

Big Data and GIS Integration for Tourism Potential Mapping: Case Study of Sinjai Regency, Indonesia

Amiruddin^{1*}, Jusniaty², Muhammad Arsyil Datau³, Jusriani⁴, Nurul Kasmi⁵

^{1,3}Urban and Regional Planning Study Program, Universitas Muhammadiyah Sinjai, 92612, Indonesia

²Government Science Study Program, Universitas Muhammadiyah Sinjai, 92612, Indonesia

^{4,5}Student of Urban and Regional Planning Study Program, Universitas Muhammadiyah Sinjai, 92612, Indonesia

Corresponding Author Email: al.amir.islam@gmail.com

Abstrak

This study aims to integrate Big Data analysis through Google Trends with spatial mapping using Geographic Information Systems (GIS) to identify and map tourism potential in Sinjai Regency, Indonesia. Google Trends data is used to search for tourist destinations that are dominant in public searches, while tourist visit data from official local government reports is analyzed to strengthen the validity of the findings. The results of the analysis show that marine destinations such as Marannu Beach, Mallenreng Beach, and Tongke-Tongke Mangrove Forest have high search and visit rates, indicating great potential for the development of marine-based tourism. Meanwhile, natural attractions such as Fafaliang Water Park, Bulu Lanceng, and Kampoeng Galung also showed significant contributions in attracting tourists. The integration of Google Trends data with actual visit data through GIS produces a distribution map that illustrates the spatial dominance of each travel category, while revealing the relationship between accessibility and visit intensity. These findings contribute to the strategic planning of sustainable tourism in the region by taking into account digitally recorded public preferences as well as empirical data from the field. This study emphasizes the importance of the use of Big Data and geospatial technology to strengthen tourism destination development policies at the local level.

Keywords: Big_Data; Geographic_Information_Systems; Google_Trends; Tourism_Potential

1. Introduction

Tourism plays an important role in Indonesia's regional development, contributing significantly to economic growth, employment, and cultural exchange. Indonesia's diverse geography—from pristine beaches to rich cultural heritage sites—makes it a leading global tourist destination. This diversity requires a comprehensive spatial analysis to optimize tourism infrastructure and sustainable development. Along with accelerating urbanization and increasing tourism demand, integrating spatial technology and big data is essential to capture nuanced dynamics in tourism patterns and resource utilization. These technological advancements provide invaluable insights into tourist behavior, land-use change, and environmental impacts, informing policy and planning frameworks to balance growth with sustainability. Various studies have highlighted the increasing utilization of public administration databases and remote sensing applications in Indonesia, providing important data that aids in the spatial analysis of tourism and effective urban growth [1]. In addition, coastal regions and archipelagic countries such as Indonesia face unique challenges given the significant anthropogenic pressures that impact coastal landscapes and ecosystems, where remote sensing techniques play an important role in monitoring environmental changes over time [2]. The use of statistical systems for tourism information further supports the integration

of spatial data with tourism management, enabling the spatial visualization and analysis that is essential for managing Indonesia's dynamic tourism landscape [3]

The integration of big data with Geographic Information Systems (GIS) has revolutionized the mapping of tourism potential, enabling real-time analysis of tourism trends, spatial distribution, and resource accessibility. Big data sources—including social media geotags, mobile location data, and Internet of Things (IoT) sensor networks—provide high-resolution spatiotemporal insights that are essential for identifying emerging tourism hotspots and visitor movement patterns. Combining these data streams with GIS technology facilitates the visualization, management, and analysis of spatial data sets at various scales. Such integration is essential for effective spatial evaluation of tourism resources, enabling planners to make data-driven decisions that support sustainable tourism development. Location service data, especially when processed through advanced big data frameworks, contributes substantially to understanding traveller behavior and improving visitor experience through intelligent service platforms [4]. In Europe, the integration of conventional statistical data with emerging large sources has facilitated the creation of new and detailed datasets displaying tourist density, thereby improving the ability to analyze spatial and temporal patterns [5]. In addition, innovative tools that leverage mobile positioning and web scraping, along with collaborative economic data, have improved evidence-based policy planning and evaluation in the tourism sector, underscoring the importance of big data and GIS integration [6].

This study aims to integrate Big Data analysis through Google Trends with spatial mapping using Geographic Information Systems (GIS) to identify and map tourism potential in Sinjai Regency, Indonesia. The scope includes data collection through Google Trends Data to search for tourist destinations that are dominant in public searches, while tourist visit data from official local government reports is analyzed to strengthen the validity of the findings. This integrative approach aspires to produce a detailed and dynamic map of tourism potential that takes into account Sinjai's specific natural, cultural, and socioeconomic variables.

2. Methodology

This study uses a descriptive-analytical approach that combines digital data from Google Trends with actual tourist visit data sourced from the official report of the Sinjai Regency Tourism Office. Google Trends data is used to track the intensity of public searches for local tourist destinations, while visit data is used as an empirical benchmark to validate digital findings. The two data sources are processed through the process of extraction, normalization, and grouping based on tourism categories (natural, cultural). This stage ensures that there is an integration between public interest recorded online and the reality of field visits.

Spatial analysis was carried out using a Geographic Information System (GIS) using ArcGIS software. Tourist attractions are mapped based on geographical coordinates, then overlay analysis is carried out. The results of this integration are validated through data triangulation between digital search trends and factual visits, which are then presented in the form of thematic maps. With this flow, the research not only describes the distribution pattern

of tourist destinations in Sinjai Regency, but also presents empirical evidence regarding the relationship between digital popularity and spatial reality in the field.

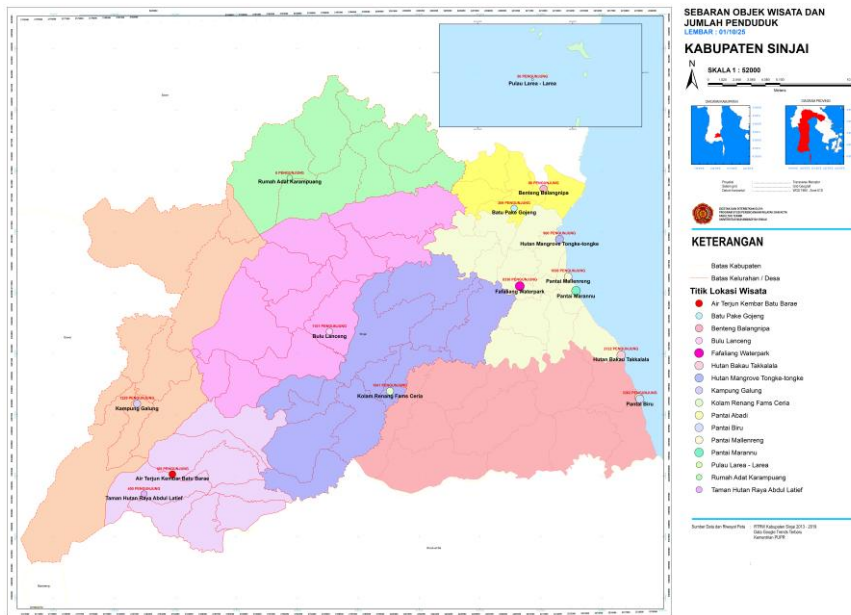


Figure 1. Map of the distribution of tourist attractions in Sinjai Regency
 Source: Results of research

3. Result and Discussion

3.1. Result

Analysis of *Google Trends* data in 2025 shows that public interest in tourist destinations in Sinjai Regency is divided into three main categories, namely marine tourism, natural tourism, and cultural tourism. Among the three, marine tourism is still the category with the most search spread. However, the cultural destination of Batu Pake Gojeng actually recorded the highest search volume overall, with an index close to 350. These findings confirm that the historical cultural site has a strong symbolic value and appeal in the digital space, even surpassing marine destinations that have tended to dominate online tourism interests.

In the marine tourism category, the three destinations with the highest search volume are Mallereng Beach, Larea-rea Island, and Bulokkong Beach, each of which has a search index in the range of 200–300. Meanwhile, Tongke-Tongke Mangrove and Marannu Beach showed medium search rates, while Abadi Beach and Blue Beach occupied positions with relatively low search volumes. However, these results need to be interpreted with caution because the level of digital popularity does not necessarily reflect the intensity of actual visits in the field.

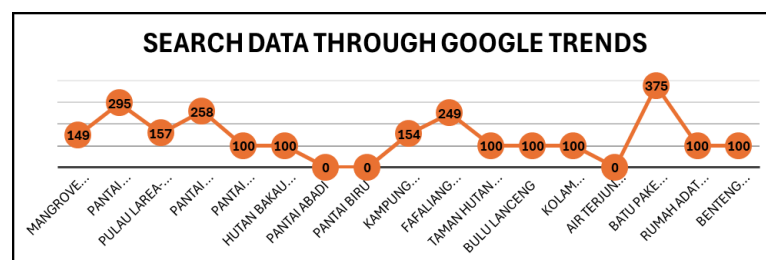


Figure 2. Search results data through google trends
 Source: Results of researcher data processing

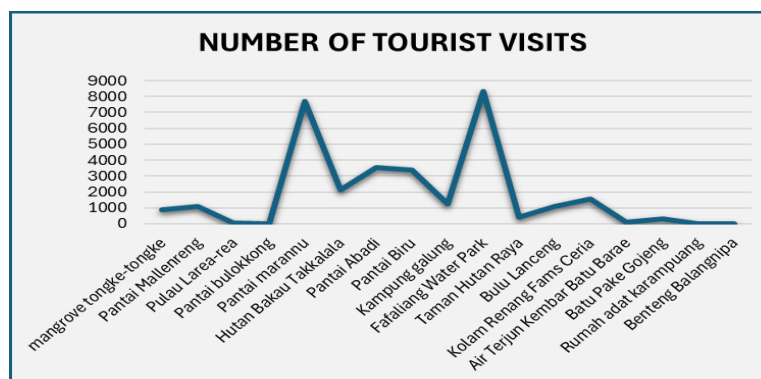


Figure 3. Data on tourist visits in Sinjai district in August 2025
 Source: Sinjai Regency Tourism Office

Tourist visit data obtained from the Sinjai Regency Tourism Office (August 2025) actually shows a different trend. The destinations with the highest number of visitors do not come from the most digitally popular group, but from locations with more adequate accessibility and facilities. Marannu Beach received 7,717 visits, Fafaliang Water Park 8,336 visits, while the two destinations with low online searches—Abadi Beach and Blue Beach—recorded 3,553 and 3,363 visitors, respectively. This phenomenon indicates a mismatch between digital exposure and the reality of tourist visits. Factors such as ease of access, geographical proximity, comfort of facilities, and environmental safety and cleanliness seem to have more influence on the actual rate of visits than the popularity in digital media.

The natural tourism category shows a more moderate pattern of interest. Fafaliang Water Park and Kampung Galung occupy positions with search indexes ranging from 150–200, reflecting the community's steady interest in family recreation-based tourism and environmental education. Meanwhile, destinations such as Bulu Lanceng, Taman Hutan Raya, and Twin Waterfalls show lower search intensity, but still have an important role in enriching the diversification of tourism products in Sinjai Regency.

In the cultural tourism category, in addition to Batu Pake Gojeng which stands out as the destination with the highest search volume in all categories, Karampung Traditional House and Balangnipa Fort show a relatively small but stable level of interest. These findings show that historical and cultural values still have their own place amid the dominance of nature and marine-based tourism.

Spatial analysis using Geographic Information System (GIS) strengthens these results. The concentration of destinations with high levels of visits and digital exposure is generally located in the east and south coastal areas of Sinjai Regency, especially in Tellulimpo and East Sinjai Districts. The area benefits from the availability of a main road network, adequate accommodation facilities, and relatively close proximity to destinations. On the other hand, the West Sinjai and Central Sinjai regions show great natural tourism potential, but have not been optimally exposed, both through digital media and in terms of actual visits.

Overall, the results of this study confirm that the relationship between digital exposure and the level of tourist visits is not always linear. Effective management of tourist destinations requires a balance between digital-based promotion strategies with improving the quality of infrastructure, comfort, and local community involvement as determining factors for regional tourism competitiveness.

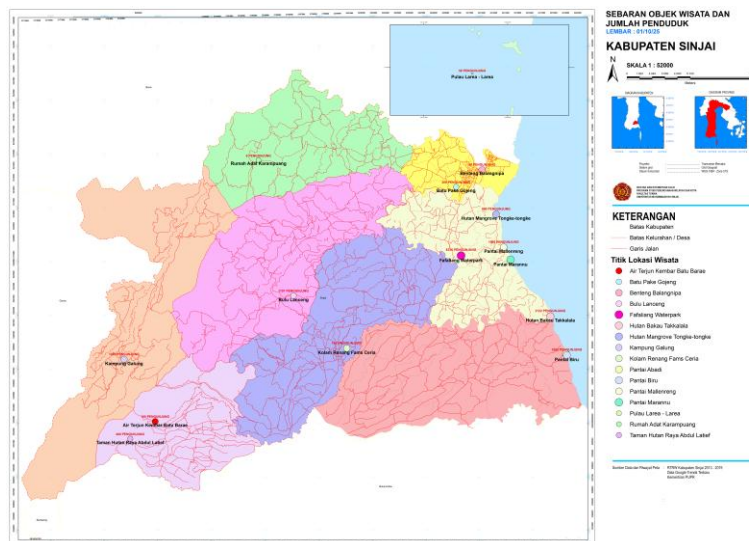


Figure 4. Map of the distribution of tourist attractions in Sinjai Regency with connecting roads
 Source: Results of research

3.2. Discussion

The findings of this study show that the use of Big Data through Google Trends provides significant empirical insights into the patterns of tourist interest in Sinjai Regency. The results of the analysis showed that Batu Pake Gojeng occupies the highest position in online search volume, indicating an increase in public interest in destinations that have historical value and local cultural identity. This trend is in line with the view that contemporary tourism is increasingly shifting towards the search for *meaningful tourism experience* and connection to cultural heritage, rather than just visual recreation [7].

However, when compared to actual visit data, the patterns that emerge are not always linear. Although Eternal Beach and Blue Beach show low search rates on Google Trends, both destinations actually record high visits. This illustrates the asymmetry between digital exposure and actual visit behavior, which can be explained through contextual factors such as accessibility, distance, availability of facilities, and social influence. Where the behavior of local tourists in the context of domestic destinations is often more influenced by physical convenience and community recommendations than by digital information [8]; [9].

The disconnect between online popularity and actual visits also points to the need for a more adaptive approach in the analysis of digital traveler behavior. Based on the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), a person's decision to utilize technology is greatly influenced by the perception of convenience, usefulness, and environmental support [10]. In the context of this study, it can be assumed that most tourists in Sinjai Regency do not fully rely on digital media to find

tourist information, but still use informal channels such as recommendations from friends, social networks, and previous experiences. These findings are in line with the results of research that highlight that the adoption of tourism technology in developing regions is often influenced by the level of digital literacy of the community and supporting infrastructure [11].

From the spatial side, the results of mapping using the Geographic Information System (GIS) show that destinations with high visitor rates and large digital exposure are concentrated on the east and south coasts of Sinjai Regency, especially in Tellulimpoe and East Sinjai Districts. This location has advantages in the form of better transportation infrastructure, proximity between tourist attractions, and the support of accommodation facilities. This pattern is in line with the principle that the intensity of inter-regional interaction is influenced by distance, attractiveness, and ease of access [12]. In other words, destinations that are easily accessible and have high connectivity tend to be visited more often, even if their digital visibility is not always high.

On the other hand, the central and western regions such as West Sinjai and Central Sinjai still show great natural tourism potential, but have not been optimally exposed in both the digital and empirical realms. Lack of infrastructure, limited online promotion, and low levels of digital literacy are the main obstacles. This reinforces the findings that emphasize the importance of integration between spatial data and digital data to formulate inclusive and evidence-based tourism planning policies [13].

The integrative approach between Big Data and GIS used in this study proves its effectiveness as an analysis and planning tool. Google Trends data can identify trends of public interest in *real-time*, while GIS helps map the spatial patterns of tourist activity. The combination of the two results in a deeper understanding of the dynamics of digital traveler behavior and the spatial distribution of tourist destinations. This kind of data-driven approach is the foundation of *smart tourism destinations*, where tourism management policies and strategies are based on actual data analysis, rather than mere intuition or short-term trends [14];[15].

In addition, the results of this study highlight the importance of strengthening the digital capacity of local tourism actors. Optimizing platforms such as Google Maps, social media, and online tourism portals can increase the visibility of destinations with low exposure but high visitor potential. The local government together with the Sinjai Regency Tourism Office need to develop digital literacy training programs and technology-based promotions in order to strengthen the position of destinations in the smart tourism ecosystem.

In the context of planning, these results indicate that the tourism development strategy of Sinjai Regency needs to combine two approaches in a balanced manner: (1) Digital approach, through the optimization of internet-based promotions to increase the visibility of leading destinations such as the Tongke-Tongke Mangrove Forest and Larea-rea Island; and (2) Community approach, by strengthening the capacity of local communities in destinations such as Pantai Abadi and Pantai Biru in terms of management, offline promotion, and tourism service innovation.

Conceptually, this study contributes to the digital tourism literature by showing that the relationship between online popularity and tourist behavior is not deterministic, but rather

influenced by local contexts, geographical conditions, and management policies. The proposed data-driven tourism planning approach can help local governments in formulating policies that are more responsive, efficient, and sustainable, while strengthening the competitiveness of regional tourism destinations in the era of digital transformation.

4. Acknowledgement

The author expresses his greatest appreciation to the Sinjai Regency Tourism and Culture Office for providing access to official data on tourist visits which is an important basis for this study. Gratitude was also expressed to colleagues and students who helped in the process of collecting field data and preparing spatial maps using GIS devices.

The author is also grateful for the valuable input from the manuscript readers and those who provided suggestions in improving this research. Technical support in Google Trends data processing and spatial analysis with GIS is very helpful in completing this research.

5. Reference

- [1] K. H. Muriadi Arip Wanglin Yan, "Using neighborhood association area as new spatial data infrastructure to link public administrative data with GIS in indonesia," *Komunitas Ilmuwan dan Profesional Muslim Indonesia*, 2019.
- [2] X. Y. Lichun Sui Jun Wang, "Spatial-temporal characteristics of coastline changes in indonesia from 1990 to 2018," *Multidisciplinary Digital Publishing Institute*, 2020.
- [3] J. H. Lulu Qin Chen Shi-jun, "Statistical system of cultural heritage tourism information based on image feature extraction technology," *Hindawi Publishing Corporation*, 2022.
- [4] L. H. B. S. Li M. Liao, "Research On Big Data Analysis Of Location Service And Intelligent Service Platform Of Urban Scenic Spots: A Case Study Of Guilin City, Guangxi, China," *None*, 2020.
- [5] K. R. Filipe Batista e Silva Mario Alberto Marn Herrera, "Analysing spatiotemporal patterns of tourism in europe at high-resolution with conventional and big data sources," *Elsevier BV*, 2018.
- [6] M. T. Tarmo Kalvet Maarja Olesk, "Innovative tools for tourism and cultural tourism impact assessment," *Multidisciplinary Digital Publishing Institute*, 2020.
- [7] Y. Hermawan, E. Tohani, L. Wibawa, R. Septiantoko, & R. Utami, "Educational tourism management based on experiential learning in pulutan tourism village", *KOLOKIUM Jurnal Pendidikan Luar Sekolah*, vol. 11, no. 3, p. 1060-1070, 2023. <https://doi.org/10.24036/kolokium.v11i3.800>
- [8] K. Kurniasari, A. Hidayah, & K. Ilmawan, "Analisis perubahan perilaku wisatawan post era pandemi covid-19 sebagai strategi pariwisata berkelanjutan: studi literatur", *Journal of Research on Business and Tourism*, vol. 3, no. 2, p. 108, 2023. <https://doi.org/10.37535/104003220234>

- [9] J. Yulianty, "Model 'planned behavior' wisatawan milenial dalam mengunjungi destinasi di indonesia", *Journey : Journal of Tourismpreneurship, Culinary, Hospitality, Convention and Event Management*, vol. 5, no. 1, p. 77-86, 2022. <https://doi.org/10.46837/journey.v5i1.101>
- [10] M. Khan, M. Siddique, M. Yasir, M. Qureshi, N. Khan, & M. Safdar, "The significance of digital marketing in shaping ecotourism behaviour through destination image", *Sustainability*, vol. 14, no. 12, p. 7395, 2022. <https://doi.org/10.3390/su14127395>
- [11] Y. Pratama, A. Sinaga, R. Sianturi, & V. Situmorang, "Literasi media digital pada komunitas pariwisata di kawasan danau toba", *Jurnal Master Pariwisata (JUMPA)*, p. 245, 2021. <https://doi.org/10.24843/jumpa.2021.v08.i01.p13>
- [12] S. Wahyudi and E. Gunanto, "Struktur jaringan spasial ekonomi pariwisata di aglomerasi perkotaan : pendekatan social network analysis", *Jurnal Manajemen Perhotelan Dan Pariwisata*, vol. 5, no. 1, p. 11-23, 2022. <https://doi.org/10.23887/jmpp.v5i1.46953>
- [13] S. Wahyudi and E. Gunanto, "Struktur jaringan spasial ekonomi pariwisata di aglomerasi perkotaan : pendekatan social network analysis", *Jurnal Manajemen Perhotelan Dan Pariwisata*, vol. 5, no. 1, p. 11-23, 2022. <https://doi.org/10.23887/jmpp.v5i1.46953>
- [14] Buhalis, D., & Amaranggana, A. (2015). Smart Tourism Destinations: Ecosystems for Tourism Destination Management. *Tourism Management*, 54, 210-220.
- [15] Gunea, V., O'Leary, S., & Pappas, N. (2021). The Role of Big Data in Developing Smart Tourism Destinations: Case Studies and Best Practices. *Tourism and Hospitality Research*, 21(4), 456-469.