

# Thousands of Ancient Paintings - Visualization of Ancient Chinese painting

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## ABSTRACT

Chinese painting is a vital and enduring component of Chinese culture, covering a rich variety of themes and styles and forming a unique system in the field of world art. This project visualizes data from 12,405 sets of Chinese painting collections, showcasing the rich content, distribution patterns, and cultural connotations of Chinese painting. Due to the openness of the data, this project selected a total of 6,168 paintings covering various dynasties and thematic types from three dimensions of time, classification, and content for visualization and analysis. A three-dimensional chart of traditional Chinese painting was constructed with each painting as a node in the space. The attribute distance algorithm and Berlin noise algorithm were utilized to demonstrate the similarities and differences in various attributes of the paintings, exploring a novel form of knowledge visualization for Chinese painting.

**Index Terms:** Ancient Chinese painting, Visual analysis of painting works, 3D visualization.

## 1 INTRODUCTION

Chinese painting is a traditional art form in China that has always been of great interest to the public. Currently, an increasing number of Chinese painting images are being digitized and displayed on the internet. Many art institutions have a large volume of digital Chinese painting images available for online access. Various museums are building digital archives of Chinese paintings and preserving original cultural relics. However, it is challenging to effectively browse, retrieve and visualize such massive data.

A *Comprehensive Collection of Ancient Chinese Paintings* [1] is a key national-scale cultural project that covers the entire Chinese history and involves Chinese and foreign museums and other cultural institutions. The project has collected a total of 12,405 Chinese painting works (sets) made of paper, silk (including silk fabric and gauze), and hemp from 263 cultural institutions both in China and abroad, covering most of the extant “national treasure” paintings. A total number of 226 books under 60 volumes have been compiled and published. These publications, covering most of the extant national treasures, are the world’s most complete, best illustrated, best printed, and most extensive collections of illustrated Chinese paintings to date.

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Therefore, this work is based on the database of *A Comprehensive Collection of Ancient Chinese Paintings*. Due to the limited attributes of the paintings, there is a significant amount of repeated attribute records. To address this issue, a visual analysis scheme is designed from three aspects: time, classification, and content. The paintings are represented as nodes in space, and their different attributes are visualized using attribute distance algorithms. The Berlin noise algorithm is used to perfect the final layout, and music elements are added to achieve a multisensory experience. The goal is to present a design work that balances data objectivity and visual aesthetics [2].

## 2 DATA DESCRIPTION

### 2.1 Data Sources

The collection and compilation of the *A Comprehensive Collection of Ancient Chinese Paintings* have been completed. However, due to issues with printing and distribution as well as the need for data confidentiality, not all the data was made publicly available. We extracted 6168 painting information for network visualization and visual analysis of painting data. Figure 1 shows the extracted data visualization. The information contained in each work includes the work name, author, classification, dynasty, and volume. The basis for this work’s visual design includes the painting’s age, classification, and content.

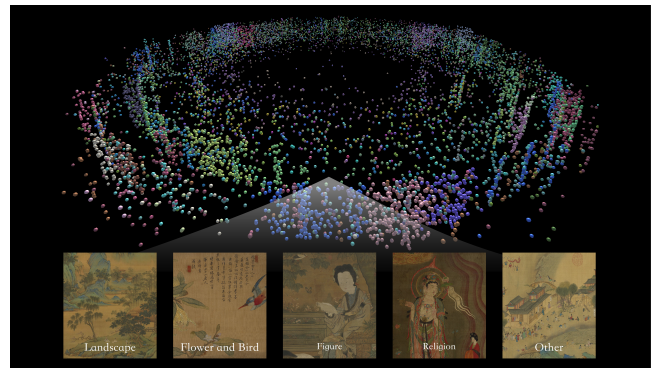


Figure 1: Extracted data visualization.

### 2.2 Painting Volume Division and Classification

The division of pre-Qin, Han, Tang, Song, and Yuan Dynasties paintings is mainly based on the location of artwork collection. As the techniques gradually matured during the Ming and Qing dynasties, the classification of paintings began to be based on regions and painting schools. In terms of classification, Chinese painting is mainly divided into three categories: landscape, figure, and flower-and-bird.

### 2.3 Data Content

On the basis of clarifying the classification of artworks, we define multiple indicators to quantify the content information in the paint-

ings, including the mountains, waters, people, and architecture in the landscape paintings, and the number of people, gender, age and status in figure painting, which providing a deeper level of expression of artwork knowledge.

### 3 VISUAL DESIGN

The design and development of this work are completed through the Unity engine. Users can understand this work from different perspectives through interactive methods such as pressing keys, clicking, and dragging, and it also supports scanning code to enter the official WeChat Mini-Program of *A Comprehensive Collection of Ancient Chinese Paintings* project to experience a more comprehensive presentation of the style of classic Chinese masterpieces.

#### 3.1 Time visualization

We use historical dynasty timelines as the longitude of the network space to form a planar two-dimensional coordinate. The radius range of concentric circles from the inside to the outside represents the duration of different dynasties. At the first step, each node will be randomly assigned a coordinate within its dynasty range. The color of each node is coded by the volume of *A Comprehensive Collection of Ancient Chinese Paintings*. Figure 2 shows the time visualization.

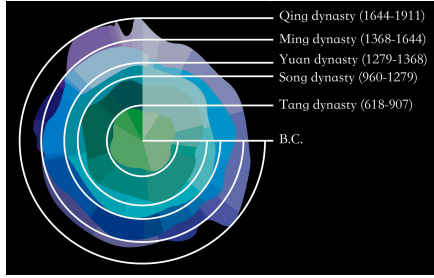


Figure 2: Time visualization.

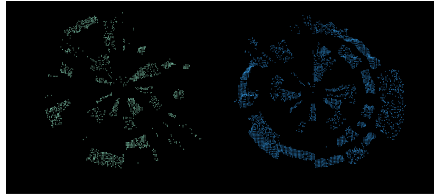


Figure 3: Classification visualization

#### 3.2 Classification visualization

Once the scope of the paintings was determined in the temporal dimension, we further study the changing trend of the work classification and techniques in different periods. We use the partition and classification of the painting as the basis for connecting the edges and use the attribute distance of the painting to optimize the layout, mainly based on the Jaccard similarity [3] of the attribute elements. Different types of paintings are color-coded to indicate their themes. Figure 3 shows the visualization of classification.

#### 3.3 Content visualization

Based on the richness of visual elements such as figures, landscapes, flora and fauna, we labeled the size proportion of these elements in each artwork with data. Combining the color and style of the blue-green landscape paintings, and referring to the Berlin noise algorithm [4], the labeled values were used to calculate the gradient vectors of the nodes, forming a "mountain" network with elements of varying heights. This resulted in a magnificent blue-green landscape of

Chinese painting history, with rolling hills and towering mountains, as shown in figure 4.

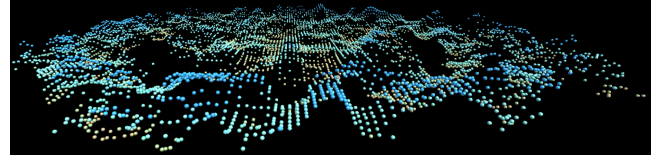


Figure 4: Content visualization.

#### 3.4 Soundtrack design

Based on the height and classification of the painting nodes, we have designed melodies with different tones and characteristics. When users click the node, it can transmit the information in the corresponding painting through the rhythm.

### 4 DATA ANALYSIS

Figure 5 shows the distribution pattern of the number of artworks over time, reflecting the flourishing level of paintings in different periods. In terms of content analysis, taking the number of paintings with animals and plants as the main subject matter as an example, we found that in the early period, there were only simple cows and sheep, while various species began to appear later. This gradually formed the characteristic of flowers and birds as the main theme, which is the origin of the category of bird-and-flower painting, as shown in figure 6.

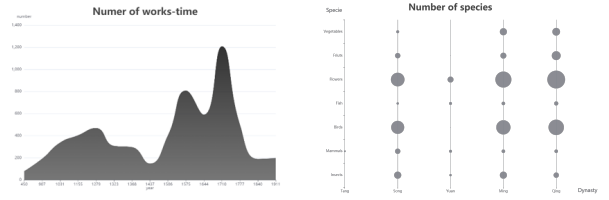


Figure 5: Distribution of the number of paintings over time. Figure 6: The evolution process of flower and bird painting content

### 5 CONCLUSION

This work has conducted visual design and analysis of traditional Chinese paintings from three dimensions: time, classification, and content. It also incorporated music elements to provide a multisensory experience. Given the subjective nature and limited objective data of paintings, this work provides a reference for the visualization of large-scale irregular artistic data.

#### ACKNOWLEDGMENTS

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