

Capstone Assignment Presentation

Restaurant location scouting in Mumbai

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Business Problem



- For our business problem, we will take up the case of an entrepreneur who wants to start a new restaurant
- Since, restaurants have a high failure rate and is generally a competitive sector, he needs some insight while deciding the location of the restaurant
- In particular, he wants to avoid competition and open the restaurant in an 'untapped' location
- Next, we will look at some facts about the city of Mumbai that might aid us in our analysis

Business Problem

- Mumbai is India's second largest city and its financial capital
- The city is home to around 12 million people and continues to attract thousands of migrants from rest of the country, thereby earning the moniker 'City of Dreams'
- The backbone of the city is indubitably its railway network, called the Mumbai Suburban Railway
- The network consists of 6 lines and has an average daily ridership of around 7 million
- The daily lives of the people in Mumbai heavily depends on the functioning of the railway network
- This presents multiple business opportunities for entrepreneurs who can look to set up different outlets around the railway stations in order to cater to the millions of commuters that travel daily

Mumbai Metropolitan Region Rail Map

Suburban Trains

- Central
- Western
- Harbour
- Trans-Harbour
- Nerul – Uran

Mumbai Monorail

- Mumbai Monorail

Mumbai Metro

- Line 1
- Line 2
- Line 3
- Line 4
- Line 5

Navi Mumbai Metro

- Line 1

Map Key

- fast train / slow train
- all trains stop
- only some fast trains stop
- only slow trains stop
- indirect or walking connection
- direct interchange
- line in construction



Business Problem

The entrepreneur decides on a few categories that will help him in narrowing down the list of potential locations:

1. The restaurant needs to be located near the stations on the Western line of the railway network. This is because of the higher ridership on the line compared to other lines
2. The restaurant needs to be located within the Mumbai city only, and not the adjoining suburban regions. For this purpose, he will only consider locations south of Borivali (refer map above)
3. The restaurant should be within the walkable distance of the station. Therefore, locations within 500m of the station will be considered
4. The restaurant will serve Indian cuisine, Chinese cuisine, and also provide some fast food snacks
5. And finally, it would be ideal if the restaurant did not have any competing restaurants nearby, since they would also be vying for the same customers and will drive down his business

Data

- The data required for this exercise will be pretty trivial. We will use Foursquare data in conjunction with the list of the stations on the Western Line.
- To obtain the list of the stations we will utilize this [Wikipedia link](#) to get the list of stations. Once we get that, we can use the Foursquare API to request data for different venues around the station within a 500m radius.
- As for the tools used in Python, we installed the following libraries:
 - Numpy
 - Pandas
 - Requests
 - BeautifulSoup
 - Geocoder
 - Folium

Methodology



- To find out the ideal location and which locations to avoid, we will need to follow a number of steps, which are:
 - Webscraping
 - Geocoding
 - Foursquare API call
 - Heatmap visualization
- **Webscraping** will be done on the Wikipedia page linked earlier
- **Geocoding** will be done using the Geopy library and Nominatim
- **Heatmap Visualization** will be done using Folium

Webscraping

- We will be relying on the Wikipedia page to get a list of train stations on the suburban railway network
- We will use the BeautifulSoup library for properly scraping the relevant data and transforming it into a presentable format
- As mentioned earlier, we will limit our analysis to Western line only

No.	Station Name		Station Code	Line	Fast train stop ^[a]	Long Distance ^[b]	Notes
	English	Marathi					
1	Airoli	ऐरोली		Trans-Harbour Line	✗	✓	
2	Aman Lodge	अमन लॉज		Central Line	✗	✓	
3	Ambernath	अंबरनाथ	A	Central Line	✓	✓	
4	Ambivli	आंबिवली		Central Line	✗	✓	
5	Andheri	अंधेरी	A/AD	Western Line Harbour Line Line 1 (Mumbai Metro)	✓	✓	
6	Apta	आपटा		Harbour Line	✗	✓	
7	Asangaon	आसनगांव	AN	Central Line	✓	✓	
8	Atgaon	आटगांव		Central Line	✗	✓	
9	Badlapur	बदलापूर	BL	Central Line	✓	✓	
10	Bamandongri	बामणडोंगरी		Nerul–Uran line	✗	✓	
11	Bandra	वांद्रे	B	Western Line Harbour Line	✓	✗	
12	Bhandup	भांडुप		Central Line	✓	✗	
13	Bhayandar	भाईंदर	BY	Western Line	✓	✓	
14	Bhivpuri Road	भिवपुरी रोड		Central Line	✗	✓	
15	Bhiwandi Road	भिवंडी रोड		Central Line	✗	✓	
16	Boisar	बोईसर		Western Line	✗	✓	
17	Borivali	बोरिवली	BO	Western Line Harbour Line (under construction)	✓	✗	
18	Byculla	भायखळा		Central Line	✓	✗	
19	CBD Belapur	सीबीडी बेलापूर	BR	Harbour Line	✗	✓	

Station Name		Line
0	Airoli	Trans-Harbour Line
1	Aman Lodge	Central Line
2	Ambernath	Central Line
3	Ambivli	Central Line
4	Andheri	Western LineHarbour LineLine 1 (Mumbai Metro)
...
141	Nhava Sheva	Nerul–Uran line
142	Ranjanpada	Nerul–Uran line
143	Sagar Sangam	Nerul–Uran line
144	Targhar	Nerul–Uran line
145	Uran City	Nerul–Uran line

146 rows × 2 columns



Station Name	
0	Andheri Station
1	Bandra Station
2	Bhayandar Station
3	Boisar Station
4	Borivali Station
5	Charni Road Station
6	Churchgate Station
7	Dadar Station
8	Dahanu Road Station
9	Dahisar Station
10	Goregaon Station
11	Grant Road Station
12	Jogeshwari Station
13	Kandivali Station
14	Kelve Road Station
15	Khar Road Station
16	Lower Parel Station
17	Mahalaxmi Station
18	Mohim Junction Station

Geocoding

- To geocode the stations, we will use the geopy and the geocoder libraries in conjunction with the Nominatim package
- This step is pretty simple and we simply pass in the station names to the function and get the coordinate data as output
- Certain stations had incorrect coordinate data as they had common names which were found in multiple countries
- Get the correct data by typing in the full name of the station

	Station Name
0	Andheri Station
1	Bandra Station
2	Bhayandar Station
3	Boisar Station
4	Borivali Station
5	Charni Road Station
6	Churchgate Station
7	Dadar Station
8	Dahanu Road Station
9	Dahisar Station
10	Goregaon Station
11	Grant Road Station
12	Jogeshwari Station
13	Kandivali Station
14	Kelve Road Station
15	Khar Road Station
16	Lower Parel Station
17	Mahalaxmi Station
18	Mahim Junction Station

Geocoding

	Station Name	Latitude	Longitude
0	Andheri Station	19.119698	72.846420
1	Bandra Station	19.054928	72.840592
2	Bhayandar Station	19.310268	72.853097
3	Boisar Station	19.786338	72.792580
4	Borivali Station	19.229068	72.857363
5	Charni Road Station	18.952456	72.817440
6	Churchgate Station	18.935957	72.827340
7	Dadar Station	19.019282	72.842876
8	Dahanu Road Station	19.991524	72.743408
9	Dahisar Station	19.249450	72.859621
10	Goregaon Station	19.164772	72.850899
11	Grant Road Station	18.962733	72.816039
12	Jogeshwari Station	19.134899	72.848820
13	Kandivali Station	19.204159	72.851682
14	Kelve Road Station	19.624053	72.791175
15	Khar Road Station	19.069658	72.839894
16	Lower Parel Station	18.996332	72.830860
17	Mahalaxmi Station	27.632457	85.379321
18	Mahim Junction Station	19.040000	72.840000

Foursquare API call

- Requires us to supply our client credentials and the list of coordinates from previous dataframe for constructing the API call to Foursquare
- For our purpose, we will explore 100 venues within a 500m radius of the stations
- Once we make the API call and get the data, we convert it onto a presentable dataframe that looks like below

Station Name	
0	Andheri Station
1	Bandra Station
2	Bhayandar Station
3	Boisar Station
4	Borivali Station
5	Charni Road Station
6	Churchgate Station
7	Dadar Station
8	Dahanu Road Station
9	Dahisar Station
10	Goregaon Station
11	Grant Road Station
12	Jogeshwari Station
13	Kandivali Station
14	Kelve Road Station
15	Khar Road Station
16	Lower Parel Station
17	Mahalaxmi Station
18	Mahim Junction Station



	Station	Station Latitude	Station Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Andheri Station	19.119698	72.846420	Merwans Cake shop	19.119300	72.845418	Bakery
1	Andheri Station	19.119698	72.846420	Narayan Sandwich	19.121398	72.850270	Sandwich Place
2	Andheri Station	19.119698	72.846420	McDonald's	19.119691	72.846102	Fast Food Restaurant
3	Andheri Station	19.119698	72.846420	Cafe Alfa	19.119667	72.843560	Indian Restaurant
4	Andheri Station	19.119698	72.846420	Vaibhav Restaurant	19.118235	72.847991	Indian Restaurant
...
361	Virar Station	19.382668	72.832025	Celebrity Hotel	19.382698	72.828143	Indian Restaurant
362	Virar Station	19.382668	72.832025	Kraft Bakery	19.382571	72.829485	Bakery
363	Virar Station	19.382668	72.832025	Woodland	19.380517	72.829270	Clothing Store
364	Virar Station	19.382668	72.832025	Globalnet Computers	19.381249	72.827964	Electronics Store
365	Virar Station	19.382668	72.832025	Sheetal Juice Centre	19.380322	72.828241	Juice Bar

366 rows × 7 columns

	Station	Station Latitude	Station Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Andheri Station	19.119698	72.846420	Merwans Cake shop	19.119300	72.845418	Bakery
1	Andheri Station	19.119698	72.846420	Narayan Sandwich	19.121398	72.850270	Sandwich Place
2	Andheri Station	19.119698	72.846420	McDonald's	19.119691	72.846102	Fast Food Restaurant
3	Andheri Station	19.119698	72.846420	Cafe Alfa	19.119667	72.843560	Indian Restaurant
4	Andheri Station	19.119698	72.846420	Vaibhav Restaurant	19.118235	72.847991	Indian Restaurant
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363	Virar Station	19.382668	72.832025	Woodland	19.380517	72.829270	Clothing Store
364	Virar Station	19.382668	72.832025	Globalnet Computers	19.381249	72.827964	Electronics Store
365	Virar Station	19.382668	72.832025	Sheetal Juice Centre	19.380322	72.828241	Juice Bar

366 rows × 7 columns

Exploring unique categories



```

: all_venues['Venue Category'].unique()
: array(['Bakery', 'Sandwich Place', 'Fast Food Restaurant',
        'Indian Restaurant', 'Restaurant', 'Food Court', 'Platform',
        'Café', 'Convenience Store', 'Train Station', 'Design Studio',
        'Italian Restaurant', 'Paper / Office Supplies Store', 'Brewery',
        'Punjabi Restaurant', 'Pier', 'Pub', 'Lake', 'Ice Cream Shop',
        'Food Truck', 'Bike Rental / Bike Share', 'Pizza Place',
        'Department Store', 'Chinese Restaurant', 'Clothing Store',
        'Burger Joint', 'Snack Place', 'Liquor Store', 'Juice Bar',
        'Harbor / Marina', 'Breakfast Spot', 'Beach', 'Gastropub',
        'Opera House', 'Indie Movie Theater',
        'Multicuisine Indian Restaurant', 'Asian Restaurant',
        'Coffee Shop', 'Gym', 'Grocery Store', 'Aquarium', 'Theater',
        'Music Venue', 'Cricket Ground', 'College Academic Building',
        'General Entertainment', 'Hotel', 'Gym / Fitness Center', 'Lounge',
        'Donut Shop', 'Hockey Arena', 'Japanese Restaurant', 'Flea Market',
        'Movie Theater', 'Athletics & Sports', 'Bar',
        'Cantonese Restaurant', 'Karaoke Bar', 'Women's Store',
        'Flower Shop', 'Vegetarian / Vegan Restaurant',
        'Maharashtrian Restaurant', 'Shopping Mall', 'Plaza',
        'Farmers Market', 'Mobile Phone Shop', 'Seafood Restaurant',
        'Bookstore', 'Electronics Store', 'Deli / Bodega', 'Bank',
        'Middle Eastern Restaurant', 'Mughlai Restaurant', 'Wine Shop',
        'Dessert Shop', 'Men's Store', 'Food', 'Playground',
        'Miscellaneous Shop', 'Park', 'Hookah Bar', 'Beer Bar',
        'Nightclub', 'Beer Garden', 'Amphitheater',
        'College Technology Building', 'Bengali Restaurant',
        'Recreation Center', 'Mediterranean Restaurant',
        'Indoor Play Area', 'Office', 'Thai Restaurant', 'Gas Station',
        'Post Office', 'American Restaurant', 'Waterfront', 'Bridal Shop',
        'Yoga Studio', 'South Indian Restaurant', 'Market', 'Concert Hall',
        'Furniture / Home Store', 'Smoke Shop', 'Bus Station',
        'Falafel Restaurant', 'Multiplex', 'Tea Room'], dtype=object)

```


	Station	Station Latitude	Station Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Andheri Station	19.119698	72.846420	Merwans Cake shop	19.119300	72.845418	Bakery
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361	Virar Station	19.382668	72.832025	Celebrity Hotel	19.382698	72.828143	Indian Restaurant
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364	Virar Station	19.382668	72.832025	Globalnet Computers	19.381249	72.827964	Electronics Store
365	Virar Station	19.382668	72.832025	Sheetal Juice Centre	19.380322	72.828241	Juice Bar

366 rows × 7 columns

Creating a dataframe of 10 common venues for each station

	Station	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	Andheri Station	Indian Restaurant	Fast Food Restaurant	Restaurant	Food Court	Sandwich Place	Bakery	Café	Platform	Falafel Restaurant	Electronics Store
1	Bandra Station	Indian Restaurant	Café	Paper / Office Supplies Store	Brewery	Platform	Pier	Italian Restaurant	Pub	Convenience Store	Design Studio
2	Bhayandar Station	Ice Cream Shop	Bakery	Bike Rental / Bike Share	Food Truck	Train Station	Lake	Pizza Place	Farmers Market	Falafel Restaurant	Electronics Store
3	Borivali Station	Ice Cream Shop	Clothing Store	Chinese Restaurant	Restaurant	Café	Department Store	Burger Joint	Liquor Store	Food Truck	Snack Place
4	Charni Road Station	Indian Restaurant	Juice Bar	Ice Cream Shop	Restaurant	Harbor / Marina	Coffee Shop	Café	Opera House	Music Venue	Multicuisine Indian Restaurant
5	Churchgate Station	Indian Restaurant	Hotel	Ice Cream Shop	Cricket Ground	Fast Food Restaurant	Train Station	Movie Theater	Café	Cantonese Restaurant	Chinese Restaurant
6	Dadar Station	Indian Restaurant	Fast Food Restaurant	Movie Theater	Coffee Shop	Café	Flea Market	Maharashtrian Restaurant	Lounge	Plaza	Farmers Market
7	Dahanu Road Station	Train Station	Mobile Phone Shop	Fast Food Restaurant	Yoga Studio	Flea Market	Cricket Ground	Deli / Bodega	Department Store	Design Studio	Dessert Shop
8	Dahisar Station	Restaurant	Indian Restaurant	Train Station	Pizza Place	Café	Yoga Studio	Fast Food Restaurant	Cricket Ground	Deli / Bodega	Department Store
9	Goregaon Station	Indian Restaurant	Fast Food Restaurant	Bar	Design Studio	Seafood Restaurant	Café	Snack Place	Bookstore	Mobile Phone Shop	Vegetarian / Vegan Restaurant
10	Grant Road Station	Indian Restaurant	Chinese Restaurant	Electronics Store	Hotel	Food Truck	Department Store	Clothing Store	Middle Eastern Restaurant	Farmers Market	Fast Food Restaurant
11	Jogeshwari Station	Asian Restaurant	Indian Restaurant	Mughlai Restaurant	Pizza Place	Yoga Studio	Flea Market	Deli / Bodega	Department Store	Design Studio	Dessert Shop
12	Kandivali Station	Indian Restaurant	Train Station	Snack Place	Playground	Platform	Fast Food Restaurant	Dessert Shop	Food	Park	Breakfast Spot
13	Kelve Road	Train Station	Platform	Yoga Studio	Fast Food	Convenience	Cricket	Deli / Bodega	Department	Design Studio	Dessert

Heatmap Visualization using Folium

- Once we have our dataframe, we will filter for Indian cuisine, Chinese cuisine and fast foods
- Next, we will start plotting using Folium
- First, we map the stations on a map of Mumbai
- Then we draw a radius of 500 metres around each station (Fig A on next slide)
- Then we get our filtered dataframe and input that using the Heatmap library in Folium
- This will show the relative concentrations of our competing restaurants around each station
- This layer is then added on top of the previously created map (Fig B on next slide)

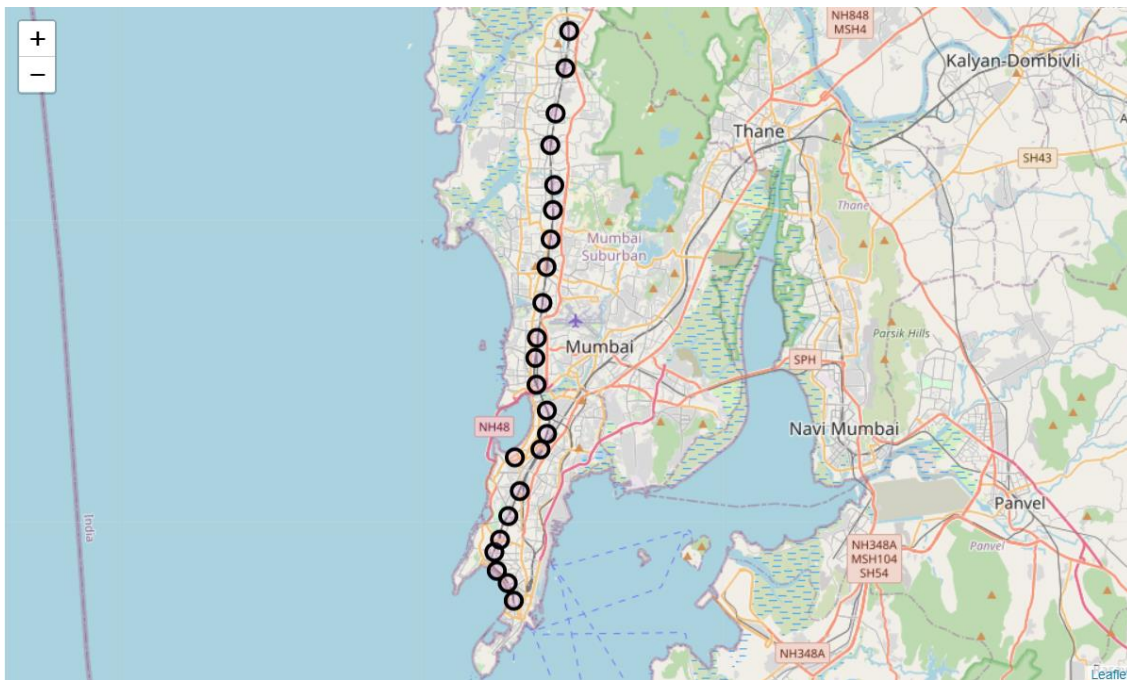


Fig A

Plotting a map of stations and a 500 metre radius around them, then adding relative concentrations of competing restaurants using heatmap

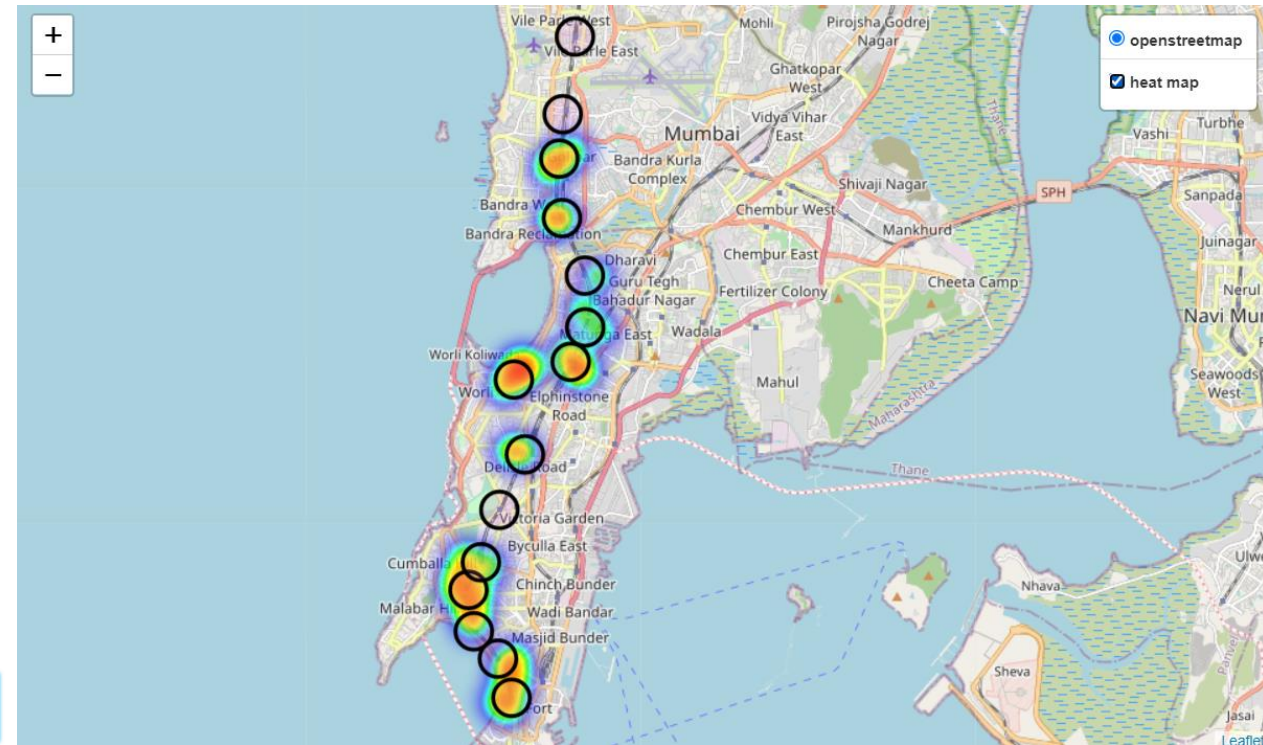
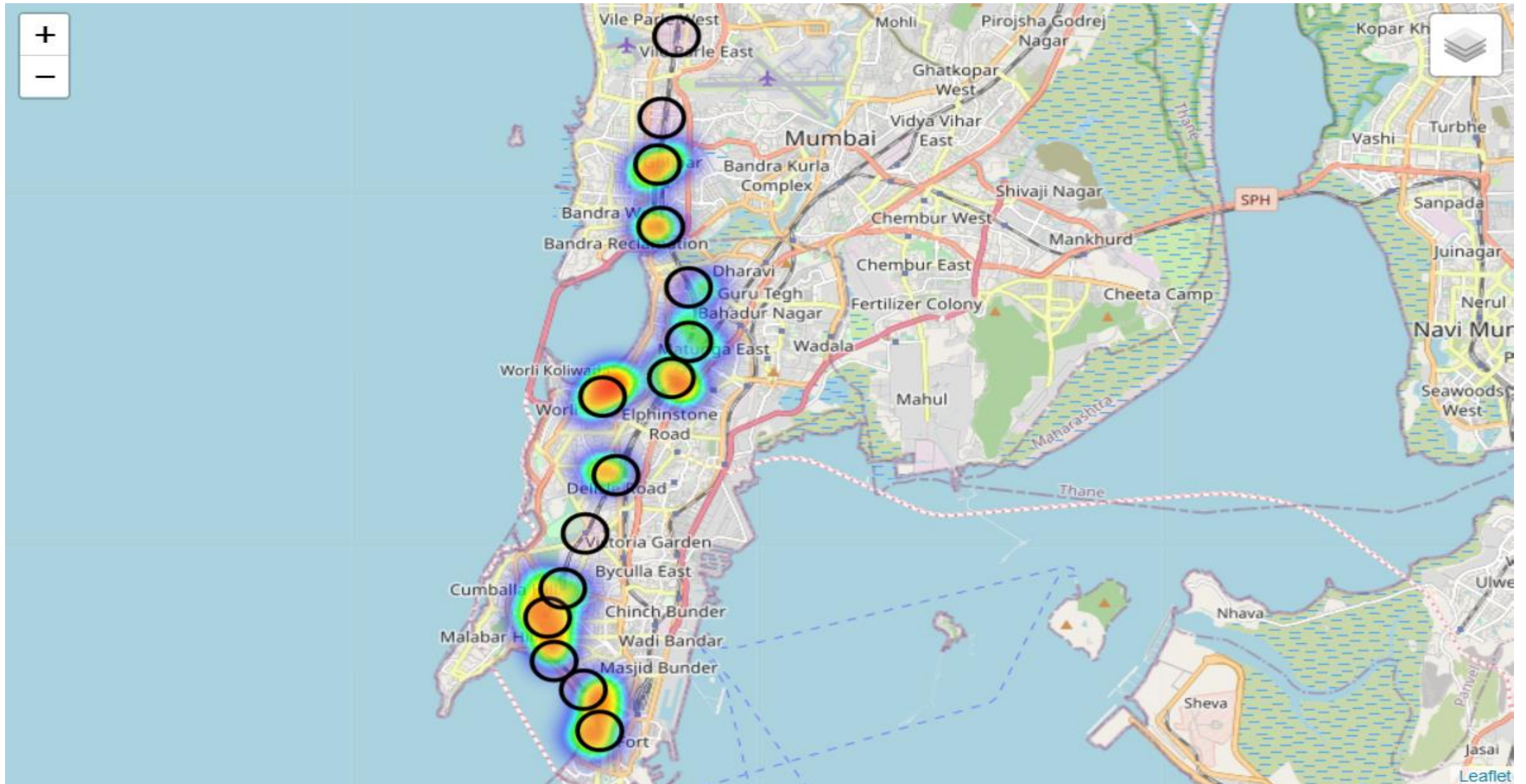


Fig B



Results & Discussion



- The map rendered above should give us a quick visual idea of which stations are ideal locations for setting up our restaurant
- More notably, it also gives us the locations which we should avoid while setting up our restaurant as these are already saturated
- We will discuss some promising locations in this section and explore these in a bit more detail

Results & Discussion

- Starting from the southern end of the line, Mahalaxmi looks like a good candidate. However, we will not include this as Foursquare does not have venue data for this location
- Moving northwards, Matunga Road looks like a promising candidate
- Further north, we see Santacruz, Vile Parle, Ram Mandir as locations with very few competing restaurants
- Finally, we end our analysis with Malad
- As noted earlier, we are limiting our analysis to the city proper limits. Hence, stations north of Borivali are not considered

	Station	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
17	Malad Station	American Restaurant	Pizza Place	Gas Station	Bar	Post Office	Burger Joint	Farmers Market	Cricket Ground	Deli / Bodega	Department Store
19	Matunga Road Station	Train Station	Department Store	Indian Restaurant	Gym	Bar	Market	Concert Hall	Sandwich Place	South Indian Restaurant	Chinese Restaurant
22	Ram Mandir Station	Indian Restaurant	Café	Chinese Restaurant	Bakery	Electronics Store	Yoga Studio	Falafel Restaurant	Mobile Phone Shop	Coffee Shop	Dessert Shop
23	Santacruz Station	Train Station	Multiplex	Tea Room	Yoga Studio	Flea Market	Cricket Ground	Deli / Bodega	Department Store	Design Studio	Dessert Shop
26	Vile Parle Station	Fast Food Restaurant	Yoga Studio	Concert Hall	Cricket Ground	Deli / Bodega	Department Store	Design Studio	Dessert Shop	Donut Shop	Electronics Store

Note: Ram Mandir and Vile Parle have competing restaurants as their most common venue type. We can therefore remove these from our initial list of locations as well

Conclusion



- We started with a premise of finding suitable locations for our new restaurant
- We came up with certain assumptions and based on those, looked for ideal locations
- Leveraging Foursquare API and the Folium library, we did manage to find suitable locations
- This was a very simple analysis, but it did act as a great starting point

Conclusion

- We could have used even more complex criteria to scout for locations, such as:
 - Real Estate prices
 - Building regulations
 - Zoning requirements
 - Median income level of neighborhood
 - Utility charges in the neighborhood
 - Supply chain logistics, etc.
- As a starting point, this analysis helped us to narrow down potential locations and allow a starting point from which more complex analysis could be done
- Much of this code and the resulting analysis can be reused in different modules that aim to do more complex analysis

Thank you