The Battle of Neighborhoods

Introduction

Background

Bangalore officially known as Bengaluru, is the capital of the Indian state of Karnataka. It has a population of about 10 million and a metropolitan population of about 8.52 million, making it the third most populous city and fifth most populous urban agglomeration in India.

Bangalore is widely regarded as the "Silicon Valley of India" (or "IT capital of India") because of its role as the nation's leading information technology (IT) exporter. IT firms in Bangalore employ about 1.5 million employees in the IT and IT-enabled services sector.

Additionally, the headquarters of several public sector undertakings such as Bharat Electronics Limited (BEL), Hindustan Aeronautics Limited (HAL), National Aerospace Laboratories (NAL) and Indian Space Research Organisation (ISRO) are located in Bangalore. Bangalore also houses several research and development centres for many firms such as ABB, Airbus, Bosch, Boeing, General Electric, General Motors, Google, Liebherr-Aerospace, Microsoft, Mercedes-Benz, Nokia, Oracle, Philips, Shell, Toyota and Tyco.

(Reference: https://en.wikipedia.org/wiki/Bangalore).

Problem Description

The vast amount of job opportunities attracts workforce from all around the country as well as other parts of the state. The huge in-flow of people created a high demand for rental residential properties in Bangalore. This has resulted in a rapid growth of real estate in Bangalore resulting in an abundance of residential properties.

The business problem we will solve is: From the overabundant residential properties, how would the migrant workforce decide the most suitable location to rent residential properties.

This project explores different localities in Bangalore. We will cluster different localities based on rental rates and distribution of various facilities like schools, malls, parks, restaurants etc. available around the neighborhood. This would give a better understanding of the localities to make an informed decision on where to rent residential properties.

Data

- The rental rates data are extracted from the "Makaan.com" website (https://www.makaan.com/price-trends/property-rates-for-rent-in-bangalore). The website lists the average rental rates and rental rate range for 1BHK, 2BKH and 3BHK properties for different localities in Bangalore. Few rows of data from the website are shown below.

Locality Name	Rental Rates					
search locality in bangalore	1 BHk		2 BHK		3 BHK	
	Rent range	Avg rent	Rent range	Avg rent	Rent range	Avg rent
HSR Layout	₹ 5,750 - 40,000	₹ 17,662.94	₹ 17,000 - 50,000	₹ 26,700	₹ 32,000 - 1.2 L	₹ 58,46.51
Koramangala	₹ 7,000 - 45,000	₹ 17,144.21	₹ 14,000 - 60,000	₹ 29,525.64	₹ 23,000 - 1.2 L	₹ 53,621.62
Whitefield	₹ 5,499 - 1.6 L	₹ 13,416.07	₹ 6,500 - 49,000	₹ 18,346.65	₹ 21,000 - 50,000	₹ 37,33.33
Krishnarajapura	₹ 4,000 - 95,000	₹ 13,212.5	₹ 10,000 - 26,000	₹ 15,176.47	₹ 60,000 - 61,000	₹ 60,500
Begur	₹ 6,500 - 18,500	₹ 9,600	₹ 8,500 - 20,000	₹ 14,681.25	₹ 22,100	₹ 22,100

Figure 1: Rental Data from Makaan.com website

- Python GeoPy package (Nominatim API) is used to get the Longitude and Latitude data of the localities in Bangalore.

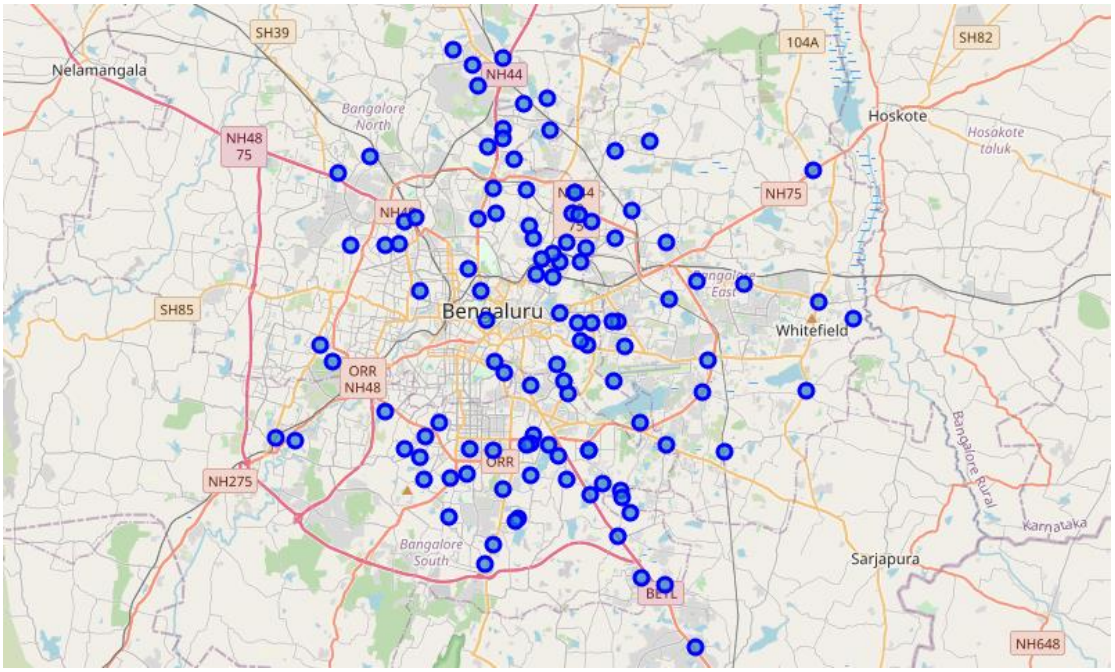

Figure 2: Localities in Bangalore

- To explore the localities and their neighborhoods, FourSquare API interface is used. FourSquare API is used to get data on various facilities like schools, malls, parks, restaurants etc. available around the neighborhood.

Methodology

The following steps are followed to solve our business problem:

- Bangalore rental rates data from Makaan.com website is scraped using BeautifulSoup and converted into a pandas dataframe. This dataframe contains the average rental rates and rental rate range for localities in Bangalore. The dataframe is cleaned and processed to suit our requirement.

	Locality	1BHK_Avg_Rent	2BHK_Avg_Rent	3BHK_Avg_Rent
0	Koramangala	17,144.21	29,525.64	53,621.62
1	Whitefield	13,416.07	18,346.65	37,33.33
2	Krishnarajapura	13,212.5	15,176.47	60,500
3	Begur	9,600	14,681.25	22,100
4	Varthur	8,787	14,400	74,000

Figure 3: Rental Rate Dataframe

- Python GeoPy package (Nominatim API) is used to get the Longitude and Latitude data of the localities in Bangalore. This data is added to the rental data dataframe. The resulting dataframe is cleaned to remove any unavailable data or any outliers.

	Locality	1BHK_Avg_Rent	2BHK_Avg_Rent	3BHK_Avg_Rent	Latitude	Longitude
0	Varthur	8,787	14,400	74,000	12.9406	77.747
1	Mahadevapura	11,205.26	17,521.43	35,000	12.9935	77.6924
2	Whitefield Hope Farm Junction	9,250	16,000	36,580.77	12.9829	77.7533
3	Budigere Cross	22,000	19,000	19,500	13.0464	77.7503
4	Jakkur	12,666.67	16,475	43,000	13.0785	77.6069

Figure 4: Rental Rate Dataframe with Locality Coordinate Data

- The localities are compared by the highest and lowest rental rates for 1BHK, 2BHK and 3BHK. Matplotlib is used to plot these data.

- K-means clustering is used to cluster the localities based on the rental rates for 1BHK, 2BHK and 3BHK.

	1BHK_Avg_Rent	2BHK_Avg_Rent	3BHK_Avg_Rent	Labels
0	7500.00	16500.00	42000.00	1
1	16500.00	25250.00	32000.00	0
2	15000.00	24000.00	30000.00	0
3	11916.67	13583.33	28333.33	1
4	8500.00	35450.00	44000.00	0

Figure 5: Locality Cluster based on Rental Rates

- FoursquareAPI is used to explore the venues within 1000 metres of each locality. The 10 most common venues for each locality are found out.

	Locality	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	1st Phase JP Nagar	Indian Restaurant	Fast Food Restaurant	Chinese Restaurant	Metro Station	Beer Garden	South Indian Restaurant	Bengali Restaurant	Boarding House	Spa	Jewelry Store
1	2nd Phase JP Nagar	Indian Restaurant	Fast Food Restaurant	Café	Chinese Restaurant	Snack Place	Coffee Shop	Pizza Place	Electronics Store	South Indian Restaurant	Bookstore
2	3rd Block HBR Layout	Pizza Place	Café	Diner	Yoga Studio	Fast Food Restaurant	Farmers Market	Falafel Restaurant	Event Service	Electronics Store	Eastern European Restaurant
3	5th Phase	Indian Restaurant	Snack Place	Bus Station	Bakery	Yoga Studio	Dive Bar	Fast Food Restaurant	Farmers Market	Falafel Restaurant	Event Service
4	Adugodi	Indian Restaurant	Dessert Shop	Café	Lounge	Multiplex	Coffee Shop	Juice Bar	Bookstore	Brewery	Donut Shop

Figure 6: 10 Common Venues for each Locality

- K-means clustering is used to cluster the localities with similar venues.

	Locality	Latitude	Longitude	Cluster Labels
0	Varthur	12.9406	77.747	3
1	Mahadevapura	12.9935	77.6924	3
2	Whitefield Hope Farm Junction	12.9829	77.7533	1
3	Budigere Cross	13.0464	77.7503	3
4	Jakkur	13.0785	77.6069	3

Figure 7: Locality Cluster based on Venues

Results

- The most and least expensive localities for 1BHK, 2BHK and 3BHK are shown below.

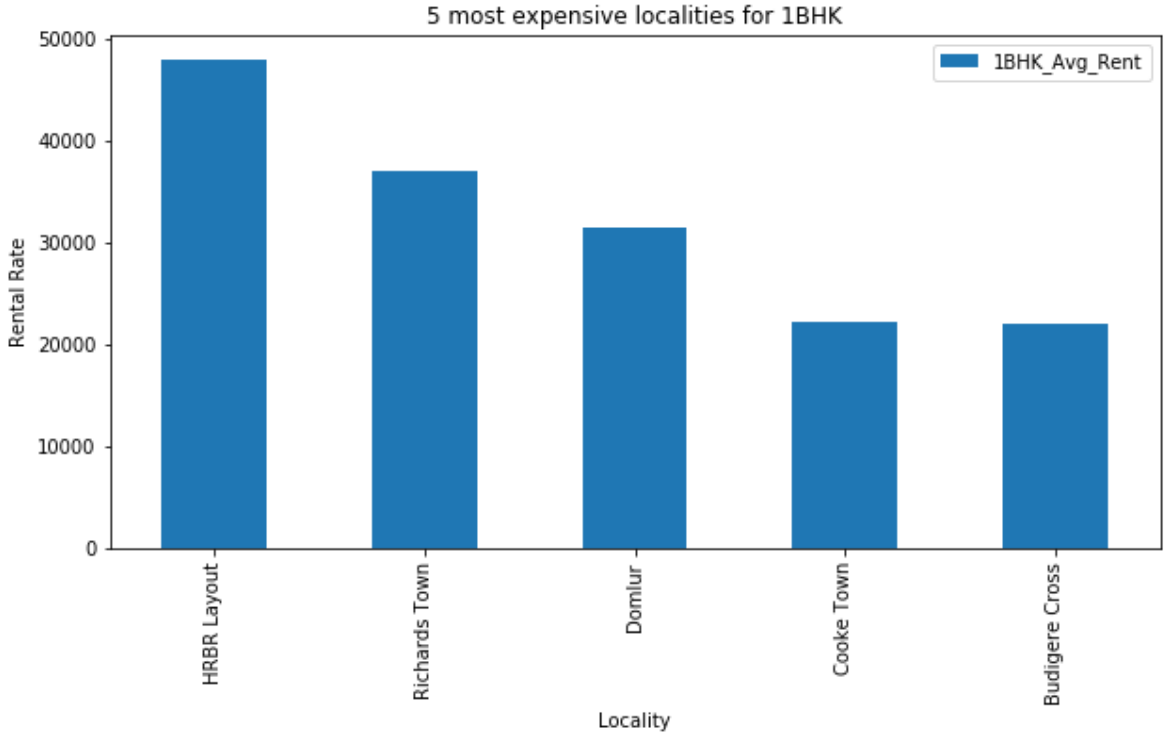

Figure 8: Most Expensive Localities for 1BHK

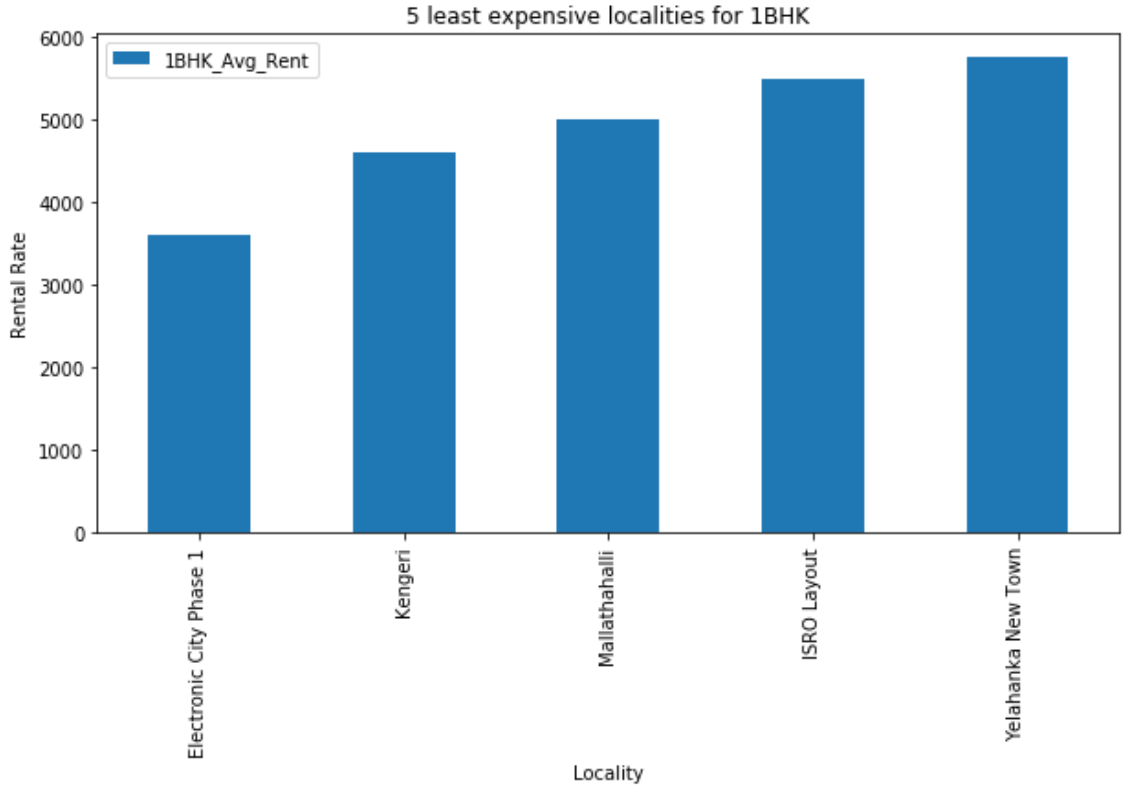

Figure 9: Least Expensive Localities for 1BHK

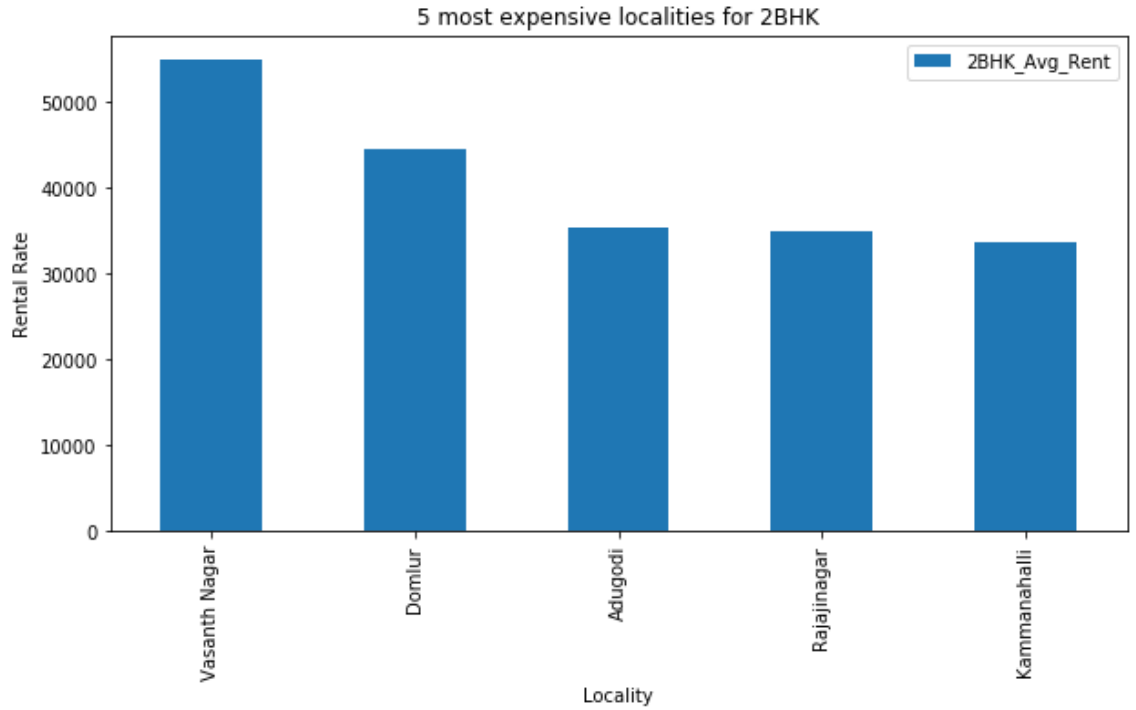

Figure 10: Most Expensive Localities for 2BHK

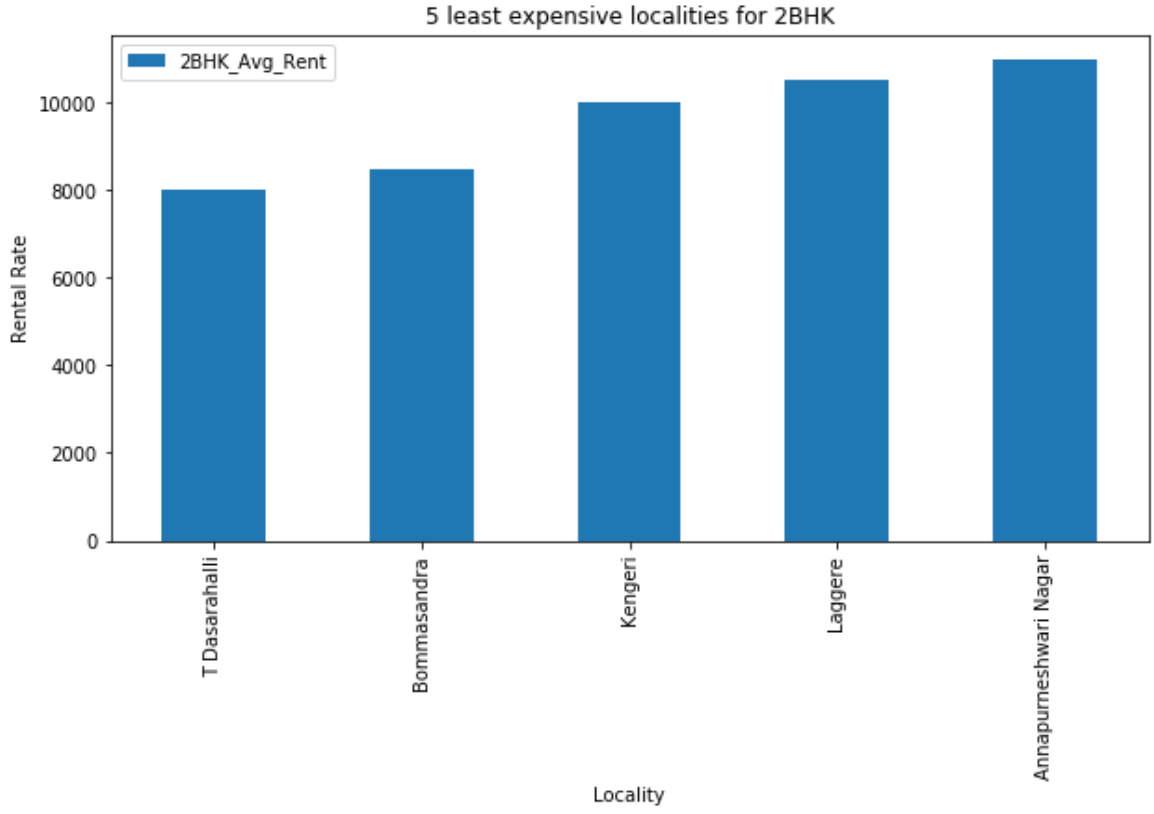

Figure 11: Least Expensive Localities for 2BHK

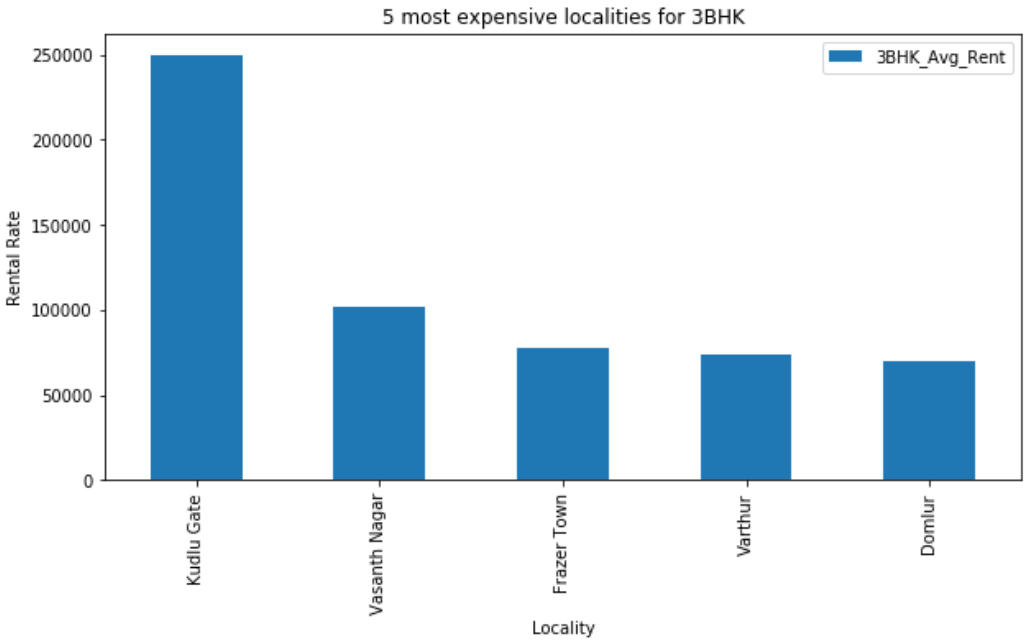

Figure 12: Most Expensive Localities for 3BHK

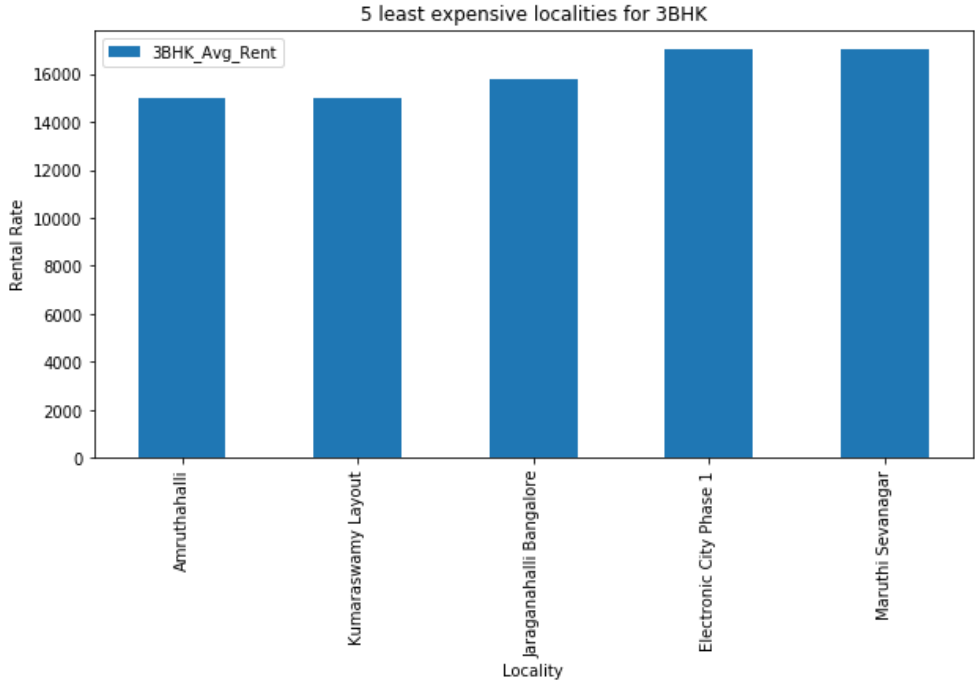

Figure 13: Least Expensive Localities for 3BHK

From above charts the following observations are made:

- The locality of Kengeri has an overall lower rental rates for 1BHK and 2BHK residential properties.
- The locality of Electronic City Phase 1 has an overall lower rental rates for 1BHK and 3BHK residential properties.
- The locality of Domlur has the overall highest rental rates for 1BHK, 2BHK and 3BHK residential properties.

- Results for K-means Clustering of the localities based on the rental rates are shown below.

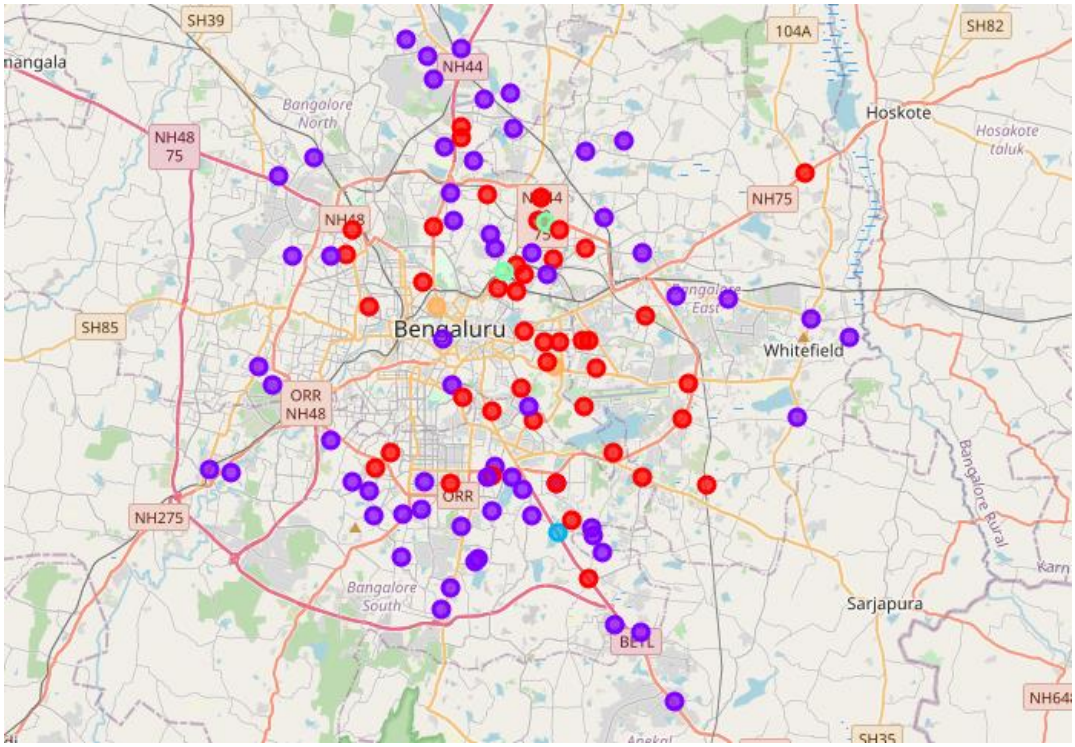

Figure 14: Locality Clustering based on Rental Rates

Labels	1BHK_Avg_Rent	2BHK_Avg_Rent	3BHK_Avg_Rent
0	13927.763636	23399.498864	37503.628409
1	9507.346885	15580.538361	28908.723770
2	8571.430000	20625.000000	250000.000000
3	38833.333333	30190.476667	58444.443333
4	10000.000000	55000.000000	101666.670000

Figure 15: Mean Rental Values of each Cluster

	Locality	1BHK_Avg_Rent	2BHK_Avg_Rent	3BHK_Avg_Rent	Latitude	Longitude	Labels
0	1st Phase JP Nagar	7500.00	16500.00	42000.00	12.9119	77.5799	1
3	5th Phase	11916.67	13583.33	28333.33	13.1051	77.5715	1
6	Annapurneshwari Nagar	15000.00	11000.00	22000.00	12.9742	77.5880	1
7	Arakere	11614.29	19600.00	24333.33	12.8785	77.6042	1
11	Bilekahalli	7300.00	20000.00	32000.00	12.8996	77.6103	1

Figure 16: Cluster 2

Localities in Cluster 2 have an overall lower rental rates for 1BHK, 2BHK and 3BHK residential properties. This is the biggest cluster with 61 localities.

- Results for K-means Clustering of the localities based on the venues are shown below.

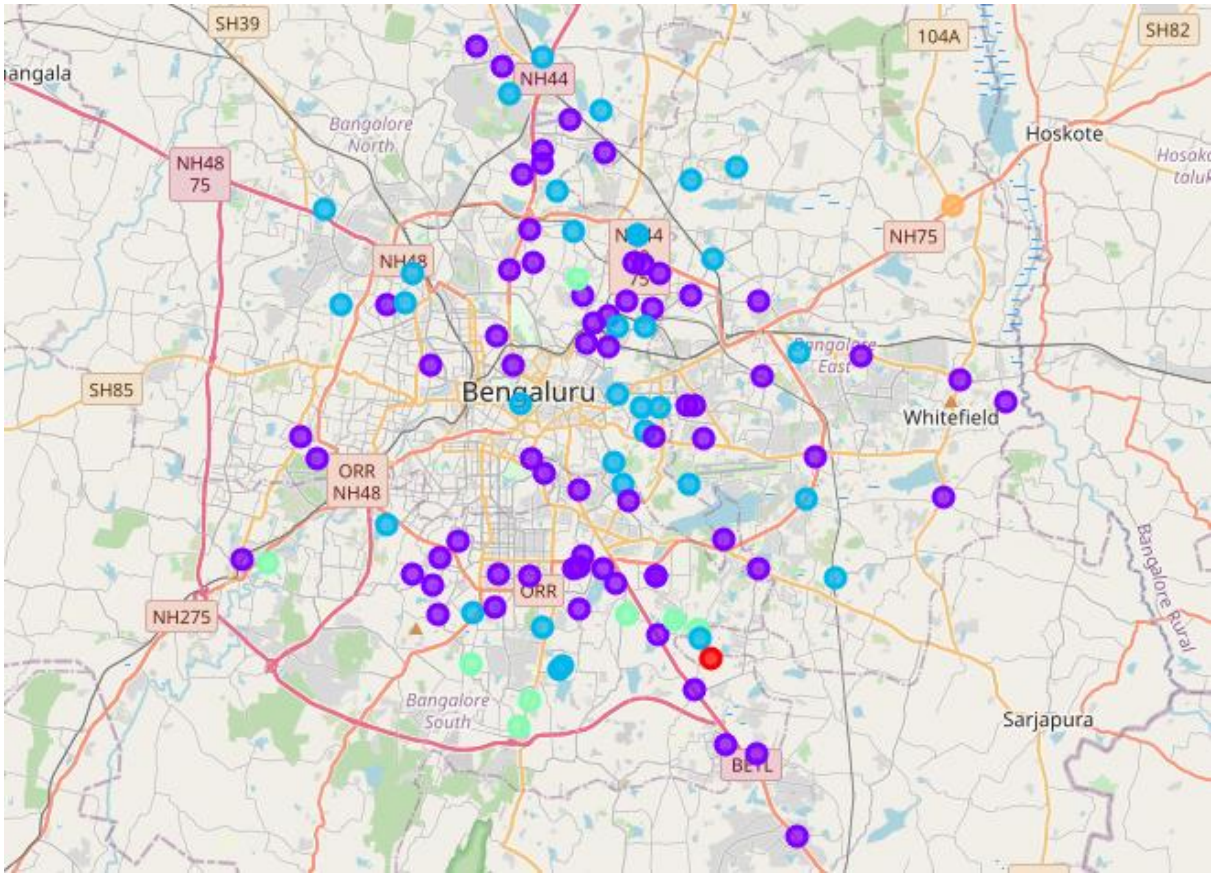

Figure 17: Locality Clustering based on Venues

	Locality	Latitude	Longitude	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	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
73	Parappana Agrahara	12.8817	77.6598	0	Gym	Yoga Studio	Donut Shop	Flea Market	Fish Market	Financial or Legal Service	Fast Food Restaurant	Farmers Market	Falafel Restaurant	Electronics Store

Figure 18: Cluster 1

	Locality	Latitude	Longitude	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	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
3	Budigere Cross	13.0464	77.7503	4	Bus Stop	Yoga Studio	Food & Drink Shop	Flea Market	Fish Market	Financial or Legal Service	Fast Food Restaurant	Farmers Market	Falafel Restaurant	Electronics Store

Figure 19: Cluster 5

Cluster 1 and 5 have only one locality each which may be the result of some unique venues in these localities.

	Locality	Latitude	Longitude	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	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Varthur	12.9406	77.747	1	Indian Restaurant	Indie Movie Theater	Lake	Bus Station	Supermarket	Yoga Studio	Dumpling Restaurant	Flea Market	Fish Market	Financial or Legal Service
2	Whitefield Hope Farm Junction	12.9829	77.7533	1	Hotel	Breakfast Spot	Chinese Restaurant	Chaat Place	Eastern European Restaurant	Fast Food Restaurant	Men's Store	Indian Restaurant	Vegetarian / Vegan Restaurant	Ice Cream Shop
4	Jakkur	13.0785	77.6069	1	Café	Indian Restaurant	Clothing Store	Animal Shelter	Donut Shop	Flea Market	Fish Market	Financial or Legal Service	Fast Food Restaurant	Farmers Market
5	Marathahalli	12.9553	77.6984	1	Indian Restaurant	Vegetarian / Vegan Restaurant	Restaurant	BBQ Joint	Andhra Restaurant	Dessert Shop	Fast Food Restaurant	Breakfast Spot	Lounge	Bus Station
9	BTM Layout	12.9152	77.6103	1	Indian Restaurant	Bakery	Vegetarian / Vegan Restaurant	Coffee Shop	Snack Place	Ice Cream Shop	Park	Chinese Restaurant	Sandwich Place	Café
10	Electronic City Phase 1	12.8497	77.665	1	Indian Restaurant	Food Court	Coffee Shop	Hotel	Ice Cream Shop	Bar	Sandwich Place	Breakfast Spot	Snack Place	French Restaurant
11	Kalyan Nagar	13.0221	77.6403	1	Indian Restaurant	Café	Fast Food Restaurant	BBQ Joint	Korean Restaurant	Ice Cream Shop	South Indian Restaurant	Bistro	Pizza Place	Lounge
12	Electronic City Phase 2	12.8469	77.6769	1	Indian Restaurant	Hyderabadi Restaurant	Toll Plaza	Basketball Court	Bus Stop	Diner	Café	Vegetarian / Vegan Restaurant	Coworking Space	Deli / Bodega

Figure 20: Cluster 2

Cluster 2 is the biggest cluster with 66 localities. The most common venues in these localities are Restaurants (Indian, Hyderabadi, Chinese, South Indian, Fast food, BBQ, Korean etc). Cluster 2 contains localities where there is an abundance of eateries which serve food of different cuisines.

	Locality	Latitude	Longitude	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	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
1	Mahadevapura	12.9935	77.6924	2	Fast Food Restaurant	Coffee Shop	Clothing Store	French Restaurant	Donut Shop	Café	Bowling Alley	Italian Restaurant	Sporting Goods Shop	Lounge
6	Yelahanka	13.1007	77.5963	2	Café	Multiplex	Smoke Shop	Fast Food Restaurant	Food Truck	Farmers Market	Clothing Store	Cosmetics Shop	Vegetarian / Vegan Restaurant	Ice Cream Shop
7	Indira Nagar	12.9733	77.6405	2	Indian Restaurant	Ice Cream Shop	Pub	Café	Lounge	Bar	Cocktail Bar	Bakery	Chinese Restaurant	Restaurant
8	Horamavu	13.0273	77.6602	2	Badminton Court	Andhra Restaurant	Athletics & Sports	Kerala Restaurant	Yoga Studio	Food	Flea Market	Fish Market	Financial or Legal Service	Fast Food Restaurant
23	Hulimavu	12.8773	77.6028	2	Café	Multiplex	Bakery	Indian Restaurant	South Indian Restaurant	Electronics Store	Movie Theater	Ice Cream Shop	Fast Food Restaurant	Italian Restaurant
26	Ejipura	12.9452	77.6269	2	Café	Pizza Place	Indian Restaurant	Gym / Fitness Center	Ice Cream Shop	Clothing Store	Bengali Restaurant	Juice Bar	Seafood Restaurant	Beer Garden
27	hebbal kempapura	13.0521	77.6018	2	Pharmacy	Department Store	Café	Pizza Place	Fast Food Restaurant	Building	Bus Station	Indian Restaurant	Coworking Space	Dry Cleaner
33	Ulsoor	12.9779	77.6247	2	Hotel	Café	Bar	Chinese Restaurant	Asian Restaurant	Department Store	Restaurant	Clothing Store	Athletics & Sports	Thai Restaurant

Figure 21: Cluster 3

Cluster 3 is the second biggest cluster with 33 localities. The most common venues in these localities are Café, Multiplex, Pubs and Bars. Cluster 3 contains localities which have venues for evening and night time entertainment.

	Locality	Latitude	Longitude	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	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
13	Harlur	12.892	77.655	3	Department Store	Indian Restaurant	Badminton Court	Yoga Studio	Dry Cleaner	Flea Market	Fish Market	Financial or Legal Service	Fast Food Restaurant	Farmers Market
22	Gottigere	12.8565	77.5877	3	Indian Restaurant	Department Store	Pharmacy	Food Truck	Italian Restaurant	Donut Shop	Fish Market	Financial or Legal Service	Fast Food Restaurant	Farmers Market
25	Konanakunte	12.8793	77.5698	3	Vegetarian / Vegan Restaurant	Indian Restaurant	Department Store	Bus Station	Yoga Studio	Dry Cleaner	Flea Market	Fish Market	Financial or Legal Service	Fast Food Restaurant
46	hongasandra bangalore	12.8975	77.6281	3	Indian Restaurant	Pizza Place	Department Store	Hotel Bar	Clothing Store	Donut Shop	Fish Market	Financial or Legal Service	Fast Food Restaurant	Farmers Market
60	Kaval Byrasandra	13.02	77.6093	3	Department Store	Pharmacy	Indian Restaurant	Gourmet Shop	Bakery	Dry Cleaner	Flea Market	Fish Market	Financial or Legal Service	Fast Food Restaurant
62	Kalena Agrahara	12.8661	77.5919	3	Indian Restaurant	Pharmacy	Gym / Fitness Center	Italian Restaurant	Department Store	Dive Bar	Fish Market	Financial or Legal Service	Fast Food Restaurant	Farmers Market
90	Mangammanapalya	12.8958	77.6457	3	Indian Restaurant	Bus Station	Automotive Shop	Department Store	Badminton Court	Asian Restaurant	Middle Eastern Restaurant	Coffee Shop	Deli / Bodega	Electronics Store

Figure 22: Cluster 4

The most common venues in Cluster 4 localities are Department Stores, Pharmacy, Dry Cleaners, Fish and Flea markets. Cluster 4 contains localities which have retail establishments or consumer goods stores.

Discussion

After analyzing the results, the following observations can be made:

- Based on the rental rates, localities of Cluster 2 and to a lesser extent Cluster 1 are the best places to rent residential properties. Cluster 2 has the overall lowest average rental rates.
- Based on venues, people who prefer dining outside most of the times should consider localities from Cluster 2 as they would have a wide variety of eateries at their disposal.
- Based on venues, people who prefer places for evening entertainment and nightlife should consider localities from Cluster 3.
- Based on venues, for a family, Cluster 4 would be suitable. These localities most commonly have Department stores, markets, pharmacy mixed with some restaurants and bus stops

The choice of choosing a place to rent will vary from person to person. Based on their choices, people can make use of this project while selecting a place to rent.

To determine a good locality we have taken only the average rental rates and nearby venues into consideration. Other important factors such as crime rates and workplace access should also be considered. For further studies, crime rate data and distance from workplace data are to be applied in this project.

Conclusion

This project makes use of rental rates and nearby venues to give a better understanding of the localities in Bangalore while choosing a place to rent. For future development of this project, crime rates data and workplace data can be taken into consideration.