Special issue on "Smart tourism 2.0: perspectives with geospatial data and AI"

Guest editors

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Introduction

Smart tourism is a technology-intensive domain in which destinations, experiences, and business ecosystems are shaped by interconnected ICT infrastructures and data-driven services (Gretzel et al., 2015). As travelers increasingly rely on digital platforms and mobile devices before, during, and after their trips, tourism activities are now mediated by applications and systems that collect, integrate, and process massive amounts of data. These data flows enable personalized, real-time, and contextually relevant services that enhance tourist experiences while simultaneously optimizing operations for firms and destination managers.

Because tourism is intrinsically spatial, rooted in the movement of visitors across locations and in interactions in both physical and digital environments, geospatial technologies such as GPS-enabled smartphones, sensor networks, and spatial analytics are essential to smart tourism development and management. These tools support a deeper understanding of mobility patterns, spatial accessibility, and destination dynamics, informing more sustainable planning, design, and policy interventions (Yang et al., 2023).

Recent technological advancements have further expanded the possibilities for smart tourism. Rapid developments in artificial intelligence (AI), machine learning, big data analytics, and geospatial data science allow more precise modeling of tourist behaviors and detection of emerging spatial patterns. The COVID-19 pandemic accelerated digital transformation across the tourism sector, emphasizing the need for resilient, adaptive, and data-informed management of tourist flows and destination capacity. More recently, the rise of large language models (LLMs), multimodal AI, and geospatial AI (GeoAI) has created new opportunities for analyzing complex human-environment interactions, supporting real-time decision-making, and uncovering psychological and behavioral drivers behind spatial mobility. Collectively, these developments signal the transition toward "Smart Tourism 2.0," an era in which tourism ecosystems operate as intelligent, adaptive, and interconnected socio-technical systems powered by integrated spatio-temporal data streams and advanced computational methods (Koo et al., 2025).

With the rapid rise of AI, particularly the integration of human-like conversational agents for itinerary recommendations within websites and applicatons, Koo et al. (2025) proposed an updated framework that reconceptualizes smart tourism through an AI-driven lens. Termed "AI-powered smart tourism 2.0," this model expands the scope of smart tourism by incorporating LLMs capable of generating text and images, web-portal search engine

integrations, AI-enhanced virtual reality/augmented reality and metaverse applications, and robotics equipped with embodied or physical AI. Collectively, AI opens new avenues for next-generation synergies across the tourism ecosystems, linking travel consumers and suppliers with advanced computing and spatio-temporal design innovations to transform virtual and physical tourism experiences.

Emerging research in geography, psychology, and computational social science highlights that tourists' spatial behaviors are not only patterns in time and space but also expressions of underlying perceptions, emotions, and decision processes. Integrating psychological perspectives with spatio-temporal analytics provides a richer understanding of why tourists behave as they do, rather than simply documenting their movements. Advances in GeoAI, natural language processing, and behavioral modeling now allow researchers to link tourists' sentiments, traits, and psychological states with high-resolution mobility data. These interdisciplinary approaches offer new insights into how experiences unfold across space, how visitors respond to contextual cues, and how destinations can design intelligent, empathetic, and sustainable services.

In this context, the *Electronic Markets* special issue, *"Smart tourism 2.0: perspectives with geospatial data and AI"* brings together cutting-edge research that bridges spatial analytics with psychological and behavioral interpretations of tourism data. The contributions in this issue advance our understanding of how geospatial big data, machine learning, and emerging AI systems can be leveraged to improve destination management, personalize tourism experiences, and create more adaptive and resilient tourism destination ecosystems. By highlighting novel theoretical perspectives, methodological innovations, and empirical applications, this special issue charts a forward-looking agenda for the next generation of smart tourism research, integrating spatio-temporal insights, psychological mechanisms, and computational intelligence to address both the "where + when" and the "why + so what" of tourist behavior.

The special issue

This special issue explores geospatial smart tourism by providing new theoretical insights and methodological contributions on how and why ICT-mediated environments influence or transform spatio-temporal patterns. Because spatial configurations shape tourist perceptions, decisions, and behaviors (Ebert et al., 2022), researchers are encouraged to integrate location-aware data with qualitative and experimental approaches to better understand tourism suppliers and consumers (Koo et al., 2021; Tilly et al., 2015).

Furthermore, examining the psychological mechanisms underlying spatially heterogeneous visitor behaviors (Jang & Kim, 2022) and employing experimental designs (Jang et al., 2021) can yield deeper insights when combined with geospatial analytics. Alongside established tools such as Geographic Information Systems (GIS) and spatial econometrics (Koo et al., 2023), this issue highlights the expanding role of spatially explicit AI techniques used for geographic knowledge discovery and intelligent decision support (Janowicz et al., 2020).

GeoAI applications accelerate real-world understanding of smart tourism by integrating spatio-temporal data with machine learning and deep learning methods to extract

meaningful geographic and behavioral insights (Gao, 2021; VoPham et al., 2018). Consequently, both theory and practice require new perspectives on the spatio-temporal ("where and when"), geo-psychological ("where and why"), and GeoAI ("where and so what") dimensions of smart tourism. Together, these perspectives enhance interdisciplinary dialogue among information systems, geography, and tourism studies, deepening our understanding of how data-driven technologies shape tourism across space and time.

Accepted papers

The accepted papers in this special issue collectively populate and advance all three layers of the smart tourism framework powered by geospatial data and AI (Figure 1). The bottom layer represents the spatio-temporal and GeoAI infrastructure (i.e., the data and methods layer). Five papers—Koo et al. (2025), Kim et al. (2025), Ebrahimi & Schneider (2025), Bollenbach et al. (2025), and Jung and Nam (2025)—anchor the technical and spatial foudnation of smart tourism by addressing the questions of "where & when" and "where & so what." The middle layer represents geo-psychological and decision mechanisms (i.e., the behavioral layer). Two papers—Hlee et al. (2025) and Chvirova et al. (2025)—explain how tourists cognitively and emotionally respond to spatial technologies, addressing the question of "where & why". The upper layer represents smart tourism outcomes (i.e., the system-level impacts layer), capturing the managerial, policy, and societal implications. All accepted papers generate meaningful smart tourism outcomes. Collectively, this framework positions data-driven spatial intelligence as the foundation for understanding tourist perceptions and decision making, which jointly shape smart tourism outcomes such as sustainable visitor management, experience optimization, and destination resilience.

Service & Policy Outcomes
Sustainable visitor management | Experience design
Destination resilience | Decision support

Geo-Psychological & Decision Mechanisms
Perception | Satisfaction | Crowding | Trust
Risk | Fairness | Travel party | Destination type

Spatio-Temporal & GeoAI Infrastructure
GIS | Reviews | GPS | Images | Routes | Mobility
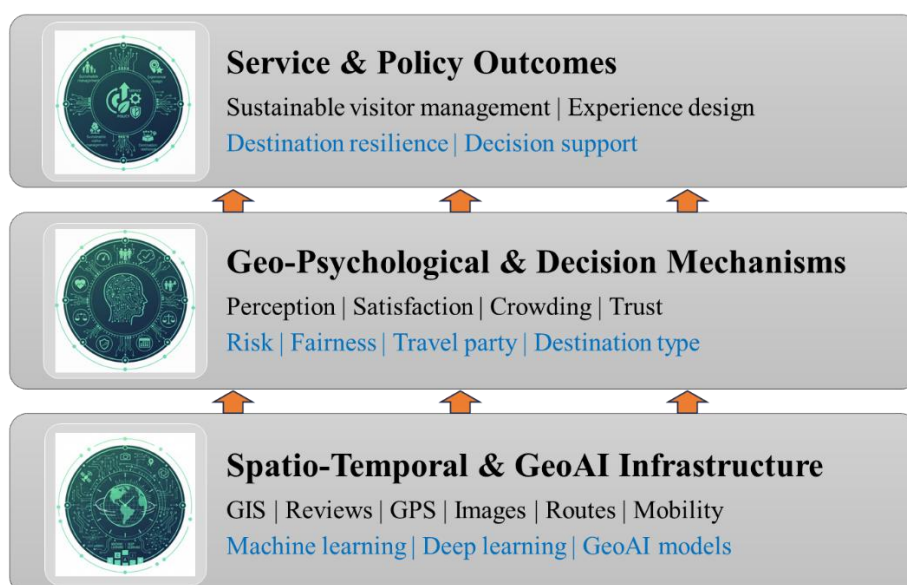Machine learning | Deep learning | GeoAI models

Figure 1. Conceptual framework of smart tourism powered by geospatial data and AI

The first paper in this special issue is a position paper titled "AI-powered smart tourism 2.0: A 10-year retrospective and updated model," by Chulmo Koo, Seunghun Shin,

Ulrike Gretzel, and Zheng Xiang (Koo et al., 2025). This paper revisits the foundational 2015 *Electronic Markets* article on smart tourism and proposes an updated framework that incorporates AI, digital transformation, and the Metaverse, and offers a vision for the future of smart tourism research and innovation.

The second paper, "A geospatial and big data exploration of tourism destinations: A case study of Busan, Republic of Korea," by Seieun Kim, Aura Lydia Riswanto, Angellie Williady, Reza Asriandi Ekaputra, and Hak-Seon Kim (Kim et al., 2025), integrates GIS with big data analytics derived from online reviews to examine the spatial dimensions of visitor satisfaction in an urban destination. The study shows that proximity and accessibility have crucial roles in shaping satisfaction, with well-connected transportation networks significantly enhancing the overall tourism experience. These findings provide actionable insights into how the integration of urban infrastructure, visitor perceptions, and attraction distribution can improve tourism planning and destination management.

The third paper, "Fine-tuning image-to-text models on Liechtenstein tourist attractions," by Pejman Ebrahimi and Johannes Schneider (Ebrahimi & Schneider, 2025), evaluates the effectiveness of fine-tuning pre-trained image-to-text models for domain-specific applications. The study demonstrates that tailored models generate highly accurate captions providing architectural, historical, and geographical information on tourist attractions. The results provide practical guidance for cultural heritage and educational use cases.

The fourth paper, "The road not taken: Representing expert knowledge for route similarities in sustainable tourism using machine learning," by Jessica Bollenbach, Dominik Rebholz, and Robert Keller (Bollenbach et al., 2025), presents a method for calculating route similarities using distance-based algorithms and machine learning models trained on expert assessments. Using real hiking data, the study shows that random forest regression outperforms traditional similarity measures, establishing a data-driven foundation for sustainable visitor management through alternative route identification.

The fifth paper, "AI-powered travel recommendations and decision making: The role of spatio-temporal efficiency, destination type, and travel party composition," by Sunyoung Hlee, Zhijun Yan, and Ping Li (Hlee et al., 2025), examines how AI-driven recommendation systems influence travel decision-making. Using a scenario-based experiment with 320 South Korean travelers, the authors report that spatio-temporal AI recommendations are perceived as significantly more helpful than non-spatio-temporal ones. The effects vary by destination type and travel party, offering insights for designing effective AI-powered decision-support systems.

The sixth paper, "The impact of information-seeking behavior and site-related factors on perceived crowding," by Diana Chvirova, Franka Menke, Christiaan Niemeijer, Arne Buchwald, and Robert Keller (Chvirova et al., 2025), investigates how information behaviors interact with site characteristics to shape tourists' perceived crowding. Analyzing survey data from 5,557 visitors at six German destinations, the study indicates that the effects vary depending on tourists' information strategies (e.g., source type, timing, familiarity) and contextual moderators (e.g., spatial constraints, environmental volatility, regional typology). The results identify boundary conditions for effective digital crowd management, refining the smart tourism discourse on information use and perception.

The final paper, "Seasonal shifts and pandemic effects on tourist mobility: A study of attraction-level movement patterns in Jeju Island," by Kisung Jung and Yoonjae Nam (Jung & Nam, 2025), explores seasonal dynamics and pandemic-related shifts in tourist mobility. Analyzing 22,962 TripAdvisor reviews across 104 attractions, the authors conclude that the COVID-19 pandemic significantly altered movement patterns. Indoor attractions lost centrality, while outdoor markets gained influence, illustrating behavioral adaptation during health crises.

Conclusion and directions for future research

This special issue demonstrates that the convergence of geospatial data, AI, and behavioral perspectives is redefining the landscape of smart tourism. The accepted papers collectively highlight how spatial analytics, computational models, and AI-driven systems can deepen our understanding of tourism dynamics, support sustainable visitor management, and enhance travelers' experiences. From urban spatial satisfaction analyses and domain-specific AI model training to route similarity modeling, pandemic-induced mobility shifts, and updated Smart Tourism 2.0 frameworks, the contributions illustrate both the maturity and the evolving frontiers of geospatial smart tourism research.

Building on these insights, several promising avenues for future research emerge. First, scholars should further investigate both the design of spatio-temporal tourism services and the psychological mechanisms underlying tourists' responses to them in the era of AI. As firms introduce route-based recommendations, dynamic pricing, congestion-aware itineraries, and context-sensitive experiences, it becomes increasingly important to understand how these influence performance outcomes, customer satisfaction, and long-term loyalty. At the same time, tourists' perceptions of time, space, fairness, and emotional significance shape how they interact with such services. Exploring these spatio-temporal-psychological dynamics will help researchers and practitioners develop personalized yet operationally efficient innovations, as well as AI-mediated experiences that are trustworthy, empathetic, and user-centric.

Second, the integration of spatio-temporal and psychological perspectives is essential for guiding tourism policy and crisis management. Global disruptions, including pandemics, natural disasters, and abrupt shifts in mobility, require policies that consider not only spatial patterns but also tourists' and tourism providers' psychological responses to risk, safety, and spatial density. Research that links behavioral interpretations with spatio-temporal constraints can support more resilient, adaptive destination strategies and contribute to evidence-based policymaking in times of uncertainty.

Finally, advancing methodological innovation remains essential. Future research should develop tools and frameworks capable of measuring spatio-temporal-psychological engagement by integrating primary data (intentions, emotions, perceptions) with secondary data (movement trajectories, digital traces). At the same time, the interpretability of GeoAI and AI-driven spatial models must be improved to ensure transparency and accountability in tourism decision support. Methods that integrate multimodal data—including text, images, GPS trajectories, sensor data, and user-generated content—will enable richer insights into how tourism behaviors evolve across space and time.

Together, these research directions offer a pathway toward more intelligent, adaptive, and human-centered smart tourism systems. By combining advanced analytical techniques with an understanding of tourists as psychological and spatial actors, future work can help shape smart tourism 2.0 ecosystems that are not only technologically sophisticated but also sustainable, inclusive, and resilient in the face of ongoing global change.

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