The Battle of Neighborhoods
IBM Applied Data Science Capstone - Final Report

Henry Hong – 2019-07-28

Table of Content

1.0 Introduction Section

Business Problem

How to buy a dream house in Silicon Valley which complies with the requirements of price, features, safety, location and venue favors?

The audience who also interested

This case is also applicable for anyone interested in exploring the ways of searching and analysis the location and real estate data for finding a suitable house to buy in Silicon Valley.

Requirements

- The amenities in the selected neighborhood shall be similar to client's current residence apartment
- The **price** is under 1.5M
- House must be at least 3 bedrooms, 2 bathrooms, 1 car garage, around 1800 to 2100 square footage of size
- Near the **park** (within 0.5 mile)
- Near the **library** (within 1 mile)
- Near the **school** (within 0.5 mile)
- The **schools** in the area should have high **rating** (Ranking greater and equal than 8)
- Not too close to the **railroad** (at least 3 mile away)
- The location is near the **supermarket** (within 0.5 mile radius)
- The location is near the **shopping mall** (within 3 mile radius)
- The location is close (within 1 mile) to **venues** such as restaurants (Asian and Mexican foods ...etc.), parks and coffee shops
- The neighborhood/community should be safe and have low **crime rate**

2.0 Data Section

Datasets and features to be extracted

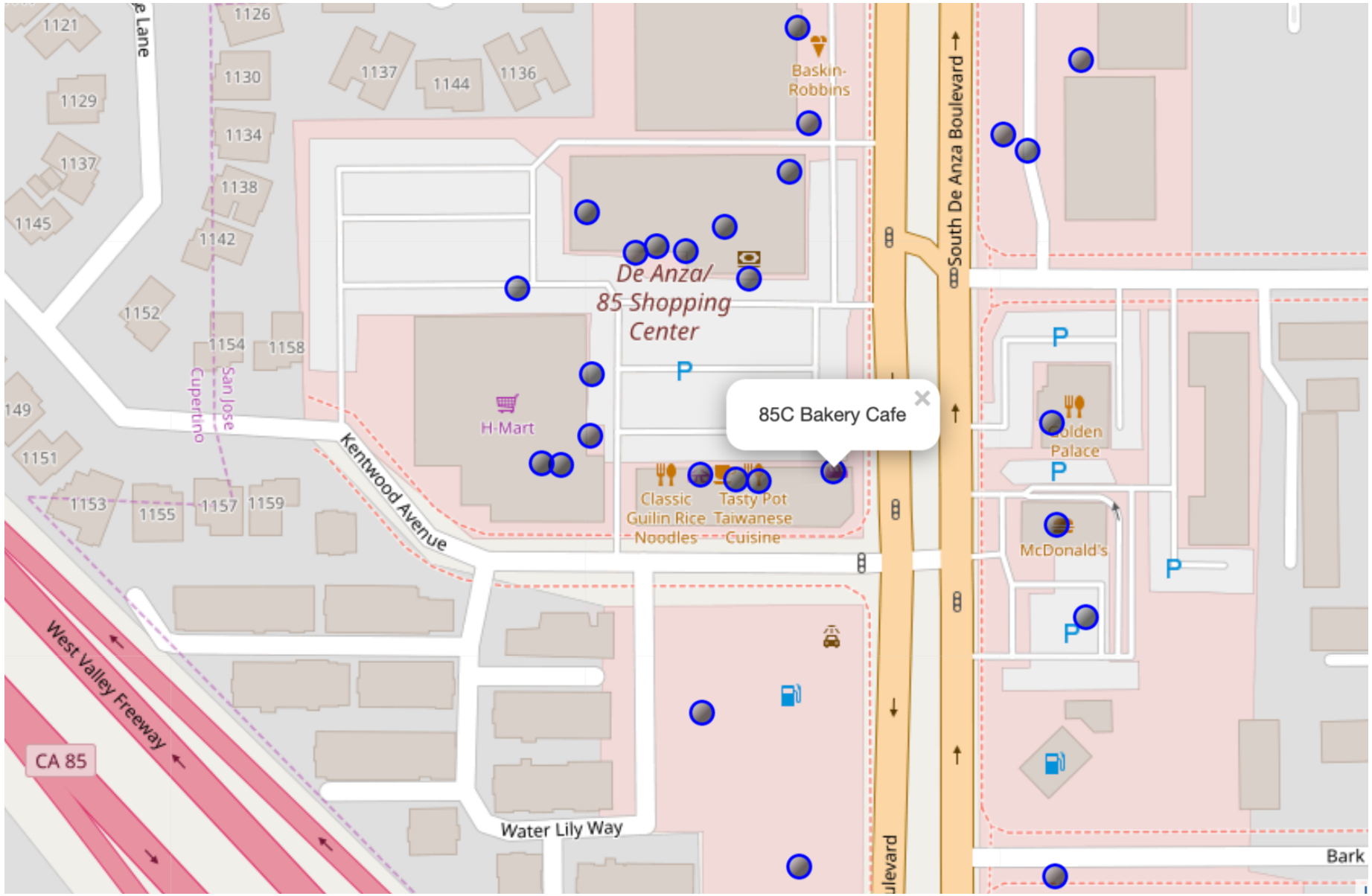
- **Schools Dataset**: ['ZIP', 'CITY', 'PLACENAME', 'ADDRESS', 'LATITUDE', 'LONGITUDE']
- **School Rating Dataset**(WebScraping by **BeautifulSoup**): ['SCHOOL', 'RANK']
- **Parks dataset**: ['PLACENAME', 'LATITUDE', 'LONGITUDE']
- **Railroad stations dataset**: ['PLACENAME', 'PLACETYPE', 'LATITUDE', 'LONGITUDE']
- **Public Libraries dataset**: ['ZIP', 'CITY', 'PLACENAME', 'ADDRESS', 'LATITUDE', 'LONGITUDE']
- **Crime Reports dataset**: ['city', 'incident_type_primary', 'parent_incident_type', 'latitude', 'longitude']
- **House price trends data**: ['City', 'Median Price', '2018 Change', '2017 Change', '2016 Change']
- **Foursquare API**: ['Neighborhood', 'Venue Category', 'venue', 'freq']
- **Recent Sold House Price Data**: ['ZIP', 'ADDRESS', 'ORGLD', 'ORIG LSPRC', 'LIST PRICE', 'SALE PRICE', 'SQFT', 'LOTSZ', 'COE', 'DOM']
- **Zillow API Comparable Sales Analysis**: ['zpid', 'zipcode', 'city', 'street', 'year_built', 'lot_size', 'finished_size', 'bedrooms', 'bathrooms', 'zestimate', 'last_sold_price', 'last_sold_date', 'latitude', 'longitude', 'home_details', 'similar_sales']

DATA processing - To answer following questions

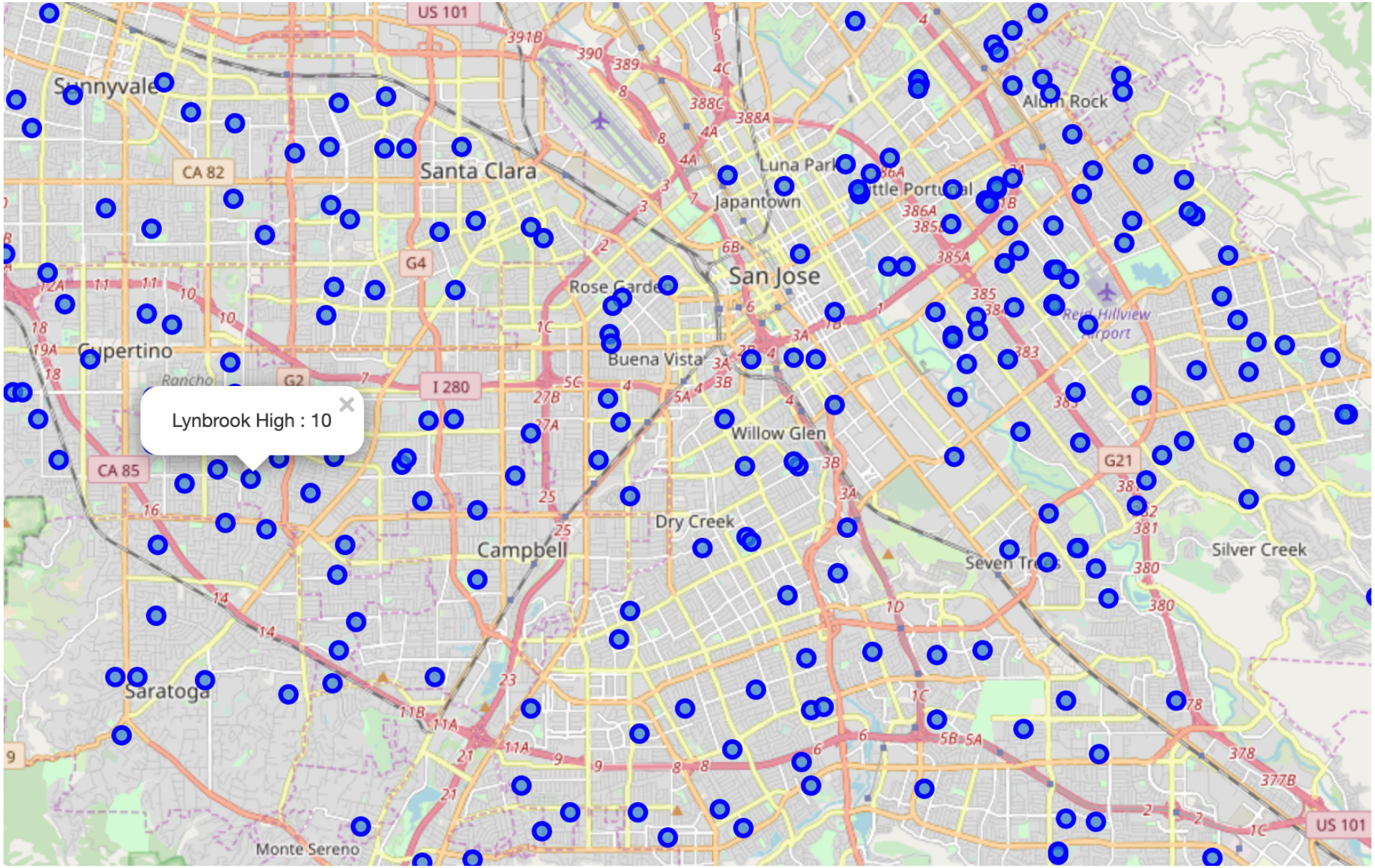
- Which city/zipcode is good to consider while considering the **price** (less than 1.5M)?
- Which city/zipcode is good to consider while considering the **school** (within 0.5 mile and ranking >= 8)?
- Which city/zipcode is good to consider while considering the **park** (within 0.5 mile)?
- Which city/zipcode is good to consider while considering the **library** (within 1 mile)?
- Which city/zipcode is good to consider while considering the **railroad** (at least 3 mile away)?
- Which city/zipcode is good to consider while considering the **supermarket** (0.5 mile radius)?
- Which city/zipcode is good to consider while considering the **shopping mall** (within 3 mile radius)?
- Which city/zipcode is good to consider while considering the **foods, restaurants (Asian and Mexican foods ...etc) and coffee shops**?
- Which city/zipcode is good to consider while considering the **safety** (low crime rate)?
- Which city/zipcode has the **best housing pricing**?
- Are there **tradeoffs** between size, price, location and safety?
- What are the venues of the **two best house** to buy?
- Any other **interesting statistical data** findings from the **Foursquare** and **ZillowAPI** real estate data?

3.0 Methodology Section

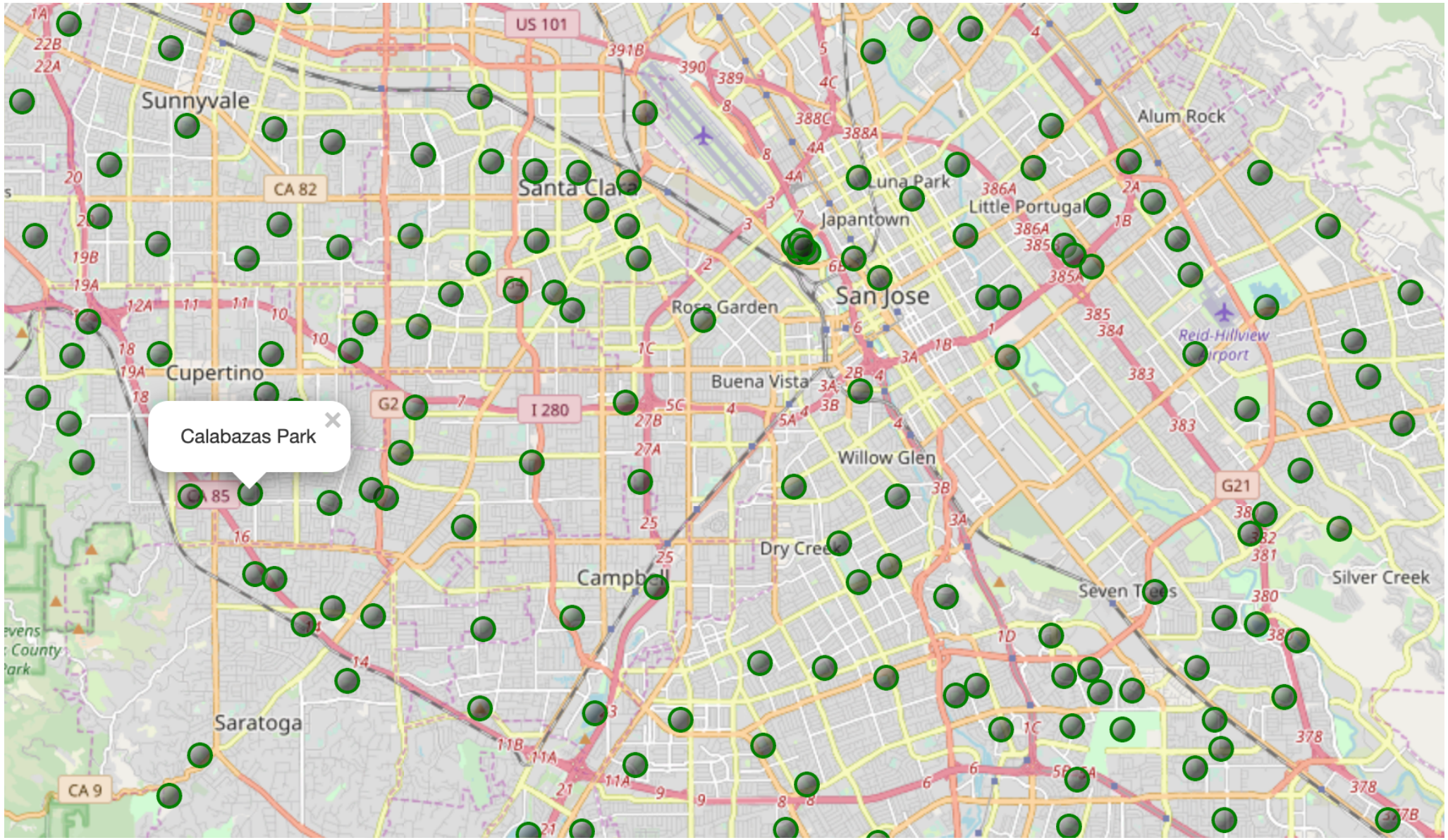
San Jose Map - Current residence and venues in San Jose (95129)



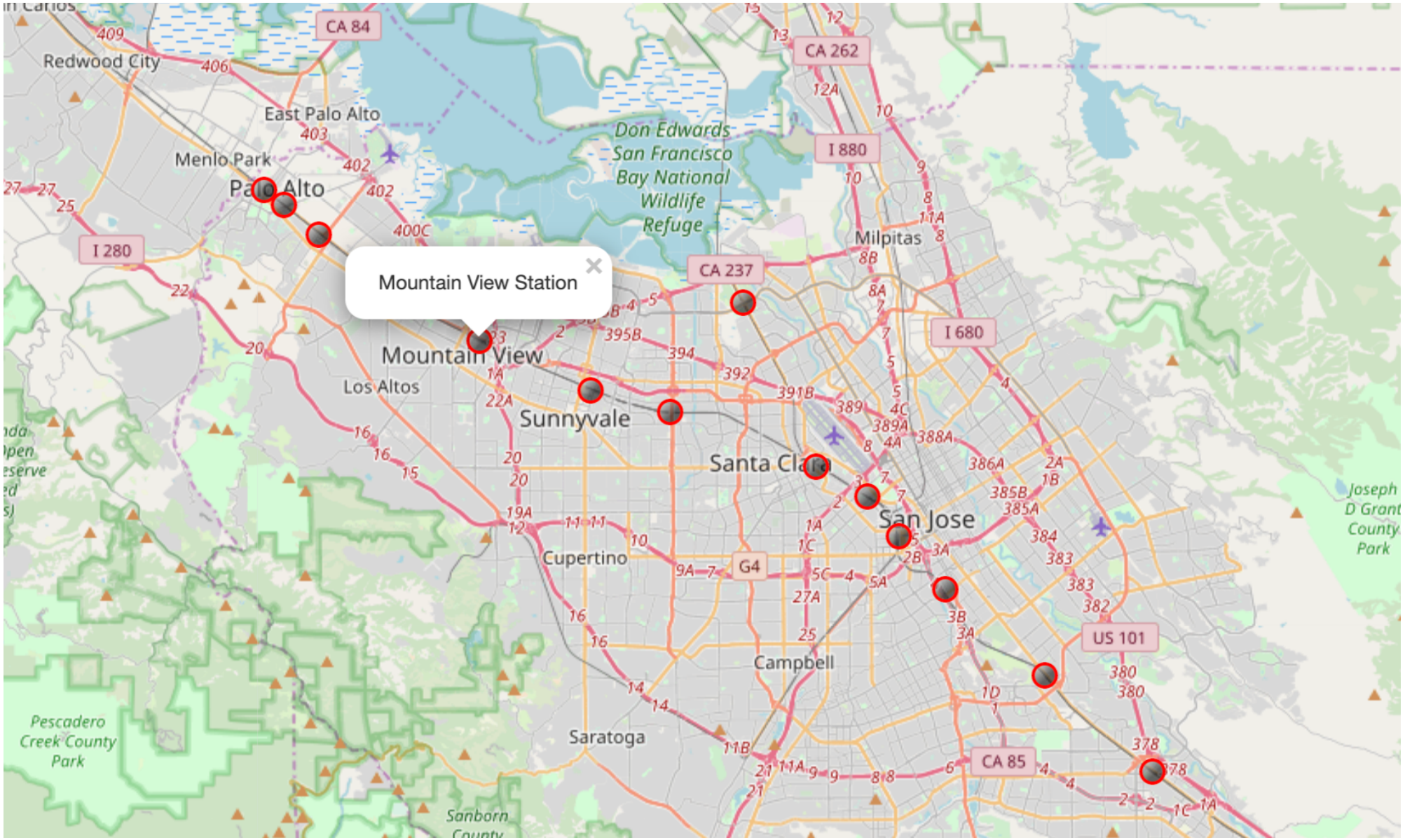
Schools in Santa Clara County



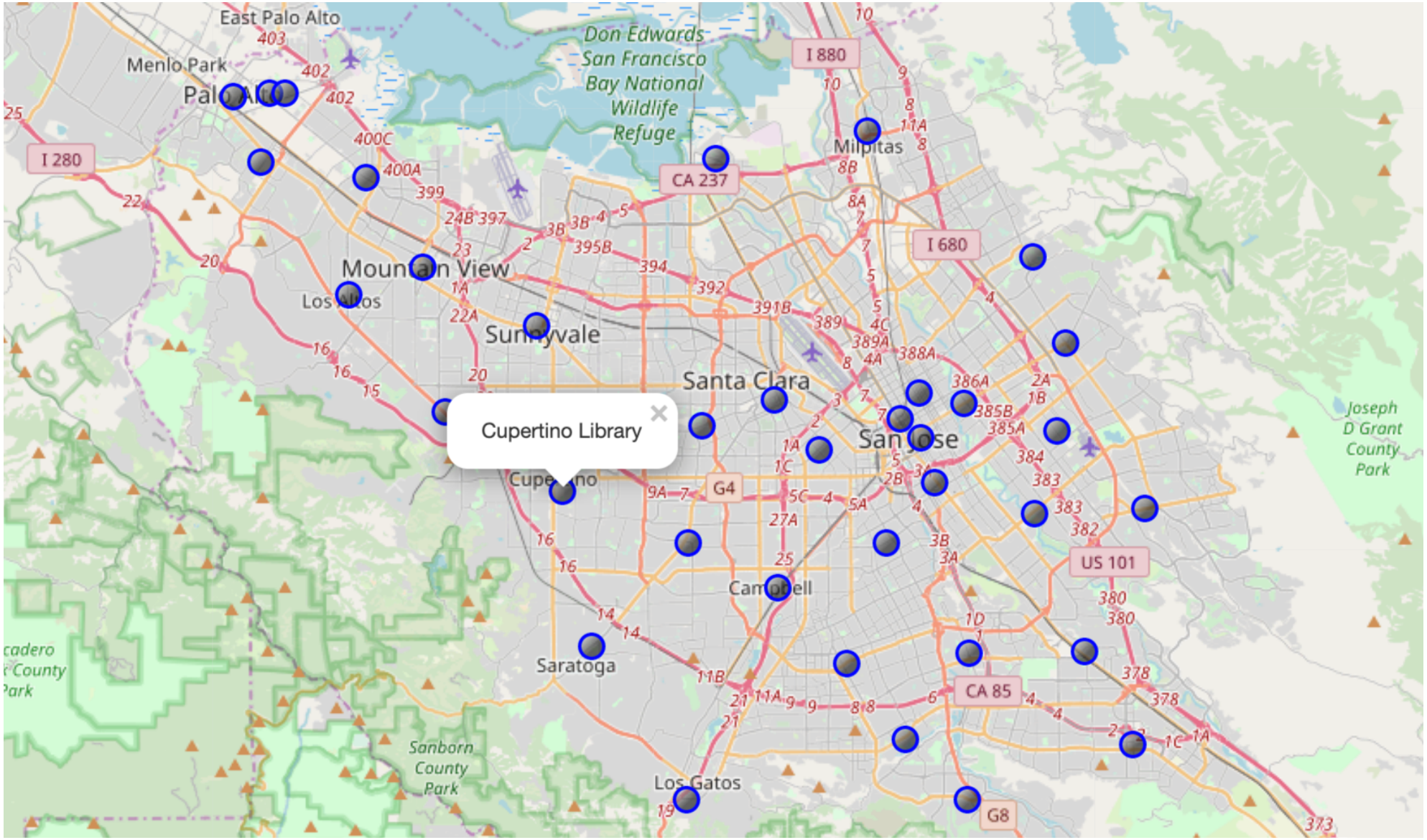
Parks in Santa Clara County



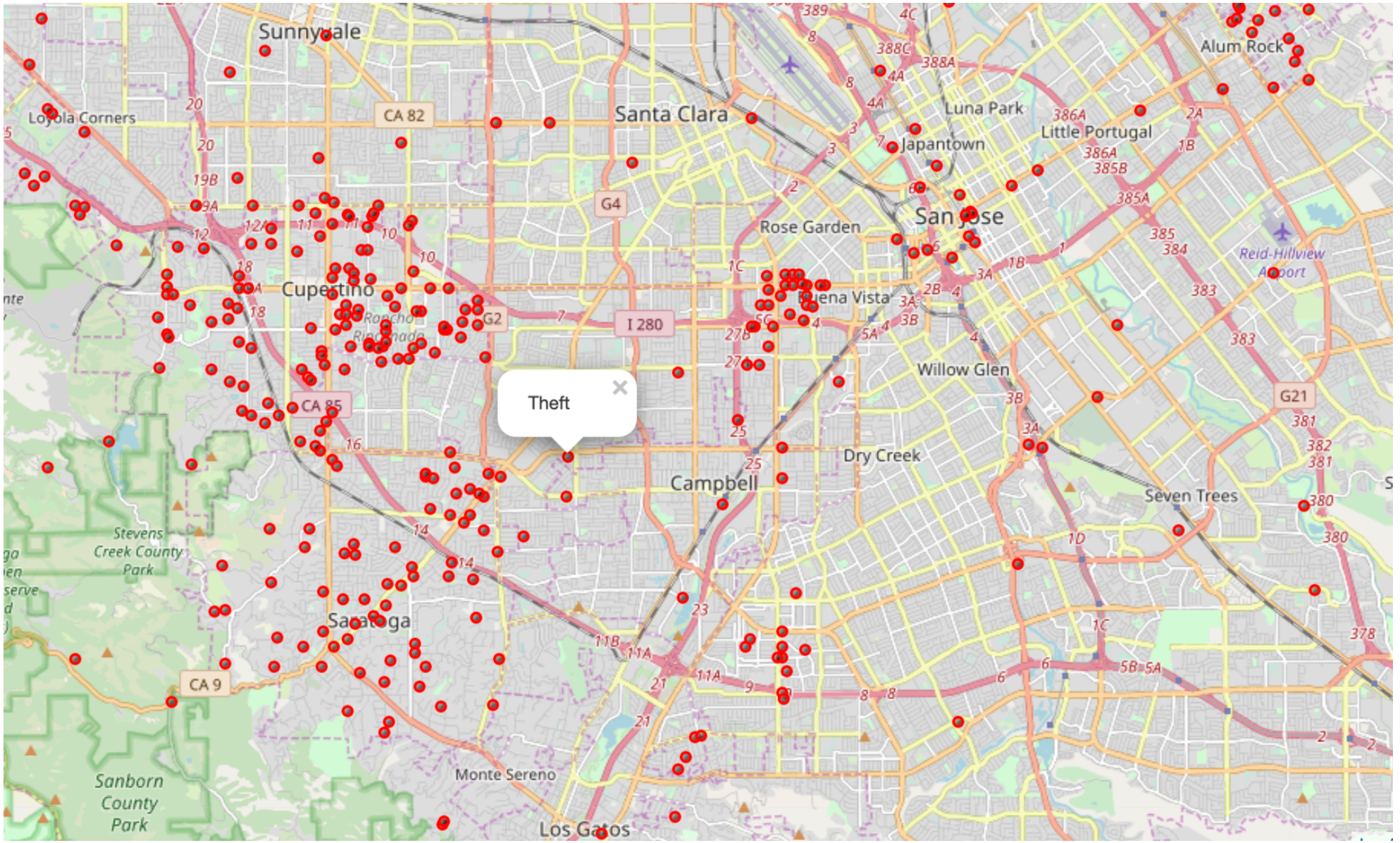
Railroad Stations in Santa Clara County



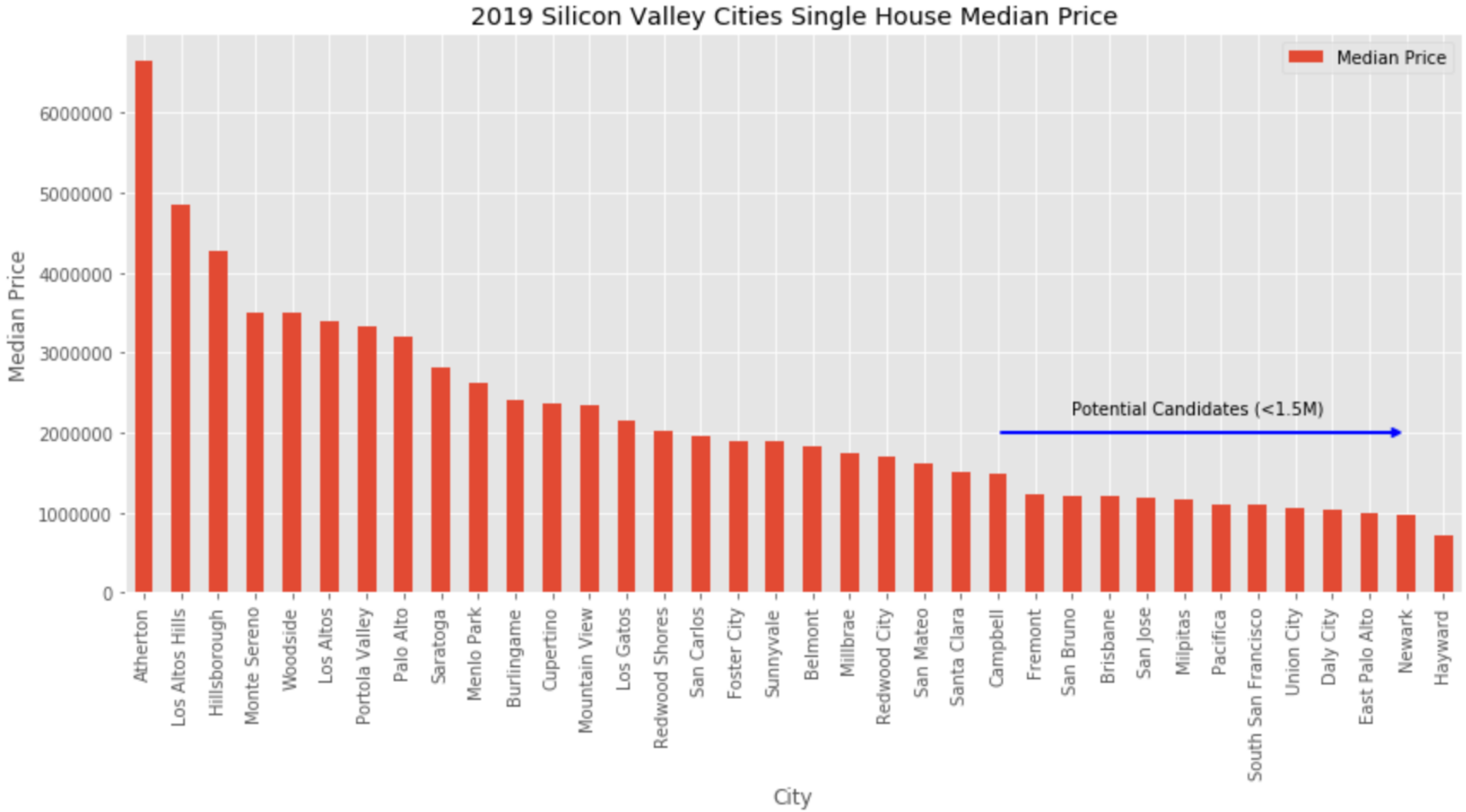
Public Libraries in Santa Clara County



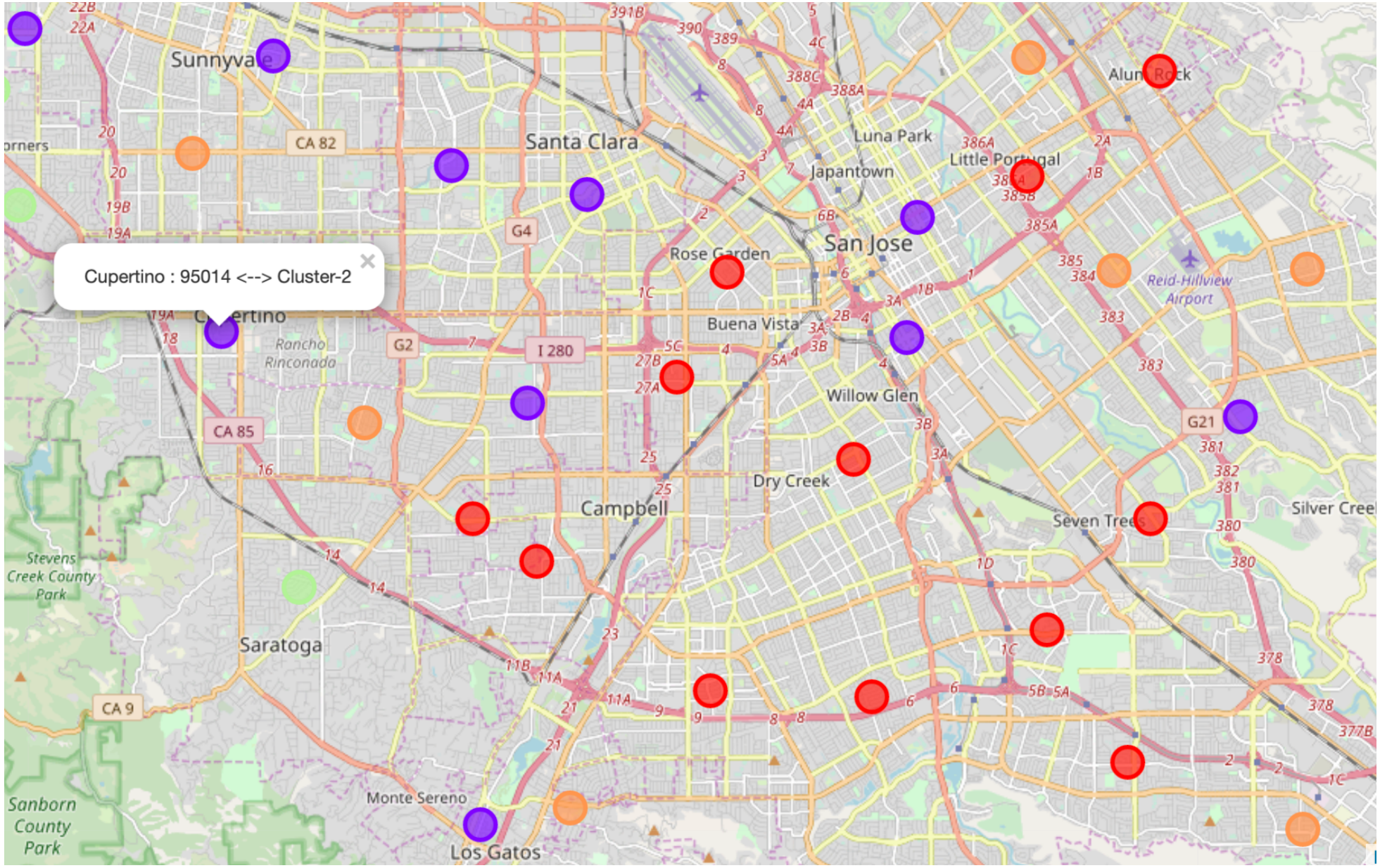
Crime Reports in Santa Clara County



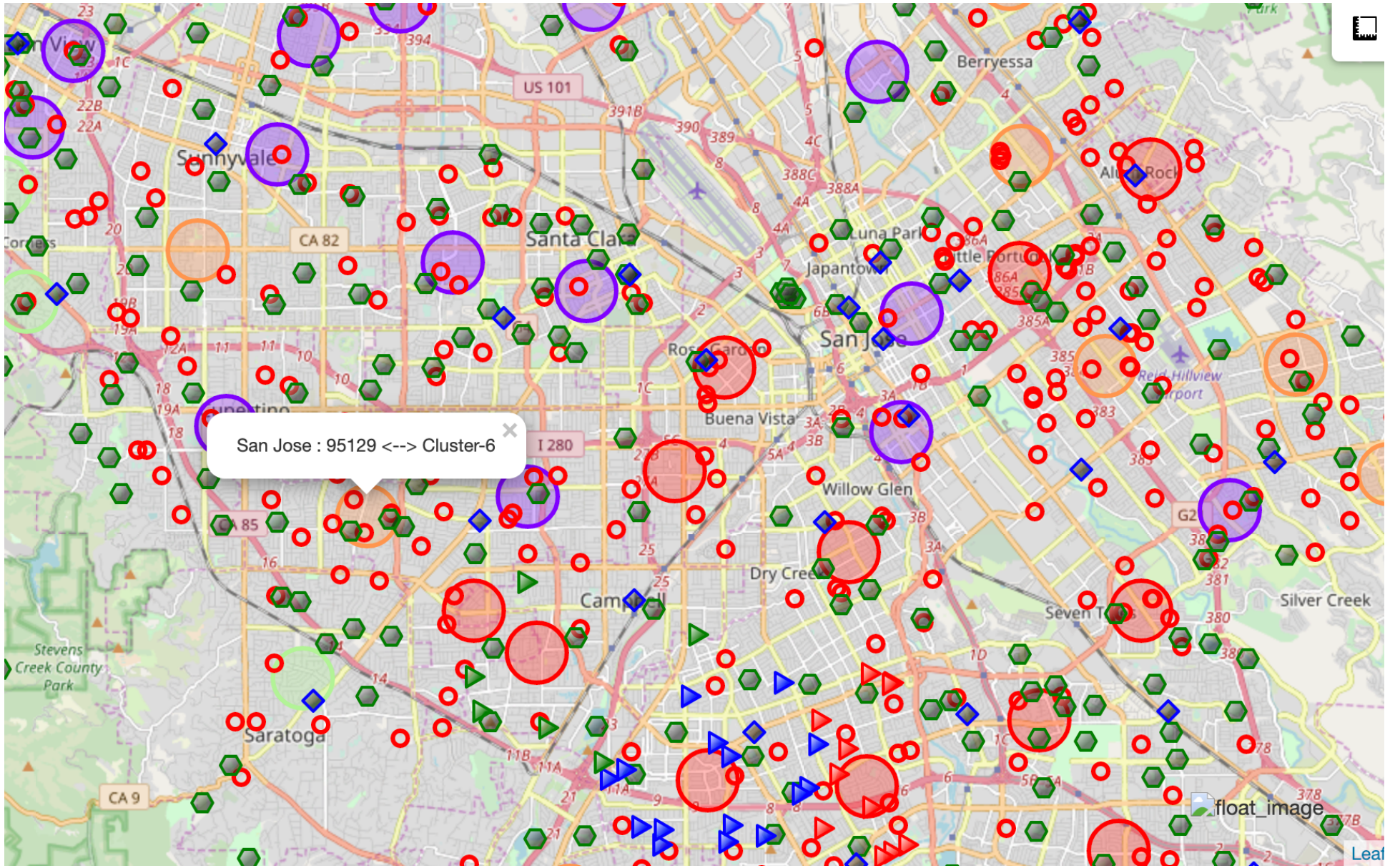
Median Prices For Silicon Valley Cities



Clustering Cities/Zipcodes



Consolidated Map of Santa Clara county with schools, parks, libraries and cluster of cities



4.0 Results Section

4.1 Problem Resolution:
The amenities in the selected neighborhood shall be similar to his current residence apartment

Solution:

My client lives in 95129 which is cluster-1 (label starts from 0) on the map. Therefore, the candidate cities/zipcodes should come from the same cluster. The number of candidate zipcodes is going down from 53 to 14 (Number will be different based on clustering result).

4.2 Problem Resolution:
The price of house for sales is under 1.5M

Solution:

There are only two cities remained (Campbell and San Jose) if we consider the affordable prices and the location (Gilroy and Morgan Hill are too far away from my client's current resident 95129). The number of candidate zipcodes goes down to 10 (Number will be different based on clustering result)

4.3 Problem Resolution:
Not too close to the railroad (at least 3 mile away)

Solution:

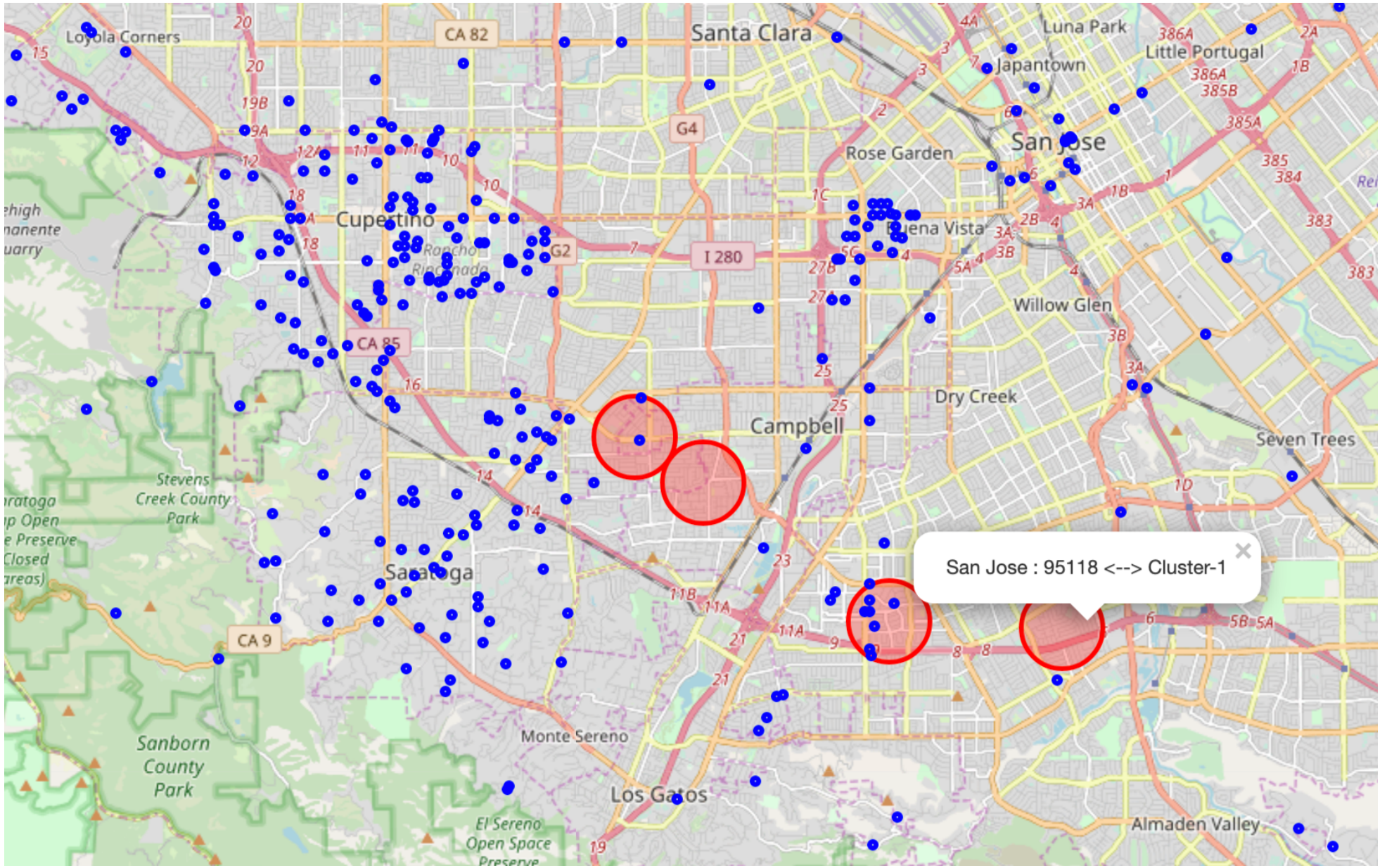
When we consider at least 3 mile away from railroad, the candidate zipcodes will be reduced to 4 (Number will be different based on clustering result). That is a lot easier when making the final decision

4.4 Problem Resolution:
The neighborhood/community should be safe and have low crime rate

Solution:

We display the crime locations and the final candidate zipcodes on the same map. It is quite obvious that only 95008, 95118 (95124 is okay too) have very low crime/theft incidents.

Crime/Theft locations and final candidate zipcodes (95008, 95118, 95124, 95130)



4.5 Problem Resolution:

1) Near the school (within 0.5 mile)
2) The schools in the area should have high rating (Ranking greater and equal than 8)

Solution:

My client can use the average school rating to select the location of his potential home. The average schools ratings are:

95129 --- 9.7

95008 --- 6.0

95118 --- 7.6

95124 --- 9.1

4.6 Problem Resolution:

1) Near the park (within 0.5 mile)
2) Near the library (within 1 mile))

Solution:

My client can use the location data (latitude and longitude) of the library when making buying decision. The parks do not have zip code associated with them. However, we can use their latitude and longitude to know the distances from the candidate houses.

4.7 Problem Resolution:

House must be at least 3 bedrooms, 2 bathrooms, 1 car garage, around 1800 to 2100 square footage of size

Solution:

Follow section 3.14 Recent Sold House Price Data and 3.15 Use Zillow API to get some house features from Zillow real estate database, we can obtain the recent sold houses information. Those information can then be used when negotiating the deal with the seller

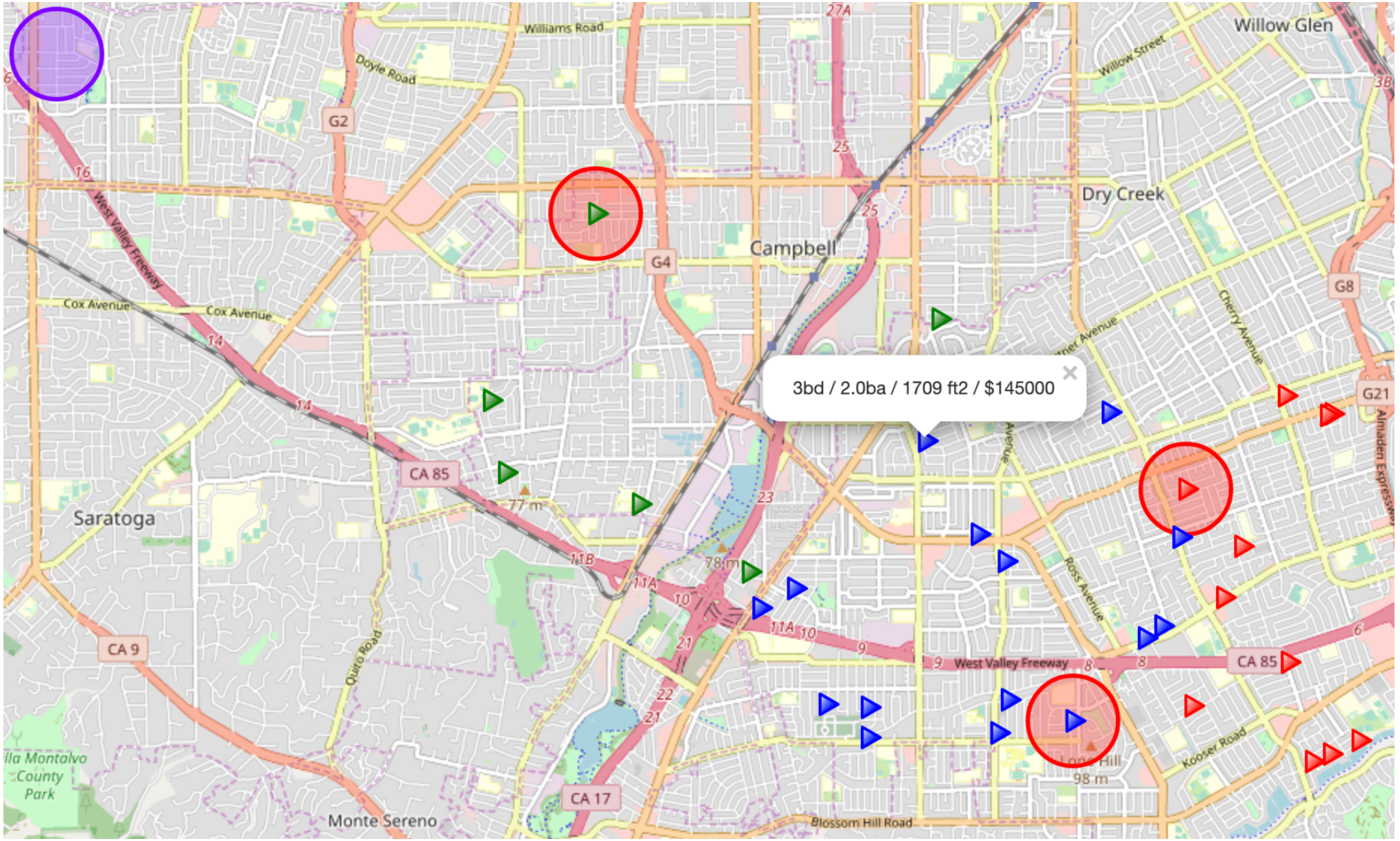
4.8 Problem Resolution:

1) The amenities in the selected neighborhood shall be similar to his current residence apartment
2) The location is near the supermarket (within 0.5 mile radius)
3) The location is near the shopping mall (within 3 mile radius),
4) The location is close (within 1 mile) to venues such as restaurants (Asian and Mexican foods ...etc.), parks and coffee shops ...

Solution:

Refer to section 3.11 Explore Cities in Santa Clara County, section 3.12 Analyze Each Neighborhood and section 3.13 Clustering Cities/Zipcodes, we can run the Foursquare on three final dream home candidates (simulated by picking from recent sold houses; one for each zipcode; 95008, 95118, 95124) and current living apartment in 95129. The result will be able to address above requirements.

Recent Sold Houses in 95008 (Green), 95118 (Red), 95124 (Blue)



4.9 House Selection:

The visualization maps and data analysis above will enable my clients to explore more options for his dream home hunting journey.
After examining all the alternatives, my client decide to buy a house at 95124 zip code area. Following is the summary ratings of each zip code:

Zip Code	Price	Crime Rate	School Rank	Park	Library	Railroad	Venues Favors
95129	1.9M	Low	9.7	Good	Good	Good	Good
95008	1.4M	Low	6.0	Good	Good	Fair	Fair
95118	1.4M	Low	7.6	Good	Good	Good	Fair
95124	1.5M	Low	9.1	Good	Good	Good	Good

So, what should my client do next? He can either go to hire a Real Estate broker or surfing homes for sale websites as below links:

* https://www.zillow.com/
* http://julianalee.com/real-estate/#homes-for-sale

5.0 Discussion Section

- **The visualization maps and data analysis in section 3 and 4 will enable my clients to explore more options on his dream home hunting journey. I know it is hard and somehow frustrated when decide to buy a house especially in the Silicon Valley. However, if you have no time and not really know what exactly you should be looking for, then this capstone project might help.**
- **By the way, I encounter the mod_security issue when I used BeautifulSoup webscraping tools. Well, the real estate website hosting company is blocking some kind of requests to their servers (where your site is located). The whole mod_security Apache module is disabled for my site. There is no other ways around it and I have to manually handle some house sales data.**
- **The Zillow API is quite useful. However, the most recent sales information may not be accessed via API. I can understand that Zillow may want to protect their valuable data. But, I may not use that API again if someone provide me more open one.**
- **The kclusters (number of cluster) selection is tricky when using KMeans for the clustering analysis. The search radius (default is 500m) is also essential if you don't have a rough idea about the city. Sometimes, the result looks weird so you have to be patient and trying different combinations.**
- **The Foursquare API has a limit of 950 Regular API Calls per day and 50 Premium API Calls per day for Sandbox Tier Accounts.**
- **In general, I am quite impressed with the overall organization, content and lab works presented during the Coursera IBM Certification Course. I feel this Capstone project presented me a great opportunity to practice and apply the Data Science tools and methodologies learned. I will present the result of my study to my client. Of course, I would like to see this can help him to find his dream home in the coming months.**

6.0 Conclusion Section

- This project has shown me a practical application to resolve a real situation that gives me the intention to use Data Science tools.
- The Folium is a powerful tool for data visualization which makes the analysis and decision making a lot easier. The FourSquare API is by all means a super tool to obtain all kinds of data based on the location. The ZillowAPI is good as long as you are not accessing to their protected data. The BeautifulSoup is terrific since webscraping is somehow exciting and it helps you to find your own treasure. I enjoy using all those tools.