# Hotel Locations in a Tourism Destination: A Spatial Analysis Approach

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**ABSTRACT**: Previous studies have shown that there is a relationship between infrastructure development and the location of tourism sites in a destination. Among them is the construction of accommodation facilities, such as hotels, motels, and guest houses. This condition shows that business developers and the tourism community need to explore various information to develop strategies. The purpose of this study was to explore information about the characteristics of the hotel location and tourism sites. This study used a Geographical Information System (GIS) to compile the spatial and attribute data, to comprehensively visualize the phenomena studied. The spatial data used in this study are hotel location data and tourism sites, along with its attribute data. The area covered in this study is the Special Region of Yogyakarta, which is one of the main tourist destinations in Indonesia. Spatial data and its complementary attributes are collected from various sources, pre-processed, and managed for further analysis. Average Nearest-Neighbour (ANN) and Kernel Density Estimation (KDE) were conducted to analyze the proximity between locations. The spatial interaction between hotels and tourism sites is identified by using an overlay technique between the density map of the distribution of hotels and the density map of the distribution of tourism sites. According to the spatial analysis of the ANN and the KDE, there is a tendency to cluster. The overlay of two KDE maps also shows spatial interactions. There are specific patterns between the categories of accommodation facilities and the categories of tourism sites. The information gained from this study can be used to better understand the current spatial characteristics of accommodation facilities as input in determining business development strategies.

## 1. INTRODUCTION

Tourism in Indonesia is still one of the sectors that are very reliable for national development because it can increase national income and regional income as well as foreign exchange. Since 2008 the Visit Indonesia program was inaugurated by the government, the development of Indonesian tourism has brought a new spirit to the tourism community in Indonesia until now. The function of tourism in development, one of which is to improve the welfare of the community, is certainly interesting to study as a scientific study for the development of tourism in an area and of course nationally.

The Special Region of Yogyakarta has become one of the tourism destinations in Indonesia, known as the city of culture, with the main attraction of various Javanese traditions and culture within the Yogyakarta Kraton Kingdom (Dinas Pariwisata DIY, 2021a). This region has a wide variety of tourism potentials that can attract domestic and foreign tourists, because of the geographical characteristics, geological, historical city, educational center, as well as cultural center (Dinas Pariwisata DIY, 2021c). Several tourism sites in Yogyakarta are very popular, both nationally and internationally, such as Malioboro, Kraton Jogja, Prambanan Temple, and Parangtritis Beach (Dinas Pariwisata DIY, 2021b). Yogyakarta has become a leading tourist destination because, in addition to the diversity of its tourism sites, it is also equipped with the availability of tourism supporting facilities and infrastructure such as accommodation, restaurants, telecommunications, entertainment venues, souvenir shops (Dinas Pariwisata DIY, 2021c).

Previous studies have shown that there is a relationship between infrastructure development and the location of tourism sites in a destination. Among them is the construction of accommodation facilities, such as hotels, motels, and guest houses. This condition shows that business developers and the tourism community need to explore various information to develop strategies. The purpose of this study was to explore information about the characteristics of the hotel location and tourism sites. The number of tourist arrivals has an impact on the room occupancy rate in accommodation facilities. According to the government tourism office, the number of hotels in Yogyakarta continues to grow every year as shown in Table 1. It can be seen in the table that the number of hotels in the city of Yogyakarta always increases from 2017 to 2020. The data for 2021 that has not been fixed cannot be used as a reference and the possibility of the number of hotels not increasing is the current corona pandemic. The table data on the number of hotels has not answered the question of the distribution of hotels and how it relates to the tourist location of the city of Yogyakarta.

**Table 1.** Hotel in Yogyakarta

| No | Purpose | Element | Year | | | | | Each | Character | Data Source |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2017 | 2018 | 2019 | 2020 | 2021*) | | | |
| **1** | **Tourism** | **Total Hotel** | **685,00** | **685,00** | **773,00** | **790,00** | **790,00** | **Unit** | **-** | **Government tourism office** |
| 1.1 | Tourism | 5 Star | 9,00 | 9,00 | 11,00 | 11,00 | 11,00 | Unit | - | Government tourism office |
| 1.2 | Tourism | 4 Star | 18,00 | 18,00 | 36,00 | 42,00 | 42,00 | Unit | - | Government tourism office |
| 1.3 | Tourism | 3 Star | 32,00 | 32,00 | 61,00 | 68,00 | 68,00 | Unit | - | Government tourism office |
| 1.4 | Tourism | 2 Star | 24,00 | 24,00 | 34,00 | 33,00 | 33,00 | Unit | - | Government tourism office |
| 1.5 | Tourism | 1 Star | 13,00 | 13,00 | 21,00 | 18,00 | 18,00 | Unit | - | Government tourism office |
| 1.6 | Tourism | 0 Star | 589,00 | 589,00 | 610,00 | 618,00 | 618,00 | Unit | - | Government tourism office |

Note: *) Not Fixed

## 2. SPATIAL AND AMENITY CONCEPT

Recent advances in Geographical Information Systems (GIS) have facilitated more rigorous spatial analysis by utilizing spatial statistics, giving researchers access to more enhanced descriptions of spatial distribution (Wolman, 2004). Luo and Yang (2013) first employed exploratory spatial statistics to examine the nationwide spatial distribution of hotels in China. However, their research was heavily focused on establishing a methodological framework rather than engaging with related theories that might explain their results. Thus, the present research will complement the previous studies' critics by applying Clark's amenity theory along with using spatial statistics. The purpose of the present paper is twofold. The first task is to assess the spatial distribution of hotels in the US using exploratory spatial data analysis techniques. The second purpose is to examine the relationship between amenities and hotel distribution patterns.

According to Rhind in Geographic Information System (GIS) is a computer system intended for the collection, examination, integration, and analysis of information relating to the earth's surface. The components in a GIS consist of 5 parts, namely people, procedures, GIS software data, and GIS hardware. People in GIS are people who run, operate, develop, and benefit from the system. GIS procedure is a collection of procedures used to process data into information. Data in GIS consists of two, namely graphic data and attribute data. GIS software is a computer program that is made specifically and could manage, store, process, analyze and display spatial data. GIS hardware is a set of computers that can support the operation of the software used, for example, scanners, digitizers, PSs, printers, and plotters (Bahri,2020).

Amenity is a series of facilities provided by a tourist destination that is used to meet the needs of visitors or tourists who come. While the facility is a tool provided by the management of tourist attractions to provide services to tourists to enjoy them, facilities can be in the form of lodging, parking lots, shopping places, management rooms, bathrooms, and toilets (Spillane, 2000). Amenity is all forms of supporting facilities that can be used by tourists to meet their needs. Amenities are related to accommodation facilities, restaurants, public toilets, rest areas, souvenir shops, parking lots, places of worship, and others that should be present in a tourist destination (Rusvitasari and Solihin, 2014). The definition of amenities remains necessarily broad because the motivation for tourism regarding natural and/or constructed amenities is highly variable, incorporating everything from parks, theatres, and museums to places with beautiful landscapes or favorable climates. Naturally, tourists' visitation patterns are associated with the spatial distribution patterns of amenities (e.g. Marcoule & Prey, 2005) and, because tourism demand is generally high around places with rich amenity resources, the hospitality industry has necessarily incorporated proximity to amenities when making locational decisions. However, tourism and hospitality scholars' efforts at fully understanding the importance of amenities have been slow to emerge.

## 3. METHOD AND DATA

The research was conducted by looking for the coordinates of hotels located in the city of Yogyakarta and available in the online booking system and searching and mapping tourism spots in the city of Yogyakarta. The data results are then mapped into QGIS with the WGS84 projection system and at the location of the city of Yogyakarta. After the

data set on WGS84, the data is then converted to UTM. Data on roads and railways also need to be exported into QGIS which will then be one of the research analysis materials. The analysis is carried out by looking at the results of the overlay of the relationship between hotel location and tourism site.

Data collection is done by finding the latitude and longitude coordinates of hotels and tourist locations. Other data also includes the Yogyakarta city highway and the train line. Coordinate point data collection is done using the API and assisted by algorithms using python. Hotel sample data was taken from as many as 437 hotels with random distribution and amenity data regarding the hotel. The total Tourism site taken is 339. The visualization of hotel and tourism site location data is shown in Figure 1 and Figure 2, Figure 3.

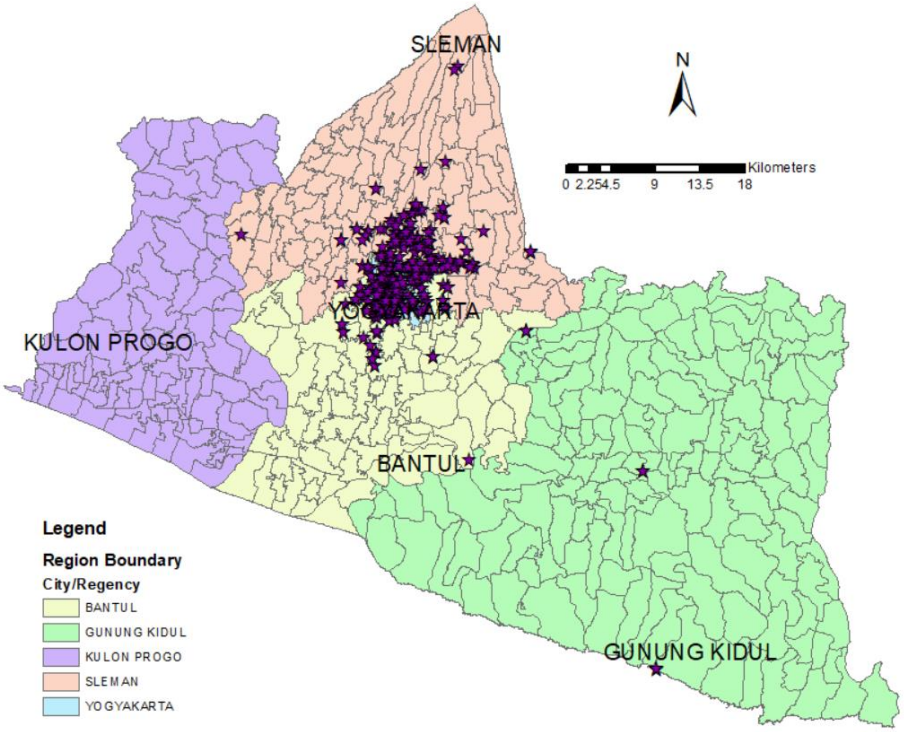



**Figure 1.** Hotel Location in Yogyakarta

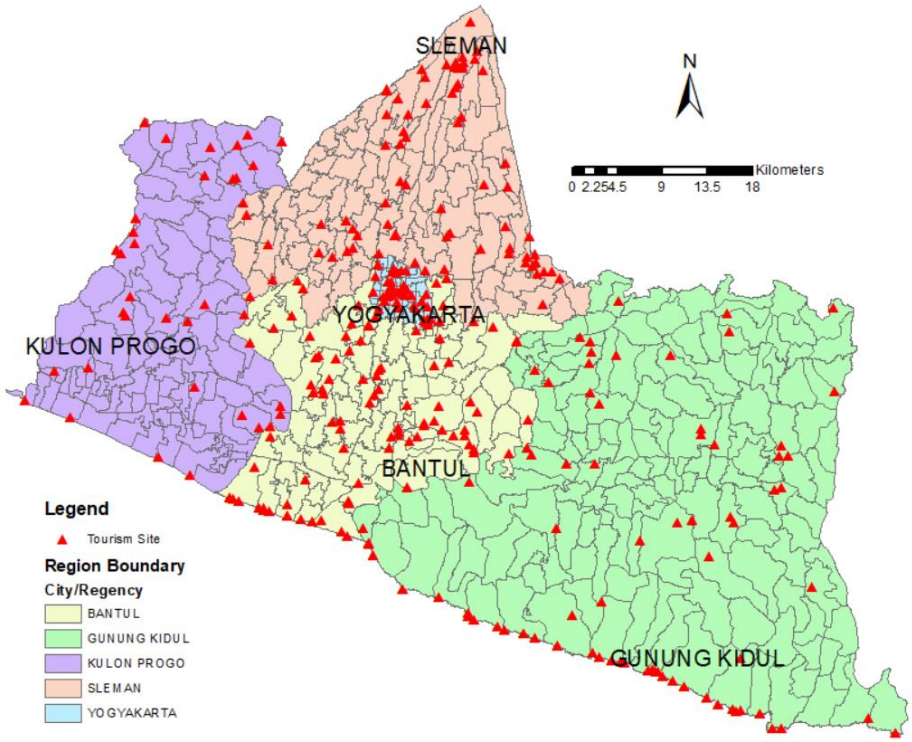



**Figure 2.** Tourism Site in Yogyakarta

## 4. SPATIAL ANALYSIS

4.1 *Kernel Density Analysis*

The analysis was carried out using kernel density estimation on QGIS visualization. Kernel Density Estimation is the method that can be used to analyze a point event distribution and KDE is a spatial method to overview the centrality of any location distribution. Figure 3 shows the Kernel Density distribution of hotels in Yogyakarta. Determination of the radius or parameters in the kernel density analysis process requires an estimation calculation first. The formulation of the optimal parameters can be seen as follows.

$$h_{opt} = \left(\frac{2}{3n}\right)^{\frac{1}{4}} \sigma$$

The optimal parameter calculation results are in meters and have different results for each data set for which this analysis is carried out. The calculation results can be seen in table 2.

**Table.2** Optimal Parameter

| Data Set | n | Standard Distance | $h_{opt}$ |
|---|---|---|---|
| Tourism | 339 | 22302 | 4696.465 |
| Hotel | 437 | 13499 | 2667.832 |

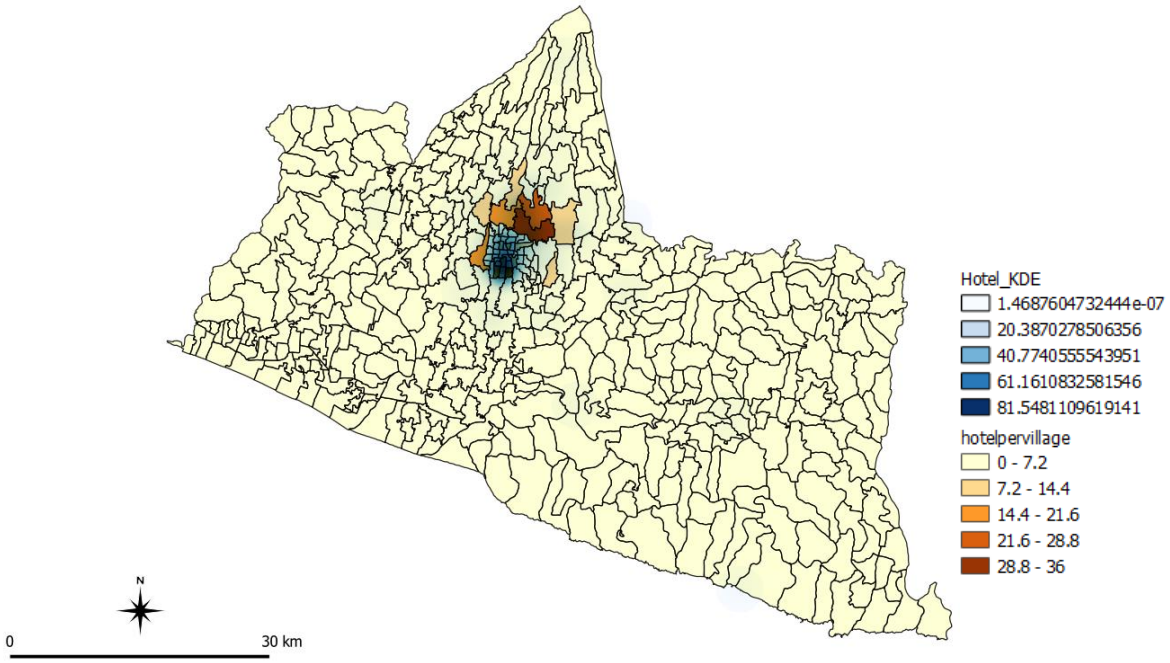



**Figure 3.** Kernel Density Estimation of Hotel

Figure 3 shows the distribution of hotels in the city of Yogyakarta. The distribution is not spread out but very focused on the center of the city. Information about the distribution of hotels can help determine whether the layout of the hotel development selection is in accordance with the needs of the number of tourist locations available.

The distribution of the density estimation kernel at tourist locations in the city of Yogyakarta is quite even, although it is still centered at one point as shown in Figure 4. Kernel Density Estimation helps us visualize that the distribution of tourist locations is not only in the city center but also in the outskirts of the city. An in-depth analysis of the comparison of the density estimation kernel for tourist and hotel locations can be seen in Figure 5.

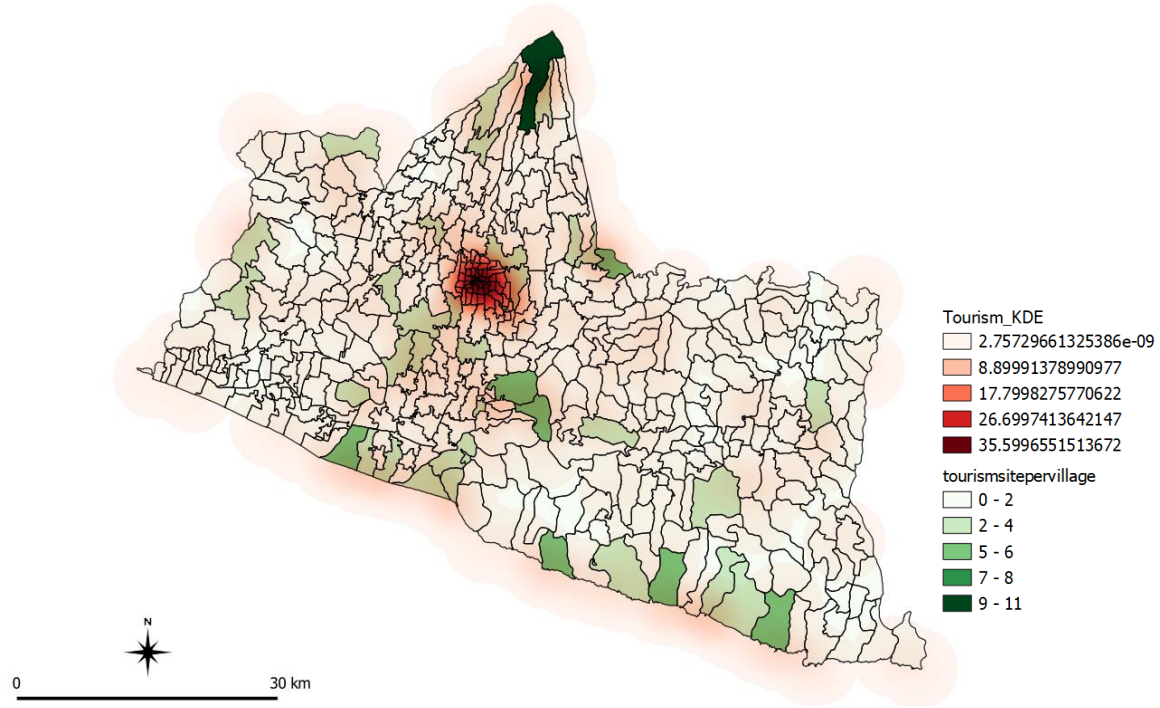



**Figure 4.** Kernel Density Estimation of Tourism Site

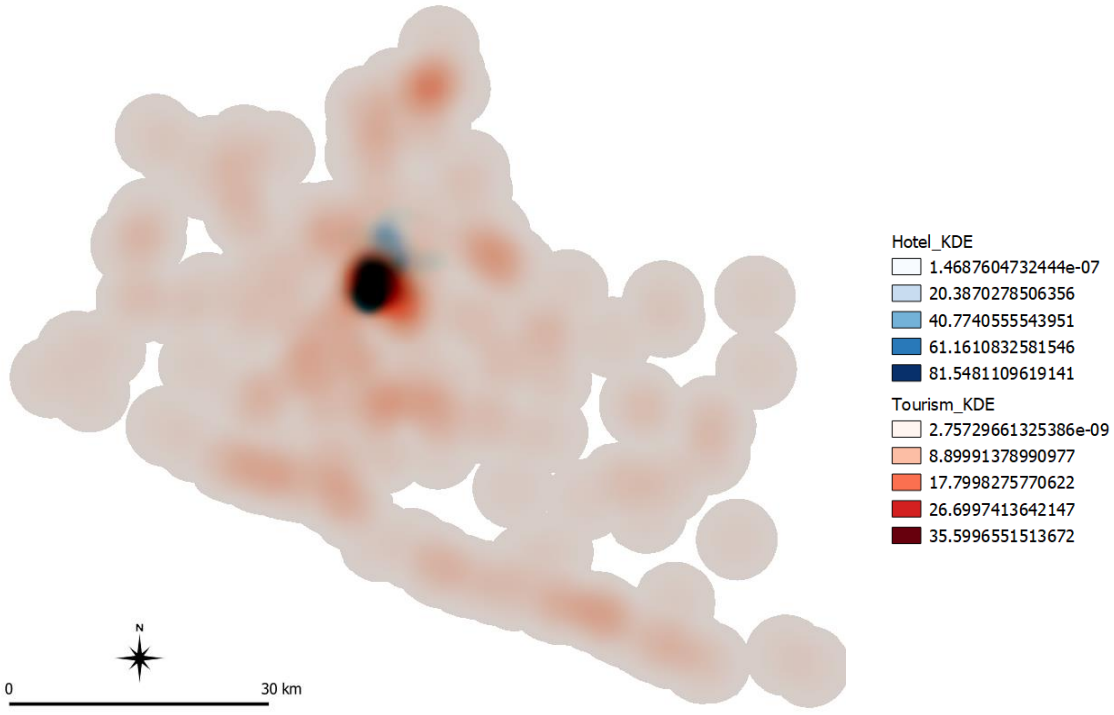



**Figure 5.** Kernel Density Estimation of Tourism Site and Hotel

Figure 5 provides a visualization of the distribution of the density estimation kernel from hotels and tourist locations and the distribution of hotels is very centered in the center of the city while the distribution of tourist locations is more evenly distributed. This difference in distribution becomes the main analysis, that the determination of hotel development in the city of Yogyakarta still does not meet the demand for lodging needed by tourists.

4.2 *Average Nearest Neighbour Analysis*

The Average Nearest Neighbour tool measures the distance between each feature centroid and its nearest neighbor's centroid location. It then averages all these nearest neighbor distances. If the average distance is less than the average for a hypothetical random distribution, the distribution of the features being analyzed is considered clustered. If the average distance is greater than a hypothetical random distribution, the features are considered dispersed. The average nearest neighbor ratio is calculated as the observed average distance divided by the expected average distance (with the expected average distance being based on a hypothetical random distribution with the same number of features covering the same total area) (Chen, 2019). In this study, the Average nearest neighbor analysis was carried out to determine whether the locations of hotels and tourist spots belong to the cluster, random, or dispersed groups. To find out, the Average nearest neighbor analysis is done using QGIS and compares the value of the Average Nearest neighbor Index (ANNI) to determine the distribution group. The Result of the Average Neighbour analysis can be seen below. The raw data can be tabulated into data that can be easier to analyze. Average Nearest Neighbour tabulation data can be seen as follows:

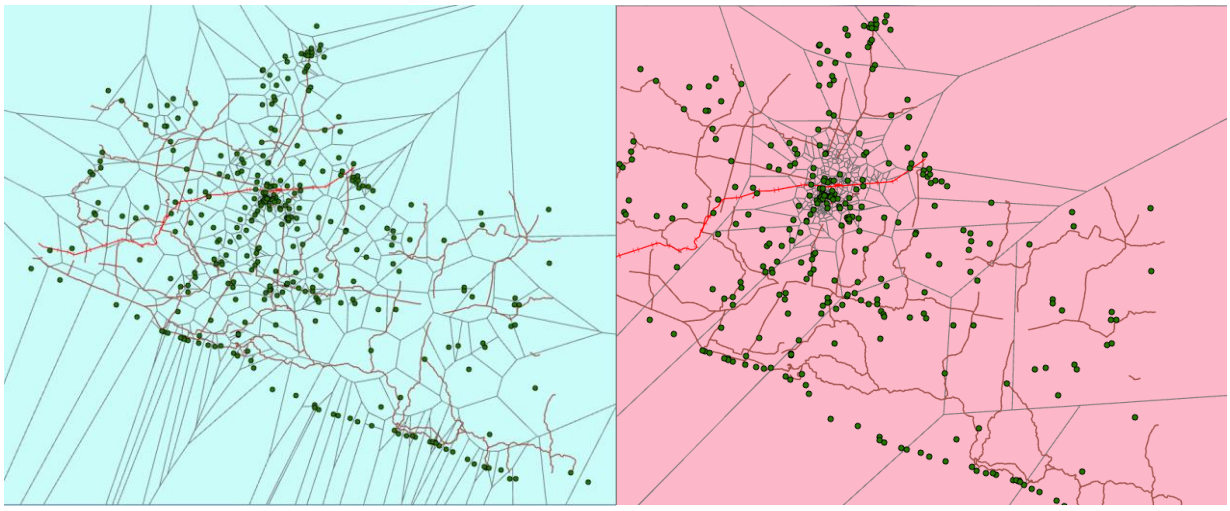
**Table 3.** Average Nearest Neighbour

| Average Nearest Neighbour Analysis | | | | | |
|---|---|---|---|---|---|
| Data Set | Sample Size | Observed Distance | Expected Distance | ANNI | Pattern |
| Hotel | 437 | 686.105 | 3036.337 | 0.2259 | Clustered |
| Tourism Site | 339 | 1146.169 | 2143.675 | 0.3546 | Clustered |

The results of the tabulated data provide 4 main components, namely Observed mean distance. The expected mean distance, Average nearest neighbor index, and Number of points. To determine the pattern of data using the average neighbor analysis technique, what needs to be considered is the value of the Average Nearest Neighbour Index (ANNI). The higher the Average Nearest Neighbour Index (ANNI) value, the more likely the pattern will be spread out, in the order of cluster, random, and dispersion. The cluster pattern is a pattern where the coordinate points converge to create a cluster while the dispersion is the opposite. The Average Nearest Neighbour Index (ANNI) that can be included in the cluster is ANNI < 1. To get a random pattern, then 1 < ANNI < 2.15. Finally, to get the dispersion pattern, the ANNI value is > 2.15. It can be concluded that the Average Nearest Neighbour Index (ANNI) for hotels and tourism sites has a clustered pattern.

4.3 *Thiessen Polygon*

The Thiessen Polygon method considers the weight of each station which represents the area around it. This method is used to expand data from point data type to polygon data type and to model an area in polygon form based on neighboring data from measurement points (Kurniawan, 2018). Mapping the city of Yogyakarta using Thiessen polygons is carried out using the ArcGIS application. The results of the Thiessen polygon can be seen in Figure 6.



(a) (b)

**Figure 6.** Thiessen Polygon: a) Tourism Site b) Hotel

4.4 *Distance Analysis*

Analysis of the distance is carried out to know the distance between the tourist location and the nearest hotel. This information will be very useful regarding the accommodation needed by tourists when staying at the hotel. Distance analysis is carried out using the QGIS feature, namely distance to nearest hub. In this case, the distance from the hub is the hotel and what you want to know is the distance from the tourist location to the nearest hotel. The results of the analysis produce a scatter plot in Figure 7.

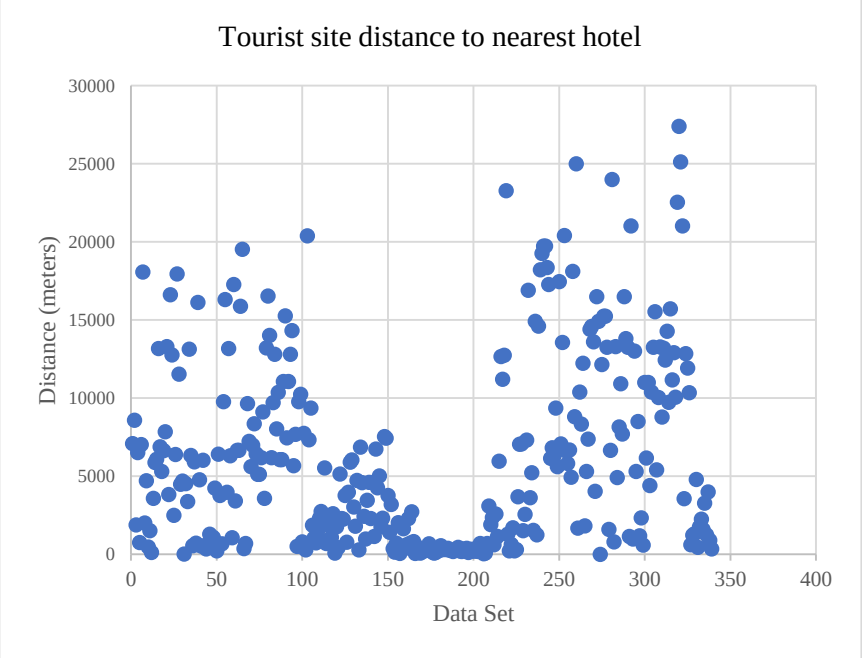



**Figure 7.** Scatter Plot of Point Distance

It can be seen in the scatterplot that the y axis is the distance that a hotel needs to travel if it wants to go to a tourist location and the x-axis is the hotel number. The furthest distance that the hotel needs to travel is 27 km and the closest distance that the hotel needs to travel is 3 meters (lodging in tourist locations). The average distance that needs to be taken if you want to go to a tourist location from all hotel data obtained is 6137 meters or 6.1 km. The distance is quite far, considering that the average speed of human walking is 5 to 8 km in an hour, which means to cover 6.1 km it is highly recommended that tourists use a vehicle or public transport.

## 5. CONCLUSION

Kernel Density Estimation analysis was carried out to visualize the density of hotel locations and tourist locations in the city of Yogyakarta. The results of the Average Neighbour Analysis are seen from the index value of hotels and tourist locations. ANNI hotel is 0.2259 and ANNI tourist site is 0.3546, so it can be concluded that Tourist site and hotel have the same pattern, namely clustered. Distance analysis shows that the average distance from the hotel location to the tourist location is 6147 meters or 6.1 km.

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