Profitable localities for Pizza shop in Bangalore

1. Introduction

Bangalore is one of the metropolitan cities in India with population around close to 10 million (1 Crore). Bangalore is also one of the restaurants hubs in India. You can find all most all cuisines of restaurants in Bangalore, but according to YourStory article, craving for Pizza among Bangaloreans has not gone down. In this project we try to explore profitable localities in Bangalore to open new Pizza restaurant or Pizza shop.

Number of pizza restaurants varies from locality to locality. It depends on population of locality and type of people living in the locality. We expect more pizza restaurants in a locality where there are more software engineers compared to a locality where there are more factory workers. It also depends on number of other restaurants in the locality. Using Foursquare APIs, we can get all the restaurant details as well as all pizza restaurant details. With the help of demographic data and the information obtained from Foursquare, we try to explore the profitable localities in Bangalore to open a new Pizza shop.

2. Data

Bangalore political map in *geoJSON* format was obtained from Data{Meet} community. This data has boundary information of 198 wards in Bangalore along with population and area of each ward. Figure 1 shows the political boundary of 198 wards in Bangalore.

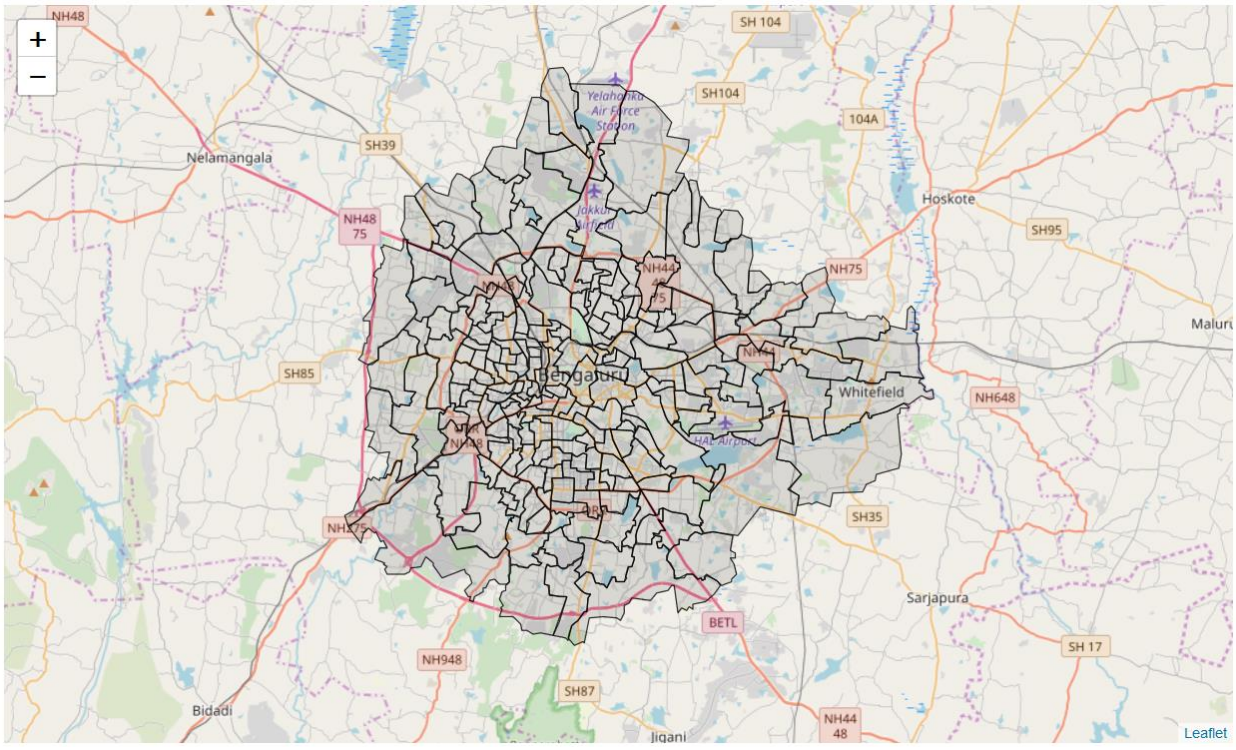

Figure 1. Political map of 198 wards in Bangalore

Using this ward information as the desired neighborhood, all the dinner restaurants in these wards were collected from Foursquare using their APIs. Figure 2 maps all the dinner restaurants in Bangalore.

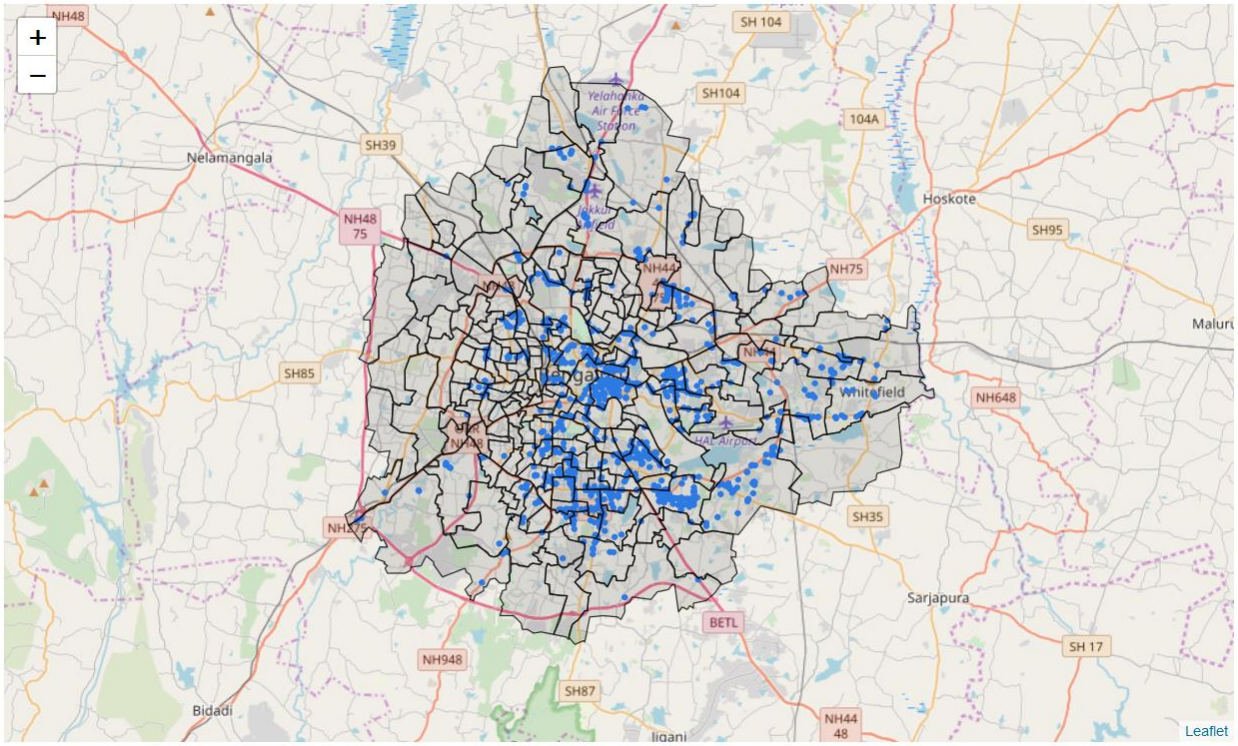

Figure 2. Map of all dinner restaurants in Bangalore

Using the same APIs, all the pizza restaurants information was also collected. Figure 3 maps all pizza restaurants. With details of all the restaurants, population size, we try to do exploratory data analysis to figure out profitable wards Bangalore to open pizza restaurants.

3. Methodology and Results

Number of pizza restaurants in a ward depends on number of total restaurants in a ward and population size in that ward. If there are more dinner restaurants, we expect more pizza restaurants as well. If there are more people in the ward, we expect a greater number of pizza restaurants. As we have count data, we fit Poisson regression with number of pizza restaurants as response y, number of dinner restaurants and population in the ward as explanatory variables x_1 and x_2 respectively. Initial graphical analysis is given in Figure 3. From this, plot we can see that many wards have pizza counts and restaurants counts as zero. Hence this is a zero inflated model. Also, pizza count increases as restaurant count increases. Population of the ward has no relationship with number of pizza restaurants. The Poisson regression equation is given by

$$log\lambda_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

where λ_i is the rate parameter for each ward. Once the model was fit, we calculated regression co-efficients β_0, β_1 and β_2. All these co-efficients turned out to be significant. Using these co-efficients we calculate expected number of pizza restaurants $\hat{y}_i$ in each ward. Residual for each

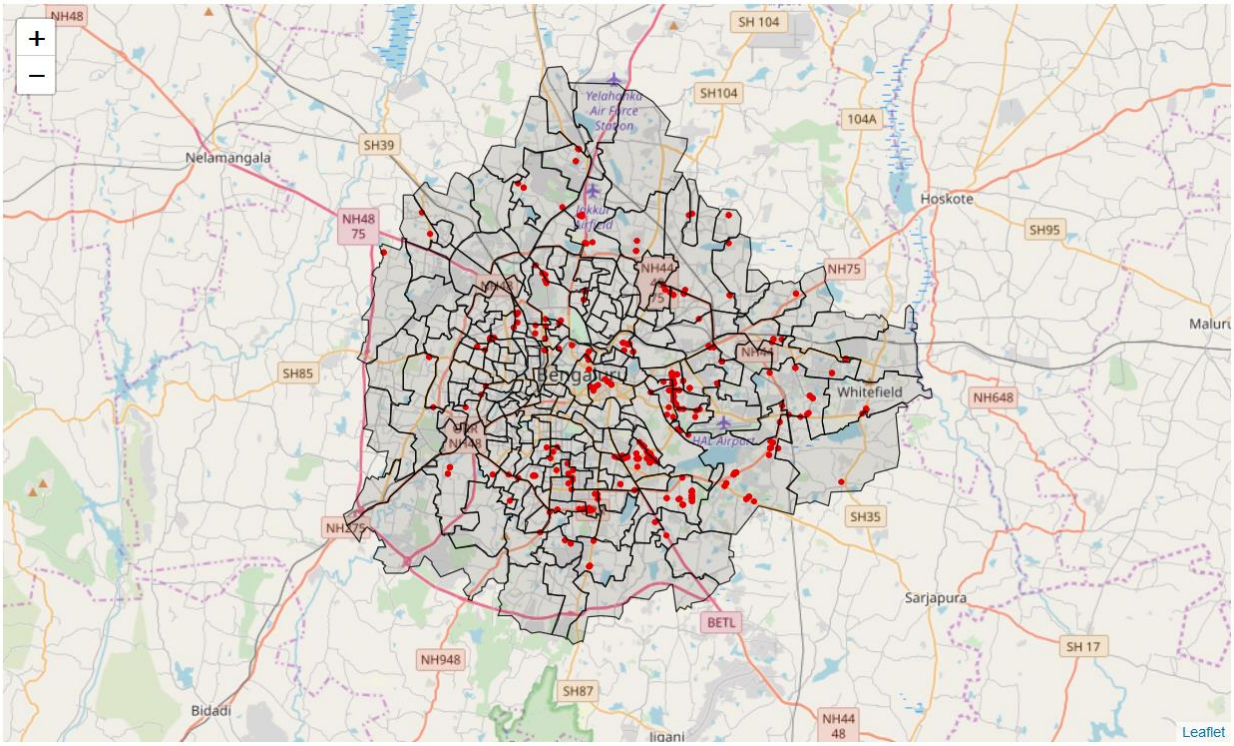

Figure 2. Map of all pizza restaurants in Bangalore

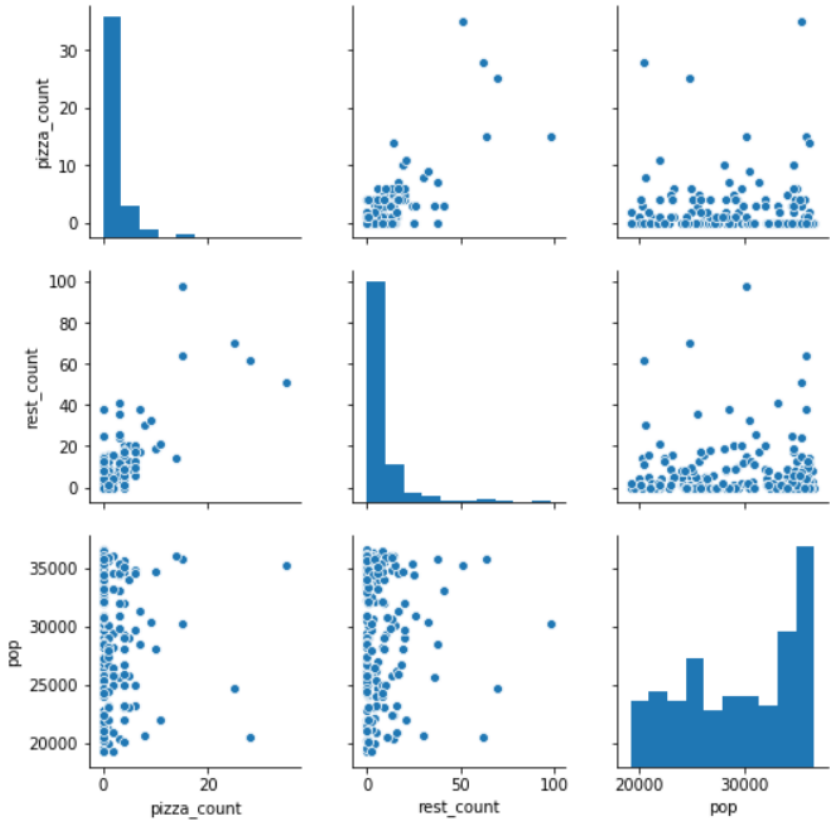

Figure 3. Pairwise plot of response and explanatory variables

ward is calculated as $e_i = \hat{y}_i - y_i$. If this residual is positive, we expect more pizza restaurants in the ward than the number of pizza restaurants actually present. If residual is negative, there are already more pizza restaurants in the ward than expected according to this model. These residuals were plotted in Figure 4.

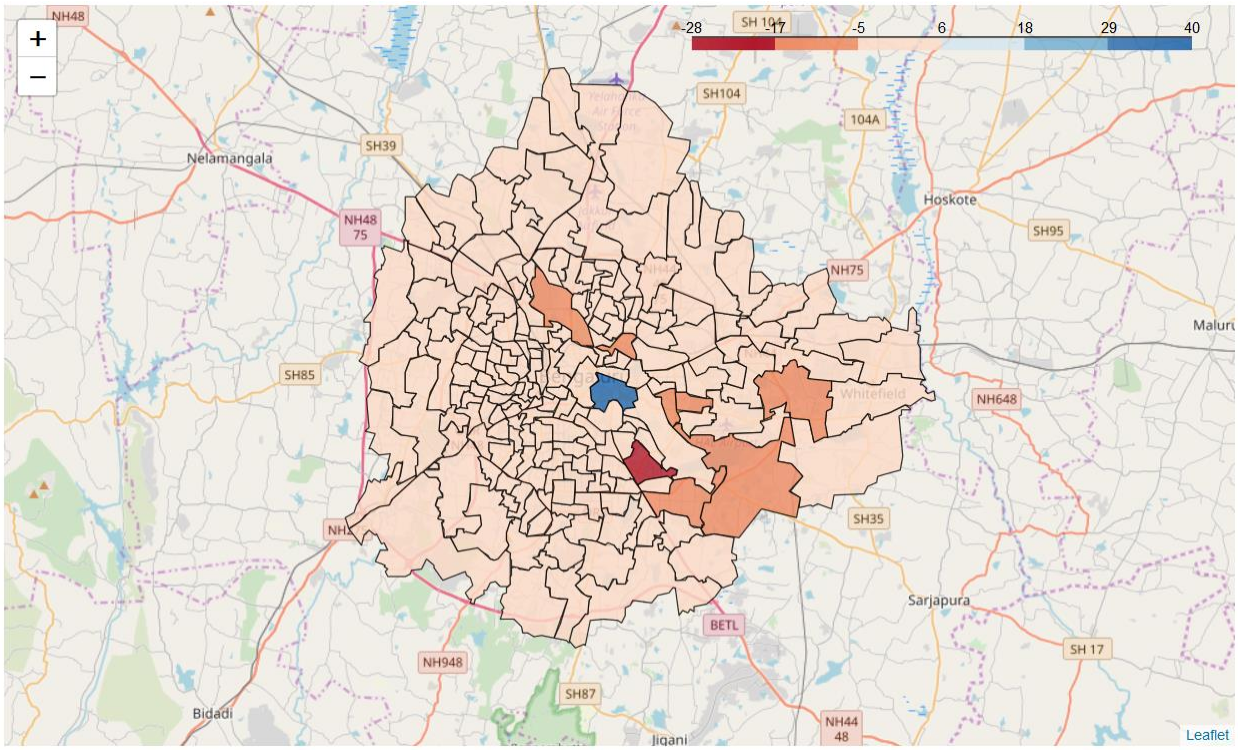

Figure 4. Residuals of each ward according to Poisson model with all zero counts

Shantala Nagar which is blue in color **has very less pizza restaurants than expected**, on the other hand, **Koramangala** which is in dark red color **has more pizza restaurants than expected**. Table 1 lists the top 10 restaurants who have less than and more than expected pizza shops. Top 10 localities which have pizza restaurants less than expected are the profitable localities to open a pizza shop. Top 10 localities with pizza restaurants more than expected are the localities with overcrowded pizza restaurants.

This model has many wards with both restaurants and pizza shop counts as zeroes in them. These wards affect our model fitting. To simplify this, we remove all the wards which have pizza restaurant count as zero. We fit the same model after all zero counts were removed. Figure 5 depicts all pairwise plot for pizza count, restaurant count and population for each ward. Again, pizza count increases as restaurant count increases. Population of the ward has no relationship with number of pizza restaurants. We fit the same model and plot the residual plot similar to the above-mentioned procedure. Figure 6 depicts the residuals for each of the wards. In this model, variation of residual has reduced. **Shantala Nagar** which is dark blue in color **has very less pizza restaurants than expected**, on the other hand, **Koramangala** which is in dark red color **has more pizza restaurants than expected**. Table 2 lists the top 10 restaurants who have less than and more than expected pizza shops according to new model.

Rank	Less than expected count	More than expected count
1	Shantala Nagar	Koramangala
2	Halsoor	Bellanduru
3	BTM Layout	Jeevanbhima Nagar
4	Bilekhalli	Dodda Nekkundi
5	Marathahalli	Domlur
6	Sampangiram Nagar	Pulikeshinagar
7	Puttenahalli	HSR Layout
8	Vasanth Nagar	Aramane Nagara
9	Byrasandra	Byatarayanapura
10	Gandhinagar	Rajarajeshwari Nagar

Table 1. List of top 10 profitable localities and top 10 overcrowded localities when the Poisson regression model has all zero counts

Rank	Less than expected count	More than expected count
1	Shantala Nagar	Koramangala
2	Sampangiram Nagar	Bellanduru
3	Vasanth Nagar	Jeevanbhima Nagar
4	Radhakrishna Temple Ward	HSR Layout
5	Karisandra	Dodda Nekkundi
6	Suddagunte Palya	Pulikeshinagar
7	Basavanagudi	Domlur
8	Pattabhiram Nagar	Rajarajeshwari Nagar
9	Subhash Nagar	Byatarayanapura
10	Lakkasandra	Arakere

Table 2. List of top 10 profitable localities and top 10 overcrowded localities without zero counts when the Poisson regression model has all zero counts

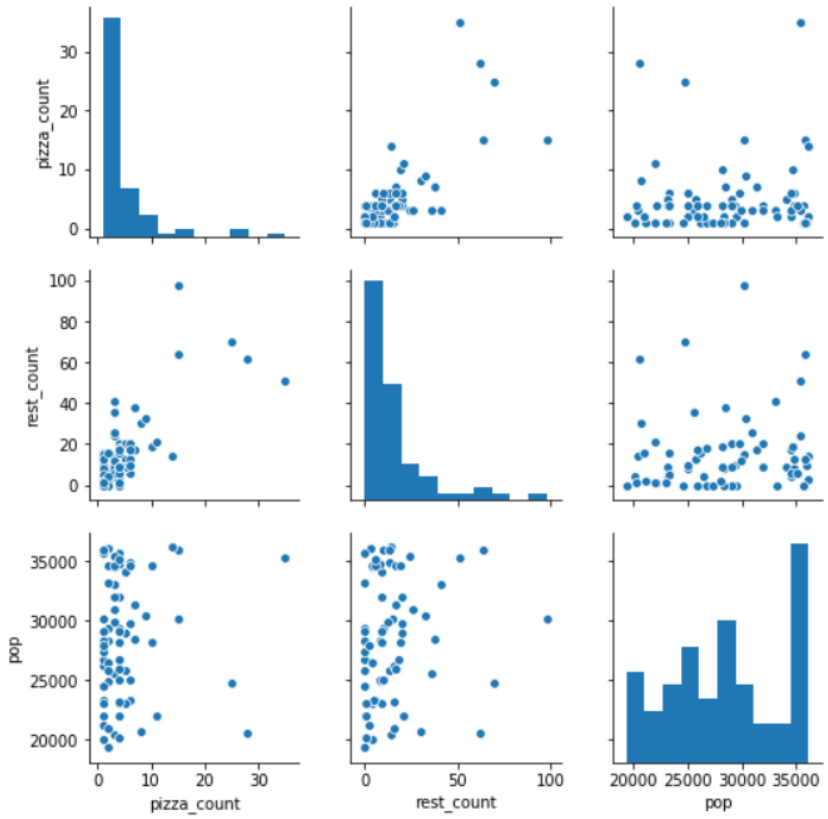

Figure 5. Pairwise plot of response and explanatory variables in a model where zero counts are removed

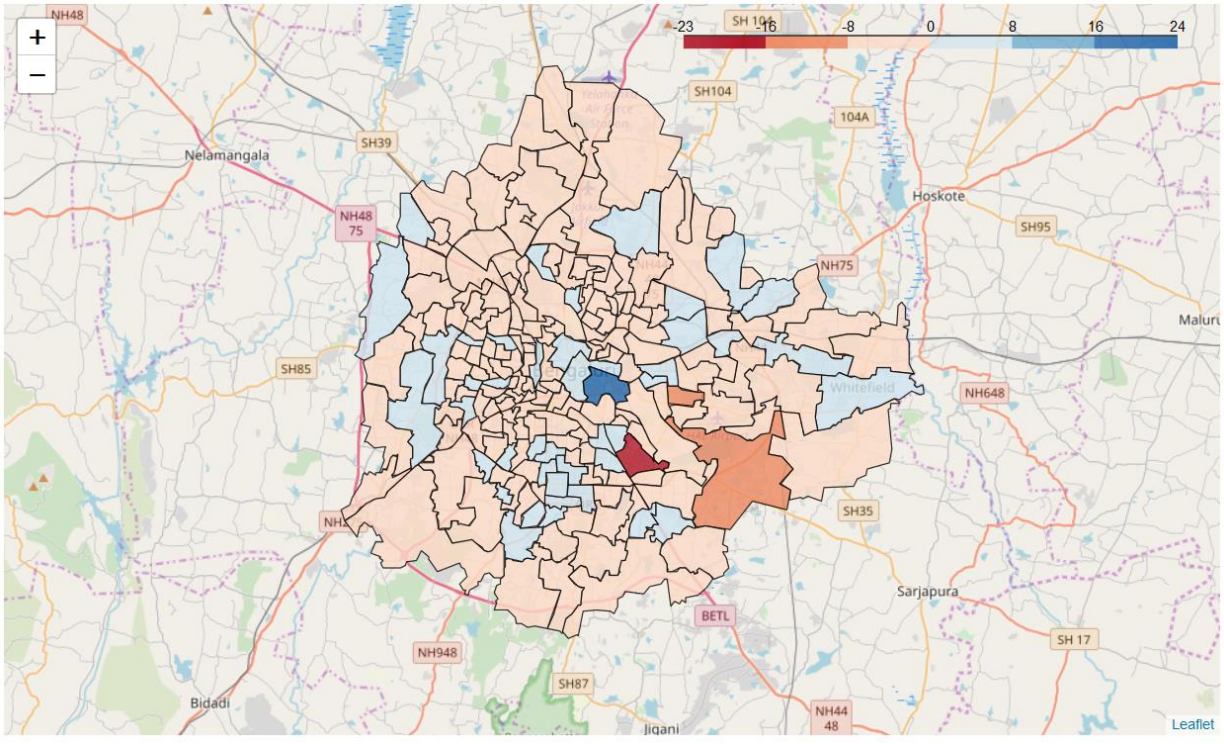

Figure 6. Residuals of each ward according to Poisson model without zero counts

Top 10 wards which have pizza shops more than expected with the new model are almost the same as the old model. But top 10 wards which have pizza shops less than expected have changed except Shantala nagar which top in both the models.

4. Conclusion

We wanted to find the most profitable localities in Bangalore to open a pizza restaurant. We used restaurant density as the main predictor to find this locality. Using this variable and population in the given locality, we fit Poisson regression model on number of pizza restaurants. We calculated residual as difference of expected restaurants and observed restaurants. Highest positive residual is the most ideal location to start a pizza shop. **Shantala nagar** turned out be the most profitable location.