



Tourism Souvenir Design Based on Knowledge Graph and CAD Technology

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Abstract. Tourist souvenirs have always been tangible memories left by tourists during their travels. They not only represent the cultural characteristics of the place of purchase but also reflect the value of the souvenirs themselves, making them an indispensable part of tourism resources. Tourism souvenirs, to a certain extent, reflect the local tourism image and play an important role in helping to spread regional culture and improve regional economic growth. With the improvement of the national economic environment, people are increasingly pursuing a combination of spiritual and material experiences. Tourism souvenirs can meet people's special requirements for spiritual needs and also change the original added value of the product. This article also studies the knowledge management of tourism souvenir design based on knowledge graphs and deep learning algorithms from the above background and explores the process and practical application effects of tourism souvenir design using CAD computer-aided design technology. Firstly, explore the quantity of research on tourism souvenirs from the perspective of bibliometric visualization of knowledge graphs, and use knowledge graph software and Chinese word segmentation to analyze data on time and keywords. Secondly, using deep learning algorithms to optimize the segmentation model, a knowledge management question and answer system related to tourism souvenir design is constructed. Finally, CAD computer-aided design technology was used to optimize the design of tourism souvenirs, and the practical application effects of the optimized souvenir design were explored. Integrate multiple tourism resources and analyze the innovative path of tourism souvenir design. Research has shown that the number of research on knowledge related to tourism souvenir design is increasing, and the visualization effect of knowledge graphs is significant. The application effect of tourism souvenir design assisted by CAD technology has been loved and supported by users.

Keywords: Knowledge Graph; CAD Technology; Tourism Souvenirs; Knowledge Management; Deep Learning

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1 INTRODUCTION

With the continuous changes in the national economic environment, people's living conditions are getting better and better. People are beginning to pursue a dual experience of both spiritual and material aspects, and the tourism industry is also developing rapidly under these conditions. In the rapid development of the tourism industry, souvenirs have always played an indispensable role as an important link between tourists and tourist destinations. However, traditional souvenirs are often limited by production techniques and materials, making it difficult to showcase the unique charm of the destination fully. With the advancement of technology, additive manufacturing technology, especially 3D printing technology, has brought revolutionary changes to the production and decoration of tourism souvenirs. 3D printing technology demonstrates its unique advantages in the decoration of tourist souvenirs. Firstly, it can quickly print various shapes and sizes of souvenirs according to the needs, meeting the personalized needs of tourists. Whether it is models designed based on the characteristics of scenic spots or artworks created by combining local cultural elements, 3D printing can accurately reproduce the designer's creativity, making souvenirs more unique and commemorative [1]. People's travel choices are not only domestic but also involve cross-border tourism experiences. After the global number of tourists reaches a new high, the tourism industry has a certain degree of observable promoting effect on global economic growth. In the field of tourism souvenir design, integrating intangible cultural heritage elements not only enriches the cultural connotation of tourism souvenirs but also promotes the dissemination and popularization of intangible cultural heritage. However, the impact of the spatial and temporal distribution pattern of intangible cultural heritage resources on the design of tourism souvenirs cannot be ignored. Chang et al. [2] explored the spatiotemporal distribution pattern of intangible cultural heritage tourism souvenir design resources and their application in design based on knowledge graphs and CAD technology. As a powerful tool for knowledge representation and inference, a knowledge graph can systematically integrate and display the spatiotemporal distribution information of intangible cultural heritage resources. By constructing a knowledge map of intangible cultural heritage, the characteristics and distribution of intangible cultural heritage resources in different regions and time periods can be clearly presented.

From the results of big data surveys, it can be seen that people usually purchase souvenirs with regional characteristics during the tourism process. Souvenirs not only represent local cultural knowledge but also reflect the commodity attributes of the tourism industry in response to the problems of a large amount and complex variety of tourism souvenir data, inconvenient management, and difficulty in displaying and promoting digital model files of souvenirs. Chen et al. [3] explored the design and development of a tourism souvenir reconstruction result visualization and data management system. The system consists of two modules: data management and model visualization. The main function of the data management module is to store and quickly search for fossil-related information. The main functions of the model visualization module are online rotation, dyeing, and cutting of souvenir model files. This system can effectively enhance tourists' understanding of the historical background of tourism. Therefore, the importance of souvenirs in the tourism process is increasing, which brings new business opportunities to the tourism industry. The construction of knowledge graphs is crucial in the augmented reality system of tourism products. By integrating various information about tourist destinations, including attractions, culture, history, etc., a vast knowledge network is formed. When tourists use the system to capture images of tourist destinations, the system can use knowledge graphs for image recognition, quickly and accurately matching relevant information and content. Chiu et al. [4] used knowledge graphs to provide tourists with in-depth information interpretation and interactive experiences. Tourists can not only understand the basic information about scenic spots through the system but also explore the historical culture, customs, and traditions behind them, making the tourism experience richer and more in-depth. Through CAD technology, designers can accurately construct three-dimensional models of tourist destinations, providing tourists with a more realistic augmented reality experience. In tourism resources, people's positioning of culture is also demonstrated through the material and

intuitive means of tourism souvenirs. People obtain cultural knowledge contained in souvenirs through tourism, and have a high degree of spiritual resonance, thus forming a special atmosphere of knowledge. In the visual communication design of tourism souvenir design, the application of computer graphics processing technology not only enriches design techniques but also improves design efficiency and quality, injecting new vitality into the prosperous development of the tourism souvenir market. Fan and Li [5] have utilized computer software and algorithms to create, edit, optimize, and output graphics with high flexibility and controllability. Through computer graphics processing, designers can easily achieve complex graphic transformations and combinations, creating unique visual effects. Finally, computer graphics processing technology can also achieve batch processing and automated output of graphics, greatly improving design efficiency.

Although tourist souvenirs have gradually emerged as commodities with the development of the tourism industry, they cover a wide range. It can be local food, jewelry, clothing, etc., as well as cultural products that combine with traditional characteristics. With the rapid development of information technology, the application of technologies such as deep learning, 3D model retrieval, and multimedia computing in the field of tourism souvenir design is becoming increasingly widespread. Gao et al. [6] explored the application of deep learning based on view-based 3D model retrieval in tourism souvenir design, as well as the role of multimedia computing in this process. View-based 3D model retrieval technology is a method that utilizes computer vision and machine learning algorithms to retrieve models similar to a given view from a large number of 3D model databases. This technology extracts 2D view features of 3D models and matches them with query views to achieve fast and accurate retrieval of 3D models. This technology provides a rich material library for tourism souvenir design, and designers can retrieve various 3D models related to tourist destinations through retrieval, providing inspiration and reference for creation. Therefore, the actual purpose of designing tourist souvenirs is to showcase the local customs and regional culture better. In addition to being easy to carry, flexible, and compact, it should also have special characteristics that distinguish it from ordinary goods. Digital tourism, as a new form of tourism, is gradually changing people's travel experience and consumption habits. In the context of digital tourism, the design of intangible cultural heritage tourism souvenirs also faces new challenges and opportunities. Sustainable design, as a design concept that emphasizes environmental protection, cultural heritage, and social responsibility, is particularly important for the design of intangible cultural heritage tourism souvenirs. Gonçalves et al. [7] explore the sustainable design perspective of intangible cultural heritage tourism souvenirs from the perspective of digital tourism. Through technologies such as virtual reality (VR) and augmented reality (AR), designers can present elements of intangible cultural heritage to tourists more vividly and intuitively. Tourists can experience the charm of traditional culture firsthand through digital devices, thereby enhancing their awareness and interest in intangible cultural heritage. Through digital means, designers can systematically collect, organize, and analyze information related to intangible cultural heritage, providing rich materials and inspiration for souvenir design.

Nowadays, the target audience for tourism is becoming more diverse, and in addition to young people, more middle-aged and elderly people are also beginning to join the travel process in keeping with the times. So, the design of tourist souvenirs should be more in line with practical needs, not only innovating in content but also bringing the most intuitive experience and visual experience. Excellent tourism souvenir design schemes can better present the cultural connotations and values of tourist attractions themselves. Knowledge graph, as a powerful tool for knowledge representation and inference, can systematically integrate relevant information about intangible cultural heritage, including historical origins, cultural connotations, production processes, etc. By constructing a knowledge graph of intangible cultural heritage, Guo and Zhu [8] have gained a comprehensive and in-depth understanding of the essence and characteristics of this cultural heritage, providing strong support for the design of souvenirs. At the same time, knowledge graphs can also help us explore elements and symbols in cultural heritage, ensuring that souvenirs are consistent with the original culture in appearance and conveying the correct cultural information. Using CAD software, designers can accurately model and design based on the information and elements provided in the knowledge graph. By simulating and optimizing the production process, CAD technology can ensure the accuracy

and quality of souvenir production while improving production efficiency. Allowing tourists to experience the unique regional ethnic culture firsthand can help tourist attractions go global and promote the highly developed industry. Traditional commemorative product design often relies on the personal experience and intuition of designers, making it difficult to meet the diverse needs of users fully. The user evaluation data-driven design method based on knowledge graph and CAD technology provides new ideas for the optimization design of tourism commemorative products. Lu et al. [9] systematically integrate and display various information related to tourism commemorative products. In the design of tourism commemorative products, the construction of knowledge graphs can start from multiple dimensions, including product attributes, user evaluations, market trends, etc. By constructing a comprehensive knowledge graph, designers can gain a deeper understanding of user needs and preferences and tap into potential design inspiration.

With the widespread application and dissemination of computer technology and information technology as a high-end manufacturing technology, CAD computer-aided design has important value in various fields such as education, culture, and art. In the process of designing tourist souvenirs, using CAD computer-aided technology to process the design model intelligently can better realize the designer's design concept. This technology for mass production can increase the manufacturing speed of the tourism souvenir industry, significantly shorten the time from design to finished product, and greatly improve the economic benefits of tourism. In addition, CAD technology has also shifted the design of tourism commemorative products from flat to three-dimensional. Breaking the limitations of space and time, making tourism commemorative design more in line with the public's demand for modern products. Therefore, this article also analyzes the future development trend of this industry from the knowledge management of tourism commemorative product design.

2 KNOWLEDGE GRAPH AND DEVELOPMENT STATUS OF CAD TECHNOLOGY

Meiklejohn et al. [10] explained the weaving behaviour under different weaving cultures and regional clothing cultural symbols. A large-scale tourism souvenir cultural knowledge map was constructed by analyzing the process parameters of textiles. Thus, exploring the essential characteristics of regional cultural symbols, combining examples for design analysis, and analyzing the significance of regional culture conveyed through tourism souvenirs as carriers. Through the analysis and interpretation of a large number of excellent design cases, the methods that can enable regional culture to be specifically applied in tourism souvenir design have been elucidated. Firstly, classify according to the attributes of regional culture and discuss from three levels: surface material layer, middle social layer, and deep spiritual layer. Thus, practical methods for constructing regional culture and a systematic design method that integrates regional culture with tourism souvenir design are proposed. This provides a practical and feasible theoretical basis for the design practice of tourist souvenirs. Pamungkas et al. [11] used computers to retrospectively construct a tourism knowledge graph. After years of development, computer vision 3D reconstruction technology has made significant progress. It has been widely used in many industries today. Suppose image processing technology can be applied to the three-dimensional reconstruction problem of tourism souvenir knowledge graph from the perspective of computer vision. So, it will provide significant assistance in the reconstruction of knowledge graph models and scientific research. Meanwhile, through rapid and efficient reconstruction, a digital knowledge graph database can be quickly established. This can provide strong data support for the sharing and dissemination of future tourism data.

Ramnath et al. [12] selected Dunhuang graphic elements as the design theme for geometric redesign in tourist souvenirs. A brief description of the concepts related to Dunhuang graphic elements and tourist souvenirs in experiential design. Analyze the design concept of tourism souvenirs through case studies, as well as explore the current design status and application fields of Dunhuang graphic elements in tourism souvenirs. It has been found that there is a correlation between experiential design and tourist souvenirs, and the involvement of experiential design in the redesign of Dunhuang graphic elements in tourist souvenirs has certain feasibility. Conduct strategic research on the redesign of Dunhuang graphic elements in tourism souvenirs based on the current

situation of Dunhuang tourism souvenirs. The expectations, event processes, and impact stages of tourists towards Dunhuang tourist souvenirs correspond one by one, and finally integrate their design strategy models. In the manufacturing of tourism commemorative products, this information needs to be efficiently and accurately interacted with CAD geometry to ensure the smooth progress of the manufacturing process. By utilizing an integrated manufacturing management system, CAD software can be seamlessly integrated with manufacturing execution systems, material management systems, etc., achieving real-time sharing and updating of data. Augmented reality (AR) technology has become a new favourite in the field of tourism souvenir design. Especially with the support of multimedia knowledge maps and deep learning technology, this new type of tourism souvenir has brought unprecedented interactive experiences to tourists. Rinaldi et al. [13] explored the application and prospects of augmented reality systems based on multimedia knowledge maps and deep learning techniques in tourism souvenirs.

With the advent of the digital age and the continuous development of virtual information technology, research on the digitization and virtualization protection of intangible cultural heritage has emerged. In practice, Selmanović et al. [14] used network and digital technology to fully present the various functions of physical museums digitally on the network. Digital museums have been built in many places, and theoretical research on establishing digital museums for intangible cultural heritage has also achieved corresponding results. At present, scholars generally believe that with the continuous development of information technology and the entry of humanity into the digital age and experience economy era, it is a trend to study the development of intangible cultural heritage tourism products from the perspective of virtualization and digitization. In the wave of intangible cultural heritage tourism development, we need to see the achievements of the tourism development model. We should pay more attention to the increasingly prominent problems and contradictions in the development of traditional tourism products. In addition, with the continuous progress of information technology and the arrival of the information and experience era, research on the development of intangible cultural heritage tourism from the perspective of digitization and virtualization not only effectively solves some of the problems and contradictions that arise in traditional tourism products. Meanwhile, the dissemination advantages and powerful functions of the internet itself have opened up more effective new models for the protection and inheritance of intangible cultural heritage. This is of great significance for the protection and inheritance of intangible cultural heritage. Wang et al. [15] applied CAD experience design new thinking, combined with the current experience era background, to promote the inheritance of excellent traditional Dunhuang graphic element culture. Organize and list the essence of traditional cultural products, and use visual expression techniques to make the past serve the present. By analyzing the expectations and memories of tourists towards tourist souvenirs, and guided by the experience EEI model as a design strategy, we integrated Dunhuang graphic elements into the redesign model of tourist souvenirs. This provides new ideas and methods for the redesign of Dunhuang graphic elements in tourism souvenirs. To better carry and optimize the tourist experience of Dunhuang as a tourist souvenir. Simultaneously meeting the experiential needs of tourists for tourism souvenirs and increasing purchasing power.

Xin et al. [16] conducted a digital analysis of the current situation in the development of traditional intangible cultural heritage tourism products, addressing a series of issues that have arisen in the current process of developing traditional cultural heritage tourism. The enrichment of the theoretical system for the development of intangible cultural heritage tourism products has certain theoretical significance. At the same time, research from the perspectives of digitization and virtualization adapts to the development of the times and is a new and effective means for the protection and inheritance of intangible cultural heritage. It attempts to fill the gap in researching the protection of intangible cultural heritage from the perspective of virtual tourism product development and explores new models for the protection and inheritance of intangible cultural heritage. The application status of graphic elements in tourism souvenirs varies, with issues such as the usual tourism souvenir carrier, simple texture forms, and poor user experience. During the design process, visual graphics and new forms of tourism souvenir carriers are used to attract and stimulate tourists' perceptions of tourism's cultural elements. Engage them in self-creation. Make tourism souvenirs a physical carrier that can carry a complete and memorable sharing. At present, there are

shortcomings in China's tourism souvenir industry, such as lack of product creativity, insufficient production scale, and serious product homogenization, which make it difficult to reflect the regional cultural characteristics of tourist attractions. Therefore, Yun and Leng [17] addressed the problems and drawbacks of current tourism souvenirs and reflected regional culture in tourism souvenirs through visual communication and symbolic elements. It proposes new design strategies and solutions to address the shortcomings and shortcomings of current tourism souvenirs. The main reason for this is that people in different regions live in different environments and geographical factors. Therefore, the thinking patterns and cultural atmosphere of people living in this area do not exhibit a significant cultural and artistic style. All of these can be seen in the regional culture that has been passed down from ancient times to the present day. The symbols in tourist souvenirs serve as a medium for achieving dialogue between people and regional culture, further explaining that the design of tourist souvenirs is actually a design expression of cultural phenomena—especially the expression of regional culture [18]. Traditional cultural tourism souvenir design is often limited to fixed styles and production techniques, making it difficult to showcase the depth and breadth of culture fully. However, with the continuous development and application of knowledge graphs and CAD technology, there has been an in-depth dialogue between modern technology and traditional culture, injecting new vitality into cultural tourism creative design. Zong et al. [19] gained a deep understanding of the inherent connections and characteristics of cultural tourism resources, providing rich materials and inspiration for creative design. Meanwhile, knowledge graphs can also help designers explore the potential value of cultural tourism resources and discover new creative points and design ideas.

3 RESEARCH ON KNOWLEDGE MANAGEMENT AND APPLICATION OF TOURISM SOUVENIR DESIGN BASED ON KNOWLEDGE GRAPH AND CAD TECHNOLOGY

3.1 Research on Knowledge Management Q&A System for Tourism Souvenir Design Based on Knowledge Graph and Deep Learning

Knowledge management, as a new concept that has emerged in recent years, is also the main means of understanding a certain industry. Effectively utilizing knowledge management can help industries carry out modern information construction. The knowledge management of tourism souvenir design can change the socio-economic model, promote the strategic development of the tourism industry, and provide data support for the competition in the tourism market environment. Knowledge management, as an operational system requirement, should not only be human-centered but also based on data and information, viewing knowledge as a visible resource that can be developed. During the process of acquiring knowledge, users can connect information with the internal functions of a certain industry, which can, to some extent, determine the future development plan of the industry. This article explores the knowledge management of tourism souvenir design, using knowledge graph methods for data analysis. This kind of Internet big data statistics technology has become an important tool for exploring the economic growth of the industry. When the dynamic changes in big data information have a significant impact on data analysis, traditional data statistics and calculations can no longer meet the needs of network structure. We need to approach the massive and heterogeneous data in network architecture from a new perspective. Therefore, a knowledge graph is an inevitable technological choice for us to explore the content of knowledge management in tourism souvenir design. The knowledge map can be seen as an intuitive development on the semantic network, reflecting an exploration result in Internet data processing. Moreover, this technology has shown good performance in search engines. It has now become a key tool in fields such as intelligent question answering, personalized recommendations, and data surveys. Knowledge graphs have a more direct representation in databases and semantic networks and can use the relationship between related node words and knowledge to represent the development process of the research field. At present, commonly used knowledge graphs can be divided into universality and verticality. The former emphasizes the breadth of knowledge management, which includes a large number of common sense questions, while the latter focuses on

specific fields and emphasizes the depth of the research content. The difference between the two is shown in Table 1.

<i>Comparison Items</i>	<i>Universal Knowledge Graph</i>	<i>Vertical Knowledge Graph</i>
Scope Of Knowledge	Common Sense And Breadth	Professionalism And Depth
Source Of Knowledge	Baidu Baike	Patents, Experience
Knowledge Acquisition	Automation	Manual Get
Expressions	Text, Images, Etc	Charts, Models, Etc
Audience Group	People	Professional
Knowledge Area	Engineering And Production	Business, Art

Table 1: Comparison Of Two Knowledge Graphs.

From Table 1, it can be seen that we distinguish the scope of the two knowledge graphs based on their knowledge characteristics and also differentiate the various domain contents applied by the knowledge graphs based on their knowledge sources. According to the method of knowledge acquisition, it can be concluded that the level of automation in general knowledge graphs is relatively high, while vertical knowledge graphs require higher quality management. We will combine the two in our research while exploring the scope of tourism resources involved in the knowledge graph and the quality of related knowledge. We also randomly selected literature from different countries on tourism souvenir design from the database and conducted a quantitative analysis to explore the overall trend of the number of publications, as shown in Figure 1:

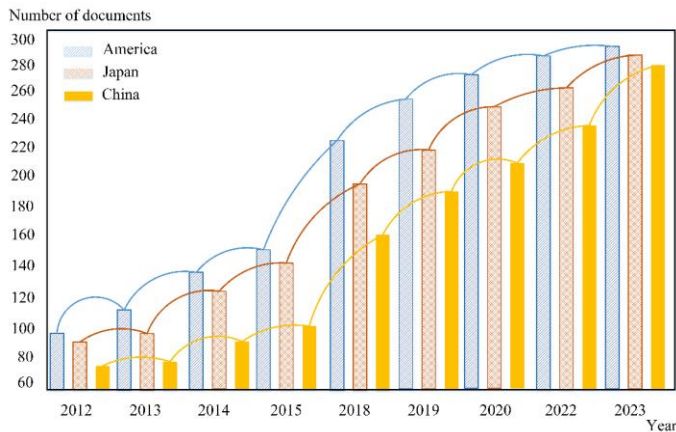


Figure 1: The overall trend is a change in the number of literature publications.

From Figure 1, it can be seen that the publication time curve of the year can visually display the changes in the number of literature publications related to tourism souvenirs. At the same time, we also set up an exponential trend curve for quantity changes in data analysis, with more research on

tourism commemorative product design in the United States and Japan. In the later stage, with the rapid development of information technology in China, the number of research literature related to tourism souvenirs has also significantly increased. The internal architecture of a knowledge graph is the foundation for constructing relevant domain content and can have a direct impact on subsequent statistical performance. The logical structure of the knowledge graph constructed in this article is divided into data and model layers. The model layer stores refined relevant knowledge based on the data layer and adopts an ontology management mode to form corresponding rules and constraints. The logical structure and key technical framework of the knowledge graph are shown in Figure 2:

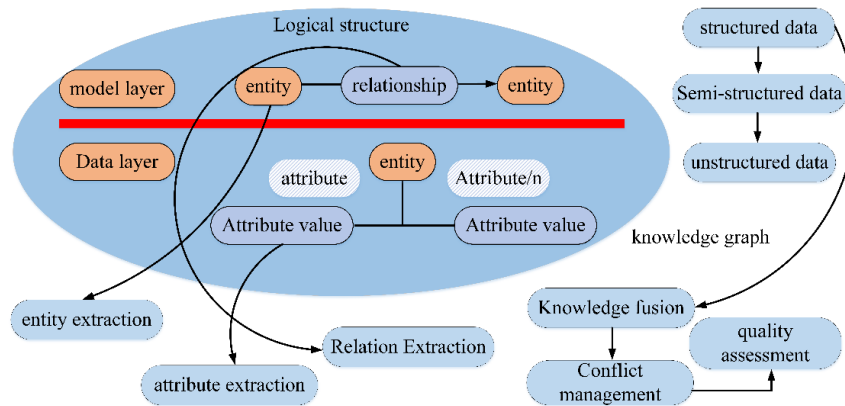


Figure 2: Knowledge of graph logic structure and key technical framework.

As shown in Figure 2, the logical architecture of the knowledge graph includes the relationship between knowledge entities and attributes. By explaining the hierarchical changes of the two in abstract concepts, further in-depth research can be defined. Its key technical architecture also includes the steps of data acquisition and the final process of knowledge fusion. The construction of knowledge graph models can be done from top to bottom or from bottom to top, continuously adding sample information from tourism resources to the database and selecting key content through auditing. In order to provide a higher quality source of data knowledge and facilitate users' understanding of the relevant knowledge of tourism souvenir design, we have designed an automated question-and-answer system to complete knowledge content management. Users can automatically match their relevant knowledge content and complete automated information extraction by inputting relevant semantics and search terms into the system. At the same time, in building a keyword segmentation framework, we also improved the accuracy of knowledge graph mapping. Using deep learning neural network algorithms, the semantic information in the knowledge graph is re-optimized, and the similarity of knowledge management content is ranked. Calculating the quantitative value of similarity in comparing multiple words and texts can help users quickly obtain demand information. The calculation formula for the deep learning training model involved is as follows:

$$Attention(K, L, V) = \text{soft max}\left(\frac{KL^T}{\sqrt{d_k}}\right)V \quad (1)$$

$$head_i = Attention(LW_i^q, KW_i^q, VW_i^q) \quad (2)$$

$$MultiHead(L, K, V) = Concat(head_1, head_2, \dots, head_h)W^q \quad (3)$$

In the formula, (K, L, V) representing a vector matrix d_k represents the numerical dimension of a vector. Adjust the weight of each keyword to express the interrelationships between words. According to the positional changes of different vector combinations, a training model is formed by

randomly stacking them. This neural network training model consists of front and back terms, including a memory layer, an output layer, and a forgetting layer. The forgetting layer selects the information to be forgotten based on the previous training state and the current input search term, and the calculation formula is as follows:

$$f_t = o(W_f[h_{t-1}, x_t] + b_f) \quad (4)$$

The memory layer determines the content to be stored based on the data-hiding process and input words and represents the formula of temporary units as follows:

$$i_t = o(W[h_{t-1}, x_t] + b_i) \quad (5)$$

$$\tilde{C}_t = \tanh(W_c[h_{t-1}, x_t] + b_c) \quad (6)$$

Finally, with the support of the calculation results, the current memory state is restored, and the training results are output using the formula:

$$C_t = f * C_{t-1} + i_t * W_c[h_{t-1}, x_t] \quad (7)$$

$$O_t = u_t(W_o[h_{t-1}, x_t] + b_o) \quad (8)$$

$$h_t = O * \tanh(C_t) \quad (9)$$

The formula O_t represents the numerical value of the output, h_t forgotten data that represents the current memory state. After obtaining the set of related words after training, calculate the similar semantics in the set for sorting and scoring. The sorting formula is as follows:

$$Score(e, c) = w_1 * \frac{|A_o \cap B_o|}{|B_o|} \quad (10)$$

$$Score(e, c)_T = (w_1, w_2, w_3) * \frac{|A_s \cap B_s|}{|B_s|} \quad (11)$$

In the formula, $Score(e, c)$ The sorting sequence number representing the entity is used to improve the accuracy of content retrieval in the knowledge management system based on the selection of synonym weights. Next, calculate the similarity value of the enhanced model semantics in this article:

$$A, B = BERT(sen_1, sen_2) \quad (12)$$

$$Similarity(sen_1) = \frac{\sum_{i=1}^n A_i B_i}{\sqrt{\sum_{i=1}^n A_i^2}} \quad (13)$$

$$Similarity(sen_2) = \frac{\sum_{i=2}^n A_i B_i}{\sqrt{\sum_{i=2}^n B_i^2}} \quad (14)$$

The vector samples represent the encoded-word order set of the training model, and after sorting out the entity relationships, calculate the feature values:

$$S_n(q, c_i) = \max \{sim(q, n_0), \dots, sim(q, n_z)\} \quad (15)$$

In the formula, $S_n(q, c_i)$ the feature coefficients represent the relevant semantic relationships. Subsequently, we will organize the frequent keywords extracted from the knowledge graph in tourism souvenir design and use the graph visualization to display them.

3.2 Practical Application Research on Tourism Souvenir Design Based on CAD Computer-Aided Design Technology

Tourism souvenirs are the most important component of tourism resource development, which can include local cultural products, snacks, accessories, clothing, etc. The existence of tourist souvenirs can help people improve their spiritual and material experience needs during the travel process while leaving behind tangible products that can be recalled during the travel process. With the increasing diversity of groups faced by the tourism industry, tourism souvenirs not only need to be designed innovatively in terms of content but also bring more novel experiences to customers in terms of visual and practical applications in the modern demand of keeping up with the times. Designing tourism souvenirs well is an important means to reflect the local cultural value of tourism and improve the economic income of the tourism industry. Tourist souvenirs are a business card that directly affects tourists in tourist attractions, allowing the public to better identify with the core content of local tourism culture. It can condense the culture and customs of tourist areas into practical materials, and complete the dissemination and promotion of tourism culture. The impact of different design styles of souvenirs on the visual impact of the public is also different. We find that graphic creativity and colour expression in visual elements are very important. Randomly survey 1000 tourists to explore their preferences for the design styles of two types of souvenirs, as shown in Figure 3:

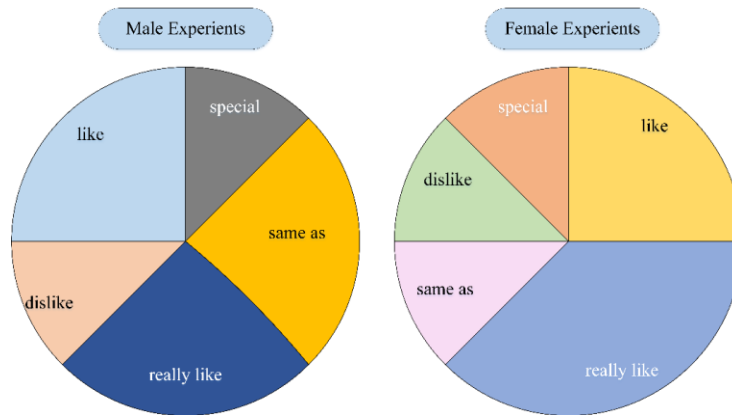


Figure 3: Comparison of favorite design styles for two kinds of souvenirs.

From Figure 3, it can be seen that in our data analysis, the participants were divided into male and female groups, and the two different groups had a higher degree of love for graphic creativity. From this, it can be seen that graphic design, as one of the important elements of expression, plays an important role in the process of conveying information through tourism souvenirs. The design changes of graphics are also more easily captured by people. The brain's ability to accept graphics has shifted from flat patterns to three-dimensional shapes, and this speed far exceeds other information. CAD technology, as a visual design software, can assist designers in optimizing graphic design schemes into three-dimensional immersive works. In addition to presenting points, lines, and surfaces simultaneously, it is also more convenient for mathematical modelling and rendering. We use CAD computer-aided design technology to update the design pattern of tourist souvenirs, improving the practical application effect of souvenirs from multiple aspects such as pattern design data processing, image colouring, pixel detail adjustment, etc. The souvenir design process and case details generated with CAD technology assistance are shown in Figure 4.

As shown in Figure 4, the design work incorporates automated matching of CAD systems in image and graphic editing, process data input, and material selection. In addition, multiple applications of the same colour scheme are compared in the design colour separation.

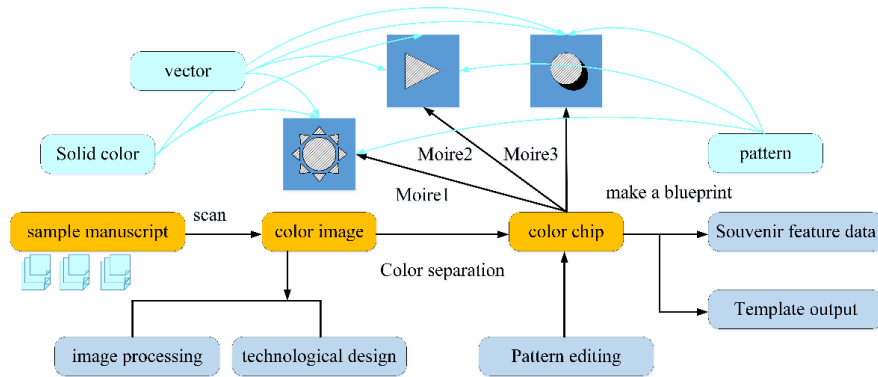


Figure 4: CAD technology souvenir design process.

The system design process includes machine interaction information classification operations to maximize the resolution of design information loss and incomplete defects. The combination of colours, saturation, brightness, and tone can all prove that the presentation of colours is three-dimensional in nature. When choosing tourist souvenirs, tourists must purchase them according to the impact of visual recognition and personal preference. Therefore, we have focused on the pixel and design rendering effects in the CAD-assisted souvenir design system by correcting data and automatically generating design images that are rich in changes and meet the needs of 3D graphics, and finally combining 3D printing technology to generate the final product quickly.

4 ANALYSIS OF RESEARCH RESULTS ON KNOWLEDGE MANAGEMENT AND APPLICATION OF TOURISM SOUVENIR DESIGN BASED ON KNOWLEDGE GRAPH AND CAD TECHNOLOGY

4.1 Research Results Analysis of Knowledge Management Question and Answer System for Tourism Souvenir Design Based on Knowledge Graph And Deep Learning

The knowledge management of tourism souvenir design is essentially a process of integrating special resources, and the control and storage of knowledge are relatively difficult. There are also explicit and implicit distinctions in nature. Although implicit knowledge resources are included in tourism resources, they are often easily overlooked, making them difficult to classify and survey. In the construction of knowledge graphs, we only focus on the key explicit content in tourism souvenir design knowledge in order to improve the stability of the graph structure. We have built a knowledge base for tourism souvenirs, classifying, processing, annotating, and refining the keywords involved in souvenirs. Collect and identify vocabulary related to tourism souvenirs in the large database and quickly classify the knowledge content. In the process of forming a knowledge graph, it was found that the directions related to tourism souvenir design include food, clothing, and cultural connotations. The number of characteristic point words contained in the three elements is compared, as shown in Figure 5.

From Figure 5, it can be seen that a set of data sets related to tourism souvenirs was randomly selected, with a higher number of words related to culture and the second highest number of words related to snacks and food. It can be seen that most tourists tend to pay more attention to these culturally distinctive products when paying attention to tourist souvenirs. In order to visualize knowledge management, we collected initial data from the literature resource library as a data source to visually analyze and display knowledge related to tourism souvenir design. The statistics of keyword frequency can be viewed in Figure 6. As shown in Figure 6, in the knowledge graph network, we change the node type from data to keyword presentation. The lexical co-occurrence analysis atlas obtained includes tourism, Xizang, Xinjiang, region, nationality, tradition, snacks, snack packaging, characteristic drinks, culture, clothing, traditional clothing, cultural and creative products, etc.

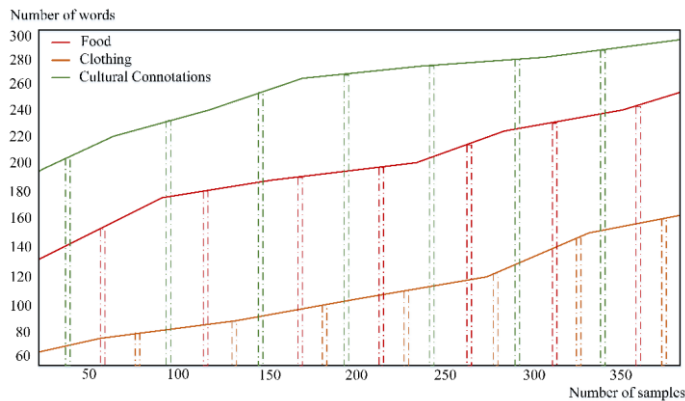


Figure 5: Comparison of the number of feature point words contained in three elements.

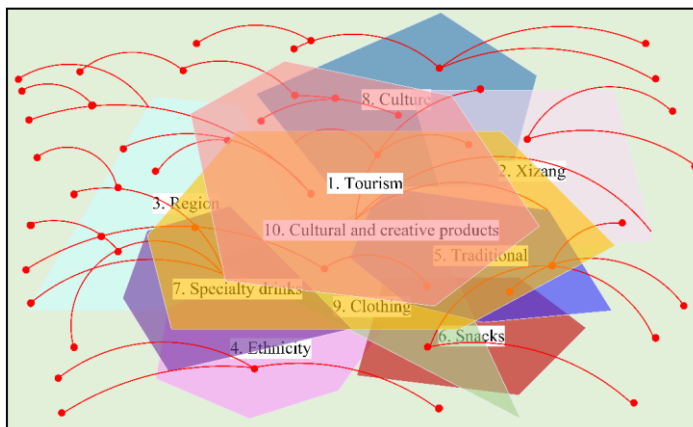


Figure 6: Visualization analysis and display of knowledge graph.

The greater the degree of central visualization, the higher the frequency of appearance of this keyword node, which also accounts for a larger proportion of knowledge information in tourism souvenir design. After analyzing the overall clustering function, we also found that there is a correlation between each key vocabulary. From this, it can be seen that based on the knowledge graph presented in the tourism souvenir design knowledge management visualization cloud, we can explore the main factors affecting the changes in the design style of tourism souvenirs and provide reliable data assistance for subsequent product design.

4.2 Results Analysis of Practical Application Research on Tourism Souvenir Design Based on CAD Computer-Aided Design Technology

For most tourists, purchasing regional tourism souvenirs has become a material and spiritual pursuit. Tourism souvenirs themselves also contain special design value and commemorative significance. Souvenirs can not only enhance the consumption economy of tourist areas but also spread local culture and historical customs and improve the overall quality development of the tourism industry. We have found that there are various types of souvenir designs in the knowledge management of tourism souvenir design. This includes cultural and creative postcards, mascot dolls, cultural handicrafts, ethnic costumes, and local cuisine for tourism. In our research, we only optimized the

overall design style of tourism souvenirs from the perspective of CAD computer-aided design, transitioning from traditional graphic design ideas to three-dimensional data modeling design and applying it to all souvenir ranges. In the design process, CAD technology has adjusted the pattern composition structure of tourist souvenirs, combining the needs of modern people in terms of layout and colour selection to form a more distinctive souvenir style. In order to verify the effectiveness of the research application, we also calculated the satisfaction of tourists after purchasing CAD technology-designed products and ordinary souvenirs in different tourist areas, as shown in Figure 7:

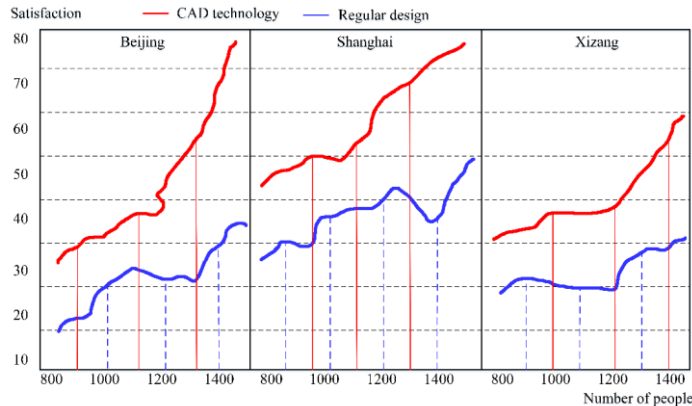


Figure 7: Comparison of satisfaction between CAD technology design and ordinary souvenirs.

It can be seen from Figure 7 that after the sample tourists bought CAD-designed souvenirs and ordinary souvenirs in Beijing, Shanghai, and Xizang, the satisfaction of CAD-designed products was significantly higher than that of ordinary souvenirs. Therefore, CAD technology combines the design style of tourism souvenirs with data-driven information, which is more in line with the public's preferences. This also reflects that people's consumption demand for tourism resources is more inclined towards personalization and modernization. We applied the knowledge management analysis results generated from the above knowledge graph to the computer-aided design system and found that tourism souvenirs produced based on the trend of mass tourism resources presented by knowledge management are more quickly sold in the actual process. By utilizing knowledge-based data information to adjust the production direction of tourism souvenirs, the revenue of the tourism industry can be increased through innovative research and development strategies and product selection styles.

5 CONCLUSIONS

Tourist souvenirs are one of the main means to present the cultural characteristics and folk customs of tourist areas. They can not only meet the material needs of tourists for tourist areas but also promote knowledge learning at the spiritual level. Strengthening the management of tourism souvenir design knowledge can better promote the overall quality development of the tourism industry, integrate tourism resources, and improve economic benefits. In this study, knowledge graphs and CAD computer-aided design technology are used to construct a knowledge management system for tourism souvenir design, and its practical application effects are explored. Firstly, use knowledge spectrum software to analyze the changes in research hotspots related to tourism souvenirs, and calculate the development trend of research literature in this field in different countries. Combining keyword feature analysis to form a knowledge graph visualization model, utilizing deep learning to construct semantic networks and knowledge resource management frameworks. Secondly, CAD computer-aided technology is used to update the design of tourist

souvenirs, transforming the graphic design concept into a three-dimensional and intuitive design style. Incorporate the knowledge management content of tourism souvenir design presented in the knowledge graph into the CAD automatic generation system to complete the overall design and creation of the product quickly. Finally, analyze the practical application results of knowledge graph and CAD technology in tourism souvenir design knowledge management. Research has shown that knowledge graphs and CAD technology help tourism souvenir design knowledge management be presented to designers in a visual form, which not only improves the design quality of tourism souvenirs but also points out the direction for the development of the tourism industry.

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