Finding a suitable place to run a restaurant in the city of Visakhapatnam, India

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1. Introduction

1.1 Motivation

An entrepreneur who wishes to start a business in a city would prefer to start business in a viable location that brings more profit. He would search for similar business entities available in the city and derives different number of factors to choose a place of interest. This extra information would help decide which place to choose amongst the many places in the city. Combining the location of the venues in the city with their price and rating information would surely help visitors in a city make better informed decisions about the places they should investigate.

Visakhapatnam is one of the beautiful cities of India. It has population of around 2 million and population density of **3000** per square kilometre. I have been residing in this city for 2 decades. The city is one the prominent destiny of tourism. This city has a name as "City of destiny" with an area of approximately **11160** square kilometres with 4 administrative divisions. Because of its location besides the Bay Of Bengal Ocean, beautiful beaches and atmosphere many tourists keep coming to this place. This can be one good profitable place to start a business. The map of the city of Visakhapatnam derived with 'geopy' library is shown below.
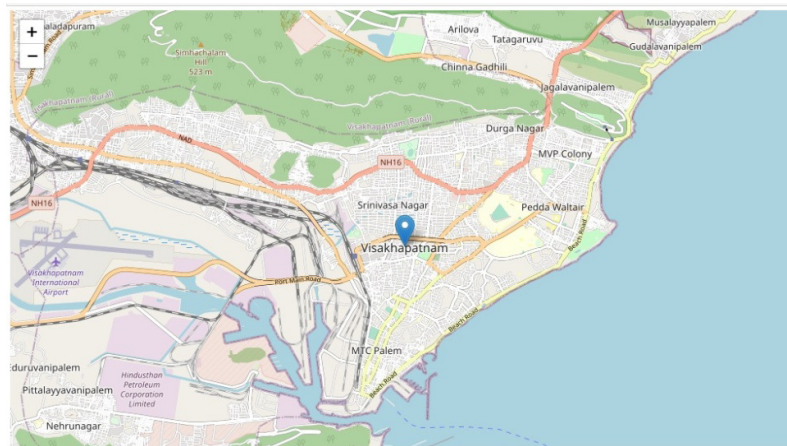

Fig.1. City of Visakhapatnam

1.2 Target Stake holder

The target audience for such a project is any business man who is willing to establish a restaurant in the city of Visakhapatnam; India. He can use the plots and maps from this work to quickly select places that suit their budget and quality preferences.

2. Data

2.1 Data Sources

To get location and other information about different venues in Visakhapatnam, two APIs namely, Foursquare and Zomoto are used.

- **Foursquare** API is used to fetch venues in Visakhapatnam with a range of 15 Kilometres from centre.
- **Zomato** API(https://developers.zomato.com/api) is used to bring out the extra information of user ratings, price for two people, price range

Foursquare API gives the following information for each venue:
- **Name:** The name of the venue.
- **Category:** The category type as defined by the API.
- **Latitude:** The latitude value of the venue.
- **Longitude:** The longitude value of the venue.

The raw data from Foursqaure API looks like

```
{'meta': {'code': 200, 'requestId': '5fddd1edee40976c11c106cc'},
 'response': {'suggestedFilters': {'header': 'Tap to show:',
   'filters': [{'name': 'Open now', 'key': 'openNow'}]},
  'headerLocation': 'Vizag',
  'headerFullLocation': 'Vizag',
  'headerLocationGranularity': 'city',
  'totalResults': 70,
  'suggestedBounds': {'ne': {'lat': 17.858127735000135,
    'lng': 83.44274624994056},
   'sw': {'lat': 17.588127464999868, 'lng': 83.15982215005944}},
  'groups': [{'type': 'Recommended Places',
    'name': 'recommended',
    'items': [{'reasons': {'count': 0,
       'items': [{'summary': 'This spot is popular',
         'type': 'general',
         'reasonName': 'globalInteractionReason'}]},
      'venue': {'id': '4c10efad81e976b033e30feb',
       'name': 'Ramakrishna Mission Beach',
       'location': {'address': 'Beach Rd.',
```

The raw data is processed to bring out only the required columns. The sample processed data of venues retrieved from Foursquare API from the city of Visakhapatnam is shown below.

	name	categories	lat	lng
0	Ramakrishna Mission Beach	Beach	17.715271	83.324016
1	Cream & Fudge	Ice Cream Shop	17.719339	83.311927
2	Novotel Varun Beach	Restaurant	17.710712	83.316263
3	Novotel Visakhapatnam Varun Beach	Hotel	17.710829	83.316218
4	Food Ex	Fast Food Restaurant	17.722155	83.318422

The number of venues retrieved is 70.

Zomato API, gives the the following information for each venue:
- **Name:** The name of the venue.
- **Address:** The complete address of the venue.
- **Rating:** The ratings as provided by many users.
- **Price range:** The price range the venue belongs to as defined by Zomato.
- **Price for two:** The average cost for two people dining at the place. I later convert the same to average price per person by dividing by 2.
- **Latitude:** The latitude value of the venue.
- **Longitude:** The longitude value of the venue.

The raw data of Zomoto API for this city is like

Fetching data for venue: 1
{'results_found': 113, 'results_start': 0, 'results_shown': 1, 'restaurants': [{'restaurant': {'R': {'res_id': 2800433, 'is_g
rocery_store': False, 'has_menu_status': {'delivery': -1, 'takeaway': -1}}, 'apikey': '09726c570fa5341aa25e773e3a34ace4', 'i
d': '2800433', 'name': 'Coffee Wave', 'url': 'https://www.zomato.com/visakhapatnam/coffee-wave-maharani-peta-vizag?utm_source
=api_basic_user&utm_medium=api&utm_campaign=v2.1', 'location': {'address': 'RK Beach Road, Next to Bay Fashion, Pandurangapur
am, Maharani Peta, Vizag', 'locality': 'Maharani Peta', 'city': 'Vizag', 'city_id': 28, 'latitude': '17.7151362888', 'longitu
de': '83.3244260028', 'zipcode': '530003', 'country_id': 1, 'locality_verbose': 'Maharani Peta, Vizag'}, 'switch_to_order_men
u': 0, 'cuisines': 'Cafe', 'timings': '11am – 11pm (Mon-Sun)', 'average_cost_for_two': 500, 'price_range': 2, 'currency': 'R
s.', 'highlights': ['Cash', 'Takeaway Available', 'Seating Available', 'Credit Card', 'Delivery', 'No Alcohol Available', 'Ou
tdoor Seating', 'Live Sports Screening', 'Smoking Area', 'Digital Payments Accepted'], 'offers': [], 'opentable_support': 0,
'is_zomato_book_res': 0, 'mezzo_provider': 'OTHER', 'is_book_form_web_view': 0, 'book_form_web_view_url': '', 'book_again_ur
l': '', 'thumb': 'https://b.zmtcdn.com/data/pictures/3/2800433/057b9fdfe7c3412e81dd4ad16ac10b62.jpg?fit=around%7C200%3A200&cr
op=200%3A200%3B%2A%2C%2A', 'user_rating': {'aggregate_rating': '3.8', 'rating_text': 'Good', 'rating_color': '9ACD32', 'ratin
g_obj': {'title': {'text': '3.8'}, 'bg_color': {'type': 'lime', 'tint': '600'}}, 'votes': 1652}, 'all_reviews_count': 30, 'ph
otos_url': 'https://www.zomato.com/visakhapatnam/coffee-wave-maharani-peta-vizag/photos?utm_source=api_basic_user&utm_medium=
api&utm_campaign=v2.1#tabtop', 'photo_count': 56, 'menu_url': 'https://www.zomato.com/visakhapatnam/coffee-wave-maharani-peta
-vizag/menu?utm_source=api_basic_user&utm_medium=api&utm_campaign=v2.1&openSwipeBox=menu&showMinimal=1#tabtop', 'featured_ima
ge': 'https://b.zmtcdn.com/data/pictures/3/2800433/057b9fdfe7c3412e81dd4ad16ac10b62.jpg', 'medio_provider': False, 'has_onlin
e_delivery': 0, 'is_delivering_now': 0, 'store_type': '', 'include_bogo_offers': True, 'deeplink': 'zomato://restaurant/28004

The raw data is processed to bring out only the required columns. The sample processed data of venues retrieved from Zomota API from the city of Visakhapatnam is shown below.

Out[7]:	Unnamed: 0	venue	latitude	longitude	price_for_two	price_range	rating	address
0	0	Coffee Wave	17.715136	83.324426	500	2	3.8	RK Beach Road, Next to Bay Fashion, Panduranga...
1	1	Mumbai Kulfi	17.718523	83.308448	150	1	4.0	10-53-280, LIG-6/3, Nehrunagar Quarters, Ram N...
2	2	Infinity - Hotel Novotel	17.710937	83.316146	2000	4	4.1	Hotel Novotel, Beach Road, Maharani Peta, Vizag
3	3	Infinity - Hotel Novotel	17.710937	83.316146	2000	4	4.1	Hotel Novotel, Beach Road, Maharani Peta, Vizag
4	4	Food Ex	17.721970	83.318490	700	2	4.2	Block A, VUDA Complex, Udyog Bhavan, Behind HS...
5	5	Sam's Griddle	17.721625	83.315758	1000	3	4.1	3rd Floor, Srikanya Canopy, Waltair Main Road,...
6	6	Hotel Attarillu	17.712026	83.302462	250	1	3.8	Beside KLM Shopping Mall Jagadamba Junction, V...
7	7	Sri Sairam Parlour	17.726345	83.303422	300	1	4.4	Diamond Park, Railway New Colony Road, Dwaraka...
8	8	Sweet India	17.725141	83.316610	150	1	4.3	Dno: 10-1-44, CBM Compound, Visakhapatnam, Sri...
9	9	Satya Sea park food court	17.716372	83.311767	200	1	2.7	Opposite to submarine near YMCA, Maharani Peta...
10	10	Baskin Robbins	17.711039	83.315791	200	1	3.4	Sarvani traders(baskin robbins), Ground Floor,...

The number of venues retrieved is 69.

3. Data Processing

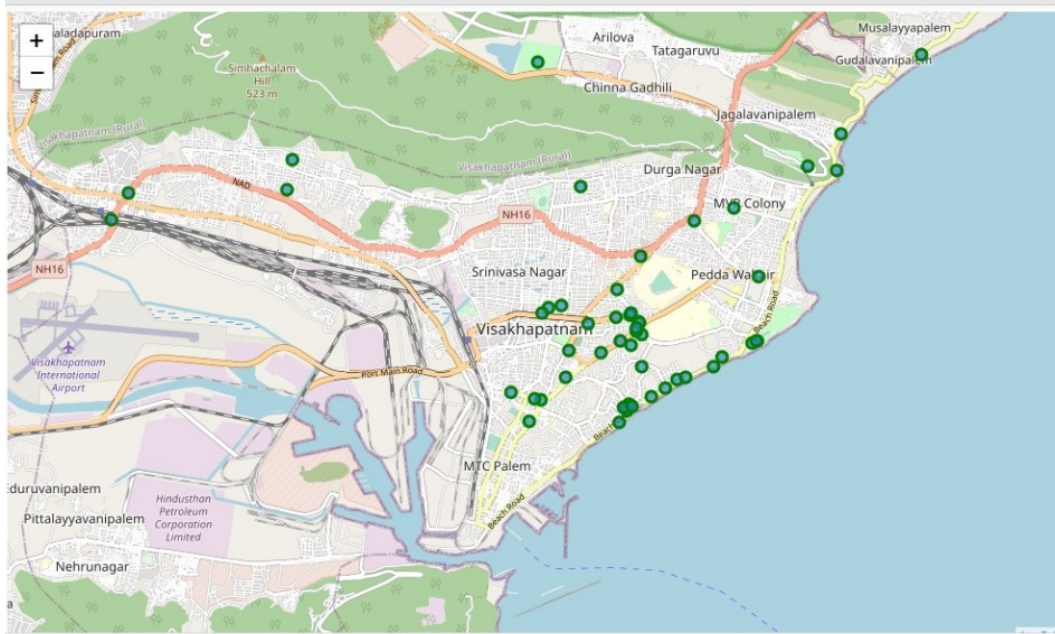The venues of data retrieved from Foursquare API are shown below.

Fig.2. Venues retrieved from Foursquare API

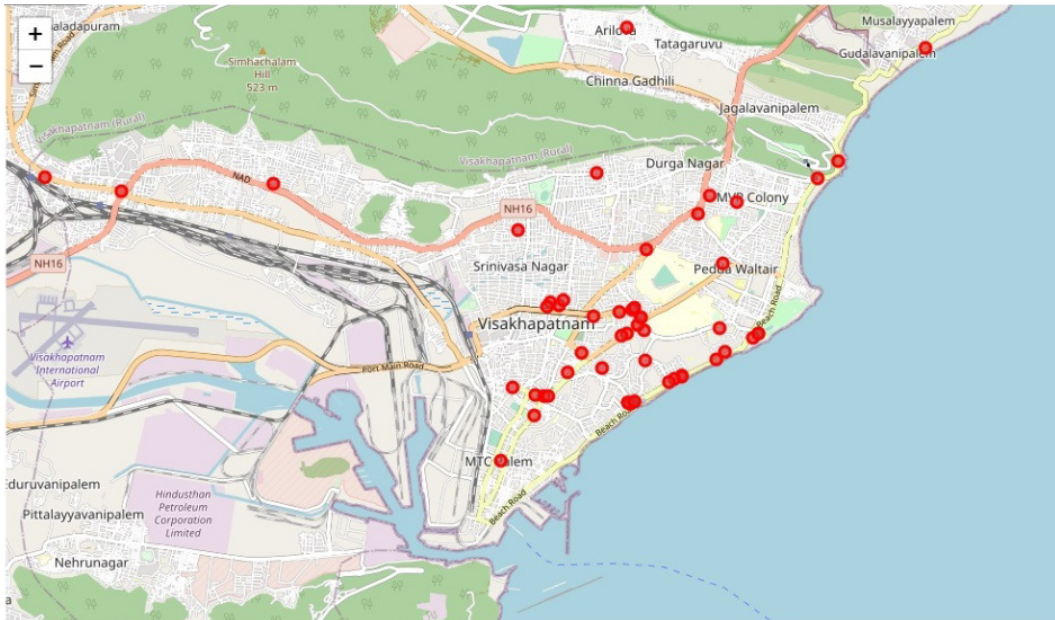The venues of data retrieved from Zomato API are shown below.

Fig.3. Venues retrieved from Zomato API

From fig.1 and fig.2, it is identified that some venues from the two APIs do not align with each other. Hence it needs to combine them using their latitude and longitude values.

To combine the two datasets, the latitude and longitude values of each corresponding venue need to match. It is necessary to drop all respective venues from the two datasets that had their latitude and longitude values differ by more than 0.0004. SO, it is needed to round both the latitude and longitude values up to 4 decimal places. Then, calculate the difference between the corresponding latitude and longitude values and find if the difference was less than 0.0004 which should ideally mean that the two locations are the same.This removed many outliers from the two datasets. Once this was done, it is observed that there were still some venues which were not correctly aligned. It is needed to drop venues that have same latitude and longitude values. The final dataset has now 34 venues. Since one venue is repeated by name it also is dropped. The sample of final data set of 33 venues is shown below.

	categories	Unnamed: 0	venue	latitude	longitude	price_range	rating	address	average_price
0	Beach	0.0	Coffee Wave	17.7151	83.3244	2.0	3.8	RK Beach Road, Next to Bay Fashion, Panduranga...	250.0
1	Restaurant	2.0	Infinity - Hotel Novotel	17.7109	83.3161	4.0	4.1	Hotel Novotel, Beach Road, Maharani Peta, Vizag	1000.0
2	Fast Food Restaurant	4.0	Food Ex	17.7220	83.3185	2.0	4.2	Block A, VUDA Complex, Udyog Bhavan, Behind HS...	350.0
3	Indie Movie Theater	6.0	Hotel Attarillu	17.7120	83.3025	1.0	3.8	Beside KLM Shopping Mall Jagadamba Junction, V...	125.0
4	Indian Restaurant	7.0	Sri Sairam Parlour	17.7263	83.3034	1.0	4.4	Diamond Park, Railway New Colony Road, Dwaraka...	150.0
5	Snack Place	8.0	Sweet India	17.7251	83.3166	1.0	4.3	Dno: 10-1-44, CBM Compound, Visakhapatnam, Sri...	75.0
6	Multiplex	10.0	Baskin Robbins	17.7110	83.3158	1.0	3.4	Sarvani traders(baskin robbins), Ground Floor,...	100.0

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24	Multiplex	42.0	KFC	17.7122	83.3011	2.0	4.2	Chitralaya Mall, N.T.S. 1678, Block 47, Suryab...	225.0
25	Clothing Store	44.0	Sri Sivarama Sweets	17.7092	83.3009	3.0	4.1	South Jail Road, Suryabagh, Opposite Vizag Cen...	500.0
26	Resort	45.0	Masala Mafia	17.7209	83.3358	3.0	0.0	Door 6-24-3, Beach Road, Suryabagh, Jagadamba ...	400.0
27	Indian Restaurant	46.0	Vihar	17.7797	83.3850	2.0	0.0	Opposite Gitam Univeristy, Beach Road, Rushiko...	350.0
28	Ice Cream Shop	47.0	Baskin Robbins	17.7110	83.3158	1.0	3.4	Sarvani traders(baskin robbins), Ground Floor,...	100.0
29	Hotel	48.0	Ming Garden - The Gateway Hotel	17.7112	83.3169	4.0	4.1	The Gateway Hotel, Beach Road, Maharani Peta, ...	1000.0

It is observed that there are venues which don't have a rating given and such venues are needed to be dropped. After dropping such venues the final dataset is left with 33 venues.

4. Methodology and Exploratory Data Analysis

This project aims at track the venues in Visakhapatnam based on their rating and average costs. This would enable any investor to identify the places where he/she wants to establish the restaurant. The following operations are performed to choose the place.

- Identify the best business in the city

- **Analyze the data** that is created based on the ratings and price of each venue.

- **Identify places where many venues are located** so that any investor can choose the place amongst many venue options.

- Explore **areas that are high rated and those that are low rated**

- Explore **high and low priced venues**.

- **Cluster the venues** based on the available information of each venue. This will allow us to clearly identify which place can be recommended and with what characteristics.

4.1. Right business

The complete dataset is now in its final form. Inspect these venues based on their rating. The rating of a venue is based on user reviews and belongs to a range from 1 to 5. Also analyze the venues based on their price per person as well as the price range.

There are different categories of venues in the data set. Take a look at the venues and check which venue categories are more in the list. The venues count category wise are shown below.
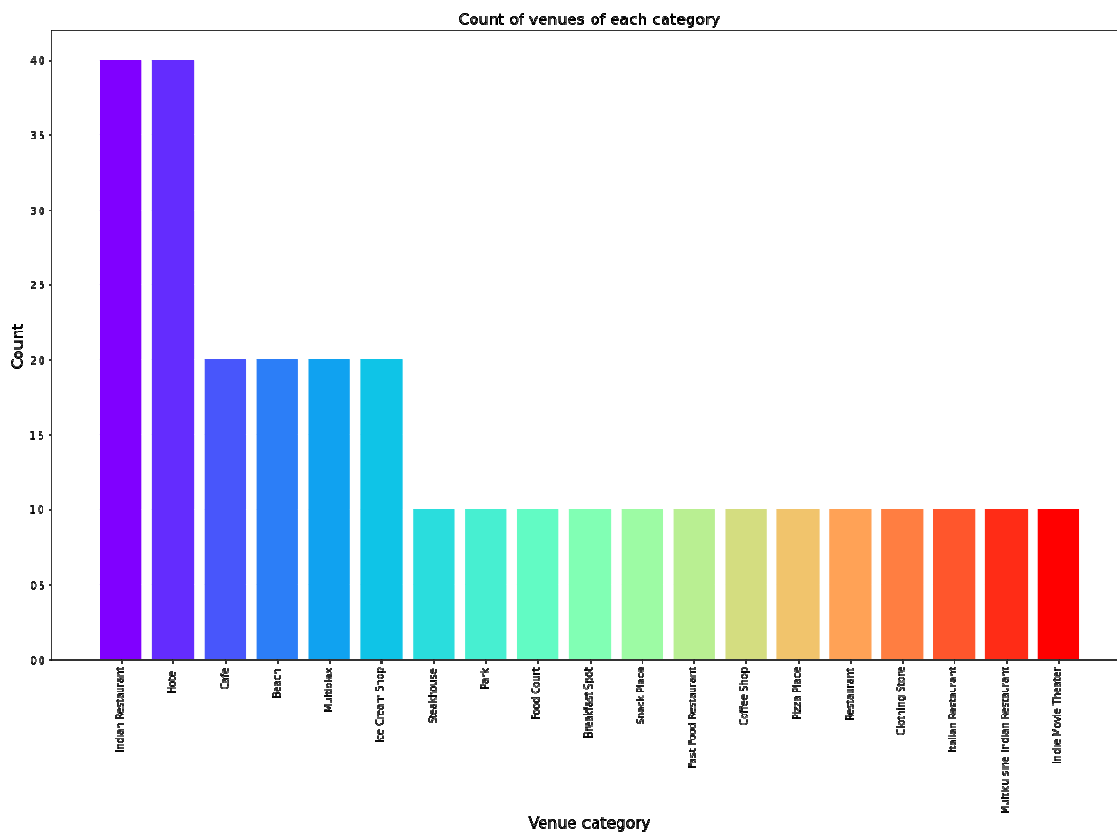

Fig.4 Count of various types of venues in Visakhapatnam

From figure 4, it is identified that the majority venues are actually Hotels and Indian Restaurants. This is closely followed by cafes. It is identified that the profitable business in Visakhapatnam must be restaurant.

4.2. Rating

In order to explore the ratings of various venues in Visakhapatnam, plot a bar chart with x-axis as the ratings from 1 to 5 and the y-axis as the count of venues with that rating. Plot the bar chart to see what average rating venues get in Visakhapatnam. This is shown in figure below.
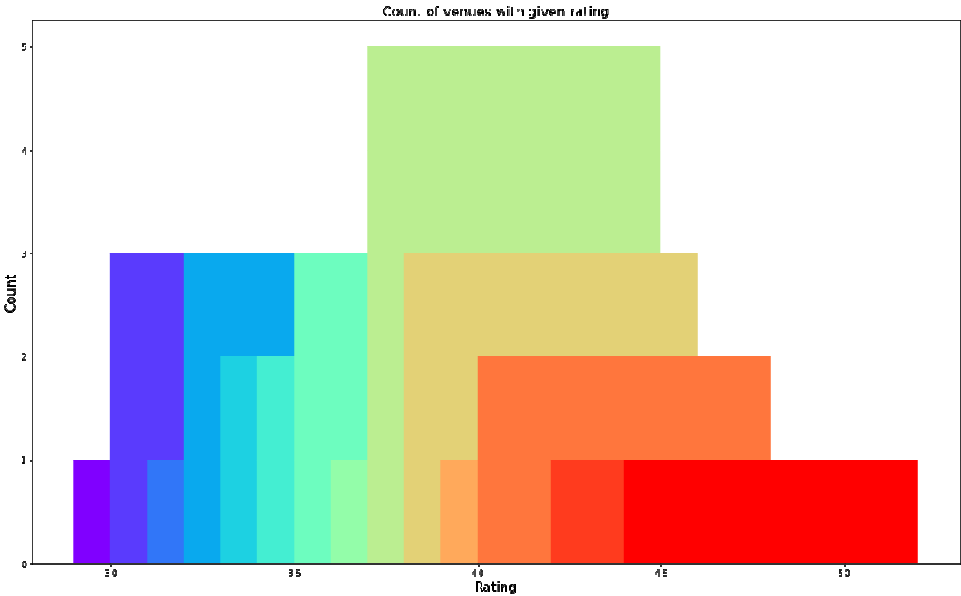
Fig.5. Rating and count of venues with that rating

It can be identified the average rating is spread across 4 with maximum number of venues scoring between 3 and 5. This information can be used to plot the venues on the map of Visakhapatnam. The venues that were rated below 3 were marked by red and orange while the venues that were rated more than or equal to 3 were plot as green and dark green.
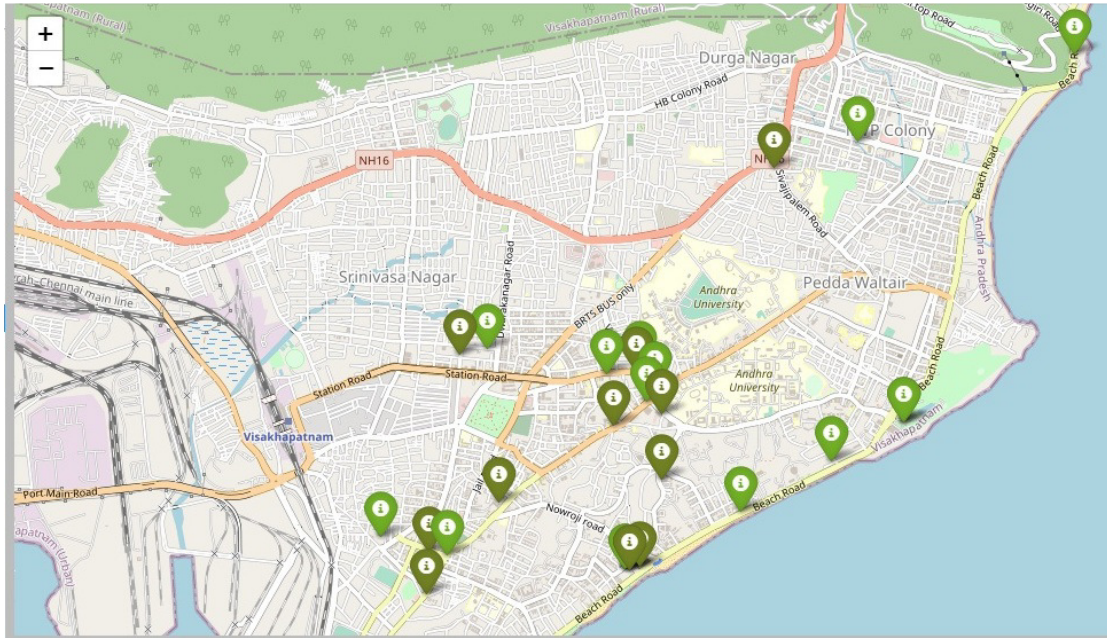
Fig.6. Plot of venues with different ratings

It can be noted that mix of high and low rated venues are located around Siripuram, Waltair uplands and other parts of the city. Low rated venues are located mostly in Beach road. There are no venues with rating less than 3.

4.3. Price

Finding the average prices of all venues for one person using a scatter plot along with the count of venues with that average price per person can help in drawing a conclusion on better place based on prices. The figure below shows the plot of count of venues with given price.
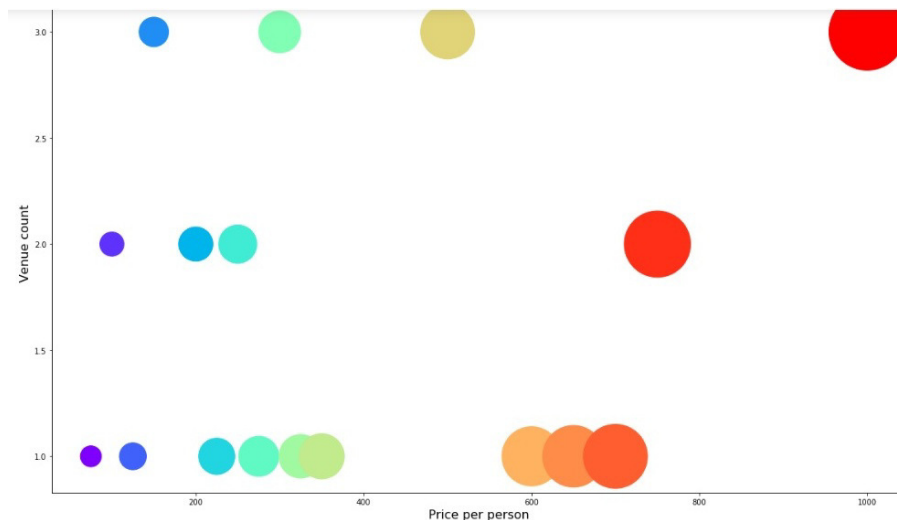

Fig.7. Price per person with count of venues with that price

The plot reveals that the majority venues have an average cost of Rs 200 to Rs 800 for one person. The map of the city based on prices ranges is shown below.
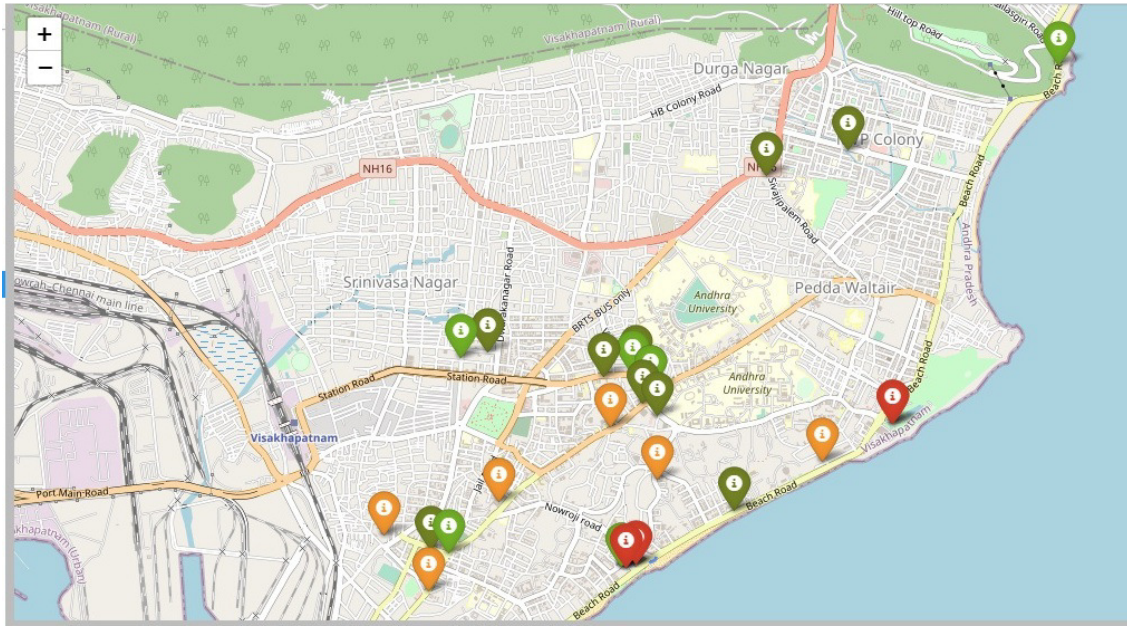
Fig.8. Plot of venues with different prices

Figure gives indication of all the venues where high priced venues are marked by orange and red while the lowpriced venues are marked with green and dark green. From the plot, it is observed that venues near Siripuram and central Visakha are primarily lower priced. The venues in Beach area and Waltair uplands have steep prices. Other places have a mix of both high priced and low priced venues.

4.4. Clustering

The clustering operation of all the venues based on their price range, location helps in identifying similar venues and the relationship amongst them. K-Means clustering is used to cluster the venues into two separate groups.
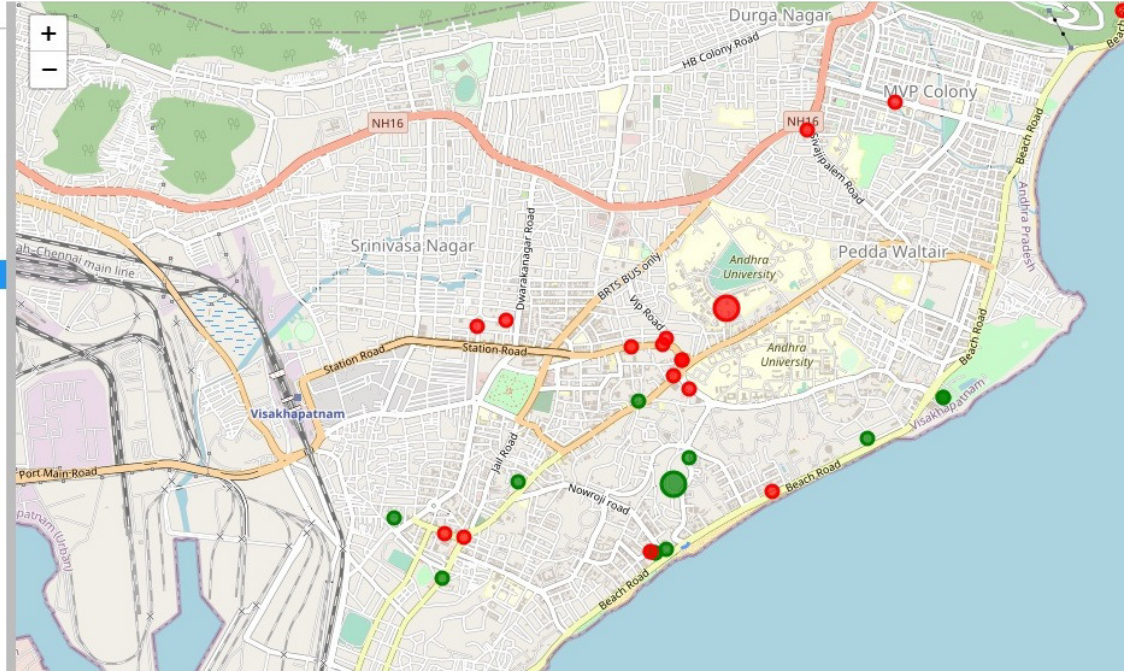
Fig.9. Clusters of venues

The figure brings about a conclusion that

1. The first cluster (green) is spread across the whole city and includes the majority venues. These venues have mean price range of 3.45 and rating spread around 4.01.
2. The second cluster (red) is very sparsely spread and has very limited venues. These venues have mean price range of 1.61 and rating spread around 3.89.

5. Results and Discussion

A list of 70 different venues was found after collecting data from the **Foursquare** and **Zomato** APIs. Since the venues from the two APIs were not identical, their latitude and longitude values as well as names are to be derived to combine them and remove all the outliers. This resulted in a total venue count of 34. It is identified that the majority of venues are **Hotels**, **Indian Restaurants** and **Cafes** from the final list of venues. Ratings were grouped to 4 groups as 1-2, 2-3, 3-4 and 4-5. Thorough observation gives the information that the **majority venues have ratings between 4 and 5**. This means that most restaurants provide good or very good food in the city, thus indicating the high ratings. When these venues plotted on the map, it is discovered that there are clusters of venues scattered around the city. These clusters also have very **high ratings (more than 3)**. Observations indicate that the area around central visakha and Siripuram have mixed ratings. Beach road has higher ratings.

When we take a look at the price values of each venue, we explore that many venues have prices which are in the range of Rs 200 to Rs 800 for one person. However, the variation in prices is very large, given the complete range starts from Rs 100 and goes uptil Rs 1200. On plotting the venues based on their price range on the map, we discovered that venues located near **Siripuram** and **central vizag** are relatively priced lower than venues in **beach**.

1. If the entrepreneur wish to establish a high priced high rated restaurant he better opt for beach road.
2. If entrepreneur wish to establish a mid priced and high rated restaurant he better choose Siripuram or central Vizag.

It can be concluded that **the best place** to choose for establishing a quality restaurant would be the Siripuram area or central Vizag as there are less number of good rated venues are existing in those areas.

6. Conclusion

This work explores the places that an entrepreneur would wish to start a business entity in the city of Visakhapatnam. The venues have been identified using foursquare and Zomato API and have been plotted on the map. The map reveals that there are three major areas a person can establish a business entity Beach road, central vizag and Siripuram area. Based on the visitor's venue rating and price requirements, he can choose amongst the three places.