

Application of Artificial Intelligence in Tourism Cultural Heritage and Its Impact on Cultural Cognition

Suping Zhang¹, 

¹ Business School, Zhengzhou Professional Technical Institute of Electronic & Information, Zhengzhou, Henan, 451450, China

ABSTRACT

The integration of artificial intelligence and tourism culture industry requires that it is consumer-centered, and everything is based on the fundamental starting point of improving service quality and providing better tourism products. The article explores the impact of AI application on the cultural cognition level of tourists based on the role mechanism of AI and innovative inheritance methods in tourism culture inheritance. The level of tourists' cultural cognition is quantified through the degree of understanding of tourism culture, the willingness to accept and disseminate tourism culture, the degree of preference and internalization of tourism culture, and the willingness to practice tourism culture, and the relevant research data are obtained through questionnaires. Then the benchmark regression model was constructed by combining the multiple linear regression model with the level of cultural cognition of tourists and the level of AI application as the explanatory variables and core explanatory variables. For every 1 percentage point increase in the level of AI application in tourism cultural heritage, the level of cultural cognition of tourists will increase by 0.419 percentage points. The application of artificial intelligence in tourism culture inheritance can expand the way of tourism culture inheritance and enhance the cultural cognition level of tourists through intelligent transmittable knowledge base.

Keywords: artificial intelligence; multiple linear regression; tourism cultural heritage; cultural cognition

1. Introduction

The term "tourism culture" has received a lot of exposure today. In terms of its connotation, generally speaking, tourism culture is the sum of material and spiritual civilization related to tourism created by human beings. Its extension is very wide, involving literature, art, philosophy, religion, folklore, architecture, ecology, horticulture, public relations and other disciplines [1-2]. The "sum theory" is generally used to define "tourism culture", but the characteristics are not distinct [3]. There is also the

 Corresponding author.

E-mail address: icecream20241212@163.com (S. Zhang).

Received 07 January 2024; Revised 02 August 2024; Accepted 21 November 2024; Published Online 16 April 2025.

DOI: [10.61091/jcmcc127b-001](https://doi.org/10.61091/jcmcc127b-001)

© 2025 The Author(s). Published by Combinatorial Press. This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>).

“tourism nation” theory, which considers tourism culture to be “the culture of an ethnic group or a country that has been manifested in the course of tourism practices over generations”. This is defined from the national specificity of tourism culture. Tourism culture is, in the final analysis, a cultural form suitable for its own development, a tourism subject culture [4-5]. Tourism culture is based on tourism objects (tourism resources composed of natural landscape, geological features, mountains and rivers, etc.), and tourism subjects (tourists) are the creators and perceivers of tourism culture. In the “collision” that is, between the tourism subject and the object there is an indispensable bridge, that is, the tourism media, connecting the tourism subject and the object, is the discovery and dissemination of tourism culture. Even better tourism landscape, no one to find, publicize, protect, can not really become a tourism resource (tourism object) [6-8]. Therefore, the role of media is irreplaceable. Here, media not only refers to mass communication media such as newspaper, television and network, but also includes people who are engaged in tourism promotion and singing the praises of tourism, such as poets, writers, journalists, singers, folklore scholars and so on [9-10]. In this way, tourism subject, tourism object and tourism media form a complete tourism culture system. In terms of basic composition, tourism as an industry also involves tourism management, service groups and practitioners (tourism bureaus, travel agencies, tour guides, etc.) [11-13].

In the field of tourism, unique cultural and creative products, not only can enhance the brand image of the scenic spot, but also to some extent can expand the scope of the scenic spot's dissemination [14]. How to reflect cultural innovation and creativity in design products, and how to effectively convey cultural connotations, visual, experiential, digital technology cultural awareness is converted into a presentation of thinking with semantic meaning, which should be done in the cultural and styling form of a strong inheritance, so that people can feel the beauty of the experience of the mood, projecting human emotions, giving the product a symbolic form to express the product in the use of the context of the display of the psychological nature of the psychological nature of the situation, social and cultural connotations in the use of the product, and at the same time to keep up with the pace of the development of science and technology of the times [15-18].

“Digital technology is reconfiguring our reality and it has become a powerful force that largely controls and determines society, economy, culture and its future development.” The appearance of smart products in tourism has achieved the perfect integration of tradition and modernity, which is a new form of presentation of cultural communication [19-20]. It will promote the cultural development of the city, promote people's understanding of science and technology culture, and in addition to the material social benefits, the most important thing is to drive the social benefits of the development of a new culture, to enhance the quality, taste and strong cultural nature [21-22].

The rapid development of artificial intelligence technology on the transformation and upgrading of tourism culture heritage and the role of high-quality development has become increasingly prominent, for tourism culture heritage digital intelligence transformation is imperative. This paper takes tourism culture inheritance as the entry point, analyzes the role mechanism of artificial intelligence technology empowering tourism culture inheritance, and innovates tourism culture inheritance methods based on artificial intelligence technology. Then set up reasonable indicators to quantify the level of cultural cognition of tourists, and selected some tourists in tourist attractions in Province T as the research object, and obtained the research data through questionnaires. The specific influence of AI application on the level of cultural cognition in tourism cultural inheritance is explored through the multiple linear regression model, and a new path of tourism cultural inheritance under the application of AI technology is proposed.

2. Artificial Intelligence Technology Enabling Tourism Cultural Inheritance

The rapid development of China's tourism industry has become a new point of economic growth. As a comprehensive industry, tourism can bring direct economic benefits to the government and the people, and at the same time, tourism also plays an important role in economic work and drives the

development of other related industries. The development of tourism makes the tourism culture inheritance new vitality, and the application of artificial intelligence technology has changed the path and way of tourism culture inheritance drastically, further expanding the effect of tourism culture inheritance.

2.1. Definition of relevant concepts

2.1.1. Cultural heritage of tourism. Tourism culture is a new and specific form of culture, a vibrant and inclusive type of culture. Although the concept of tourism culture inevitably includes components of tourism and culture, it is by no means a simple combination of “tourism + culture”. Tourism culture is a kind of abstract and systematic result formed by the interaction of three basic elements in tourism activities, such as tourism subject, tourism object and tourism medium, and it is a unique cultural form based on tourism, which is different from other kinds of culture [23].

Tourism culture must have a positive, healthy, upward cultural qualities, is a positive role in promoting human development of cultural categories, bad customs, tourism habits and so on must be abandoned and need to improve the tourism culture. The purpose of tourism culture inheritance is to better retain the cultural elements in the process of tourism destinations, so that the audience can realize the cultural infiltration in the process of tourism, and promote the enhancement of the audience's knowledge of tourism culture, but also for the wide dissemination of the culture of tourism destinations to lay the foundation.

2.1.2. Artificial intelligence technologies. Artificial Intelligence (AI) is a broad concept aimed at allowing machines to think, learn and deal with problems like humans, and AI technology is the specific method used to achieve this. Artificial intelligence technology is the science and technology that allows machines to simulate human perception, cognition, reasoning and decision-making processes through human means so that they can achieve this purpose of autonomous learning, autonomous adaptation and autonomous innovation. Artificial intelligence technology is categorized into five main types according to the type of function, which are computer vision, speech recognition, natural language processing, machine learning and big data. These functions are developed based on the extension of human senses and ways of thinking, and are widely used in human daily life [24].

Artificial Intelligence technology is a technical means to build computer systems through the principles of cybernetics and mathematical models to achieve the transfer of information, so as to simulate human intelligent behaviors and thinking processes, as well as perception and understanding of the environment, and to achieve behaviors such as autonomy, intelligence, and flexibility. The ultimate goal of this technology is to equip machines with human-like intelligence, i.e., with human-like intelligence and thinking ability. It is a specific method that allows a machine or computer system to think, learn, make decisions and perform tasks like a human being, and it is a technology that allows a machine or computer system to have human-like thinking ability, reasoning ability, learning ability and perception and other intelligent abilities. The original intention of the research is to improve the machine so that it has human-like intelligence, and its essence is to make the machine better serve human beings and human society.

2.1.3. Cultural perceptions. Culture is an organic synthesis containing multi-level and multi-faceted content, including all the material and spiritual wealth created and accumulated by human beings, with historical inheritance, specifically expressed in housing construction, labor products, social systems, religious beliefs, folk customs, traditional crafts, literature and drama, dance and art, values and so on. Cognition is the process of acquiring or processing information, including sensation, perception, memory, thinking, imagination and language. Cultural cognition, with the help of cognitive theory, is the cognitive process by which a person receives and processes cultural information, and

develops all activities around the cultural nature of the cognitive object, emphasizing cognition immersed in culture and cognition with culture as the main object [25].

Figure 1 shows the research process of cultural cognition theory. It is mainly the process of receiving and processing information about external things with the culture mastered by the cognitive subject as the intermediary, and completing the cognition of cognitive objects through cultural means, and then obtaining value-based awareness.

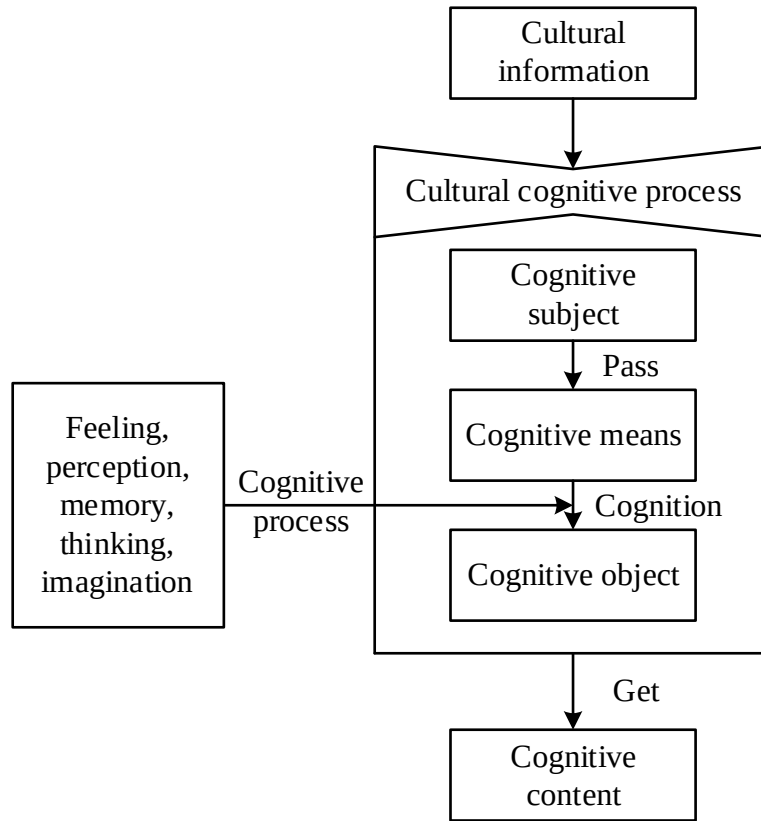


Fig. 1. The research process of cultural cognition theory

2.2. AI-enabled tourism cultural heritage

2.2.1. Mechanism of action analysis. Tourism culture is a valuable historical heritage of mankind, carrying rich historical memory and cultural genes. It is necessary to continuously strengthen the inheritance and utilization of tourism culture, so that it can be revitalized and blossom in the new era, and better meet the people's needs for a better life. However, the traditional way of protection and inheritance of tourism culture mainly relies on written records, physical collections and oral tradition, which has limitations such as incomplete information, difficult to reach and insufficient infectious power. With the arrival of the intelligent era, the static and single cultural heritage records and display methods can no longer meet the growing cultural needs of the public, and there is an urgent need to innovate the inheritance methods and realize the transformation and upgrading from informationization to intelligentization.

Figure 2 shows the elemental framework of artificial intelligence technology-enabled tourism cultural heritage. It is framed by operational logic intelligence, multi-directional strategic goals, and basic structural integration, and then realizes the sustainable inheritance and development of tourism culture. Traditional tourism culture intelligence mainly focuses on the collection, storage and display of information, however, with the development of artificial intelligence technology, tourism culture intelligence is experiencing intelligent evolution from static recording to dynamic reproduction. Through cross-modal semantic understanding and knowledge correlation, a comprehensive, three-dimensional and correlated knowledge base of tourism culture is formed. This not only enriches the

information dimension of tourism culture intelligence, but also builds up a semantic network among tourism culture elements, so that isolated tourism culture “fragments” can be understood and interpreted in a broader context.

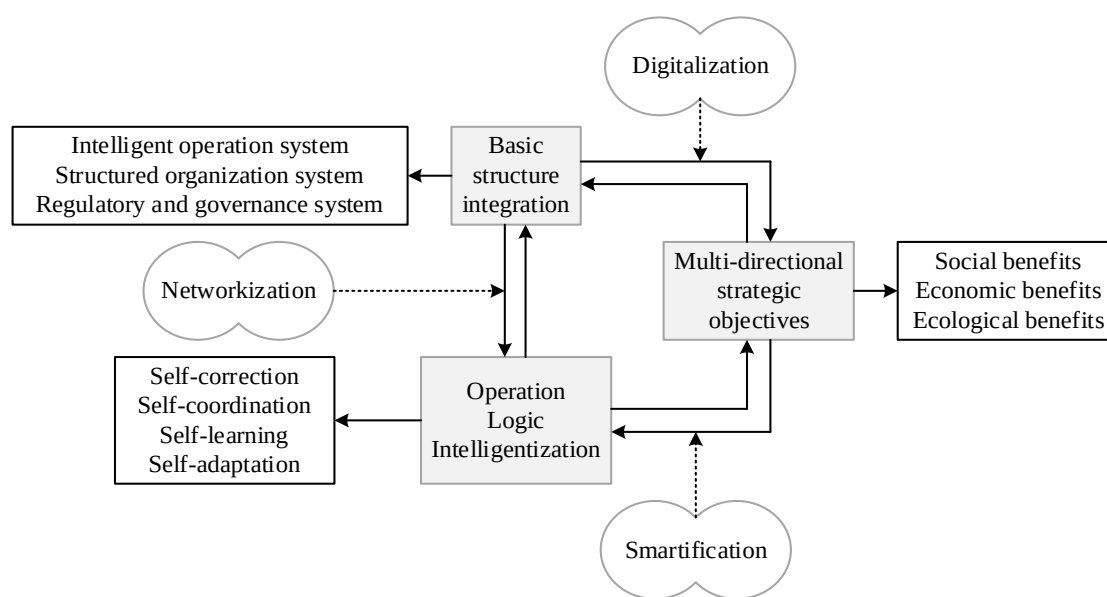


Fig. 2. The elements of the tourism culture inheritance of AI

Relying on artificial intelligence technology, the historical background, cultural connotation, value and significance of tourism culture can be comprehensively presented, and its rich period characteristics, regional characteristics, and development veins become clear and palpable. The complete context of tourism culture is reproduced in a digitalized, semanticized and related way, making its stored historical memory “alive”. The application of artificial intelligence technology in tourism culture inheritance brings new possibilities for innovating the narrative mode of tourism culture inheritance and improving the narrative effect of tourism culture inheritance.

2.2.2. Innovative approaches to transmission. Tourism culture is a treasure of human history and culture, carrying national memory, cultural genes and spiritual values. However, with the acceleration of economic globalization and the advancement of modernization, many tourism cultural items are facing the plight of disappearance or endangerment. The arrival of the digital intelligence era, especially the rise of artificial intelligence technology, has opened up a new path for the inheritance and protection of tourism culture. AI technology has injected new vitality into the innovation and inheritance of tourism culture with its powerful content generation ability, accurate data analysis ability and flexible interactivity.

1) Intelligent content production. Artificial intelligence technology can quickly and efficiently generate a large amount of digital content related to tourism culture, such as articles, pictures, videos and so on. These contents not only enrich the communication form of tourism culture, but also improve the efficiency and quality of communication.

2) Personalized and precise communication. Through big data analysis and user profiling technology, AI can accurately analyze users' interests and needs for tourism culture and realize the precise push of personalized content. This helps to improve the dissemination effect of tourism culture and attract more young people to pay attention to and participate in tourism culture inheritance.

3) Cross-discipline creation: AI technology can be combined with technology in other fields to create creative products with elements of tourism culture. AI can also promote the cross-discipline integration of tourism culture elements into modern homes, games and animation, film and television music, clothing and other industries, giving rise to a large number of new products and service forms.

Or the elements of tourism culture can be integrated into games, animation and other modern entertainment products to attract more attention from young people.

4) Multi-cultural dissemination: AI technology provides strong support for the revitalization and utilization of tourism culture, helps tourism culture to carry out multi-cultural dissemination globally, and realizes the online display and exchange of tourism culture by constructing virtual platforms such as tourism culture meta-universe, which breaks down the boundaries of regions and cultures, and allows more people to understand and identify with the value of tourism culture.

3. Impact of Artificial Intelligence Applications on Cultural Cognition

With the development of big data, artificial intelligence, cloud computing, 5G and other information technologies, digitalization and intelligence have become an important engine to promote the transformation and upgrading of tourism cultural heritage. The wide application of digital technology and artificial intelligence technology has not only changed the production and marketing methods of tourism culture, but also profoundly affected the level of cultural cognition of tourists, and pushed the tourism culture inheritance into a new stage of digitalization, networking and intelligent development. In order to further analyze the influence of artificial intelligence application on the cultural cognition level of tourists in tourism culture inheritance, this paper constructs a multiple regression model to study the degree of influence of artificial intelligence application.

3.1. Empirical research design

3.1.1. Mechanisms by which AI influences cultural cognition. The impact of AI application on cultural cognition in tourism culture inheritance is mainly reflected in the judgment of information value, respect for historical memory and cultural diversity. In terms of judging the value of information, traditional tourism culture has formed an important record of human history and culture through the organization and preservation of documents and other historical materials, which need to be professionally appraised and evaluated, and the preserved archives often contain profound cultural connotations and historical values.

The introduction of artificial intelligence technology makes the dissemination of tourism culture more intelligent and personalized. The AI system based on big data analysis and machine learning algorithms can accurately capture the travelers' tourism culture preferences and needs, and then better cultivate the cultural cognition of the travelers and help them understand the spiritual connotation of tourism culture, which fully meets the needs of the travelers in tourism culture. At the same time, AI technology also plays a pivotal role in tourism culture education, through the development of intelligent question and answer system, interactive games and other tools, AI system can teach tourism culture knowledge in a more vivid and interesting way, which greatly broadens the dissemination channels and audience scope of tourism culture while lowering the threshold of tourism culture dissemination and further improves the level of cultural cognition of tourists.

Based on the above analysis, this paper puts forward the following hypotheses:

H1: The application of artificial intelligence in tourism culture transmission has a positive effect on the level of cultural cognition.

3.1.2. Sample Selection and Data Sources. This study was conducted from March 1, 2024 to July 1, 2024 by selecting some tourists of tourist attractions in Province T as the research subjects and conducting questionnaire surveys under the condition of obtaining informed consent from the research subjects. 800 questionnaires were distributed using Questionnaire Star, and 782 valid questionnaires were retrieved, with an effective recovery rate of 97.75%. Among them, 369 cases (47.19%) were male and 413 cases (52.81%) were female.

Tourists' cultural cognition level is mainly from the degree of understanding of tourism culture, the willingness to accept and spread tourism culture, the degree of preference and internalization of tourism culture, and the willingness to practice tourism culture. By adopting a five-level Likert scale, with 1 to 5 indicating complete lack of conformity to complete lack of conformity, college students were asked to answer the questions according to their actual situation and the degree of conformity with the content of the question expression, and the level of cultural cognition in tourism cultural inheritance was rated from low to high.

The application of artificial intelligence in tourism cultural heritage is mainly through the collection of statistics on the frequency of the appearance of intelligent keywords related to the cultural heritage of tourism destinations on the Chinese Internet, and then obtain the relevant data on the application of artificial intelligence in tourism cultural heritage.

3.2. Variable definition and modeling

3.2.1. Multiple linear regression models:

1) Principle of multiple linear regression. Regression analysis is one of the most commonly used data analysis methods, which is based on the existing experimental results and previous experience to establish statistical models and study the correlation between variables, to establish an approximate expression (i.e., empirical formulas) of the relationship between the variables, and from this, to predict and control the corresponding variables. If there is more than one independent variable that is correlated with the dependent variable as judged by experience and knowledge, a multiple linear regression model should be considered using the least squares criterion [26].

Let there be m main factors (independent variables) affecting the dependent variable y , denoted as $x = (x_1, \dots, x_m)$. The multiple linear regression equation is established as:

$$y = \beta_0 + \beta_1 x_1 + \dots + \beta_n x_n + \varepsilon, \varepsilon \sim N(0, \delta^2) \quad (1)$$

where $\beta_0, \beta_1, \dots, \beta_m, \delta^2$ is an unknown parameter independent of $x_1, \dots, x_n$ and $\beta_0, \beta_1, \dots, \beta_m$ is the regression coefficient.

If n observations of variable y and independent variable $x_1, \dots, x_m$ are made simultaneously ($n > m$) resulting in n sets of observations, the regression equation is obtained using least squares estimation:

$$y = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \dots + \hat{\beta}_k x_m \quad (2)$$

2) Least squares parameter estimation for regression models. The purpose of multiple linear regression is to solve an optimal equation by which the dependent variable can be predicted with known information X about the independent variable of the data. In this optimal equation, "optimality" is reflected in the regression coefficients, which can generally be solved by using the sum of squares of the minimization errors [27]. If the sum of differences is used as the regression coefficient solution method, in the solution process, due to the existence of positive and negative values of the difference, there will be positive and negative cancel each other out, which will have a negative impact on the regression results, so the sum of squares of the error is generally used. Then:

$$Q(b) = \sum_{i=1}^m ((b_0 + b_1 x_{i1} + b_2 x_{i2} + \dots + b_n x_{in}) - y_i)^2 \quad (3)$$

where $Q(b)$ is the sum of the squares of the errors between the predicted and actual values. Then multiple linear regression is the process of solving for the value of the parameter vector b such that the value of Eq. $Q(b)$ is minimized. The process by which we minimize the $Q(b)$ function as a constraint to find the optimal solution to the parameter vector is the least squares algorithm.

Definition y'_i is used as the predicted value of the model corresponding to the actual result y_i , and its expression is:

$$\begin{cases} y'_i = b_0 + b_1 x_{i1} + b_2 x_{i2} + \cdots + b_n x_{in} \\ y' = [y'_1 \ y'_2 \ \cdots \ y'_m]^T = Xb \end{cases} \quad (4)$$

Then the sum of error squares can be written as:

$$h(b) = \sum_{i=1}^m (y'_i - y_i)^2 \quad (5)$$

where $h(b)$ is defined as being a function so that solving for the $Q(b)$ -minimum can be transformed into solving for the $h(b)$ -minimum. Then:

$$h(b) = \sum_{i=1}^m (y'_i - y_i)^2 = (y - y')^T (y - y') = (y - Xb)^T (y - Xb) \quad (6)$$

When y' is infinitely close to Y , then $h(b)$ is equal to a minimal value denoted as δ . At this point, its two sides are derived separately from the parameter b , and the final regular equation can be obtained by expanding it. Then:

$$h(b) = (y - Xb)^T (y - Xb) = \delta \quad (7)$$

$$2X^T (y - Xb) = 0 \quad (8)$$

$$b = (X^T X)^{-1} X^T y \quad (9)$$

Where X^T is the transpose matrix of matrix X and $(X^T X)^{-1}$ is the inverse matrix of $X^T X$. It is also known that this method must be applied in the presence of the inverse matrix of $X^T X$.

3) Significance test of regression equation. Consider the hypothesis testing problem, i.e:

$$H_0 : \beta_0 = \beta_1 = \cdots = \beta_p = 0 \quad H_1 : \beta_0, \beta_1, \cdots, \beta_p \text{ Not all is } 0 \quad (10)$$

It can be shown that when H_0 holds, the statistic is:

$$F = \frac{SSR / p}{SSE / n - p - 1} \sim F(p, n - p - 1) \quad (11)$$

Among them:

$$\begin{cases} SSR = \sum_{i=1}^n (\hat{Y}_i - \bar{Y})^2 \\ SSE = \sum_{i=1}^n (Y_i - \hat{Y}_i)^2 \\ SST = \sum_{i=1}^n (Y_i - \bar{Y})^2 \end{cases} \quad (12)$$

$$\bar{Y} = \frac{1}{n} \sum_{i=1}^n Y_i, \hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_{i1} + \hat{\beta}_2 X_{i2} + \cdots + \hat{\beta}_p X_{ip} \quad (13)$$

Where SST is the total sum of squares, which represents the sum of the squares of the changes in the n sample number y_i values. $SSR = SST - SSE$ is the regression sum of squares.

The above is a test of significance for the regression equation as a whole, and the next section describes a test of each of the parameter estimates before each regression dependent variable X_j one by one. The hypothesis tests are as follows:

$$H_{0j} : \beta_j = 0 \quad H_{1j} : \beta_j \neq 0 (j = 0, 1, \dots, p) \quad (14)$$

The F-statistic for this hypothesis test is:

$$F_j = \frac{Q_j}{SSE / n - p - 1} \sim F(1, n - p - 1) \quad (15)$$

Where $Q_j = SSE_{(j)} - SSE$, $SSE_{(j)}$ is the sum of squares of the residuals after removing X_j .

For a given confidence level α , the original hypothesis H_{0j} is rejected when $F_j > F_{1-\alpha}(1, n - p - 1)$, otherwise the original hypothesis H_{1j} is accepted. The value of P for the test is:

$$p = P(F(1, n - p - 1) > F_j) \quad (16)$$

The original hypothesis H_{0j} is rejected when the value of P is less than α^2 , otherwise the original hypothesis H_{1j} is accepted.

If the original hypothesis H_{0j} is accepted, it means that the independent variable X_j has a lesser degree of influence on the dependent variable Y , therefore, it is necessary to redo the regression analysis and hypothesis testing after deleting the independent variable X_j .

3.2.2. Selection of research variables. The research content of this paper is the impact of artificial intelligence application in tourism cultural heritage on the level of cultural cognition of tourists, based on this, the research variables of this paper are selected as follows:

1) Explained variables. The cultural cognition level (CCL) of tourists reflects the awareness of tourists of the relevant cultural connotations of tourism destinations in tourism culture inheritance, and this paper mainly obtains the cultural cognition level of tourists through questionnaires, which mainly contains the degree of understanding of tourism culture, the willingness of accepting and spreading tourism culture, the degree of preference and internalization of tourism culture and the willingness of practicing tourism culture.

2) Core explanatory variables. The application of artificial intelligence (AI) in tourism culture inheritance is a related technology that utilizes intelligent technology to carry out tourism culture dissemination and development, and this paper utilizes a data crawler framework to crawl the number of times intelligent keywords about tourism culture inheritance appear on the Internet as quantitative data.

3) Control variables. The control variables in this paper mainly include age (AGE), gender (SEX), education level (EDU), occupation type (OCC) and economic status (ECO) of tourists. Their data were collected along with the questionnaire as a basis for analyzing the impact of AI application on the level of cultural awareness.

3.2.3. Research model design. In order to test whether there is an impact of AI application on the level of cultural cognition in tourism cultural heritage, this paper is based on the theoretical analysis and multiple linear regression model in the previous paper, and draws on the research of previous scholars to set up a benchmark regression model for benchmark regression analysis. The specific model settings are as follows:

$$CCL = \alpha_0 + \alpha_1 AI + \alpha_2 \sum Control + \varepsilon \quad (17)$$

Where, CCL denotes the cognitive level of tourists, AI is the application of artificial intelligence in the cultural heritage of tourism, $\sum Control$ is each control variable, ε is a random perturbation term, α_0 is a constant term, and α_1, α_2 is the regression coefficient of each variable.

4. Empirical Evidence and Optimization of Artificial Intelligence Applications Affecting Cultural Cognition

Culture is both the root of national continuity and the spiritual bond of national unity, and its importance is self-evident. Based on the application of artificial intelligence in tourism culture inheritance, on the basis of maintaining the characteristics of tourism culture, we vigorously introduce artificial intelligence technology to break the limitations and restrictions of natural geographical conditions on tourism culture inheritance. Focusing on the creative development of tourism culture, digging deeply into the connotation of tourism culture, effectively enhancing the added value of industrial products, realizing the sustainable development and scientific development of tourism culture construction, and further enhancing the level of cultural cognition of tourists.

4.1. Descriptive statistics and correlation analysis

4.1.1. Descriptive statistical analysis. Descriptive statistical analysis of the variables is required before regression analysis to understand the basic characteristics and distribution of the data, which is essential for subsequent analysis. In this paper, the main variables were analyzed with descriptive statistics with the help of Stata software. Table 1 shows the descriptive statistics results of the main variables.

From the point of view of the explanatory variables, the cultural cognition level of tourists varies greatly, its mean value is 2.146, and the standard deviation reaches 1.572, and the data of each tourist in the data has a high degree of difference. This indicates that there is a large difference in the level of cultural cognition among tourists in the current tourism cultural heritage. It indicates that the cultural cognition level of tourists is uneven, and the tourism culture inheritance should focus on improving its own development and dissemination mode, and promote tourists to subconsciously improve their cultural cognition level in the process of tourism. From the point of view of the explanatory variables, the maximum and minimum values of the indexes measuring artificial intelligence differ greatly, with the mean and standard deviation of 1.931 and 1.036, respectively, indicating that there is a great difference in the degree of importance attached to the application of artificial intelligence in the tourism culture inheritance, reflecting that the average degree of importance attached to artificial intelligence in different modes of the tourism culture inheritance is still insufficient and still needs to be improved. From the point of view of control variables, there are large differences among tourists in age, gender, education level, occupation type and economic status.

Table 1. Descriptive Statistics of Main Variables

Variable	Means	STD	Min	Max	Skewness	Kurtosis
CCL	2.146	1.572	1.000	5.000	-1.394	-1.537
AI	1.931	1.036	0.052	4.249	-1.552	0.526
AGE	36.57	2.758	16.74	58.54	-1.106	-1.379
SEX	2.078	1.163	0.561	4.276	-1.325	0.205
EDU	0.542	0.945	0.327	0.938	-1.243	-1.341
OCC	0.872	0.528	0.438	1.132	-1.495	-1.506
ECO	0.063	0.179	0.043	0.157	-1.362	0.317

4.1.2. Correlation analysis. Before carrying out the benchmark regression analysis, the correlation between the variables in the model needs to be tested to understand whether there is a large correlation between the variables that affects the benchmark regression results. Table 2 shows the correlation coefficients of the variables in the model, with ***, **, and * denoting the significance levels of 1%, 5%, and 10%, respectively.

As can be seen from the table, the correlation coefficient between the core explanatory variable artificial intelligence and tourists' cultural awareness level is 0.232, which passes the 1% significance level test. It indicates that there is a positive correlation between artificial intelligence and tourists' cultural awareness level, which provides preliminary support for the research hypothesis H1 of this paper. In addition, the correlation coefficients between each control variable and the cultural cognition level of tourists are all significantly positive, indicating that there is also a positive relationship between each control variable and the cultural cognition level of tourists. The correlation coefficients of the variables in the model are lower than 0.25, which indicates that there is no large correlation between the variables and there is no large influence between the variables.

Table 2. The correlation coefficients of each variable in the model

Variable	CCL	AI	AGE	SEX	EDU	OCC	ECO
CCL	1.000	-	-	-	-	-	-
AI	0.232***	1.000	-	-	-	-	-
AGE	0.078**	0.171**	1.000	-	-	-	-
SEX	0.107***	0.137**	0.159**	1.000	-	-	-
EDU	0.154***	0.125*	0.168**	0.074**	1.000	-	-
OCC	0.085**	0.106**	0.147***	0.121*	0.185**	1.000	-
ECO	0.063*	0.084***	0.101***	0.086**	0.162***	0.116***	1.000

In addition, in order to further verify the multicollinearity among the variables, this paper performs the multicollinearity test by variance inflation factor (VIF). Table 3 shows the multicollinearity test results of the variables. The VIF of the individual variables in the table are small, and the average VIF value of all variables is 1.747, and the maximum value is 2.574, which is much smaller than the threshold value of 8 and smaller than the critical value of the rule of thumb of 4. Therefore, the multicollinearity of the core explanatory variables and control variables in this paper is weak, and there is no need to worry about a serious multicollinearity problem.

Table 3. Multiple common linear test results of variables

Variable	VIF	1/VIF	Variable	VIF	1/VIF
AI	2.574	0.389	EDU	1.631	0.613
AGE	2.038	0.491	OCC	1.327	0.754
SEX	1.846	0.542	ECO	1.063	0.941

4.2. Benchmark regression test and analysis

4.2.1. Model Setting Tests. This paper uses data to empirically test the hypothesis of the impact of artificial intelligence application on the level of cultural cognition in tourism cultural heritage, and due to the specificity of the data, it is necessary to further determine the validity of the model to make the regression estimation more accurate. Using the F test and Hausman test to select the regression method among the mixed-effects regression model, fixed-effects regression model, and random-effects regression model for the regression model set up in the previous section, the test results are shown in Table 4.

First, by conducting the F-test to determine whether to use the fixed effect model or the mixed effect model, the original hypothesis that the mixed effect and random effect regression models are acceptable. Since the p-value of the fixed effect model in the F-test is 0.002, the original hypothesis is strongly rejected, i.e., the fixed effect model is considered to be significantly better than the mixed effect and random effect regression model. Secondly, when dealing with panel data, it is important to consider whether to use a fixed effect or random effect model, and for this purpose the Hausman test

is conducted, and since the P-value is $0.000 < 0.01$, the original hypothesis is rejected, and it is considered that a fixed effect model should be used instead of a random effect model.

Table 4. F-test and Hausman test results

Test method	Check object	Statistic	P	Test result
F-test	Fixed effect	$F(24.174) = 12.741$	0.002	Fixed effect
	Mixing effect	$F(24.174) = 3.285$	0.439	
	Random effect	$F(24.174) = 1.329$	0.501	
Hausman	Fixed effect	$\chi^2 = 80.328$	0.000	Fixed effect
	Mixing effect	$\chi^2 = 2.051$	0.748	
	Random effect	$\chi^2 = 1.743$	0.627	

4.2.2. Benchmark regression results. Based on the multivariate linear regression model established in the previous section, combined with the relevant data, the baseline regression results of the application of artificial intelligence in the cultural heritage of tourism on the level of cultural cognition of tourists are obtained as shown in Table 5. Where model (1)~(4) are the regression results without adding control variables and after gradually adding control variables, respectively, *, **, *** denote significant at 10%, 5% and 1% significance level in turn, and the corresponding t-statistic values are in parentheses.

From the data in the table, it can be seen that on the basis of not adding control variables, the application of artificial intelligence in tourism cultural heritage has an extremely significant effect on the cultural cognition level of tourists at the 1% level, and its regression coefficient is 0.419. It indicates that for every 1 percentage point increase in the level of the application of artificial intelligence in tourism cultural heritage, the cultural cognition level of the tourists will be increased by 0.419 percentage points, and then H1 can be verified. The application of artificial intelligence technology in tourism culture inheritance can significantly enhance the dissemination effect of tourism culture, so that tourists can feel the spiritual connotation of tourism culture in tourism destinations, thus significantly enhancing the cultural cognition level of tourists. In addition, after the gradual addition of control variables, the impact of the application of artificial intelligence in tourism culture inheritance on the level of cultural cognition of tourists gradually weakened, although the value of the regression coefficient was reduced from 0.419 to 0.376, but the overall still exists at the level of 1% extremely significant impact. And among the control variables, except for the sex of tourists (SEX), age, education level, occupation type and economic status all have a positive effect on the level of cultural cognition of tourists at the 5% level. This indicates that age, education level, occupation type and economic status of tourists have a corresponding effect on the cultural cognition level of tourists in tourism cultural heritage. And in the process of continuous addition of variables, the goodness of fit of the model increases from 0.407 to 0.434, which indicates that the explanatory degree of each variable on the cultural cognition level of tourists reaches 43.4%. Therefore, the application of artificial intelligence in tourism culture inheritance has a positive and significant effect on the cultural cognition level of tourists, and the application of artificial intelligence technology can improve the effect of tourism culture inheritance and enhance the cultural cognition level of tourists.

Table 5. The result of Benchmark regression

Variable	Model (1)	Model (2)	Model (3)	Model (4)
(Con.)	2.471***(0.247)	2.421***(0.235)	2.418***(0.226)	2.401***(0.207)
AI	0.419***(0.576)	0.407***(0.509)	0.382***(0.475)	0.376***(0.451)
AGE	-	0.074**(0.127)	0.063**(0.119)	0.059**(0.112)
SEX	-	0.138***(0.436)	0.127***(0.424)	0.109***(0.406)

EDU	-	-	0.118*** (0.367)	0.103** (0.343)
OCC	-	-	-	0.085** (0.284)
ECO	-	-	-	0.114** (0.319)
R2	0.418	0.436	0.447	0.459
Adj.R2	0.407	0.415	0.421	0.434

4.2.3. Endogeneity test. A valid instrumental variable should satisfy both the assumption of “relevance” and the assumption of “exogeneity”. Theoretically, the application of AI in tourism culture heritage obviously affects the cultural cognition level of tourists, and this effect also varies according to the different applications of AI in tourism culture heritage. Therefore the level of application in tourism cultural heritage in the same city will be positively correlated with the level of cultural cognition, thus satisfying the correlation assumption of instrumental variables. Since our sample data are randomly selected, the exogeneity assumption of the instrumental variables is met. The regression results for the instrumental variables are shown in Table 6.

With the level of artificial intelligence application (AI) as the core explanatory variable, the F-statistic in the first-stage estimation results is 117.241, and with the frequency of AI keywords (AI-F) as the core explanatory variable, the F-statistic in the first-stage estimation results is 143.579, both of which are much larger than 10, indicating that there is no weak instrumental variable problem. In addition, with the level of artificial intelligence application (AI) and the frequency of keywords (AI-F) as the core explanatory variables, the instrumental variables and the endogenous variables both show significant positive correlations at the 1% level, and the correlation of the instrumental variables is satisfied, indicating that the instrumental variables have strong explanatory power for the endogenous variables. The results of the second stage show that the effect of AI application on the level of cultural awareness of tourists is still significantly positive at the 1% level with the level of AI application (AI) and the frequency of keywords (AI-F) as the core explanatory variables. After re-estimating the baseline model with the help of instrumental variable method, unbiased estimates of the regression coefficients are obtained. Specifically, for every 1% increase in the amount of industrial robots used, the cultural cognition level of tourists increases by about 0.427% on average, and for every 1% increase in the frequency of AI keywords (AI-F), the business performance of enterprises increases by about 0.429% on average, with the coefficient values significantly larger than those of the benchmark regression results, which suggests that the previous regression underestimated the effect of AI application on the improvement of cultural cognition level of tourists.

Table 6. Regression of tool variables

Variable	Model (1) FE-2SLS stage1	Model (2) FE-2SLS stage2	Model (3) FE-2SLS stage1	Model (4) FE-2SLS stage2
(Con_)	2.452*** (0.231)	2.438*** (0.219)	2.446*** (0.229)	2.436*** (0.211)
AI	0.438*** (0.606)	0.427*** (0.586)	-	-
AI-F	-	-	0.432*** (0.575)	0.429*** (0.569)
AGE	-	0.078** (0.124)	-	0.081** (0.127)
SEX	-	0.115*** (0.438)	-	0.122*** (0.458)
EDU	-	0.127** (0.359)	-	0.133** (0.372)
OCC	-	0.096** (0.291)	-	0.092** (0.285)
ECO	-	0.114** (0.336)	-	0.116** (0.331)
R2	0.412	0.426	0.418	0.435
F	117.241	-	143.579	-

4.3. Robustness test analysis

4.3.1. Robustness Tests. To ensure the robustness of the benchmark regression results, this paper conducts robustness tests by replacing the core explanatory variables, replacing the explanatory variables, controlling for possible omitted variables, and adjusting the sample. Table 7 shows the results of the robustness test.

1) Replacing core explanatory variables. Referring to existing related studies, this paper adopts the ratio of AI word frequency to the total number of words in the textual data of tourism and cultural heritage (AI-F) as a measure. The regression results are shown in column (1), and the estimated coefficient of AI-F is 0.338, which is significantly positive at the 1% level, consistent with the baseline regression results, and the robustness test is passed.

2) Replacing explanatory variables. In this paper, the cultural awareness level rating (Level) is used as a replacement variable for the explanatory variables for the robustness test. The variable is assigned according to its rating. The regression results are shown in column (2). The estimated coefficient of Level is significantly positive, which indicates that AI applications can improve the cultural cognitive level ratings of tourists. This result supports the baseline regression conclusion and the robustness test is passed.

3) Controlling for possible omitted variables. Considering that the cultural awareness level of tourists may be affected by external factors, this paper also adds tourism attention (Media), tourism cultural awareness (Culture), and the level of regional intelligent technology application (INT) as control variables. The regression results in column (3) show that the coefficient signs and significance levels of the core explanatory variables are consistent with the results of the benchmark regression, indicating that the robustness test is passed.

4) Adjustment sample. Considering the impact of the new crown epidemic on the tourism and culture industry in 2020, tourists, as the main subject of tourism and culture inheritance, are extremely likely to be affected, therefore, this paper selects the 2010-2019 samples to re-regress and use them as a robustness test. The regression results in column (4) show that the coefficient sign and significance level of the core explanatory variables are consistent with the results of the benchmark regression, indicating that the robustness test passes.

Table 7. Robustness tests results

Variable	Model (1)	Model (2)	Model (3)	Model (4)
AI-F	0.281*** (0.346)	-	-	-
Level	-	0.089*** (0.412)	-	-
AI	-	-	0.084*** (0.457)	-
AI	-	-	-	0.063*** (0.328)
Control	YES	YES	YES	YES
Adj.R2	0.042	0.075	0.038	0.039

4.3.2. Subgroup regression analysis. In order to further examine whether the research hypothesis H1 is still robust across different samples, this paper further groups the samples into regressions according to gender. The full sample is divided into male and female groups and regressed on the multiple linear regression model separately. Tests are conducted according to 2SLS and GMM, respectively, and the robustness test results for grouping by gender are obtained as shown in Table 8.

From the empirical results reported in the table, among both males and females, the coefficient estimates of the main explanatory variable Artificial Intelligence Applications (AI) are significantly positive at the 1% level, regardless of the regression method used. This indicates that there is a significant contribution of AI application in tourism cultural heritage to the level of cultural cognition of tourists, both among men and women, which to some extent indicates that the research hypothesis

H1 has a good robustness across samples as well. Moreover, in terms of the level of the coefficient estimates, compared with the baseline regression results under the full sample reported in the previous section, the coefficient estimates of the explanatory variable Artificial Intelligence Application (AI) under each estimation method are taken at approximately equal levels, which indicates that the degree of influence of AI application in the cultural heritage of tourism on the level of cultural cognition of the tourists is relatively similar among both males and females, and this is able to illustrate the findings of the study's Robustness.

Table 8. Performance test results by gender groups

Variable	Male		Female	
	(1)-2SLS	(2)-GMM	(3)-2SLS	(4)-GMM
(Con.)	2.582*** (0.316)	2.571*** (0.309)	2.494*** (0.312)	2.527*** (0.311)
AI	0.285*** (0.384)	0.281*** (0.375)	0.279*** (0.365)	0.274*** (0.357)
AI-F	0.067** (0.127)	0.072** (0.134)	0.066** (0.131)	0.071** (0.135)
AGE	0.115*** (0.349)	0.107*** (0.343)	0.108*** (0.338)	0.126*** (0.352)
SEX	0.138** (0.327)	0.129** (0.316)	0.135** (0.322)	0.141** (0.338)
EDU	0.058** (0.176)	0.061** (0.182)	0.053** (0.165)	0.062** (0.183)
OCC	0.103** (0.302)	0.118** (0.315)	0.106** (0.311)	0.106** (0.308)
ECO	0.138** (0.324)	0.124** (0.312)	0.131** (0.318)	0.132** (0.327)
R2	0.276	0.281	0.275	0.283

4.4. Artificial Intelligence Optimizes Tourism Cultural Heritage

The application of artificial intelligence in tourism culture inheritance can help to significantly improve the effect of tourism culture inheritance, and then promote the enhancement of the level of cultural cognition of tourists, and provide new opportunities for the extensive inheritance and revitalization of tourism culture inheritance. Based on this, this paper proposes an innovative path for the application of artificial intelligence technology in tourism culture inheritance.

4.4.1. Preservation and experience of tourism culture. Relying on the foundation of artificial intelligence technology, with advanced intelligent means, the wisdom of tourism culture inheritance will be injected into the service of tourists with the results of the latest scientific and technological information revolution such as the Internet of Things, cloud computing, radio frequency technology, etc., and the "Internet of Things" will be integrated through supercomputers and cloud computing, so as to realize the integration of people and tourism resources and tourism information, and manage tourist attractions in a more refined and dynamic way, so as to achieve the "smart" state. The development process of intelligent tourism culture inheritance can reasonably control and arrange the number of tourists in each attraction according to the number of tourists in the tourist destination, and provide staggered peak traffic flow, food and drink, travel modes and other information transmission, providing more convenient and intelligent information for tourists, and achieving the requirements of intelligent tourism culture inheritance.

The rational use of intelligent technology can become a new cultural element of tourism culture. Similarly, the modern digital virtual augmented reality technology realizes the virtual display of the historical change scene of the tourist cultural heritage sites, on the one hand, it can realize the intuitive experience and understanding of these sites, and achieve the purpose of the protection of the sites. On the other hand, the integration of science and technology development to realize the participation and experience of history and culture, to attract more tourists from the depth of the cultural connotation of the tourist destination, and further enhance the level of cultural cognition of tourists.

4.4.2. Building an intelligent and communicable knowledge base. Effective organization and management of tourism culture is the basis for the protection and inheritance of tourism culture. In-depth excavation and integration of tourism culture is a prerequisite for artificial intelligence technology to promote the dissemination of tourism culture. The use of artificial intelligence technology can help build an intelligent resource content integration warehouse and realize the related integration of multi-state digital resources.

On the one hand, the original tourism cultural resources and cultural content to activate. To break through the stereotypes and traditional content production logic, through such means as artificial intelligence, intelligent data and other means to explore the connotation of tourism and cultural resources, the establishment of traditional tourism and cultural genealogy and the intersection of the associated knowledge system. For traditional tourism cultural resources on the verge of destruction, new media technology can be used to repair and protect and reproduce them, realizing the representation of traditional tourism cultural carriers. On the other hand, the inherent tourism culture model or paradigm is transformed to integrate content innovation with other elements. Fully utilize technologies such as drone collection, 5G transmission, natural language processing, cloud computing, text theme analysis, robot writing, computer vision, etc. to collect high-quality traditional tourism culture materials, optimize the content presentation, and realize the dynamic, visual, multi-dimensional display of the content as well as the live-action and interactive integration. To digitally enrich the connotation of traditional tourism culture, bring tourism culture content into a vivid visual and dynamic world, and use algorithms to assist in realizing the organic integration of tourism culture heritage resources.

5. Conclusion

Based on analyzing the mechanism of AI-enabled tourism culture inheritance, the article introduces a multiple linear regression model to explore the extent of AI's influence on tourists' cultural cognition level. For every 1 percentage point increase in the application of AI in tourism culture inheritance, the cultural cognition level of tourists will rise by 0.419 percentage points. And based on the robustness test results show that there is no difference between men and women in the level of tourism cultural cognition, and the level of AI application affects the level of cultural cognition of tourists at the 1% level. Therefore, the application of artificial intelligence technology in tourism culture inheritance will promote the innovation of tourism culture inheritance method, based on the intelligent transmittable knowledge base to give tourists more tourism culture knowledge, and enhance the cultural cognition level of tourists.

References

- [1] Bendix, R. (2018). *Culture and value: Tourism, heritage, and property*. Indiana University Press.
- [2] Yu, X., & Xu, H. (2019). Cultural heritage elements in tourism: A tier structure from a tripartite analytical framework. *Journal of Destination Marketing & Management*, 13, 39-50.
- [3] Magnelli, A., Pantile, D., Falcone, R., & Pizziol, V. (2020). The video guides at the Musei Civici in Rome: an example of technological innovation in touristic cultural heritage experiences. In *Advances in Tourism, Technology and Smart Systems: Proceedings of ICOTTS 2019* (pp. 199-209). Springer Singapore.
- [4] Santa, E. D., & Tiatco, A. (2019). Tourism, heritage and cultural performance: Developing a modality of heritage tourism. *Tourism Management Perspectives*, 31, 301-309.
- [5] Rasulov, A., Madjitova, J., & Islomova, D. (2022). Principles of tourism development in downstream zarafshan district. *American Journal Of Social Sciences And Humanity Research*, 2(05), 11-16.
- [6] Santa-Cruz, F. G., & López-Guzmán, T. (2017). Culture, tourism and world heritage sites. *Tourism*

- Management Perspectives, 24, 111-116.
- [7] Terkenli, T. S. (2024). Tourism and landscape. *The Wiley Blackwell Companion to Tourism*, 166-180.
 - [8] Camilleri, M. A., & Camilleri, M. A. (2018). The tourism industry: An overview (pp. 3-27). Springer International Publishing.
 - [9] Bianchi, R. (2018). The political economy of tourism development: A critical review. *Annals of tourism research*, 70, 88-102.
 - [10] Richards, G. (2018). Cultural tourism: A review of recent research and trends. *Journal of Hospitality and Tourism Management*, 36, 12-21.
 - [11] Canavan, B. (2016). Tourism culture: Nexus, characteristics, context and sustainability. *Tourism management*, 53, 229-243.
 - [12] Cohen, S. A., & Cohen, E. (2019). New directions in the sociology of tourism. *Current Issues in Tourism*, 22(2), 153-172.
 - [13] Jansson, A. (2018). Rethinking post-tourism in the age of social media. *Annals of Tourism Research*, 69, 101-110.
 - [14] Prasiasa, D. P. O., Widari, D. A. D. S., & Susanti, P. H. (2023). Authenticity and Commodification of Creative Industry Products in The Tourism Sector, Bali. *Mudra Jurnal Seni Budaya*, 38(3).
 - [15] Liang, Y., & Qi, Z. (2021). Research on Innovative design of tourism cultural and creative products from the perspective of Huizhou intangible cultural heritage culture: Taking wood carving patterns as an example. *Scientific and Social Research*, 3(3), 228-232.
 - [16] Richards, G. (2020). Designing creative places: The role of creative tourism. *Annals of tourism research*, 85, 102922.
 - [17] Jurėnienė, V. (2016). Interaction between cultural/creative tourism and tourism/cultural heritage industries. *Tourism-from empirical research towards practical application.*, 137-157.
 - [18] Qiu, L. (2020). Design of cultural and creative products of marine cultural tourism. *Journal of Coastal Research*, 112(SI), 100-102.
 - [19] Liu, S. (2024). Tourism Cultural and Creative Product Design Based on Style Migration Algorithm. *Journal of Electrical Systems*, 20(9s), 1388-1395.
 - [20] Wu, Y. (2021). Design of tourism cultural and creative products based on regional historical and cultural elements. In *E3S Web of Conferences* (Vol. 251, p. 03004). EDP Sciences.
 - [21] Liu, X. (2020). Design of Creative products for marine tourism culture. *Journal of Coastal Research*, 110(SI), 60-63.
 - [22] Zhang, S. N., Zhang, W. Y., Li, Y. Q., Ruan, W. Q., & Zhou, Y. (2023). Will visual peripheral cues motivate you to purchase tourism cultural and creative products? Evidence from China. *Asia Pacific Journal of Tourism Research*, 28(12), 1434-1451.
 - [23] Zuhui Liao, Qingyun Pang & Honggen Xiao. (2025). Glocalization: Cross-cultural communication of tourism research. *Tourism Management* 105129-105129.
 - [24] Madhu Puttegowda & Sharath Ballupete Nagaraju. (2025). Artificial intelligence and machine learning in mechanical engineering: Current trends and future prospects. *Engineering Applications of Artificial Intelligence* 109910-109910.
 - [25] Deng Chao & Dato Roselan Baki. (2024). Research on the status quo and influencing factors of college students' cognition of local culture under the background of cultural inheritance—Based on the empirical investigation of 5 universities in Yichun City. *Adult and Higher Education*(7).

-
- [26] Xuzhen Du,Dongyun Ge,Zhangchi Dang & Xiangming Wang. (2025). Rapid aerodynamic estimation of annular wings based on multiple linear regression. *Aerospace Science and Technology*109887-109887.
 - [27] Meng Wang,Ming liang Shu,Jian jun Zhou,Si xin Wu & Min Chen. (2024). Least Square Estimation for Multiple Functional Linear Model with Autoregressive Errors. *Acta Mathematicae Applicatae Sinica, English Series*(1),84-98.