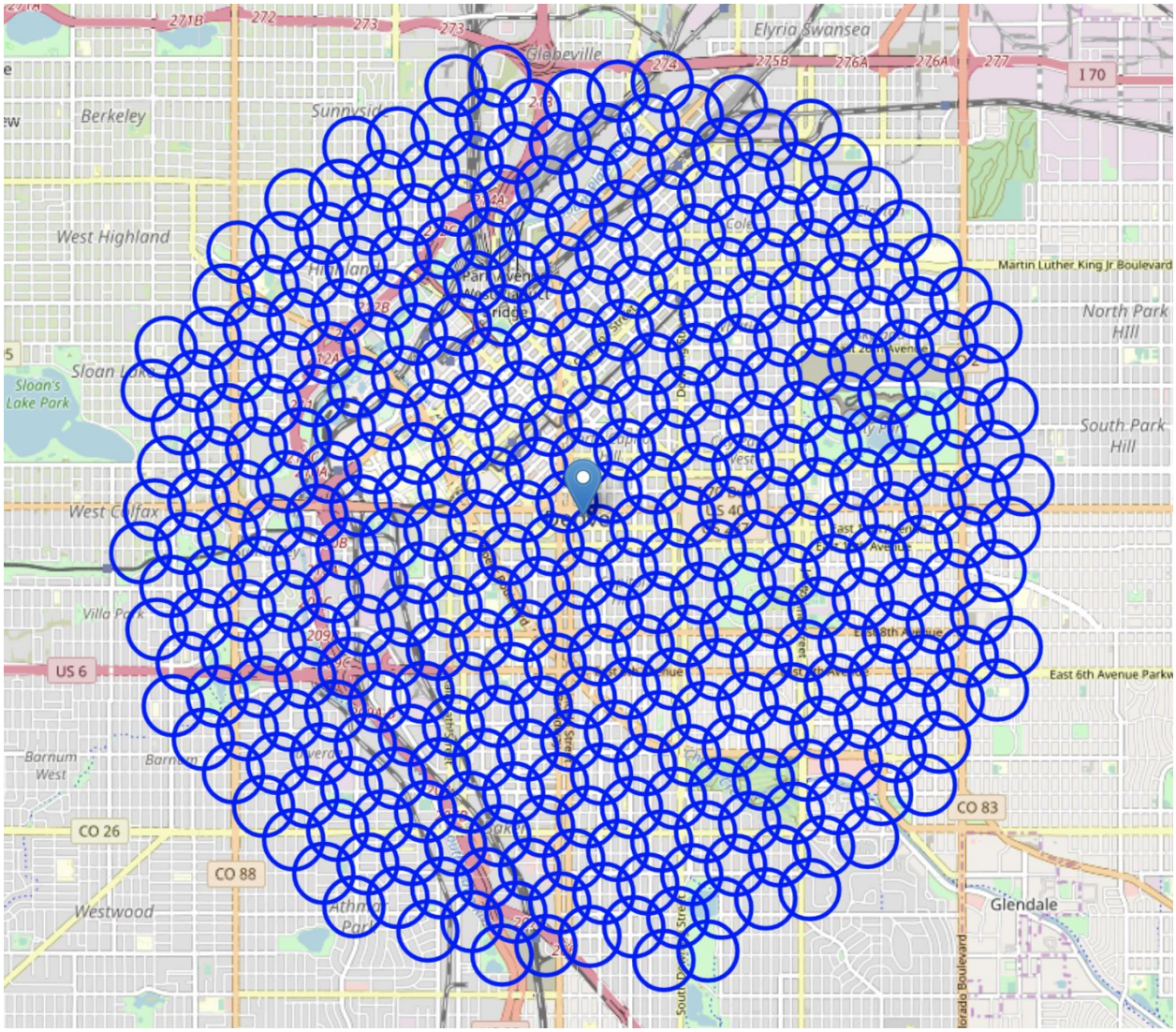
3.2. Workflow

- HTTP requests would be made to Foursquare API server using zip codes of Denver city neighborhoods to get the location information
- We will use Foursquare API search feature to collect information on nearby restaurants
- We will use Folium (Python visualization library) to visualize our neighborhood candidates in Denver
- Unsupervised machine learning algorithm K-mean clustering would be applied to form the cluster of different categories of restaurants in and around the neighborhood
- Based on clusters, we will draw our conclusions and recommendations

4. Results and Discussion

Our analysis focuses on a low restuarant density area that is fairly close to Denver city center. We think those areas would be a great choice to open a restaurant considering the tourists popularity and less competition.

After directing our attention to this more narrow area of interest we first created a dense grid of location candidates (spaced 100m apart); those locations were then filtered so that those with more than two restaurants in radius of 250m and those with a restaurant closer than 400m were removed.



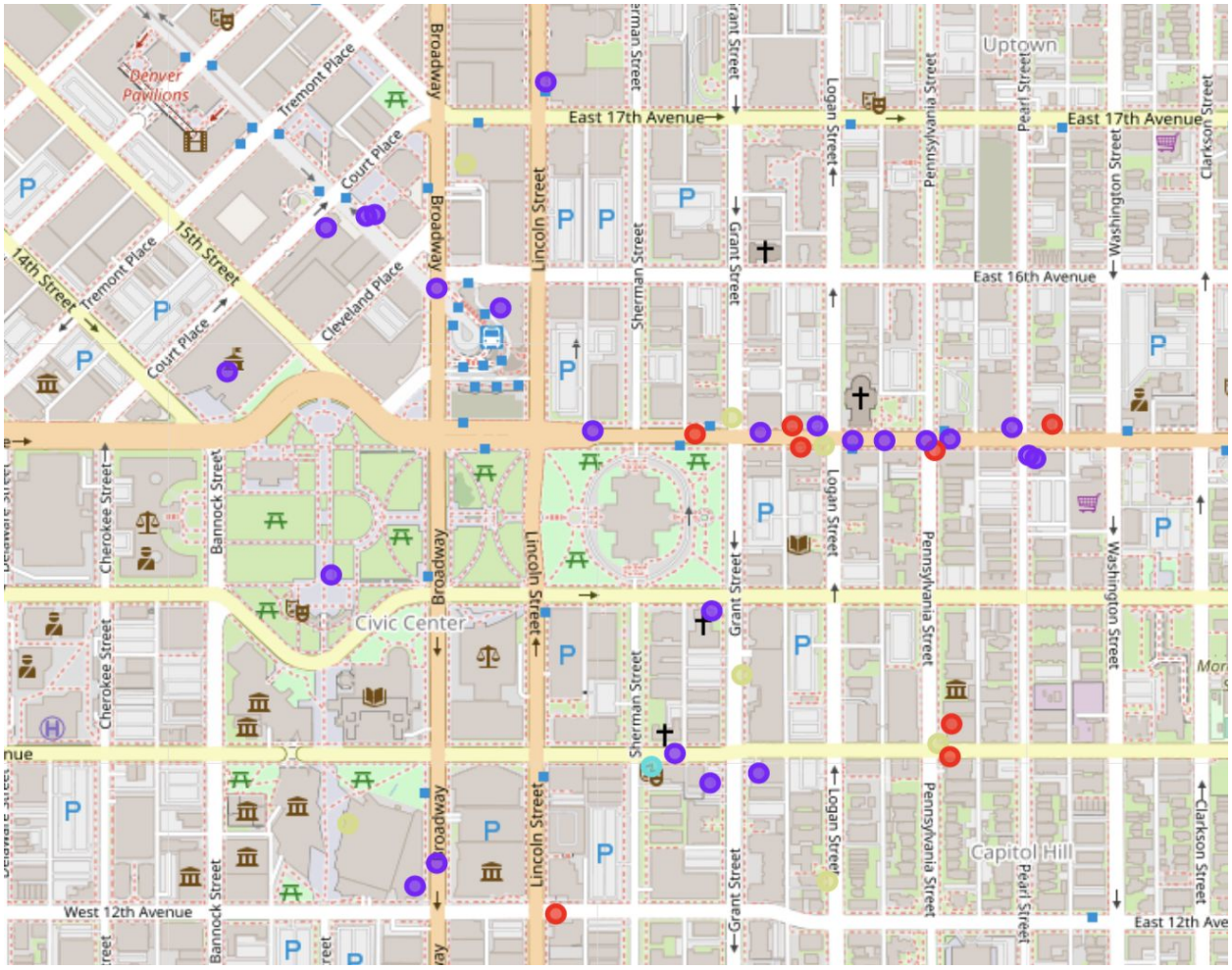
Grid of Location Candidates in Denver

In addition, we clustered those neighborhood candidates to try to identify zones of interest. 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.

Result of all this is all zones containing the largest number of potential new restaurant locations based on number of and distance to existing venues. 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 Denver center but not crowded with existing restaurants - 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.

Four recommended clusters and restaurant types are as follows:



Restaurants Clusters in Denver

- Cluster 1
    - Mostly bars and Cafes
    - Good quality food

name	id	categories	lat	lng	total likes	categories_new	label
Sassafras American Eatery	53b03e59498e0929747864bc	Breakfast Spot	39.739949	-104.982756	90	other	0
Phở-natic	4c7d40c2b33a224b957ed781	Noodle House	39.740081	-104.984111	75	euro asia indian food	0
City Grille	4a0842c3f964a520a8731fe3	Burger Joint	39.740165	-104.982861	74	american food	0
The Church	40e0b100f964a52044031fe3	Nightclub	39.735245	-104.985891	89	bars	0
Prohibition	4dddb008b0fbc2c4eef3896a	Pub	39.739908	-104.981048	121	bars	0
Pablo's Coffee	50ba9a6be4b09ef2d94c3021	Coffee Shop	39.737160	-104.980835	67	other	0
Pub on Penn	4bfdf6e64cf820a1b24fedf4	Pub	39.736833	-104.980850	78	bars	0
Tom's Diner	4a7e9575f964a52005f21fe3	Diner	39.740183	-104.979532	84	other	0

- Cluster 2
    - Mostly Cafe and India Restaurants
    - Below average quality food

name	id	categories	lat	lng	total likes	categories_new	label
La Abeja	4bc0b9644cdfc9b675559321	Mexican Restaurant	39.740026	-104.980851	16	mex southam food	1
Quiero Arepas	4e0cc05c7d8bfe35bbc4d86d	Food Truck	39.738654	-104.988764	13	other	1
Fork & Spoon	538a2731498e5e2ed87ffe3a	Restaurant	39.740160	-104.982540	18	other	1
Make Believe Bakery	57e81188498e2d323bd59833	Bakery	39.736855	-104.984370	6	other	1
The Spring Cafe	56325b77498ebde73e1975e8	Café	39.738297	-104.983892	7	other	1
Tuscany Coffee & Deli	4c72b58b4bc4236a26fbcb7a	Coffee Shop	39.743625	-104.986026	8	other	1
Fire	55e10513498e44d12474f5f0	Gastropub	39.735522	-104.987698	19	bars	1
Quiznos	4b94231af964a5208f6a34e3	Sandwich Place	39.736565	-104.983921	15	other	1
Bourbon Grill	599e325ef96b2c3468d75ec2	Asian Restaurant	39.740138	-104.980051	7	euro asia indian food	1
Satellite Bar	4abd9fe4f964a520338b20e3	Bar	39.740097	-104.983265	14	bars	1
Jimmy John's	514213bf3d7ca5b4135a944a	Sandwich Place	39.741546	-104.987418	14	other	1
Hacienda Colorado	5bb955ce7dc9e1002c0c68ad	Mexican Restaurant	39.742153	-104.988830	6	mex southam food	1
Snow Thai	51f1daf0498e5c6ef3018963	Thai Restaurant	39.740017	-104.982100	5	euro asia indian food	1
Nob Hill Inn	4ac6d449f964a52067b620e3	Dive Bar	39.740008	-104.981681	14	bars	1
Rendezvous Cafe	4faeb10ce4b097c37e642ee9	Café	39.735751	-104.987418	3	other	1
Wok & Roll	51017d8fe4b073cacfe81bf3	Asian Restaurant	39.742273	-104.988313	6	euro asia indian food	1
Subway Sandwiches	4b92c9fcf964a520e01b34e3	Sandwich Place	39.741354	-104.986587	0	other	1
Subway	4c76772066be6dcb2327c30f	Sandwich Place	39.740707	-104.990092	1	other	1
Great Wall	4bc52c1e5935c9b64faca5d2	Chinese Restaurant	39.740019	-104.981141	14	euro asia indian food	1
Los Tacos Famous Taqueria	562343cd498ed9b3714302d1	Mexican Restaurant	39.739861	-104.979832	7	mex southam food	1
Domino's Pizza	4bf43a40cad2c92823ad9b99	Pizza Place	39.736663	-104.983292	5	italian food	1
Civic Center Eats	57587316498e48689229416d	Food Truck	39.740114	-104.985415	7	other	1
Menya	5a519edf0d173f4b97b1f523	Ramen Restaurant	39.739826	-104.979750	6	euro asia indian food	1
Espresso Americano	56b0d838498e05333d5fae21	Coffee Shop	39.742290	-104.988211	2	other	1

- Cluster 3
    - Vegetarian Restaurants
    - High quality food

name	id	categories	lat	lng	total likes	categories_new	label
City, O' City	4a062ed5f964a520cb721fe3	Vegetarian / Vegan Restaurant	39.736724	-104.984669	432	other	2

- Cluster 4
    - Mixed Restaurants
    - Moderate quality food

name	id	categories	lat	lng	total likes	categories_new	label
Shish Kabob Grill	4a7a3db4f964a520f9e81fe3	Middle Eastern Restaurant	39.740246	-104.983633	43	euro asia indian food	3
Tycoon Ramen & Sushi Bar	56882b46498e46899321ab14	Noodle House	39.739958	-104.982459	25	euro asia indian food	3
Sub Culture	4e7e98056da1103ad2492244	Sandwich Place	39.736963	-104.980995	50	other	3
Tokyo Joe's	4b1d4dedf964a5207b0e24e3	Japanese Restaurant	39.737657	-104.983505	24	euro asia indian food	3
MAD Greens - Inspired Eats	4ad4d7f0f964a5202efc20e3	Salad Place	39.736147	-104.988549	35	other	3
Oblio's Cap Hill Tavern	52abbb1811d28f0e43511c09	Pizza Place	39.735570	-104.982422	33	italian food	3
Starbucks	4a5e689df964a52083be1fe3	Coffee Shop	39.742794	-104.987040	33	other	3

Conclusion

This project is to identify ideal places to open a new restaurant in Denver. We focused on an area that is close to the city center but has low resturants density.

We utilized Foursquare API and Google Maps geocoding API to get the information on city center and nearby restaurants. Then we used K-mean clustering to create major zones of interest, addresses of these zone centers were also provided for businesses to explore.

We identified four zones of interest and provided our recommendations in terms of zone characteristics and restaurant types. 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.