Use of artificial intelligence in smart tourism: bibliometric analysis

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Abstract. The investigation of artificial intelligence utilization in smart tourism is a pertinent and dynamically evolving direction that combines innovative technologies with practical applications in the tourism industry. The search for the most relevant publications was conducted using the search terms “artificial intelligence,” “AI,” and “smart tourism” in titles, abstracts, and keywords within the Scopus bibliographic database for the period from 2013 to July 2023. Utilizing the Scopus database tool “Analyze results,” the growth dynamics of indexed publications were identified; the industry structure of indexed publications in Scopus was determined; and the most cited publications and journals were ascertained. Employing VOSviewer software, network maps of shared words were constructed based on bibliographic data. Six main thematic directions and trends in the study of artificial intelligence utilization in smart tourism were identified.

1 Introduction

The artificial intelligence (AI) has a significant potential to transform various sectors of human activity due to its capabilities in data analysis, experiential learning, and automation of complex tasks. Its relevance spans across numerous fields [1–4] including medicine, finance, transportation, education, science, social services, and more. The utilization of AI helps enhance work processes, optimize resources, and tackle challenging tasks that might be infeasible or highly time-consuming for humans [5,6]. However, along with these advancements, ethical concerns, data confidentiality, and the impact on job roles emerge, necessitating a cautious approach to the implementation of this technology.

Artificial Intelligence (AI) plays a significant role in transforming the tourism industry, making it more efficient, personalized, and enjoyable for travelers. AI analyzes user data such as past travel history, preferences, and online behavior to provide personalized travel recommendations. This includes suggesting destinations, accommodations, restaurants, and activities tailored to individual preferences. AI helps optimize transportation and energy consumption, reducing the environmental impact of tourism by providing data-driven solutions for more sustainable practices.

The use of AI in tourism can streamline booking processes, offer personalized recommendations, optimize routes [7,8], and facilitate effective interactions between tourists and hospitality establishments [9]. Moreover, AI can contribute to improving service quality, refining marketing strategies [10], [11], enhancing customer feedback analysis, and resource management [12]. In the context of tourism, where comfort, individuality, and efficiency are crucial, the application of AI can significantly elevate the quality and satisfaction of tourism services. The productive use of this technology can lead to an enhanced tourism experience, increased industry revenues, and support sustainable development [13].

An important task in modern conditions, when technological development and changes in tourists’ perceptions require a new approach to travel, is to increase interest in the implementation of the concept of smart tourism [14]. Research and use of artificial intelligence within the concept of smart tourism is an important and relevant direction in the development of the modern tourism industry [15]. Taking into account the growing interest of the public and the scientific community in the use of artificial intelligence in smart tourism, we will continue the study of the scientific activity of researchers in this field using bibliometric analysis.

By incorporating AI into various aspects of the tourism industry, businesses can enhance the overall travel experience, increase operational efficiency, and contribute to more sustainable and responsible tourism practices.

This research aims to identify trends and priority directions in studying the use of AI in smart tourism, uncover collaborative networks among authors based on their affiliations to specific countries engaged in this research. The study is focused on accomplishing the following objectives: (1) analyzing the publication dynamics in Scopus related to the study of AI usage in smart tourism, (2) determining the industry structure of...
the indexed publications in Scopus dedicated to the application of AI in smart tourism, (3) analyzing the state of author collaboration based on their country affiliations, and (4) formulating key thematic directions and trends in researching the application of AI in smart tourism.

2 Research Methodology

Bibliometric analysis allows for the examination and visualization of key characteristics of published articles and identifying research trends in a specific field using online scientific literature databases.

To analyze scientific publications dedicated to the study of artificial intelligence usage in smart tourism, this research was conducted in several stages.

First stage. Search for relevant publications in the Scopus bibliometric database. Research period: 2013 – July 2023. The search for scientific publications was conducted in titles, abstracts, and keywords using the search terms “artificial intelligence,” “AI,” and “smart tourism.” The search query was: TITLE-ABS-KEY (“Artificial Intelligence” OR “AI”) AND TITLE-ABS-KEY (“smart tourism”). The research sample consists of 103 publications of various types. The publication distribution in the Scopus database is as follows: 55 Conference Papers (53.4%), 29 Articles (28.2%), 8 Conference Reviews (7.8%), 7 Book Chapters (6.8%), 3 Reviews (2.9%), and 1 Book (0.9%).

Second stage. Processing and visualization of data using the Scopus database tool “Analyze results.” This tool facilitates identifying the growth dynamics of indexed publications, determining the industry structure of indexed publications in Scopus, identifying the most cited publications and journals, and revealing authors with the highest publication activity in the studied theme.

Third stage. Processing and visualization of data using the VOSviewer software. This tool allows for the analysis of bibliographic data, which is previously saved in .csv format and imported into the software. Using VOSviewer, network maps of keyword co-occurrence (824) and research chronology (2019-2022) were constructed. The analysis aimed to establish the frequency of shared usage of terms by scholars in titles, abstracts, and keywords.

Fourth stage. Data analysis, conclusion formation, and addressing the research questions posed at the beginning of our study. Identifying the main thematic directions and trends in researching the application of artificial intelligence in smart tourism.

3 Results of the research

Over the past few years, a significant surge in interest among scholars regarding the utilization of artificial intelligence (AI) in smart tourism has been observed. This trend stems from the rapid development of AI technologies and their potential for optimizing various aspects of the tourism industry (Figure 1).
These factors, among others, have led to a surge in scholarly research on the application of AI in smart tourism. Researchers recognize the potential of AI to revolutionize how tourism is managed, marketed, and experienced while addressing pressing issues like personalization and sustainability. As AI technology continues to evolve, it is expected that scholars will continue to explore innovative ways to harness its power for the benefit of the tourism industry and its stakeholders.

In general, the increasing interest of scholars in researching the application of artificial intelligence in smart tourism reflects the potential of this field for changes and improvements in the tourism industry, aligning with contemporary demands and tourist expectations.

Research on the application of artificial intelligence in smart tourism is interdisciplinary, as it requires the integration of knowledge and approaches from various fields of science and technology, including computer science (31.7%), engineering (11.5%), business and management (10.6%), decision sciences (8.3%), physics (7.3%), mathematics (6.9%), social sciences (5.5%), economics (5%), and other disciplines. The interaction of these disciplines contributes to the development and implementation of effective tools that enhance the quality of tourist services, optimize business processes, and promote sustainable tourism development as a whole.

The first five most cited scientific publications on the topic of using artificial intelligence in smart tourism are presented in Table 1.

### Table 1. Most Cited Scientific Publications on the Topic of Using Artificial Intelligence (AI) in Smart Tourism

<table>
<thead>
<tr>
<th>Document title</th>
<th>Authors</th>
<th>Countries</th>
<th>Cited by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realizing the Potential of Internet of Things for Smart Tourism with 5G and AI</td>
<td>Wang, W., Kumar, N., Chen, J., Gong, Z., Kong, X., Wei, W., Gao, H.</td>
<td>Macao, India</td>
<td>121</td>
</tr>
<tr>
<td>What makes tourists feel negatively about tourism destinations? Application of hybrid text mining methodology to smart destination management</td>
<td>Kim, K., Park, O.-J., Yun, S., Yun, H.</td>
<td>South Korea</td>
<td>113</td>
</tr>
<tr>
<td>The adoption of artificial intelligence and robotics in the hotel industry: prospects and challenges</td>
<td>Nam, K., Dutt, C.S., Chaiithoth, P., Daithfous, A., Khan, M.S.</td>
<td>United Arab Emirates</td>
<td>52</td>
</tr>
<tr>
<td>Navigating through the complex transport system: A heuristic approach for city tourism recommendation</td>
<td>Zheng, W., Liao, Z., Lin, Z.</td>
<td>China, United Kingdom</td>
<td>32</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors

An analysis of the most cited scientific publications on the topic of utilizing artificial intelligence in smart tourism reveals that this field captures significant attention from scholars and researchers across various countries. The publications demonstrate how a broad spectrum of tourism and artificial intelligence aspects converge to create innovative solutions and enhance travel experiences. The most cited publications underscore the importance and relevance of the theme of AI in smart tourism, while also showcasing international interest and collaboration in this domain.

During the period of 2013-2023, researchers from China (40), India (11), Spain (7), Italy (5), and the United Kingdom (5) have published the highest number of articles on the investigated topic in the Scopus database (Figure 2).

Using VOSviewer software, a network map of shared words based on bibliographic data of publications indexed in the Scopus database was constructed. These network maps enable researchers to identify clusters of related terms, central keywords, and patterns of co-occurrence, offering valuable insights into the underlying themes and topics present in the literature. Researchers can use these visualizations to guide further analysis and make data-driven decisions. Considering the requirement that a keyword should be used at least three times, out of the 824 keywords, 64 were selected for visualizing the network map of keyword co-occurrence (Figure 3).
Keywords related to the utilization of artificial intelligence in smart tourism can be grouped into six clusters, which represent the main research directions in this field. The characteristics of these clusters are presented in Table 2.

<table>
<thead>
<tr>
<th>No</th>
<th>Cluster Color</th>
<th>Number of Keywords</th>
<th>Most Used Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>red</td>
<td>16</td>
<td>tourism, tourism development, information use, leisure industry, information systems, information management, blockchain</td>
</tr>
<tr>
<td>2</td>
<td>green</td>
<td>14</td>
<td>artificial intelligence, big data, data handling, social networking (online), data mining, electronic commerce, smart cities</td>
</tr>
<tr>
<td>3</td>
<td>blue</td>
<td>10</td>
<td>machine learning, metadata, deep learning, forecasting</td>
</tr>
<tr>
<td>4</td>
<td>yellow</td>
<td>9</td>
<td>smart tourism, virtual reality, augmented reality, digital tourism, technology</td>
</tr>
<tr>
<td>5</td>
<td>violet</td>
<td>8</td>
<td>internet of things, smart city, 5g mobile communication systems, sustainable development</td>
</tr>
<tr>
<td>6</td>
<td>light blue</td>
<td>7</td>
<td>tourism industry, tourism services, travel experiences, user experience</td>
</tr>
</tbody>
</table>

The first cluster (tentatively named “information systems in tourism”) encompasses research related to the development and management of modern, information-oriented strategies for the tourism industry, the use of smart technologies to enhance travel experiences and service efficiency, as well as the impact of technological innovations on this field.

The second cluster (tentatively named “data handling in systems”) indicates a profound connection between contemporary technological trends and their influence on the tourism sector. Significant emphasis is placed on data search, collection, and processing. This role becomes pivotal in refining processes, business management, fostering innovation, and improving the quality of services for users.

The third cluster (tentatively named “learning technologies in tourism”) focuses on research involving data analysis, automation, and prediction in tourism through the use of various machine learning and deep learning algorithms. This direction revolves around utilizing diverse methods to comprehend and process large volumes of metadata-enriched data, aiming to make forecasts and predictions about future events in smart tourism.

The fourth cluster (tentatively named “virtual technologies in tourism”) is dedicated to the investigation and development of innovative technologies to enhance and transform the tourism industry. This research zeroes in on the application of modern technologies such as virtual reality (VR), augmented reality (AR), and digital tourism to create innovative and personalized travel experiences.

The fifth cluster (tentatively named “communication technologies in tourism”) focuses on researching how communication technologies can be leveraged for the development of smart tourism with a strategic focus on sustainable development. The studies explore how these technologies can interact to reduce energy consumption, improve resource utilization efficiency, ensure a more comfortable and convenient life for residents and tourists, and decrease emissions of pollutants.

The sixth cluster (tentatively named “user experiences in tourism”) encompasses research aimed at enhancing and optimizing the quality and efficiency of the tourism industry through the analysis and improvement of user experiences, including the utilization of artificial intelligence. The results of the keyword analysis in chronological perspective demonstrate that a surge in publication activity regarding the use of artificial intelligence in smart tourism is notable between 2019 and 2022 (Figure 4).
that enrich travel. Blockchain can provide transparency, security, and traceability in tourism transactions and data exchanges.

4 Conclusions

Artificial Intelligence (AI) has become an invaluable tool in the tourism industry, driving the concept of “smart tourism.” It empowers businesses and destinations to provide more personalized, efficient, and enjoyable experiences for travelers while optimizing their operations. From personalized recommendations and chatbots for customer support to predictive analytics and sustainability efforts, AI touches every aspect of the travel journey. As technology continues to evolve, AI's role in shaping the future of tourism is likely to expand, promising even more innovative and seamless travel experiences for people around the world.

Based on the analysis, the following conclusions can be drawn: (1) a positive and consistent growth trend in researchers’ interest in the utilization of artificial intelligence in smart tourism has been observed since 2017, (2) research on the use of artificial intelligence in smart tourism is multidisciplinary, requiring the integration of knowledge and approaches from various fields of science and technology, (3) the analysis of the most cited scientific publications on the theme of artificial intelligence in smart tourism indicates significant attention from researchers and scholars from different countries, (4) during the period of 2013-2023, the highest number of articles related to the studied topic in the Scopus database were published by researchers from China, India, Spain, Italy, and the United Kingdom, (5) six major thematic directions and trends in the research on the utilization of artificial intelligence in smart tourism have been identified.

Conclusions derived from the study of scientific publications on the use of artificial intelligence in smart tourism point to a dynamic and crucial research field with the potential to transform and enhance the tourism industry. The increasing number of publications in this field reflects the deepening interest of the scientific community in integrating artificial intelligence technologies into tourism.

The results of the bibliometric analysis can serve as a foundation for making decisions regarding research strategies, development, and implementation of new artificial intelligence technologies in smart tourism. This information can be utilized to formulate the most relevant scientific questions for future research. Scholars, researchers, and industry practitioners can employ the outcomes of the bibliometric analysis to identify promising developmental directions, recognize shortcomings and improvement opportunities, and select the most effective strategies for implementing artificial intelligence technologies in smart tourism. The results of the bibliometric analysis can facilitate the development of cooperation strategies among researchers, universities, companies, and government. This can foster knowledge exchange, partnerships, and collaborative initiatives for the advancement of new technological solutions in tourism.

Among the limitations, it’s important to mention the focus on publications indexed solely in the Scopus bibliographic database. Expanding the scope to include publications from the Web of Science database, for instance, could potentially influence the research outcomes.

References

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