Aesthetic Differences Between Chinese and Western Cultures
Based on Big Data Analysis

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Abstract. With the development of the times, the gradual integration of Chinese and
foreign civilizations and the continuous expansion of people’s living circles, the
aesthetic consciousness of the interior space design of Chinese and Western residential
buildings is also changing. The purpose of this article is to analyze the aesthetic
differences between Chinese and Western cultures based on big data, analyze the
clustering algorithms for aesthetic differences between Chinese and Western cultures,
and conclude that different clustering algorithms have their own blind spots and
misunderstandings for different data calculation processes. Aiming at the spatial
distribution characteristics of aesthetic difference data between Chinese and Western
cultures, an improved spectral clustering algorithm is proposed to better solve the
problem of clustering and mining of aesthetic difference data between Chinese and
Western cultures. The experimental results show that the fast clustering algorithm
suitable for the aesthetic difference data sets of Chinese and Western cultures, the
improved algorithm reduces the time of the traditional spectral clustering algorithm by
2%.

Keywords: Big Data Analysis, Chinese and Western Culture, Interior Space Design,
Aesthetic Difference

1. Introduction
With the development of information technology, the world has become a global village and is
developing globally [1]. Economic, political and cultural purposes are bringing people from different
cultural backgrounds together [2]. The impact of cultural differences on human communication and the
connection between people and the world around them is closer than ever before [3]. Especially in the
past two decades, cultural contrast research has continuously penetrated into different fields of
humanities and social sciences. In cross-cultural activities, cultural exchange and cooperation play an
important role. It is a two-way communication [4]. The prediction of cultural differences and cultural
aesthetic development is of practical significance. It can not only point out our direction, but also
provide some reference data and theoretical basis [5-6].

Big data plays an important transformative role in our aesthetic culture. The continuous exploration
of technical potential is both a motivation and a challenge for design. Victoria's pretense, the "Qianlong style" criticized by Mr. Lin Huiyin is the original technology stacking caused by the stagnation of technology development, and the update of technology often brings subversive changes in design works [7]. Whether it is from a Western standpoint that the Renaissance is the awakening of science and humanities, or the resistance to scientific development caused by China's Confucian culture and agricultural civilization, we can see the connection between culture and science. From the cheapness of Chinese manufacturing, we feel the technicality of China's intelligent manufacturing, and the intelligent upgrade under big data is also assuming the mission of traditional cultural aesthetics. Residential space is an important type of architecture-related culture. By analyzing the aesthetic differences of the interior spaces of Chinese and Western residential buildings and the feelings and experiences of the occupants themselves, through multi-level and multi-angle comparisons between them, we can understand their aesthetic history and culture, etc. The differences and commonalities in these aspects have trans-era significance. Interior design, like architecture, is the product of a long civilization and both represent a unique cultural form. Through the understanding and evaluation of the interior and exterior of the residential building interior design, layout geometry, and decorative components combined with big data analysis and comparison, it is concluded that there are very significant differences between the two, indicating that the residents have greater social and cultural differences. Participation.

This paper studies statistical characteristics and distribution characteristics analysis and cultural aesthetic correlation analysis, and develops a big data platform for aesthetic differences between Chinese and Western cultures. The platform uses J2EE technology architecture and database technology to realize the normal working process of the big data platform for aesthetic differences between Chinese and Western cultures. The various functions of the platform are used normally. The platform can not only realize the query function of the aesthetic differences between Chinese and Western cultures, but also realize the functions of data analysis.

2. Research on the Aesthetic Differences Between Chinese and Western Cultures Based on Big Data Analysis

2.1 Analysis of Statistical Characteristics and Distribution Characteristics

The measurement of the deviation trend of the data reflects the degree of dispersion of the data, generally using standard deviation, coefficient of variation, quartiles and other parameters for description. The general calculation formula for each calculation amount is as follows:

$$\sigma = \sqrt{\frac{1}{2} \sum_{i=1}^{n} (x_i - \bar{x})^2}$$  \hspace{1cm} (1)

The distribution of data is mainly investigated by two quantities: skewness and kurtosis. Based on the standard normal distribution, the distribution of data can be defined as right-skewed distribution, left-skewed distribution, flat distribution, peaked distribution and other types. The system not only calculates the skewness coefficient and kurtosis coefficient of the data, but also draws the intuitive distribution with graphics. The formula used in the calculation is as follows:

$$SK = \frac{n \sum_{i=1}^{n} (x_i - \bar{x})^3}{(n-1)(n-2)\sigma^3}$$  \hspace{1cm} (2)

The positive or negative of SK indicates the skewness of the data. When SK is positive, the data presents a right-skewed distribution, and when SK is negative, the data presents a left-skewed distribution; the K value reflects the flatness of the data, and when K is positive, the data is distributed with the standard positive too. Compared to sharper, when K is negative, the data is flatter.

$$K = \frac{n(n+1) \sum_{i=1}^{n} (x_i - \bar{x})^4 - 3 \sum_{i=1}^{n} (x_i - \bar{x})^2 (n-1)}{(n-1)(n-2)(n-3)\sigma^4}$$  \hspace{1cm} (3)
2.2 Analysis of Cultural Aesthetic Relevance

When exploring the relationship between cultural aesthetic data, it is often necessary to compare the degree of similarity between the various dimensional attributes of cultural aesthetic data. The higher the degree of similarity, the higher the possibility of potential logical associations among them. Due to the different types of data attributes, the measurement methods for calculating the similarity between different categories of attributes are also different. The system mainly considers the processing of the relationship between the similarity of the cultural aesthetic category attribute.

3. Experiments on the Aesthetic Differences Between Chinese and Western Cultures based on Big Data Analysis

Chinese and Western cultural aesthetics have high differences. From the collection of similar files on the data platform to the final display of clustering results, the overall test of the platform's clustering experiment on the aesthetic differences between Chinese and Western living spaces. The specific working steps of the platform are as follows: In the first step, the platform web crawler module grabs the required data in the environmental design paper database, and grabs it according to the year, and grabs the relevant data of Chinese and Western residential interior design. And store the captured data according to the database mechanical table structure. The crawl type is defined as the cultural aesthetic category attribute data, and the input of the crawl data URL is the specific website to collect data. The above-mentioned data sets were tested respectively before and after the improvement of the spectral clustering algorithm, and the clustering was completed according to the steps of the spectral clustering algorithm.

4. An Experimental Analysis of the Aesthetic Differences Between Chinese and Western Cultures Based on Big Data Analysis

4.1 Aesthetic Differences in Indoor Space of Residential Buildings

There are 64 results retrieved from the keyword "big data, interior design" on HowNet, among which 7 are the main research objects of residential space. There were 89 results retrieved by the entry of "Chinese and Western, interior design", of which only 4 were studied from a comparatively differentiated perspective. The content involved decorative components, fabric furnishings and food culture. The author analyzes the three dimensions of interior and exterior space, layout geometry, and decorative components of the interior space aesthetics of Chinese and Western residential buildings, which are focused on big data, as shown in Table 1. First of all, in the aesthetic comparison between the inside and outside of the space, it is easy to see the opposing nature of the choices between the two. Western houses have walls to form their own space boundaries, while Chinese houses have no walls, and courtyards and fences form a fuzzy division. Boundaries. In terms of layout geometry, China is dominated by multiple courtyards, with Beijing Siheyuan as the main representative. Western residences are dominated by atrium and apartment styles, which reflect the same level of differentiation and status symbolism as Chinese culture. All have multi-access multi-way courtyard layouts for nobles to live in. Arrange the transmission of power and status with a central axis and symmetry. Different details of the same layout type can also convey the different expression effects brought about by the differences in living space and personality between China and the West. Finally, from the selection and application of decorative components, we can make it clear from the retrieval of Wanfang data that traditional Chinese interior decoration more embodies the social attributes of "a round sky" and male chauvinism, and emphasizes simplicity in culture and ideology. Natural aesthetic characteristics. The western traditional interior decoration mainly reflects the personality and taste of the inhabitants, such as luxury and nobility, which coincides with the history of Western religion and romanticism.

Table 1. Aesthetic analysis of interior space in residential buildings in China and western countries
After retrieval, there are 92 research papers on modern residential space, accounting for 60% of the data retrieved on HowNet, and 60 research papers on traditional residential space, accounting for 39% of the total. As shown in Figure 1, it can be seen that the attention to the indoor space of residential buildings has gradually increased from focusing on the culture and materials of traditional spaces to the discussion of modern living patterns, especially the design methods that combine artificial intelligence and big data. It not only takes care of the historical and cultural accumulation of traditional Chinese architecture, but also innovates and pays attention to the attention and application of new materials and new processes.

Statistics are made on the country, time, and type of indoor living spaces in China and Western countries. Residential buildings that China pays more attention to include Beijing Siheyuan, Jiangsu and Zhejiang Courtyard, cave dwellings in northern Shaanxi, and Lingnan Tulou. The Palladio-style rotunda villas, Savoy villas, and Marseille apartments have attracted more attention in the West.

The selection of aesthetic types of interior space in China and the West is also very representative, from the inside and outside of the space, the layout set to the decorative components, from the macro to the micro, it shows the aesthetic value and cultural heritage of the living space in varying degrees. In particular, the study of decoration construction is a hot topic of this type, which reflects the hierarchical concept and order norms of Chinese culture from the decoration language and aesthetic creation. It can be said that readers can truly feel the unique aesthetic experience brought by architecture as solidified music, and feel the respect for science and rational spirit, the original divinity and the "people-oriented" romance in the Western aesthetic language. This Chinese style The
combination of the softness of wood and the rigidity of Western stone is the essence of architectural aesthetics.

From the perspective of the function and connotation of the residential space, the indoor space of residential buildings in China and the West is to meet the needs of "settlement." The "Ten Books of Architecture" and "The Yellow Emperor's Internal Classic" all put forward the mission and premise of construction. Considering materials, functions, and aesthetics, a house as a shelter from wind and rain cannot be separated from human instinct.

4.2 Big Data Analysis of The Aesthetic Difference Between Chinese and Western Residential Buildings

The accuracy of the improved spectral clustering algorithm proposed in this paper is compared with that of the improved spectral clustering algorithm; at the same time, a timing comparison is made on the operating speed of the improved spectral clustering algorithm before and after. Aiming at the dataset of aesthetic differences between Chinese and Western residential buildings, the algorithm runs 10 times to get the average clustering accuracy. The selection of the algorithm's p value and σ value is through the experiment of Iris and Wine to obtain the optimal values, which are 1.3 and 9 respectively. The calculation process of the algorithm records the number of error clusters and the error classification of the algorithm. At the same time, the calculation process of this paper also records the calculation time of the algorithm. The specific situation is shown in Table 2.

| data set                           | category | K-means | Spectral clustering | Improved spectral clustering algorithm |
|------------------------------------|----------|---------|---------------------|----------------------------------------|
| Aesthetic differences between Chinese and Western Interior space of living | 1        | 10      | 9                   | 10                                     |
|                                    | 2        | 11      | 8                   | 10.5                                   |
|                                    | 3        | 9       | 7                   | 9.5                                    |

![Figure 2](image_url)

**Figure 2.** Clustering results of seeds data sets (the number of clusters per error)

Through experiments on datasets of aesthetic differences between Chinese and Western living spaces, the spectral clustering algorithm has improved the clustering accuracy and time compared to the K-means algorithm. As shown in Figure 2, the improved algorithm improves the clustering time for data with higher attributes and ellipsoidal spatial distribution, and the error rate of the clustering
results is significantly reduced. The algorithm clustering operation of the aesthetic difference data set of Chinese and Western living space, comparative analysis of the clustering accuracy of K-means, spectral clustering, and improved spectral clustering algorithm found that the error rate of improved spectral clustering was 8%, which is the same as traditional spectral clustering. Compared with the algorithm, the error rate is reduced by 2%, which fully proves the feasibility of the improved Minkowski distance as a measure of the similarity of the aesthetic difference between Chinese and Western living spaces. The results are true and effective, which provides an algorithm basis for the platform's subsequent mining work. The total time and sub-step time of the three algorithms are in a decreasing distribution, which proves that the fast clustering algorithm is suitable for the aesthetic difference data sets of Chinese and Western living spaces. The experiment proves that the improved spectral clustering algorithm has the advantage of fast processing speed. It can meet the requirements of fast processing of big data of aesthetic differences between Chinese and Western living spaces.

5. Conclusions
The lack of aesthetic education in the interior space of residential buildings is a teaching method that meets their own aesthetic characteristics. It is precisely because of this that students cannot perceive the differences in the aesthetics of the interior spaces of Chinese and foreign residential buildings. This lack of aesthetic differences makes the entire architectural aesthetic teaching lack. New ideas, not to mention the unique aesthetic teaching strategies, so it is necessary to compare the differences between the two. According to the characteristics of Chinese and Western cultural aesthetic differences data, this paper proposes an improved spectral clustering algorithm as a data processing technology for Chinese and Western cultural aesthetic differences, clustering large amounts of high-dimensional data on aesthetic differences between Chinese and Western cultures. Using an appropriate distance to measure the degree of similarity can accurately reflect the correlation between data points. Establishing an accurate and feasible similarity matrix is the key to measuring the pros and cons of the spectral clustering algorithm, and improving the performance of the spectral clustering algorithm. The result is more reasonable.

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2.People worship phoenix and Maternal worship-On the Aesthetic Difference between Chinese and Western Public Art.

References
[1] Lili W. Cultivate Talents with Both Noble Qualities and Knowledge of Chinese and Western Culture——Exclusive Interview with Professor Yin Meiqun, Dean of the Business School of Beijing International Studies University[J]. China's Foreign Trade, 2019, 572(02):30-33.
[2] Guo J. The Life and Afterlife of a Western Han "Covered Mirror" from the Tomb of Marquis of Haihun (59 BCE)[J]. Journal of Chinese History, 2019, 3(2):203-232.
[3] Chen J, Gao J. English and Chinese Humorous Languages under the Heterogeneous Domain Valve of Eastern and Western Culture[J]. Open Journal of Social Sciences, 2019, 07(2):110-117.
[4] Li Q, Jong M D T D, Karreman J. Cultural Differences Between Chinese and Western User Instructions: A Content Analysis of User Manuals for Household Appliances[J]. IEEE Transactions on Professional Communication, 2020, 63(99):3-20.
[5] Memmi D. The relevance for science of Western and Eastern cultures[J]. Ai & Society, 2019, 34(3):599-608.
[6] Vrhovski J. From Mohism to the school of names, from pragmatism to materialist dialectics: Chinese interpretations of Gongsun Longzi as a text and source of Chinese logic, 1919–
[7] Yang yaqian, Yuanchuanhcuan, Jiangmu. Research on sustainable Design Trend under big Data and Intelligent Environment[J]. Packaging engineering, 2020, 7(14): 16-20.