Moving to Palm Beach County Florida
Data Analysis

As I find myself in the process of moving to Palm Beach County, Florida, I decided to use this as my Capstone Project - Battle of the Neighborhoods – for the IBM Data Science Professional Certificate.

Introduction: Business Problem

Currently trending, many active seniors, especially those who live in states like New York and New Jersey, once retired, look to relocate to a warmer, less expensive location like Florida. They would like to move to an area where they can still enjoy many of the same activities in their new home as they enjoyed in their northern one, while maintaining a comparable quality of life in terms of affordability and demographics.

An important consideration for active seniors is to move to an area that is close to family and friends, as well as an area that their guests, including grandchildren, can enjoy visiting. For this study, that area will be limited to Palm Beach County, Florida. Palm Beach County is a large area - 2,386 square miles - on the east coast of Florida consisting of 39 municipalities.

Although there are many factors to consider when moving to a new neighborhood such as available social activities, recreational activities, access to healthcare, as well as the crime rate, taxes, affordability, and public amenities including transportation, this study will focus on venue data collected by FOURSQUARE.

FOURSQUARE provides a variety of categories of venues such as restaurants, shopping, and leisure activities. This study will cluster neighborhoods (municipalities) in Palm Beach County, Florida by venues collected from FOURSQUARE. In addition, median income, median property value, population density, and area (square miles) data will be collected and analyzed.

The goal of the analysis is to provide seniors with information that will help them make a better determination as to which areas they should explore further when considering relocation to Palm Beach County, Florida.

Data

I collected data from the following sources:

- geopy.geocoders Nominatim from which I retrieved latitude and longitude for Palm Beach County and each municipality in order to display Folium maps of Palm Beach County and its municipalities.

- I retrieved Palm Beach County municipality demographic information from the homefacts.com website. Data retrieved includes Median Income, Median Property Value, Population, Population Density, and Area. These values are from 2016.

- I called the FOURSQUARE API to retrieve venues trending at the time of execution including restaurants, shopping, leisure activities, etc. for Palm Beach County neighborhoods (municipalities).

I used pandas and python to perform the analysis for my project.
The data was read from an Excel file into the following pandas DataFrame.

	Municipality	Latitude	Longitude	Median Household Income	Median Property Value	Population	Area - sq miles	Population Density - people per sq mi
0	Atlantis	26.5909	-80.4494	76641	316100	1883	1.44	1309.45
1	Belle Glade	26.6845	-80.6676	26859	94000	17597	5.71	3079.62
2	Boca Raton	26.3587	-80.0831	68804	418100	87848	31.29	2807.81
3	Boyton Beach	26.5256	-80.0666	53188	206100	70120	16.51	4247.63
4	Briny Breezes	26.5094	-80.055	38274	147800	702	0.11	6324.32

Figure 1. pandas DataFrame of data read from an Excel file (first 5 rows)

Methodology

To visualize Palm Beach County and its municipalities, I generated two Folium maps. The first marks the location of Palm Beach County within the state of Florida; the second marks each municipality within Palm Beach County. The second map also incorporates popups with demographic information.

I created histograms and bar charts to visualize demographics of each of the municipalities as they relate to each other and to the whole.

The goal of this project is to group municipalities that have similar venues. Due to the nature of the municipality data, labeling is not possible; and therefore, requires an unsupervised method of analysis. I chose KMeans for my analysis because it is an unsuperivised algorithm that clusters data into groups based upon their similarities.

Display Maps of Palm Beach County and Neighborhoods
Palm Beach County Map

The first of two maps places Palm Beach County in context to its location in Florida. I called Nominatim to get the latitude and longitude of Palm Beach County which were then used to generate the following Folium map.
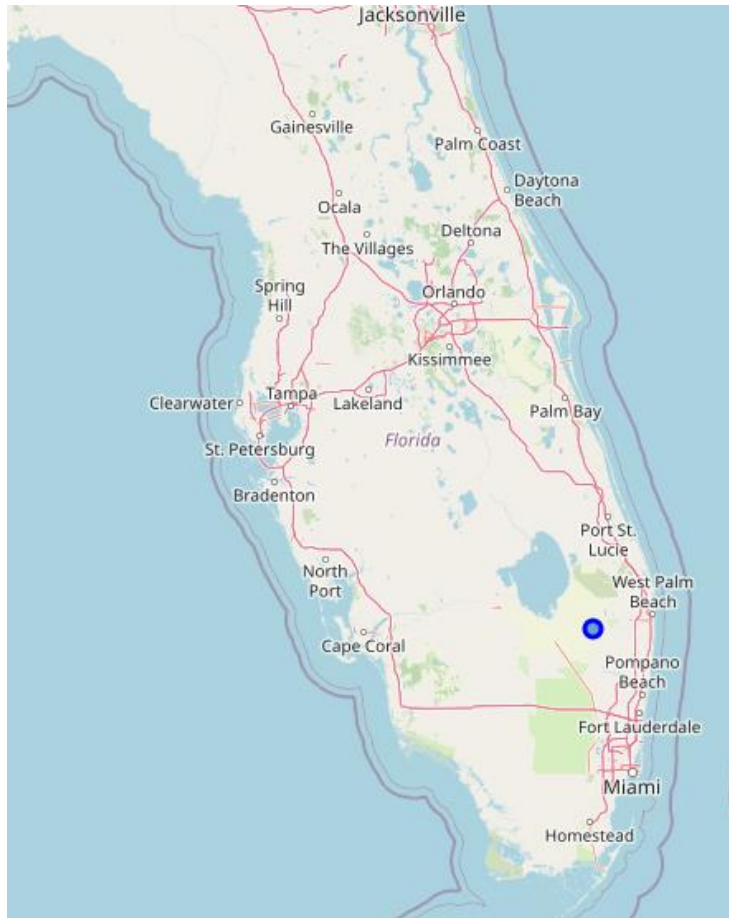
Figure 2. Florida map with Palm Beach County identified by the blue dot

Palm Beach County Neighborhoods Map

The second map places neighborhoods (by municipality) in context to their locations within Palm Beach County. In the same manner as the first map, I obtained the latitude and longitude of each municipality in Palm Beach County from Nominatim so that Folium could generate the following map.
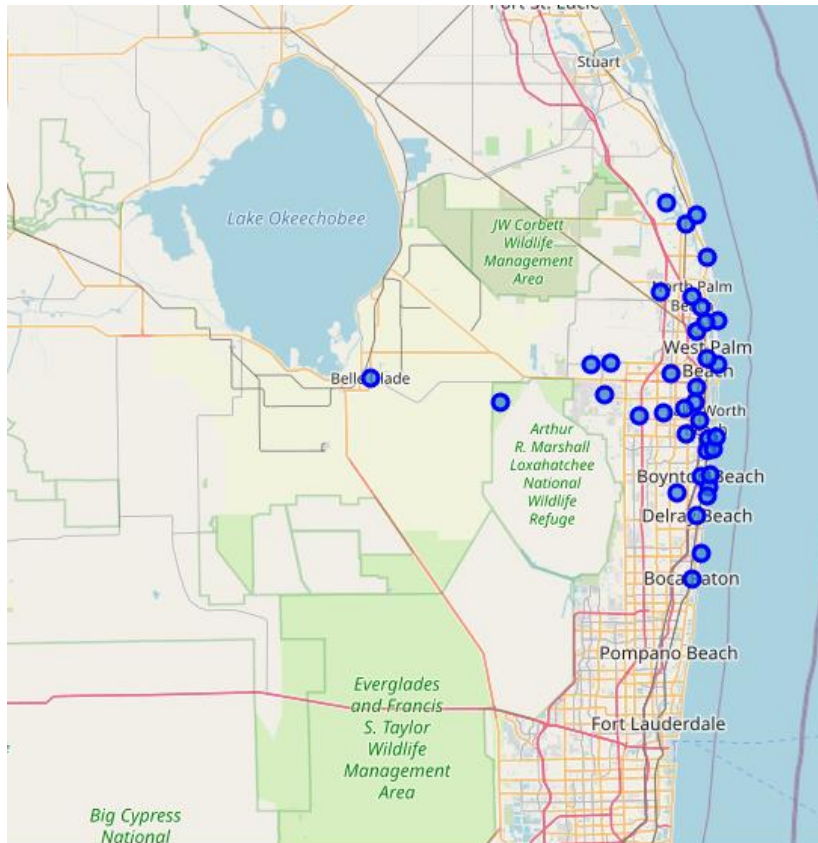
Figure 3. Palm Beach County Neighborhoods Map with each municipality identified by a blue dot

FOURSQUARE API

I called the FOURSQUARE API to retrieve up to 100 venues with a radius of one and a half miles of the latitude and longitude of each neighborhood. The radius was calculated as the average square mile area of all municipalities. The API retrieved 248 unique venue categories. The first five rows of the retrieved data:

	Neighborhoods	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Belle Glade	26.68451	-80.667558	Walgreens	26.686691	-80.667077	Pharmacy
1	Belle Glade	26.68451	-80.667558	Banyan Tree	26.697297	-80.683464	Southern / Soul Food Restaurant
2	Belle Glade	26.68451	-80.667558	CVS Pharmacy	26.685225	-80.667529	Pharmacy
3	Belle Glade	26.68451	-80.667558	Wells Fargo Drive-Up Bank	26.685185	-80.668703	Bank
4	Belle Glade	26.68451	-80.667558	United States Postal Service	26.696251	-80.680954	Post Office

Figure 4. pandas DataFrame of neighborhood venues retrieved by FOURSQUARE API (first 5 rows)

Most of the municipalities reached the 100 venue limit or came close to it, but a quarter of them did not. Those that did not are at the lower end in terms of population density. One municipality; however, Atlantis, did not return any venues.

The FOURSQUARE API results are dependent upon FOURSQUARE user input at the time the API is run. The pandas DataFrame below shows the ten most common venues for each municipality. At

the time the API was run, Florida had recently opened from the lockdown from COVID-19. Palm Beach County was a hot spot in Florida at the time; and therefore, was more restricted in terms of opening businesses. The venues listed reflect this situation as grocery stores, restaurants with takeout, banks, and parks and beaches predominate.

	Neighborhoods	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	Belle Glade	Fast Food Restaurant	Pharmacy	Fried Chicken Joint	Southern / Soul Food Restaurant	Gas Station	Bank	Park	Theater	Donut Shop	Grocery Store
1	Boca Raton	Grocery Store	Bar	Sushi Restaurant	Pizza Place	Coffee Shop	Hotel	Bakery	Italian Restaurant	Mexican Restaurant	Asian Restaurant
2	Boyton Beach	Beach	American Restaurant	Bakery	Seafood Restaurant	Sushi Restaurant	Department Store	Mexican Restaurant	Italian Restaurant	Latin American Restaurant	Burger Joint
3	Briny Breezes	Beach	American Restaurant	Fast Food Restaurant	Seafood Restaurant	Diner	Pizza Place	Deli / Bodega	Donut Shop	Bank	Park
4	Cloud Lake	Rental Car Location	American Restaurant	Diner	Donut Shop	Convenience Store	Hotel	Italian Restaurant	Fast Food Restaurant	Grocery Store	Café
5	Delray Beach	Beach	Italian Restaurant	Grocery Store	Pizza Place	Hotel	American Restaurant	Seafood Restaurant	Coffee Shop	Burger Joint	New American Restaurant
6	Glen Ridge	Rental Car Location	American Restaurant	Donut Shop	Hotel	Diner	Convenience Store	Café	Pharmacy	Fast Food Restaurant	Sandwich Place
7	Golf	American Restaurant	Fast Food Restaurant	Pizza Place	Golf Course	Pharmacy	Donut Shop	Bakery	Grocery Store	Sandwich Place	Department Store
8	Greenacres	Pizza Place	Pharmacy	Discount Store	Convenience Store	Latin American Restaurant	Bank	American Restaurant	Donut Shop	Sandwich Place	Ice Cream Shop
9	Gulf Stream	Beach	Seafood Restaurant	Hotel	American Restaurant	Pizza Place	Diner	Italian Restaurant	Spa	New American Restaurant	Coffee Shop
10	Haverhill	Sandwich Place	Pizza Place	Latin American Restaurant	Grocery Store	Pharmacy	American Restaurant	Park	Mobile Phone Shop	Hardware Store	Fast Food Restaurant
11	Highland Beach	Gym / Fitness Center	Hotel	Grocery Store	Italian Restaurant	Pizza Place	Pharmacy	Shipping Store	Brewery	Park	Pub
12	Hypoluxo	Harbor / Marina	Beach	Donut Shop	Sushi Restaurant	Brewery	Grocery Store	American Restaurant	Pizza Place	Seafood Restaurant	Breakfast Spot
13	Juno Beach	Beach	Seafood Restaurant	Park	Thai Restaurant	Café	Harbor / Marina	Board Shop	Pharmacy	American Restaurant	Resort
14	Jupiter	Sandwich Place	Pizza Place	Italian Restaurant	Breakfast Spot	Donut Shop	Fast Food Restaurant	Grocery Store	Ice Cream Shop	Mexican Restaurant	Convenience Store
15	Jupiter Inlet Colony	Beach	Seafood Restaurant	Coffee Shop	Convenience Store	Italian Restaurant	Grocery Store	Ice Cream Shop	Thai Restaurant	Bank	Fast Food Restaurant
16	Lake Clarke Shores	Pizza Place	Discount Store	Bank	Pharmacy	American Restaurant	Donut Shop	Convenience Store	Bar	Cuban Restaurant	Fast Food Restaurant
17	Lake Park	American Restaurant	Harbor / Marina	Park	Pizza Place	Beach	Coffee Shop	Seafood Restaurant	Grocery Store	Convenience Store	Sandwich Place

18	Lake Worth	Grocery Store	American Restaurant	Pizza Place	Seafood Restaurant	Coffee Shop	Convenience Store	Golf Course	Bank	Donut Shop	Hotel
19	Lantana	Pizza Place	Discount Store	Seafood Restaurant	Harbor / Marina	Grocery Store	Fast Food Restaurant	American Restaurant	Hotel	Gas Station	Pharmacy
20	Loxahatchee Groves	Grocery Store	Bank	Fast Food Restaurant	Pizza Place	Pharmacy	Sandwich Place	Construction & Landscaping	Gas Station	Convenience Store	Donut Shop
21	Manalapan	Pizza Place	Harbor / Marina	Gas Station	Hotel	Grocery Store	American Restaurant	Fast Food Restaurant	Brewery	Discount Store	Beach
22	Mangonia Park	Fast Food Restaurant	Hotel	Sandwich Place	Convenience Store	Pharmacy	Fried Chicken Joint	Harbor / Marina	Bank	Discount Store	American Restaurant
23	North Palm Beach	American Restaurant	Pizza Place	Seafood Restaurant	Sandwich Place	Grocery Store	Italian Restaurant	Breakfast Spot	Pharmacy	Spa	Café
24	Ocean Ridge	Beach	Fast Food Restaurant	American Restaurant	Bank	Seafood Restaurant	Harbor / Marina	Pizza Place	Convenience Store	Donut Shop	Park
25	Pahokee	Home Service	Convenience Store	Park	Bank	Lake	Grocery Store	American Restaurant	Discount Store	Diner	French Restaurant
26	Palm Beach	Business Service	Zoo	Fast Food Restaurant	Fruit & Vegetable Store	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Truck	Food Service	Food & Drink Shop
27	Palm Beach Gardens	Golf Course	Steakhouse	Mexican Restaurant	Health Food Store	Restaurant	Japanese Restaurant	Coffee Shop	Grocery Store	Seafood Restaurant	Pharmacy
28	Palm Beach Shores	Seafood Restaurant	Beach	Grocery Store	Pool	Café	Park	Harbor / Marina	American Restaurant	Donut Shop	Resort
29	Palm Springs	Convenience Store	Bank	Sandwich Place	Donut Shop	Discount Store	Pizza Place	Pharmacy	Grocery Store	American Restaurant	Latin American Restaurant
30	Riviera Beach	Grocery Store	American Restaurant	Convenience Store	Fast Food Restaurant	Seafood Restaurant	Fried Chicken Joint	Discount Store	Pharmacy	Donut Shop	Pizza Place
31	Royal Palm Beach	Bank	Department Store	Pizza Place	Coffee Shop	Golf Course	American Restaurant	Grocery Store	Fast Food Restaurant	Pharmacy	Ice Cream Shop
32	South Bay	Park	Business Service	Theater	Mexican Restaurant	Trail	Snack Place	Harbor / Marina	Lake	Gas Station	Sandwich Place
33	South Palm Beach	Hotel	Pizza Place	American Restaurant	Discount Store	Grocery Store	Seafood Restaurant	Gas Station	Sandwich Place	Restaurant	Pharmacy
34	Tequesta	Golf Course	Campground	River	Baseball Field	Trail	Home Service	Science Museum	Church	Park	Dive Bar
35	Wellington	Stadium	Grocery Store	Bank	Pizza Place	Restaurant	Gas Station	Shipping Store	Golf Course	Asian Restaurant	Sandwich Place
36	West Palm Beach	Italian Restaurant	French Restaurant	American Restaurant	Bar	Restaurant	Asian Restaurant	Gastropub	Ice Cream Shop	Steakhouse	Mediterranean Restaurant
37	Westgate	American Restaurant	Sandwich Place	Discount Store	Pizza Place	Mexican Restaurant	Grocery Store	Convenience Store	Coffee Shop	Shopping Mall	Latin American Restaurant

Figure 5. pandas DataFrame of top ten venues retrieve from FOURSQUARE API for municipalities

K Nearest Neighbor

I chose sklearn.cluster.KMeans in the scikit-learn library to perform a K Nearest Neighbor unsupervised algorithm to cluster neighborhoods based upon their shared top venue types. First, I found the best k by executing KMeans from 2 to 10 values for k, calculated the squared error and graphed the result. The best value for k is 3 as indicated by the first 'elbow' on the graph.
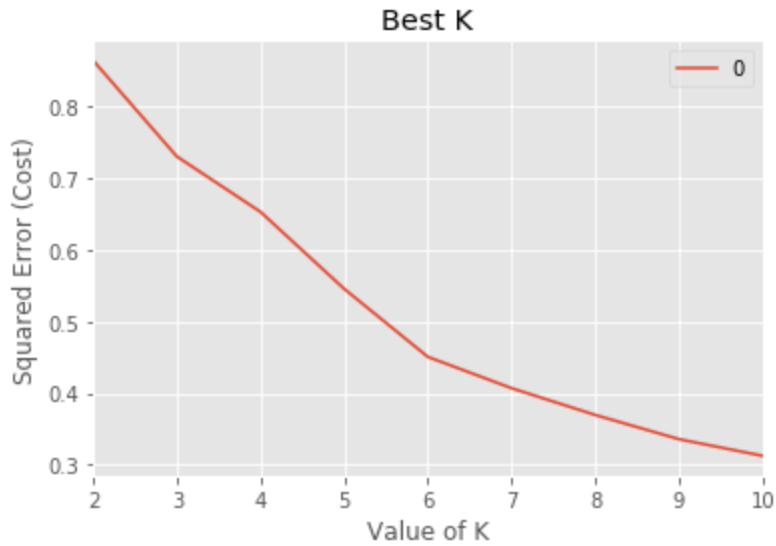
Figure 6. Graph indicating best K as 3

I then ran KMeans again with k set to 3 to produce Cluster Labels for each neighborhood. The resulting three clusters can be characterized by their main venues. The clusters are visualized with the following Folium map.
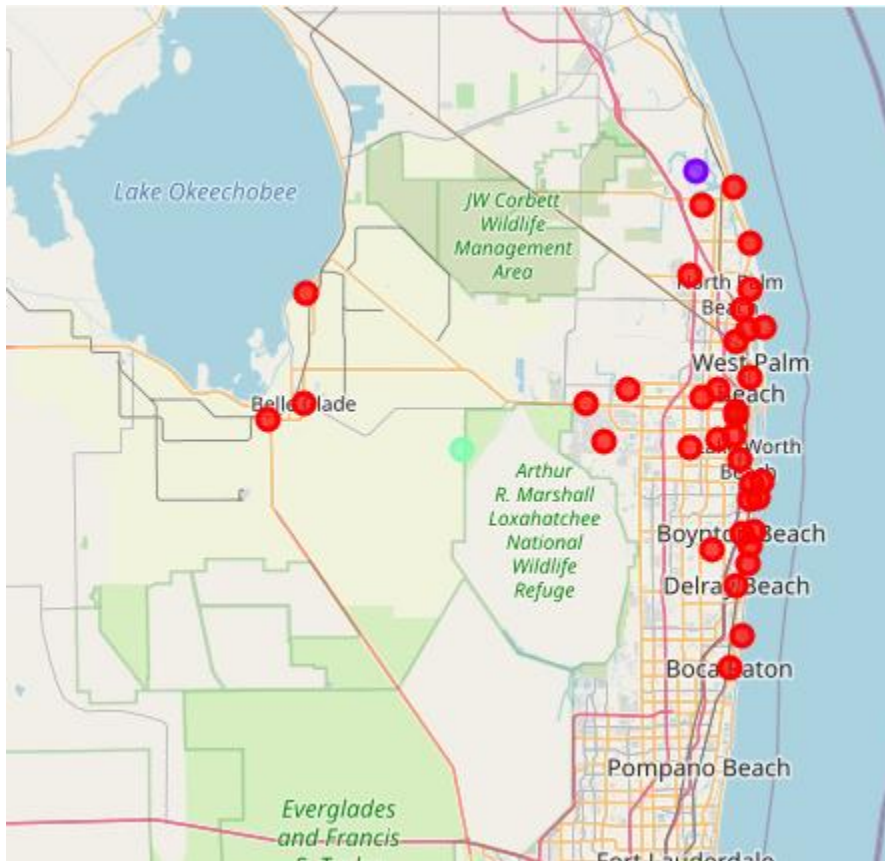

Figure 7. Cluster Map: Cluster 0 in red, Cluster 1 in purple, Cluster 3 in green

By examining the top ten venues in each cluster, I defined them as follows:

CLUSTER 0 - Residential - with a variety of restaurants and other eateries

	Neighborhood	Pop_Density	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
1	Belle Glade	3079.62	0.0	Fast Food Restaurant	Pharmacy	Fried Chicken Joint	Southern / Soul Food Restaurant	Gas Station	Bank	Park	Theater	Donut Shop
2	Boca Raton	2807.81	0.0	Grocery Store	Bar	Sushi Restaurant	Pizza Place	Coffee Shop	Hotel	Bakery	Italian Restaurant	Mexican Restaurant
3	Boyton Beach	4247.63	0.0	Beach	American Restaurant	Bakery	Seafood Restaurant	Sushi Restaurant	Department Store	Mexican Restaurant	Italian Restaurant	Latin American Restaurant
4	Briny Breezes	6324.32	0.0	Beach	American Restaurant	Fast Food Restaurant	Seafood Restaurant	Diner	Pizza Place	Deli / Bodega	Donut Shop	Bank
5	Cloud Lake	1833.33	0.0	Rental Car Location	American Restaurant	Diner	Donut Shop	Convenience Store	Hotel	Italian Restaurant	Fast Food Restaurant	Grocery Store
6	Delray Beach	3787.64	0.0	Beach	Italian Restaurant	Grocery Store	Pizza Place	Hotel	American Restaurant	Seafood Restaurant	Coffee Shop	Burger Joint
7	Glen Ridge	888.37	0.0	Rental Car Location	American Restaurant	Donut Shop	Hotel	Diner	Convenience Store	Café	Pharmacy	Fast Food Restaurant
8	Golf	345.60	0.0	American Restaurant	Fast Food Restaurant	Pizza Place	Golf Course	Pharmacy	Donut Shop	Bakery	Grocery Store	Sandwich Place
9	Greenacres	6485.85	0.0	Pizza Place	Pharmacy	Discount Store	Convenience Store	Latin American Restaurant	Bank	American Restaurant	Donut Shop	Sandwich Place
10	Gulf Stream	1061.81	0.0	Beach	Seafood Restaurant	Hotel	American Restaurant	Pizza Place	Diner	Italian Restaurant	Spa	New American Restaurant
11	Haverhill	2966.98	0.0	Sandwich Place	Pizza Place	Latin American Restaurant	Grocery Store	Pharmacy	American Restaurant	Park	Mobile Phone Shop	Hardware Store
12	Highland Beach	2809.41	0.0	Gym / Fitness Center	Hotel	Grocery Store	Italian Restaurant	Pizza Place	Pharmacy	Shipping Store	Brewery	Park
13	Hypoluxo	3183.49	0.0	Harbor / Marina	Beach	Donut Shop	Sushi Restaurant	Brewery	Grocery Store	American Restaurant	Pizza Place	Seafood Restaurant
14	Juno Beach	1194.57	0.0	Beach	Seafood Restaurant	Park	Thai Restaurant	Café	Harbor / Marina	Board Shop	Pharmacy	American Restaurant
15	Jupiter	2420.83	0.0	Sandwich Place	Pizza Place	Italian Restaurant	Breakfast Spot	Donut Shop	Fast Food Restaurant	Grocery Store	Ice Cream Shop	Mexican Restaurant
16	Jupiter Inlet Colony	1537.38	0.0	Beach	Seafood Restaurant	Coffee Shop	Convenience Store	Italian Restaurant	Grocery Store	Ice Cream Shop	Thai Restaurant	Bank
17	Lake Clarke Shores	3328.78	0.0	Pizza Place	Discount Store	Bank	Pharmacy	American Restaurant	Donut Shop	Convenience Store	Bar	Cuban Restaurant
18	Lake Park	3491.06	0.0	American Restaurant	Harbor / Marina	Park	Pizza Place	Beach	Coffee Shop	Seafood Restaurant	Grocery Store	Convenience Store
19	Lake Worth	5302.31	0.0	Grocery Store	American Restaurant	Pizza Place	Seafood Restaurant	Coffee Shop	Convenience Store	Golf Course	Bank	Donut Shop
20	Lantana	3621.70	0.0	Pizza Place	Discount Store	Seafood Restaurant	Harbor / Marina	Grocery Store	Fast Food Restaurant	American Restaurant	Hotel	Gas Station
21	Loxahatchee Groves	257.03	0.0	Grocery Store	Bank	Fast Food Restaurant	Pizza Place	Pharmacy	Sandwich Place	Construction & Landscaping	Gas Station	Convenience Store
22	Manalapan	30.14	0.0	Pizza Place	Harbor / Marina	Gas Station	Hotel	Grocery Store	American Restaurant	Fast Food Restaurant	Brewery	Discount Store
23	Mangonia Park	2248.99	0.0	Fast Food Restaurant	Hotel	Sandwich Place	Convenience Store	Pharmacy	Fried Chicken Joint	Harbor / Marina	Bank	Discount Store
24	North Palm Beach	2090.06	0.0	American Restaurant	Pizza Place	Seafood Restaurant	Sandwich Place	Grocery Store	Italian Restaurant	Breakfast Spot	Pharmacy	Spa
25	Ocean Ridge	977.56	0.0	Beach	Fast Food Restaurant	American Restaurant	Bank	Seafood Restaurant	Harbor / Marina	Pizza Place	Convenience Store	Donut Shop

	Neighborhood	Pop_Density	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
26	Pahokee	1052.85	0.0	Home Service	Convenience Store	Park	Bank	Lake	Grocery Store	American Restaurant	Discount Store	Diner
28	Palm Beach Gardens	889.08	0.0	Golf Course	Steakhouse	Mexican Restaurant	Health Food Store	Restaurant	Japanese Restaurant	Coffee Shop	Grocery Store	Seafood Restaurant
29	Palm Beach Shores	1737.67	0.0	Seafood Restaurant	Beach	Grocery Store	Pool	Café	Park	Harbor / Marina	American Restaurant	Donut Shop
30	Palm Springs	6016.14	0.0	Convenience Store	Bank	Sandwich Place	Donut Shop	Discount Store	Pizza Place	Pharmacy	Grocery Store	American Restaurant
31	Riviera Beach	3203.70	0.0	Grocery Store	American Restaurant	Convenience Store	Fast Food Restaurant	Seafood Restaurant	Fried Chicken Joint	Discount Store	Pharmacy	Donut Shop
32	Royal Palm Beach	3053.39	0.0	Bank	Department Store	Pizza Place	Coffee Shop	Golf Course	American Restaurant	Grocery Store	Fast Food Restaurant	Pharmacy
33	South Bay	1311.45	0.0	Park	Business Service	Theater	Mexican Restaurant	Trail	Snack Place	Harbor / Marina	Lake	Gas Station
34	South Palm Beach	3663.19	0.0	Hotel	Pizza Place	American Restaurant	Discount Store	Grocery Store	Seafood Restaurant	Gas Station	Sandwich Place	Restaurant
36	Wellington	1280.07	0.0	Stadium	Grocery Store	Bank	Pizza Place	Restaurant	Gas Station	Shipping Store	Golf Course	Asian Restaurant
37	West Palm Beach	1755.88	0.0	Italian Restaurant	French Restaurant	American Restaurant	Bar	Restaurant	Asian Restaurant	Gastropub	Ice Cream Shop	Steakhouse
38	Westgate	5231.83	0.0	American Restaurant	Sandwich Place	Discount Store	Pizza Place	Mexican Restaurant	Grocery Store	Convenience Store	Coffee Shop	Shopping Mall

Figure 8. Top nine venues for Cluster 0

CLUSTER 1 - Outdoor leisure activities - golfing, camping, boating - and parks

	Neighborhood	Pop_Density	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
35	Tequesta	2518.66	1.0	Golf Course	Campground	River	Baseball Field	Trail	Home Service	Science Museum	Church	Park	Dive Bar

Figure 9. Top ten venues for Cluster 1

CLUSTER 2 - Food and Business

	Neighborhood	Pop_Density	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
27	Palm Beach	766.02	2.0	Business Service	Zoo	Fast Food Restaurant	Fruit & Vegetable Store	Frozen Yogurt Shop	Fried Chicken Joint	French Restaurant	Food Truck	Food Service	Food & Drink Shop

Figure 10. Top 10 venues for Cluster 2

Results

KMeans
The best value for K is 3 according to the calculation of cost or squared error when plotted.

Cluster 0 includes 36 neighborhoods which includes all neighborhoods except for the two that are in Clusters 1 and 2. I characterized this cluster as residential. It is made up of a wide variety of restaurants and other eateries as well as grocery stores, banks and beaches.

Cluster 1 includes only the municipality of Tequesta. I called this cluster outdoor leisure activities

because the most common venues are golfing, camping, boating, and baseball. Also included are science museum, church, and parks.

Cluster 2 includes only the municipality of Palm Beach. I characterized this cluster as business and food. The top venues are business services, zoo, and eateries.

Venues were not retrieved for the municipality of Atlantis; and therefore, was not included in a cluster.

Histograms and Bar Charts
I created histograms and bar charts with matplotlib.pyplot to visualize median income, median property values, and population density in Palm Beach County.

Median Income

The histogram of Median Income shows three groups.

Groups	Median Income	Neighborhoods
1 - Lowest	$27,000 to $81,000	Remaining 32 Neighborhoods
2 – Medium	$83,000	Wellington
	$100,000	Highland Beach
	$115,000	Palm Beah
3 – High	$163,000	Jupiter Inlet Colony
	$183,000	Gulf Stream
	$189,000	Golf
	$209,000	Manalapan

Median Property Values

The histogram of Median Property Values shows four groups.

Groups	Median Property Values	Neighborhoods
1 - Lowest	$77,000 to $370,000	Remaining 28 Neighborhoods
2 - Medium	$418,000 to $687,000	Boca Raton
		Palm Beach Shores
		Highland Beach
		Ocean Ridge
3 – Medium-High	$956,000 to $1.1 million	Palm Beach
		Golf
		Jupiter Inlet
4 - High	over $1.6 million	Gulf Stream
		Manalapan

Population Density

The histogram of Population Density shows three groups.

Group	Neighborhoods
Group 1 – Low	Manalapan
	Loxahatchee Groves
	Golf
Group 2 – Medium	Remaining Neighborhoods
Group 3 – High	Westgate
	Lake Worth
	Palm Springs
	Briny Breezes
	Greenacres

Area

The histogram of Area shows there are four major neighborhoods in terms of square mile area.

Groups	Area (sq mil)	Neighborhoods
1 – Very Small	Under 7	Remaining 27 Neighborhoods
2 – Small	10 to about 17	Riviera Beach
		Manalapan
		Palm Beach
		Royal Palm Beach
		Loxahatchee Groves
		Delray Beach
		Boynton Beach
		Jupiter
3 – Medium	31	Boca Raton
4 – Medium-High	45	Wellington
5 – Large	55 – 58	Palm Beach Gardens
		West Palm Beach

Discussion

Palm Beach County is diverse in terms of income levels, and property values. Palm Beach County median income ranges from below the national average of $57,617 to well above it. Similarly, Palm Beach County median property values ranges from below the national average of $205,000 to well above it. As a result, Palm Beach County offers home affordability for all income levels.

Most municipalities are relatively small in terms of area in square miles. And, most of Palm Beach County has a higher population density than the national average of 92.9 residents per square mile of land area.

According to K Means, Palm Beach County can be segregated into three main clusters. Two of these clusters have only one municipality (Tequesta, and Palm Beach), and the third cluster has the rest of the municipalities.

Tequesta (Cluster 0) is the northernmost municipality in Palm Beach County, situated between the Atlantic Ocean and the Loxahatchee River, with an active recreational department, lots of golf

courses, and many campgrounds.

Palm Beach (Cluster 1) is an island centrally located in Palm Beach County with the Atlantic Ocean to the east and the Intracoastal Waterway to the west. It is just across the waterway to West Palm Beach; and as such, the venues cited are more related to West Palm Beach than Palm Beach. For example, zoo is the second most common venue, but there is not a zoo on Palm Beach; rather, it is in West Palm Beach. In addition, fast food restaurants, the third most common venue are also not found on Palm Beach. Palm Beach is mostly residential and home to the wealthy and upscale dining and shopping. Notable examples are Mar-a-Lago and Worth Avenue.

The third cluster (Cluster 2) groups municipalities that are inland with those that are on the coast. Inland municipalities are mainly residential whereas coastline municipalities, while also residential, contribute to Florida's tourism economy with their beaches and hotels. The most popular venues in this cluster are restaurants, grocery stores, and banks.

The clustering is skewed by COVID-19. Although Florida was one of the first states to open from the lockdown, people mainly patronize grocery stores, and banks as well as restaurants and other eateries, and the beach. The tourist industry in Florida has greatly suffered as people are not traveling in general, and specifically to Florida. Once the economy has recovered, the K Means clustering should be more representative of Palm Beach County municipalities.

Conclusion

This project is meant to give active seniors who plan to relocate an overview of Palm Beach County, Florida information that will help them determine which areas they should explore. The data shows that Palm Beach County allows affordability to a wide range of incomes and desired property values. According to K Means, the county is fairly homogeneous in terms of the most common venues which center around grocery stores, restaurants, banks, and beaches. Because of COVID-19, I believe the data is skewed. Although the state has opened, people are not yet shopping, and taking part in activities as they were before the onset of the pandemic. Also, the tourist industry has suffered greatly since people are not traveling. Once life gets back to normal, the clustering data will be more helpful.

References

Coursera, IBM Professional Data Science Certificate, Course 9, Applied Data Science Capstone, https://www.coursera.org/learn/applied-data-science-capstone/home/welcome

FOURSQUARE API https://api.foursquare.com/v2/venues/explore

Homefacts website https://www.homefacts.com/demographics/Florida/Palm-Beach-County.html
The data for each municipality was retrieved by following the links for each municipality where *Palm-Beach-County* was replaced with municipality name. For example, to obtain data for the municipality *Atlantis*, the URL becomes https://www.homefacts.com/demographics/Florida/Palm-Beach-County/Atlantis.html

Palm Beach County logo, http://discover.pbcgov.org/Pages/default.aspx

Palm Beach County photo, Wikipedia, https://en.wikipedia.org/wiki/West_Palm_Beach,_Florida