

## **A.BACKGROUND & Problem Statement OF THE CITY UNDER ANALYSIS**

Chandigarh is a city and a union territory in India that serves as the capital of the two neighbouring states of Punjab and Haryana. The city is unique as it is not a part of either of the two states but is governed directly by the Union Government, which administers all such territories in the country.

Chandigarh is bordered by the state of Punjab to the north, the west and the south, and by the state of Haryana to the east. It is considered to be a part of the Chandigarh capital region or Greater Chandigarh, which includes Chandigarh, and the city of Panchkula (in Haryana) and cities of Kharar, Kurali, Mohali, Zirakpur (in Punjab). It is located 260 km (162 miles) north of New Delhi and 229 km (143 miles) southeast of Amritsar.

It was one of the early planned cities in post-independence India and is internationally known for its architecture and urban design. The master plan of the city was prepared by Swiss-French architect Le Corbusier, which transformed from earlier plans created by the Polish architect Maciej Nowicki and the American planner Albert Mayer. Most of the government buildings and housing in the city were designed by the Chandigarh Capital Project Team headed by Le Corbusier, Jane Drew and Maxwell Fry. In 2015, an article published by BBC named Chandigarh as one of the few master-planned cities in the world to have succeeded in terms of combining monumental architecture, cultural growth and modernisation.

Chandigarh's Capitol Complex was in July 2016 declared by UNESCO as World Heritage at the 40th session of World Heritage Conference held in Istanbul. UNESCO inscription was under "The Architectural Work of Le Corbusier an outstanding contribution to the Modern Movement". The Capitol Complex buildings include the Punjab and Haryana High Court, Punjab and Haryana Secretariat and Punjab and Haryana Assembly along with monuments Open hand, Martyrs Memorial, Geometric Hill and Tower of Shadow and the Rock Garden

The city has one of the highest per capita incomes in the country. The city was reported to be one of the cleanest in India based on a national government study. The union territory also heads the list of Indian states and territories according to Human Development Index. In 2015, a survey by LG Electronics, ranked it as the happiest city in India over the happiness index. The metropolitan area of Chandigarh–Mohali–Panchkula collectively forms a Tri-city, with a combined population of over 1,611,770.

### **Problem Statement**

The People moving into Chandigarh would better insights of what to expect from the City in terms of quality of life and what Neighbourhoods they could choose to live in.

## B. Data acquisition and cleaning

Data where you describe the data that will be used to solve the problem and the source of the data.

Since the City of Chandigarh is being analysed the objective is to obtain primarily the Postal Code and Neighbourhoods data. For obtaining this data the below 'pageocode' python library was used.

1. **'pageocode'** has been used for getting the 'GPS coordinates', 'region name' and municipality name from postal codes

### Postal code geocoding and distance calculations:

**pgeocode** is a Python library for high performance off-line querying of GPS coordinates, region name and municipality name from postal codes. Distances between postal codes as well as general distance queries are also supported. The used GeoNames database includes postal codes for 83 countries. Currently, only queries within the same country are supported. For additional documentation see [pgeocode.readthedocs.io](http://pgeocode.readthedocs.io).

2. Have first applied the postal code query
3. The Dataframe consists the below

Geocoding format

The result of a geo-localistion query is a pandas.DataFrame with the following columns,

country\_code: iso country code, 2 characters

postal\_code : postal code

place\_name : place name (e.g. town, city etc)

state\_name : 1. order subdivision (state)

state\_code : 1. order subdivision (state)

county\_name : 2. order subdivision (county/province)

county\_code : 2. order subdivision (county/province)

community\_name : 3. order subdivision (community)

community\_code : 3. order subdivision (community)

latitude : estimated latitude (wgs84)

longitude : estimated longitude (wgs84)

accuracy : accuracy of lat/lng from 1=estimated to 6=centroid

4. Using the function obtain the below data.

|  | country_code | postal_code | place_name   | state_name | state_code | county_name | county_code | community_name | community_code | latitude | longitude | accuracy |
|--|--------------|-------------|--|------------|------------|-------------|-------------|----------------|----------------|----------|-----------|----------|
|  | IN           | 140119      | Abiana, Dhamana, Bajrur, Tibba Taparian, Bhaow...  | Chandigarh | 5          | Chandigarh  | 55.0        | Ropar          | NaN            | 31.1115  | 76.532129 | 3        |
|  | IN           | 140125      | Ajauli, Manakpur, Pratap Nagar Nangal, Behramp...  | Chandigarh | 5          | Chandigarh  | 55.0        | Ropar          | NaN            | 30.5969  | 76.602480 | 3        |
|  | IN           | 140133      | Kalitrana, Dher, Daroli, Jandbari, Bhanupali, K... | Chandigarh | 5          | Chandigarh  | 55.0        | Ropar          | NaN            | 31.0954  | 75.963200 | 3        |
|  | IN           | 140603      | Babhat, Chhatt, Dayalpur Sodhian, Zirakpur         | Chandigarh | 5          | Chandigarh  | 55.0        | chandigarh     | NaN            | 31.2068  | 76.282600 | 3        |
|  |              |             | High Court   |            |            |             |             |                |                |          |           |          |

5. A subset of Dataframe was created -Chandigarh=  
Chandigarh[['postal\_code','place\_name', 'community\_name', 'latitude', 'longitude']]

```
Chandigarh.head()
```

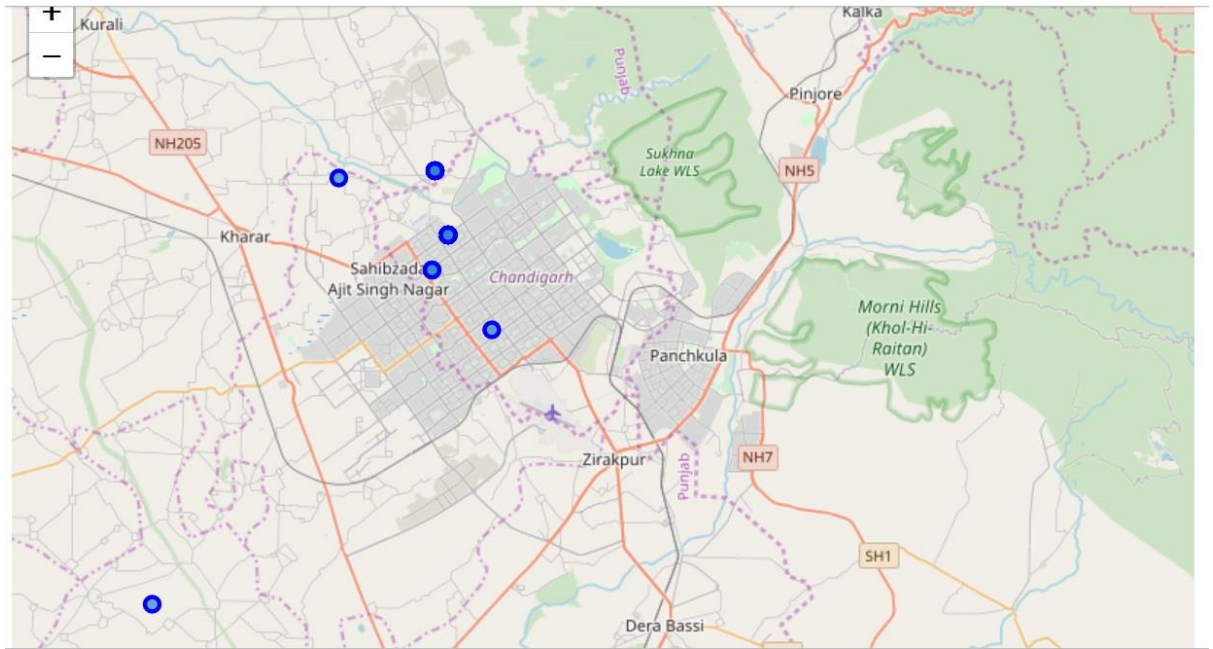
|     | postal_code | place_name   | community_name | latitude | longitude |
|-----|-------------|--|----------------|----------|-----------|
| 427 | 140119      | Abiana, Dhamana, Bajrur, Tibba Taparian, Bhaow...  | Ropar          | 31.1115  | 76.532129 |
| 430 | 140125      | Ajauli, Manakpur, Pratap Nagar Nangal, Behramp...  | Ropar          | 30.5969  | 76.602480 |
| 432 | 140133      | Kalitrana, Dher, Daroli, Jandbari, Bhanupali, K... | Ropar          | 31.0954  | 75.963200 |
| 452 | 140603      | Babhat, Chhatt, Dayalpur Sodhian, Zirakpur         | chandigarh     | 31.2068  | 76.282600 |
| 933 | 160001      | High Court (Chandigarh), New Sectt Chandigarh,...  | Chandigarh     | 30.7465  | 76.741700 |

## METHODOLOGY

Methodology section which represents the main component of the report where you discuss and describe any exploratory data analysis that you did, any inferential statistical testing that you performed, if any, and what machine learnings were used and why.

### Explore Neighborhoods in Chandigarh

1. Applied Unique filter Chandigarh.community\_name.unique() and dropped NAN fields
2. Using the geopy.geocoders import Nominatim library obtained the Chandigarh Latitude and longitude info.



### 3. Using Four Square find the Venues in the respective Neighbourhoods

[44]:

|   | Neighborhood                                      | Neighborhood Latitude | Neighborhood Longitude | Venue          | Venue Latitude | Venue Longitude | Venue Category |
|---|---|-----------------------|------------------------|----------------|----------------|-----------------|----------------|
| 0 | High Court (Chandigarh), New Sectt Chandigarh,... | 30.7465               | 76.7417                | Subway         | 30.746311      | 76.743513       | Sandwich Place |
| 1 | High Court (Chandigarh), New Sectt Chandigarh,... | 30.7465               | 76.7417                | Books And Brew | 30.744771      | 76.743924       | Arcade         |
| 2 | High Court (Chandigarh), New Sectt Chandigarh,... | 30.7465               | 76.7417                | Domino's Pizza | 30.744813      | 76.745485       | Pizza Place    |
| 3 | High Court (Chandigarh), New Sectt Chandigarh,... | 30.7465               | 76.7417                | Oceanic Gym    | 30.748260      | 76.736969       | Gym            |
| 4 | Ram Darbar, Hallomajra, Ind Area Chandigarh       | 30.7465               | 76.7417                | Subway         | 30.746311      | 76.743513       | Sandwich Place |
| 5 | Ram Darbar, Hallomajra, Ind Area Chandigarh       | 30.7465               | 76.7417                | Books And Brew | 30.744771      | 76.743924       | Arcade         |
| 6 | Ram Darbar, Hallomajra, Ind Area Chandigarh       | 30.7465               | 76.7417                | Domino's Pizza | 30.744813      | 76.745485       | Pizza Place    |
| 7 | Ram Darbar, Hallomajra, Ind Area Chandigarh       | 30.7465               | 76.7417                | Oceanic Gym    | 30.748260      | 76.736969       | Gym            |
| 8 | Aerodrome, Behlana                                | 30.7465               | 76.7417                | Subway         | 30.746311      | 76.743513       | Sandwich Place |

### 4. Using One Hot ...Find the Frequency of the most visited venue

[47]:

```
CHD_grouped = Chandigarh_onehot.groupby('Neighborhood').mean().reset_index()
```

[48]:

```
CHD_grouped.head()
```

[48]:

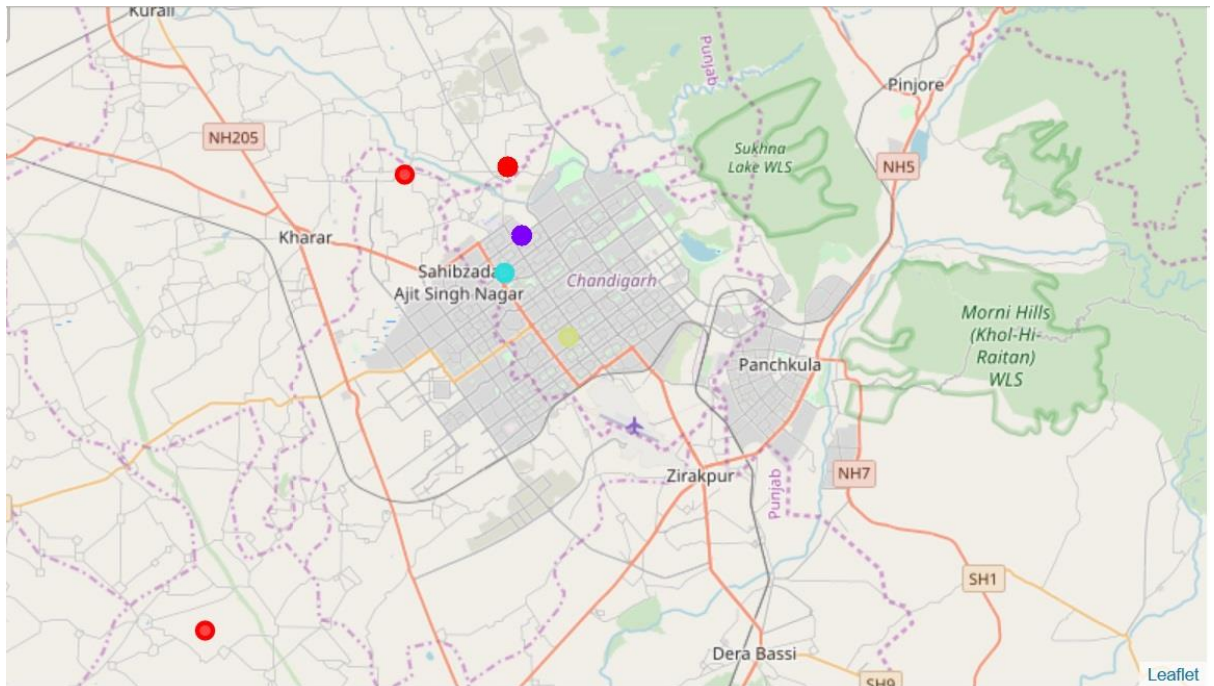
|   | Neighborhood                                      | ATM | Airport Service | Arcade | Café | Electronics Store | Gym  | Market | Miscellaneous Shop | Pharmacy | Pizza Place | Sandwich Place |
|---|---|-----|-----------------|--------|------|-------------------|------|--------|--------------------|----------|-------------|----------------|
| 0 | Aerodrome, Behlana                                | 0.0 | 0.00            | 0.25   | 0.0  | 0.0               | 0.25 | 0.00   | 0.0                | 0.00     | 0.25        | 0.25           |
| 1 | Airforce Highground                               | 0.0 | 0.00            | 0.25   | 0.0  | 0.0               | 0.25 | 0.00   | 0.0                | 0.00     | 0.25        | 0.25           |
| 2 | Burail, Sector 47 Chandigarh, Sector 44 (Chand... | 0.0 | 0.25            | 0.00   | 0.0  | 0.0               | 0.00 | 0.25   | 0.0                | 0.25     | 0.25        | 0.00           |
| 3 | Chandigarh G.P.O.                                 | 0.0 | 0.00            | 0.00   | 0.0  | 1.0               | 0.00 | 0.00   | 0.0                | 0.00     | 0.00        | 0.00           |
| 4 | Daria, Mhc Manimajra, Manimajra, Kishangarh       | 0.0 | 0.00            | 0.25   | 0.0  | 0.0               | 0.25 | 0.00   | 0.0                | 0.00     | 0.25        | 0.25           |

## 5. Top 10 Sorted Common Venues

[51]:

|   | Neighborhood                                      | 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 | Aerodrome, Behlana                                | Sandwich Place        | Pizza Place           | Gym                   | Arcade                | Pharmacy              | Miscellaneous Shop    | Market                | Electronics Store     | Café                  | Airport Service        |
| 1 | Airforce Highground                               | Sandwich Place        | Pizza Place           | Gym                   | Arcade                | Pharmacy              | Miscellaneous Shop    | Market                | Electronics Store     | Café                  | Airport Service        |
| 2 | Burail, Sector 47 Chandigarh, Sector 44 (Chand... | Pizza Place           | Pharmacy              | Market                | Airport Service       | Sandwich Place        | Miscellaneous Shop    | Gym                   | Electronics Store     | Café                  | Arcade                 |
| 3 | Chandigarh G.P.O.                                 | Electronics Store     | Sandwich Place        | Pizza Place           | Pharmacy              | Miscellaneous Shop    | Market                | Gym                   | Café                  | Arcade                | Airport Service        |
| 4 | Daria, Mhc Manimajra, Manimajra, Kishangarh       | Sandwich Place        | Pizza Place           | Gym                   | Arcade                | Pharmacy              | Miscellaneous Shop    | Market                | Electronics Store     | Café                  | Airport Service        |
| 5 | Engg College, Sector 12 (Chandigarh)              | Electronics Store     | Sandwich Place        | Pizza Place           | Pharmacy              | Miscellaneous Shop    | Market                | Gym                   | Café                  | Arcade                | Airport Service        |

## 6. Plotting the Clusters on MAP



Key: Yellow- Cluster3, Red :Cluster0, Sky Blue: Cluster2 , Violet: Cluster1

## RESULTS AND ANALYSIS

Finally we Examine the Clusters

**1: Cluster0** – is primarily areas on the outer skirts of **Chandigarh** with minimal metropolitan facilities except for Sector 10 and Sector 12 (Having Punjab Engineering College). The outer skirts have manufacturing units. There are about 15 medium to large industries including two in the public sector. In addition, Chandigarh has over 2,500 units registered under small-scale sector. The

important industries are paper manufacturing, basic metals and alloys, and machinery. Other industries are relating to food products, sanitary ware, auto parts, machine tools, pharmaceuticals, and electrical appliances.

## **2:Cluster1- Contains**

Four major trade promotion organisations have their offices in Chandigarh. These are: The Associated Chambers of Commerce & Industry, ASSOCHAM India in Sector 8, Chandigarh, Federation of Indian Chambers of Commerce & Industry, (FICCI) the PHD Chamber of Commerce and Industry (PHDCCI) and the Confederation of Indian Industry (CII) which has its regional headquarters at Sector 31, Chandigarh.

Chandigarh IT Park (also known as Rajiv Gandhi Chandigarh Technology Park) is the city's attempt to break into the information technology world. Chandigarh's infrastructure, proximity to Delhi, Haryana, Punjab and Himachal Pradesh, and the IT talent pool attracts IT businesses looking for office space in the area. Major Indian firms and multinational corporations like Quark, Infosys, EVRY, Dell, IBM, TechMahindra, Airtel, Amadeus IT Group, DLF have set up base in the city and its suburbs.

There are numerous educational institutions in Chandigarh. These range from privately and publicly operated schools to colleges and the Panjab University. Other Institutions are Post Graduate Institute of Medical Education and Research (PGIMER), Government Medical College and Hospital, Punjab Engineering College Deemed University, Government College for Men, Government College for Women, DAV College, MCM DAV College for Women, Goswami Ganesh Dutta Sanatan Dharma College Sector-32, Government Homeopathic College, Ayurvedic College, Government Polytechnical College, Government Home Science College, Dr. Ambedkar Institute of Hotel management, Khalsa College Sec- 26, National Institute of Technical Teachers Training and Research (NITTTR) Sec-26, Government College of Commerce and Business Administration (GCCBA) Sec-50 etc.

According to Chandigarh administration's department of education, there are a total of 115 government schools in Chandigarh, including Government Model Senior Secondary School, Sector 16, Jawahar Navodaya Vidyalaya, Bhavan Vidyalaya, sector 27 and convent schools like St. Stephen's School, St. John's High School, Chandigarh, St. Anne's Convent School, St. Kabir Public School, St. Xavier's Senior Secondary School and Carmel Convent School.

**Cluster 3 & Cluster 2 have a mix of Government offices and schools**

**Discussion section where you discuss any observations you noted and any recommendations you can make based on the results.**

**Observations :** The most frequently visited places in the City are Cafes / Eateries (Sandwich Corners)/ Pizza corners and GYMs followed by local shopping Centres.

Cluster1 has ample opportunities of occupation/ entertainment (Arcades) and education facilities and is the most preferred location for both Students and families.

Cluster 0 is on the peripherals with better living facilities in Cluter1. If a person is employed in factories the commute distance would be relatively higher.

## **Recommendations:**

The quality of living in the City is very high. With good living facilities and good mix of Shopping facilities/ Educational institutes/Gym facilities with well spread network of quick bite joints catering to the young college population...Cluster1

Also a very good city for retired population with well spread network of hospitals/ Parks and pharmacies.

## **Conclusion section where you conclude the report.**

This report offers a comprehensive view of Chandigarh City giving a fairly good insights of what People moving into the City could expect