Exploring housing alternatives within the Dallas-Fort Worth-Arlington metropolitan area

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1 Introduction

The Dallas-Fort Worth-Arlington metropolitan area is one of the most populous metropolitan area in Texas (the 4th in the Country), being home for 24 Fortune 500 companies with a prosperous economy based on banking, commerce, medical care and research and logistics among other areas. Also the area has an important number of public and private Universities, sports scenarios and one of the largest airports of the country, the Dallas-Fort Worth International Airport[1].
This area includes 11 counties, however the cities of Dallas, Fort Worth and in third place Arlington, are those with the mayor concentration of the economic activity. If we see some comparative data in the portal of *Numbeo.com* between these three cities, we note some interesting points:

Comparing Arlington and Dallas[2]:

a. Rent Prices in Dallas are 51.13% higher than in Arlington.

b. Restaurant Prices in Dallas are 21.55% higher than in Arlington.

c. Price per Square Meter to Buy Apartment Outside of Centre is 2.24 % higher in Dallas.

However,

d. Groceries Prices in Dallas are 19.63% lower than in Arlington.

e. Average Monthly Net Salary (After Tax) is 60.77 % higher in Dallas.

Comparing Arlington and Fort Worth[3]:

a. Rent Prices in Fort Worth are 6.61% higher than in Arlington.

b. Restaurant Prices in Fort Worth are 29.21% higher than in Arlington.

However,

c. Groceries Prices in Fort Worth are 19.63% lower than in Arlington.

d. Price per Square Meter to Buy Apartment Outside of Centre is 21.22% lower in Fort Worth.

e. Average Monthly Net Salary (After Tax) is 10.71% higher in Fort Worth.

This exercise proposes compare some of the principal aspects related to cost of live and wellness between these cities considering that from Arlington we can reach the cities of Dallas or Fort Worth in a reasonable time by driving (it can be 1 hour or less in some cases), so it is possible to live in one of the cities and drive to another city to work or study.
This type of comparative analysis could be important no just for people who is thinking in working or living in this area but for the all the companies and people dedicated to advice families to get a good place to live.

This small exercise will consider just some of the multiple aspects considered by a family when is looking for a place to living such as the cost of rent, which are the safest areas to live and the venues around different neighborhoods in the cities of Fort Worth, Dallas and Arlington.
The question to be answer in this case is which are the best neighborhoods to live within the Dallas-Fort Worth-Arlington metropolitan area? This exercise will consider a family composed by two adults, a young son and a dog in order to have some criteria to evaluate the options that we found in the analysis of data.

2 Data sources and initial exploration of neighborhoods

One of the first data important in our analysis is a list of neighborhoods in each of the cities involve in our exercise: Fort-Worth, Dallas and Arlington. The Neighborhoods for each city are extracted from the webpage of rentcafe.com, a page dedicated to help the users in the search of houses for rent. The lists extracted are very useful because contain a list of neighborhoods and the mean cost for rent for each one: The data can be found in the following links for Arlington, Dallas and Fort–Worth

2.1 Data procedure

2.1.1 BeautifulSoup

Use the *BeautifulSoup* library to extract the neighborhoods names and rent cost for each city and get a dataframe for each city.

2.1.2 Geopy

Use the *geopy* library to obtain the coordinates of each neighborhoods and add this information to our dataframe in each case.

2.1.3 Select safest zones

Select the safest zones of each city from the information in webpage areavibes.com: In Fort-Worth here, for Dallas is here and for Arlington here. Considering the name of the safe zone in each city, we use *Google maps* to determine a point of coordinates within this zone (table 1), and we use it as reference to filter dataframes and get the neighborhoods in each city which are nearest to these safe zones.

Fort-Worth		**Dallas**		**Arlington**	
Zone	Lat, Long	Zone	Lat, Long	Zone	Lat, Long
Far SouthWest	32.74, -97.36	Far North	32.98, -96.80	Southeast	32.64, -97.10
Downtown	32.75, -97.33	Arts District	32.79, -96.80	West	32.70, -97.15
West Cliff	32.69, -97.36	Winnetka Heights	32.74, -96.84	Pantego	32.72, -97.15
Far North	32.93, -97.30	Highland Park	32.83, -96.80	Dalworthington Gardens	32.69, -97.16
Far NorthWest	32.88, -97.41	Main Street District	32.78, -96.79	Southwest	32.65, -97.16
Wedgwood	32.65, -97.40	Northeast Dallas	32.85, -96.75	Central	32.74, -97.11
Far South	32.60, -97.31	University Park	32.85, -96.80	North	32.78, -97.09
		City Center District	32.78, -96.80	East	32.72, -97.08
		North Dallas	32.96, -96.79		
		Love Field Area	32.83, -96.85		
		m Streets	32.82, -96.77		

Table 1: Safest zones reference coordinates

2.1.4 Rent cost distribution and final neighborhoods selection

After selecting the safest neighborhoods in each city, we compare the rent cost distribution for each city (figure 1). We choose the price range $900 - $1265 from what is observed in the histogram in order to compare neighborhoods of the three cities with similar 'average rent cost'. After select data in this range of prices, we get just 40 neighborhoods by city. The final set of neighborhoods is shown in the map of figure 2.

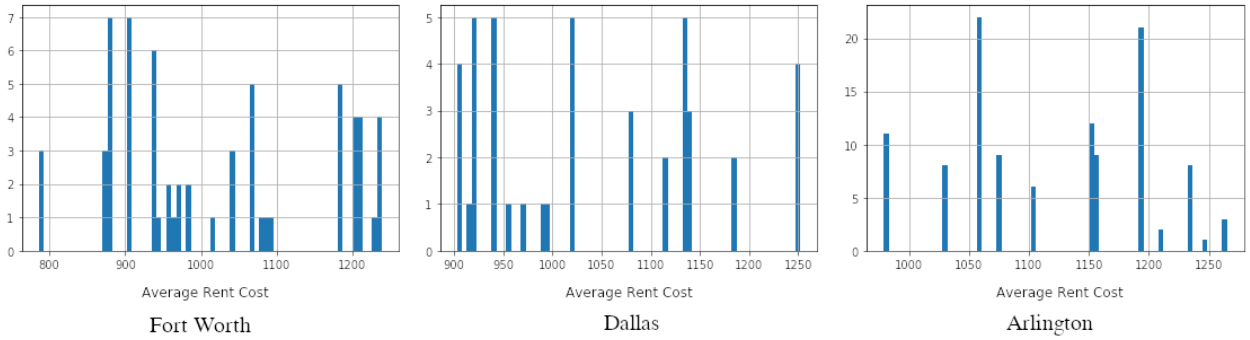

Figure 1: Comparative rent cost distribution.

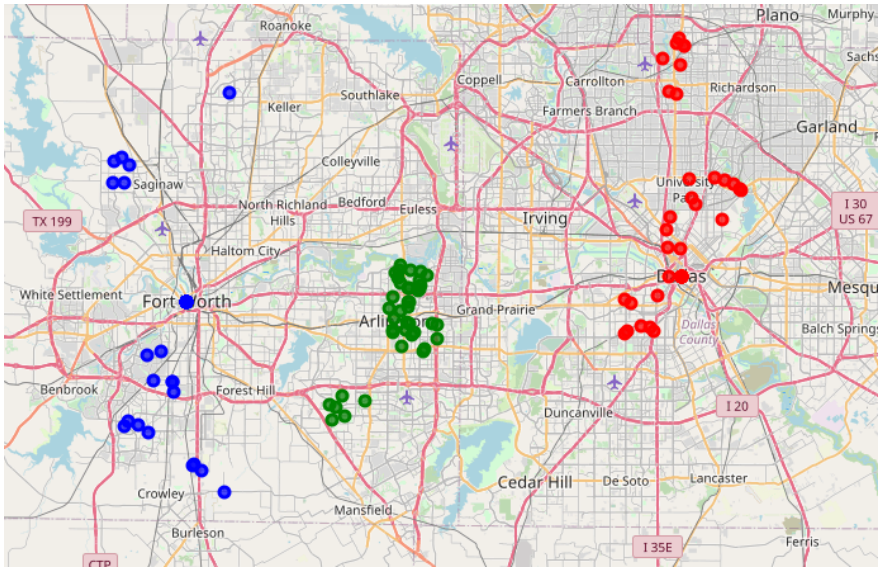

Figure 2: Map with the selected neighborhoods.

3 Methodology

3.1 Neighborhoods venues

From the 40 neighborhoods for each city, we proceed to find the venues of each neighborhood using the Foursquare API in a radius of 500m. Then, analyze the occurence of each venue category and grouping the information by neighborhood to obtain the frequency of occurrence of each venue category. In the case of Fort Worth, we obtain 109 unique venues categories while for Dallas and Arlington we found 143 and 104 respectively.

3.2 K-means algorithm

On the data obtained, we apply the k-means classification algorithm to clustering neighborhoods with similar characteristics. For the family taken as an example in this exercise, it could be great to have places such as schools, convenience stores, supermarkets, pet stores, parks, and places to eat and spend free time near home. The neighborhoods with some of these characteristics will be chosen from the classification provided by the algorithm. To apply the k-means algorithm, it was necessary to find the appropriate number of clusters (k) using the Elbow method[4]. Our optimal k will be the one in which the variation of the curve changes from very abrupt to smooth. In figure 3 the curve for each city is shown. The algorithm was applied with k = 3 in the case of Fort-Worth, and k = 4 in the case of Dallas and Arlington.

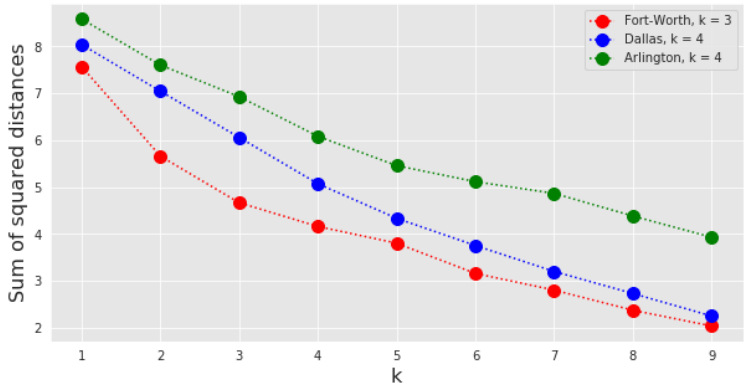

Figure 3: Elbow Method For Optimal k

4 Results

The dataframe for each cluster contains the name, rent cost and coordinates as well as the 10 most common venues of each neighborhood. In each city, one cluster is selected according to its characteristics. In the case of Fort-Worth, the cluster selected seems to have schools within its most common venues in the neighborhood 'Bailey Gardens'. The final selection includes the 3 neighborhoods nearest to 'Bailey Gardens':

	Neighborhood	Average Rent Cost	lat	lon	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Westcliff, Fort Worth	1210.0	32.704224	-97.375851	0.0	Athletics & Sports	College Baseball Diamond	Tennis Court	Pet Store	Food & Drink Shop	Wings Joint	Flower Shop	Deli / Bodega	Department Store	Dessert Shop
1	Bailey Gardens, Fort Worth	1204.0	32.707329	-97.360866	0.0	Pizza Place	Sandwich Place	Coffee Shop	Mexican Restaurant	Fast Food Restaurant	College Arts Building	Smoothie Shop	Convenience Store	Concert Hall	College Bookstore
2	Southcrest, Fort Worth	958.0	32.670546	-97.346661	0.0	Grocery Store	Discount Store	Chinese Restaurant	Wings Joint	Fondue Restaurant	Deli / Bodega	Department Store	Dessert Shop	Dive Bar	Dog Run
3	Kellis Park, Fort Worth	943.0	32.680640	-97.369760	0.0	Burger Joint	American Restaurant	Park	Food	Grocery Store	Greek Restaurant	Deli / Bodega	Department Store	Dessert Shop	Discount Store

In the case of Dallas, the cluster selected was 'University Terrace' because it has 'college squad' as one of its most common venues. The neighborhoods in this cluster are very close to each other, so applying a simple proximity criterion does not seem very useful to select only 3 neighborhoods in a unique way. Taking into

account the conditions that we would like for the family considered in this exercise, we take as essential the following venues categories in the selected neighborhoods: 'Convenience Store', 'Park', 'Plaza', 'Pet Store', 'Fast Food Restaurant' and 'Department Store'. The final neighborhoods considered are:

	Neighborhood	Average Rent Cost	lat	lon	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Heritage Square, Dallas	920.0	32.802766	-96.811985	0.0	Convenience Store	Bar	Park	Nail Salon	Coffee Shop	Recreation Center	Plaza	Playground	Pizza Place	Pet Store
1	University Terrace, Dallas	1136.0	32.841801	-96.781528	0.0	Plaza	Coffee Shop	Park	Fast Food Restaurant	College Quad	Monument / Landmark	Sporting Goods Shop	Museum	New American Restaurant	Library
2	Eastridge Park, Dallas	921.0	32.863701	-96.749493	0.0	Pizza Place	Women's Store	Big Box Store	Coffee Shop	Department Store	Discount Store	Pharmacy	Convenience Store	Bank	Check Cashing Service
3	Artisan Ridge, Dallas	1078.0	32.818324	-96.812575	0.0	Mexican Restaurant	Gym	Bank	Salon / Barbershop	Fast Food Restaurant	Convenience Store	Yoga Studio	Wings Joint	Fried Chicken Joint	Latin American Restaurant

The same criteria was applied on Arlington data:

	Neighborhood	Average Rent Cost	lat	lon	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Coldwater Creek, Arlington	1236.0	32.767315	-97.078661	1.0	Go Kart Track	Cosmetics Shop	Hotel	Convenience Store	Gas Station	Farmers Market	Fast Food Restaurant	Fish & Chips Shop	Food Court	Food Service
1	Glenbury, Arlington	1077.0	32.781317	-97.089949	1.0	Pet Store	Asian Restaurant	Cosmetics Shop	Gym / Fitness Center	Grocery Store	Golf Course	Nail Salon	Coffee Shop	Wings Joint	Fast Food Restaurant
2	River Oaks, Arlington	1077.0	32.786428	-97.101089	1.0	Smoke Shop	Chinese Restaurant	Park	Rental Service	Wings Joint	Fried Chicken Joint	Dry Cleaner	Farmers Market	Fast Food Restaurant	Fish & Chips Shop
3	Hidden Meadow, Arlington	1058.0	32.779994	-97.078948	1.0	Residential Building (Apartment / Condo)	Home Service	Furniture / Home Store	Donut Shop	Dry Cleaner	Farmers Market	Fast Food Restaurant	Fish & Chips Shop	Food Court	Food Service

If we examine the neighborhoods for the three cities together, we can see how the venues categories considered important are distributed in Figure 4.
We can see that there are more parks, fast food restaurants and convenience stores in Dallas than those in Fort-Worth and Arlington. Additional to this, the distribution of rent cost are shown in figure 5.
For the selected neighborhoods, it seems that rent cost is a little bit lower in Dallas with a price between $900 and $1150.

5 Discussion

With the criteria applied in the analysis of the data for each city, the selected neighborhoods in Dallas seem to be the closest to what we expect in terms of rental price, security and nearby amenities for a family of two adults, a child and a dog as a pet.
For a more complete future analysis we would have to consider other variables such as:

- Consider whether family members will use a car or public transportation to get around. This will allow to examine the alternatives that could be close by according to the neighborhood they choose to live in.
- Which school might be most suitable for the young family member.

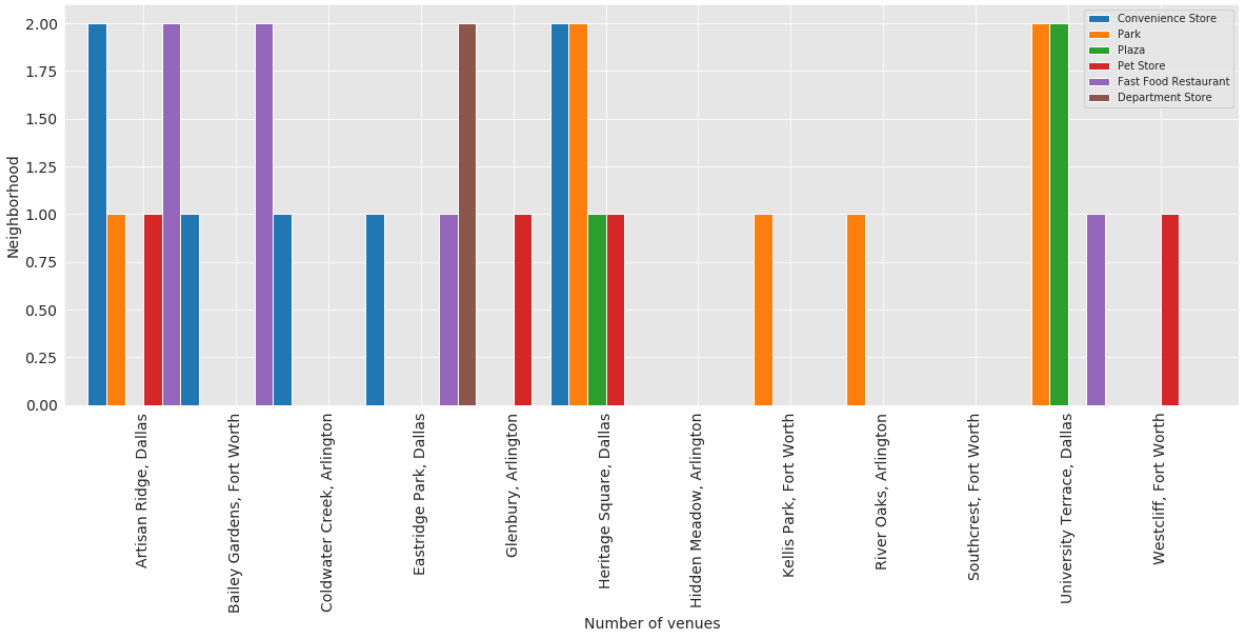

Figure 4: Number of selected venues in Fort-Worth, Dallas and Arlington

- Examine the quality of health services in each city and how close the hospitals are to the area of residence.
- Consider the type of employment that adults in the family will have to examine the salary they will receive according to the city where they work. This will determine the family budget for rent cost.

6 Conclusion

The Dallas-Fort-Worth-Arlington metropolitan area offers several housing alternatives for a family that wants to move to this area. There are many criteria that must be considered when deciding to find a city to settle but from this analysis we can establish that in this metropolitan area it is possible to obtain a comfortable home with a rental cost of less than $1200 with recreation areas, schools and nearby stores.

7 References

[1] Dallas Fort–Worth metroplex
[2] Cost of Living Comparison Between Arlington, TX and Dallas, TX
[3] Cost of Living Comparison Between Arlington, TX and Fort Worth, TX
[4] Tutorial: How to determine the optimal number of clusters for k–means clustering

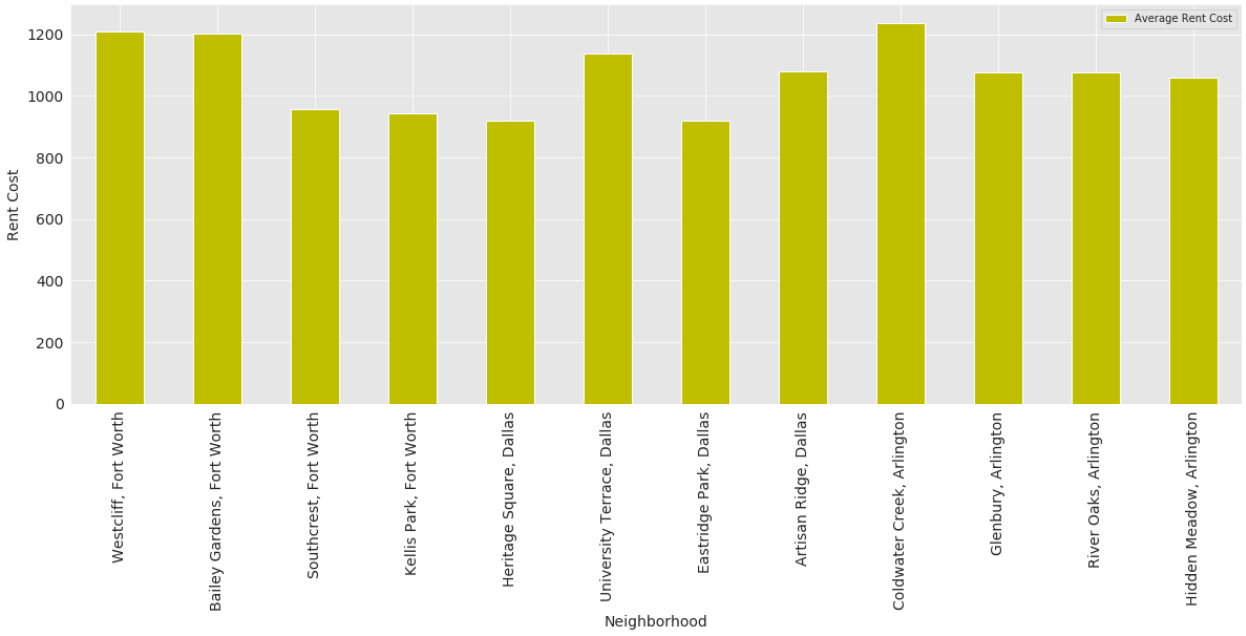

Figure 5: Rent cost in selected neighborhoods of Fort-Worth, Dallas and Arlington