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From Social Sensing to Tourism Sensing: A Tentative Discussion

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Introduction

Tourism is a multifaceted social and economic sector that involves various parties and is closely connected to different industries [1]. It is characterized by a significant level of uncertainty and constant changes. Tourism statistics and sustainability monitoring encounter obstacles due to the distinctiveness of tourists and their behaviors, the intricacy of tourism operations, and the intricate nature of the evolution of tourism destinations. Developing strategies and techniques to enhance efficient monitoring in the tourism business is a crucial and pressing new proposal.

This article will examine the pressing issues that require resolution through the use of big data monitoring. It will also evaluate the difficulties associated with implementing social sensing in the tourism industry and present a research framework for tourism sensing based on these findings. The introduction of the concept of social sensing and its research framework offers novel insights for studying tourist statistics and monitoring. It facilitates the coordination between tourism and land, and presents a viable approach to foster the growth of tourism destinations.

Perspective on Big Data: Monitoring Tourism with Big Data

Since the inception of tourism big data research in 2013, the academic community focused on tourism has generated valuable research findings, particularly in the areas of tourists, tourism flows, and tourism destinations.

Tourists

With the assistance of the "affective computing" paradigm and the utilization of big data, the academic community in the field of tourism has created numerous models for evaluating emotions. Liu et al. [2] created a TSE model that utilized UGC text data as the data source, effectively addressing the issue of limited interpretability in the machine learning model [2]. Kang et al. [3] utilized deep learning techniques to address challenges such as cross-cultural bias in text data sources and the absence of universal models by leveraging UGC expression photos [3]. Subsequent research will investigate the spatial and temporal distribution of travelers' emotions in tourist places, based on this foundation [4]. However, there are still existing concerns around the inherent bias of emotion, privacy security, and the inadequate timeliness of visitors' emotions. The tourist industry has experienced a surge in the use of portable human factors devices, questionnaires, and other research methods to evaluate instant emotional experiences. This trend has been driven by the recognition of the significant value these tools provide to research situations [5].

Tourism flow

Tourism flow refers to the spatial movement of tourists in response to the closeness of tourism opportunities within a given area, regardless of its size. Tourist mobility generates tourist origin locations and tourist destinations, establishing a spatial pattern of movement between the two. There are three levels of spatial

movement modes in tourism flow. The first level is the single-point mode, which revolves around either the tourist source or the tourist destination, with a primary focus on the destination. The second level is the point-to-point mode, which revolves around both the tourist source and the tourist destination. The third level of the tourism system is the tourist destination, which encompasses the complete tourism system [6].

Tourism flow data mostly originates from digital footprints, which encompass the textual content, images, videos, and other information that users leave on the Internet, providing insights into the locations visited by visitors. Mobile roaming data can provide a more objective measurement of tourists' spatiotemporal behavior [7], but visual photos are more effective in explaining travel behavior [8].

Tourist Destination

The majority of research concentrate on the sensing and reputation of a certain destination. UGC data has emerged as the primary source of tourism location photographs due to its inherent advantages. Prior studies primarily utilize online texts to examine the "perceived image" and "imagery" of a place from a "emic" standpoint [9]. Recently, researchers led by Dunning have utilized deep learning algorithms to quantify the sensing of tourism sites by analyzing photos as data inputs. This approach successfully overcomes the constraints of conventional picture content analysis technologies [10].

Review

Academics commonly hold the view that big data leads to the broadening of tourism statistics and monitoring, resulting in an enhanced level of accuracy. Nevertheless, there remain several pressing issues that require immediate resolution. Existing research mostly centers around three research directions: tourist emotions, tourist destination impressions, and tourist movements. This research primarily focuses on the study of "Human," while the investigation of "place" remains relatively limited. Nevertheless, tourism research focuses on analyzing the intricate connections between places, as well as the interplay between individuals and their surroundings [11]. Earth information science facilitates the shift in tourism research from a focus on individuals to a focus on geographical locations, thanks to the assistance of advanced technology and big data [11].

Furthermore, while considering the precision of big data, it is imperative to address consensus matters like as bias, sampling, and representativeness, as highlighted by Zheng [12]. Given the intricate and organized nature of tourism scenes, it is important to not only describe tourism phenomena based on basic spatio-temporal features, but also consider the social interactions among tourists and the interactions between tourists and the tourism environment [11]. These interactions can be observed and analyzed through geographical big data. In order to enhance the adaptability of analysis methods and incorporate factors peculiar to the tourism phenomena [13], the present analysis technology for second-order features needs to be modified.

The social sensing, a crucial scientific approach in geographic information science, introduces a research perspective known as "Human-to-place". This perspective offers insights into the intricate dynamics of the "Human-Human" and "Human-place" relationships, while also facilitating their integration. The field of anthropology shifts its focus from the examination of individuals to the examination of geographical locations in order to offer valuable methodologies and insights.

Human and Places: Social Sensing

Social sensing is the study and technique of extracting spatiotemporal behavioral patterns from large amounts of individual data [14]. It involves analyzing how individuals interact with their surroundings and uncovering the spatiotemporal distribution, relationships, and processes of socioeconomic events. In 2015, Liu Yu implemented a comparable concept to Goodchild by replicating the notion of remote sensing. This involved the use of humans as data sensors, gathering geographical big data from numerous individuals to serve as the source of sensing data. Consequently, the sensing objects were transformed accordingly. The attributes of the natural environment were transformed into the attributes of the social economy, so introducing the notion of Social Sensing.

The First-Order Characteristics of the Place Perceived by the First-Order Attributes of Human

This study was the pioneer in deducing urban functions by analyzing the temporal distribution of taxi pick-up and drop-off sites, and accurately identifying the commercial and residential districts of the city. The research in question involves the study of movement trajectories and the simultaneous occurrence of Points of Interest (POIs). These investigations focus solely on the viewpoint of human activities and overlook the distinctive features of human activities and the constructed surroundings [15]. Therefore, Ye et al. [16] utilized Weibo social media data as a surrogate variable for activity categories, in conjunction with street view picture sensing, for the first time [16].

Previous studies infer emotions from social media content and utilize the location data provided by social media as a substitute variable for the location in order to describe the distribution of emotions in the city. Mitchell et al. [17] assessed the extent to which happiness is spread across New York and the Bay Area using Twitter data [17]. Yang et al. [18] gauged the prevalence of depressive emotions in the New York metropolitan area using Twitter Weibo [18]. Zhang et al. [19] identified six emotional characteristics, namely security, wealth, despair, and boredom, using a dataset and Tencent Street View photos [19].

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Second-Order Attributes of Human and Characteristics of Place

Perceiving the attributes of locations based on the distance of spatial contact. Geospatial accessibility is determined by the spatial interaction distance between individuals in two locations. Guo et al. [20] utilized mobile phone data to derive the travel paths of older individuals who visited parks, and assessed the level of accessibility for the elderly population to these parks [20].

Assessing the attributes of a location by evaluating the intensity of spatial interactions. In a study conducted in 2015, researchers analyzed taxi trajectory data to quantify the level of spatial interaction among persons in various cities [21]. They specifically focused on Shanghai and discovered that it has a polycentric urban spatial structure. This research offers an unbiased and detailed perspective on the spatial organization of the city.

Deducing urban functions by analyzing variations in the strength of spatial interactions across time. Kang et al. [22] utilized taxi data to construct an internal spatial interaction network within the city [22]. They deduced functional zones for commuting and entertainment activities by analyzing the variations in interaction intensity across time.

Integrate the characteristics of human first-order and second-order attribute sensing

Based on the aforementioned studies, it is evident that the social function of a location is influenced not only by its own characteristics, but also by the surrounding areas. Zhu et al. [23] utilized the graph neural network model to incorporate the primary features of human visual sensing of the environment as node attributes, and the secondary attributes such as spatial interaction attributes between places as edge attributes [23]. These attributes were then integrated into a network relationship figure to infer the social function of the place.

The process of participatory evolution of perceptual space from individuals to the ground.

Zhong et al. [24] utilized bus travel data to create Singapore's internal spatial interaction network and determine the urban spatial interaction framework [24]. By analyzing the spatial configuration over a span of three consecutive years (2010-2012), researchers were able to discern the pattern of Singapore's multi-center city.

Review

While current social sensing research methodologies and theories offer a foundation for investigating the "human-land relationship" in tourism, they encounter the following problems when applied to this area: The social sensing framework primarily examines the attributes and development of locations, while neglecting the investigation into the connection between tourism and individuals, particularly the geographical features, structure, arrangement, and progression of the tourism sector.

Furthermore, the "Human-place-time" paradigm of social sensing primarily emphasizes a specific level of individuals, location, and timeframe, making it challenging to apply to the intricate growth of tourist attractions where time and space interact. The growth of tourist destinations involves the dynamic interplay of time and place, encompassing temporal processes and shifts in spatial linkages. Current research on social sensing mostly examines either temporal structure or spatial structure, but fails to integrate the two, which hinders the analysis of system formation and evolution mechanisms [25].

Furthermore, when considering research data, geographical big data is deficient in physical environment information, individual attribute information, and economic information. It also faces the constraint of an independent duality between "Human and land," which hinders the investigation of the interaction mechanism between individuals and the land in the context of tourism.

Furthermore, in terms of research methodology, data-driven verification is used to validate overarching principles, whereas model-driven research relies on microscopic mechanisms. Nevertheless, there is still ongoing debate regarding the laws and procedures governing the interaction between humans and land in the tourism industry. As of now, there is no universally accepted research framework or research paradigm in place for studying this phenomenon [26]. The presence of these two factors complicates the analysis of the system's development and evolution mechanism [25].

Proposal of Tourism Sensing Framework

This paper aims to address the limitations of monitoring tourism big data and the challenges associated with applying social sensing in tourism monitoring. To achieve this, the research framework of social sensing is utilized, incorporating tourism-specific variables, resulting in the proposal of a tourism sensing research framework. This article aims to address the limitations of previous research on the sensing of "tourist destinations" and the interaction between tourism "Human and places" by developing a comprehensive research framework based on existing studies. Simultaneously, it presents the concept of social sensing, shifting the focus from individuals and locations to the dimension of time. Enhance and incorporate current tourism data and surveillance systems, with a specific emphasis on examining the geographical development of tourist sites and the tourism sector.

Prioritizing the investigation of individuals, current research predominantly neglects the examination of the correlation between location and individuals. Thus, the framework developed in this article encompasses both the emotional distribution of tourists and the spatial structure of tourism flow, while also emphasizing the importance of the tourist destination. The study focuses on the geographical arrangement of tourism resources

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and the dynamics of tourism land use, with an emphasis on the spatial distribution of elements within the tourism industry.

Furthermore, previous research mostly concentrates on the spatial distribution and characteristics when it comes to sensing, while neglecting to adequately monitor the process. In order to achieve this objective, the concept of time is incorporated into social sensing, and the forecast of spatial evolution in the tourism business and the sensing of spatial evolution in tourist sites are included.

Furthermore, the current research utilizing geographical big data is deficient in terms of physical environment information, individual qualities, and economic attribute data. Thus, by incorporating geographical data, remote sensing image data, user portrait data, and tourism industry economic attributes, we can extract the physical environment system, individual attribute information, and economic attribute information. This helps to compensate for the limitations of big data in accurately describing the relationship between tourists and places.

The spatial development of tourism sector components and tourist destinations is an intricate system of interaction between humans and the land. The examination of the relationship between humans and the land in the context of tourism is crucial in determining the outcome of spatial development. To gain a comprehensive understanding of the interaction between Human and places in tourism, it is necessary to examine the underlying mechanisms and processes involved. By doing so, we can ensure that the perceived impact of the relationship between Human and places is effectively managed. Thus, the paradigm developed in this paper emphasizes the examination of industrial determinants and the developmental trajectory of tourism sites.

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