

Social media resonance on destination dispersion to predict tourist behavior and travel distance using geospatial analysis

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Article Info

Article history:

Received Aug 11, 2024

Revised May 27, 2026

Accepted Jun 17, 2026

Keywords:

Big data

Geospatial analysis

Social media

Tourism

Tourist behavior

ABSTRACT

This study investigates the influence of social media popularity on tourist destination preferences in Gunungkidul Regency, Yogyakarta, Indonesia, using an integrated big data and geographic information system (GIS) approach. Field surveys involving 504 respondents were combined with sentiment analysis of 30,432 cleaned tweets collected from X (formerly Twitter). Spatial analysis was applied to identify tourist origin patterns and destination attractiveness. The results show that neutral sentiment dominates online discussions, indicating generally positive but moderate tourist experiences. Destinations with higher popularity on social media, particularly Heha Sky View, Drini Beach, and Indrayanti Beach, attracted visitors from broader and more diverse origins. Spatial analysis also indicates stronger preferences for coastal and highland destinations. The integration of big data and GIS enhances understanding of tourism behavior and spatial destination patterns. Future studies are recommended to integrate multiple social media platforms and comparative spatial analyses to improve tourism planning and destination management.

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1. INTRODUCTION

Tourism is a key economic sector that supports the local economy, significantly contributes to the livelihoods of rural communities, and boosts local revenue [1], [2]. However, this sector is highly vulnerable to crises. During the COVID-19 pandemic, it was the most affected sector due to its inherent vulnerabilities [3], [4]. Travel restrictions implemented to curb the spread of the virus have led to a significant and a prolonged decline in tourist numbers, thereby negatively affecting the sustainability of the tourism industry [4]. Additionally, as tourism is considered a major source of virus transmission, the pandemic has halted tourism activities, causing substantial financial losses for the industry [5], [6]. Following the subsidence of the pandemic, growth in the tourism sector is urgently needed to revive operations that were halted during the epidemic. The resilience of the sector, developed through innovation and stakeholder engagement in the post-COVID-19 period, will be crucial for economic recovery [4], [7]. On the other hand, the growth and revival of tourism extend beyond financial benefits, as tourism is recognized as a global right, as declared by the World Tourism Organization in the Manila Declaration of 1980 [8].

Gunungkidul Regency is one of the regions in Yogyakarta, Indonesia that has experienced significant growth in the tourism industry, driven by local autonomy policies implemented since January 1, 2001. The policy directives have prompted the local government to increase regional revenue from the

tourism sector [9]. According to available data, the tourism industry in this regency contributes approximately 3.34% to the gross domestic product (GDP) and has exhibited one of the highest post-COVID-19 growth rates, reaching 18.37%. The resurgence of tourism, which had previously stagnated due to the impact of the pandemic, has attracted academic interest, particularly regarding the untapped tourism potential within the regency.

This study employs geographic information system (GIS)-based geospatial analysis to forecast tourism potential across various destinations in Gunungkidul Regency. GIS has long been recognized as a valuable tool in tourism development. Its capacity to aggregate geographic data according to specific criteria is particularly advantageous for decision-making within the tourism sector [10]. Consequently, GIS offers a robust framework for integrating tourism information with spatial data analysis [11]. It has become one of the most widely utilized tools for spatial planning and management, particularly in the fields of tourism and big data analytics. GIS's ability to transform text-based data into easily interpretable spatial representations enhances its efficiency and reliability in research, particularly in tourism development projects involving major destinations. When integrated with big data obtained from social media, these capabilities provide valuable insights into the issue.

In developing tourist attractions, decision makers and planners require access to data on visitors and potential destinations, which can be extracted from social media, based on big data. The application of big data in the tourism industry offers several advantages, including the estimation of visitor arrivals by destination, government assessment of tourism's national economic impact, and the formulation of strategic marketing initiatives by industry stakeholders [12]. This argument is reinforced by previous studies highlighting the significance of big data in the tourism sector. Big data is considered more suitable for tourism forecasting and decision-making because it provides comprehensive and real-time information, enabling more accurate analysis and strategic planning in the tourism sector [13]. In addition, the utilization of big data derived from social media platforms allows researchers to obtain deeper insights into visitor behavior and tourist activities at tourism destinations, particularly in understanding travel patterns and destination preferences [14]. The key challenge lies in how big data can be effectively applied to tourism-related analyses, particularly sentiment analysis supported by geospatial data.

Although the application of big data in tourism presents challenges related to accuracy, validity, and reliability, its integration is strongly encouraged by the United Nations World Tourism Organization (UNWTO) due to its ability to provide large and complex datasets beyond traditional methods. When combined with GIS, big data enables comprehensive analysis of the spatial distribution of tourism activities. This study integrates field survey data on tourist origins with social media big data from X to examine tourism patterns in Gunungkidul. Social media data also offer spatial advantages through geotagging features, supporting the convergence of GIS and social media technologies for tourism analysis and management. Moreover, big data enables the integration of numerous interconnected users [11], thereby offering deeper and more valuable insights for tourism management [15]. This study proposes an integrated approach combining big data and geospatial analysis to examine tourist behavior and evaluate the influence of social media popularity on destination preferences, an area still rarely explored.

2. LITERATURE REVIEW

Tourism is regarded as one of the world's most promising and rapidly evolving industries. The expansion of the tourism sector has significantly contributed to rural community development by enhancing education, employment opportunities, income levels, and consumption growth [2]. Through industry substitution and integration, the expansion of tourism also contributes to productivity growth in neighboring sectors [16]. Furthermore, momentum and initiatives aimed at promoting the tourism industry in the post-COVID-19 era is highly promising, as the sector's development could serve as a catalyst for broader economic recovery [17]. Nonetheless, a well-designed blueprint for tourism industry development is essential to guide the sector in pursuing a growth strategy that not only generates financial returns but also promotes broader societal well-being beyond the business and its core operations [18]. A deeper understanding of destination management is essential to gain a comprehensive view of how tourism destinations are developed and promoted [19]. Previous studies on tourism destination management have highlighted the growing influence of information and communication technology (ICT) on how destinations are managed and promoted [20]. However, to further advance the use of ICT as a tool for developing a new approach to destination management, an alternative management strategy is arguably necessary [21].

2.1. Social exchange theory and social network theory

Previous studies have shown that social exchange theory and its applications are closely associated with tourism development, emphasizing the importance of understanding local social networks and

stakeholder relationships [22]. Effective tourism promotion requires strengthening local network structures and enhancing collaboration, particularly with informal leaders who influence tourism activities. In this context, social media has evolved into an important instrument for encouraging social change and supporting tourism development. This study recommends implementing structured social media management based on social exchange theory and social network theory principles. Social media can also facilitate stakeholder engagement, strengthen collaboration, and improve demand–supply interactions, thereby supporting more effective tourism management and sustainable destination development.

2.2. Geographic information system, big data, and tourism

In recent years, researchers and scholars in many countries, including Indonesia, have increasingly adopted GIS for tourism management and development [23]. Several previous studies have demonstrated how GIS is utilized in tourism planning as an integral part of the development process [24]. GIS's ability to manage geographical data makes it an effective tool for analyzing visitor distribution patterns [25], identifying potential tourism attractions [26], and monitoring and evaluating these attractions [10]. The use of big data in this study is essential for enhancing tourism development and the management of destination organizations. Big data refers to vast quantities of information that are complex, diverse, and challenging to store, analyze, and present for further processing or decision-making [27]. Several previous studies have employed big data to assess visitor preferences [28], tourism flows [29], and tourism demand [30], often within the framework of systematic reviews on the application of big data in the hospitality and tourism industry. A previous study on harnessing big data for tourism purposes, specifically for Destination Management Organizations (DMOs), was conducted based on Fonseca's thesis, which identified “crawling” as a method for collecting big data from social media platforms such as X [31]. The method also offers several advantages, including the capability and flexibility to access large volumes of data across multiple platforms. In particular, it enables a more comprehensive understanding of various issues, such as tourist behavior and spatio-temporal patterns of tourist activity within specific destinations [14].

2.3. Social media engagement in tourism

Social media undoubtedly plays a significant role in the tourism industry, particularly as a tool for promoting destinations and attracting tourists. Social media advertising based on user-generated content has been identified as a form of electronic word-of-mouth behavior that positively influences customer loyalty in the hospitality, travel, and tourism industries [32]. Recent studies indicate that advertising through social media influencers positively affects visitors' travel motivation, highlighting the important role of social media in tourism promotion and destination marketing [33]. The influence of social media on the tourism industry has recently emerged as a critical area of scholarly inquiry, particularly concerning the evaluation of tourism destination management. Despite its importance in tourism development, studies examining the relationship between tourism destinations and geographical variables remain relatively scarce, especially within the Indonesian context.

3. RESEARCH METHOD

The research flow is illustrated in Figure 1. The study combined questionnaire surveys and X data crawling to examine tourist preferences and behavior in Gunungkidul. Survey data were collected through interviews and Google Forms, while X crawling gathered tourism-related user content. The analysis integrated spatial and sentiment approaches, including geospatial mapping, thematic maps, buffer analysis, tourist origin mapping, and sentiment classification into positive, neutral, and negative categories. The combined results provided a comprehensive understanding of tourism patterns, tourist behavior, and destination popularity in Gunungkidul.

3.1. Data collection

This study was conducted from February to May 2022 at several tourist destinations in Gunungkidul Regency. Data collection employed two methods: questionnaire surveys and X-based big data crawling. The survey involved 504 respondents through direct interviews and Google Forms distributed to tourists who had visited Gunungkidul destinations. Social media data were collected from tweets mentioning six major attractions: Nglanggeran, Bukit Bintang, Heha Sky View, Drini Beach, Indrayanti Beach, and Sepanjang Beach. Data crawling was performed using the API function in Orange software with eight tourism-related keywords: #gunungkidul, #wisata, #pantaiindrayanti, #pantaidrini, #pantaisepanjang, #hehasky, #nglanggeran, and #bukitbintang. A total of 278,117 tweets were collected from February to March 2022. After data cleaning procedures [34], the final dataset used for analysis consisted of 30,432 tweets, which were further processed for sentiment and spatial analysis.

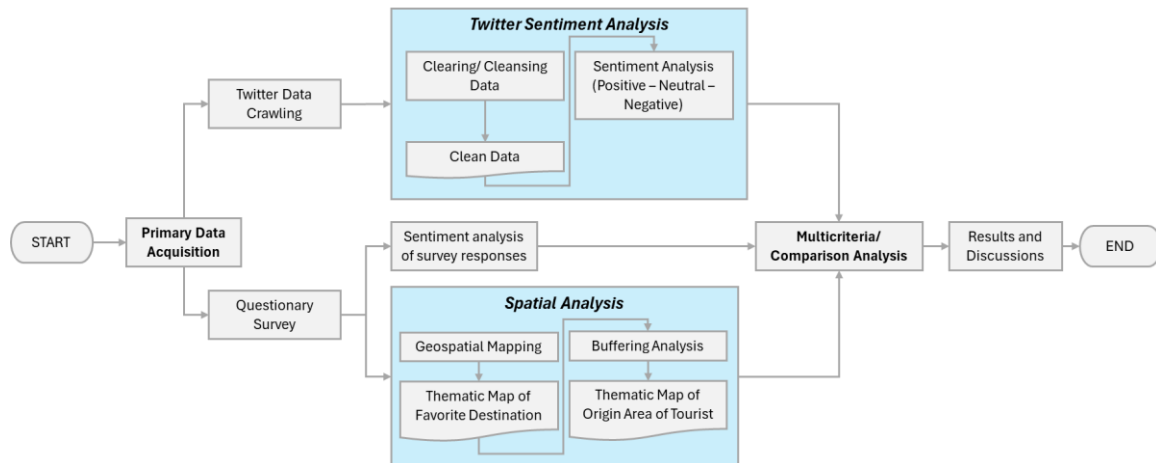


Figure 1. Methodology

3.2. Data analysis

The travel destinations of 504 respondents were mapped using geospatial analysis to generate thematic maps of tourist preferences and visitor distribution. Survey data were processed using Microsoft Excel, converted into spatial points through Google My Maps, and further analyzed in ArcGIS to visualize destination patterns and tourist distribution. For social media analysis, X data crawling was conducted using Orange software (the data crawling process is illustrated in Figure 2), while sentiment classification was performed in RStudio. The sentiment results were integrated with spatial data in ArcGIS to examine relationships between social media sentiment, destination popularity, and tourist distribution patterns. Additional spatial analyses included dot distribution mapping and buffer analysis to identify tourist origin dispersion and travel radius. This integrated approach enabled assessment of whether favorable social media sentiment influenced tourist numbers and travel distance to destinations.

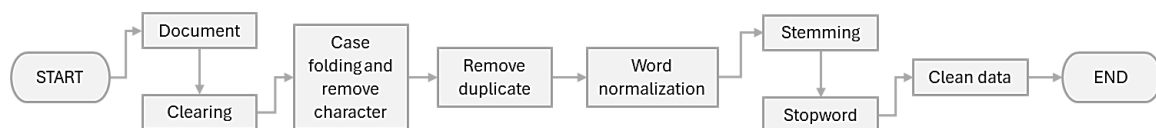


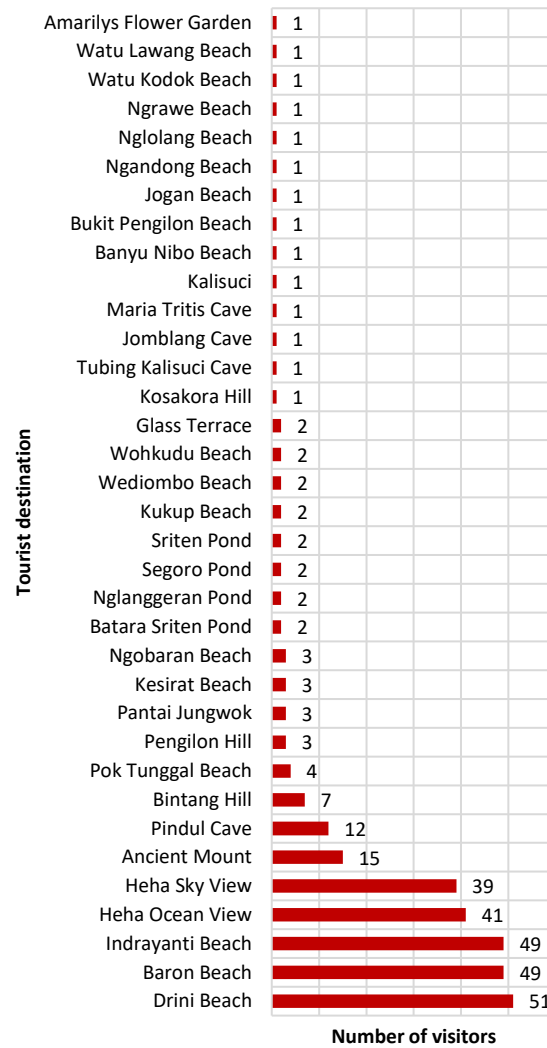
Figure 2. Preprocessing data flowchart

4. RESULTS AND DISCUSSION

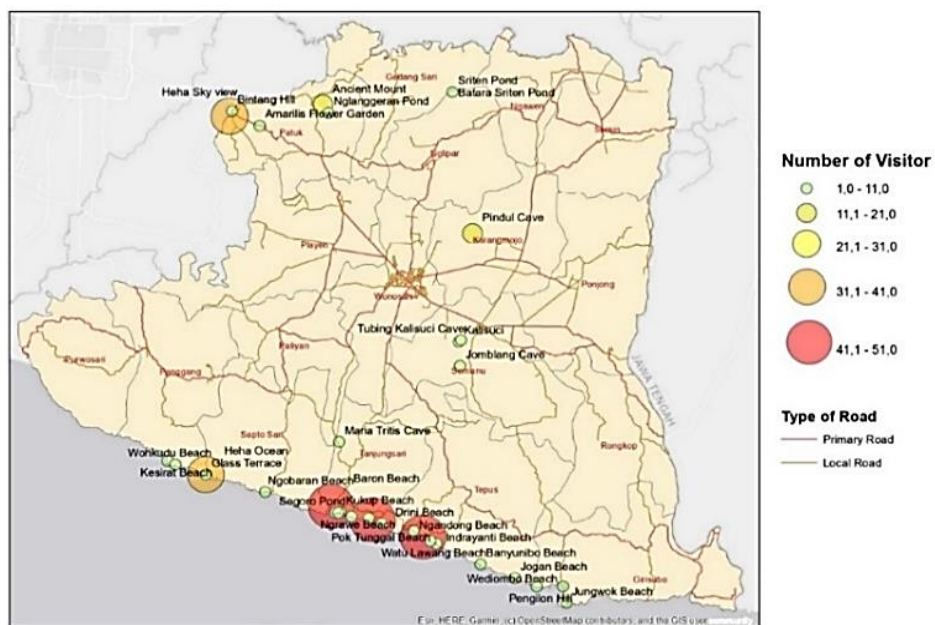
4.1. Field survey

Based on the field survey data, the demographic profile of the 504 respondents shows that female tourists dominated the sample, representing 55% of participants, while males accounted for 45%. In terms of age distribution, the largest proportion consisted of respondents aged 15–25 years (55%), followed by those aged 36–55 years (25%), 26–35 years (18%), and above 55 years (2%). This indicates that young adults constitute the primary tourism market segment in the study area. Regarding destination preference, most respondents (61%) preferred tourism destinations located within Gunungkidul, whereas 39% selected destinations outside the regency. These results highlight the strong attractiveness of Gunungkidul tourism and suggest that younger visitors may have higher exposure to digital information and social media influences in shaping travel preferences.

Figure 3 shows that tourist destination preferences in Gunungkidul are unevenly distributed, with Drini Beach (51 respondents), Indrayanti Beach (49 respondents), Baron Beach (49 respondents), Pindul Cave (41 respondents), and Heha Sky View (39 respondents) emerging as the most preferred destinations. Figure 3(a) presents the number of visitors for each destination, while Figure 3(b) illustrates their spatial distribution using a thematic GIS map. The map indicates that popular destinations are mainly concentrated in coastal areas and highland regions. This finding suggests that tourists tend to prefer destinations offering natural landscapes, open spaces, and scenic views.



(a)



(b)

Figure 3. Distribution of visitors, including (a) number of visitors and (b) thematic map of visitor distribution

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4.2. Data crawling (sentiment analysis)

Figure 4 shows the crawling method on X was conducted at six tourism destinations in Gunungkidul Regency: Heha Sky View, Drini Beach, Indrayanti Beach, Sepanjang Beach, Nglanggeran, and Bukit Bintang. The crawling method was specifically conducted to identify how commonly the tourism locations are discussed on X, as well as the public's favorability, negative sentiments, and neutral feelings expressed by users toward the six tourism destinations. According to Figure 4(a), the results of X crawling on six tourist objects reveal a substantial difference in the number of tweets retrieved. This significant difference is demonstrated by the large gap between the destination groups. The crawling results are as follows: the destinations with the fewest tweets (<5,000) are Bukit Bintang and Nglanggeran; the group with medium results (19,000–24,000) includes Drini Beach, Indrayanti Beach, and Sepanjang Beach; and the destination with the highest number of tweets (>40,000) is Heha Sky View. Based on the crawling results, neutral sentiment was the most dominant, followed by positive sentiment, with negative sentiment being the last.

However, the proportion of negative sentiment across each destination is not different. Positive sentiment averaged 35.04%, neutral sentiment 63.36%, and negative sentiment only 1.59%. This finding is less encouraging because it differs from previous studies reporting that positive sentiment toward tourism in Indonesia reached 68%, while negative sentiment accounted for 10% [35]. The high proportion of neutral sentiment may indicate that tourists' experience related to cultural items or transportation only meets basic expectations [36]. In such cases, there is potential for these experiences to easily change into either negative or positive sentiments, which warrants attention [37]. The results of this sentiment analysis suggest that tourists perceive the destination as adequate but not extraordinary [38].

4.3. Integrated analysis (popular destination, origin of tourists, and geospatial location)

Field data and crawling result data are then used to analyze and determine which tourism destinations are more likely to attract more visitors. The integration of these datasets reveals an intersection between field survey data and crawling results. Data from field surveys reflect direct experience and satisfaction [39], while crawling data represents indirect data and the experiences of other tourists [40]. Correspondingly, the intersection of tourist destinations from field data and crawling results data indicates highly popular tourism destinations that are regularly mentioned on X [41]. Drini Beach, Baron Beach, Indrayanti Beach, and Heha Sky View were the most popular destinations based on field survey data, while Heha Sky View, Drini Beach, Indrayanti Beach, and Sepanjang Beach were identified as the most popular destinations in the crawling data results. Based on these data, three types of intersection are formed. One intersection consists of three tourism destinations: Heha Sky View, Drini Beach, and Indrayanti Beach, as shown in Figure 4(b).

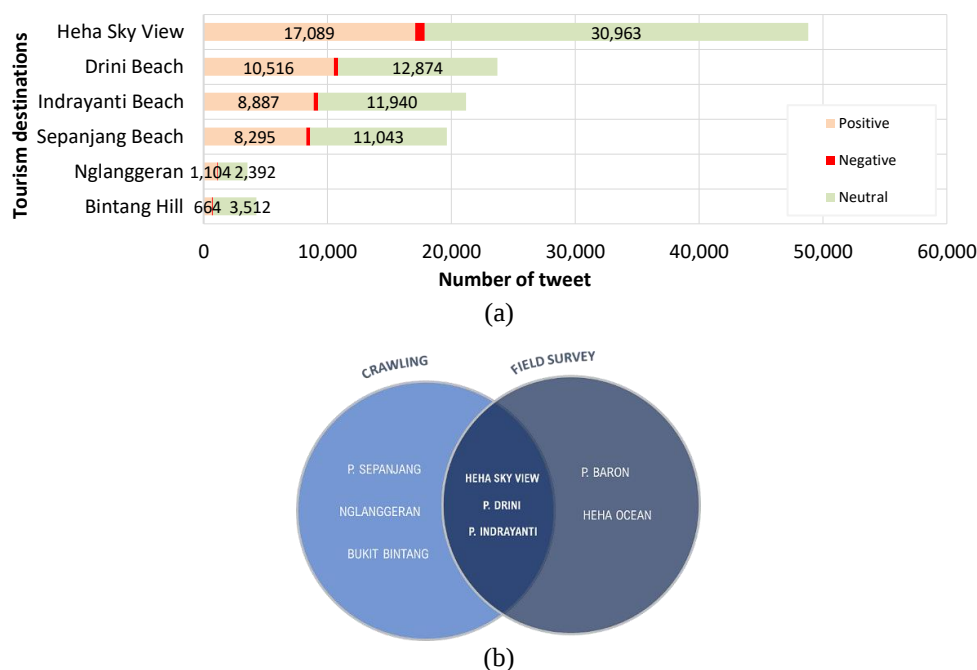


Figure 4. Data crawling and field survey result of (a) number of tweets based on sentiment type and (b) popularity destination

Figure 5 shows the origins of tourists visiting Gunungkidul were identified by integrating field survey data with social media big data from X and converting them into spatial maps. The analysis examined whether destination popularity on social media influences visitor numbers and geographical distribution patterns. Five destinations were included in the mapping process: Drini Beach (Figure 5(a)), Heha Sky View (Figure 5(b)), Indrayanti Beach (Figure 5(c)), Bukit Bintang (Figure 5(d)), and Nglanggeran (Figure 5(e)). The results show that Indrayanti Beach, Drini Beach, and Heha Sky View achieved the highest popularity on X and attracted visitors from broader origins. These findings support previous studies indicating that social media engagement contributes significantly to destination popularity and image formation [42]. Social media also strengthens emotional attachment and influences travel preferences and destination selection behavior [43], [44].

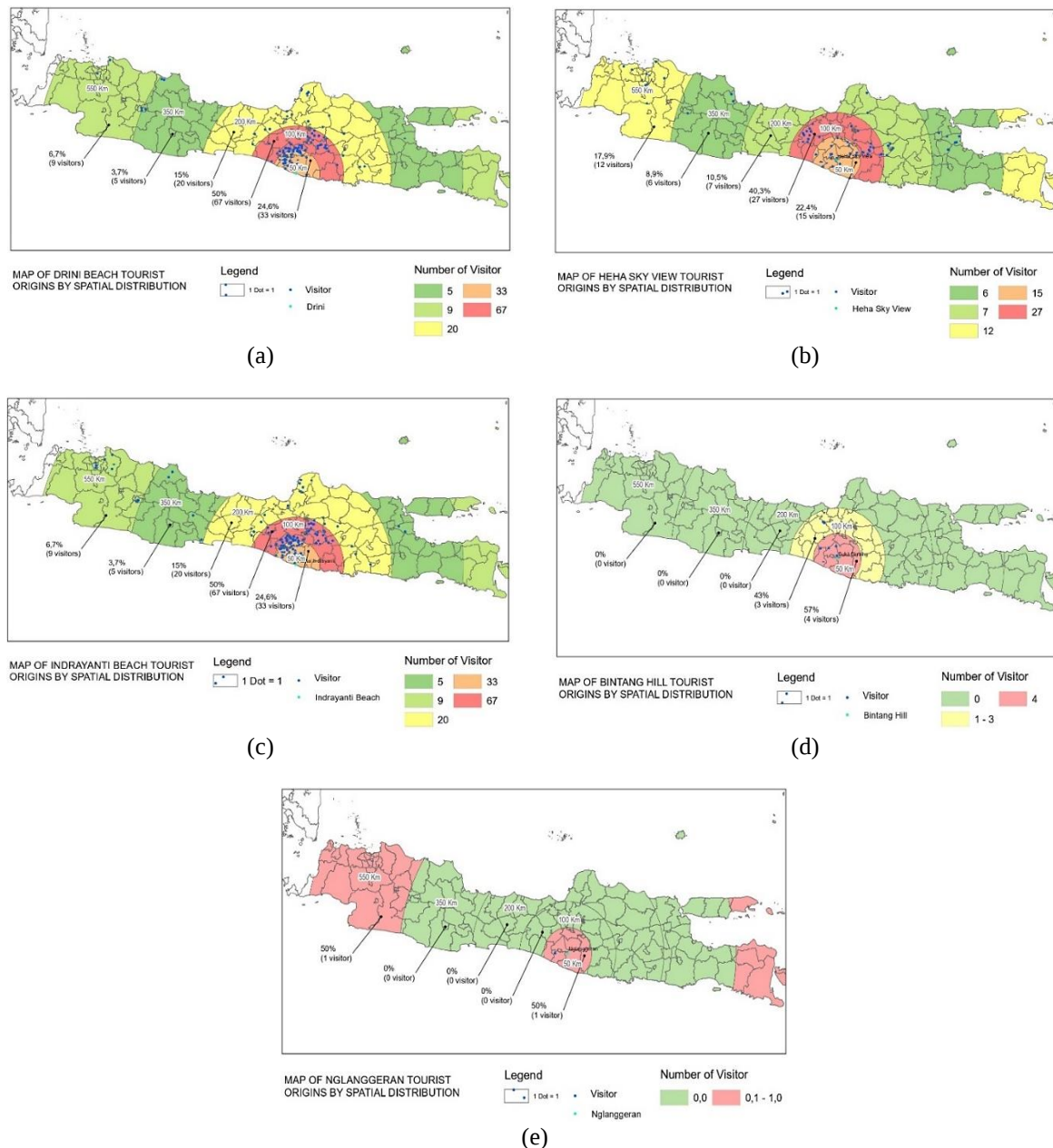


Figure 5. Tourist origin spatial distribution of (a) Drini Beach, (b) HEHA Sky View, (c) Indrayanti Beach, (d) Bukit Bintang, and (e) Nglanggeran

The topographical map in Figure 6 illustrates the distribution of popular tourism destinations in Gunungkidul identified through field surveys. Elevation differences among locations are represented using

color gradients, where dark green indicates lower elevations and dark red represents higher elevations. Tourist concentration is visualized using circle symbols, with smaller circles indicating lower visitor numbers and larger circles representing more popular destinations. The map shows that highly visited attractions are generally concentrated in either highland areas, such as mountains and hills, or lowland coastal zones. This finding aligns with previous studies suggesting that natural environments characterized by vegetation, landscapes, and water features provide greater restorative and healing benefits than urban settings, thereby increasing tourist preference and destination attractiveness [45].

The popularity of open spaces in both preference and recreation categories is evident, as three of the four highest-rated scenes are open landscape views. This finding is supported by various studies, which have found that people tend to prefer landscapes such as beaches as their most preferred views [46]. Moreover, people prefer open spaces because they offer greater recreational value [47]. The assumption is based on Appleton's (1975) "Habitat theory," which posits that humans have unconscious reflexes that drive them to look for survival-enhancing environmental features. The survey findings align with the hypothesis, as the image that received the best ratings was a view of the ocean and the shoreline, while the scene with third-highest ratings featured a tiny artificial pond in the background [48].

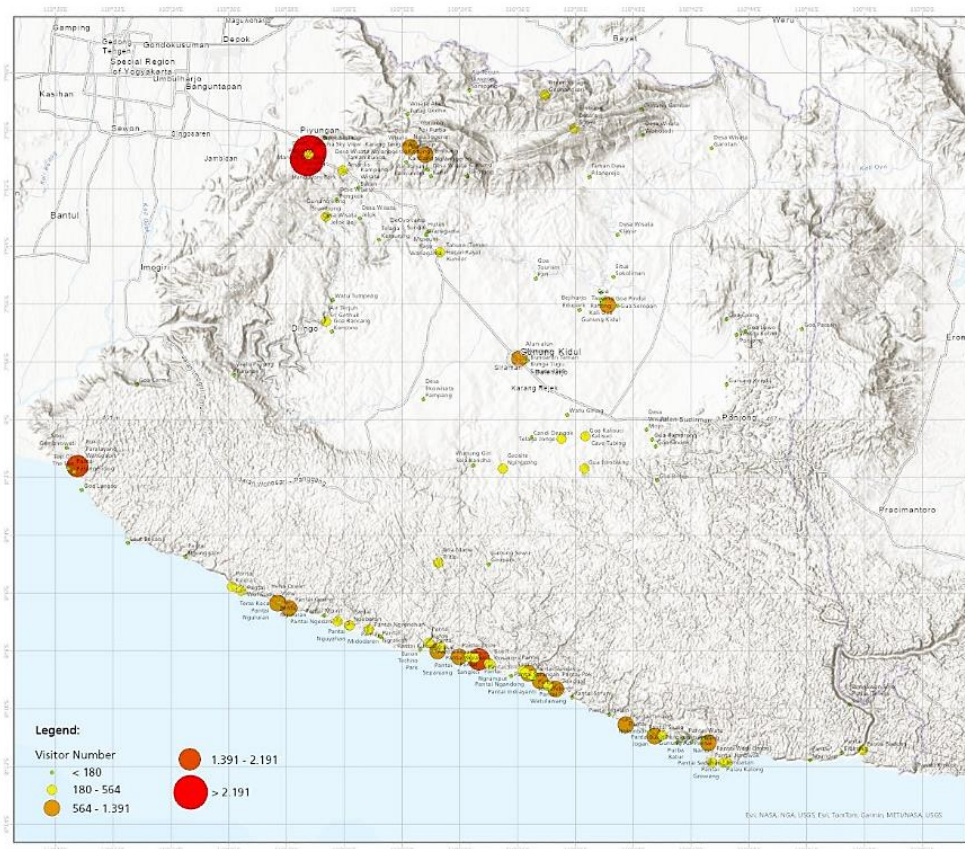


Figure 6. Popular tourist location based on a topographical map

5. CONCLUSION

This study demonstrates that social media popularity significantly influences tourist destination preferences in Gunungkidul Regency through the integration of social media big data and GIS-based spatial analysis. The findings reveal that destinations with higher popularity on X, particularly those located in highland and coastal environments, attract tourists from broader and more diverse geographical origins. The combined use of sentiment analysis and geospatial mapping provides practical insights for tourism planning, destination promotion, and spatial management strategies. Nevertheless, the study is limited by the use of only one social media platform and potential sampling bias from field surveys. Future studies should incorporate additional social media sources and comparative analyses across platforms to strengthen the understanding of social media effects on tourism development.

FUNDING INFORMATION

This research was funded by the Diktisaintek Scientific Research Grant (Hibah Riset Keilmuan Diktisaintek) Program under Grant No. 3840/E4/AK.04/2021, ratified through Decree No. KEP-2/LPDP/LPDP.4/2021.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : Conceptualization

M : Methodology

So : Software

Va : Validation

Fo : Formal analysis

I : Investigation

R : Resources

D : Data Curation

O : Writing - Original Draft

E : Writing - Review & Editing

Vi : Visualization

Su : Supervision

P : Project administration

Fu : Funding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest regarding the publication of this study.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [NCK], upon reasonable request. The datasets include survey responses and processed social media data used for the analyses presented in this article. Certain restrictions may apply to protect participant confidentiality and to comply with the terms governing the use of data obtained from third-party platforms.

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