INTRODUCTION

Nairobi is the capital city of Kenya and accounts for 40 percent of all financial transactions in the country.The population of Nairobi as at 2019 was estimated to be 4,397,073 accounting for more than 10 percent of the total Kenyan population
This makes it a viable option for an investor looking to get higher margins especially in the entertainment and hospitality industry.

Problem statement

For an entrepreneur looking to set up a major restaurant in the city strategic location is key to the success and sustainability of the business , this is primarily because customers are the backbone of such a business and the more the customers the higher the profit margins . Owing to the number of existing restaurants within the city it is important to set up a new one where it would be much more reasonable to target newer audiences .

However, it is increasingly difficult to obtain information that will guide investors in this direction.

In regard to this I aim to use Kernel Density Estimates to help solve this through weighting the distances of all the data points of the existing restaurants from the center of the city . USing this a map can be generated and the points with higher concentration of restaurants identified

2. Data Description

Obtaining relevant location data is key to solving the problem of strategic location of a restaurant . I have therefore used geolocation data from Foursquare to get Data pertaining the location of the restaurant and its neighbours within a 4 km radius . This include the longitude and latitude coordinates as these are essential in mapping ,the shop name of the restaurant and the about has also been collected . This I have then converted to a pandas dataframe for ease of use .

With the information about the location of the existing restaurants it is possible to apply KDE(Kernel Density Estimation) to identify the concentration of existing restaurants and set up a new restaurant where there exists few

	name	shortname	lat	lng
0	CJ's	Coffee Shop	-1.283147	36.818323
1	Subway,Kenyatta Avenue	Sandwiches	-1.284390	36.821827
2	Cafe Maghreb (Serena)	Eastern European	-1.286752	36.814836
3	Najmi Fast Food	Fast Food	-1.280862	36.821209
4	Tatu Restaurant	African	-1.278291	36.816383

Methodology

The Kernel Density tool calculates the density of features in a neighborhood around those features. It can be calculated for both point and line features. It can be useful in calculation of point features through

Kernel Density calculates the density of point features around each output raster cell

This is done with the following procedure :a smoothly curved surface is fitted over each point. The surface value is highest at the location of the point and diminishes with increasing distance from the point, reaching zero at the Search radius distance from the point. Only a circular neighborhood is possible. The volume under the surface equals the Population field value for the point, or 1 if NONE is specified. The density at each output raster cell is calculated by adding the values of all the kernel surfaces where they overlay the raster cell center

Methodology

The predicted density at a new (x,y) location is determined by the following formula

$$Density = \frac{1}{radius^2} = \sum_{i=n}^{n} \left[\left(\frac{3}{\pi} \left(1 - \frac{dist_i}{radius_i} \right)^2 \right)^2 \right]$$

where i=1,...,n are the input points. Only include points in the sum if they are within the radius distance of the (x,y) location. $dist\_i$ is the distance between point i and the (x,y) location. The formula will need to be calculated for every location where we want to estimate the density. Since a raster is being created, the calculations are applied to the center of every cell in the output raster.

Results

Heatmap-based kernel density estimation is used. Heatmat is an already implemented as plugin for Folium, which can be used to visualize data to map
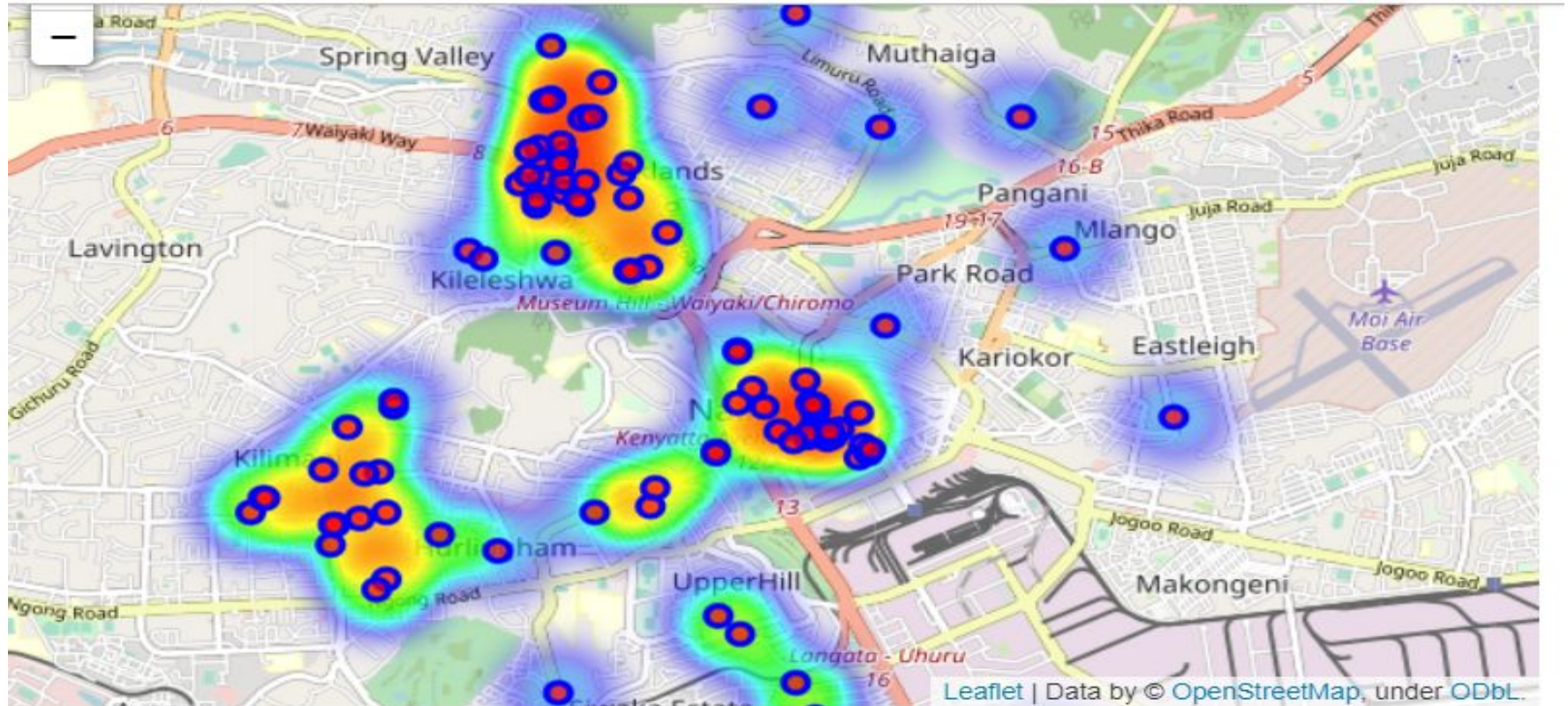
Discussion
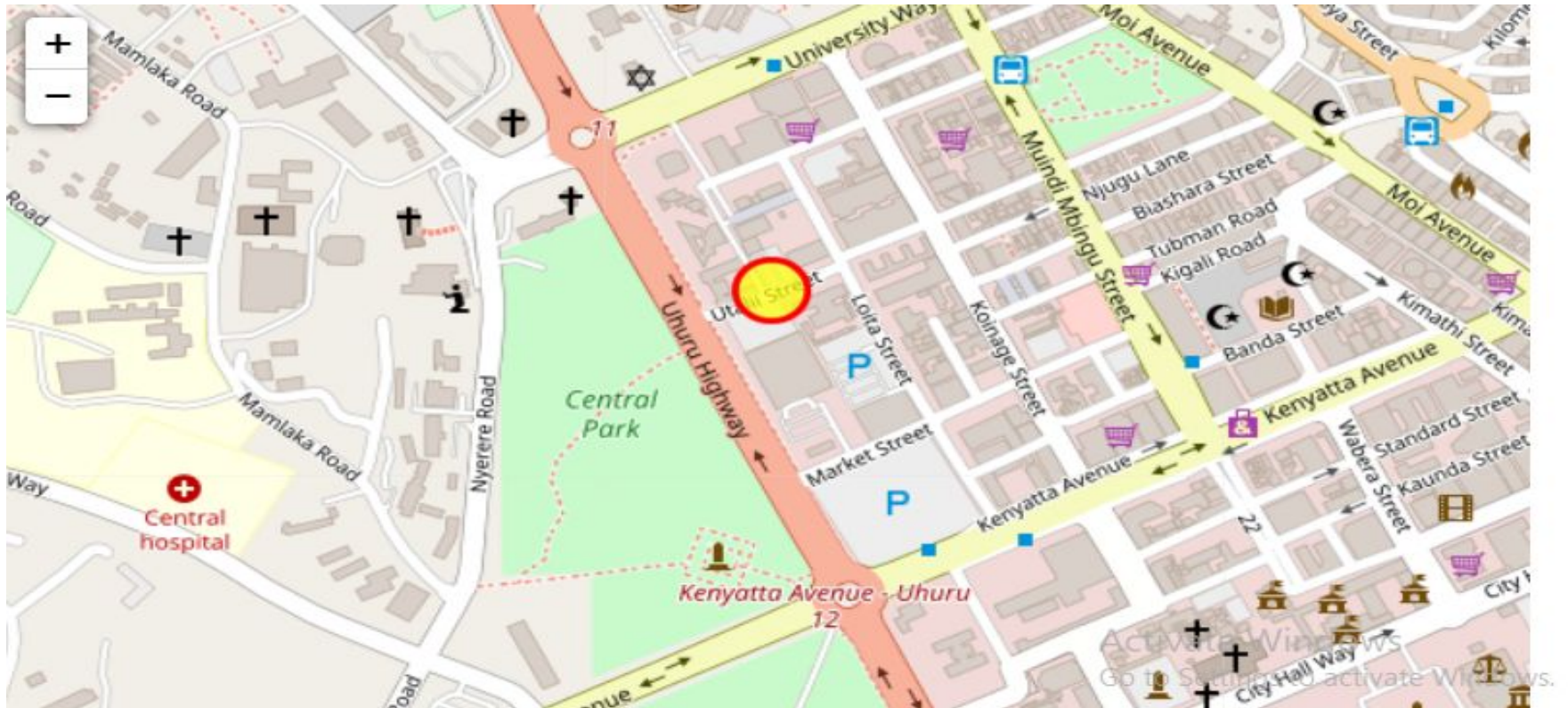
Conclusion

Strategic location of a business with customers at its core is important and a restaurant being one such it is therefore appropriate to use good methods for visualizing and communicating this to potential investors