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Invited Research Article

Big Data in Smart Tourism: A Perspective Article

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Abstract

The advancement of Information Communication Technology has provided tourism researchers with a golden opportunity to access big data, which plays a critical role in smart tourism. Recognizing the current issue, this paper discusses the evolution of the literature on tourism big data focusing on conceptual understanding of and types of big data, and insights from big data analytics. Indeed, this article provides important research agenda for future tourism researchers who would like to conduct academic research about big data and smart tourism.

Keywords

big data; data analytics; smart tourism

The evolution of information and communication technology (ICT), such as social media, mobile technology, artificial intelligence, and the Internet of Things, has reshaped the entire tourism industry (Xiang, 2018). This includes the ways in which travelers search for destination information and communicate with service providers and other travelers (Park & Tussyadiah, 2017) as well as how tourism organizations develop strategies for destination marketing, management, and planning (Hays et al., 2013). The penetration of advanced technology into tourism has also brought about new paradigms in tourism studies. Recently, the terms "smart city," "smart tourism," "smart tourism destinations," and "smart hospitality" have gained attention from tourism scholars, who have proposed their own definitions (Gretzel et al., 2015) and sought to shed light on associations with the existing tourism concepts and literature (Li et al., 2017).

Gretzel et al. (2015) described smart tourism as "a distinct step in the evolution of ICT in tourism in that the physical and governance dimensions of tourism are entering the digital playing field, [and] new levels of intelligence are achieved in tourism systems" (p. 180). This has reshaped how tourism experiences are created, consumed, and shared. Lopez de Avila (2015) described a smart tourism destination as an innovative tourist destination built on an infrastructure of state-of-the-art technology that guarantees the sustainable development of tourist areas that are accessible to everyone; facilitates visitors' interaction with and integration into their surroundings; enhances the tourist experience at the destination; and improves residents' quality of life. Considering the notions of smart tourism, it can be recognized that merely adopting ICT at a destination is insufficient to make smart tourism and/or a smart destination successful. Faced with tourists' constant needs seeking for personalized services, the data from connected technology and analytics to uncover insights from the data set have been recognized one of the most important steps in building smart tourism (Xiang & Fesenmaier, 2017). The author argues that the key benefits of the evolution of ICT in terms of gaining a competitive advantage in smart tourism are afforded by "big data," consisting of data collection, exchange, processing, and analytics.

For instance, tourists can use their mobile phones to explore destinations and events of interest using in-situ data collection and reporting. These activities leave massive digital traces, producing a multidimensional set of data known as big data (Buhalis & Amaranggana, 2013). Initially, Laney (2001) denoted the key features of big data in terms of "3 'V's," referring to volume (the dimensionality/size of data), variety (different types of data comprising both the structured and unstructured data as well as various sources of data), and velocity (speed/swiftness of data generation or transfer). Scholars have since expanded the notion of big data by introducing additional "V"s, namely veracity (the reliability and credibility of data) and value (insights from the data by means of advanced analytics), creating a framework of "5 'V's" (Mariani & Fosso Wamba, 2020).

The tourism literature on big data has addressed three main types of big data: user-generated data, device data, and transaction data (Li et al., 2018). User-generated data are mainly obtained from social media platforms, comprising online textual data (e.g., product reviews and stories of travel experiences), photos uploaded to content-sharing websites, and online ratings (generally a 5-point evaluation system). A number of studies have analyzed user-generated content, as a major source of big data in tourism, to understand travelers' profiles and experiences and the effects of product/service evaluations. For example, Zhang et al. (2010) demonstrated the positive effect of online popularity on restaurant performance. Liu and Park (2015) identified the mechanisms involved in interpreting the elements of online reviews to make them useful for travelers evaluating the services reviewed. Xiang et al. (2015) used text analytics to evaluate textual comments and examine hotel guest experiences and their relationship with satisfaction. Likewise, quantitative text analyses have been conducted to understand the service

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attributes of accommodation (Tussyadiah & Zach, 2017) and to propose data-driven market segmentation (Ahani et al., 2019).

Understanding travel movement so that destination marketing organizations can effectively develop destination planning and management is a critical task in tourism. The evolution of location-based systems on mobile devices has enabled tourism researchers to obtain fine-grained data containing spatiotemporal information about travel flows. The establishment of technologies such as Bluetooth, RFID, and Wi-Fi (Shoval & Ahas, 2016) and the increasing availability of weather and traffic sensor data have enabled researchers to obtain large volumes of high-quality travel behavior data. A series of papers by Park and his colleagues (Park et al., 2020, 2021; Xu et al., 2021) showed how mobile sensor data can be analyzed to generate empirical insights. In addition to unveiling travel patterns, researchers have applied machine learning algorithms to predict travelers' next destinations (Zheng et al., 2017). Ultimately, a tourism recommendation system can be proposed based on contextual information on travelers, which can provide travelers with the customized tourism services (Fesenmaier et al., 2006).

The third category of studies of big data in tourism have focused on transactional data, such as credit card transaction, Web traffic, and online booking data. Tourism studies have used credit card data more limitedly because this can be attributed to restricted access to credit card datasets. Instead, tourism researchers have tended to use Web traffic data, mostly from Google Analytics, to forecast demand in hotels (Saito et al., 2016) and/or destinations (Gunter & Önder, 2016) and to understand information-searching behaviors (Bokelmann & Lessmann, 2019).

In essence, the advancement of ICT has provided tourism researchers with a golden opportunity to access big data, which play a critical role in smart tourism. Smart tourism must have the ability (1) to collect massive amounts of data; (2) to intelligently store, process, combine, and analyze big data; and (3) to interpret insights from big data to inform business innovation, operations, and management. Tourism studies have demonstrated the importance and applications of big data in understanding travel behaviors and experiences, predicting demand, and uncovering travel movement patterns (Fuchs et al., 2014). However, there is still much room to develop the literature on tourism—particularly smart tourism—in relation to big data.

First, most big data studies in tourism have been large-scale case studies. Instead, the focus of big data research should shift from a data-driven approach to "theory building" (Mazanec, 2020). As research in social science requires "points of views and theoretical problem[s]" (Popper, 1959, p. 88), tourism researchers should endeavor to expand frontiers of knowledge in and contribute to the literature on tourism in general and smart tourism in particular. Focusing on big data is the perfect approach, as big data analytics involve huge volumes of various types of data and multiple methods of manipulating, processing, and analyzing data. Compared with traditional methods, these innovative approaches have greater power to discover new findings and build tourism-oriented theories. As the success of smart tourism relies on digital technologies that can collect data on all phases of travel behaviors, big data should offer tourism researchers fruitful opportunities to develop new knowledge and theories.

Second, big data research in tourism has mostly analyzed a single type of data. Importantly, however, travel behavior is a complex process involving cognitive, affective, and conative experiences arising from multiple travel activities (Lam & Hsu, 2006; Park & Fesenmaier, 2014). Findings from a single data source/type are likely to offer only partial insights into travel behaviors. For instance, while mobile sensor data provide fine-grained information on travel flow, they are limited to identifying the activities and experiences of travelers at a destination. In this sense, the integration of multiple datasets is an important step in comprehensively understanding multi-dimensional travel experiences (Stienmetz et al., 2021). These insights will make a fundamental contribution to smart tourism design, as a multi-layer, systematic design approach focusing on tourist experience, and ultimately serve as the conceptual underpinning for the development of smart destinations (Xiang et al., 2021).

Third, while the tourism studies have been being revolutionized over several decades, the gap between what tourism academics propose and the industry wants is not reduced in a significant way (Wang et al., 2010). Big data can be considered as an area where the academics and practitioners can cooperate closely and come up with mutual benefits. The success of big data requires for individuals advanced analytical skills and continuous updates on the innovative knowledge. The academics should be able to fulfil the task of knowledge development about big data and that the tourism practitioners can get the insights and directly apply them into the industry to achieve their business goals. The author says that this activity dyadic relationship is essential for the success of smart tourism: indeed, the big data field is the perfect place in which the knowledge creation, sharing and application can be dynamically conducted.

Fourth, the curriculum redesign of the tourism education is important. Along with the changes of tourism industry adopting new technology and requiring new skills, the curriculum on a higher education should offer tourism students sufficient learning opportunities to get analytical skills and knowledge about smart applications as suggested by Professor Kaye Chon from his TechTalk (Shin, 2021). The state-of-the-art program should improve the absorptive capacity to adopt innovative technology by organizations and improve its efficiency to perform various tasks in tourism business.

Declaration of competing interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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