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Explore and Compare two Cities

**24th May 2021**

# INTRODUCTION

Suppose someone is living in Noida and is moving to Thane. The person wants to know which areas in Thane would be most suitable for him/her to live and which areas to avoid.

In this project we will solve this problem.

This project will explore residential areas in two cities based on the most popular locations in the area. This information will be used to create sets of areas/neighborhoods which are most similar or not similar.

This will enable anyone moving between the cities to understand the similar areas to live in.

# DATA

Following data has been used for the project:

* List of residential sectors for Noida has been extracted from url - “<https://www.findeasy.in/noida-sectors/>”
* List of residential areas for Thane and Navi Mumbai has been extracted from following urls -

“https://www.magicbricks.com/localities-in-thane”

“https://www.magicbricks.com/localities-in-Navi-Mumbai”

* The neighborhood data for residential sectors has been extracted from Foursquare API - “https://api.foursquare.com/v2/venues/explore”
* The latitude and longitude for the residential sectors has been extracted using geolocator from Nominatim.
* The areas for which the location data was not available with Nominatim were extracted manually and updated to the data.

# METHODOLOGY

The project involved multiple steps like Exploratory Data Analysis, Model building etc. The actions performed in these steps are described below.

## Exploratory Data Analysis:

In this project we have explored two different cities. To enable this following steps were performed as part of data extraction and analysis -

* We used multiple libraries in python to extract and parse the list of residential neighborhoods in Noida and Thane.
* This list of residential neighborhoods was then used to get the location information or in other words to fix the pin as the starting point. This was achieved using the “geolocator” library in python. Geolocator uses the “Nominatum” database to get the location data.
* The pin(with latitude and longitude) data was used to get the data for nearby venues and venue categories from “Foursquare”.

**Background to Foursquare:**

Foursquare City Guide, commonly known as Foursquare, is a local search-and-discovery mobile app developed by Foursquare Labs Inc. The app provides personalized recommendations of places to go near a user's current location based on users' previous browsing history and check-in history.

* While using an API provided by Foursquare we have to decide how far out from the pin we have to search for restaurants, etc. (Venues). In other words we are deciding the radius of search.
* The search radius was limited to “2000” meters to get the relevant results.
* This data was now modified to be used to generate the ML model. The details are explained in the next section.

**ML Model Creation:**

For this project we have used the “k-means” clustering model. This model will help us to separate the neighborhoods based on the frequency of the different types of venues around the neighborhood.

To achieve this the following steps were performed -

* Venue Categories are a set of categorical values. These values have to be converted to numerical values so that we can use them to train the model.
* We have used one-hot encoding method to convert the categorical value to numerical values.
* The dataframe containing venue categories contained values as below -

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Neighborhood** | **Neighborhood Latitude** | **Neighborhood Longitude** | **Venue** | **Venue Latitude** | **Venue Longitude** | **Venue Category** |
| Sector 11 | 28.598112 | 77.333814 | Fresh Food Factory - Accha Khao Accha Khilao | 28.580971 | 77.317292 | Indian Restaurant |
| Sector 11 | 28.598112 | 77.333814 | Lakshmi Coffee House | 28.57014 | 77.332734 | South Indian Restaurant |
| Sector 11 | 28.598112 | 77.333814 | DLF Mall Of India | 28.567503 | 77.321362 | Shopping Mall |
| Sector 11 | 28.598112 | 77.333814 | PVR Superplex | 28.574257 | 77.353622 | Multiplex |
| Sector 11 | 28.598112 | 77.333814 | Berco's Garden Restaurant | 28.594078 | 77.338786 | Chinese Restaurant |

* After one-hot encoding, we created new dataframe and the value look like below -

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Neighborhood** | **ATM** | **American Restaurant** | **Arcade** | **Asian Restaurant** | **Athletics & Sports** |
| Sector 11 | 0 | 0 | 0 | 0 | 0 |
| Sector 11 | 0 | 0 | 0 | 0 | 0 |
| Sector 11 | 0 | 0 | 0 | 0 | 0 |
| Sector 11 | 0 | 0 | 0 | 0 | 0 |
| Sector 11 | 0 | 0 | 0 | 0 | 0 |

* We then group the values by Neighborhood and calculate the mean for each column. This is done so that we can understand the weightage of each venue type for a neighborhood location -

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Neighborhood** | **ATM** | **American Restaurant** | **Arcade** | **Asian Restaurant** | **Athletics & Sports** | **BBQ Joint** | **Bakery** |
| Sector 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0.25 |
| Sector 104 | 0 | 0 | 0 | 0 | 0 | 0.029412 | 0 |
| Sector 105 | 0 | 0 | 0 | 0 | 0 | 0 | 0.142857 |
| Sector 107 | 0 | 0 | 0 | 0 | 0 | 0 | 0.125 |
| Sector 108 | 0 | 0 | 0 | 0 | 0 | 0 | 0.076923 |
| ... | ... | ... | ... | ... | ... | ... | ... |
| Sector 79 | 0 | 0 | 0 | 0 | 0 | 0.029412 | 0 |
| Sector 82 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 |
| Sector 92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sector 93 | 0 | 0 | 0 | 0 | 0 | 0 | 0.076923 |
| Sector 99 | 0 | 0 | 0.111111 | 0 | 0 | 0 | 0 |

* This data is now used to generate clusters/sets using k-means clustering.
* We tried multiple cluster sizes and decided to use a cluster size of “6”.
* The mean data for each neighborhood is used to decide the 10 most common venue categories for each neighborhood.
* Exploring the two cities helps us understand the similar areas in each city and also generate data for the next step.
* The data generated using Foursquare API for Noida and Thane was merged and clustered or sets were generated.
* The clusters generated from the data provided us the list of similar areas in two cities.
* Each cluster generated represents the similar areas a person can look to live if he/she is planning to move between the cities.

# RESULTS

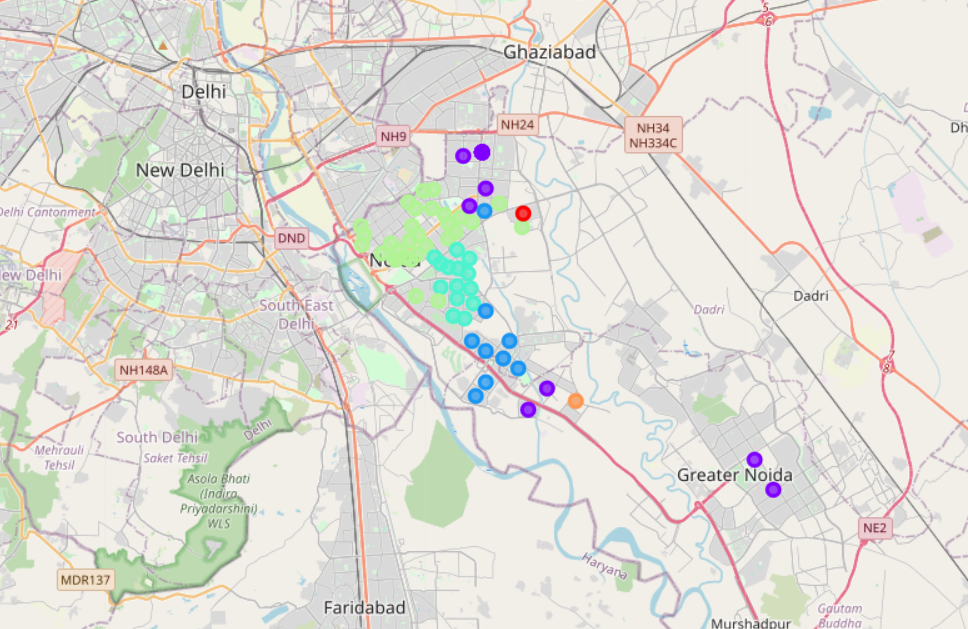
In this section we will show the data generated from exploring two cities and also after comparing the data for two cities(Noida and Thane).

## Noida:

* The data for top ten venue categories for each neighborhood was generated. Including only limited here due to space constraints and for clarity -

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Neighborhood | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue |
| Sector 100 | Golf Course | Gym / Fitness Center | Bakery | Market | Dry Cleaner |
| Sector 104 | Fast Food Restaurant | Indian Restaurant | Café | Food | Coffee Shop |
| Sector 105 | Pizza Place | Pharmacy | Bakery | Market | Diner |
| Sector 107 | Pizza Place | Thai Restaurant | Gym / Fitness Center | Bakery | Market |
| Sector 108 | Pizza Place | Café | Golf Course | Snack Place | Pharmacy |

* A map was generated using “folium” library to show the resulting clusters as a visual aid to understand how the city is divided into different sets -

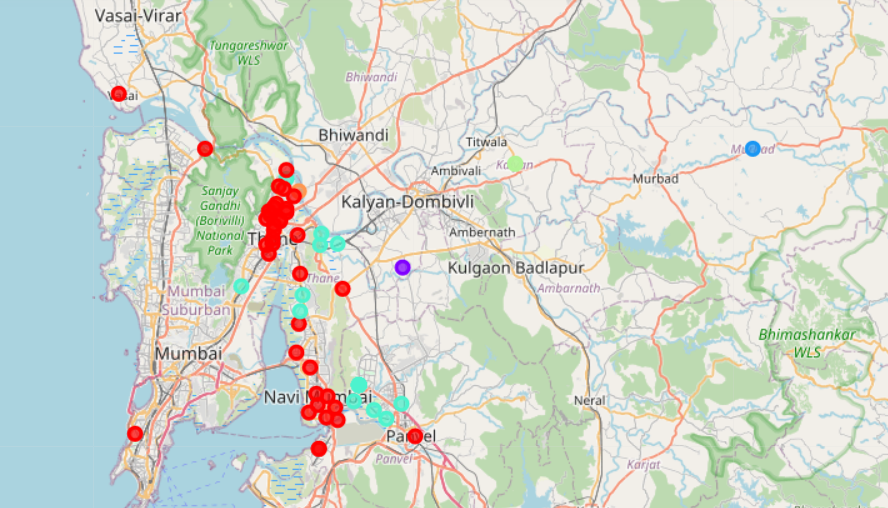


## Thane:

* The data for top ten venue categories for each neighborhood was generated -

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Neighborhood | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue |
| Airoli, Navi Mumbai | Fast Food Restaurant | Pizza Place | Indian Restaurant | Gym | Department Store |
| Anand Nagar, Thane | Indian Restaurant | Fast Food Restaurant | Ice Cream Shop | Dessert Shop | Pizza Place |
| Balkum village, Thane | Pizza Place | Indian Restaurant | Coffee Shop | Fast Food Restaurant | Shopping Mall |
| Belapur, Navi Mumbai | Indian Restaurant | Café | Fast Food Restaurant | Pizza Place | Dessert Shop |
| Bhayanderpada, Thane | Café | Indian Restaurant | Pizza Place | Fast Food Restaurant | Multiplex |

* A map was generated using “folium” library to show the resulting clusters as a visual aid to understand how the city is divided into different sets -



**Comparing Neighbourhoods in Noida and Thane:**

* Comparing the two cities we decided to generate 10 clusters/sets.
* We analysed a total 157 areas.
* These clusters contain similar neighborhoods from Noida and Thane along with ten venue categories in both cities.
* Here we will take three clusters/sets as an example which will help us to draw our conclusions.

**Cluster 0:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Neighborhood** | **City** | **Latitude** | **Longitude** | **Cluster Labels** | **1st Most Common Venue** | **2nd Most Common Venue** | **3rd Most Common Venue** | **4th Most Common Venue** | **5th Most Common Venue** |
| Sector 11 | Noida | 28.59811245 | 77.33381362 | 0 | Indian Restaurant | Market | Stadium | Sandwich Place | Pizza Place |
| Sector 12 | Noida | 28.59511835 | 77.33848623 | 0 | Indian Restaurant | Stadium | Pizza Place | Restaurant | Electronics Store |
| Sector 14 | Noida | 28.58723095 | 77.30822174 | 0 | Indian Restaurant | Hotel | Plaza | Bakery | Department Store |
| Sector 15 | Noida | 28.58279785 | 77.31022209 | 0 | Indian Restaurant | Hotel | Chinese Restaurant | Sandwich Place | Café |
| Sector 15a | Noida | 28.5779969 | 77.30850904 | 0 | Indian Restaurant | Café | Chinese Restaurant | Restaurant | Fast Food Restaurant |
| Sector 17 | Noida | 28.5737469 | 77.32003759 | 0 | Indian Restaurant | Café | Coffee Shop | Chinese Restaurant | Fast Food Restaurant |
| Sector 19 | Noida | 28.5783966 | 77.32476922 | 0 | Indian Restaurant | Café | Coffee Shop | Chinese Restaurant | Sandwich Place |
| Sector 21 | Noida | 28.58682275 | 77.33616219 | 0 | Indian Restaurant | Market | Sandwich Place | Stadium | Pizza Place |
| Sector 22 | Noida | 28.5952028 | 77.34727924 | 0 | Indian Restaurant | Pizza Place | Gym | Coffee Shop | Shopping Mall |
| Sector 23 | Noida | 28.5923544 | 77.35381332 | 0 | Indian Restaurant | Pizza Place | Gym | Vegetarian / Vegan Restaurant | Coffee Shop |
| Sector 25 | Noida | 28.5830083 | 77.33981906 | 0 | Indian Restaurant | Market | Multiplex | Sandwich Place | Hotel |
| Sector 26 | Noida | 28.57946555 | 77.33512252 | 0 | Indian Restaurant | Chinese Restaurant | Multiplex | Sandwich Place | Coffee Shop |
| Sector 27 | Noida | 28.5746768 | 77.32872811 | 0 | Indian Restaurant | Café | Coffee Shop | Chinese Restaurant | Sandwich Place |
| Sector 28 | Noida | 28.57160795 | 77.3318283 | 0 | Indian Restaurant | Chinese Restaurant | Café | Coffee Shop | Sandwich Place |
| Sector 29 | Noida | 28.5708315 | 77.33582067 | 0 | Indian Restaurant | Café | Coffee Shop | Chinese Restaurant | Pizza Place |
| Sector 30 | Noida | 28.57330205 | 77.33917321 | 0 | Indian Restaurant | Chinese Restaurant | Coffee Shop | Café | Multiplex |
| Sector 31 | Noida | 28.57720495 | 77.34370348 | 0 | Indian Restaurant | Multiplex | Pizza Place | Sandwich Place | Bakery |
| Sector 33 | Noida | 28.58839945 | 77.35633363 | 0 | Indian Restaurant | Gym | Convenience Store | Multiplex | Pizza Place |
| Sector 34 | Noida | 28.58372415 | 77.36046749 | 0 | Pizza Place | Gym | Indian Restaurant | Multiplex | Vegetarian / Vegan Restaurant |
| Sector 37 | Noida | 28.5707841 | 77.3271074 | 0 | Indian Restaurant | Café | Chinese Restaurant | Sandwich Place | Coffee Shop |
| Sector 44 | Noida | 28.5531837 | 77.3381716 | 0 | Chinese Restaurant | Indian Restaurant | Pizza Place | Sandwich Place | Coffee Shop |
| Sector 45 | Noida | 28.55060205 | 77.35051279 | 0 | Sandwich Place | Golf Course | Chinese Restaurant | Indian Restaurant | Thai Restaurant |
| Sector 52 | Noida | 28.5885198 | 77.36890648 | 0 | Pizza Place | Gym | Vegetarian / Vegan Restaurant | Indian Restaurant | Convenience Store |
| Sector 55 | Noida | 28.6043261 | 77.34802934 | 0 | Indian Restaurant | Pizza Place | Gym | Food | Vegetarian / Vegan Restaurant |
| Sector 56 | Noida | 28.60387165 | 77.34257203 | 0 | Indian Restaurant | Coffee Shop | Pizza Place | Restaurant | American Restaurant |
| Sector 70 | Noida | 28.59763785 | 77.38432381 | 0 | Indian Restaurant | Pizza Place | Gym | Convenience Store | Vegetarian / Vegan Restaurant |
| Sector 74 | Noida | 28.5707841 | 77.3271074 | 0 | Indian Restaurant | Café | Chinese Restaurant | Sandwich Place | Coffee Shop |
| Sector 120 | Noida | 28.58623125 | 77.39659348 | 0 | Indian Restaurant | Recording Studio | Dry Cleaner | Wine Shop | Donut Shop |
| Sector 128 | Noida | 28.5707841 | 77.3271074 | 0 | Indian Restaurant | Café | Chinese Restaurant | Sandwich Place | Coffee Shop |
| Sector 168 | Noida | 28.5707841 | 77.3271074 | 0 | Indian Restaurant | Café | Chinese Restaurant | Sandwich Place | Coffee Shop |
| Thane West | Thane | 19.1943294 | 72.9701779 | 0 | Indian Restaurant | Fast Food Restaurant | Ice Cream Shop | Coffee Shop | Seafood Restaurant |
| Ghodbunder Road | Thane | 19.2882132 | 72.8955745 | 0 | Indian Restaurant | Restaurant | Food | Gym / Fitness Center | Food Court |
| Majiwada | Thane | 19.2130251 | 72.9784852 | 0 | Indian Restaurant | Coffee Shop | Fast Food Restaurant | Pizza Place | Seafood Restaurant |
| Hiranandani Estate | Thane | 19.25685595 | 72.98427052 | 0 | Grocery Store | Bus Station | Café | Bakery | Food |
| Manpada | Thane | 19.2314156 | 72.9738156 | 0 | Indian Restaurant | Pizza Place | Coffee Shop | Dessert Shop | Bakery |
| Balkum village | Thane | 19.22169075 | 72.98449242 | 0 | Pizza Place | Coffee Shop | Indian Restaurant | Fast Food Restaurant | Bakery |
| Naupada | Thane | 19.1890469 | 72.9692339 | 0 | Indian Restaurant | Fast Food Restaurant | Ice Cream Shop | Dessert Shop | Chinese Restaurant |
| Anand Nagar | Thane | 19.178556 | 72.966004 | 0 | Indian Restaurant | Fast Food Restaurant | Ice Cream Shop | Dessert Shop | Pizza Place |
| Waghbil | Thane | 19.2659668 | 72.9847705 | 0 | Pizza Place | Café | Grocery Store | Food Court | Department Store |
| Teen Hath Naka | Thane | 19.1883779 | 72.9635894 | 0 | Indian Restaurant | Fast Food Restaurant | Ice Cream Shop | Dessert Shop | Coffee Shop |
| Dhokali | Thane | 19.2255786 | 72.9845436 | 0 | Indian Restaurant | Coffee Shop | Pizza Place | Fast Food Restaurant | Shopping Mall |
| Vartak Nagar | Thane | 19.2155371 | 72.9627101 | 0 | Indian Restaurant | Coffee Shop | Fast Food Restaurant | Seafood Restaurant | Pizza Place |
| Vasant Vihar | Thane | 19.2224897 | 72.9663424 | 0 | Indian Restaurant | Pizza Place | Fast Food Restaurant | Coffee Shop | Shopping Mall |
| Pokhran Road | Thane | 19.2191453 | 72.9674865 | 0 | Indian Restaurant | Coffee Shop | Fast Food Restaurant | Pizza Place | Shopping Mall |
| Shilphata | Thane | 19.1430394 | 73.0467879 | 0 | Indian Restaurant | Tea Room | Fast Food Restaurant | Art Gallery | Train Station |
| Kapurbawdi | Thane | 19.2142578 | 72.9778462 | 0 | Indian Restaurant | Coffee Shop | Fast Food Restaurant | Pizza Place | Shopping Mall |
| Patlipada | Thane | 19.2493501 | 72.9760694 | 0 | Indian Restaurant | Bakery | Ice Cream Shop | Café | Bus Station |
| Hiranandani Meadows | Thane | 19.22734225 | 72.9718477 | 0 | Indian Restaurant | Coffee Shop | Pizza Place | Fast Food Restaurant | Shopping Mall |
| Brahmand | Thane | 19.2469649 | 72.9818412 | 0 | Indian Restaurant | Coffee Shop | Bus Station | Café | Pizza Place |
| Kolshet | Thane | 19.2389025 | 72.9932692 | 0 | Pizza Place | Wine Shop | Thai Restaurant | Pub | Coffee Shop |
| Khopat | Thane | 19.2033291 | 72.9717815 | 0 | Indian Restaurant | Fast Food Restaurant | Coffee Shop | Ice Cream Shop | Chinese Restaurant |
| Palghar | Thane | 19.3453756 | 72.8007115 | 0 | Seafood Restaurant | Indian Restaurant | Flea Market | Café | Bus Station |
| Jeejamata Nagar | Thane | 18.9922889 | 72.81878651 | 0 | Indian Restaurant | Coffee Shop | Italian Restaurant | Café | Pub |
| Louis Wadi | Thane | 19.20886565 | 72.97167426 | 0 | Indian Restaurant | Coffee Shop | Fast Food Restaurant | Ice Cream Shop | Pizza Place |
| Hiranandani Road | Thane | 19.22734225 | 72.9718477 | 0 | Indian Restaurant | Coffee Shop | Pizza Place | Fast Food Restaurant | Shopping Mall |
| Panvel | Navi Mumbai | 19.0067566 | 73.04075004 | 0 | Indian Restaurant | Fast Food Restaurant | Café | Italian Restaurant | Pizza Place |
| Nerul | Navi Mumbai | 19.0336118 | 73.01813957 | 0 | Indian Restaurant | Fast Food Restaurant | Coffee Shop | Chinese Restaurant | Snack Place |
| Airoli | Navi Mumbai | 19.1585147 | 72.99940185 | 0 | Fast Food Restaurant | Pizza Place | Indian Restaurant | Gym | Bus Station |
| Seawoods | Navi Mumbai | 19.0221923 | 73.01873757 | 0 | Indian Restaurant | Café | Fast Food Restaurant | Coffee Shop | Sandwich Place |
| Kopar Khairane | Navi Mumbai | 19.1056227 | 72.9988648 | 0 | Fast Food Restaurant | Department Store | Indian Restaurant | Ice Cream Shop | Hotel |
| Vashi | Navi Mumbai | 19.075784 | 72.9952364 | 0 | Indian Restaurant | Ice Cream Shop | Coffee Shop | Hotel | Fast Food Restaurant |
| Sanpada | Navi Mumbai | 19.0607337 | 73.0116775 | 0 | Indian Restaurant | Fast Food Restaurant | Hotel | Chinese Restaurant | Café |
| CBD Belapur | Navi Mumbai | 19.01898695 | 73.03909472 | 0 | Indian Restaurant | Fast Food Restaurant | Café | Pizza Place | Restaurant |
| Belapur | Navi Mumbai | 19.0088205 | 73.028701 | 0 | Indian Restaurant | Café | Fast Food Restaurant | Pizza Place | Dessert Shop |
| Uran | Navi Mumbai | 19.0307053 | 73.0300046 | 0 | Fast Food Restaurant | Indian Restaurant | Coffee Shop | Diner | Garden |
| Sector 36 | Navi Mumbai | 19.01371895 | 73.00999035 | 0 | Café | Shopping Mall | Fast Food Restaurant | Sandwich Place | Indian Restaurant |

* This is a big set with 66 neighborhoods.
* This set contains mixed neighborhoods from Noida, Thane and Navi Mumbai(part of Thane district).

**Cluster 7:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Neighborhood | City | Latitude | Longitude | Cluster Labels | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue | 4th Most Common Venue | 5th Most Common Venue |
| Sector 35 | Noida | 28.5806152 | 77.35630307 | 2 | Multiplex | Pizza Place | Stadium | Market | Sandwich Place |
| Sector 36 | Noida | 28.57190815 | 77.34853224 | 2 | Bakery | Indian Restaurant | Multiplex | Market | Metro Station |
| Sector 39 | Noida | 28.5686223 | 77.35210967 | 2 | Bakery | Gym / Fitness Center | Pizza Place | Multiplex | Café |
| Sector 40 | Noida | 28.5670239 | 77.3561036 | 2 | Multiplex | Gym | Sandwich Place | Bakery | Pizza Place |
| Sector 41 | Noida | 28.5662237 | 77.36174561 | 2 | Gym / Fitness Center | Multiplex | Bakery | Italian Restaurant | Food Truck |
| Sector 42 | Noida | 28.5580927 | 77.36117784 | 2 | Café | Gym / Fitness Center | Multiplex | Bakery | Pizza Place |
| Sector 43 | Noida | 28.55759455 | 77.35167905 | 2 | Pizza Place | Indian Restaurant | Multiplex | Café | Golf Course |
| Sector 46 | Noida | 28.55216265 | 77.36060566 | 2 | Café | Golf Course | Lounge | Arcade | Pizza Place |
| Sector 48 | Noida | 28.55671025 | 77.36874453 | 2 | Bakery | Café | Gym / Fitness Center | Pizza Place | Sandwich Place |
| Sector 49 | Noida | 28.5640158 | 77.36719145 | 2 | Gym / Fitness Center | Multiplex | Bakery | Pizza Place | Food Truck |
| Sector 50 | Noida | 28.5711552 | 77.36748745 | 2 | Bakery | Pizza Place | Multiplex | Gym / Fitness Center | Dessert Shop |
| Sector 51 | Noida | 28.57540685 | 77.36124549 | 2 | Pizza Place | Bakery | Multiplex | Arcade | Vegetarian / Vegan Restaurant |
| Sector 99 | Noida | 28.54345895 | 77.35892385 | 2 | Sandwich Place | Market | Arcade | Coffee Shop | Café |
| Sector 100 | Noida | 28.5422873 | 77.36509586 | 2 | Golf Course | Gym / Fitness Center | Bakery | Market | Wine Shop |
| Kalwa | Thane | 19.197722 | 72.9978735 | 2 | Seafood Restaurant | Multiplex | Pizza Place | Dessert Shop | Wine Shop |
| Mumbra | Thane | 19.188536 | 73.0215253 | 2 | Flea Market | Multiplex | Restaurant | Bakery | Donut Shop |

* This set contains 16 values.
* This set contains neighborhoods mostly from Noida. Just 2 neighborhoods are from Thane.
* We have one more big cluster with 32 values with the same characteristics. But, this time the neighborhoods are mostly from Thane.
* We also generated a set of clusters which do not have any neighborhoods from both the cities -

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Neighborhood** | **City** | **Latitude** | **Longitude** | **Cluster Labels** |
| Kalyan | Thane | 19.2716301 | 73.23586553 | 1 |
| Kalyan West | Thane | 19.2716301 | 73.23586553 | 1 |
| Palava | Thane | 19.16460915 | 73.11278411 | 4 |
| Ulwe | Navi Mumbai | 18.97686135 | 73.02013111 | 7 |
| Ulwe Village | Navi Mumbai | 18.97686135 | 73.02013111 | 7 |
| Sector 53 | Noida | 28.5911007 | 77.3628053 | 8 |
| Sector 61 | Noida | 28.59645805 | 77.36756438 | 8 |
| Sector 66 | Noida | 28.6052229 | 77.3764073 | 8 |
| Sector 71 | Noida | 28.59425315 | 77.37619464 | 8 |
| Sector 82 | Noida | 28.5311541 | 77.38993356 | 8 |
| Sector 92 | Noida | 28.5181771 | 77.39489696 | 8 |
| Sector 93 | Noida | 28.5229507 | 77.38611653 | 8 |
| Sector 105 | Noida | 28.5315704 | 77.36917722 | 8 |
| Sector 107 | Noida | 28.545932 | 77.37656097 | 8 |
| Sector 108 | Noida | 28.52660665 | 77.37679363 | 8 |
| Sector 47 | Noida | 28.5498284 | 77.37006993 | 9 |

# DISCUSSION

In this section we will discuss the results and observations we can see from the results.

* After exploring the cities Noida and Thane we can see that there is only one large cluster/set(66 neighborhoods) with mixed values from both Noida and Thane.
* The rest of the clusters either have one few values from another city or no values from another city.
* The neighborhoods in Cluster 0 are mostly the area situated near the city center in their respective cities.
* This shows most of the areas in Noida are not similar to areas in Thane.
* Only the areas situated near the city center are similar in Noida and Thane.

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# CONCLUSION

After analysing the data from both cities we can conclude the following -

* Someone living near the city center in one city should look to find a place near the city center in another city. Only then they will be able to get similar experience.
* If someone is not living in the city center in one city, they will have a different experience when he/she moves to the other city. This is because either they live near the city center or far from the city center they are moving from one set of neighborhoods to another.