

Comparative Study of Indian Cities

Mumbai and Kolkata

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1.Introduction

1.1 Background

India (ISO: Bhārat), also known as the Republic of India (ISO: Bhārat Gaṇarājya), is a country in South Asia. It is the seventh largest country by area and with more than 1.3 billion people, it is the second most populous country as well as the most populous democracy in the world. Bounded by the Indian Ocean on the south, the Arabian Sea on the southwest, and the Bay of Bengal on the southeast, it shares land borders with Pakistan to the west; China, Nepal, and Bhutan to the northeast; and Bangladesh and Myanmar to the east. In the Indian Ocean, India is in the vicinity of Sri Lanka and the Maldives, while its Andaman and Nicobar Islands share a maritime border with Thailand and Indonesia.

India has multiple metropolitan areas in with a huge number of populations. Here is few Central National Capital Region, Mumbai Metropolitan Region, Kolkata metropolitan area, Bangalore Metropolitan Region etc. All these areas are changing in its everyday with respect to all environmental components. For example, Kolkata is competing with Delhi with respect to pollution, Bangalore is competing with Mumbai with respect to business.

My interest is on two cities among these, Mumbai and Kolkata. Here is some more details on those two cities.

Mumbai : Mumbai (/mʊmˈbaɪ/, also known as Bombay /bɒmˈbeɪ/, the official name until 1995) is the capital city of the Indian state of Maharashtra. As of 2011 it is the most populous city in India with an estimated city proper population of 12.4 million. The larger Mumbai Metropolitan Region is the second most populous metropolitan area in India, with a population of 21.3 million as of 2016. Mumbai lies on the Konkan coast on the west coast of India and has a deep natural harbour. In 2008, Mumbai was named an alpha world city. It is also the wealthiest city in India, and has the highest number of millionaires and billionaires among all cities in India. Mumbai is home to three UNESCO World Heritage Sites: the Elephanta Caves, Chhatrapati Shivaji Maharaj Terminus, and the city's distinctive ensemble of Victorian and Art Deco buildings. Ref : <https://en.wikipedia.org/wiki/Mumbai>

Kolkata : Kolkata /kɒlˈkʌtə/ ([kɒlkata] (About this soundlisten), also known as Calcutta /kælˈkʌtə/, the official name until 2001) is the capital of the Indian state of West Bengal. Located on the east bank of the Hooghly River approximately 75 kilometers (47 mi) west of the border with Bangladesh, it is the principal commercial, cultural, and educational centre of East India, while the Port of Kolkata is India's oldest operating port and its sole major riverine port. The city is widely regarded as the "cultural capital" of India, and is also nicknamed the "City of Joy". According to the 2011 Indian census, it is the seventh most populous city; the city had a population of 4.5 million, while the suburb population brought the total to 14.1 million, making it the third-most populous metropolitan area in India. Ref : <https://en.wikipedia.org/wiki/Kolkata>

1.2 Problem :

I want to do a comparative study in between two cities Kolkata and Mumbai. That would help to understand these two cities area-wise with respect to business, population, tourism, education etc.

1.3 Interest and Intended Audience

- Business People
- Job-seekers
- Tourist
- People who are planning to move to these cities
- Students

2.Data

2.1 What Data :

- Population and Area data for Mumbai and Kolkata
: https://en.wikipedia.org/wiki/List_of_metropolitan_areas_in_India
- Mumbai Area Information <https://github.com/rajibkrsarkar/The-Battle-of-Neighborhood/blob/master/MumbaiPC.csv>
- Kolkata Area Information <https://github.com/rajibkrsarkar/The-Battle-of-Neighborhood/blob/master/KolkataPC.csv>
- Kolkata Climate Data : <https://en.wikipedia.org/wiki/Kolkata#Rainfall>
- Mumbai Climate Data : <https://en.wikipedia.org/wiki/Mumbai#Climate>
- Colleges and Universities in Kolkata along with Degrees offered
:https://en.wikipedia.org/wiki/Universities_and_colleges_of_West_Bengal
- Mumbai All College and List :https://github.com/rajibkrsarkar/The-Battle-of-Neighborhood/blob/master/Mumbai_Updated-All-College-List-with-Course-Detailss.pdf
- HPI data from <https://data.gov.in/node/113600/download>

2.2 Data Understanding and Data Cleaning :

To understand, the data with respect to variety and versatility and then apply cleaning process on various kinds of data. I have tried to collect the data as much as possible in the web, based on whatever data available. If not available, looking for data and creating data set for my analysis on this. I found lots of data are missing for all the data I have collected and scraped from multiple sources. If, key fields are missing, I have removed those records. For example, while comparing education based on different part of area of Mumbai with respect to Kolkata, I found highest education provided for an institute is missing. I have removed those records for both cities.

3. Exploratory Analysis of Data

Comparative study of population over the years in these two cities.

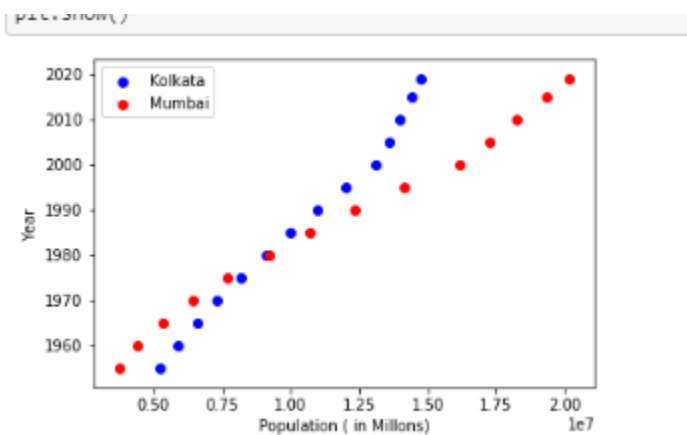
Population Data of Kolkata

	Year	Population	GrowthRate	Growth
0	2019	14755186	0.57%	332516.0
1	2015	14422670	0.59%	419872.0
2	2010	14002798	0.59%	407646.0
3	2005	13595152	0.75%	497999.0
4	2000	13097153	1.78%	1104959.0

Population Data of Mumbai

	Year	Population	GrowthRate	Growth
0	2019	20185064	1.11%	869327.0
1	2015	19315737	1.13%	1058324.0
2	2010	18257413	1.13%	1000341.0
3	2005	17257072	1.34%	1110545.0
4	2000	16146527	2.70%	2011164.0

Viewing data in scatter plot :



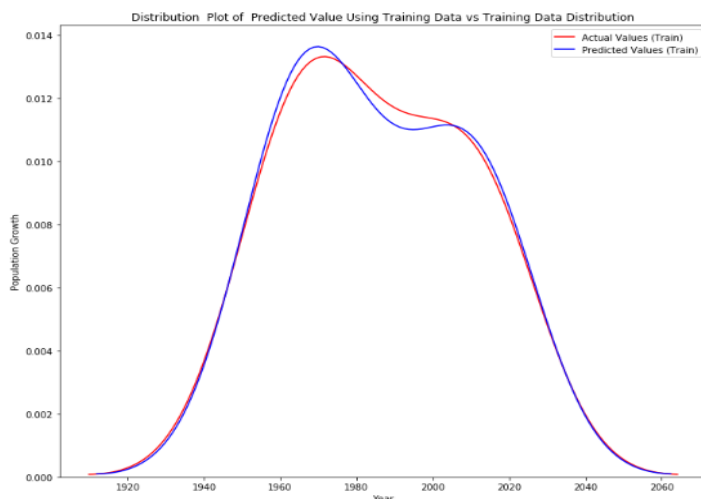
4. Predictive Modeling of data:

There are two types of models, regression and classification, that can be used to predict population of Mumbai and Kolkata. Regression models can provide additional information on the amount of improvement, while classification models focus on the probabilities of future growth of population. Underlying algorithms are similar between regression and classification models, but different audience might prefer one over the other.

8]:

	Population	Growth
0	20185064	869327.0
1	19315737	1058324.0
2	18257413	1000341.0
3	17257072	1110545.0
4	16146527	2011164.0
5	14135363	1780273.0
6	12355090	1669560.0
7	10685530	1485987.0
8	9199543	1514197.0
9	7685346	1272470.0
10	6412876	1098576.0
11	5314300	899396.0
12	4414904	688694.0
13	3726210	637399.0

Distribution Plot of Population Growth :



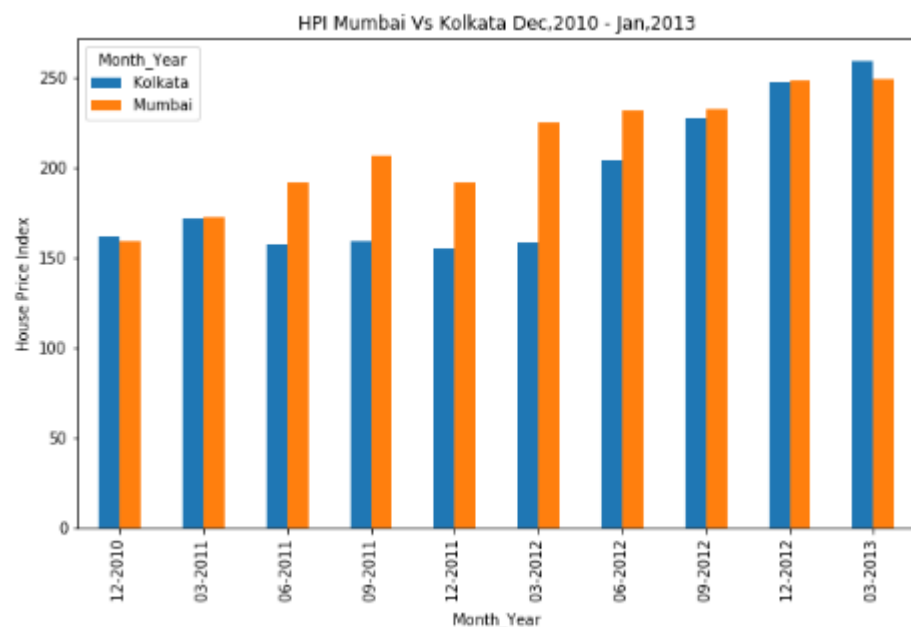
Comparative study of House Prices over the years in these two cities.

The study of House prices over the years between two cities will provide are future growth of cities as it impact the GDP of the city and finally impacts on the country. The comparative study shows how the price changes occurred and we can do a prediction of future prices increase from the study of hpi.

1):

	Month_Year	12-2010	03-2011	06-2011	09-2011	12-2011	03-2012	06-2012	09-2012	12-2012	03-2013
0	All India	132.6	141.7	152.0	157.8	164.1	176.9	188.6	194.3	206.8	211.2
1	Ahmedabad	128.8	128.7	152.3	162.8	171.8	177.2	176.6	183.4	187.8	193.5
2	Bangalore	104.7	113.6	116.9	116.0	146.1	140.6	140.2	143.0	147.9	148.3
3	Chennai	118.4	106.8	106.3	113.9	120.3	117.0	133.9	129.5	149.2	148.0
4	Delhi	111.4	135.2	152.8	153.0	168.6	195.3	217.3	225.2	247.8	259.2

Month_Year	Kolkata	Mumbai
12-2010	161.2	159.3
03-2011	171.9	172.3
06-2011	157.0	191.6
09-2011	159.0	206.1
12-2011	155.0	191.7
03-2012	158.4	224.7
06-2012	204.2	231.8
09-2012	226.9	232.4
12-2012	247.3	248.5
03-2013	258.6	248.6



Trending Place study of Mumbai and Kolkata

The study of trending places would show the growth of business by number of places and location of the places and will help us to decide the future of the city growth.

Collected Trending data of Mumbai from Foursquare

	reasons.count	reasons.items	referralId	venue.categories	venue.id
0	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-4bd1a0bd5e0cce72d3bda184-0	[{"id": "4bf58dd8d48988d1fa931735", "name": "H..."}]	4bd1a0bd5e0cce72d3bda184
1	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-4bc9c62b511f9521982faec7-1	[{"id": "4bf58dd8d48988d18a941735", "name": "C..."}]	4bc9c62b511f9521982faec7
2	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-4d4c107ee1ec6dcbad95d475-2	[{"id": "4bf58dd8d48988d1fa931735", "name": "H..."}]	4d4c107ee1ec6dcbad95d475
3	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-4c7661a45db9bfb792904913-3	[{"id": "4f2a25ac4b909258e854f55f", "name": "N..."}]	4c7661a45db9bfb792904913
4	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-4d79f7bd1bf03704dd56d9d5-4	[{"id": "54135bf5e4b08f3d2429dfe4", "name": "I..."}]	4d79f7bd1bf03704dd56d9d5

Collected Trending data of Kolkata from Foursquare

1:

	reasons.count	reasons.items	referralId	venue.categories	venue.id
0	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-4caa0096d971b1f7ccca23e1-0	[{"id": "4bf58dd8d48988d145941735", "name": "C..."}]	4caa0096d971b1f7ccca23e1
1	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-5263e1ba11d265711e8024bf-1	[{"id": "4bf58dd8d48988d116941735", "name": "B..."}]	5263e1ba11d265711e8024bf
2	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-4babe4fff964a520f8d23ae3-2	[{"id": "4bf58dd8d48988d129951735", "name": "T..."}]	4babe4fff964a520f8d23ae3
3	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-4b0587d9f964a52023a422e3-3	[{"id": "4bf58dd8d48988d10f941735", "name": "I..."}]	4b0587d9f964a52023a422e3
4	0	[{"summary": "This spot is popular", "type": "..."}]	e-0-4c714f4fd7fab1f715d760c9-4	[{"id": "4bf58dd8d48988d16d941735", "name": "C..."}]	4c714f4fd7fab1f715d760c9

5 rows × 22 columns

A map of Mumbai, India, showing the city's layout and surrounding water bodies. The central business district (CBD) is highlighted in yellow, indicating the study area. Key locations labeled include Malakshmi, Cotton Green, Victoria Garden, Darikhana, Bysculla East, Mazagaon, Chinch Bunder, Wadi Bandar, Masjid Bunder, Colaba, and Defence Station Colaba. The map also shows the Gateway of India, the Gateway - Elephanta Island Ferry, and the Mumbai Naval Base and Dockyard. The Arabian Sea is visible to the west and south, and the Thane Creek is to the east.

5. Result and Observation:

- As of now from the results we have seen, the population growth rate of Kolkata is higher than Mumbai but, total pollution of Mumbai is greater than Kolkata.
- The HPI of Mumbai is greater than Kolkata .
- The trending places in Mumbai is greater than Kolkata

6. Conclusion

The population of Kolkata has increased more higher rate than Mumbai. The study can predict the future population growth by using the model we have. Along with that the study of house prices show that Kolkata house prices has grown slower than Mumbai and we have more trending places exist in Mumbai than Kolkata. So, growth of business stays in Mumbai.

7. Future Plan

I have a further study or pollution, educated peoples, health and crime rates would help to determine the livelihood of the cities.