Forest Chemicals Revew
www.forestchemicalsreview.com
ISSN: 1520-0191
March-April 2021 Page No. 216-225
Article History: Received: 05 January 2021, Revised: 02 February 2021, Accepted: 10 March 2021, Publication: 30 April 2021

Display Color Design Method Based on Cloud Platform Forest Model and Data Mining

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Abstract:

Stochastic forest model improves the prediction accuracy of the model by summarizing a large number of classification trees. It is a new model to replace the traditional machine learning methods such as neural network. Exhibition hall design should not only meet the requirements of people's visual function, but also meet the aesthetic psychological needs of visitors seeking novelty, novelty and change, which requires designers to use light and color to strengthen the design works. Only in this way can the design concept be highlighted, and the audience can better accept and understand the information. This paper studies the display color design method based on cloud platform data mining. The experimental research shows that the color of space plays an important role in creating environmental atmosphere and promoting visual beauty. At the same time, color and space function, shape, size, building materials, lighting and other factors are closely related. So the application of color in space design is comprehensive and changeable. The display color design method based on cloud platform data mining can use big data to improve the efficiency and beauty of design.

Keywords: *Forest model, cloud platform, data mining, display color design, big data.*

I. INTRODUCTION

From the visual point of view, when people perceive the city, they first feel the impact of urban color. As an important part of urban visual experience, residential building facade color directly affects the color of a city as a whole [1-2]. However, architectural color is often grasped by designers' perceptual cognition and design experience, and the fuzziness and complexity of color itself are more likely to cause confusion [3].

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In China, scientific and independent color research did not begin until modern times [4]. We carried out the research on Chinese color system, formulated the national standard of color, and then established the national standard of Chinese building color card for the use of physical color standard samples in the construction industry. Subsequently, special color planning for urban construction was gradually carried out in some coastal developed cities, and the basic regional color guidelines were established. In terms of the theoretical research on the color design of residential buildings, the article "Research on the color design of urban residential buildings" takes the typical residential buildings in Shanghai and its surrounding areas as the research object, and discusses the color design of urban residential buildings from the basic theories of architectural colorology and color aesthetics [5-7].

Although the research on urban architectural color has made some achievements, there are still some problems that can not be ignored: on the one hand, the basic theoretical framework of color design formed by these studies is broad in principle, which is not conducive to the practical application of theoretical results [8]. On the other hand, the quantitative research on the internal law of residential building facade color design is not sufficient. With the development of information society, the way of explaining problems with data is more suitable for the rapid development of social situation [9]. In view of this, we decided to take the current situation of residential building facade color design as the breakthrough point, through the investigation of relevant building facade color, using the method of Photoshop computer software color value extraction and extension data mining, combing the regularity of the collocation among basic color, collocation color and embellishment color in facade color design. Based on this, the color selection guidance of urban residential building color design is put forward.

II. RESEARCH METHOD

2.1 Definition of concept

Extension data mining is the product of the combination of extension and data mining. It studies how to use the theory and method of extension to mine the knowledge related to the transformation of solving contradictions in the database or knowledge base [10]. It is a mining method that emphasizes data modeling and variability. It expresses the data in the database in the form of primitives to form information elements. Through the construction of classification criteria for a large number of information elements in the extension set (database), it can judge the degree of things belonging to the set, realize the clustering or classification of data, so as to obtain rules, and find knowledge and solve contradictions.

The advantage of extension data mining method lies in: the primitive expression method

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makes the data information content not limited to mathematical information, but extended to semantic information mining. On the basis of the original data mining, through the extension transformation, we can get the extension knowledge which is different from the original static knowledge, and then extract the extension knowledge, so as to provide decision support for finding knowledge and solving contradiction problems.

2.2 General process of research

Extension data mining generally includes three stages: data preparation, extension data mining and knowledge expression (Fig. 1).

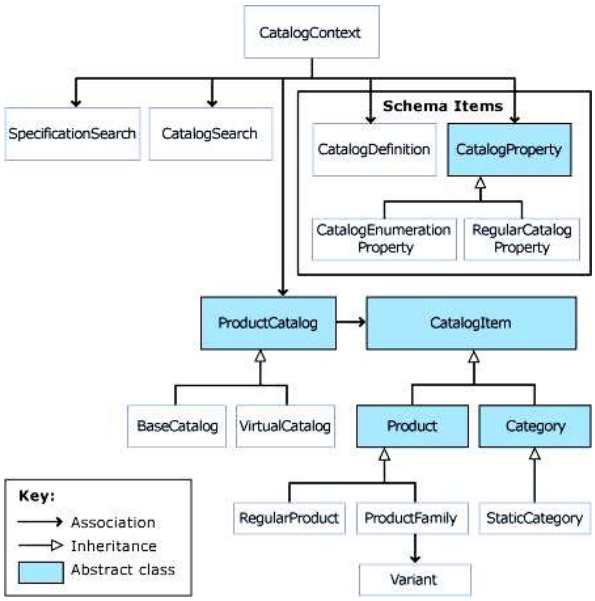

Fig 1: Data mining flow chart of extension residential building facade color design

2.2.1 Data preparation

The data preparation stage includes four steps: first, determine the relevant target data information according to the user needs. Secondly, the research object of extension data mining is the original data information obtained through the necessary data collection methods. After the completion of data collection, it is sorted according to the general data mining preprocessing method. Finally, the information element set obtained is described in the form of extension set:

$$\{I\} = \left\{ I_i \middle| I_i = (O_i, c_i, v_i), i = 1,2,...,n \right\} \quad (1)$$

2.2.2 Knowledge of rules in extension data mining

Statistics are made on the quantitative rules of data in extension set, and its importance and

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accuracy are measured by support and reliability. In knowledge formula, support degree and reliability are usually expressed by l= (support, confidence) = (support, confidence).

Set minimum support and confidence to measure the correlation of classification rules, ensure that their support and confidence are greater than the minimum support and minimum confidence threshold set by users. Then, the rule mode analysis is conducted for high frequency complex data items greater than preset support and reliability. Finally, the rules database is entered and recorded as I_o.

2.2.3 The expression of knowledge

According to extenics, knowledge can be expressed by the relation of primitives, and extended knowledge can be obtained by the extended analysis of primitives. Relevant knowledge is expressed as: I_i i_j, where I_i, $i_j \in I_o$. It can be obtained by statistical regularity among class information elements or data mining method.

III. CASE STUDY

3.1 Demand analysis of extension data mining

This paper mainly uses the extension data mining technology to find the regularity of residential building facade color design. In order to understand the actual situation of the use of urban residential building color, this paper selects Changchun, the capital city of Jilin Province, as the experimental site to carry out research.

3.2 Color data preparation

According to the previous research experience of building facade color, the single building facade color is divided into three categories according to the area ratio. One is the color that occupies the largest area in the facade, namely the basic color, which usually establishes the color tone of the building. One is the color whose area is less than the basic color, which forms an obvious collocation relationship with the basic color, which is called collocation color. The smallest proportion area is called embellishment color, which plays an embellishment role. Judging whether the designers use the architectural color properly or not is mainly based on the balance and grasp of the three architectural color combinations.

The collection of color data is based on certain conditions. There are researches based on local color and traditional color, mainly through field measurement, evidence collection, recording and analyzing the relevant color data. There are also methods of recording the colors of different regions through photography, analyzing and summarizing on the basis of photos. In this paper, the second acquisition method is used to obtain the original information of color data. In the process of data acquisition, the building backlight surface is used as the

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measurement surface, and the digital camera is used to take pictures. The real photos are imported into the computer, and combined with Adobe Photoshop software, the image color is converted into the international common Munsell color system HBS value, and the data is sorted according to the color value. Any color is demarcated by three indexes of hue, brightness and saturation on the three-dimensional model of color, and the basic situation questionnaire of residential building facade color is made (Table 1).

In the urban area, the facade of 96 residential quarters were selected. In the residential quarters, 96 groups of different facade color schemes were obtained, with a total of 259 different facade colors (2 buildings only contain one color, 27 buildings contain two colors, 2 buildings contain four colors, and the rest 65 buildings have three colors).

TABLE I. Basic information of residential building facade color collection (example)

NUMBER	BASIC COLOR			MATCHING COLORS			EMBELLISHMENT COLOR		
	Hue	Brightness	Saturation	Hue	Brightness	Saturation	Hue	Brightness	Saturation
1	7	91%	12%	5	26%	18%	249	62%	4%

3.3 Extension data mining

Although the color is very complex, it also has certain rules and order. In addition to using the basic theory of color, designers can also take the completed residential buildings as the basis, make full use of the existing mature color status system as a template, summarize their practical experience of color design, and grasp the law of color.

As shown in Table 2, in all 96 color data groups, from the perspective of hue distribution, the selection range of residential building facade color is gradually widened from basic color, collocation color to embellishment color, reflecting that the hue selection of collocation color and embellishment color is more flexible. The hues of basic colors are mainly concentrated in the warm color range of R-Y, accounting for 95.83%. Among them, buildings with yr (red and yellow) hue account for the largest proportion, with 64 groups, accounting for 66.67% of the total. The second is R (red) facade, with 26 buildings, accounting for 27.08%. The distribution of B (blue) and P (purple) cold phase is also found, but only a small proportion, about 4.17%. The proportion of R-Y's warm color system is 84.37%, among which the buildings with yr (red and yellow) hue account for the largest proportion, with a total of 57 groups. The hue distribution of embellishment color is the most extensive.

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In the aspect of facade color saturation design, there is a decreasing trend from basic color, collocation color to embellishment color. The saturation values are mostly distributed below grade 8, and concentrated between grade 1-5, which indicates that residential building color is mainly medium and low saturation. The brightness range from basic color, collocation color to embellishment color is gradually broadened, and the frequency peak value appears between 5-7 levels, which indicates that the facade color collocation is dominated by medium and high brightness.

Generally speaking, the range of hue, brightness and saturation of basic colors is relatively narrow, and warm colors with high brightness and medium saturation are dominant. The range of hue, lightness and chroma of collocation color and embellishment color is relatively wide, and the warm color with medium and high lightness and medium and low saturation is the main color. This kind of color collocation law reflects the adaptability of color to cold climate environment.

TABLE II. Data arrangement

HUE	**R**	**Y**	**Y**	**G**	**B**	**P**
Basic color	26	64	2	0	0	0	3	0	1	0
Matching colors	21	57	3	0	0	1	7	3	1	1
Embellishment color	8	37	3	3	0	2	7	2	1	4
Saturation	1	2	3	4	5	6	7	8	9	10
Basic color	8	12	20	21	18	13	3	1	0	0
Matching colors	18	20	22	9	9	9	6	1	0	0
Embellishment color	24	9	16	10	4	1	2	1	0	0
Brightness	1	2	3	4	5	6	7	8	9	10
Basic color	0	0	4	10	12	12	20	9	17	12

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Matching colors	0	1	9	1 1	1 4	1 8	1 5	1 1	1 1	1	4
Embellishment color	1	3	8	5	1 2	6	8	8	1 0	1	6

3.4 The expression of knowledge

The above classification rules show that in the quantitative statistics of the current situation of urban residential building facade color design, the basic color, matching color and decorative color have obvious related knowledge.

By summing up the residential building facade color properties, the regular characteristics of color design are obtained. Designers can choose the color matching intelligently in this range according to the above rules.

Extension set describes the mutual transformation of "yes" and "no" of things, and describes the process of change by quantity change, quality change and extension boundary. As shown in the figure, color design is constantly changing. Only in this way can we create a colorful living environment. When the facade color changes, we need to use appropriate extension transformation to meet the needs of diversity and intelligent color design. Taking the extension transformation of hue in basic color as an example, when the hue value of basic color is actively transformed as follows: $\varphi(M) = M'$

According to the acquired relevant knowledge, matching color and embellishment color need to make corresponding conduction transformation, so that under the condition of primitive transformation, the method of facade color design through extension transformation is as follows: $T_{\varphi}(M) = M'$

Similarly, when other values in the basic color change actively again, according to the law of static data mining, matching color and embellishment color make corresponding conduction transformation, and so on. When adapting to the changing color composition, according to the extension knowledge, the extension transformation is implemented on the three basic attributes of color to meet the changing needs of color design.

IV. DESIGN AND APPLICATION OF FACADE COLOR MATCHING LAW

In the real world, the degree of color difference between cold and warm is not invariable. The implementation of hue, lightness and purity transformation will change the information of

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cold and warm state. When the basic color of residential building facade color changes, the corresponding matching color and embellishment color should also be changed to obtain a better visual experience. According to the above rules, we can change the matching color and point level color with changing thinking. This changing law is the driving force to promote the colorful facade color of residential buildings.

4.1 Unify the whole color order

In the selection of facade color, we should first coordinate with the climate, regional characteristics and natural environment, respect the existing color rules, and cancel too many gorgeous colors. Warm colors with low purity and high brightness are the main colors, which are suitable for the regional climate conditions, and easy to coordinate with the surrounding environment and natural landscape (Fig. 2ab).

4.2 Establish local color contrast

The survey data analysis shows that 2-3 colors are usually selected for the facade of residential buildings. When choosing a variety of colors to decorate the facade, we need to pay attention to the color coordination between them. When using three or more colors on a building, we should try to unify the hue to avoid visual confusion. Collocation color and basic color can form a certain difference in some parts, and pay attention to the color change of building itself. Collocation color generally chooses medium high purity, and maintains a reasonable brightness and purity color difference with basic color. Decorative color can use some bright colors with high purity to achieve eye-catching effect (Figure 2CD).

a. Warm color matching with same color

b. warm color matching with near color

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c. Contrast color matching

d. Match with cool colors

Fig 2: Application of color design law of residential building facade

V. CONCLUSION

In this paper, combined with computer software color information extraction technology and extension data mining method, taking HBS color model as the quantity value, the current situation of residential building facade color is analyzed. Through the example verification, there are obvious correlation rules between residential building colors (basic color, matching color and embellishment color).

First, in terms of hue, the overall hue is mainly warm color, which is often matched with the same warm color or small area cold color. Most of them choose yr as the matching color, which has high reliability.

Secondly, in terms of brightness, 5-9 is mainly medium and high brightness, which can be matched with small area medium and low brightness.

Third, in terms of saturation, the basic color, collocation color and embellishment color are all based on 1-4 low saturation.

Based on this rule, designers can summarize the experience of residential building facade color design, and provide recommended color range when the facade color design is confused, so as to preliminarily realize the calculation aided color and design.

In addition, this paper puts forward data-aided residential building design, which is limited to the extension data mining of the color status of the facade of the residential building, and

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does not involve the collection and analysis of the relevant data about the site environment, color cognition and color evaluation. With the deepening of the research on architectural color, the author will carry out more detailed research on the depth and breadth of data to fill in the defects and gaps. I hope that through this study, we will introduce more detailed thinking.

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