Find the Best Location for a new Coffee Shop in Mount Pleasant, SC

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1. Introduction

1.1 Background

Several coffee shop options exist for residents of Mount Pleasant, SC including well known coffee franchise shops to single-store coffee shops. Coffee consumers in Mount Pleasant include those looking for a quick cup of coffee "on the go" to those who want a location to conduct business (w/wifi) while enjoying a good cup of coffee. Since so many coffee consumers exist in Mount Pleasant, this project involves identification of potential new locations that current or new coffee shop owners might consider for attracting more coffee consumers.

1.2 Business Problem

Finding the best location for new coffee shop in Mount Pleasant, the fourth largest city in SC (by population of approximately 95,000 people) is based on several factors. Mount Pleasant has over 175 neighborhoods within the vicinity of essentially two major thoroughfares, Highway 17 and Coleman Boulevard. Both the neighborhoods of Mount Pleasant and access are different regarding factors that can directly or indirectly affect business success. For example, many businesses along Highway 17 are only accessible from offroads that parallell Highway 17 in both directions. For Coleman Boulevard, businesses along this stretch may have parking limitations. To make an informed decision for the best location(s) for a new coffee shop, it is essential to evaluate the neighborhoods, accessibiity, demand, and the current competitors. Lease costs also need to be considered, especially for small businesses.

1.3 Interest

For this project, the goal is to help a client find the best location(s) in Mount Pleasant to open a new coffee shop. Servicing coffee consumers, whether "on the go" or dining in near their neighborhoods or that have ease of accessibility, have fewer competitors, and is affordable will improve the client's chances for success. A coffee shop that can serve customers during the morning rush hour or those who need an offsite place to work will have better chances to succeed. Also, locating in areas with fewer competitors will reduce risks and improve sales in order for the client to start and grow the business.

2. Data Acquisition and Cleaning

2.1 Data Description

Several data sources and tools will be needed to conduct the analysis of best location(s) for a new coffee shop in Mount Pleasant, SC. These include:

- BeautifulSoup will be used with a Charleston real estate website to extract the neighborhoods: https://www.buyingcharlestonrealestate.com/mount-pleasant-neighborhoods.php

- Geopy will be used to determine the coordinates of the neighborhoods.

- Foursquare will be used to identify and quantify existing coffeeshops in proximity to the neighborhoods; these results will be used later to prioritize which neighborhoods are least to best served (least served will influence potential locations).

- Folium will be used to publish maps of the neighborhood and coffee shops in addition to analysis results (i.e., k-means centroids of these features).

2.1 List of Mount Pleasant Neighborhoods

Beautifulsoup was used to get a list of neighborhoods from a regional real estate website (i.e., “buyingcharlestonrealestate.com") that lists Mount Pleasant neighborhoods using HTML list tags (i.e., "li" tag). We need to know where neighborhoods are so we can compare these locations to existing coffee shop locations. We will also perform a k-means cluster analysis on the neighborhoods to see where the density of neighborhoods (and future customers) might be concentrated. This will inform us where the areas in Mount Pleasant are that might be underserved with respect to coffee shop options.

Beautifulsoup extracted 78 neighborhood names from the website using the HTML tag <li> as a search item. Since this produced every list item from the page, a subset of just the neighborhood list items was extracted and stored in a Python data frame for later analysis. Also, as discovered later when using Geopy, we needed to append the neighborhood name string and add “Mount Pleasant, SC” to the neighborhood name in

order for Geopy to know in which state and city to search for the neighborhood. Table 1 shows and excerpt of the completed extraction and full naming of Mount Pleasant, SC neighborhoods.

Table 1 - List of Mount Pleasant, SC neighborhoods extracted from regional real estate website with Beautifulsoup (the first five of 77 are shown).

	neighborhoods
0	Alston Point, Mount Pleasant, SC
1	Back Bay Village, Mount Pleasant, SC
2	Bayview Acres, Mount Pleasant, SC
3	Belle Hall, Mount Pleasant, SC
4	Bentley Park, Mount Pleasant, SC

2.2 GPS Coordinates of Mount Pleasant Neighborhoods

Geopy was used to get the coordinates of the list of neighborhoods previously developed from a regional real estate website that lists Mount Plesant neighborhoods. The coordinates of neighborhoods was used later within the k-means cluster analysis to identify the relative density or clustering of neighborhoods about existing coffee shops.

Results of applying Geopy are shown in Table 2. As shown, three outputs were observed including: 1) correct coordinates, 2) no coordinates, and 3) erroneous coordinates. The “None” coordinates situation most likely occurred because these were newer neighborhoods not yet reflected in Geopy’s database. The erroneous coordinates are most likely attributed to either limited quality control of Geopy’s database or an algorithm that generates the coordinates upon a Geopy query. For outputs 2 and 3, some additional effort was required to clean up the data in order to have a complete and accurate list of neighborhoods and corresponding coordinates. This cleanup is described in the next section of this report (i.e., Section 2.3 Data Cleanup).

Table 2 - List of Mount Pleasant, SC neighborhoods and corresponding GPS coordinates extracted from Geopy (the first five of 77 are shown).

	neighborhoods	latitude	longitude
0	Alston Point, Mount Pleasant, SC	None	None
1	Back Bay Village, Mount Pleasant, SC	51.0065	-2.28742
2	Bayview Acres, Mount Pleasant, SC	32.7954	-79.8909
3	Belle Hall, Mount Pleasant, SC	None	None
4	Bentley Park, Mount Pleasant, SC	None	None

2.3 Data Cleanup

Geopy did a great job of providing many GPS neighborhood coordinates (approximately 50% of the coordinates were correctly determined). However, as common with data ETL, some cleanup was required as previously noted. The cleanup steps involved exporting the Geopy dataframe outputs to a CSV file, then cleaning this file up. Cleanup involved checking, fixing erroneous coordinates, and filling in blank coordinates. Blank coordinates were determined from a variety of manual checks using various searches of neighborhood names and mapping websites.

No single website GPS tool seemed to provide a complete source for all coordinate searches. So, in some instances, a manual search of neighborhood names in Google provided general websites that described the neighborhoods and roads within these neighborhoods. The neighborhood road names were then used in the Apple Maps application to determine the coordinates.

Table 3 - List of Mount Pleasant, SC neighborhoods extracted from regional real estate website with Geopy and then manually cleaned (the first five of 77 are shown).

	Unnamed: 0	neighborhoods	latitude	longitude
0	0	Alston Point, Mount Pleasant, SC	32.845053	-79.854121
1	1	Back Bay Village, Mount Pleasant, SC	32.829698	-79.806596
2	2	Bayview Acres, Mount Pleasant, SC	32.795410	-79.890948
3	3	Belle Hall, Mount Pleasant, SC	32.843173	-79.859902
4	4	Bentley Park, Mount Pleasant, SC	32.833038	-79.805575

2.4 Mount Pleasant Coffee Shop

The next piece of information we needed was to know where the current coffee shops are in Mount Pleasant, SC. This informaiton is used later to determine the relative proximity or distance and density of coffee shops to neighborhoods in Mount Pleasant, which will inform where new locations might be targeted. Foursquare was used to determine where the coffee shops are located.

Foursquare did a perfect job extracting coffee shops in Mount Pleasant with complete (and accurate) GPS coordinates. Consequently, no data cleaning was required for this data set. The location of coffee shops is used later in a k-means analysis to determine the relative proximity and density of current coffee shops in the city.

Table 4 - List of Mount Pleasant, SC coffee shops extracted from regional real estate website with Geopy and then manually cleaned (the first five of 18 are shown).

	name	categories	address	lat	lng
0	Metto Coffee & Tea	Coffee Shop	354 W Coleman Blvd	32.80	-79.89
1	Coffee & Cars (new location)	Racetrack	NaN	32.79	-79.87
2	Cooper River Coffee Roasters	Coffee Shop	1303 Ben Sawyer Blvd Ste 5	32.79	-79.86
3	cars and coffee	Other Great Outdoors	NaN	32.79	-79.87
4	Brownfox Coffee Co	Food Truck	NaN	32.79	-79.87

2.5 Mount Pleasant Neighborhoods and Coffee Shops (Map)

Now that we have the neighborhoods and coffee shops of Mount Pleasant, complete with accurate GPS coordinates, Folium was used to plot these features on a map (see Figure 1). Based on the results, the features appear to be located correctly geosnatially.

Also of interest is, by visual inspection, one can see the relative location of coffee shops to neighborhoods in Mount Pleasant, SC. Several “take aways” include:

- The majority of coffee shops are located in the southern area of Mount Pleasant.
- No coffee shops are location above the intersection of the IOP connector.
- Highway 17 and Coleman Boulevard appear to provide the most access to coffee shops.

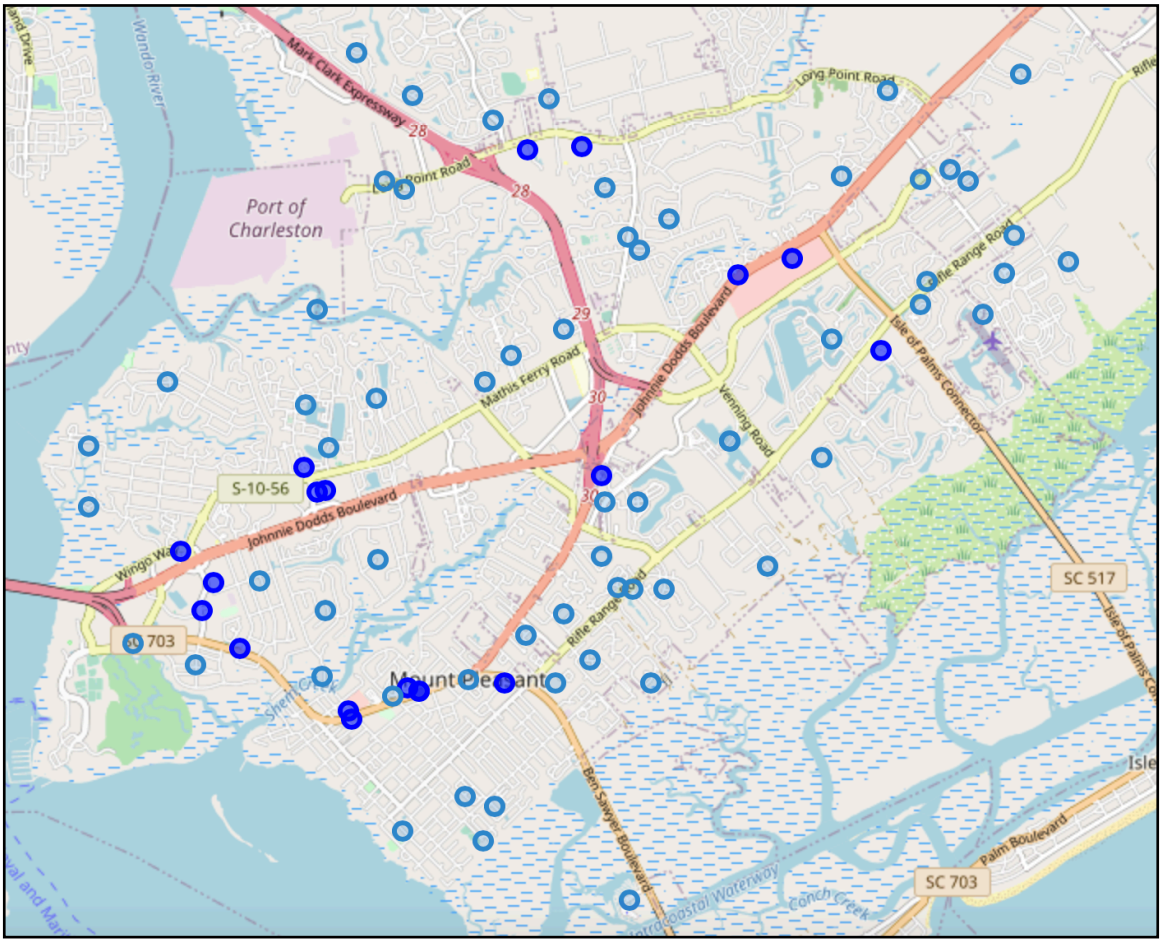

Figure 1 - Map of Mount Pleasant neighborhoods and coffee shops (using Folium); light blue circles represent neighborhoods and the dark blue circles represent coffee shops.

3.0 Analysis

3.1 Mount Pleasant Neighborhood Clustering

Now that we have the neighborhoods and coffee shops of Mount Pleasant, complete with accurate GPS coordinates, we conducted an analysis of the relative proximity or density of these features with respect to one another. To accomplish this, we applied a k-means clustering analysis. Due to the shape of Mount Pleasant, we estimated two centroids were sufficient. This section describes the clustering analysis on neighborhoods.

Four iterations were used to converge the neighborhood clusters. Based on the results of the k-means clustering as shown in Figure 2. Using the coordinates of the clusters, when mapped with Folium (see Figure 3), essentially two regions of Mount Pleasant neighborhoods prevail, those neighborhoods south of the junction of I-526 and Highway 17, and those to the north. This information will be used later in conjunction with a k-means analysis on coffee shops.

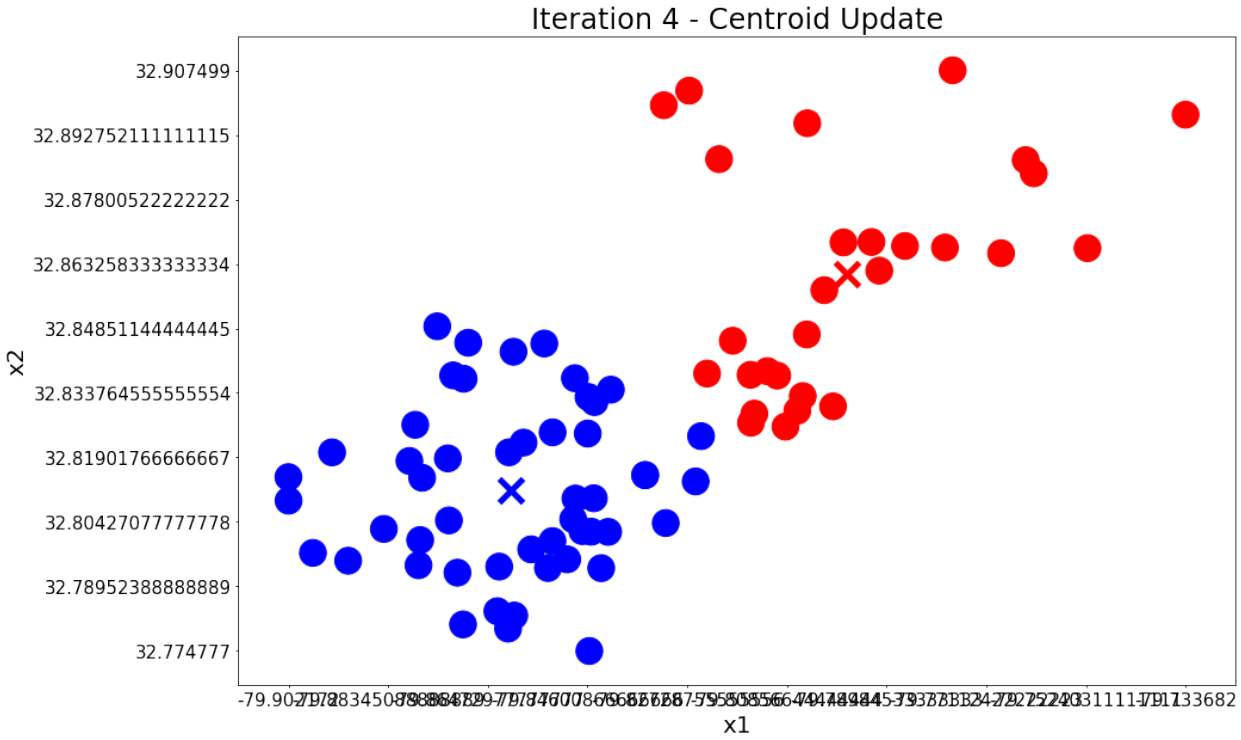

Figure 2 - Plot of Map of Mount Pleasant neighborhoods and the relative centroid of southern neighborhoods and northern neighborhood clusters; drawing is not to geospatial scale and the blue and red x's denote the centroids.

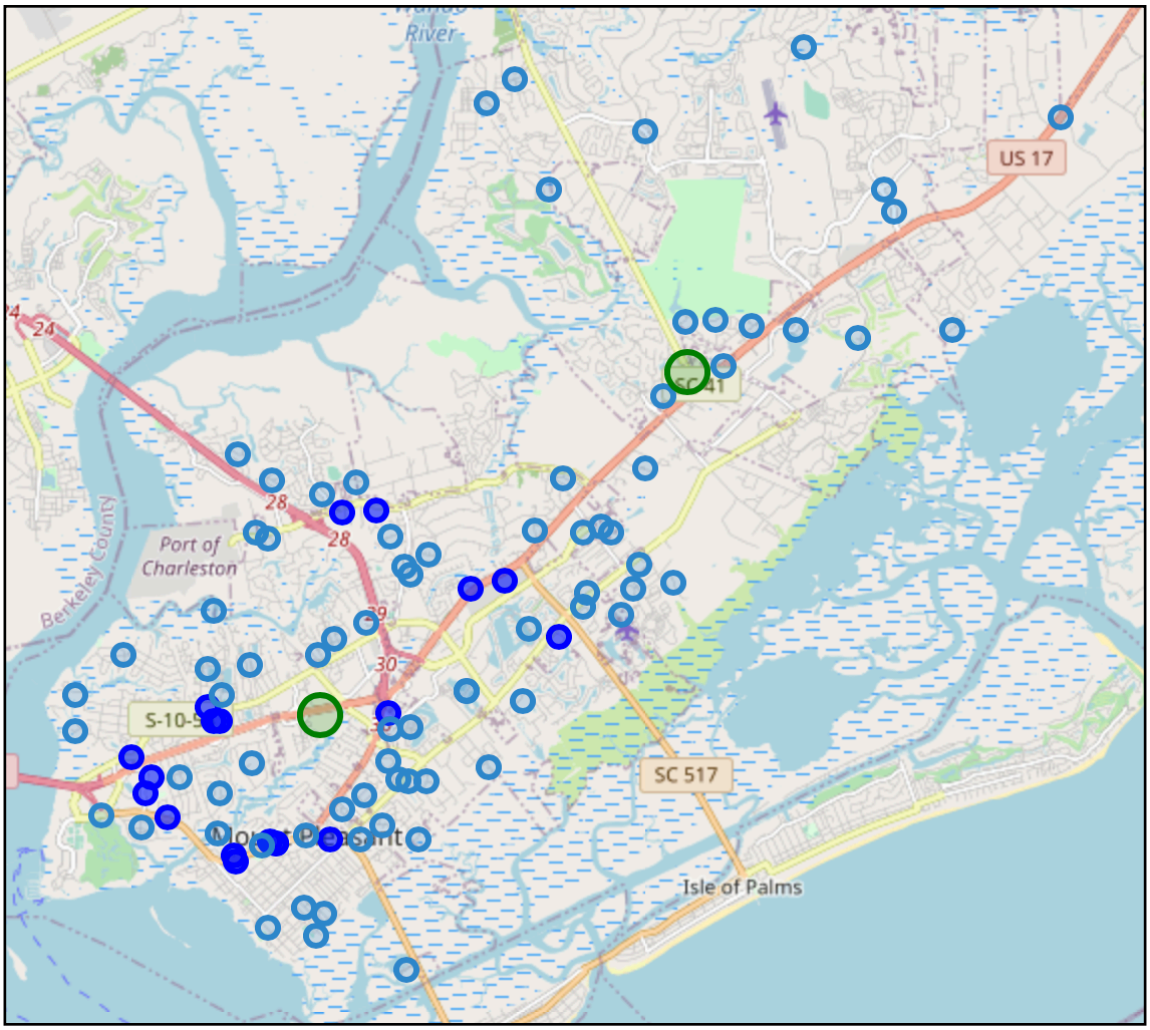

Figure 3 - Map of Mount Pleasant neighborhoods and coffee shops and neighborhood centroids (using Folium); light blue circles represent neighborhoods dark blue circles represent coffee shops, and the larger green circles represent the centroids of the neighborhoods

3.2 Mount Pleasant Coffee Shop Clustering

As noted in Section 3.1, now that we have the neighborhoods and coffee shops of Mount Pleasant, complete with accurate GPS coordinates, we conducted an analysis of the relative proximity or density of these features with respect to one another. To accomplish this, we applied a k-means clustering analysis. Due to the shape of Mount Pleasant, we estimated two centroids were sufficient. This section describes the clustering analysis on neighborhoods.

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coffee shops prevail, those coffee shops located in the southern portion of Mount Pleasant between Highway 17 and Coleman Boulevard and those located in the vicinity north of the junction of I-526 and Highway 17, and those to the north. The centroids reflect the relative density of coffee shops and indicate scarcity of coffee shops in the upper northern neighborhoods.

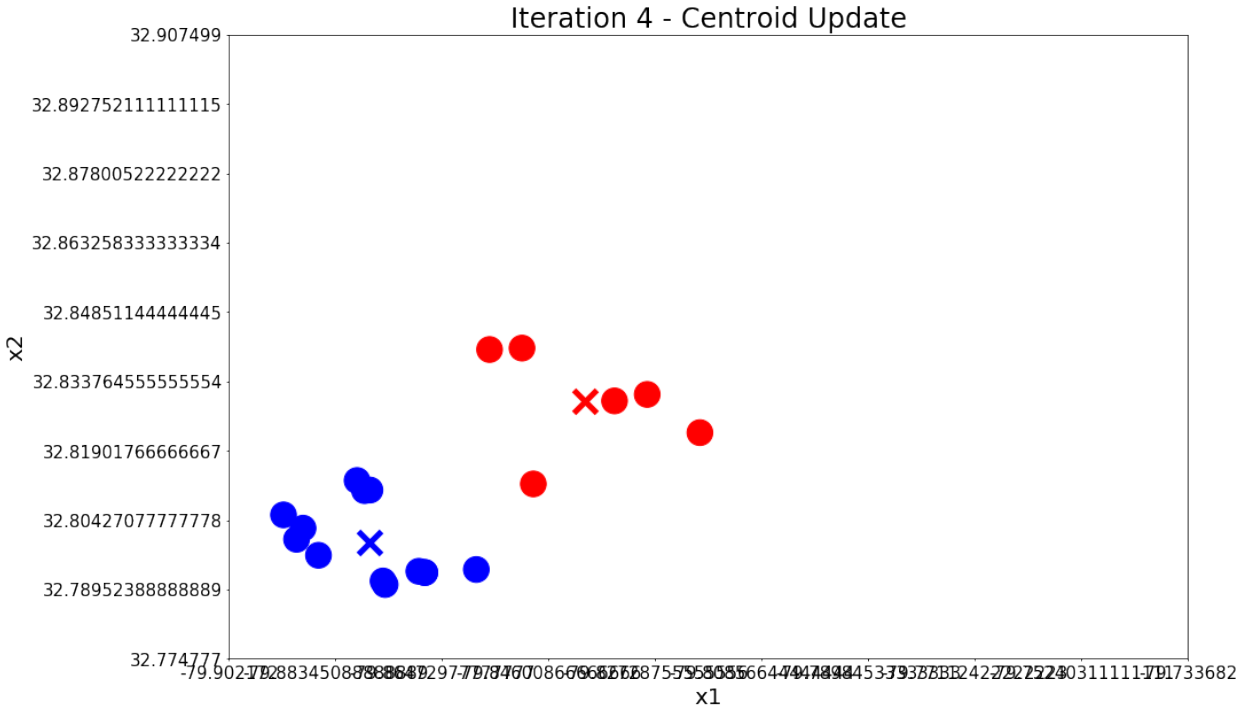

Figure 4 - Plot of Map of Mount Pleasant coffee shops and the relative centroid of the coffee shop clusters; drawing is not to geospatial scale and the blue and red x's denote the centroids.

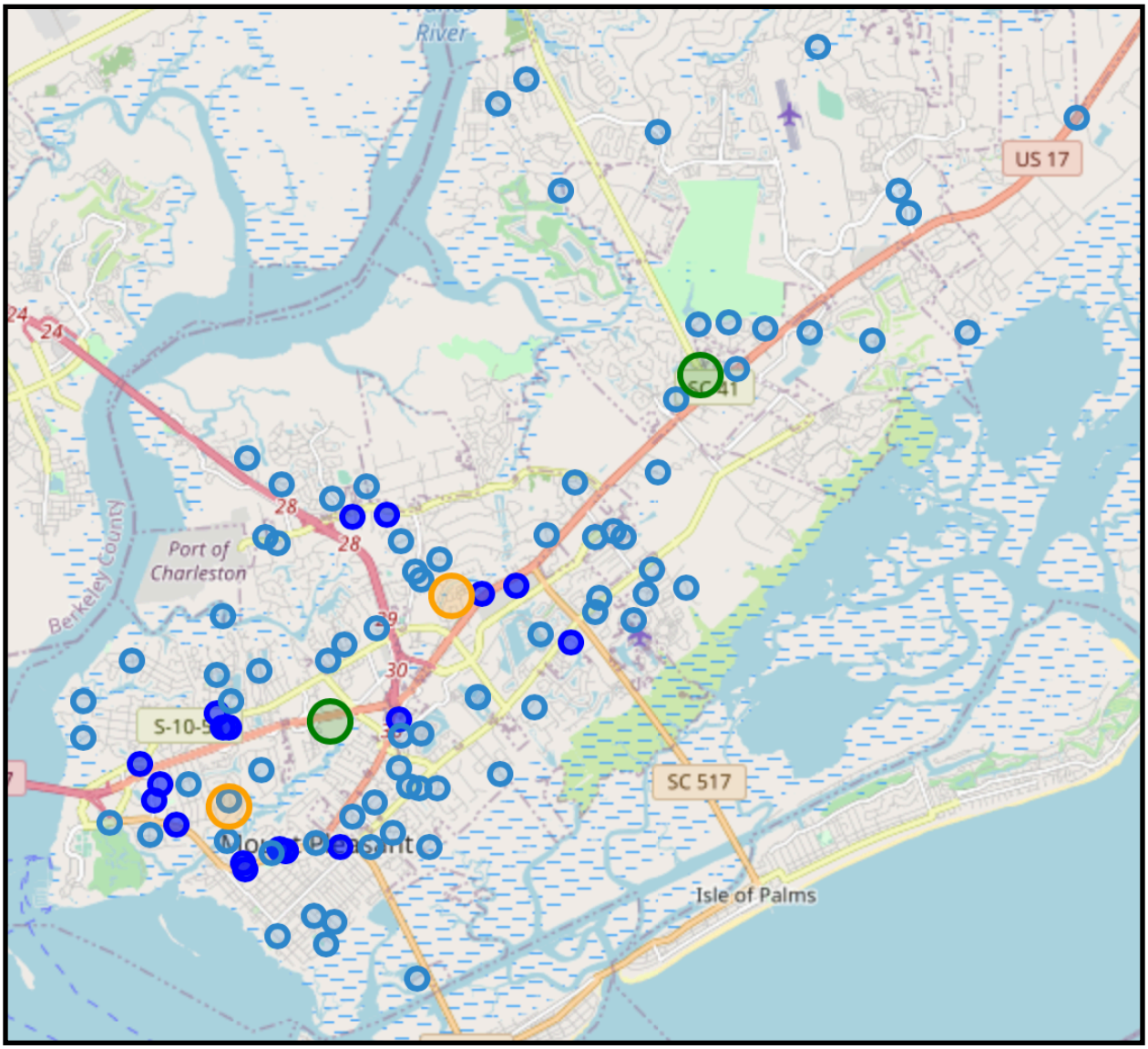

Figure 5 - Map of Mount Pleasant neighborhoods and coffee shops and neighborhood centroids (using Folium); light blue circles represent neighborhoods dark blue circles represent coffee shops, and the larger green circles represent the centroids of the neighborhoods. The orange circles represent the centroids of the coffee shops.

4.0 Determining the Best Coffee Shop Locations

4.1 Mount Pleasant Neighborhood and Coffee Shop Clustering

Based on the k-means clustering coupled with the density of features (i.e., neighborhoods and coffee shops, we can identify potentially prime locations for a new coffee shop. For the southern area of Mount Pleasant (below I-526 and Highway 17), based on the centroids of the existing coffee shops (orange circles in Figure 6) and the southern centroid of neighborhoods, two locations emerge: 1) at the intersection of Bowman Road, and 2) at the intersection just further west at Anna Knapp Boulevard).

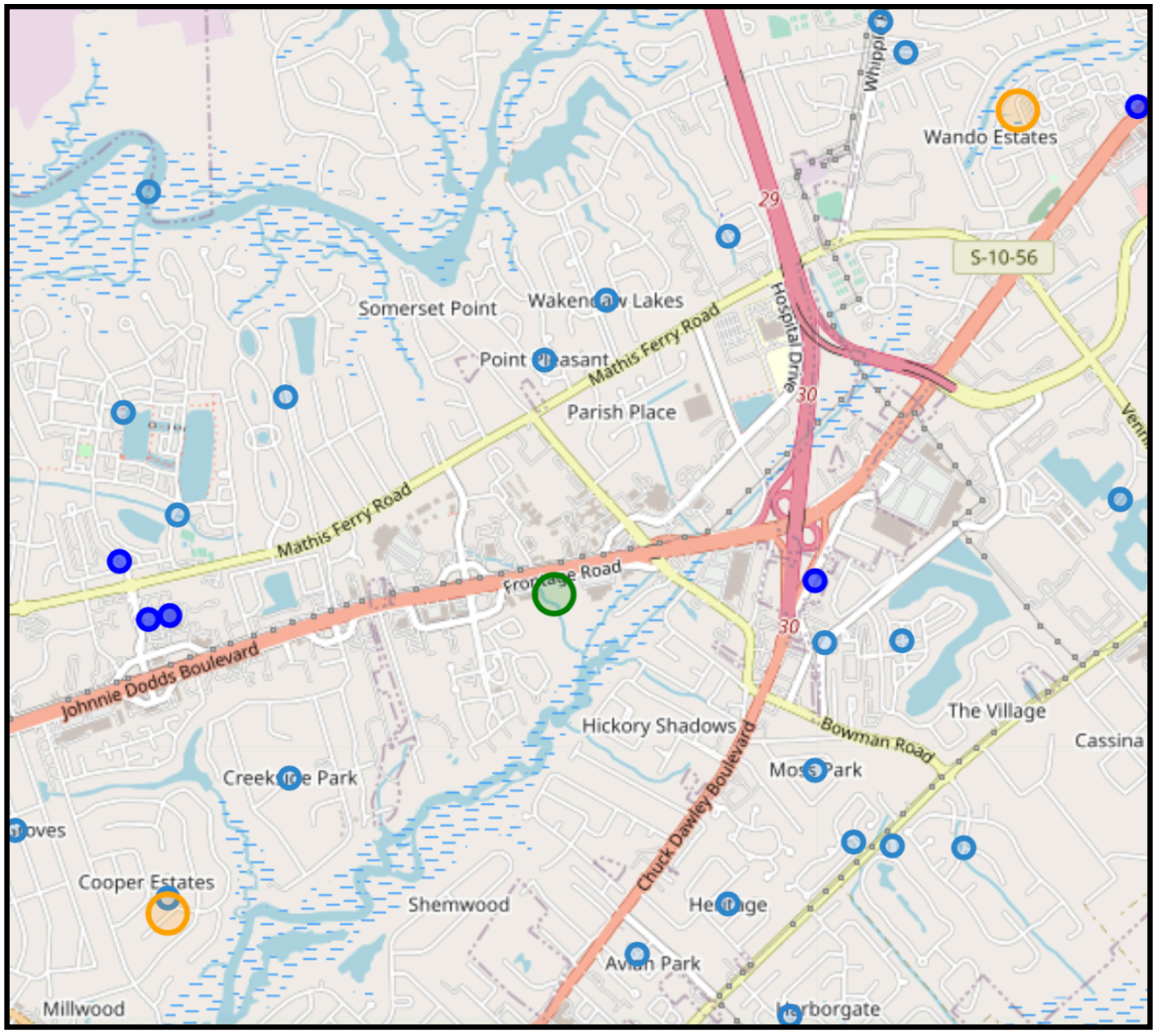

Figure 6 - Map of Mount Pleasant neighborhoods and coffee shop centroids; green circle is the southern neighborhoods centroid and the orange represent the two coffee shop centroids.

The next decision would be which side of Highway 17 would the new coffee shop be located at these intersections. Since the largest volume of traffic in the morning (when many people desire coffee) would be to the west, we'd recommend locating the coffee shops for this southern location on the north side of Highway 17 in the vicinity of these two potential intersections. Both intersections offer several commercial retail properties that would be suitable for a coffee shop.

Figure 7 shows that the centroid of the coffee shops is located near several neighborhoods about the intersection of I-526 and Highway 17. Note, there are no coffee shops about the centroid of the northern neighborhoods (green circle in Figure 7). Consequently, this location (Highway 17 and SC Highway 41) would be a prime location for a coffee shop. This intersection already has multiple retail buildings that could accommodate a coffee shop. As with the other potential location, we'd recommend locating the coffee shop on the west side of Highway 17 and SC Highway 41 to capture the morning flow of traffic (and largest number of consumers interested in coffee). A secondary location would be just south at a smaller intersection (Highway 17 and Hamlin Road).

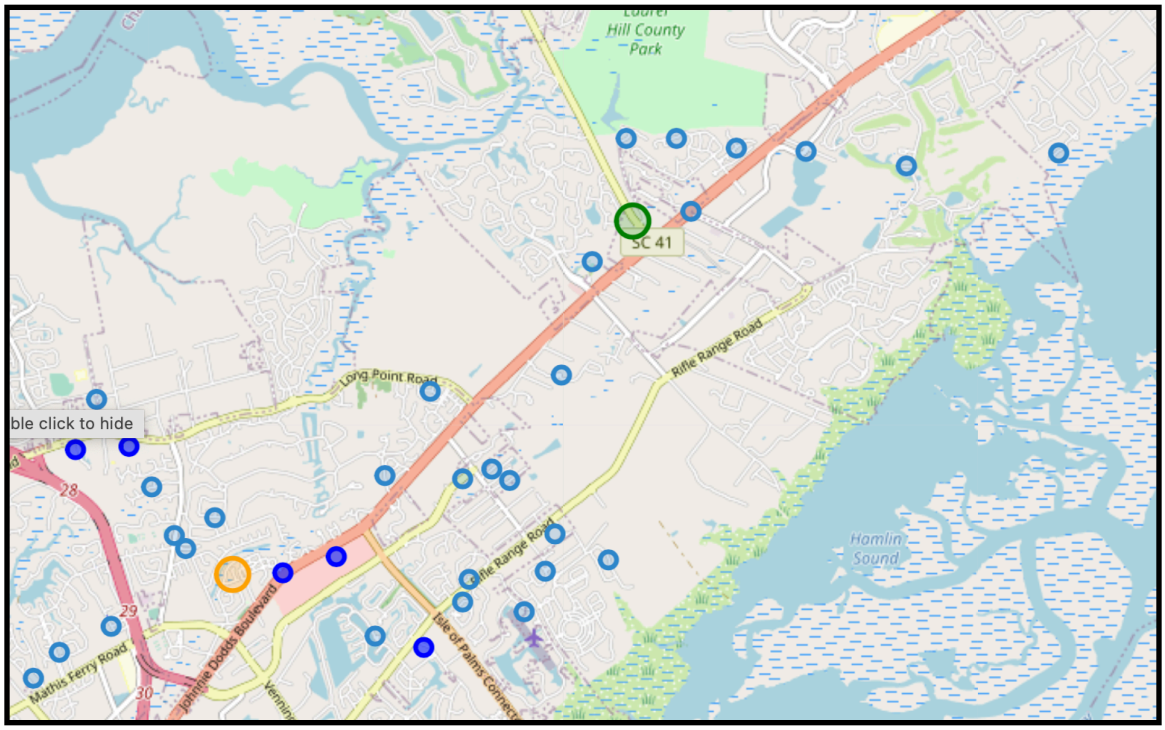

Figure 7 - Map of Mount Pleasant neighborhoods and coffee shop centroids; green circle is the norther neighborhoods centroid and the orange represent the one of the coffee shop centroids.

5.0 Conclusion

This project showed the power of data science in evaluating real world problems such as helping a client determine the best location of a coffee shop in Mount Pleasant. Several powerful tools in Python including Beautifulsoup, Geopy, and Foursquare provided powerful means to extract information from websites (i.e., neighborhoods and coffee shops in Mount Pleasant, SC). K-means clustering tools in Python provided key insight into the relative proximity and density of neighborhoods and existing coffee shops. In addition, k-means helped determine opportunities where coffee shops could be located relevant to the centroids calculated from k-means. Finally, Folium provided a very flexible means to plot features and "see" the results of the analysis. Folium also helped validate the final selection of new coffee shops since one could see these locations in the same context as the existing coffee shops and neighborhoods that might be serviced by new coffee shops.

Two sets of new locations were determined by this analysis. These include:

1) New coffee shop at Highway 17 and Bowman Road,
2) New coffee shop at Highway 17 and Anna Knapp Boulevard,
3) New coffee shop at Highway 17 and SC Highway 41, and
4) New coffee shop at Highway 17 and Hamlin Road.

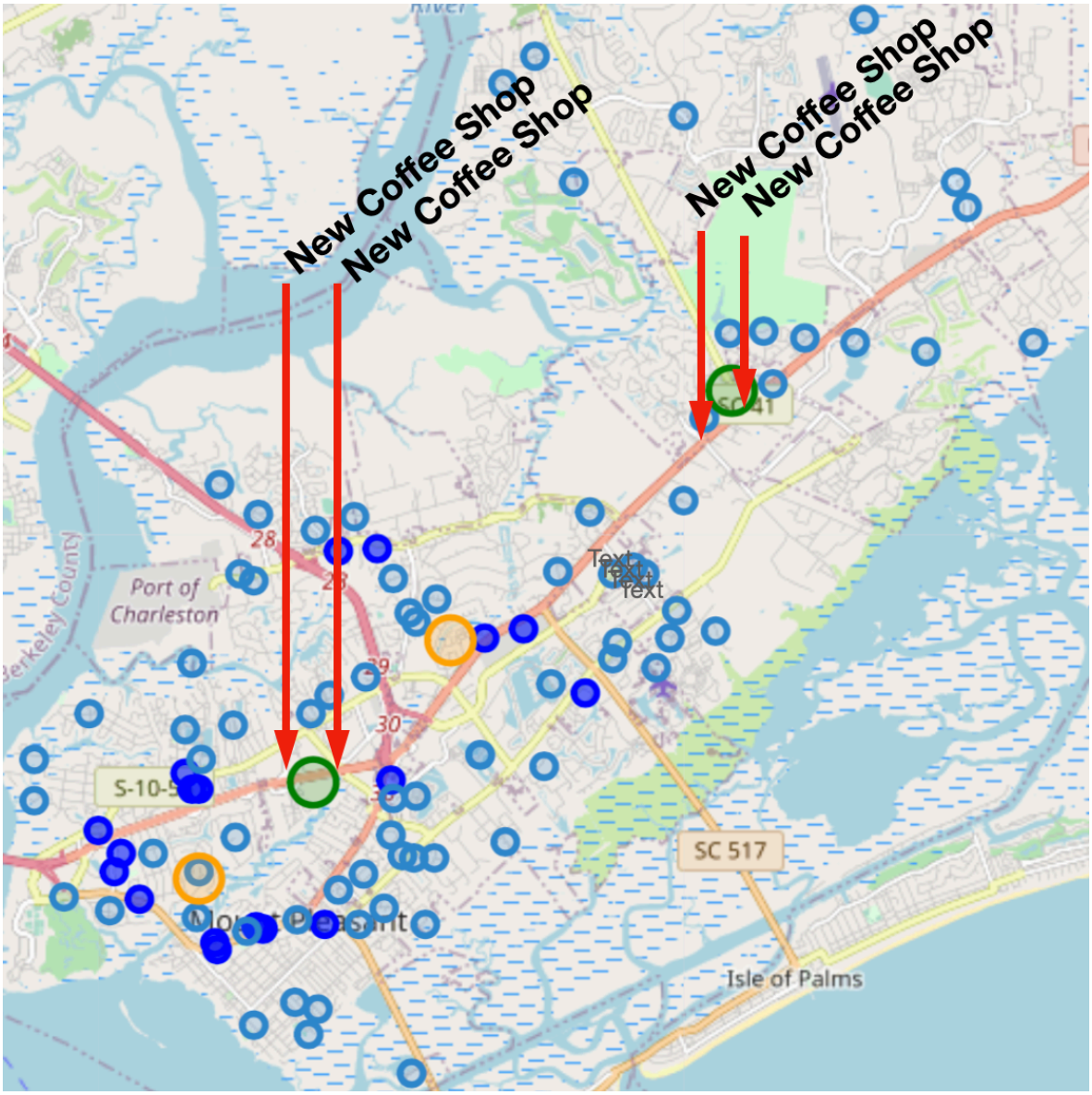

Figure 8 - Map of Mount Pleasant neighborhoods, existing coffee shops and potential locations for new coffee shops; dark blue circles are existing coffee shops and the orange are the two centroids of these shops; light blue circles are the neighborhoods and the green circles are the two centroids of the neighborhoods representing south and north regions of Mount Pleasant.

6.0 Future Directions

Additional analyses that could compliment this approach would include evaluating traffic volumes in all directions especially in the mornings when many consumers would want coffee. This would inform which side of Highway 17 or Coleman Boulevard might be better for siting a coffee shop based on consumer access. Another analysis would be to evaluate the population of people in a neighborhood. This information could be used to weight the neighborhood by the number of potential customers it could provide to a coffee shop in the area or along a commute route. The neighborhood weighting could be based additionally on additional centroid analyses by subdividing the relative regions of Mount Pleasant. Traffic route analysis might also be another compliment to the siting of coffee shops since it might provide an indication of access (i.e., people who would rather take a right turn at an intersection (less wait time) versus a left turn (more time).