



EVALUATING CITIES IN FAIRFAX COUNTY OF VIRGINIA, USA

JICHONG WU
JUNE 2020



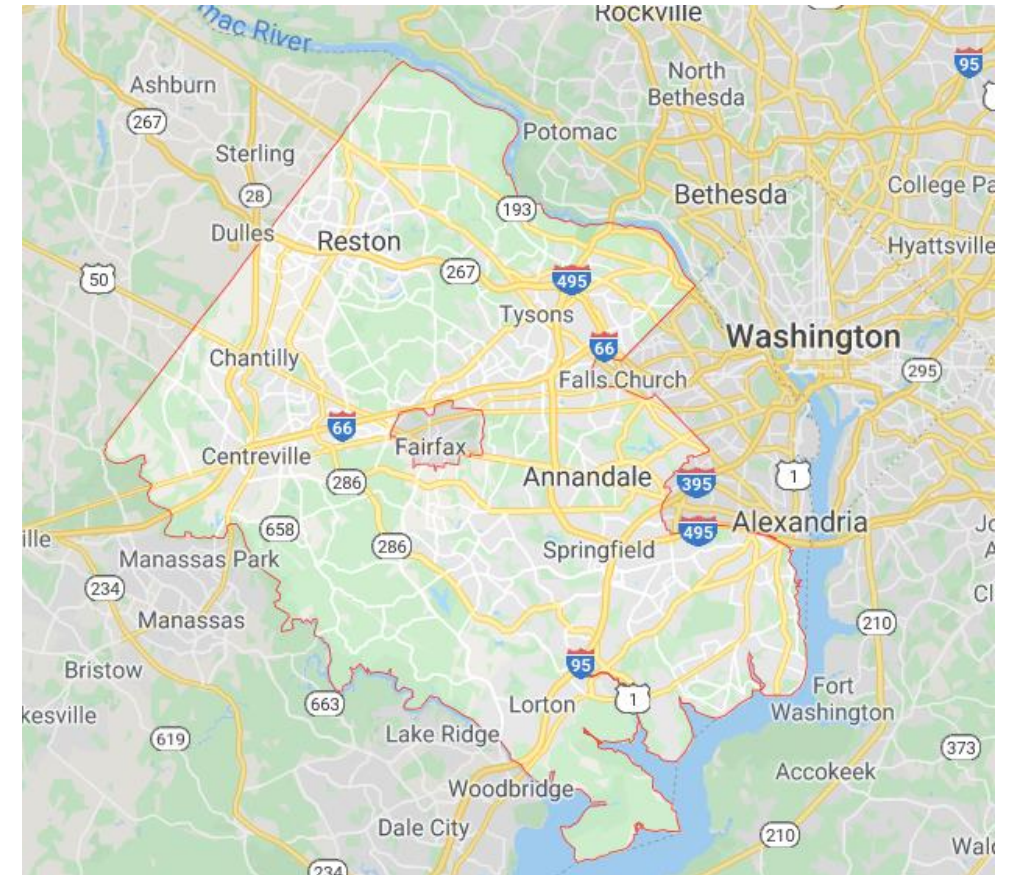


OUTLINE

- 
- Introduction
 - Background
 - The Problem
 - Methodology
 - Data Collection
 - City (zip code) List
 - Population
 - Income
 - Housing Market
 - Safety
 - School Quality
 - Nearby Feature
 - Data Understanding and Analysis
 - City Segmentation and Clustering
 - Scatter Plot
 - Weighted Average and Rating
 - Conclusion
 - Future Studies

INTRODUCTION

- Background
 - Fairfax County located on suburb of US capital Washington, D.C.
 - 3rd highest-income county in US
 - 7 Fortune 500 companies
 - Accounted for 20% of the DC-VA-MD Metropolitan Area population
- The Problem
 - evaluate all 58 cities in Fairfax and identify “good” ones to live in
- Target Audience
 - current and future residents
 - investors



METHODOLOGY

- Data acquisition
 - Value of a venue is determined by local housing market, demographic, income level, safety, school quality and the nearby features
 - Each dataset was collected accordingly
- Data cleaning
 - Find each dataset for all city/zipcode
 - Drop NaN if no data found, drop non-relevant data
 - Group by city/zipcode and get sum or mean value for each unique city/zipcode
 - Format data for easy reading (e.g. add '\$', thousand separator)
- Analysis
 - Use Foursquare venue category to segment cities based on nearby venue features (get most common venues)
 - Plot city clusters on map for visual examination
 - Normalize other dataset for 1) visual comparison (scatter plot) and 2) calculating weighted average score for ranking

#	Indicator	Data
1	Full list of Fairfax County cities	Fairfax County city and zip code list
2	Housing market	Property Value
3	Demographic	Population
4	Income	Average per capita income
5	Safety	Total crime # in the past week
6	School quality	School scores and rating
7	Nearby features	Foursquare Venue Category

DATA COLLECTION

#	Indicator Category	Collected Data	Data Source
1	Full list of Fairfax County cities	Fairfax County city and zip code list	Open Geospatial Data Fairfax County Government
2	Housing market	Property Value	Home value index (by zip code and by city) current, Zillow
3	Demographic	Population	Demographics Data 2019 Economic, Demographic and Statistical Research (EDSR) Unit Fairfax County Government
4	Income	Average per capita income	Per capita income (mean), 2014-2018 American Community Survey
5	Safety	Total crime # in the past week	Weekly Crime Data, current Fairfax County Police Department
6	School quality	School scores and rating	Fairfax County elementary public school scores, 2019 SchoolDigger
7	Nearby features	Foursquare Venue Category	Explore venue categories for a given location (coordinates) Foursquare

DATA COLLECTION – CITY LIST, ZIPCODE LIST, POPULATION



Interactive Map - ZIP Code

Block Group Community ZIP Code Census Explorer

How to Use the Map

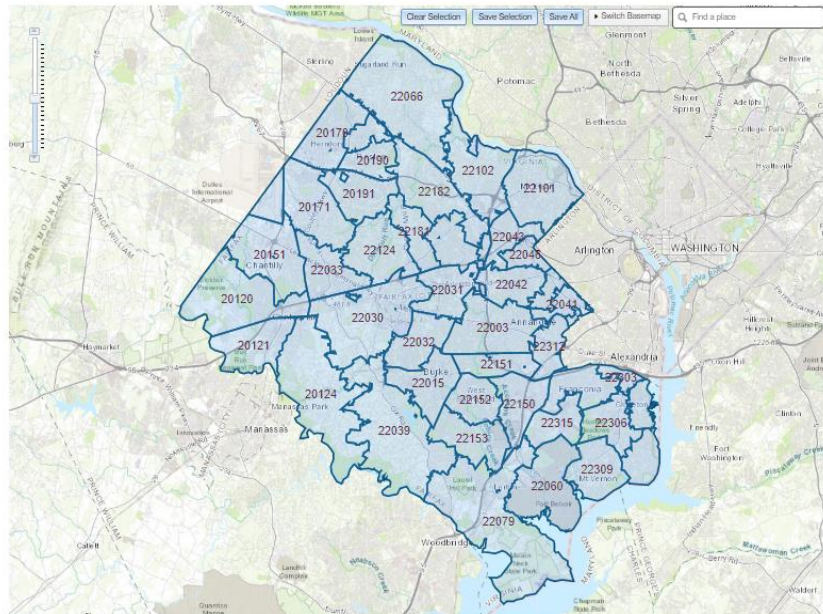
To pan: Click left mouse button and hold. Move the mouse to pan across the map.

To zoom: Use the scroll bar to zoom in and out, or double click to zoom in to a particular location.

To get information: Click the left mouse button once to select a feature. Additional features can be selected. Click again to unselect feature, or click "Clear Selection" button to clear all feature selections. Data will appear in table below map.

To download information: After selecting features, click "Save Selection" button to export data for selected features. To export data for all features, click "Save All" button.

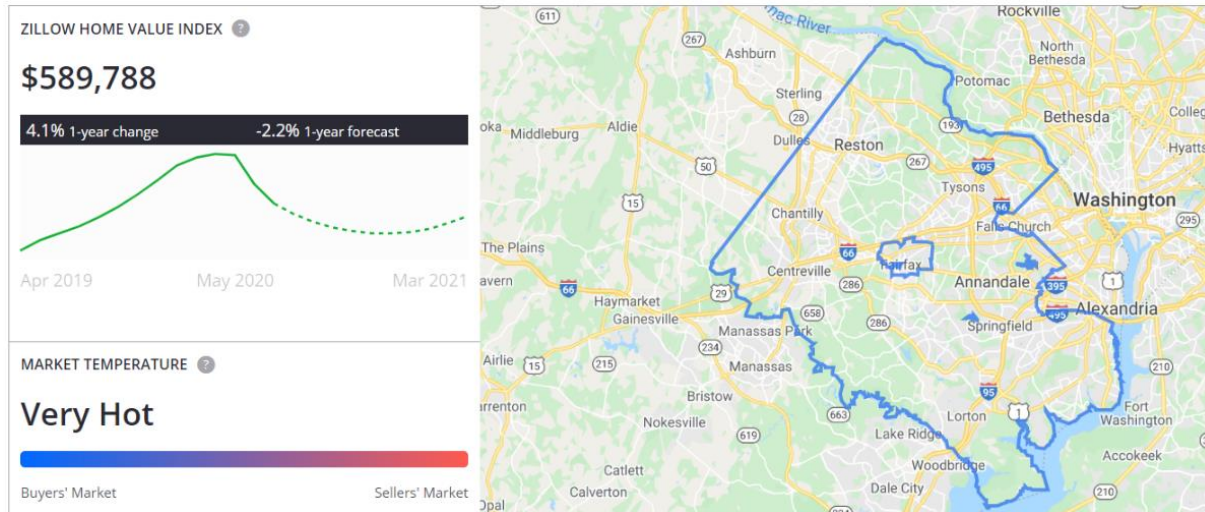
To search: Click next to the magnifying glass in the top right corner of the window. Type in an address, place, or ZIP Code and hit enter.



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DATA COLLECTION – HOUSE VALUE

Fairfax County Home Prices & Values



	Metros	Counties	Cities	Zip Codes	Neighborhoods
Region					Value
20105				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 4% ▲	\$661,141
20109				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 5% ▲	\$309,583
20110				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 4% ▲	\$348,495
20111				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 5% ▲	\$354,128
20112				M-o-M: 0% Q-o-Q: 0% Y-o-Y: 3% ▲	\$498,343
20120				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 4% ▲	\$506,854
20121				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 5% ▲	\$417,424
20136				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 4% ▲	\$489,959
20147				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 4% ▲	\$547,144
20148				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 3% ▲	\$651,057
20151				M-o-M: 0% Q-o-Q: 0% Y-o-Y: 4% ▲	\$582,431
20152				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 4% ▲	\$595,783
20155				M-o-M: 0% Q-o-Q: 0% Y-o-Y: 4% ▲	\$503,664
20164				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 5% ▲	\$428,953
20165				M-o-M: 0% Q-o-Q: 0% Y-o-Y: 3% ▲	\$539,341
20169				M-o-M: 0% Q-o-Q: 0% Y-o-Y: 3% ▲	\$560,017
20170				M-o-M: 0% Q-o-Q: 0% Y-o-Y: 4% ▲	\$518,025
20171				M-o-M: 0% Q-o-Q: 0% Y-o-Y: 4% ▲	\$643,871
20175				M-o-M: 0% Q-o-Q: 1% ▲ Y-o-Y: 4% ▲	\$558,236

DATA COLLECTION – INCOME, SAFETY

Per Capita Income

Select a Zip Code ▼

Measurement Period: 2014-2018 ▼

Filter: none (all Zip Codes)

\$29,973 - \$43,096

\$43,096 - \$58,568

\$58,568 - \$72,355

\$72,355 - \$82,958

\$82,958 - \$105,363

N/A

Zip Code	Source	Measurement Period	Dollars	
22060	American Community Survey	2014-2018	\$29,973	●
22306	American Community Survey	2014-2018	\$35,320	●
22041	American Community Survey	2014-2018	\$37,103	●
22309	American Community Survey	2014-2018	\$38,678	●
20121	American Community Survey	2014-2018	\$38,713	●
22150	American Community Survey	2014-2018	\$38,819	●
22312	American Community Survey	2014-2018	\$39,982	●
22003	American Community Survey	2014-2018	\$41,863	●
22151	American Community Survey	2014-2018	\$43,096	●
22079	American Community Survey	2014-2018	\$45,698	●
20151	American Community Survey	2014-2018	\$46,391	●
20170	American Community Survey	2014-2018	\$47,320	●
22030	American Community Survey	2014-2018	\$47,714	●
22044	American Community Survey	2014-2018	\$48,975	●

A1	A	B	C	D	E	F	G	H	I
1	1	FRAUD-26	FRAUD - IN	6/22/2020	912	5100 PORT FAIRFAX	VA		22032
2	1	FRAUD-26	FRAUD - IN	6/22/2020	1458	14400 LAK CHANTILL	VA		20151
3	1	FRAUD-26	FRAUD - IN	6/22/2020	1539	2200 CENT VIENNA	VA		22182
4	1	FRAUD-26	FRAUD - IN	6/22/2020		1900 HOPE FALLS CHU	VA		22043
5	1	SERV-8	SERVICE -	6/22/2020	13	6000 OXPE ALEXANDR	VA		22315
6	1	ASSLT-13B	ASSAULT -	6/22/2020	6	11600 FAIR FAIRFAX	VA		22030
7	1	DEST-290-	DESTRUCT	6/22/2020	22	7600 BRO/ FALLS CHU	VA		22043
8	1	SUSP-3	SUSPICIOU	6/22/2020	32	6200 DAN/ SPRINGFI	VA		22150
9	1	SERV-1	SERVICE -	6/22/2020	5	1600 BELL ALEXANDR	VA		22307
10	2	TRES-90J-	TRESPASSI	6/22/2020	152	6300 WAT FALLS CHU	VA		22044
11	1	DRUG-35A	DRUGS - M	6/22/2020	152	6300 WAT FALLS CHU	VA		22044
12	1	SERV-29	SERVICE -	6/22/2020	49	11000 BEC RESTON	VA		20190
13	1	SUSP-2	SUSPICIOU	6/22/2020	156	11000 BEC RESTON	VA		20190
14	1	DRUG-35A	DRUGS - C	6/22/2020	216	6300 COTT ALEXANDR	VA		22310
15	1	DEST-290-	DESTRUCT	6/22/2020	208	5800 FRAN ALEXANDR	VA		22310
16	2	ROB-120-4	ROBBERY	6/22/2020	204	10400 FAIR FAIRFAX	VA		22030
17	1	ABDCT-10	ABDUCTIO	6/22/2020	204	10400 FAIR FAIRFAX	VA		22030
18	2	DRUG-35A	DRUGS - M	6/22/2020	304	8400 RICH ALEXANDR	VA		22309
19	1	ASSLT-13B	ASSAULT -	6/22/2020	304	8400 RICH ALEXANDR	VA		22309
20	1	ASSLT-13B	ASSAULT -	6/22/2020	402	8000 CHA FALLS CHU	VA		22042
21	2	DEST-290-	DESTRUCT	6/22/2020	402	8000 CHA FALLS CHU	VA		22042
22	2	SERV-999	POLICE PH	6/22/2020	407	7500 REPL ALEXANDR	VA		22306
23	1	SERV-29	SERVICE -	6/22/2020	351	10000 CHE BURKE	VA		22015
24	1	ASSLT-13B	ASSAULT -	6/22/2020	407	12100 SUN RESTON	VA		20190
25	1	SERV-1	SERVICE -	6/22/2020	426	5500 SEMI FALLS CHU	VA		22041
26	1	SERV-1	SERVICE -	6/22/2020	403	6900 BRAC ANNANDA	VA		22003
27	1	LARC-23-9	LARCENY	6/22/2020	213	3300 WILL FAIRFAX	VA		22030

DATA COLLECTION – SCHOOL QUALITY

Best Public Schools in Zip Code 22033

Schools: All Public ▾ My Schools 34 ▾

List / Map Table

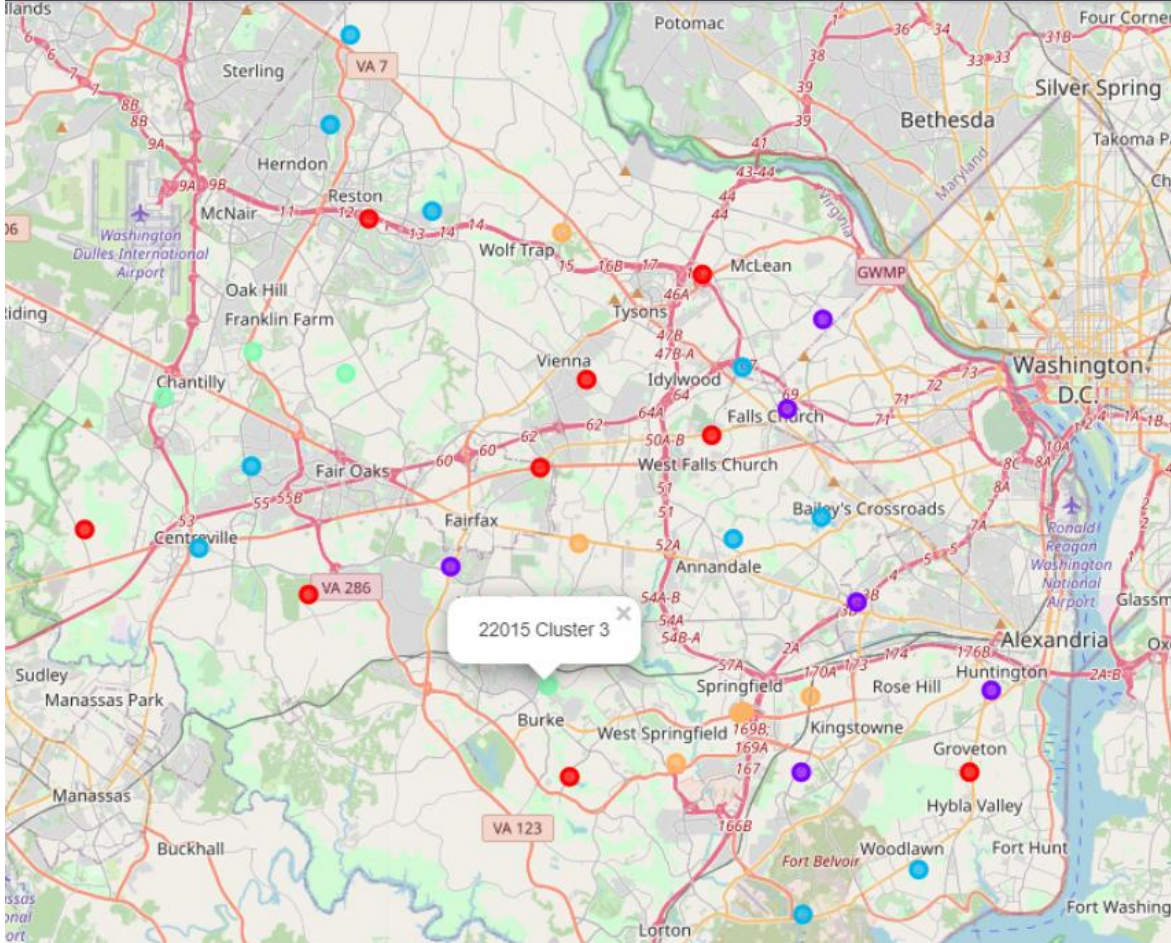
Choose columns to see: Summary School Students/Teachers Ranking Test Scores

Search:

School	Ranking (2019)				Ranking (2018)			
Name	Average Standard Score (2019)	Statewide Rank (2019)	State Percentile (2019)	SchoolDigger Rating (2019)	Average Standard Score (2018)	Statewide Rank (2018)	State Percentile (2018)	Rank Change from Previous Year
Greenbriar East Elementary	47.6	667 th of 1102 public elementary schools	39.5%	★☆☆☆☆	51.1	607 th of 1097 public elementary schools	44.7%	▼ 60
Greenbriar West Elementary	82.6	121 st of 1102 public elementary schools	89.0%	★★★★★	79.4	165 th of 1097 public elementary schools	85.0%	▲ 44
Lees Corner Elementary	72	286 th of 1102 public elementary schools	74.0%	★★★★★	74.5	231 st of 1097 public elementary schools	78.9%	▼ 55
Navy Elementary	89.1	26 th of 1102 public elementary schools	97.6%	★★★★★	87.2	57 th of 1097 public elementary schools	94.8%	▲ 31

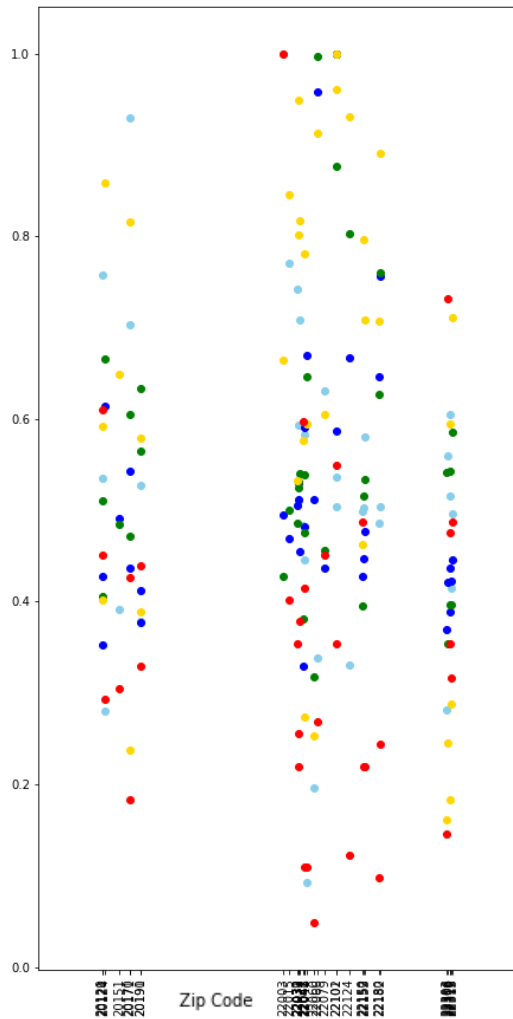
Show 10 ▾ schools

ANALYSIS – CITY SEGMENTATION & CLUSTERING

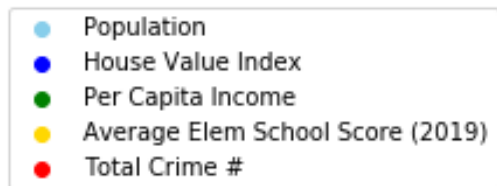


- **Cluster0:** convenient store-cluster area
- **Cluster1:** high house value, park area
- **Cluster2:** restaurant-cluster (American, Asian food) area, closer to city centers
- **Cluster3:** suburban area (away from city centers)
- **Cluster4:** restaurant-cluster area, away from city centers

ANALYSIS – SCATTER PLOT



- First, normalize data for population, house value, income, school scores, crime number
- Plot normalized values by zip code, using red for crime # as it's easy to stand out and it's different than other data values – the higher value the worse
- Scattered plot makes it easy to compare between cities(zip code), the dots on the top part of the chart (except the red dot) are good cities



ANALYSIS – WEIGHTED AVERAGE RATING

To calculate weighted average scores:

- Convert normalized crime# to negative value
- Sum up all normalized data values
- Sort city(zip code) by the sum-up score to get the ranking

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, Ki...	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 Mi...	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	Afghan 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

CONCLUSION

According to the ranking, here's the top 10 cities in 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

FUTURE STUDIES

To further improve this research, the following areas can be explored:

- Expanding the indicators and get more dataset
 - User ratings for selected venues in each city/zipcode
- Applying more sophisticated evaluation/rating calculation methods
- Predicting city value/outlook by building a regression model