

Evaluating Cities in Fairfax County of Virginia, USA

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1. INTRODUCTION

1.1 The Background

The Fairfax County is a county of the Virginia State of the United States located in the suburban of the capital city Washington, D.C. The county is one of the well-developed city clusters that has a promising future to continue to flourish, in terms of population, demographics, income level, location, and employment opportunities.

The Fairfax County is the 3rd highest-income county in US, accounts for 13% of Virginia's population and 20% of the DC-VA-MD Metropolitan Area population, and is home to seven Fortune 500 companies. Also, Amazon's second headquarter offices has been selected to locate right next to the Fairfax County.

1.2 The Problem

The county has a total area of 406 square miles (1,050 km²), including 58 cities or 80 zip codes. With the rapid development and also as a resident living in the area myself, it is helpful to know which cities have the higher potential or in other words more attractive to live in.

This project is designed to evaluate all the 58 cities in Fairfax County and identify those "good" cities to live in. Coding will use data in areas of population, housing market, income level, crime, and school quality, Foursquare location data will also be used to explore and segment these cities.

1.3 Target Audience

The result of this project might be of interest to the current and future residents of the Fairfax County, as well as to property investors.

2. DATA COLLECTION

2.1 Data Source

City values are typically determined by the following factors: real estate market trends, demographic trends, income level and job access, crime and safety, school quality, and nearby features. The following datasets were collected accordingly (Table 1):

- 1. Fairfax County city list and zip code list.** This is the foundation of this project and other indicator data will be organized by this city and/or zip code list. Official lists gained from the Fairfax County Government was selected for this data needs.

2. **Real estate market.** Property values in each city is a good indicator of the value and potential of the city. The popular real estate website Zillow has its own house value index by zip code. Higher index indicates higher city value.
3. **Demographics.** Population is a good indicator for a city. The better a city is, the more residents it has. Official 2019 population data from the Fairfax County Government was selected, the higher population the more positive for a city assessment.
Data Example: screenshot of the data source website and raw data of Fairfax County city population by zip code
4. **Income level.** Good cities tend to have more high-income residents. The per capita income from 2014-2018 by zip code/city of Fairfax County from the popular income statistics source American Community Survey was selected for this assessment indicator. The higher per capita income, the more positive for a city.
5. **Crime and safety.** Crime rate is another common indicator for city evaluation. The Weekly Crime Data from the Fairfax County Police Department will be used, and it is a real time database that's always updated for the most recent 7 days. The more total crime number for a selected city, the lower value of this city.
Data Example: screenshot of the crime dataset with dates and by zip code
6. **School quality.** School quality is another common and important indicator. School scores of the public elementary schools of Fairfax County for 2019 from the popular school rating website SchoolDigger was selected for this indicator. School scores will be aggregated by zip code/city, the higher score the better city.
7. **Nearby features.** Location is everything for a city. It makes a city more valuable and attractive if, for example, it's close to shopping centers, entertainment businesses, food and beverage amenities, city centers, recreational centers, sought-after tourist areas, and office buildings. Foursquare venue category data will be used to explore and evaluate the nearby features for a given city, cities with similar characteristics may be segmented and grouped in this analysis.

Table 1: Data Collection Summary

#	Data	Source	Method
1	Fairfax County city and zip code list	Fairfax County Government, Open Geospatial Data https://opendata.arcgis.com/datasets/3111976184004077_b836f535f31eadf1_21.csv	Import from a downloadable csv file from the source
2	Property Value	Zillow, home value index (by zip code and by city), current https://www.zillow.com/fairfax-county-va/home-values/	Import from a downloadable csv file from the source
3	Population	Fairfax County Government, Economic, Demographic and Statistical Research (EDSR) unit, demographics data 2019 https://www.fairfaxcounty.gov/gisapps/iplsmap/IPLSExport.ashx?Type=Z&Year=2019&Param=ALL	Import from a downloadable csv file from the source
4	Income	American Community Survey, per capita income, 2014-2018 http://www.livehealthyfairfax.org/indicators/index/view?indicatorId=15&localeTypeId=3&periodId=1581	Import from a downloadable csv file from the source

5	Crime	Fairfax County Police Department, Weekly Crime Data, current https://www.fairfaxcounty.gov/apps/pfsu/api/file/crimereportsfromsp	Import from a downloadable csv file from the source
6	School quality	SchoolDigger, Fairfax County elementary public school scores, 2019 https://www.schooldigger.com/go/VA/zip/22033/search.aspx	Make an excel spreadsheet
7	Nearby features	Foursquare	Venue category feature (most common venues)

2.2 Data Cleaning

The Fairfax city and zip code list was downloaded from the government website. Cleaning work included rename the column titles and drop irrelevant columns to get data frame

Fairfax_city_list.

The house value data can't be scraped from the website but it was downloadable. Original data separates house values by zip code and by city and they are different subsets. Cleaning work focused on obtaining a complete list of house values including all zip codes and cities the source has. Also, a dollar sign and thousand separator were added to the values for easy reading.

Then the two lists were merged with the *Fairfax_city_list* data frame, named *df_fairfax_masterlist*. Following datasets will follow cities and zip codes from this master list.

The population data had no issues and data frame *df_pop_clean* was created.

The income data required grouping by zip code and calculating the average values after grouping. Data frame *df_income_clean* was created.

The real-time (constantly being updated) crime data has a non-integer zip code value being as point zero. Decimal place was needed to be removed, then crime data was grouped by zip code and counted the total. Data frame *df_crime_clean* was created.

The school scores were calculated by mean value after grouping by zip code. Data frame *df_school* was created.

Then, merging these data frames (data frame *df_merged_final* was created) and using geopy to get the geo-coordinates for each zip code.

Using Foursquare API, 100 venues within 15,000 meters for each zip code were obtained (data frame *df_fairfax_venue_category*), then the top 5 most common venues for each zip code were able to obtain (data frame *fairfax_top_venues*). Adding these top 5 venues back to the main data frame *df_merged_final* to get *df_final*.

2.3 Data Feature Selection

For each zip code, population, income (average per capita), house value, total crime number, school rating scores, and the top 5 venues were the feature that will be used for evaluating each city.

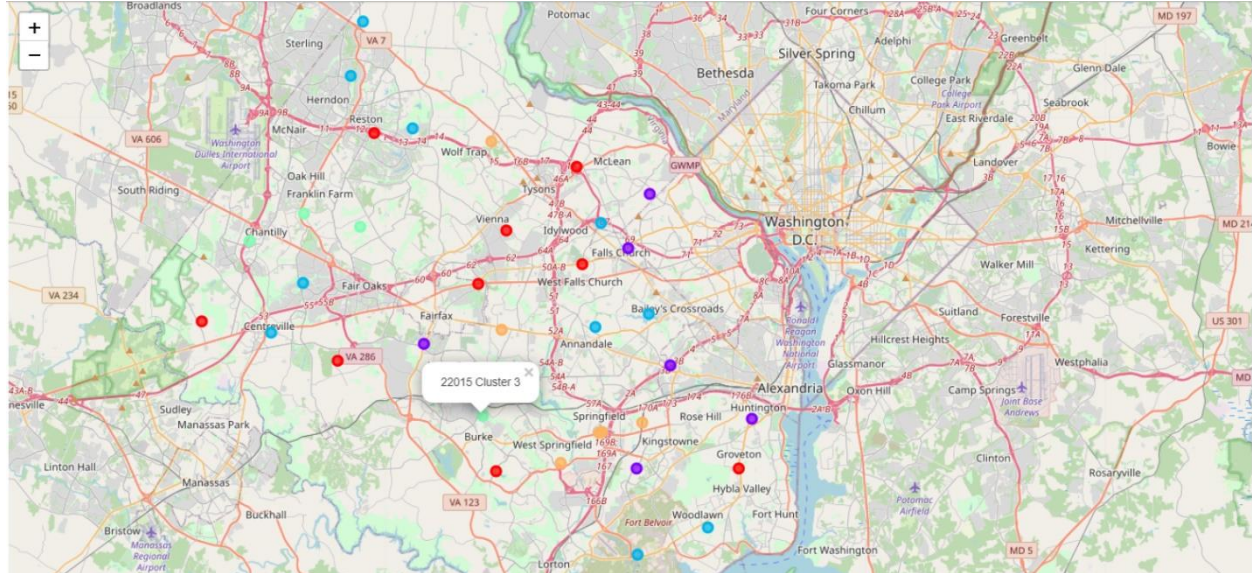
Data frame *df_nor* was then created after applying data normalization for column population, income, house value, total crime number, and school rating scores for the calculation.

Data Frame *df_rank* was the final results after ranking and comparison.

3. DATA ANALYSIS

3.1 City Segmentation & Clustering

Five segments were identified based on the most common venues for each zip code.



Cluster0 is featured with a convenient store-cluster.

```
# Cluster 0  
df_final.loc[df_final['Cluster Labels'] == 0]
```

	Zip Code	City	County	Cluster Labels	House Value Index	Yearly Growth Rate	Population	Per Capita Income	Total Crime #	Elem School	Average Elem School Score (2019)	Latitude	Longitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	20120	CENTREVILLE	Fairfax County	0	\$506,854	4%	43440	\$47,632	37	Cardinal Ridge Elementary, Powell Elementary, ...	52.78	38.843078	-77.478514	Library	Golf Course	Flower Shop	Historic Site	Italian Restaurant
2	20124	CLIFTON	Fairfax County	0	\$727,546	3%	16062	\$62,148	24	Union Mill Elementary	76.50	38.820280	-77.378782	Coffee Shop	Italian Restaurant	Indian Restaurant	Pizza Place	Golf Course
7	20191	RESTON	Fairfax County	0	\$488,935	4%	30278	\$52,784	36	Sunrise Valley Elementary, Hunters Woods Eleme...	51.65	38.950408	-77.352100	Taco Place	Fast Food Restaurant	American Restaurant	American Restaurant	Garden
11	22031	FAIRFAX	Fairfax County	0	\$606,461	4%	34074	\$49,049	21	Mosby Woods Elementary, Mantua Elementary, Fai...	84.60	38.864393	-77.275968	American Restaurant	Neighborhood	Seafood Restaurant	Soup Place	Thai Restaurant
15	22042	FALLS CHURCH	Fairfax County	0	\$570,645	5%	33453	\$44,372	34	Beech Tree Elementary, Pine Spring Elementary...	24.44	38.875781	-77.199764	Sandwich Place	Bar	American Restaurant	Theater	Bakery
22	22102	MCLEAN	Fairfax County	0	\$695,482	4%	28921	\$81,923	45	Spring Hill Elementary	89.10	38.931275	-77.203997	Wine Shop	Vietnamese Restaurant	Butcher	Neighborhood	Park
26	22153	SPRINGFIELD	Fairfax County	0	\$565,618	5%	33323	\$49,875	18	Sangster Elementary, Newington Forest Elementa...	63.17	38.757142	-77.262515	Coffee Shop	Trail	Food Court	Pizza Place	Bakery
27	22180	VIENNA	Fairfax County	0	\$766,672	3%	27859	\$58,543	8	Stenwood Elementary, Louise Archer Elementary...	62.96	38.894999	-77.254909	Taco Place	Shopping Mall	Butcher	Supermarket	Thai Restaurant
30	22306	ALEXANDRIA	Fairfax County	0	\$499,905	5%	32100	\$33,044	60	Hybla Valley Elementary, Groveton Elementary, ...	21.90	38.758644	-77.084751	Cosmetics Shop	Accessories Store	Restaurant	Park	Portuguese Restaurant

Cluster1 has a higher house value with many parks.

```
# Cluster 1
df_final.loc[df_final['Cluster Labels'] == 1]
```

	Zip Code	City	County	Cluster Labels	House Value Index	Yearly Growth Rate	Population	Per Capita Income	Total Crime #	Elem School	Average Elem School Score (2019)	Latitude	Longitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
10	22030	FAIRFAX	Fairfax County	1	\$598,352	3%	42543	\$45,347	29	Willow Springs Elementary, Fairfax Villa Eleme...	47.50	38.830000	-77.315903	Food Court	Greek Restaurant	Indian Restaurant	Brazilian Restaurant	Coffee Shop
17	22046	FALLS CHURCH	Fairfax County	1	\$793,526	4%	5333	\$60,432	9	Thomas Jefferson Elementary, Timber Lane Eleme...	52.95	38.884855	-77.166097	Park	Gym	Trail	Neighborhood	Park
21	22101	MCLEAN	Fairfax County	1	\$1,185,071	3%	30789	\$93,407	29	Chesterbrook Elementary, Sherman Elementary, K...	85.58	38.915843	-77.150000	Art Museum	Hotel	National Park	South American Restaurant	Thai Restaurant
29	22303	ALEXANDRIA	Fairfax County	1	\$437,248	6%	16182	\$50,648	12	Cameron Elementary, Mount Eagle Elementary	14.35	38.787532	-77.075285	Park	Theme Park Ride / Attraction	Coffee Shop	Cheese Shop	Juice Bar
33	22312	ALEXANDRIA	Fairfax County	1	\$501,081	5%	23788	\$37,036	26	Bren Mar Park Elementary, Parklawn Elementary, ...	25.63	38.817692	-77.134886	Park	Monument / Landmark	Wine Shop	BBQ Joint	Park
34	22315	ALEXANDRIA	Fairfax County	1	\$528,806	5%	28498	\$54,699	40	Island Creek Elementary, Lane Elementary, Hayf...	63.40	38.759121	-77.159664	Park	Brewery	Fast Food Restaurant	Sandwich Place	Shopping Mall

Cluster2 is restaurant-clusters with many American and Asian food, and they are all closer to city centers.

```
# Cluster 2
df_final.loc[df_final['Cluster Labels'] == 2]
```

	Zip Code	City	County	Cluster Labels	House Value Index	Yearly Growth Rate	Population	Per Capita Income	Total Crime #	Elem School	Average Elem School Score (2019)	Latitude	Longitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
1	20121	CENTREVILLE	Fairfax County	2	\$417,424	5%	30691	\$37,923	50	Bull Run Elementary, Centreville Elementary, C...	35.77	38.836485	-77.427402	Exhibit	Mediterranean Restaurant	Mexican Restaurant	Fast Food Restaurant	Furniture / Home Store
4	20170	HERNDON	Fairfax County	2	\$518,025	4%	40361	\$44,008	15	Clearview Elementary, Dranesville Elementary, ...	21.18	38.983054	-77.369003	Asian Restaurant	Bakery	French Restaurant	Lake	Shopping Mall
6	20190	RESTON	Fairfax County	2	\$446,958	4%	21755	\$59,136	27	Forest Edge Elementary, Lake Anne Elementary	34.70	38.953155	-77.323839	Coffee Shop	Brazilian Restaurant	Coffee Shop	Bakery	Mediterranean Restaurant
8	22003	ANNANDALE	Fairfax County	2	\$587,067	4%	57381	\$39,934	82	Canterbury Woods Elementary, Columbia Elementa...	59.15	38.839683	-77.190084	Bubble Tea Shop	Bar	Seafood Restaurant	Gym	New American Restaurant
13	22033	FAIRFAX	Fairfax County	2	\$539,207	4%	40665	\$50,481	31	Navy Elementary, Greenbriar West Elementary, L...	72.82	38.864965	-77.404055	Gym	Spa	Japanese Restaurant	Museum	Fast Food Restaurant
14	22041	FALLS CHURCH	Fairfax County	2	\$390,446	7%	27717	\$35,564	49	Belvedere Elementary, Glen Forest Elementary	51.35	38.847229	-77.150876	American Restaurant	Café	Taco Place	Taco Place	Grocery Store
16	22043	FALLS CHURCH	Fairfax County	2	\$699,676	4%	25580	\$50,388	9	Haycock Elementary, Lemon Road Elementary, Shr...	69.60	38.898800	-77.186142	American Restaurant	Golf Course	Italian Restaurant	Supermarket	Pizza Place
18	22060	FORT BELVOIR	Fairfax County	2	\$606,990	3%	11261	\$29,650	4	Fort Belvoir Upper	22.60	38.709850	-77.158811	Historic Site	Fast Food Restaurant	American Restaurant	Wine Shop	Sushi Restaurant
19	22066	GREAT FALLS	Fairfax County	2	\$1,136,056	0%	19431	\$93,056	22	Forestville Elementary, Great Falls Elementary	81.35	39.013654	-77.360544	Asian Restaurant	Coffee Shop	Shopping Mall	Fried Chicken Joint	Gym
31	22309	ALEXANDRIA	Fairfax County	2	\$461,243	5%	34736	\$37,004	29	Riverside Elementary, Washington Mill Elementa...	16.36	38.725223	-77.107354	Sushi Restaurant	BBQ Joint	Fast Food Restaurant	Pet Store	Chinese Restaurant

Cities in Cluster3 locate in suburban area and most of them are relatively away from city centers.

```
# Cluster 3
df_final.loc[df_final['Cluster Labels'] == 3]
```

	Zip Code	City	County	Cluster Labels	House Value Index	Yearly Growth Rate	Population	Per Capita Income	Total Crime #	Elem School	Average Elem School Score (2019)	Latitude	Longitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
3	20151	CHANTILLY	Fairfax County	3	\$582,431	4%	22451	\$45,317	25	Poplar Tree Elementary, Brookfield Elementary	57.85	38.888639	-77.443135	Pizza Place	Golf Course	Exhibit	Spanish Restaurant	Coffee Shop
5	20171	HERNDON	Fairfax County	3	\$643,871	4%	53320	\$56,554	35	Oak Hill Elementary, Floris Elementary, Fox M...	72.72	38.904368	-77.403626	Trail	Coffee Shop	Airport Lounge	Brewery	Fast Food Restaurant
9	22015	BURKE	Fairfax County	3	\$556,615	4%	44213	\$46,771	33	Terra Centre Elementary, Cherry Run Elementary...	75.30	38.788896	-77.272504	Afghan Restaurant	Portuguese Restaurant	American Restaurant	Grocery Store	American Restaurant
23	22124	OAKTON	Fairfax County	3	\$790,650	2%	18983	\$74,955	10	Oakton Elementary, Waples Mill Elementary	82.90	38.896743	-77.362288	Gym	American Restaurant	Spa	Deli / Bodega	Pizza Place

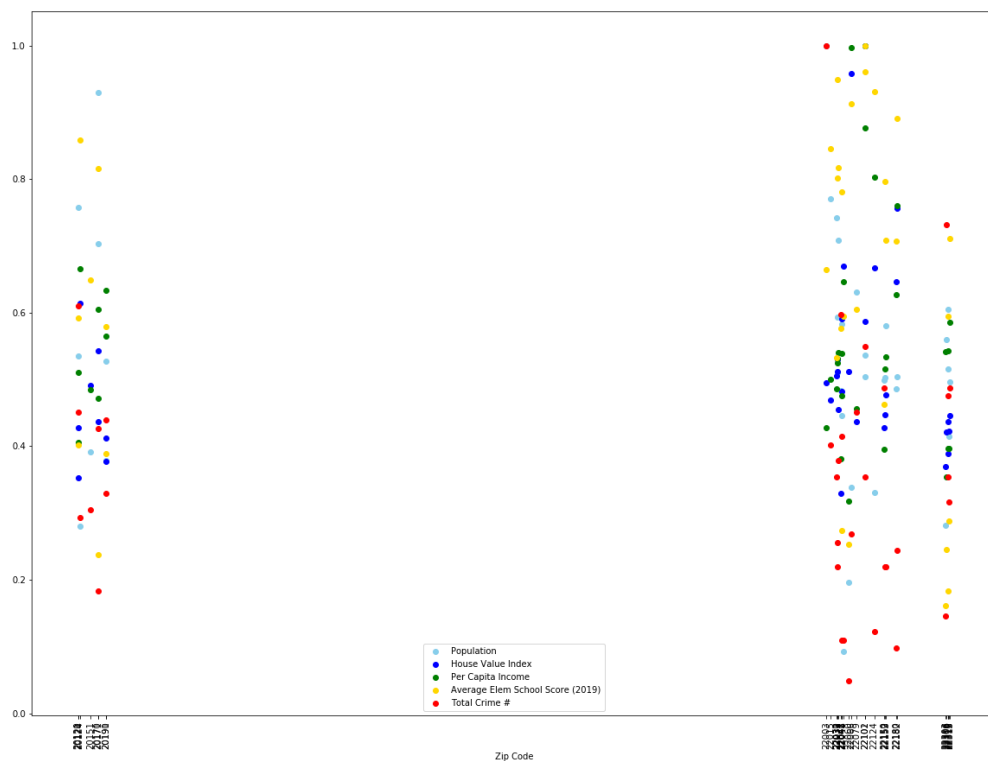
Cities in Cluster4 are restaurant-cluster area and are away from city centers.

```
# Cluster 4
df_final.loc[df_final['Cluster Labels'] == 4]
```

	Zip Code	City	County	Cluster Labels	House Value Index	Yearly Growth Rate	Population	Per Capita Income	Total Crime #	Elem School	Average Elem School Score (2019)	Latitude	Longitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
12	22032	FAIRFAX	Fairfax County	4	\$628,088	4%	29317	\$49,660	18	Wakefield Forest Elementary, Oak View Elementa...	71.43	38.837883	-77.258316	Diner	Coffee Shop	Fast Food Restaurant	Sushi Restaurant	Grocery Store
20	22079	LORTON	Fairfax County	4	\$517,581	4%	36203	\$42,645	37	Laurel Hill Elementary, Gunston Elementary, Lo...	53.87	38.779636	-77.184847	Mediterranean Restaurant	Toy / Game Store	Italian Restaurant	Warehouse Store	Brewery
24	22150	SPRINGFIELD	Fairfax County	4	\$506,861	4%	28626	\$36,946	40	Key Center, Springfield Estates Elementary, Fo...	41.25	38.779030	-77.187414	Coffee Shop	Brewery	Italian Restaurant	Gym / Fitness Center	Toy / Game Store
25	22152	SPRINGFIELD	Fairfax County	4	\$529,866	5%	28867	\$48,209	18	Keene Mill Elementary, West Springfield Elemen...	70.98	38.762084	-77.215550	Bubble Tea Shop	Thai Restaurant	BBQ Joint	Salad Place	Grocery Store
28	22182	VIENNA	Fairfax County	4	\$896,903	2%	28952	\$71,029	20	Wolftrap Elementary, Colvin Run Elementary, Ki...	79.32	38.945437	-77.266294	Restaurant	Portuguese Restaurant	Salad Place	BBQ Joint	Gym
32	22310	ALEXANDRIA	Fairfax County	4	\$517,466	5%	29621	\$50,766	39	Clermont Elementary, Bush Hill Elementary, Fra...	52.98	38.785138	-77.155274	Waterfront	Afghan Restaurant	Theater	Park	Mediterranean Restaurant

3.2 Scatter Plot Visualization & Comparison

Normalized column data population, income, house value, total crime number, and school rating scores were able to be compared on a same scale. Scatter plot was applied to visualize zip code strengths and weakness. Red color was used for crime # as it's easy to stand out and it's different than other data values – the higher value the worse. The dots on the top part of the chart (except the red dot) indicate good cities



3.3 Weighted Average Score & City Ranking

To calculate the weighted average scores, first the normalized crime data was converted to negative values since the higher the worse. Then all normalized data values of column data population, income, house value, total crime number, and school rating scores were added up. Finally ranking of each zip code was created by sort the total add-up score.

	Zip Code	Rank	City	County	Cluster Labels	House Value Index	Yearly Growth Rate	Population	Per Capita Income	Total Crime #	Elem School	Average Elem School Score (2019)	Latitude	Longitude	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
21	22101	3.143407	MCLEAN	Fairfax County	1	1.000000	3%	0.536571	1.000000	-0.353659	Chesterbrook Elementary, Sherman Elementary, K...	0.960494	38.915843	-77.150000	Art Museum	Hotel	National Park	South American Restaurant	Thai Restaurant
19	22066	2.938240	GREAT FALLS	Fairfax County	2	0.958640	0%	0.338631	0.996242	-0.268293	Forestville Elementary, Great Falls Elementary	0.913019	39.013654	-77.360544	Asian Restaurant	Coffee Shop	Shopping Mall	Fried Chicken Joint	Gym
28	22182	2.668150	VIENNA	Fairfax County	4	0.756835	2%	0.504557	0.760425	-0.243902	Wolftrap Elementary, Colvin Run Elementary, K...	0.890236	38.945437	-77.266294	Restaurant	Portuguese Restaurant	Salad Place	BBQ Joint	Gym
23	22124	2.608919	OAKTON	Fairfax County	3	0.667175	2%	0.330824	0.802456	-0.121951	Oakton Elementary, Waples Mill Elementary	0.930415	38.896743	-77.362288	Gym	American Restaurant	Spa	Deli / Bodega	Pizza Place
5	20171	2.467336	HERNDON	Fairfax County	3	0.543319	4%	0.929227	0.605458	-0.426829	Oak Hill Elementary, Floris Elementary, Fox M...	0.816162	38.904368	-77.403626	Trail	Coffee Shop	Airport Lounge	Brewery	Fast Food Restaurant
22	22102	2.419160	MCLEAN	Fairfax County	0	0.586869	4%	0.504017	0.877054	-0.548780	Spring Hill Elementary	1.000000	38.931275	-77.203997	Wine Shop	Vietnamese Restaurant	Butcher	Neighborhood	Park
27	22180	2.368264	VIENNA	Fairfax County	0	0.646942	3%	0.485509	0.626752	-0.097561	Stenwood Elementary, Louise Archer Elementary,...	0.706622	38.894999	-77.254909	Taco Place	Shopping Mall	Butcher	Supermarket	Thai Restaurant
11	22031	2.324079	FAIRFAX	Fairfax County	0	0.511751	4%	0.593820	0.525111	-0.256098	Mosby Woods Elementary, Mantua Elementary, Fai...	0.949495	38.864393	-77.275968	American Restaurant	Neighborhood	Seafood Restaurant	Soup Place	Thai Restaurant
16	22043	2.247035	FALLS CHURCH	Fairfax County	2	0.590409	4%	0.445792	0.539446	-0.109756	Haycock Elementary, Lemon Road Elementary, Shr...	0.781145	38.898800	-77.186142	American Restaurant	Golf Course	Italian Restaurant	Supermarket	Pizza Place
9	22015	2.183607	BURKE	Fairfax County	3	0.469689	4%	0.770516	0.500723	-0.402439	Terra Centre Elementary, Cherry Run Elementary...	0.845118	38.788896	-77.272504	Alghan Restaurant	Portuguese Restaurant	American Restaurant	Grocery Store	American Restaurant
12	22032	2.154742	FAIRFAX	Fairfax County	4	0.530000	4%	0.510918	0.531652	-0.219512	Wakefield Forest Elementary, Oak View Elementa...	0.801684	38.837883	-77.258316	Diner	Coffee Shop	Fast Food Restaurant	Sushi Restaurant	Grocery Store
13	22033	2.143360	FAIRFAX	Fairfax County	2	0.455000	4%	0.708684	0.540441	-0.378049	Navy Elementary, Greenbriar West Elementary, L...	0.817284	38.864965	-77.404055	Gym	Spa	Japanese Restaurant	Museum	Fast Food Restaurant
2	20124	2.125094	CLIFTON	Fairfax County	0	0.613926	3%	0.279918	0.665346	-0.292683	Union Mill Elementary	0.858586	38.820280	-77.378782	Coffee Shop	Italian Restaurant	Indian Restaurant	Pizza Place	Golf Course
26	22153	2.081439	SPRINGFIELD	Fairfax County	0	0.477286	5%	0.580732	0.533954	-0.219512	Sangster Elementary, Newington Forest Elementa...	0.708979	38.757142	-77.262515	Coffee Shop	Trail	Food Court	Pizza Place	Bakery
25	22152	2.043432	SPRINGFIELD	Fairfax County	4	0.447118	5%	0.503076	0.516118	-0.219512	Keene Mill Elementary, West Springfield Elemen...	0.796633	38.762084	-77.215550	Bubble Tea Shop	Thai Restaurant	BBQ Joint	Salad Place	Grocery Store
10	22030	1.911249	FAIRFAX	Fairfax County	1	0.504908	3%	0.741413	0.485478	-0.353659	Willow Springs Elementary, Fairfax Villa Eleme...	0.533109	38.830000	-77.315903	Food Court	Greek Restaurant	Indian Restaurant	Brazilian Restaurant	Coffee Shop

4. CONCLUSION

According to the ranking, here's top 10 cities of Fairfax County, it is very much consistent with the general sense and reality:

#	Zip Code	City	Score
1	22101	MCLEAN	3.143407
2	22066	GREAT FALLS	2.93824
3	22182	VIENNA	2.66815
4	22124	OAKTON	2.608919
5	20171	HERNDON	2.467336
6	22102	MCLEAN	2.41916
7	22180	VIENNA	2.368264
8	22031	FAIRFAX	2.324079

9	22043	FALLS CHURCH	2.247035
10	22015	BURKE	2.183607

5. FUTURE STUDIES

To further improve this research, the indicators can be expanded and more dataset can be added to make the calculation system more robust. Also, user ratings for selected venues in each city/zipcode from Foursquare can be added. It's stronger to evaluate a city by comparing aggregated user ratings. Lastly, more sophisticated evaluation/rating calculation methods can be applied than the weighted average model. A regression model can also be built to predict city value and development outlook.