

# Location feasibility study for opening

## Old Age Home in Mumbai City

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# 1. Introduction

## a. Background

Mumbai (also known as Bombay, the official name until 1995) is the capital city of the Indian state of Maharashtra. According to United Nations, as of 2018, Mumbai was the second-most populous city in India after Delhi and the seventh-most populous city in the world with a population of roughly 20 million.[1]

According to Population Census 2011 there are nearly 104 million elderly persons (aged 60 years or above) in India; 53 million females and 51 million males. A report released by the United Nations Population Fund and HelpAge India suggests that the number of elderly persons is expected to grow to 173 million by 2026.[2]

So for this project, I thought of identifying affordable areas in Mumbai, where old age home can be opened for taking care of growing number of elderly people.

At the same time, we need to ensure that needs of the elderly people are also taken care.

## b. Problem Statement

We need to answer below two questions by our analysis:

- Identify areas which have Hospitals, Medicals, Parks and Spiritual places nearby.
- Property price should be minimum as far as possible.

## c. Data Description

Data required for analysis is obtained as below:

- List of areas and locations in Mumbai is obtained from Wikipedia.[3]
- Correct coordinates are obtained for areas with help of Google API.
- Nearby venues (Specifically Hospitals, Medical, Parks and Spiritual places) for individual areas are obtained using Foursquare API.[4]
- Property prices are obtained from multiple property selling / renting websites [5][6]

## 2. Methodology

In this project we will try to identify suitable locations to open old age home in Mumbai city.

In first step we have collected the required data: Area, Locations in Mumbai. We have also got nearby venues within 2 KM's of each Area in specific categories (with help of **Foursquare API**) like **Hospitals, Medical Centers, Parks and Spiritual places** which will be useful for old people. We had also collected property prices.

In second step we will further analyze each area by forming different **clusters (using k-means clustering)**, basis nearby venues. Post that based on first most common venue, we can identify cluster suitable to our requirement of opening old age home.

In final step we will further study areas in selected cluster in detail with average price per square feet for property, to short list 10 suitable and affordable areas for opening old age home.

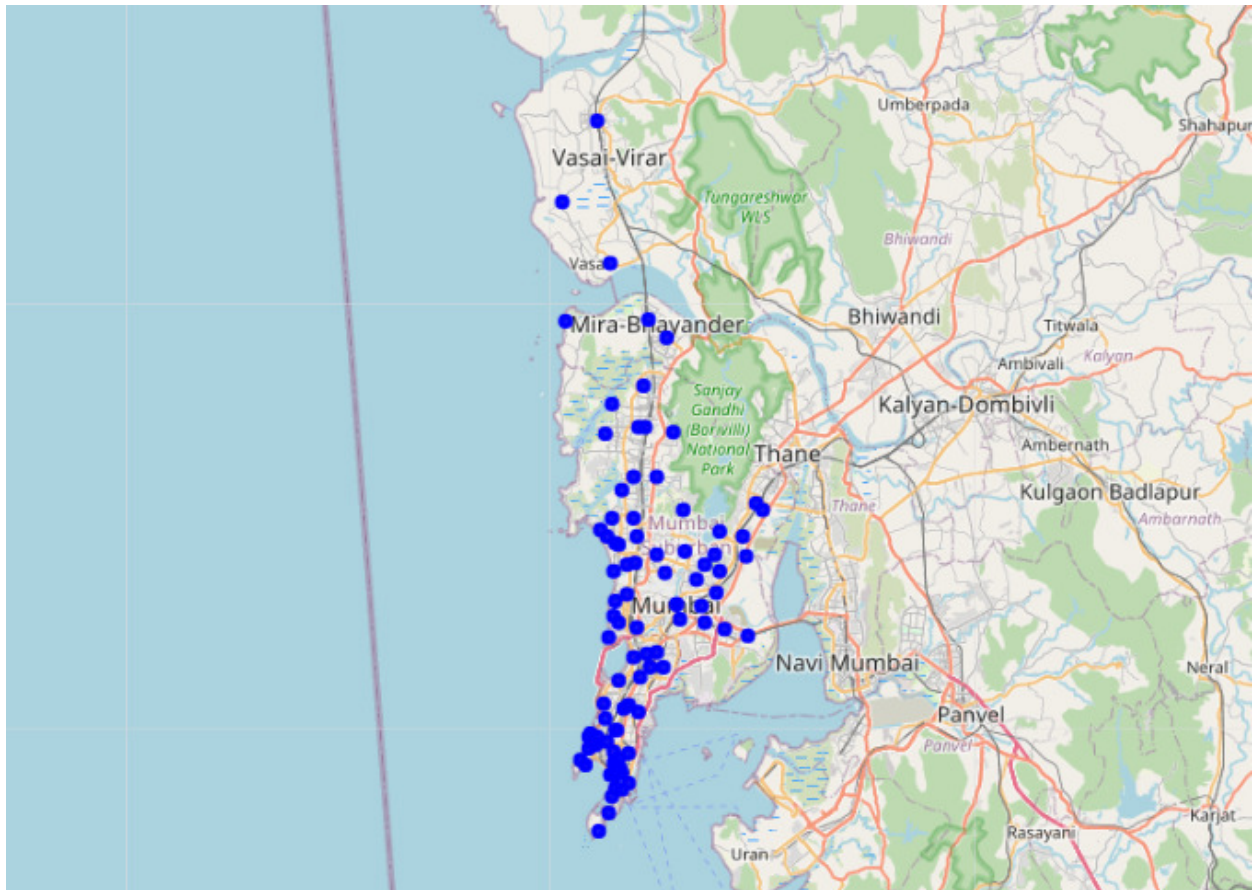
We extracted the list of the areas in Mumbai along with respective location from Wikipedia.[3]

Below is the sample data snapshot for areas in Mumbai.

	Area	Location	Latitude	Longitude
74	Nariman Point	South Mumbai	18.926000	72.823000
22	Charkop	Kandivali West,Western Suburbs	19.216182	72.830575
25	Thakur village	Kandivali East,Western Suburbs	19.210206	72.872980
81	Navy Nagar	Colaba,South Mumbai	18.901200	72.810100
77	Walkeshwar	South Mumbai	18.947596	72.795957
49	Deonar	Govandi,Harbour Suburbs	19.050000	72.890000
1	Chakala, Andheri	Western Suburbs	19.111388	72.860833
13	Kherwadi	Bandra,Western Suburbs	19.055300	72.831400
70	Malabar Hill	South Mumbai	18.950000	72.795000
66	Kemps Corner	South Mumbai	18.962900	72.805400

We noticed that some of Areas were not having proper coordinates, so we corrected same by using google API.

## 93 Areas in Mumbai under study



Property prices are obtained from multiple property selling / renting websites [5][6]  
We will need this data to identify comparatively low-price property.

Below is the sample data snapshot for property prices.

Area	Average_Property_SQF_Price
Aarey Milk Colony	10056.0
Agripada	28490.0
Altamount Road	75591.0
Amboli	18198.0
Amrut Nagar	17968.0

One of our criteria for finding location for old age home is to have Hospital, Doctors clinics, Parks and spiritual areas nearby.

Hence we will be using **Foursquare API** to get nearby venues for selected categories within **2 KM radius** for each area.

We had got 1772 venues, with 36 unique categories from foursquare API.

Below is the sample data snapshot for nearby venues to the respective areas in Mumbai.

	Area	Area Latitude	Area Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
187	Mira Road	19.285637	72.869109	Iskcon Temple, Mira Road, Mumbai	19.269497	72.871645	Temple
478	Khar Danda	19.078758	72.826438	NM Medical	19.065580	72.832436	Medical Center
1451	C.G.S. colony	19.027213	72.867075	Gurdwara Sri Dasmesh Darbar	19.033414	72.863896	Temple
1567	Chira Bazaar	18.948085	72.827524	Saifee Masjid	18.958808	72.830526	Mosque
1170	Kemps Corner	18.962918	72.805388	ISKON Temple	18.957565	72.809760	Temple

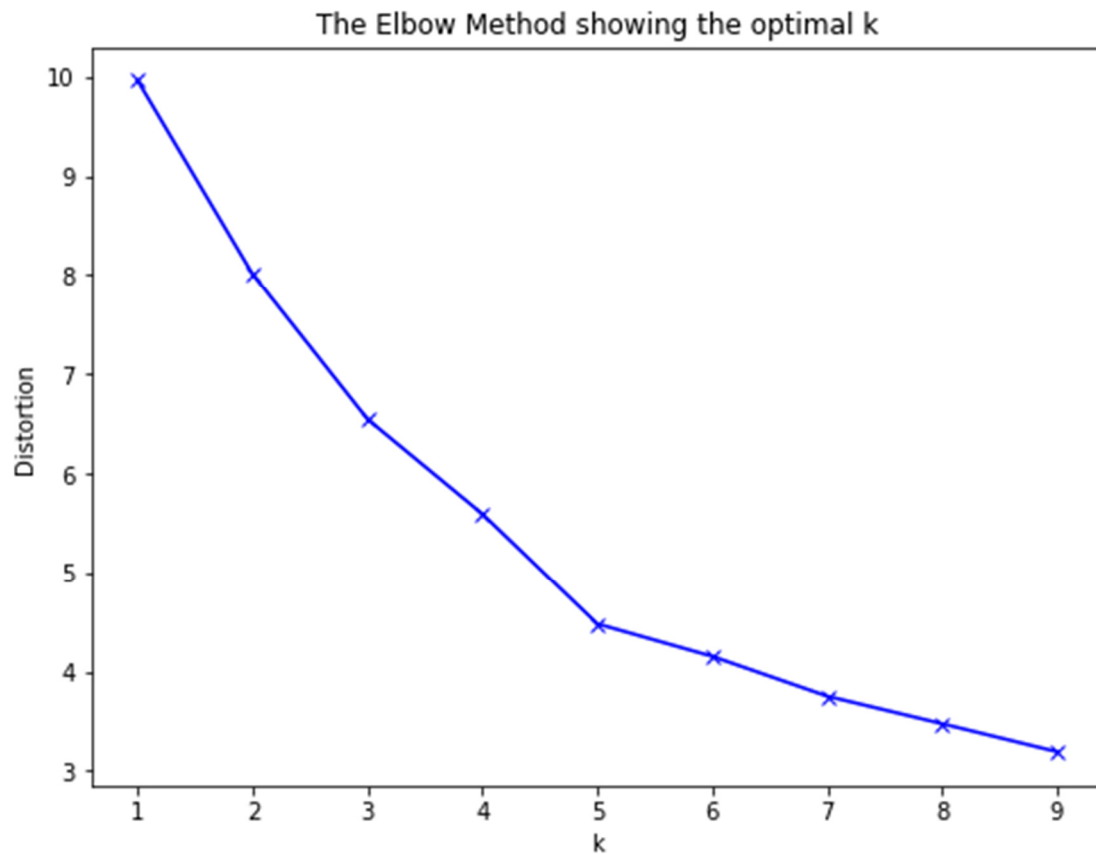
We had further processed data to get table with 10 Most common venues for each area.

	Area	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	Aarey Milk Colony	Monument / Landmark	Veterinarian	Medical Lab	Housing Development	Hospital	Hindu Temple	High School	General Entertainment	Garden	Field
1	Agripada	Mosque	Hospital	Temple	Church	Medical Center	Medical Lab	Dentist's Office	Monument / Landmark	Park	Garden
2	Altamount Road	Hospital	Temple	Park	Mosque	Doctor's Office	Church	Emergency Room	Medical Center	Garden	Veterinarian
3	Amboli	Hospital	Mosque	Church	Spiritual Center	Alternative Healer	Dentist's Office	Residential Building (Apartment / Condo)	Park	Garden	Hindu Temple
4	Amrut Nagar	Park	Church	Hospital	Pharmacy	Residential Building (Apartment / Condo)	Housing Development	Temple	Dentist's Office	Doctor's Office	Emergency Room

### 3. Analysis

Now as we have all required data in place, we can analyze each area by forming different **clusters (using k-means clustering)**, basis nearby venues.

We used **Elbow method** to identify optimum number of clusters, and then apply **KMeans** clustering algorithm to divide venues in different clusters.

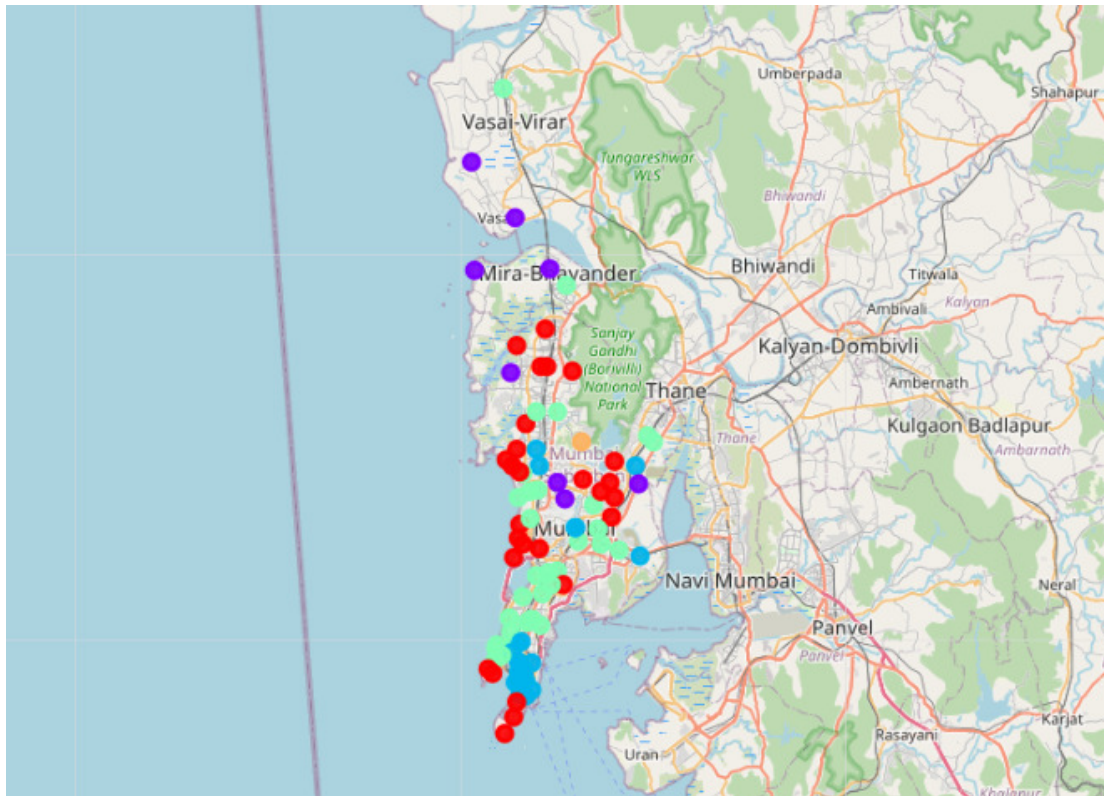


From the Elbow method optimum number of clusters is **5**.

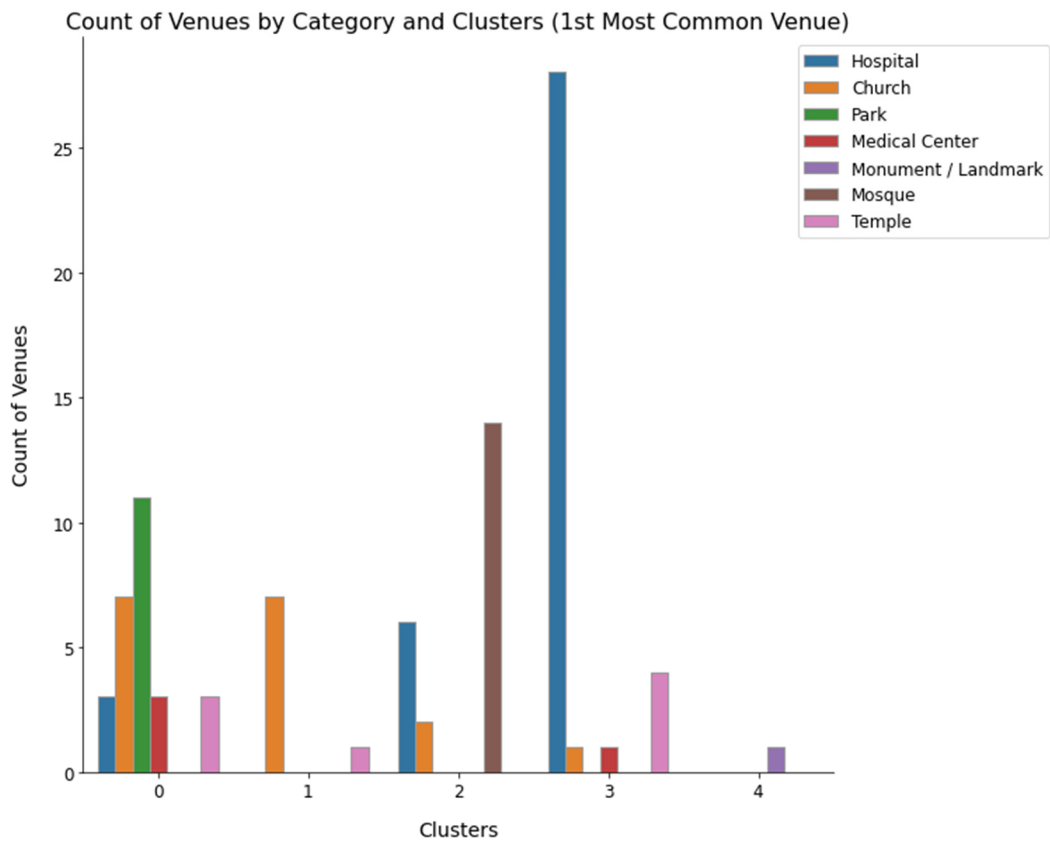
Below is the data post clustering with cluster labels.

	Area	Location	Latitude	Longitude	Average_Property_SQF_Price	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
0	Amboli	Andheri, Western Suburbs	19.129594	72.844293	18198.0	2	Hospital	Mosque	Church	Spiritual Center	Alternative Healer	Dentist's Office
1	Chakala, Andheri	Western Suburbs	19.115747	72.861152	21649.0	1	Church	Hospital	Garden	Mosque	Alternative Healer	Spiritual Center
2	D.N. Nagar	Andheri, Western Suburbs	19.122933	72.830131	22599.0	3	Hospital	Park	Temple	Church	Alternative Healer	Hindu Temple
3	Four Bungalows	Andheri, Western Suburbs	19.124735	72.826438	31561.0	0	Hospital	Park	Temple	Medical Center	Church	Dentist's Office
4	Lokhandwala	Andheri, Western Suburbs	19.143591	72.824629	21588.0	0	Park	Hospital	Medical Center	Mosque	Church	Spiritual Center

## Visualizing clusters



## Closer look at clusters

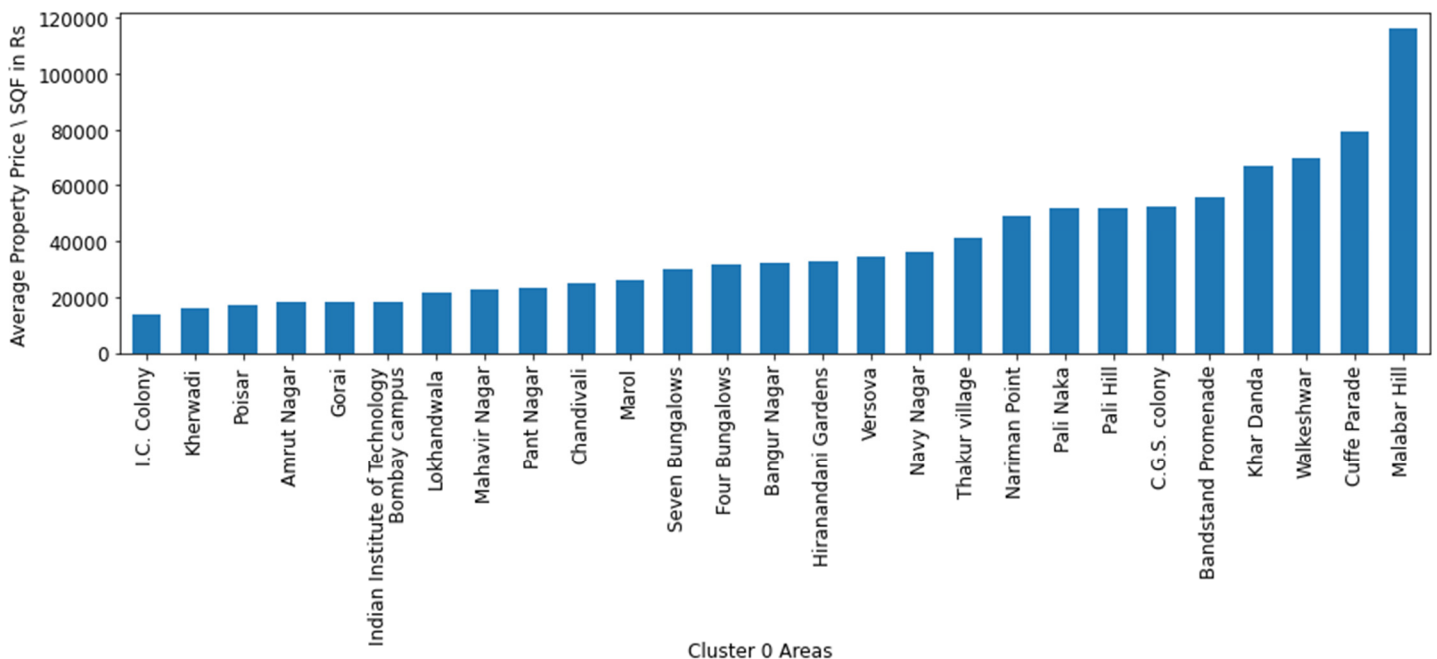


Below is the distribution of areas among cluster based on nearby venues.

Cluster	Description	Area Count
<b>Cluster 0</b>	Hospitals,Medical Centres,Parks and Spiritual	27
<b>Cluster 1</b>	Spiritual	8
<b>Cluster 2</b>	Hospitals and Spiritual	22
<b>Cluster 3</b>	Large no of Hospitals	34
<b>Cluster 4</b>	Monument	1

**Cluster 0** seems to be as per our expectation of having **Hospitals, Medical centers, Spiritual places and Parks** together within **2 KM** for old age home which will be helpful for old people.

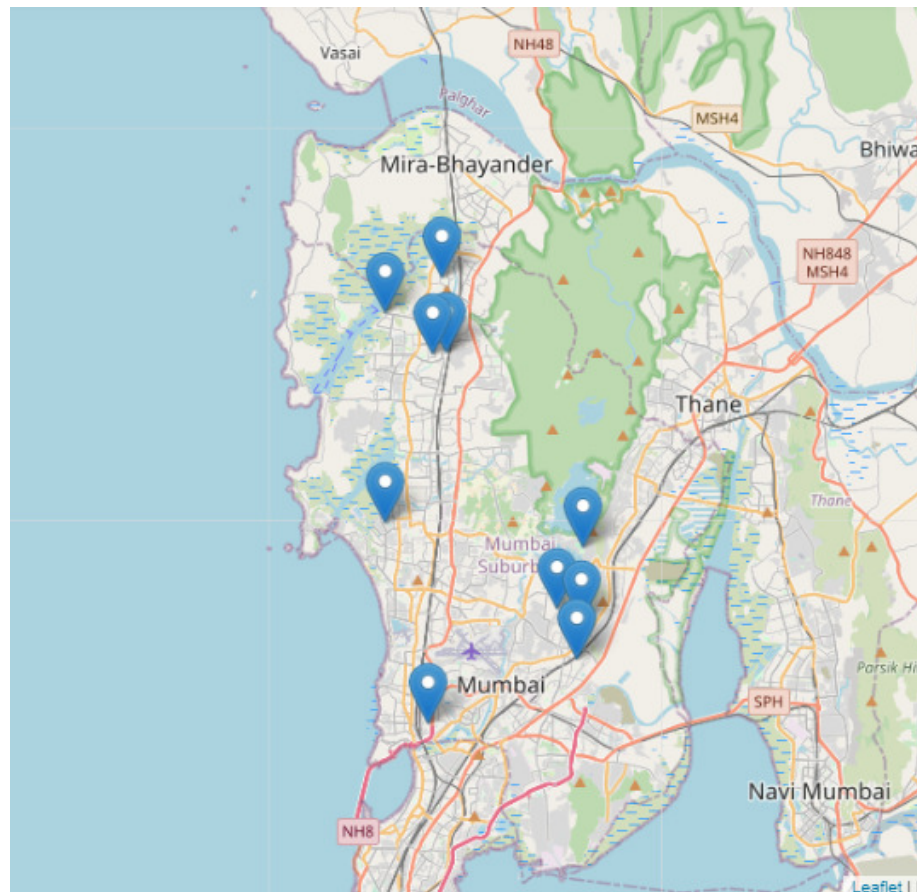
Selection of areas in cluster 0 basis nearby venues and average property price per square feet.





10 locations as below are shortlisted from Cluster 0

Area	Location	Latitude	Longitude	Average_Property_SQF_Price	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
I.C. Colony	Borivali (West), Western Suburbs	19.247720	72.850071	13636.0	0	Park	Hospital	Church	Medical Center	Temple
Kherwadi	Bandra, Western Suburbs	19.058679	72.844377	16158.0	0	Medical Center	Hospital	Church	Park	Mosque
Poisar	Kandivali West, Western Suburbs	19.215592	72.852286	17200.0	0	Hospital	Park	Church	Garden	Temple
Amrut Nagar	Ghatkopar, Eastern Suburbs	19.102077	72.912835	17968.0	0	Park	Church	Hospital	Pharmacy	Residential Building (Apartment / Condo)
Gorai	Borivali (West), Western Suburbs	19.232958	72.824901	18122.0	0	Medical Center	Park	Temple	Church	Hospital
Indian Institute of Technology Bombay campus	Powai, Eastern Suburbs	19.133430	72.913268	18333.0	0	Park	Hospital	Pharmacy	Church	Mosque
Lokhandwala	Andheri, Western Suburbs	19.143591	72.824629	21588.0	0	Park	Hospital	Medical Center	Mosque	Church
Mahavir Nagar	Kandivali West, Western Suburbs	19.215025	72.846378	22956.0	0	Hospital	Park	Church	Medical Center	Garden
Pant Nagar	Ghatkopar, Eastern Suburbs	19.085852	72.910597	23280.0	0	Park	Church	Hospital	Temple	Housing Development
Chandivali	Powai, Eastern Suburbs	19.107491	72.901760	25018.0	0	Park	Housing Development	Church	Hindu Temple	Residential Building (Apartment / Condo)



## 4. Result

From the detailed analysis we had grouped 92 Areas in Mumbai into 5 clusters (**using KMeans clustering** algorithm). Below are the five clusters:

- Hospitals, Medical Center's, Parks and Spiritual
- Spiritual
- Hospitals and Spiritual
- Large no of Hospital's
- Monument

One of our major criteria for opening old age home was having Hospitals, Medical center's, Parks and Spiritual places within 2 KM from the area for benefit of old people, hence we can go with first cluster Hospitals, Medical Center's, Parks and Spiritual

Further based on average property price per square feet we had shortlisted 10 areas as below in selected cluster for having affordable place as this old age home may be nonprofit organization.

- I.C. Colony (Borivali (West), Western Suburbs)
- Kherwadi (Bandra, Western Suburbs)
- Poisar (Kandivali West, Western Suburbs)
- Amrut Nagar (Ghatkopar, Eastern Suburbs)
- Gorai (Borivali (West), Western Suburbs)
- Indian Institute of Technology Bombay campus (Powai, Eastern Suburbs)
- Lokhandwala (Andheri, Western Suburbs)
- Mahavir Nagar (Kandivali West, Western Suburbs)
- Pant Nagar (Ghatkopar, Eastern Suburbs)
- Chandivali (Powai, Eastern Suburbs)

## 5. Discussion

Shortlisted areas can now be enquired further with property agents and other people in localities for more details. Details need to be checked by visiting the localities for quality of the nearby facilities also, price and nearby venues list cannot be the only decision factors.

## 6. Conclusion

Purpose of the project was to identify affordable areas in Mumbai to build old age home which will be nonprofit organization.

At the same time, we need to ensure that old age home should have Hospitals, Medical center's, Parks and Spiritual places which are of interest for old people in Mumbai.

Tools like Folium, Google API, Four square API and KMeans clustering algorithms are very useful in location analysis not only for this use case of old age home but also for opening new businesses.

## 7. References

- [1] <https://en.wikipedia.org/wiki/Mumbai>
- [2] <https://vikaspedia.in/social-welfare/senior-citizens-welfare/senior-citizens-status-in-india>
- [3] [https://en.wikipedia.org/wiki/List\\_of\\_neighbourhoods\\_in\\_Mumbai](https://en.wikipedia.org/wiki/List_of_neighbourhoods_in_Mumbai)
- [4] <https://developer.foursquare.com/>
- [5] <https://www.makaan.com/price-trends>
- [6] <https://www.99acres.com/>