

Clustering Kansas City, MO neighborhoods by nonemergency city helpline (311 call) requests

Sarah E Smith

Data Science Capstone

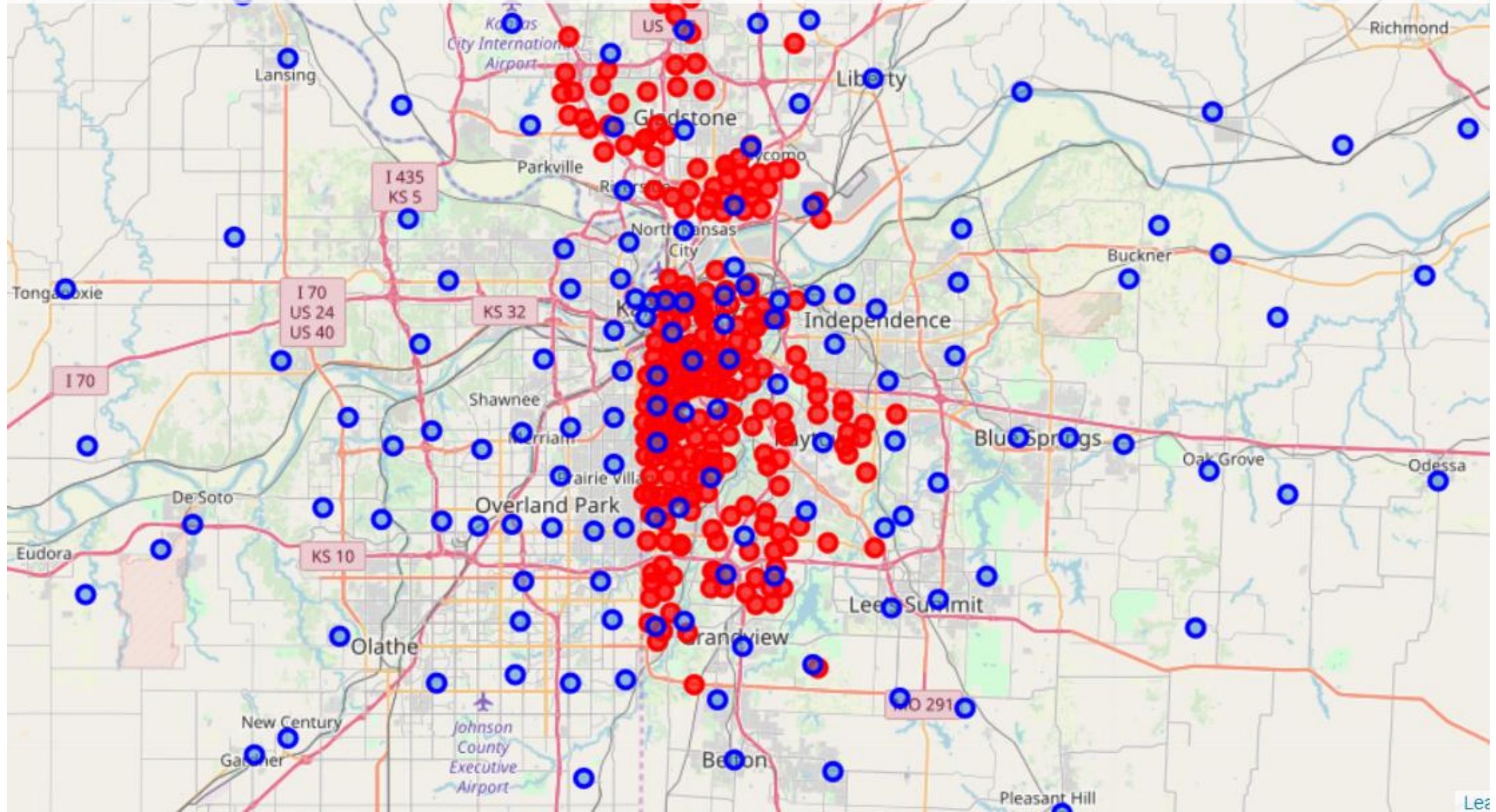
Introduction of the Problem and Description of the Data

Kansas City, Missouri is a medium sized city in the Midwestern United States. A regional arts hub, barbecue capitol and recent setting for "Queer Eye" on Netflix, the city is undergoing an economic renewal in its urban core. Strategic investment at the neighborhood level could help insure that prosperity increases for residents city-wide, while imprudent investment could exacerbate economic disparities across neighborhoods. One measure of neighborhood health especially relevant to City investment is the type and frequency of nonemergency city helpline ("311 call") requests. Available for download at OpenDataKC

(<https://data.kcmo.org/311/311-Call-Center-Service-Requests/7at3-sxhp>), the 311 call database is a trove of over 1.3 million nonemergency calls from Kansas City residents, ranging from pothole reports and animal control requests to property violations (e.g. broken windows or peeling paint) and abandoned vehicles. The relative frequency of different types of calls in each neighborhood could give insight into whether there are special infrastructure or blight issues in certain areas. Clustering neighborhoods facing similar issues across the city (using K means clustering of 311 data) could allow city leaders to focus investment, and to develop neighborhood-cluster-level committees and task forces to address pressing issues especially facing neighborhoods in a cluster. Finally, assessing the economic vibrancy of neighborhood clusters by frequency of venues recorded in Foursquare could suggest which neighborhood clusters (and therefore which prominent nonemergency issues) are associated with decreased economic activity. For geographic visual context, I will map neighborhoods color-coded by cluster against a background of complete Kansas City metro area zipcodes (acquired by web scraping Statistical Atlas, <https://statisticalatlas.com/metro-area/Missouri/Kansas-City/Overview>), with latitude and longitude data pulled from the csv download OpenDataSoft: <https://public.opendatasoft.com/explore/dataset/us-zip-code-latitude-and-longitude/export/?refine.state=MO&refine.state=KS>).

- Problem to Address: How should Kansas City government officials direct investment funds to improve economic activity?

Overview of Kansas City neighborhoods (red) in context of Kansas City metro zipcodes

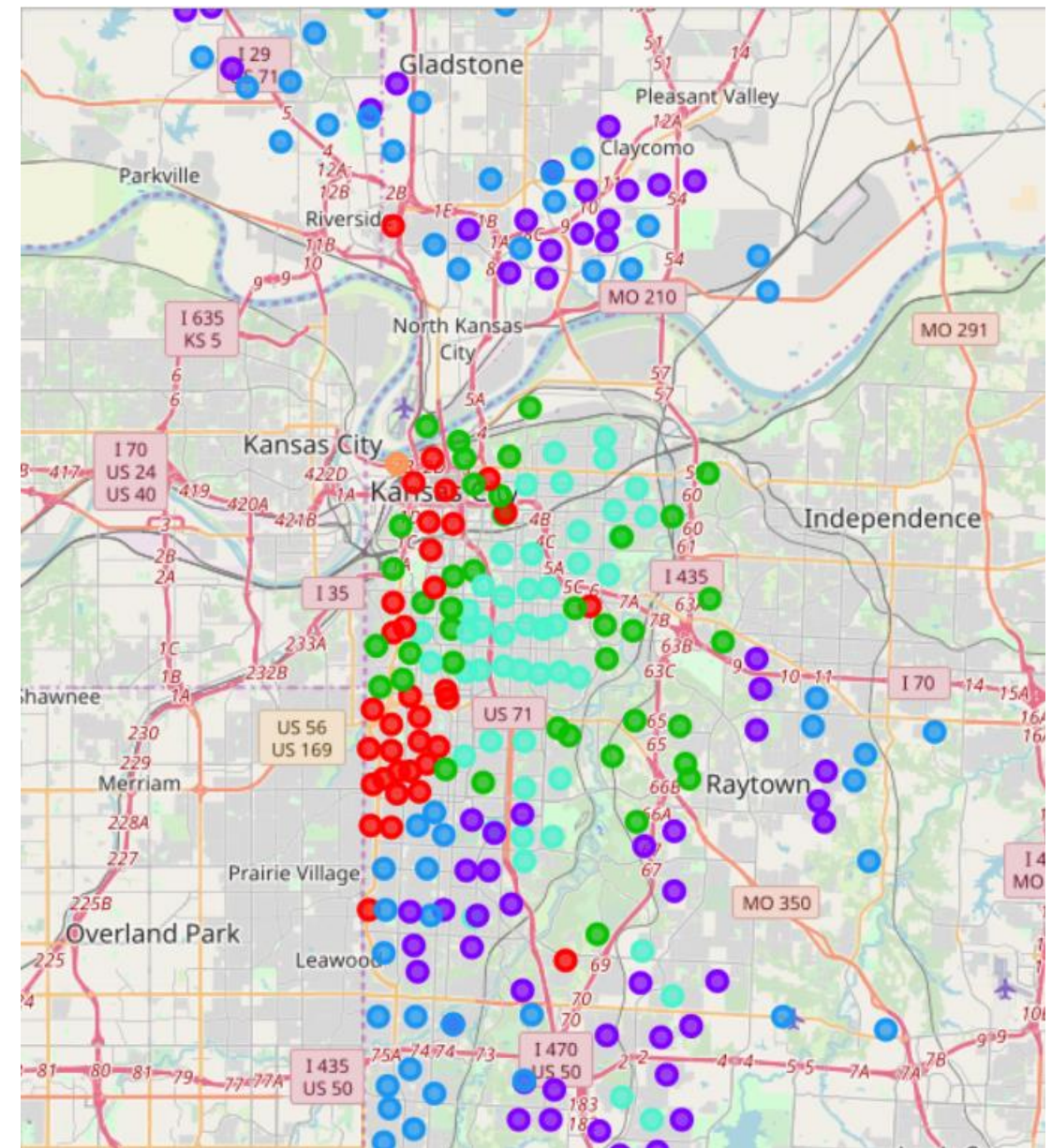


Kansas City nonemergency call data

- Now that we have a good geographical overview of Kansas City, let's look at Kansas City 311 data. 311 is the non-emergency service number to report problems such as potholes, building violations, and stray animals. This data comes from the city of Kansas City and is available for neighborhoods within the city limits. There are 1.35M rows of call data with 30 columns. The data set is available for download from OpenDataKC at: <https://data.kcmo.org/311/311-Call-Center-Service-Requests/7at3-sxhp>
- Below you see a table of the first five rows of data
- We will use the 311 data to cluster KC neighborhoods using K means Clustering based on Call Type, and get more complete information by finding the most common request for each most popular call type in each cluster of neighborhoods.

| Row | Zipcode | Category | Type | Request | Neighborhood | Latitude | Longitude |
|-----|---------|--|-------------------------|--|--------------------------------------|----------|-----------|
| 0 | 64132 | Trees | Services | Trees-Services-Question | Blenheim Square Research Hospital | 39.00243 | -94.55917 |
| 1 | 64131 | Trash / Recycling | Dumping | Trash / Recycling-Dumping-Solid Waste Referral | East Meyer 6 | 38.99432 | -94.57471 |
| 2 | 64117 | Property / Buildings / Construction | Property Maintenance | Property Violations | Winnwood | 39.17599 | -94.52394 |
| 3 | 64127 | Trash / Recycling | Nuisance | Property Violations | Lykins | 39.10092 | -94.53666 |
| 4 | 64156 | Lights / Signals | Traffic Signal | Lights / Signals-Traffic Signal-New Signal Req... | Shoal Creek | 39.30241 | -94.49321 |

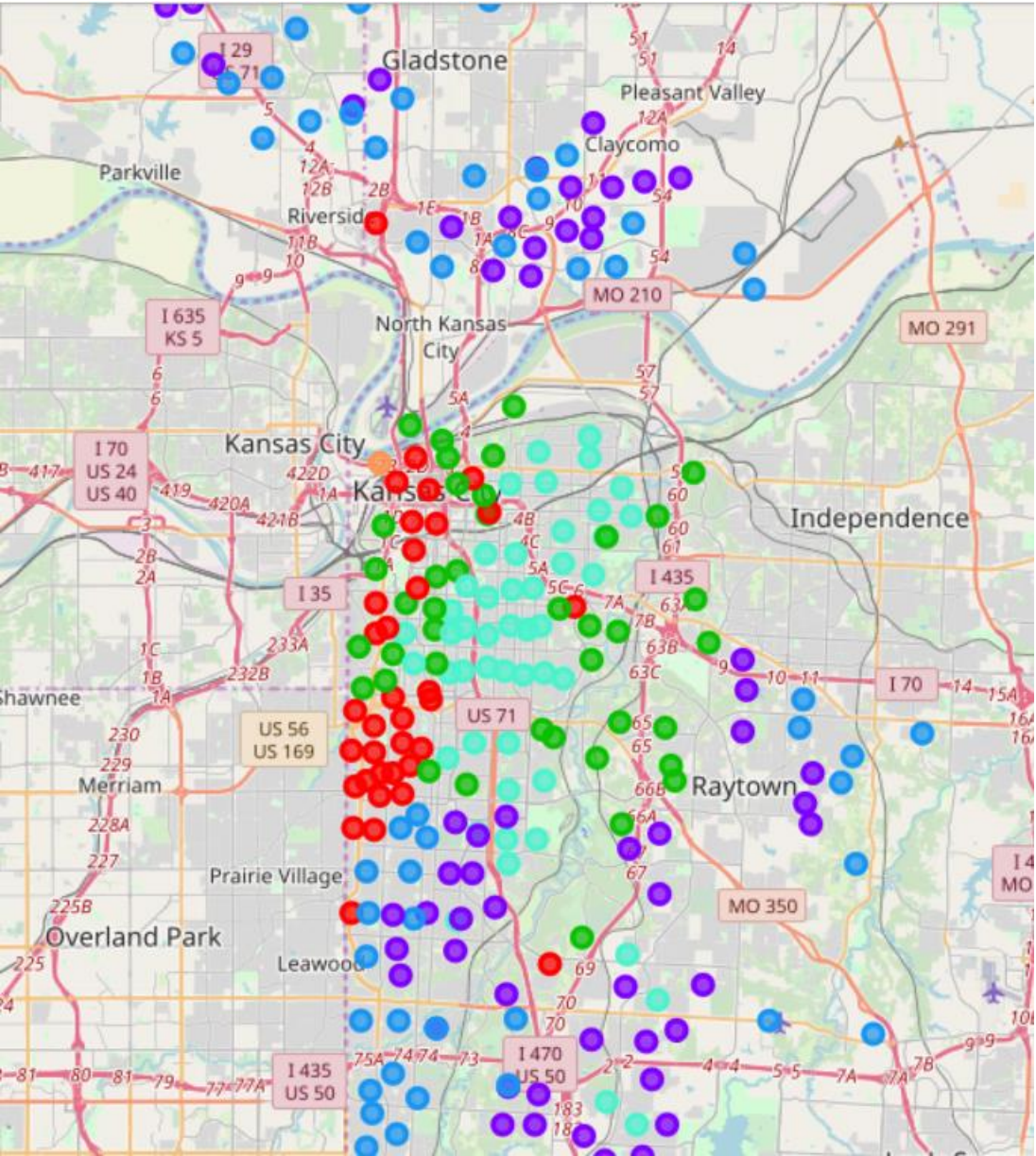
Neighborhoods are clustered using K means clustering on 311 call type frequency, and colored according to cluster.



A few telling features jump out of the neighborhood clusters and their most frequent 311 calls: Cluster 5 (Orange) is a single neighborhood, "Central Blue Valley and Park Tower Gardens", bordering the river dealing with unique problems relating to water metering, leaks, and access; at least 60% of 311 calls in Cluster 5 were water-related.

Cluster 5

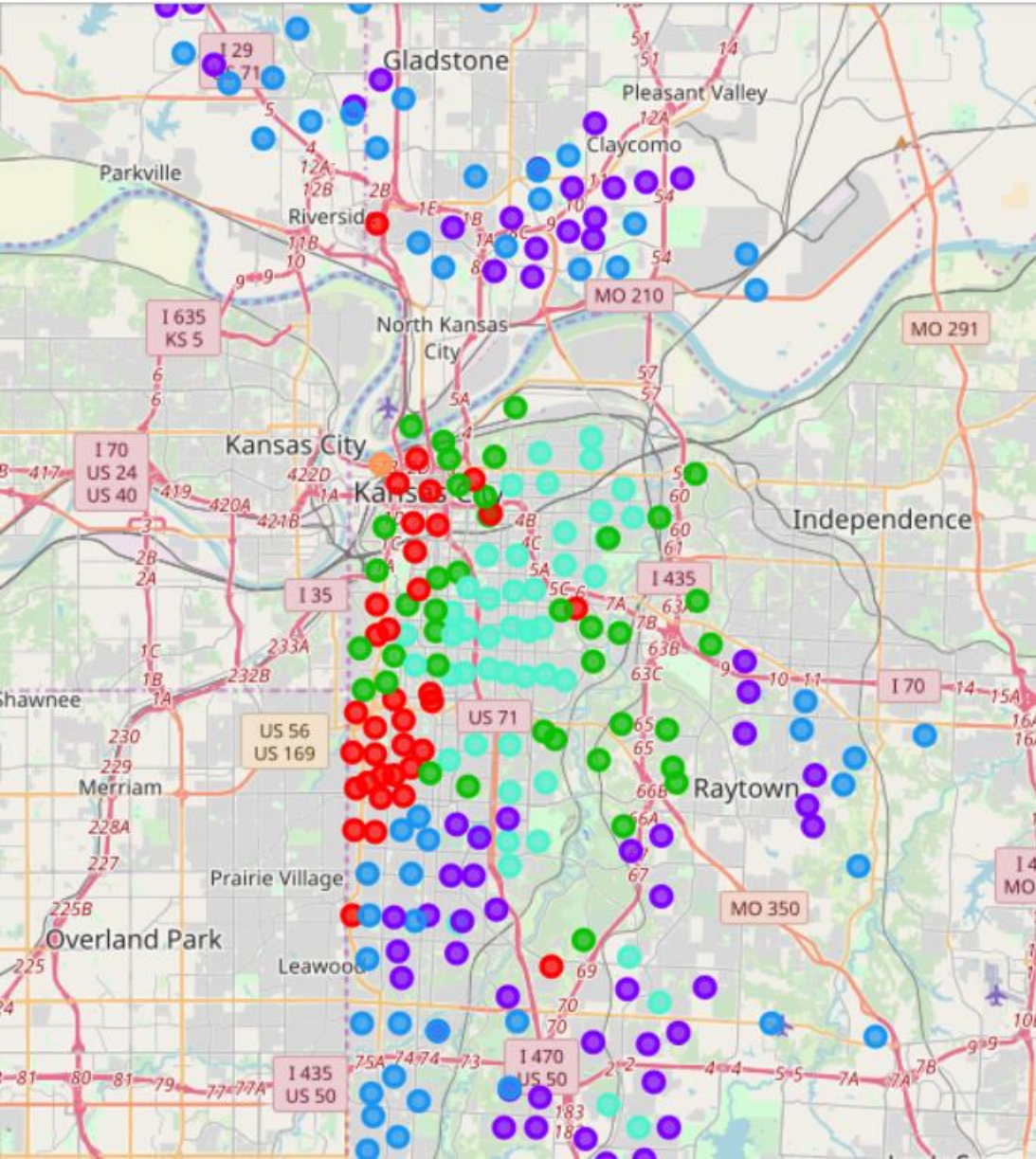
| Rank | Frequency | Type | Request |
|------|-----------|----------------------|--|
| 1 | 0.4 | Investigations | Meter Leak or Problem |
| 2 | 0.2 | No Water / Pressure | Water-No Water / Pressure-No Water |
| 3 | 0.2 | Administration | City Planning & Development-Administration |
| 4 | 0.2 | Traffic Sign | Signs-Traffic Sign-New Sign Request |
| 5 | 0 | Property Maintenance | |



Cluster 3 (Turquoise), a broad swath of neighborhoods mostly in East Central Kansas City, is dealing with issues associated with blight including vacant buildings stray animals, as well as a high proportion (21%) of calls dealing with property violations (encompassing code and ordinance violations such as excessive wood rot or missing stair railings).

Cluster 3

| Rank | Frequency | Type | Request |
|------|-----------|----------------------|--------------------------------|
| 1 | 0.21 | Private Property | Property Violations |
| 2 | 0.04 | Board Up | Vacant Structure Open to Entry |
| 3 | 0.03 | Property Maintenance | Property Violations |
| 4 | 0.03 | Other | Animal Control |
| 5 | 0.02 | Bulky | Bulky Pick-up Missed |



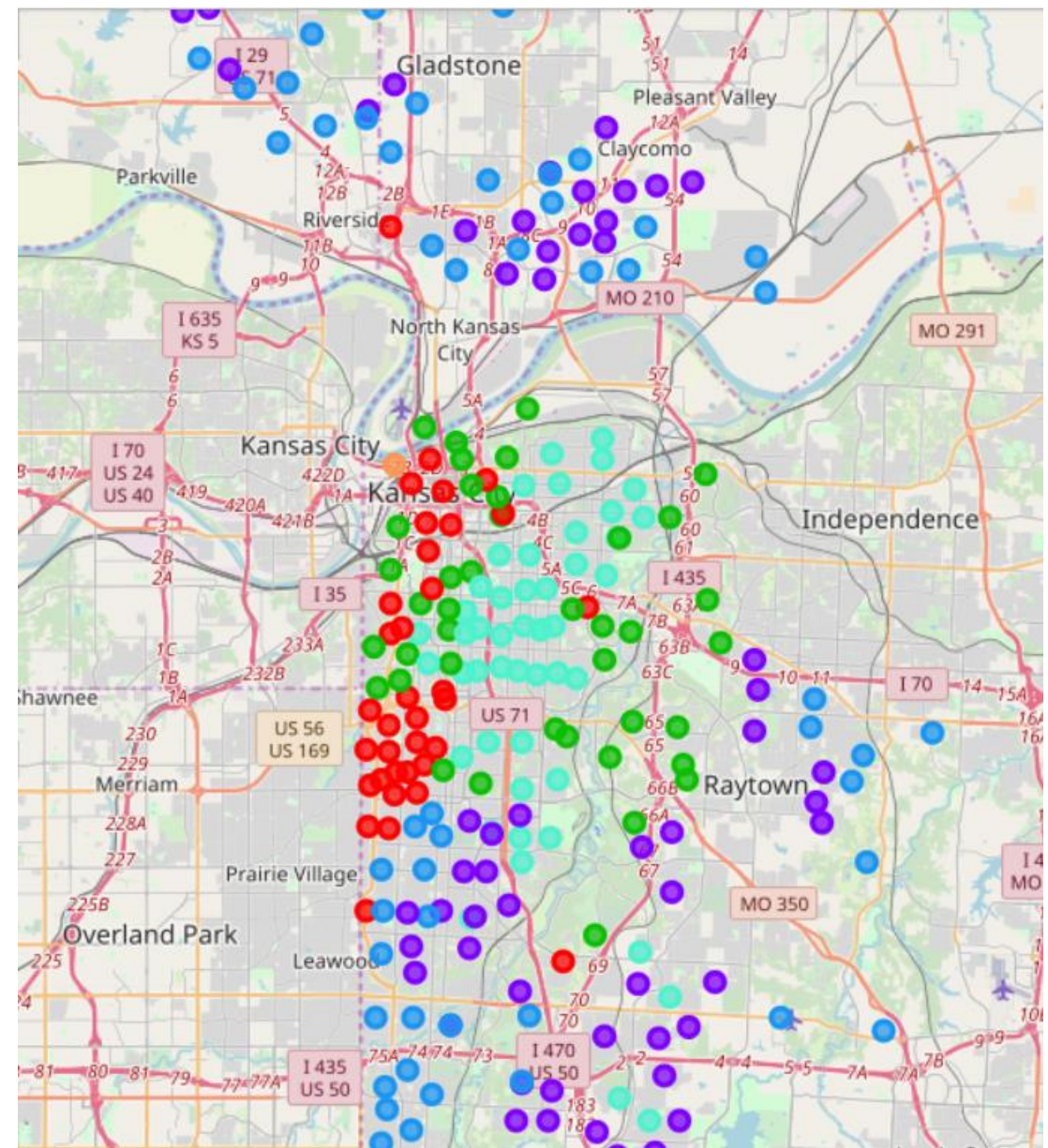
Cluster 1 (Purple), consisting mostly of inner ring suburban neighborhoods in Southeast and North Central KC, is also dealing with an above average proportion of property violations (13%), as well as issues with weekly trash pickup and snow/ice removal, problems also faced by Cluster 2 (Blue) which covers a similar geographic area but which has a lower frequency (7%) of property violations.

Cluster 1

| Rank | Frequency | Type | Request |
|------|-----------|----------------------|---|
| 1 | 0.13 | Private Property | Property Violations |
| 2 | 0.04 | Street | Snow or Ice on Street District 3 |
| 3 | 0.04 | Trash Collection | Trash / Recycling-Trash Collection-Missed by C... |
| 4 | 0.04 | Contractor | Trash - Missed by Contractor |
| 5 | 0.03 | Property Maintenance | Property Violations |

Cluster 2

| Rank | Frequency | Type | Request |
|------|-----------|------------------|---|
| 1 | 0.07 | Private Property | Property Violations |
| 2 | 0.05 | Street | Snow or Ice on Street District 1 |
| 3 | 0.05 | Contractor | Trash - Missed by Contractor |
| 4 | 0.05 | Trash Collection | Trash / Recycling-Trash Collection-Missed by C... |
| 5 | 0.04 | Recycling | Trash / Recycling-Recycling-Missed by Contract... |



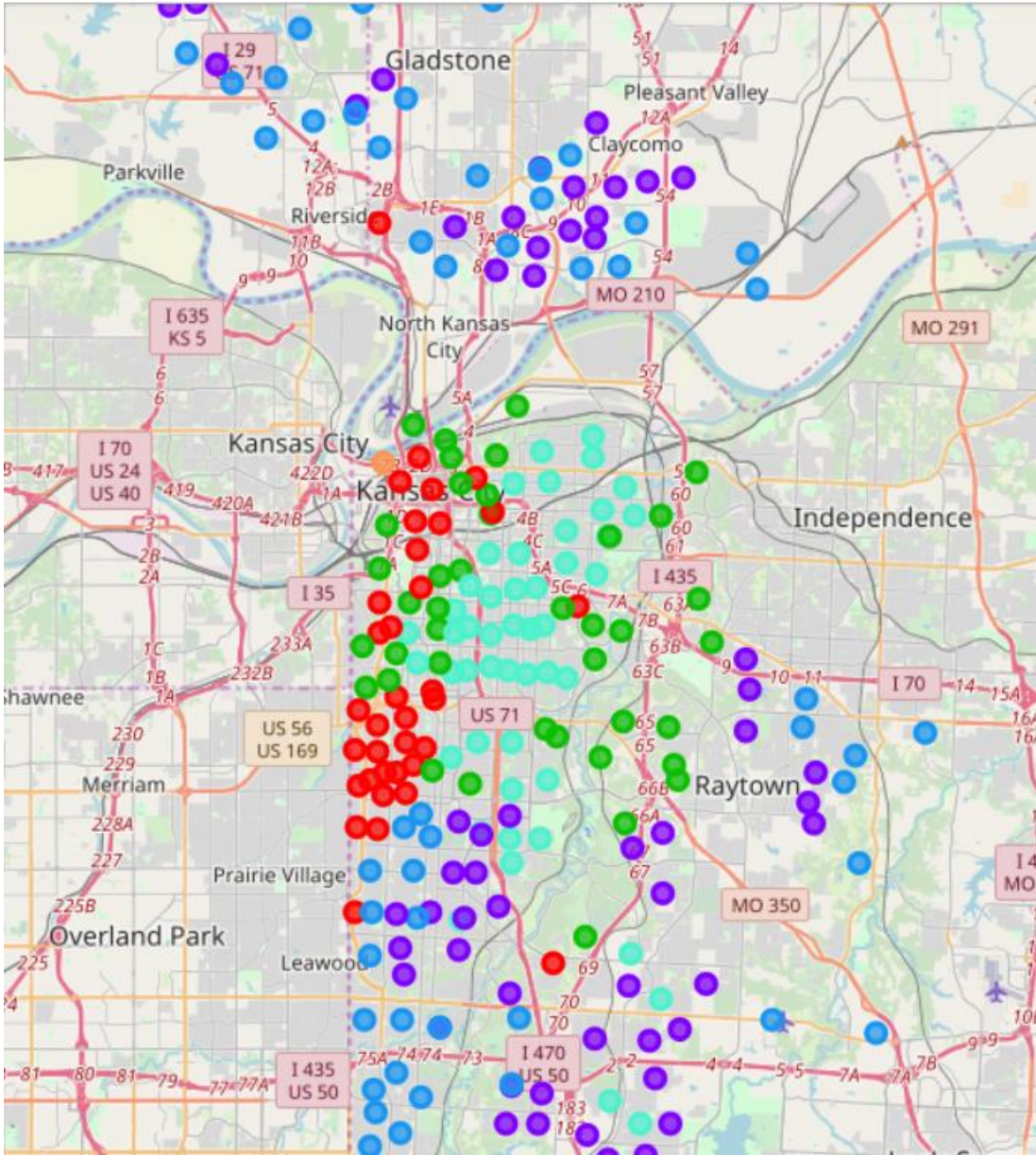
Finally Cluster 0 (Red) and Cluster 4 (Green), are focused mostly in the midtown/downtown areas with some scattered suburban neighborhoods also included. Both have relatively distributed frequencies of 311 calls, suggesting that neighborhood issues are not focused in a single area, although Cluster 0 has a notably low frequency of property violations calls (5%) while Cluster 4 is more typical at 11%.

Cluster 0

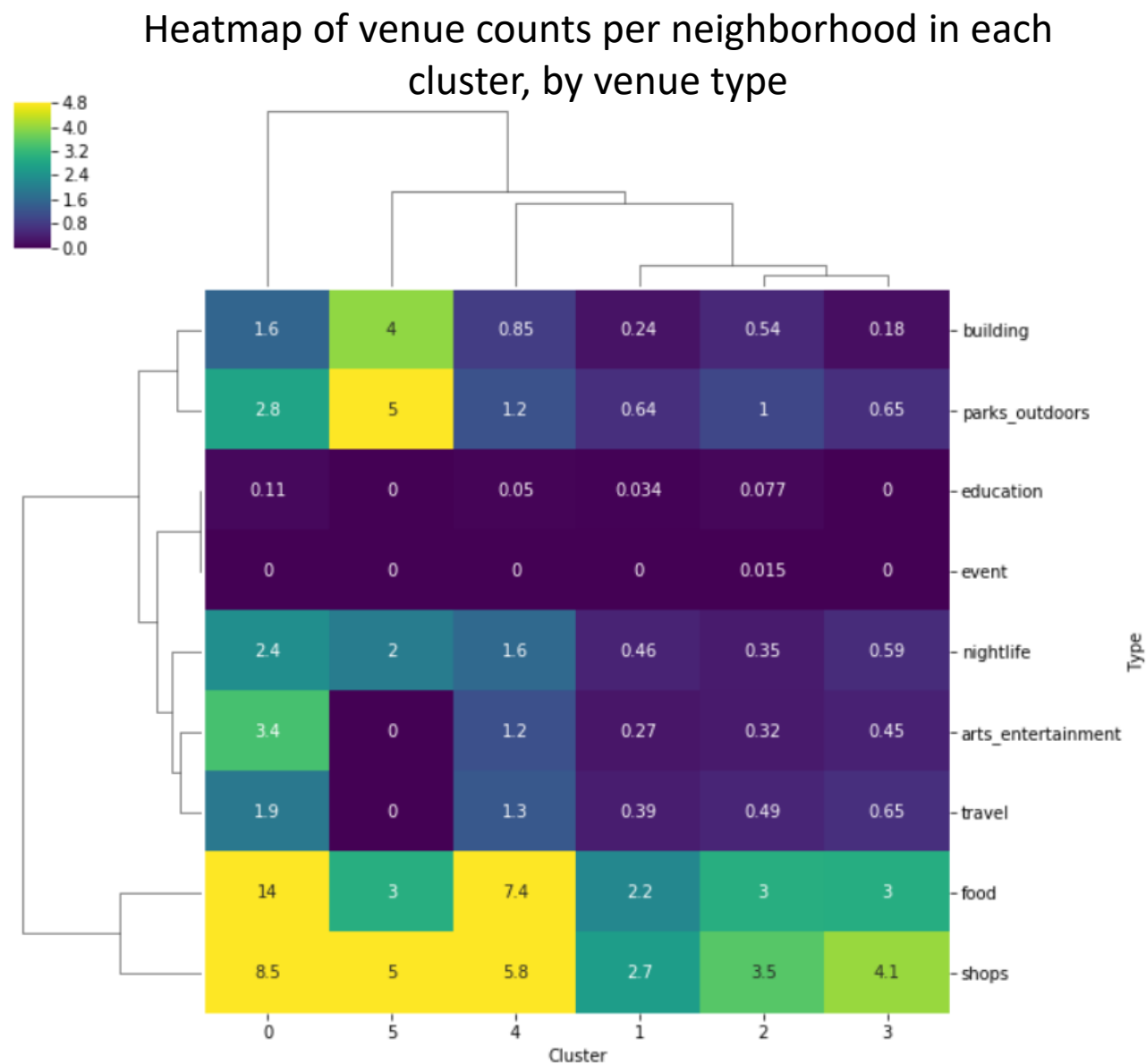
| Rank | Frequency | Type | Request |
|------|-----------|------------------|---|
| 1 | 0.05 | Street | Pothole (South of 47th Street and West Of Blue... |
| 2 | 0.04 | Pothole | Streets / Roadways / Alleys-Pothole-District 3 |
| 3 | 0.04 | Private Property | Property Violations |
| 4 | 0.03 | Removal | Tree Removal of a City Tree |
| 5 | 0.03 | All | Water Leak or Pressure Problem |

Cluster 4

| Rank | Frequency | Type | Request |
|------|-----------|------------------|----------------------------------|
| 1 | 0.11 | Private Property | Property Violations |
| 2 | 0.04 | Street | Snow or Ice on Street District 2 |
| 3 | 0.03 | Other | Animal Control |
| 4 | 0.03 | Investigations | Water Leak or Pressure Problem |
| 5 | 0.03 | All | Water Leak or Pressure Problem |



How is 311 call activity reflective of neighborhood economic activity, as measured by number and type of venues recorded on Foursquare?



Clearly, Clusters 4 and especially 0 are economic hubs, with restaurants/food and shops focused in those neighborhoods. It's notable that venues data groups Cluster 5 together with Clusters 0 and 4. It may be that if water issues were resolved, that neighborhood would group with those prosperous clusters.

Cluster 3, which also represents a cohort of neighborhoods that are geographically centrally located but facing issues of blight according to 311 data, also shows an above average frequency of shops but appears economically underserved in general.

Conclusions and Recommendations

Neighborhood Clusters could assist in directing City funds toward problem areas, and provide a framework for building coalitions of neighborhoods facing similar issues to generate issue task forces and plans of action for addressing the issues Cluster-wide.

Suggestions for City of Kansas City budget: The city may wish to prioritize addressing distinct infrastructure issues that are dominating 311 call frequencies in some clusters, such as water infrastructure issues in cluster 5, and weekly trash pickup in Clusters 1 and 2. When strategizing for long term economic investment, Cluster 3 neighborhoods should be prioritized. These are centrally located but facing issues of blight and low economic activity as measured by Foursquare venues. Traditionally, special investment districts have been outlined in broad strokes, with Troost St, the historic racial dividing line of the city, frequently demarcating the border of investment. It may be advantageous to the city to take a more granular neighborhood-by-neighborhood approach and focus specifically on Cluster 3 neighborhoods. Suggested investment programs could include assistance with addressing property violations and vacant structures which are markedly prevalent in Cluster 3 neighborhoods. Cluster 0 neighborhoods, which tend to be economically active and show few property violations, tend to be grouped geographically with Cluster 4 neighborhoods in the downtown and midtown zones of Kansas City. However, there are a few geographic outliers which could be promising areas for economic development. The "Boulevard Village Cluster" neighborhood is on the East Side of KC, and adjacent to Cluster 3 neighborhoods. Investment in the "Boulevard Village Cluster" neighborhood could prove especially effective in increasing access to services for Cluster 3 neighborhood residents, and seed the expansion of economic activity in that region.

