Analysis of Hotel Distribution Patterns in Hail, Saudi Arabia, Using Geographic Information Systems (GIS)

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Abstract
Hail City has experienced several transformations and urban advancements in the last two decades. These developments have attracted visitors and tourists to the city and led to a significant and urgent demand for accommodations. Local Investors have responded to this demand by establishing numerous hotels, albeit in a random manner. This paper aims to examine the patterns of hotel locational distribution in Hai City, Saudi Arabia, by utilizing Geographic Information Systems (GIS) technology. Both Primary and secondary data were used. The primary data was collected using the Global Positioning System (GPS) (x, y) coordinates of each hotel within the city. Secondary data were obtained from the tourism authorities, the city chamber, and the municipality of Hail City. The data underwent meticulous and rigorous processing and analysis, including several analytical techniques such as multi-ring buffer, Kernel density, mean center, central feature, standard distance, directional distribution, and the average nearest neighbor analysis. This comprehensive approach produced a reliable and accurate geospatial database of the hotels. The study results indicate that hotels in Hail are predominantly clustered and concentrated on the city's western and Northern sides, demonstrating a significant agglomeration. Furthermore, the findings revealed that the hotels are far from the Central Business District (CBD).

Keywords: Distribution Patterns, GIS, Hotels, Saudi Arabia, Spatial Analysis

1. Introduction

1.1 General Background

The tourism industry is a highly dynamic economic sector due to its significant contribution to economic growth. It is achieved by generating numerous employment opportunities, substantial funding of a country's Gross Domestic Product, and facilitating foreign currency inflow from goods and services offered to international visitors. Consequently, this aids in enhancing the national income and balance of payments. It is widely acknowledged that the hospitality industry is crucial in driving the tourism sector across various levels. According to the United Nations World Tourism Organization (UNWTO), 70% to 75% of international tourists' expenditures are directed towards hospitality services annually [1].

Tourism geography, a component of socio-economic geography, highlights the relationship between geographical and economic space. This relationship is particularly evident in tourism, which relies on environmental factors. The scientific study of tourism, incorporating geographical concepts, is classified as a distinct field, namely tourism geography [2]. Hotels have emerged as a focal point in tourism and geography research since the latter part of the 1980s. Subsequently, hotels are frequently featured in scholarly investigations for various reasons. Hotels primarily focus on tourists and are therefore regarded as 'the most unadulterated and conspicuous embodiments of tourism in urban areas,' as opposed to most tourist offerings and facilities in cities that cater mainly to the local populace.

Moreover, hotels account for a substantial portion of overall tourist expenditures and represent a significant segment of the urban economy. Consequently, they play a crucial role in strategies for tourism development and urban revitalization initiatives. Their geographical location dictates the patterns of tourist behavior and expenditures, shaping the structure, functions, and perception of urban neighborhoods and cities in their entirety [3].

1.2 Saudi Arabia Tourism

Tourism in Saudi Arabia has a long-standing history, dating back centuries, positioning itself as a prominent hub for religious tourism among Muslims worldwide owing to the presence of the two most sacred sites. Saudi Arabia is renowned for its extensive historical legacy and diverse cultural background, further enriched by its plentiful natural resources, all enhanced by the stunning and awe-inspiring landscapes that travelers frequently admire.

Additionally, Saudi Arabia is home to many significant cultural and historical landmarks showcasing the depth of its heritage. The Kingdom of Saudi Arabia provides many tourist attractions and activities, presenting many opportunities for those seeking to explore its offerings. With its varied landscapes and historical sites, Saudi Arabia presents a compelling destination for travelers looking to immerse themselves in a unique blend of history, culture, and natural beauty [4] [5] and [6].

The effects of the COVID-19 pandemic have severely impacted the hospitality and tourism sector in Saudi Arabia, which is currently recuperating. Experts anticipate that a full recovery may not be achieved until 2024. Following the relaxation of lockdown measures and the rise in vaccinated individuals in Saudi Arabia, there has been a resurgence in activities such as dining out, attending events, and visiting sports venues.

The hospitality sector, a vital pillar of the 2030 Vision plan, is set to significantly contribute to the country's GDP, aiming for a 10% share by 2030, a substantial increase from its current 3%. This industry has been the fastest-growing in the region, with projections indicating further exponential expansion in the coming years. The surge in tourist numbers due to religious pilgrimages and hosting world-class events in Saudi Arabia have spurred a heightened demand and swift development in the hotel sector. Notably, Saudi Arabia is the location for 6 out of the 11 most significant hotel projects globally. It is estimated that the hotel market in Saudi Arabia will surpass a value of USD 24 billion by the conclusion of 2025, with a total of 163 hotel projects boasting 72,617 rooms scheduled to commence operations across the kingdom, a testament to the sector's promising future [4][5][6] and [27].

Saudi Arabia aspires to assert its dominance in the Middle East's tourism sector and emerge as a critical player of utmost importance on the global tourism stage. Saudi Arabia will host the 2030 World Expo and the 2034 World FIFA Cup. The upcoming 2030 World Expo is expected to inject a substantial economic boost into the nation's capital, with an estimated 40 million visitors expected during the six-month exhibition. Moreover, in a strategic move to attract visitors, Saudi Arabia introduced a novel tourist visa tailored for international visitors in September 2019. The realm's travel and tourism sector plays a pivotal role in the economy by generating 1.1 million jobs, constituting 8.5% of total employment, thereby making a substantial economic impact. Recent endeavors in the tourism domain in Saudi Arabia have been centered around promoting various other tourism attractions to fortify the overall tourism landscape, such as organizing shopping extravaganzas, cultural exhibitions, recreational pursuits, and sporting spectacles. The amalgamation of tourism and entertainment serves as catalysts propelling the economic advancement of Saudi Arabia [5].

In numerous nations, it is a prevalent occurrence that domestic tourism surpasses international flows in scale and economic significance. From a financial standpoint, stakeholders within the travel and hospitality sector share a mutual interest in attracting more tourists who invest their disposable income in tourism activities. The role of domestic tourism is pivotal not only in bolstering tourism infrastructure but also in fostering economic growth. A well-developed tourism sector is a critical facilitator for expanding Saudi Arabia's economy, constituting a fundamental element of Vision 2030's strategy to promote economic diversification and diminish reliance on oil for development and revenue generation. The essential metrics outlined in Table 1 unequivocally underscore the significance of tourism in advancing and fortifying the Saudi economy. Projections suggest that the travel and tourism industry's contribution to Saudi Arabia's GDP will reach approximately 573 billion Saudi Riyals by 2028, positioning the nation as an emerging and prominent player in the contemporary landscape of international tourism destinations [5][5] and [6]. This emphasis on economic diversification should make the audience proud of Saudi Arabia's potential as an international tourism destination.

The exceptional geographical location of Hail City, coupled with its vast array of tourist attractions, is crucial in drawing in visitors and travelers, both locally and globally. In the last twenty years, Hail City has undergone transformations and urban advancements, including establishing a new state university, a specialized hospital, and various tourism-related activities such as the Desert Festival, the Summer Nights Festival, and the Hail International Rally. As a result, there has been a surge in the influx of tourists, visitors, and students, leading to a corresponding rise in the provision of hotels to meet the growing demand prompted by the factors above [4] and [5]. On the other side, hotel proprietors and stakeholders must comprehend the significance of hotel location on market value when engaging in purchasing, divesting, and development determinations. Likewise, hotel evaluators and experts must grasp the impacts of location on market value, as it is a crucial factor affecting guest satisfaction, performance, and overall success of a hotel [7].

Table 1: Saudi Tourism Key Indicators in 2022 and 2030

2022				
Contribution to GDP	**New jobs created**	**Total visitation**	**Domestic visitation**	**International visitation**
5.3%	8,36,000	62 million	32. Million	29.5 million
2030				
Contribution to GDP	**New jobs created**	**Total visitation**	**Domestic visitation**	**International visitation**
10%+	1,000,000	100 million	45 million	55 million

1.3 GIS in Tourism Research

Using spatial statistical methodologies to enhance understanding of tourism activities has become increasingly prevalent in contemporary times. Understanding the distribution trends of tourism supply and demand is crucial for destination managers, investors, and other stakeholders in the private sector. The knowledge of accommodation locations is essential for regional planning endeavors, especially in cases related to infrastructure service planning. On the other hand, private investors derive valuable insights into market accessibility for potential tourists from the spatial arrangement of hotel accommodations and utilize this information to gauge the competitive landscape within a specific region [8]. Given the inherent geographical information in hotel location data, integrating Geographic Information System (GIS) technologies in this research is paramount. This integration not only enhances the efficiency of data management, retrieval, examination, and representation but also has the potential to improve hotel location determinations significantly. With the advent of the Internet and the wealth of data available, GIS location analysis has entered a new era of complexity and sophistication, enabling us to conduct more detailed and nuanced investigations into spatial patterns and relationships [8].

1.4 Related Work

A notable number of studies worldwide have extensively explored the spatial distribution patterns of hotels. The investigations are categorized into three spatial scales: national [9][10][11][12] and [13], regional [14][15] and [16], and international, [17][18][19][20][21][22][23][24][25] and [26]. On the national level, a density of hotels is observed in Taif City, Saudi Arabia, highlighting a peak concentration on the city's western side [9]. In another instance, [10] leveraged geographic information systems GIS and the Nearest Neighbor Index to analyze hotel spatial distribution in Al-Madinah, revealing a clustered distribution influenced by the proximity to the Holy Mosque and major roads. Three additional studies have been carried out in Jeddah City, Saudi Arabia.[11][12] and [13]. For example, [11] employed GIS to study the spatial distribution of hotels in Jeddah, noting a rise in hotel numbers near main roads. Similarly, [12] used Kernel density analysis and found a concentration of hotels along the city's main roads, with a dense cluster around the airport and the old city area. Furthermore, [13] identified the central business district (CBD) as having the highest number of hotels, with large-scale hotels situated further from the CBD. In contrast, smaller hotels are concentrated within the CBD of Jeddah City.

Regionally, several investigations have been conducted in the Middle East and North Africa region (MENA) regarding the spatial distribution of hotels [14][15] and [16]. For instance, [14] observed notable variations in the distribution patterns of hotels in Misrata, Libya, with a tendency to cluster in specific geographical areas, a trend attributed to urban expansion and access to public amenities. Similarly, [15] scrutinized hotel distribution in the Greater Amman area of Jordan, noting a concentration of hotels predominantly in the city's western sector. Additionally, [16] demonstrated that in Jericho, Palestine, hotels exhibited a clustered and irregular distribution, primarily focusing on the city center rather than evenly spread across the urban landscape. An early investigation conducted in Toronto, Canada, [17] revealed a significant increase in the average size of hotel establishments, with larger hotels gravitating towards downtown and airport regions due to less spatial constraints. The non-random distribution of hotels, leading to regional clustering, was a common trend. [18] delved into the spatial analysis of hotel establishments in Boyacá, Colombia, identifying intense clustering in five distinct clusters associated with three city municipalities, alongside a notable dispersion attributed to road networks and the growing appeal of natural attractions.

In Nigeria, three studies have investigated the distribution of hotels across various regions. [19] explored the spatial distribution of hotels in Port

Harcourt Metropolis, revealing a significant clustering pattern with hotels concentrated in specific areas following an east-to-west directional ellipse. [20] noted a widespread distribution of hotels throughout Akure, with a higher concentration along the city axis and some proximity to the central business district. Additionally, [21] utilized GIS technology to map hotels in Lagos, highlighting the prevalence of hotels in the Local Government Areas of Lagos state. Studies from Europe have also delved into the spatial distribution patterns of hotels.

For example, [22] argues that the distribution of hotel establishments in Extremadura, Spain, follows various regional patterns. [2] utilized kernel density estimation (KDE) of Points-of-Interest data to illustrate the spatial distribution of different hotel types in Poland, revealing a close association between the type of hotel and nearby tourist attractions. [23] identified a polycentric clustering trend in the hotel industry in Beijing, particularly within a 20 km radius of the city center, indicating a significant spatial presence at a large scale.

Asia has also been a focal point for research on hotel distribution trends. For instance, [24] demonstrated an uneven distribution of chain hotels in the central urban area of Wuhan, primarily concentrated in specific locations. This clustering trend is characterized by hotels near transportation hubs, commercial areas, tourist sites, and main thoroughfares. [25] highlighted a consistent growth trajectory in Beijing's hotel industry from 2003 to 2018, influenced by major historical events such as the Olympic Games, leading to a shift from centralized clustering to a more dispersed state. [26] identified clusters of Chinese star-rated hotels, with their distribution closely linked to local economic conditions and dependence on foreign investment.

These studies underscore that the distribution of hotels is not uniform or random across cities but instead is confined to specific spatial densities at certain locations. Additionally, these studies unanimously affirm hotels' pivotal and significant role in the travel and tourism sector. Moreover, most literature reinforces the importance of spatial methods and tools, particularly geographic information systems (GIS) and other spatial statistical analyses, in understanding hotel distribution patterns. While many studies have examined the spatial distribution of hotels in various Saudi cities, the city of Hail remains a gap in the literature.

Therefore, the current study tries to fill that gap by using a Geographical information system (GIS) to investigate the spatial distribution of hotels in Hail City. More specifically, this paper aims to examine the distribution patterns of hotels in Hail City and (2) investigate the geographic and economic factors influencing the spatial distribution of hotels in Hail City. This study is expected to provide valuable insights into the dynamic relationship between urban geography and the tourism industry, shedding light on the spatial development patterns in Hail. Further, this research contributes to the current body of knowledge by examining the spatial distribution patterns of hotels.

This study is structured as follows: Section 2 provides a detailed research design, including information about the study area and the data collection process. Section 3 outlines the spatial analysis techniques used in the study. Section 4 presents and discusses the results of the analysis. Finally, Section 5 concludes the study by summarizing the essential findings and insights and discussing the research objectives, outcomes, limitations, and future work. Figure 1 provides a visual representation of the study's workflow.

Figure 1: Study workflow

2. Research Design

2.1 The Study Area

This study was conducted in Hail, Saudi Arabia (Figure 2). Hail City, a unique geographical entity, is home to 510,623 individuals [27]. Nestled at coordinates 27.5114° N and 41.7208° E, it is the capital of the Hail province and spans an area of 400 km². Hail City, strategically perched at 980 m above sea level, is a crucial point on the Saudi Arabian map. It is located at a distance of (645) kilometers from the Saudi capital, Riyadh, (820) kilometers from Jeddah City on the west coast, and (1200) kilometers from Dammam on the east coast, making it a gateway to various vital regions. The climate of Hail City can be categorized as continental. The average annual temperature registers at 23 °C, with summer temperatures between 35–42 °C and winter temperatures between 5–15 °C. Precipitation levels reach around 110 mm, with two peaks occurring in March and November. Humidity levels plummet to as low as 17% in the summer and rise to approximately 54% during winter. The mean annual relative humidity stands at 35%.

Hail City is intricately connected to major urban centers in neighboring Saudi regions through a network of highways. Highway 70 links the Southwest and Northeast of the region and the country, while Highway 65 connects the Southeast and Northwest of the region and country, and Highway 400 extends from the city center towards the east. These three highways directly connect to the city's ring road and central urban fabric, enhancing vehicular movement efficiency and accessibility. Hail plays a pivotal role in the logistical framework of the Northern Saudi Arabian Rail system (SAR), with the railway linking the city to Riyadh in the South and to the Saudi-Jordan border in the North (650 km). The regional railway station is approximately 20 kilometers North of the city center. The regional Hail airport facilitates domestic and international flights. Given Hail's strategic positioning within the Middle East, plans are to construct a new international airport allowing one-hour flights to 11 Arab capital cities [28] and [29].

The economic prowess of Hail City is evident in the gross domestic product (GDP) of the Hail Region (2012), which stood at a substantial 29.6 billion riyals ($7.9bn), contributing 2.07% to the Kingdom's GDP. The trade sector, a significant contributor to the Hail Region's output, accounts for 26%. An investment of USD 338.66 million has been proposed for infrastructure, accommodation, food and beverage, entertainment, leisure, and retail sectors, further stimulating the economic growth and potential for investment in Hail. Hail region is a prominent agricultural center and a critical economic driver, impacting various societal segments in the region. In 2011, the total crop area in the region reached around 84,000 hectares, representing about 10.7% of Saudi Arabia's total crop area, which equated to 788,000 hectares in the same year. Hail is renowned for its UNESCO heritage sites and is poised to become a significant hub for tourism and investment in the foreseeable future. From 2016 to 2020, tourist trips to Hail have steadily risen from below 500,000 to over 1,170,000. Domestic tourism has been the primary driver of this growth, doubling in the past five years to reach 1,160,000 tourist trips in 2020. The tourism and manufacturing sectors play crucial roles in Hail's economy, contributing 60% to its GDP [30].

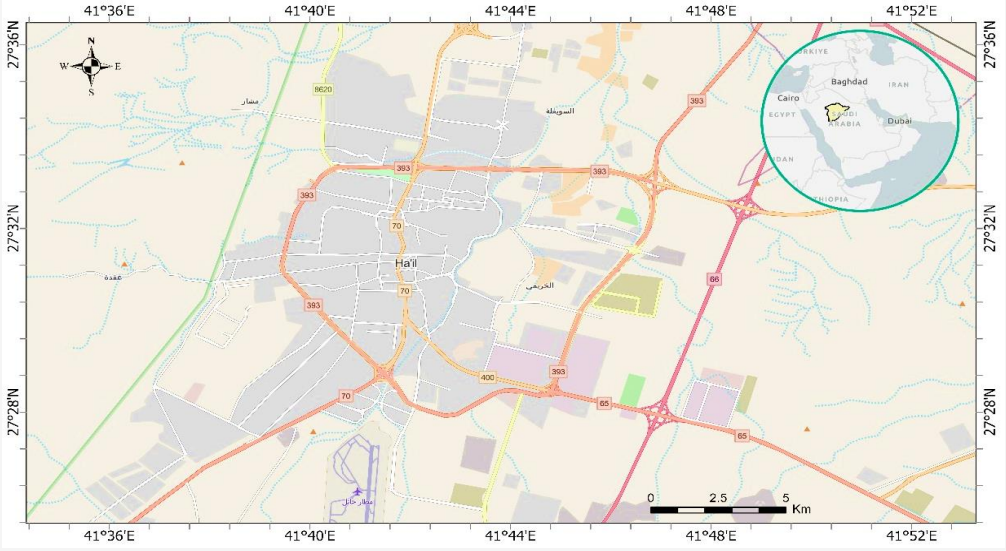


Figure 2: Location of Hail City and Hail Province, Saudi Arabia

2.2 Data Collection

The present research relies on the data gathered as the geographical coordinates (x, y) of 88 hotels in Hail City, Saudi Arabia, in March 2024. Then, a geographic database of all the hotels was built. In addition, several field visits were made to ensure the existence of the hotel locations. The database contained the hotel name, address, street, and location. The presence of temporal data on hotels posed a significant challenge for the research. The Ministry of Tourism, Hail branch, disposed of outdated records about the size, location, amenities, openings, and closures of hotels and all accommodations.

3. Spatial Analysis

Spatial pattern analysis entails recognizing, depicting, and quantifying the form, distribution, positioning, structure, tendency, or connections within geographical data. Geographical data become spatial or geographic data upon being gathered with or designated by specific locations like X and Y coordinates (longitude and latitude) or a physical address. Once data are linked with locations, they become mappable, and the cartographic representation of geographic data serves as a crucial initial phase in examining spatial arrangements [31].

3.1 Kernel Density Estimation (KDE)

Kernel Density Estimation (KDE), a powerful tool in spatial analysis, primarily aims to create a refined density surface for point events across space. It achieves this by evaluating event intensity as a form of density estimation, thereby revealing spatial heterogeneity or inconsistency in the geographical process. The precision and accuracy of KDE are ensured by using simple and kernel methods. The kernel density technique's basic approach involves dividing an area into cells and determining the density level surrounding each cell using the circular neighborhood technique. This is accomplished by calculating the ratio of the number of features concerning the area size. By expanding the radius of the circular neighborhood, a smoother density surface is attained, attributable to the increased coverage of points by the circular neighborhood [2]. The Kernel formula is defined in equation 1.

$$\hat{f}(x) = \frac{1}{nh} \sum_{i=1}^{n} K\left(\frac{x - x_i}{h} \right)$$

Equation 1

Where:

$\hat{f}(x)$ is the estimated PDF at point x.
n is the number of data points.
x_i is each data point.
h is the bandwidth or smoothing parameter, which determines the width of the kernel function.
K is the kernel function.

3.2 Multi-ring Buffer Analysis

Buffer Analysis is an essential operation in GIS. It automatically generates zones of a specified width around geometric objects such as points, lines, or regions based on a designated buffer distance. This operation can be applied to point, line, or region datasets to create buffers for all objects or selected objects within the dataset. Creating a geometric buffer for a point layer necessitates the availability of a point layer for which the buffer will be generated alongside an input parameter denoting the buffer width. A circular polygon with a specified radius is generated around a point to serve as its buffer. The buffer points for a point layer are situated at a distance equivalent to the buffer width from the initial point. The determination of the necessary buffer points is facilitated through the utilization of parametric equations defining a circle. Refer to an algorithm for generating geometric [32] and [33].

3.3 Average Nearest Neighbor Analysis

The Average Nearest Neighbor tool measures the distance between each feature centroid and its nearest neighbor's centroid location. It then averages all these nearest-neighbor distances to get the nearest-neighbor index. As shown in Figure 3, if the index is less than 1, the pattern exhibits clustering. If the index is greater than 1, the trend is toward dispersion. If the average distance is less than the average for a hypothetical random distribution, the distribution of the features being analyzed is considered clustered. The features are dispersed if the average distance is more significant than a hypothetical random distribution. The average nearest neighbor can come up with an index of the specific concentration of data, which can be used to compare different data with the largest concentration of data. The average nearest neighbor method is susceptible to the Area value. Consequently, the Average Nearest Neighbor tool is most effective for comparing different features in a fixed study area [34]. The formula used is defined in equation 2.

$$R_n = \frac{\bar{D}_{obs}}{0.5\sqrt{a/n}}$$

Equation 2

Where:

R_n is the nearest neighbor value.
$\bar{D}_{Obs}$ is the mean observed nearest neighbor distance.
a is the area under study.
n is the total number of points [35]

3.3 Spatial Statistics Analysis

3.3.1 The mean center

The Mean Center is one of the primary metrics used to assess central tendency. The mean center is calculated by averaging the X and Y coordinates of all features within a dataset. Despite its simplicity, the mean center holds significant practical implications. For instance, epidemiologists may utilize the mean center to investigate potential disease sources or enhance their understanding of disease transmission mechanisms. When attribute values are incorporated as weights in the mean center computation, the resultant location is influenced by features with the highest attributes [29]. The Mean Center is given in equation 3.

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}, \quad \bar{Y} = \frac{\sum_{i=1}^{n} Y_i}{n}$$

Equation 3

Where: X_i and Y_i are the coordinates for feature i
n is the total number of features

3.4.2 The central feature

The Central Feature represents the point with the shortest distance to all other points in the dataset, thereby identifying the most centrally positioned feature. It proves helpful in determining the most easily accessible feature, such as the closest hotel for hosting a meeting with hotel managers in a specific area. By calculating the total distance to all other features for each one, the Central Feature is identified as the feature with the shortest total distance [35].

3.4.3 The directional distribution (Standard Deviational Ellipse)

The Directional Distribution method, an exact tool, is a common way of measuring the trend for a set of points or areas. It calculates the standard distance separately in the x-, y- and z-directions, defining the axes of an ellipse (or ellipsoid) encompassing the distribution of features. The ellipse, known as the standard deviational ellipse, is a testament to the method's accuracy as it calculates the standard deviation of the x-coordinates and y-coordinates from the mean center to define the axes of the ellipse. The ellipse allows us to see if the distribution of features is elongated and, hence, has a particular orientation [34] and [35].

3.4.4 Standard distance

The standard distance is helpful as it provides a single summary measure of feature distribution around their center. It functions similarly to how a standard deviation measures the distribution of data values around the statistical mean. The Standard Distance tool creates a new feature class containing a circle polygon or sphere multipatch centered on the mean for each case. Each circle polygon or sphere multipatch is drawn with a radius equal to the standard distance. The attribute value for each circle polygon or sphere multipatch is its standard distance value [35]. The Standard Distance is given in equation 4.

$$SD = \sqrt{\frac{\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2 + \sum_{i=1}^{n}\left(Y_i - \bar{Y}\right)^2}{n}}$$

Equation 4

Where:

- x_i, y_i, and z_i are the coordinates for feature i
- $\bar{x}$, $\bar{y}$, $\bar{z}$ are the mean center for the features
- n is the total number of features [31].

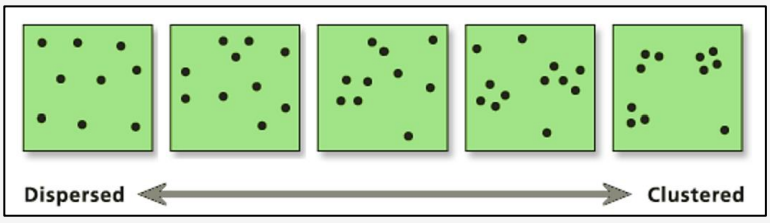


Figure 3: The output of the Average Nearest Neighbor analysis

4. Result and Discussion

4.1 Hotel Distributions

Analyzing spatial patterns involves identifying, describing, and quantifying geographical data's form, organization, positioning, structure, trend, or connections. Spatial or geographical data are characterized by their association with specific locations, such as X and Y coordinates (longitude and latitude) or an address. The initial crucial step in spatial pattern analysis is visualizing these data through mapping, facilitating a comprehensive examination of spatial relationships [32]. The spatial point patterns examined in this research pertain to the aggregate count of hotels in Hail City as of 1 April 2024, comprising 88 spatial points. Figure 4 depicts the spatial dispersion of hotels within Hail City.

As the map shows, many hotels are situated along the city's ring road, mainly around the western and northern sides. A predominant observation is the positioning of hotels along the city's primary thoroughfares, underscoring the pivotal role of accessibility in determining optimal hotel positioning. Additionally, the map indicates the absence of hotels on the city's east side and in the Central Business District (CBD) due to prolonged infrastructural developments, resulting in a paucity of hotel options. The results of hotel distribution within city neighborhoods, as depicted in the significant data of Figures 5 and 6, reveal that the Niqrah and Wusaitah neighborhoods hold a substantial share of the total number of hotels. This is primarily due to the proximity of the airport and the availability of amenities in these areas. Notably, the city's western side demonstrates a higher level of development than other areas.

Moreover, the density of hotels along the northern ring road, potentially influenced by the presence of the university and specialized hospitals, presents a unique opportunity for urban planners and city developers. However, a more balanced distribution of hotels could be achieved on the eastern and southern peripheries, with only ten and fifteen establishments, respectively. This suggests a promising potential for growth and development in these areas, especially considering the need for more recreational, governmental, and public amenities on the eastern and southern main roads. It is worth noting that the only shopping centers are currently located on the northern and western sides of the city, indicating a potential market gap in the other areas.

4.2 Kernel Analysis of Density

Figure 7 illustrates the results of the Kernel density examination, revealing four distinct levels of high densities and saturations within the city. These high densities can be categorized as follows: Two areas exhibit high density, notably along the Southwestern ring road near the airport. The heightened concentration in these locations may be rationalized by their proximity to the airport facilities and the city's primary shopping center.

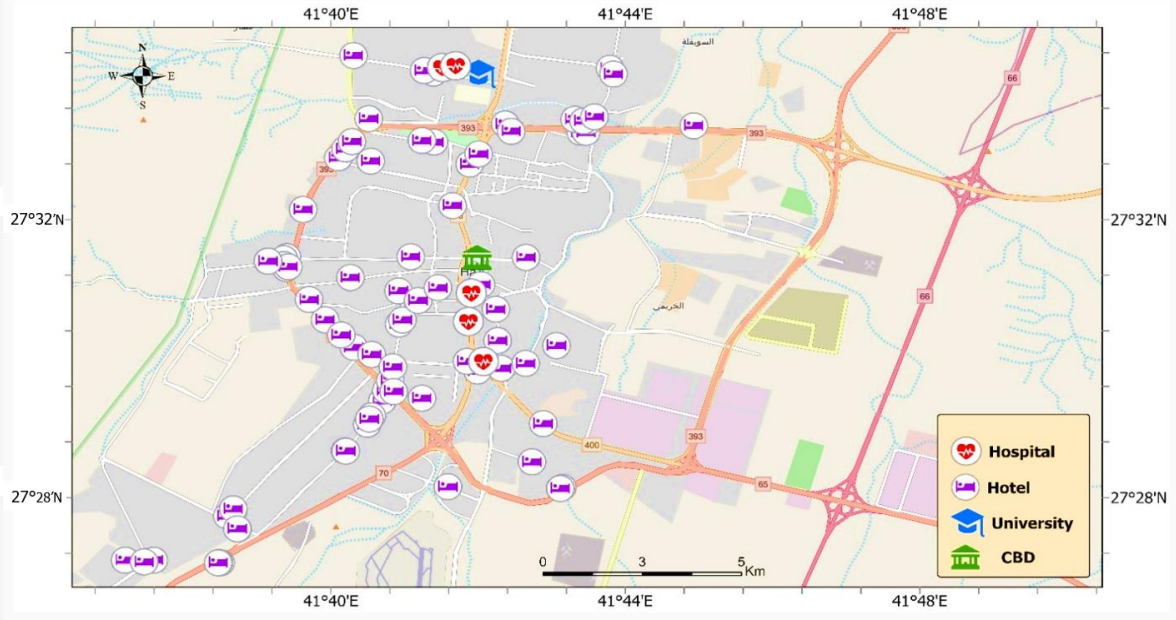


Figure 4: Map of hotel distribution

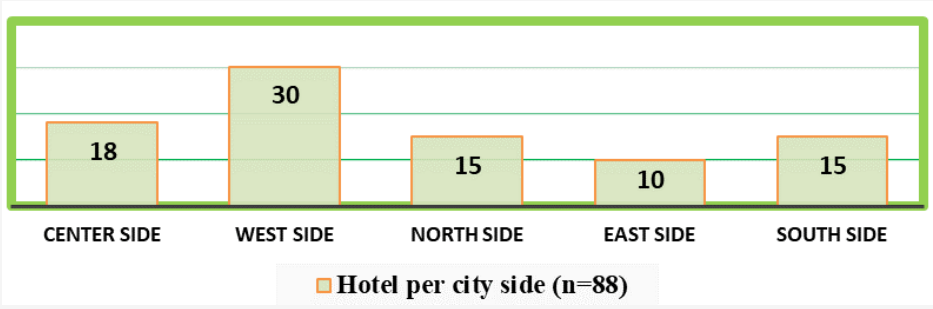


Figure 5: Distribution of hotels per city side

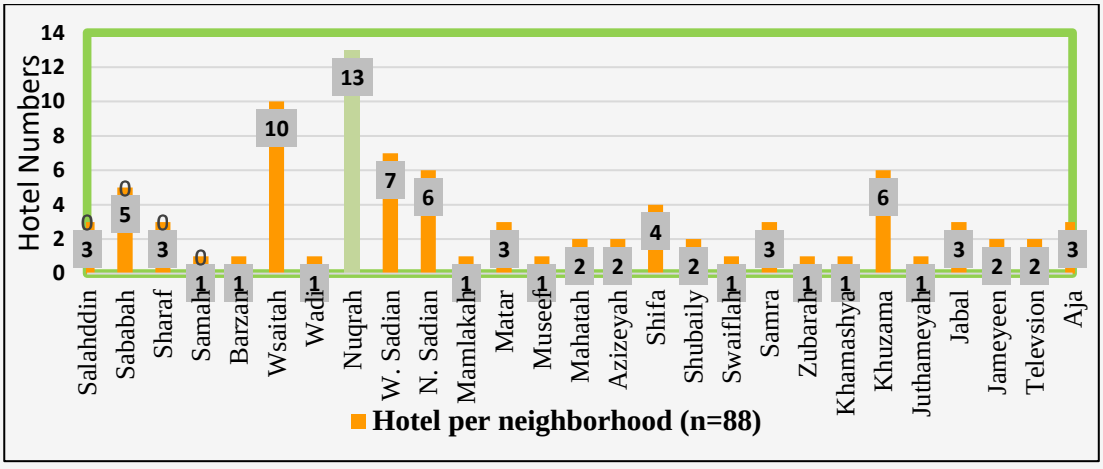


Figure 6: Distribution of Hotels per neighborhood

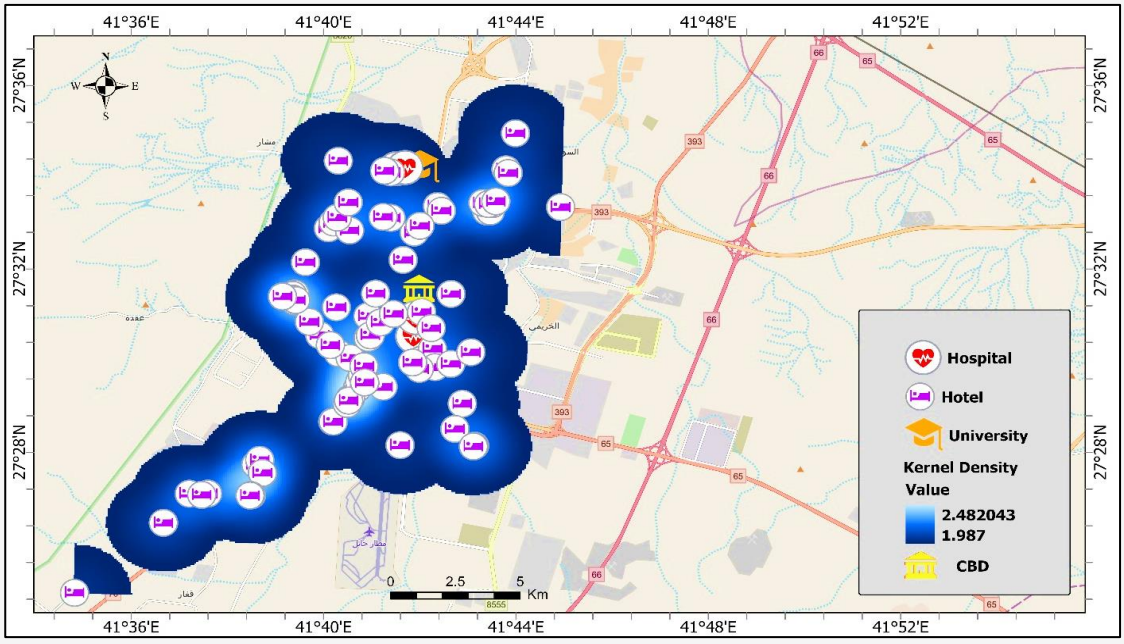


Figure 7: Results of Kernel Density Analysis

Two high densities display medium densities: one near the Mount Aja area, renowned for its rural retreats and camping sites, and the other along the northern ring road. There is also a large concentration of hotels along the highway to Al-Madinah province. The sole rationale for this spatial distribution is the proximity to the university campus and the specialized hospital. Conversely, low densities are observed in the remaining sides of the city, specifically in the northwest, central, east, and southeast sides. Like any service within the tourism sector, hotels are subject to various geographical and non-geographical influences. These determinants include ease of access, tourist attractions, natural landscapes, and economic provisions.

4.3 Multi-ring Buffer

Figure 8 and Table 2 show the analysis results of the Multi-ring Buffer, which generated buffer polygons encircling the Central Business District (CBD) up to a specified distance. Owing to the city's size, 1 kilometer is designated due to its shortness from the east to the west. The findings reveal that each zone neighboring the CBD area encompassed several hotels. The initial zone comprises solely one hotel, whereas the second zone accommodates seven hotels. Details regarding the remaining zones can be found in Table 1. Looking at the literature on hotel location distribution, [36] introduced the Tourist-historic city model (THC Model). The model delineates the typology of hotel locations in medium-sized Western European towns, identifying six distinct location zones: 1) Traditional city gates, 2) Railway station/approach roads, 3) Main access roads, 4) Desirable locations, 5) Transition zones and urban periphery along a motorway, and 6) airport transport interchanges. Each of these zones is correlated with different categories of hotels.

Comparing these results with the THC model, this model may not apply to Hail as it does not qualify as a historic town or is situated in Europe. Some scholars have posited that while this model is suitable for tourist-historic cities, it may be less relevant for cities lacking historical tourist significance [24].

Table 2: Hotels per city zone

Zone	Number of hotels	Zone	Number of hotels
First	1	**Sixth**	7
Second	9	**Seventh**	5
Third	13	**Eighth**	1
Forth	19	**Ninth**	4
Fifth	24	**Other**	5

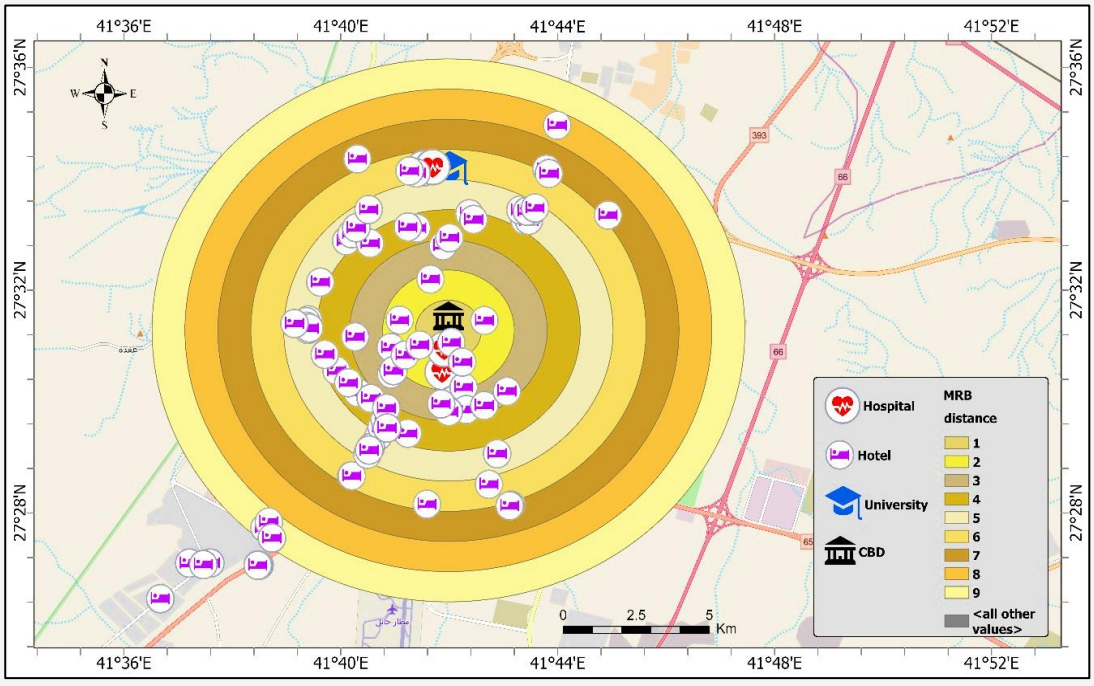


Figure 8: Results of Multiple Ring Buffer analysis of hotels in Hail City

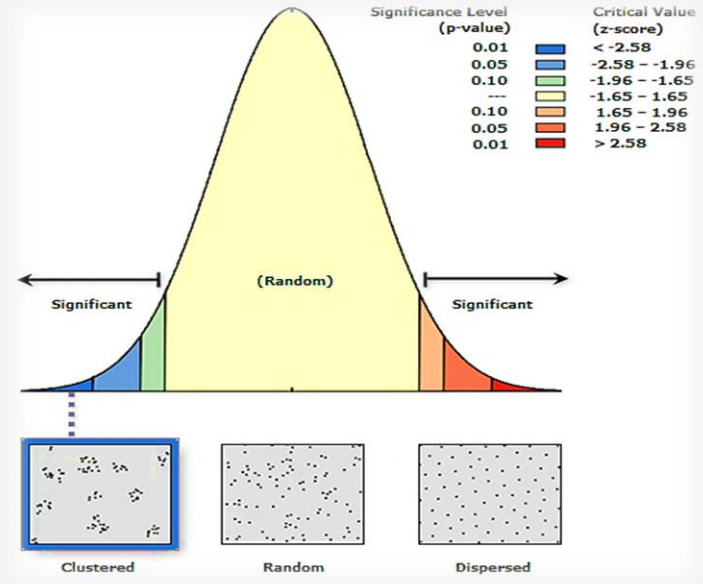
4.4 The Average Nearest Neighbor

Figure 9 shows the results of the Nearest Neighbor analysis, revealing a saturation of hotels within the confines of the city, as opposed to a random or dispersed arrangement. The findings further denote that the mean observed distance amounts to 521.8090 meters, contrasting with the expected mean distance of 929.1539 meters. The nearest neighbor ratio is calculated at 0.561596, accompanied by a Z-score of z-8.088109, indicating a probability of less than 1% for this pattern to occur by chance. These results substantiate the preceding analyses conducted in this research, including the Kernal density and multi-ring Buffer analyses, showcasing a concentration in selected city areas.

4.5 Spatial Statistics Analyses

Figure 10 shows the results of the Central Tendency analysis: the mean, the center, the Central Feature, the directional distribution, and the standard distance. These results suggest that hotels in the city tend to gravitate toward the southwestern side of the town. This spatial pattern is attributed to the concentrated hotels predominantly on the city's western side. The standard distance examination reveals a relatively large circle size, indicating an increased dispersion of the hotels. The limited presence of hotels on the city's outskirts may elucidate this phenomenon.

Furthermore, the circle delineates that approximately 80% of the hotels are within its confines. Regarding directional distribution analysis, the findings of the Ellipses demonstrate an extension from the northeast to the southwest, aligning with the city sprawl while strategically avoiding the adjacent valleys and mountains. The directional ellipse runs from North-East to Southwest. The ellipse captured 55 out of 88 hotels. The Standard Distance Analysis captured most hotels (68 hotels). The Mean Center and the Central Feature did not fall in the same place because the center is obtained by averaging the X and Y values and will fall on a new coordinate. At the same time, the Central Feature is the feature that has the shortest distance to all other features and will fall on the coordinates of an existing feature.



Average Nearest Neighbor Summary

Observed Mean Distance	521.8090 Meters
Expected Mean Distance	929.1539 Meters
Nearest Neighbor Ratio	0.561596
z-score	-8.088109
p-value	0.000000

Figure 9: The results of the Average Nearest Neighbor

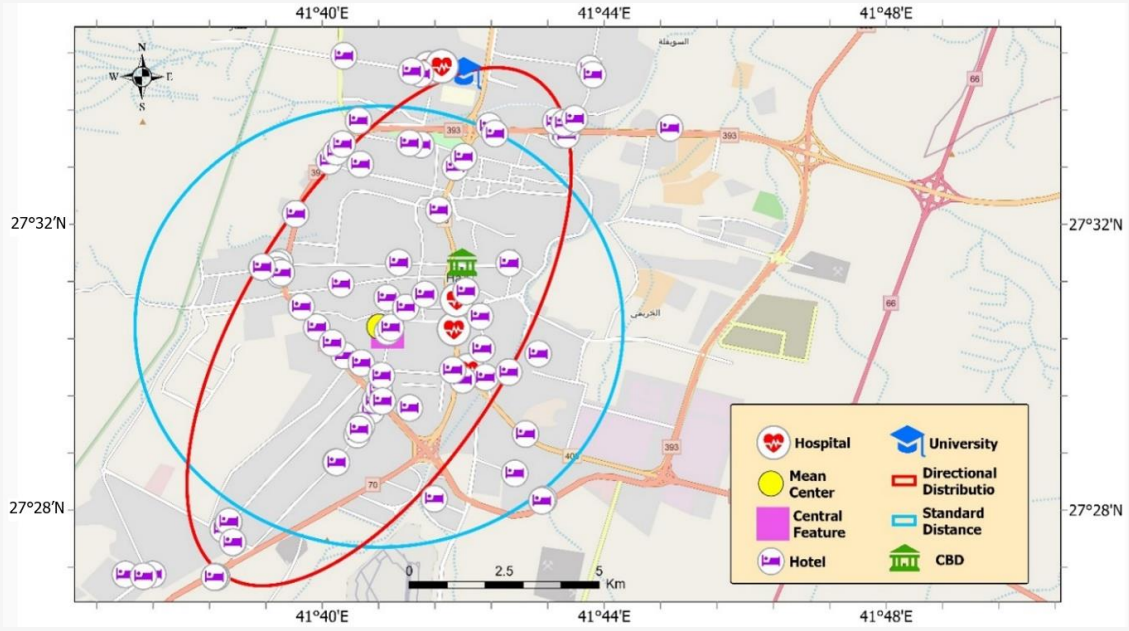


Figure 10: The results of the Mean Center, Central Feature, distance standard, and Directional Distribution of the hotels in Hail City

5. Conclusion

This study carried out the spatial distribution of hotels in Hail City, Saudi Arabia, and demonstrated the significance of Geographic Information Systems (GIS) in such investigations. The increasing demand for accommodations in Hail City resulted in a high supply without planning. The study concludes that hotels in Hail City have various densities, with a notable concentration around the city's west and southwest sides and an apparent absence of hotels on the other sides.

The study found that accessibility to the central transportation hub plays a vital role in the density of hotels. The analysis shows that most hotels are along major roads and near the airport, supporting the results from previous studies. Notably, two-thirds of hotels are located in affluent neighborhoods, underscoring the economic implications of hotel distribution. Kernel density estimation (KDE) shows that hotels in Hail City predominantly align with business districts, hospitals, and universities, revealing a distinct spatial density and concentration. In contrast with several studies from the literature, the Multi-ring Buffer shows that Hail CBD does not attract hotels. This might be explained by congestion and poor planning in the CBD. The study's findings align with existing literature, suggesting that geographic factors, such as proximity to major roads and airports, and non-geographic factors, including the economic status of the neighborhood, significantly influence hotel distribution. Understanding these factors can empower policymakers and urban planners to make informed decisions about future hotel development and spatial planning, thereby shaping the future of Hail City.

This research, the first of its kind, significantly contributes to the literature on hotels in Hail City. Its findings hold practical implications, particularly for stakeholders in the hotel industry. These insights can empower decision-making regarding location and timing by leveraging spatial patterns. For instance, hospitality enterprises could explore growth possibilities in persistent hotspots, especially in newly identified regions. This study has identified some limitations. The lack of comprehensive data on hotels in Hail City, including type, size, beds, and occupancy rate, has posed a challenge to understanding this industry fully. Additionally, the methodology for calculating traveler volumes between different regions has limitations. These insights highlight the need for further research and the potential for more accurate and comprehensive data to enhance our understanding of hotel distribution in Hail City.

Finally, this study serves as a call to action for researchers to delve deeper into this field, particularly the temporal evolution side. More reliable data will be needed. The established framework and identified factors can guide future work in this field and support stakeholders in tourism destination management.

The high concentration and saturation of hotels in certain parts of the city indicate a need for strategic relocation. This insight can inspire policymakers and urban planners to balance the distribution of hotels and promote sustainable urban development.

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