Original Research Article

Research on the application of bayesian network model in the tourism industry of Jilin Province

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Abstract: In the current era where the digital economy is deeply integrated with the tourism industry, precise and intelligent management has become the core driving force for promoting the high-quality development of regional tourism. The Bayesian network model, leveraging its advantages in probability reasoning and handling uncertainty issues, can provide a new perspective for solving the problems in the development of tourism in Jilin Province. Based on the core principles of the Bayesian network model and combined with the actual development situation of digital and intelligent tourism in Jilin Province, this paper systematically analyzes the significance and existing problems of the application of this model in the tourism industry of Jilin, and then proposes optimization strategies and draws conclusions. The aim is to provide theoretical and practical support for the intelligent transformation of the tourism industry in Jilin Province, and also to indicate the direction for the educational and teaching reform of the tourism management major.

Keywords: bayesian network model; tourism industry of Jilin Province; intelligent transformation; educational guidance

1. Introduction

Jilin Province boasts rich resources in ice and snow, ecology, and folk customs, making it a core area for cultural tourism in the north. Currently, Jilin is actively promoting digital transformation in culture and has implemented digital and intelligent tourism projects such as intelligent interactive holographic stores and virtual digital person guided tours. However, in the development of the tourism industry, there are still many uncertain challenges in deeply exploring unique resources, providing digital and intelligent services, and risk prevention in ice and snow tourism. The Bayesian network model has the advantages of multi-factor correlation reasoning and handling uncertainty issues, and has shown potential for application in the tourism field. Integrating this model with the digital and intelligent tourism construction in Jilin Province can effectively solve problems such as delayed decision-making and homogenized services under the traditional management model, and promote the tourism industry to shift from "experience-driven" to "data intelligence-driven".

2. The significance of applying bayesian network model in the tourism industry of Jilin Province

Applying the Bayesian network model to the tourism industry of Jilin Province is in line with the development strategy of Digital Jilin, and has three meanings: theoretical innovation, practical empowerment, and educational leadership.

From a theoretical perspective, this fills the gap in the research on the integration of digital technologies in northern characteristic tourism regions, breaking the previous limitation of the model's main application in industry and healthcare. By combining the seasonal characteristics of Jilin's ice and snow tourism and the regional characteristics of virtual digital person interaction, such as local specialties, a "Bayesian Network + Cultural Tourism Mini Model" integration framework is constructed. This can improve the theoretical system of intelligent algorithms and regional cultural tourism integration, providing a reference for the digital transformation of other similar regions [1]. At the same time, it can also enrich the theoretical connotation of intelligent development and digital service supply of ice and snow tourism, promoting a better integration of tourism management theory and digital economy practice.

From a practical perspective, first, it can help with the precise development of characteristic resources. Addressing the imbalance in the development of resources such as Jilin's ice and snow and folk culture, and the

low added value, this model can integrate resource endowments, climate conditions, tourists' preferences, and user behavior data of intelligent holographic warehouses to determine the development potential of projects such as Longbaishan ice study and Korean ethnic culture experience, helping to create a characteristic product system of "ice and snow + digital" and "folk culture + technology". Secondly, it can optimize digital service and marketing work. Based on the guest information data of the tourism cloud platform, combining the Bayesian network model and the KNN algorithm to build a hybrid recommendation system, it can not only provide full-chain personalized recommendations for tourists, but also support the guiding services of virtual digital persons "Chigui" and "Xuanlong". At the same time, integrating meteorological and traffic data to predict the seasonal tourist flow of ice and snow tourism, it can provide reliable basis for scenic area management and hotel pricing. Finally, it can strengthen risk prevention and control capabilities. By integrating real-time monitoring data and historical safety event data, a dynamic warning model is constructed to accurately determine risk levels such as skiing safety, road icing, and traffic congestion to ensure tourism safety.

In terms of education and teaching, the application of this model also provides a reform direction for the connection between tourism management majors and the digital needs of the industry. Currently, Jilin is promoting the "government-use-production-study-academy" collaborative education model. The actual application of this model can promote universities to optimize their curriculum systems, add core courses such as "Cultural Tourism Big Data Analysis", introduce real cases of intelligent holographic warehouse operation for project-based teaching, and through the joint establishment of practice bases by universities and enterprises, allow students to participate in the practical training of model operation, cultivating a comprehensive type of talents who both understand tourism and possess data intelligence capabilities, solving the problem of disconnection between talent cultivation and industry needs, and preparing sufficient talents for the digital transformation of cultural tourism.

3. Issues of applying bayesian network model in the tourism industry of Jilin Province

Although this model is highly compatible with the demand for digital transformation of tourism and culture in Jilin, it still faces many bottlenecks in practical application.

The first problem is the fragmentation of data integration. Although Jilin has already established a tourism cloud platform, the data standards of tourism, transportation, and meteorology departments are not unified. Therefore, real-time data such as intelligent holographic warehouses and scenic area monitoring have not been fully integrated, and the data of the virtual digital person's tourism mini-model has not been integrated with general tourism data. This has led to incomplete data dimensions and insufficient timeliness required for model training. In addition, the data collection awareness of small tourism enterprises is weak and their records are not standardized, thus further reducing the data support capability.

The second issue is a significant shortage of specialized talents. To apply this model, one needs to possess skills in both tourism operation and data modeling, as well as knowledge of digital technology. However, most of the current employees in the tourism industry of Jilin are proficient in traditional service and management work, have limited understanding of the integration and application of "Bayesian Network + Cultural Tourism Mini Model", and the tourism management major in universities lacks interdisciplinary courses and a dedicated "Tourism + Data Intelligence" training module. It is difficult to cultivate the required talents, and the scarcity of professional technical service teams within the industry makes it hard to implement key aspects such as model parameter optimization and data integration.

The third issue is the insufficient regional adaptability of the model. The models currently in use are mostly of a general version and have not been optimized based on the seasonal characteristics of Jilin's ice and snow tourism and the interaction of virtual digital humans, for example, not incorporating core factors such as snow quality and freezing period. This makes it difficult to provide effective support for the development decisions of ice and snow projects and also fails to connect with the user question-and-answer data of the intelligent holographic warehouse. Therefore, it is impossible to assist in the optimization of the virtual digital person guiding service. Moreover, the application exploration of emerging scenarios such as the integration of cultural tourism metaverse and the ice equipment industry chain is insufficient.

The fourth issue is the limited application scenarios and insufficient integration with the industry chain. Currently, the model is mainly used for destination prediction, such as ice and snow tourism risk warning and the optimization of virtual digital person services. These key scenarios have not yet been applied. The application

scope is only concentrated in a few key scenic areas and has not been linked with the accommodation, catering, and ice equipment manufacturing industry chain links. It is difficult to form a complete intelligent management system. Additionally, universities have not fully integrated digital and intelligent tourism case studies and model teaching, resulting in a mismatch between talent cultivation and industry demand, which also limits the large-scale application of the model.

4. Strategies for optimizing the application of bayesian network models in the tourism industry of Jilin Province

Based on these issues and in light of the actual situation of the digital transformation of tourism and culture in Jilin, the following optimization strategies are proposed. The first is to establish a "platform + scenario" data integration system. Relying on the tourism cloud platform, promote unified data standards among different departments, achieve regular sharing, thereby breaking through "data silos", and connect real-time data from platforms such as intelligent holographic warehouses, scenic area monitoring, and "Enjoy Jilin" new media, integrate question-and-answer data of virtual digital humans and non-structured data such as tourists' evaluations, and after cleaning and indexing, form standardized data sets [2].

The second is to establish a "government-business-industry-research" collaborative education system. Relying on the collaborative body of modern tourism industry colleges in Jilin Province, we will promote the establishment of a "digital and intelligent tourism" minor program in the tourism management major, offer courses such as "Bayesian Networks and Application of Tourism Mini-models", introduce practical Python projects, and through the joint construction of practice bases by schools and enterprises, carry out "order-based" training, allowing students to participate in the practical operation of real projects. At the same time, we will introduce relevant policies to attract interdisciplinary talents, form professional technical teams to provide guidance, and thereby enhance the capabilities of existing employees.

The third is to establish a model system that suits the regional characteristics. By optimizing the model based on the unique scenarios such as Jilin's ice and snow tourism and virtual digital person interaction, factors such as snow quality and freezing period are incorporated into the ice tourism field to build an assessment model for development potential and a risk warning model. In the digital and intelligent service field, data related to virtual digital persons is connected to build a user demand prediction model, which supports the optimization of guided tour services, and the exploration model is applied to the cultural tourism metaverse scenarios. Combined with XR technology, the simulation of tourism scenarios is carried out, and through model analysis, virtual experience data is analyzed to optimize the service configuration of the real tourism scenarios [3].

The fourth is to expand the application scenarios across the entire chain and promote the deep integration of industries. The model will be applied in scenarios such as collaborative development of ice and snow equipment, innovation of tourism products, and optimization of homestay services, providing decision support for equipment manufacturing and product design. Relying on the "One Mobile App for Travel in Jilin" platform, the application results of the model will be integrated to achieve coordinated interaction among scenic spots, accommodation, and other links, and to build a full-chain intelligent service system. At the educational level, cross-disciplinary teaching will be carried out based on the entire chain application scenarios, cultivating students' ability in collaborative management of the industrial chain and intelligent application, achieving synchronous resonance between industrial development and education.

At the same time, efforts should be made to strengthen policy and financial support. In accordance with the requirements of the "Action Plan for Accelerating the Digital Transformation of Cultural Enterprises in Jilin Province (2024-2026)", a special fund for digital and intelligent tourism and culture innovation should be established to support projects related to model application. Moreover, a collaborative innovation platform involving government, enterprises and universities should be built to promote joint research and development and scenario pilot projects among all parties, forming a virtuous cycle of "technology research and development - scenario application - talent cultivation".

5. Conclusion

In summary, applying the Bayesian network model to the tourism industry of Jilin is an important path in response to the Digital Jilin strategy and promoting the high-quality development of the cultural tourism industry. It has multiple values. Currently, it faces problems such as fragmented data, lack of talents, insufficient

model adaptability, and single application scenarios. By establishing a "platform + scenario" data system and a "government, industry, production, research, education" education system, creating characteristic models, expanding full-chain application scenarios, etc., these strategies can effectively solve these problems and improve the application effect of the model. In the future, as digital technology continues to update and the deepening of the digital transformation of tourism, the application prospects of this model will be even broader. Through the collaborative efforts of the government, enterprises, and universities, promoting the deep integration of the model and characteristic scenarios such as ice and snow tourism and the cultural tourism metaverse, coordinating with the full chain of the industry, and connecting with the teaching work of tourism management majors, it can not only achieve precise management of Jilin tourism, help build a strong province in ice and snow tourism, but also cultivate more interdisciplinary talents, providing practical support for the new liberal arts reform of tourism management majors.

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