Application of Computer Vision and Machine Learning Technology in the Development of Museum Cultural and Creative Products

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Abstract

The development of digital technology and multimedia technology has been widely used in exhibition, publicity, education and other fields. The purpose of this paper is to study museum cultural and creative products based on computer vision and machine learning technology. Start with the importance of computer technology in the development of museums such as Anhui Province. Research information about museum portals, virtual museums, and touchscreen navigation systems in museum applications. The application of MCACP technology is studied by using literature research method, analytic hierarchy process and field investigation method, and an analytic hierarchy process is established to solve the model, and the application of computer vision and machine learning technology in the development of museum cultural and creative products is evaluated, using historical data Model revisions and assessments of the state of the art in computer vision and machine learning. The experimental results of this paper show that the AHP process improves the efficiency of museum cultural and creative product development by 43%. Finally, through the salience of the development and design of cultural and creative products (CCP) in museums, it systematically explains the influence of computer vision and learning technology on the development of museums. It has practical significance for the development of museum cultural and creative products.

Keywords: *Computer Vision, Machine Learning Technology, Museum, Analytic Hierarchy Process*

1. INTRODUCTION

1.1. Background and Significance

The museum has extensive and profound cultural resources, but if these cultural resources are only preserved and passed on in a static display, it will eventually be just a cold cultural relic lying in the museum, and the distance from the real society will be farther and farther [2]. Only when culture and creativity, classics and fashion are integrated, such cultural heritage can be spread vividly and powerfully [8]. With the rapid advancement of machine learning and in-depth learning technology, there is no doubt that computer vision has been one of the fastest growing areas of artificial intelligence in recent years [9]. All areas of society progress over time and museums are no exception. Among them, behavior changes its structure [3]. This is the basic method for obtaining CI [7]. At the same time, the computer is constantly evolving. The computer perspective is based on a computer algorithm to automatically detect the image area [1][10]. It originated in artificial intelligence and cognitive neuroscience in the 1960s.

1.2. Related Work

Liu Xiaoyu provides a method that can evaluate participatory stakeholder innovation in a complex stakeholder environment to solve essential problems [5]. Based on the principle of common value creation, he proposed a research framework that illustrates the product development process. In this process, stakeholders integrate their resources and capabilities to develop an innovative analytic hierarchy process [4][6]. The case of computer science and machine learning and the use of machine learning technology in the development of CCP in museums reflects this fact. But the data results are not very accurate as the message collection process is very complicated.

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1.3. Main Content

The innovation of this article lies in the literature research method, the analytical hierarchy process, and field research and investigation. Based on the development and research of CCP in museums behind computer vision and machine learning, research its application in the development of CCP in museums through computer vision and machine learning technology. Establish a calculation method that combines the process of analytical hierarchy and the method of researching literature to apply research guidance to apply computer vision and machine learning to the development of CCP in museums.

2. APPLICATION METHODS OF COMPUTER VISION AND MACHINE LEARNING TECHNOLOGY MUSEUM

2.1. Literature Research Method

Prior to the creation of this article, various written materials related to the development of CCP of the Beijing Museum and Palace Museum were collected, including monographs, magazine articles, newspapers, newspaper articles, and official materials.And summarize these materials to facilitate literature research and explore relevant knowledge. A way to understand scientific literature information through scientific research. In the process of comparing theories and cases related to museum culture and the development of the creative product, the author needs a lot of data and useful literature.

In the process of research and writing, according to the designated research materials, with the help of China's Wan fang database and CNKI database, such as Vi pu and SDOS full-text database, many books, master's and doctoral degrees. A large number of theoretical discoveries about the culture and landscape of the coastal area provide theoretical support for the dissertation and provide a reference to a detailed study of the subject.The study of theory and related literature is an important learning method. Read and study national literature, understand and summarize newspapers, news, magazines and related theories.

2.2. AHP

Analytic hierarchy Process (AHP) is a multi-objective decision-making method, which combines qualitative and quantitative analysis systems. This kind of technology decomposes a relatively complex matter at multiple levels, and the relevant sub-factors are decomposed into several levels from top to bottom according to the classification of different attributes, and then the decision is made. Analytic hierarchy process needs to establish the hierarchy model, and then create the weight evaluation method, and then get the optimal solution. This technology has the characteristics of system and simplicity, and is widely used in the evaluation, decision-making, prediction, planning and other fields of safety science, society and economy.

In the process of analyzing social, economic and scientific problems, we often encounter many interrelated and restrictive factors, which together constitute a complex system lacking quantitative data. AHP provides a new modeling method for the decision making and ranking of such problems, which is suitable for the problems that are difficult to be completely quantitatively analyzed. It compares risks in projects by layers, calculates and analyzes them through mathematical models, manages potential risks according to the results, and provides corresponding solutions.

Normalize the functional range required to classify the value of each evaluation factor (ie, weight). The test should use the following formula:

$$Q_A = \gamma_{\max} A \tag{1}$$

The random sequence relationship of the scoring matrix is represented by EI; the general sequence index of the estimation matrix is represented by M:

$$EI = (\gamma_{\max} - M)/(M - 1) \tag{2}$$

AHP can be used by individuals who need to make direct decisions, when team members are dealing with complex problems, especially those that involve high stakes in human perception and judgment. It has a unique advantage especially when the elements requiring decisions are difficult to quantify or compare, or when communication between team members is hampered because of differences in expertise, terminology, or opinions. The process of this decision-making method is very simple and practical. It does not pay too much attention to advanced mathematical theory and logical reasoning, but combines qualitative and quantitative methods to help team members to mathematize and systematize their thinking process. At the same time, the complex factors with different objectives, different standards and difficult to quantify in the project are transformed into problems with single objectives and multiple levels.

2.3. Field Research

Use comparative analysis to study the application of computer methods and machine learning technology in actual research in the museum culture, draw on excellent results domestic and foreign research and formulate comprehensive museum culture and creative product development plans. Investigate the regional cultural characteristics of different periods and regions

and study the theory of creating museum cultural creative products based on modern development. Field research is the continuous elaboration and supplementation of theoretical research, and it can be proven to be correct and incorrect in theoretical research. In the analysis of current cases, new understandings and new ideas about research topics will also be formed, making theoretical research a reality. More complete and complete and thus has a deeper understanding of the theory.classify applications computer vision machine learning technologies in museum culture and creative product development, and demonstrate a combination Museum culture and the need for creative product development make the dissertation more practical and instructive. This document provides a solid guarantee of performance, addresses design issues, combines local cultural roots and integrates traditional cultural products and materials.

3. APPLICATION EXPERIMENT OF CVAM LEARNING TECHNOLOGY IN MUSEUM CULTURAL AND CREATIVE PRODUCT DEVELOPMENT

3.1. Experimental Design

This is the heart of artificial intelligence and the ultimate way to make computers smarter.In order to realize the functions of computer vision, two technical methods can be used, namely the bionic method and the engineering method.The general approach to engineering techniques is to treat the human visual system like a black box and realize that it only focuses on what kind of output the visual system will provide for the input. Both methods are theoretically available, but the difficulty lies in the fact that the output of the human visual system corresponding to a given input is not directly measurable. And since human intellectual activity is the result of a combination of multifunctional systems, even if input and output pairs are obtained, it is difficult to determine that this is the response of the current input visual stimulus, rather than the result of conditions historical.

3.2 Collecting Data on Consumer Satisfaction with Museum CCP

Computer vision research has two meanings. It requires an understanding of the requirements of artificial intelligence applications (i.e., a computer’s manual vision system). Therefore, the museum uses to understand consumer preferences for purchasing power.

To this end, a survey was conducted on consumer satisfaction in most museums. They were fully satisfied with the product requirements including price, reviews, quality assurance, after sales service and personalized service. More than half of them were satisfied or completely satisfied. Satisfaction; includes better performance, accessibility and rich cultural heritage, usability, performance levels and other features. The rating high, and buyer satisfaction is less than 15%, and they are completely satisfied. To use the correct questionnaire, use SPSS statistical software to organize the questionnaire data, make the necessary corrections and exceptions for other areas, and use the average exchange method to process recommendation data and obtain it for consumers before the experiment creates value expectations, there is a difference between the two. The satisfaction rate has been revised and the data are presented in Table 1:

Table 1. Data table of consumer satisfaction with museum CCP

Evaluation item	Before buying (%)	Actual experience (%)	Difference value (%)	Satisfaction index (%)
After-sales service	78.71	84.89	85.53	91.59
Product quality	61.32	96.80	84.69	86.64
Customer return rate	65.47	80.75	97.94	94.19

It can be clearly seen from Table 1 that dissatisfaction and high dissatisfaction make up a large part of after-sales service, product quality and customer return time. In the after-sales service and product quality, after-sales service refers to the service quality control with problems to consumer aftermath. Product quality refers quality that consumers buy, customer's return rate. It refers to customers returning to consumption to from museums. The more repurchases, the higher the customer's rate. More than 59% of the customers are satisfied and very satisfied with the service after the sale and the quality of the product, which recognized by the assistive technology by many people. In the same situation, the reflected error shows a certain trend. To make the relationship between the three clearer, the data analysis of Table 1 is performed, and the analysis results are shown in Figure 1:

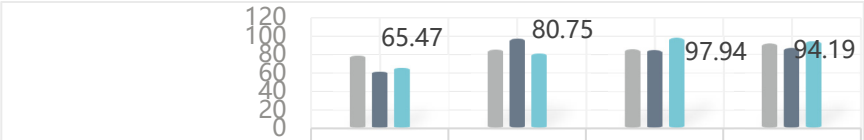

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Figure 1. Data graph of consumer satisfaction with museum

The data in Figure 1 shows that customers did not have high expectations for the product before they experienced the product, culture and creative museum. However, after customers bought cultural and innovative products, their satisfaction increased rapidly. From this it can be concluded that with the help of vision technology, innovative products, culture is very satisfied.

4 DEVELOPMENT AND DESIGN STRATEGY OF MUSEUM CCP

4.1. Significance Analysis of Museum Cultural Creative Product Development

Most of the museums in our country are mainly reproductions. When designing, there is an integration of the museum’s unique resources and a lack of research on visitor purchasing needs. This has led to a lack of most and created museum. The characteristics do not meet real needs of visitors. Prior to the creation of literature and the distribution of products, the museum's special resources and scientific research are the basis for further development and design in consumer science. After integrating the cultural resources available in the museum, studying the needs of the customers and receiving a large amount of information, we analyzed the data and found that the needs of the customers can provide a clear direction for further development and design of the products.

At an early stage of design, large-scale questionnaire survey methods should be used to collect all types of available data. These data museums provide useful information.This research method requires a very short time and the standardization of the questionnaire can be controlled to some extent. Query research can not only obtain large amounts of data, but also avoid the shortcomings of other research methods, and increase data accuracy. Higher, so it has a higher reference value.

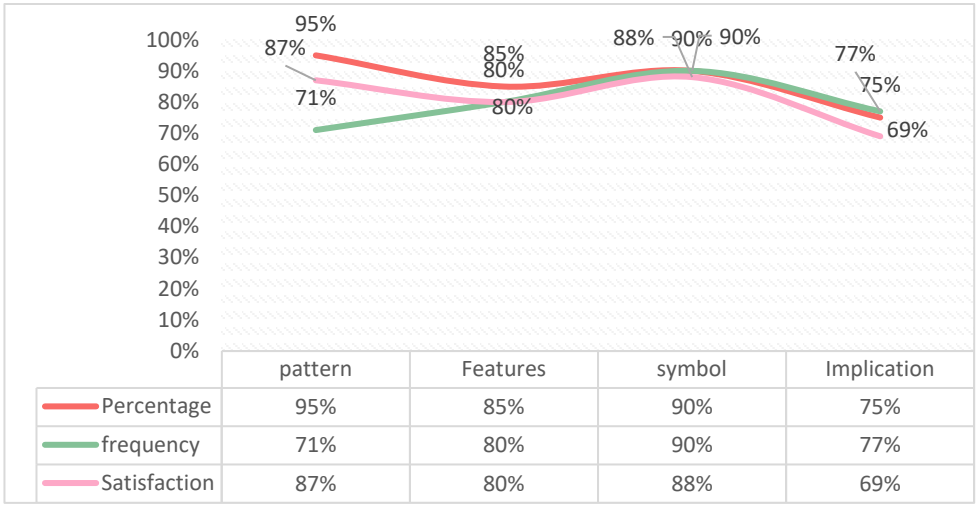
4.2. Development Museum Products

This article examines the data developed by the Palace Museum in a particular area. Among them, this article focuses on the model, function, symbol and meaning of CCP. Gather importance model, function, symbol meaning in development through the process of analytical hierarchy, as well as the frequency of use and public satisfaction. The results of survey are shown in Table 2:

Table 2. museum CCP

Design level	pattern	Features	symbol	Implication
Percentage	95%	85%	90%	75%
frequency	71%	80%	90%	77%
Satisfaction	87%	80%	88%	79%

It can be seen in Table 2 that the pattern, function, symbol, and meaning are points in design. Overall, symbolic significance , with average value being 89.3%, followed by patterns, with an average value of 84.33%. As the so-called pattern gives people the first feeling, the meaning is endless. Then came the function and the symbol although the average values of the function and the symbols were 81.67% and 73.67% respectively. In order to be able to see the relationship between the four more clearly, we analyzed the data in Table 2, and the analysis results are shown in Figure 2:



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frequency	71%	80%	90%	77%
Satisfaction	87%	80%	88%	69%

Figure 2. Development and design drawing of museum CCP

Figure 2 high image is based on a unique product system and product image. These two points can be reflected through the pattern, function, symbol and meaning of the picture. This is because the satisfaction of consumers with CCP has reached a high level. Therefore, a high degree of image recognition for CCP is also a starting point for promoting museum brands. The use of general images will help the public recognize the deep impression of the museum public and will increase the popularity of the museum among the public. The popularity and presence in your mind can attract more visitors.

5. CONCLUSIONS

Although this article has found some research findings in the field of literature research, systematic review and regional research and analysis, there are still many shortcomings. Computer science and machine learning are so in-depth that it is worth studying the methods of researching product development. There are still many steps in the research process that cannot be covered because of the space and capacity of the individual. Moreover, the actual impact of an improved algorithm application can be compared to a traditional model only from the level of theory and simulation.

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