

The classification method of different glasses is clear and composition analysis

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Abstract: With the development of the Silk Road, this paper mainly studies the glass category, glass pattern decoration, weathering, glass color, chemical composition content as the indicators to make statistical rules and analysis rules, and analyze and summarize the relationship between chemical components content. For question 1, it is divided into three problems. Preprocess the attached data, process its invalid data, and integrate the data. The first question first uses bivariate correlation analysis, using Spearman correlation coefficient and Pearson correlation coefficient, and then using chi-square test to test the results of the correlation analysis. The result is: there is a strong correlation between category and weathering, while there is no correlation between color, ornamentation and weathering.[1]The second question is based on the statistical analysis model of the first question, under the condition of glass type and surface weathering, and the vertical sample T test obtained the statistical law of silica, potassium oxide, calcium oxide and lead oxide. The third question established a predictive model and used multiple linear regression to obtain the prediction results.

Keywords: Statistical analysis model, Multiple linear regression prediction, K-Means cluster analysis, Multiple logistic regression.

1. Restatement of the problem

The silk road is the communication of Eurasian cultural, political, economic ties and bridge, and then extended to other regions such as southeast Asia, promote China's foreign trade, glass is the product, China absorption, to, for foreign, although learning western glass appearance basic consistent, but the glass composition is different. The main component of glass is silica (SiO_2), and Chinese glass has higher lead oxide (PbO) and barium oxide (BaO) content than others. [2]On the basis of its own chemical content, the proportion of chemical composition is affected by external factors, such as atmospheric environment, underlying surface, latitude position and human activities.[3] Glass is most susceptible to weathering, resulting in different colors, lines and other obvious weathering areas in the glass samples. Therefore, how to classify the chemical composition of different glass has gained great significance.

The table in the attachment alone gives the basic information of glass relics. Form two and three respectively give the chemical composition content of the classified and unclassified glass relics, and a glass relic has two parts, and the form is also supplemented. Based on the above background, please establish a mathematical model to solve the following problems:

Problem 1: Analyze the relationship between the weathering of glass cultural relics and the type, decoration and color of glass, summarize the statistical law of the comparison of weathering chemical content, and predict the proportion of each chemical composition in the glass before weathering.

Problem 2: Analyze the attached data, summarize the classification methods and rules of the two glass types, and then divide the division of each category twice according to the core chemical composition, clarify the induction and classification methods, show the results and analyze the rationality and sensitivity of the results.

Problem 3: Analyze the chemical composition of the unknown category of form III in the annex, and identify the form type of belongs, and then analyze the sensitivity of the results.

2. Problem analysis

This question mainly analyzes the relationship between different glass, weathering, decoration, color and chemical composition content, and then takes the type of glass and the representative chemical composition as the criterion to make the corresponding classification and statistical rules, and analyze the sensitivity and difference of different categories.[4] Problem 1 requires glass to be divided into high potassium and lead barium, The chemical content of weathered and unweathered separately in each class, Determine the chemical composition content before weathering according to the unweathered ability; In question 2, according to the statistical law in question 1, The indicators of the classification rules can be specified, Then for the division involved in the secondary definition of its rationality, sensitive 3 4 perceptual analysis; Then identify the unsolved types based on the chemical composition content analysis conclusion of problem 2, And analyze the sensitivity; Finally, follow the diversification relationship obtained in Question 1 and 2 to further analyze the association and difference between chemical components. Thus considerable, the four problems are consistent and progressive.[5]

3. Model hypothesis

Hypothesis 1: Suppose that the surface weathering degree of this batch of glass products is only related to the glass itself, excluding other external influence factors.

Hypothesis 2: Suppose that the chemical composition of the incomplete component detection caused by the detection means and other reasons is negligible.

Hypothesis 3: Suppose that only one flux is used when refining glass.

4. Model building and solution

This group performed the correlation analysis by spss by Pearson correlation, with significant differences in significance values less than 0.05, and the irrelevant hypothesis could not be accepted. Thus, weathering and color significance is 0.68, and that of weathering decoration is 0.371, both are greater than 8 0.05, and have no correlation; weathering and type correlation is 0.000.

Weathering is divided into physical weathering and chemical weathering. This paper mainly studies the performance of chemical weathering is the decomposition and change of the chemical composition of glass, possibly due to the geographical location, such as climate, earth, surface water, soil, biological factors, but also affected by human factors, such as people using photography, camera to take glass photos, mobile phone flash, and people exhaled carbon dioxide will reduce the life of glass. [6]Glass has a very high chemical stability, generally not easy to withstand erosion, but also can resist all acids except hydrofluoric acid corrosion. Take the window glass in life as an example, the use of a long time will lead to dim or yellow, glass products are even more so, and even appear spots and other abnormal phenomena, after the understanding of the glass for heat treatment, can reduce the occurrence of such a situation. [7]

Significant values less than 0.05 are significantly different, and the irrelevant assumption cannot be accepted. It conclude that weathering and color significance is 0.68, and weathering decoration is 0.371, both than 0.05; weathering and type are 0.000, with strong correlation. It is reasonable to conclude that this correlation by the chi-square test.

From salience, the correlation between weathering and type is quite correct.If the significance of weathering and color is greater than 0.05, the relationship between weathering and color are unrelated is correct.

Their weathering and not weathering chemical elements data pretreatment, the attachment contains blank data, from the topic is undetected chemical composition content, can be used to fill 0 processing, this group using the method of spss missing value to replace the sequence average of the pretreatment, the second text in the text of the digital processing, such as weathering =1, no weathering =2, etc.

Meanwhile, for the cultural relics with empty color column, the sequence average value is used to replace the missing value on the SPSS. The processing results are as follows:

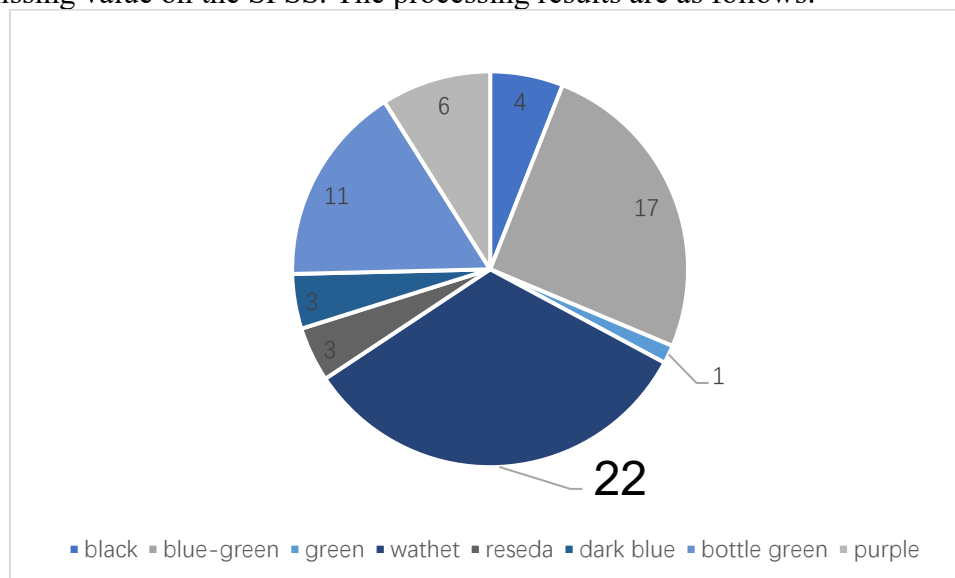


Figure 1

An independent sample t-test of spss yielded significant differences between all chemical elements before and after weathering. Conclusion: in high potassium: silica, potassium oxide, calcium oxide have a significant difference; magnesium oxide, alumina, iron oxide, copper oxide, lead oxide have no significant difference; nano oxide, lead oxide, barium oxide, phosphorus pentoxide, strontium oxide, tin oxide, sulfur dioxide are not the core elements.

Based on the conclusion of problem 1, multiple linear regression is used to obtain the distribution pattern of high-potassium glass and lead-barium glass. The main component of glass is silica, according to the chemical formula, it is very vulnerable to hydrofluoric acid corrosion, and the chemical element can corrode many other elements can not corrode. In ancient times, lead and barium glass rich elegance was thought by some experts that lead and barium glass contains the highest proportion of lead by the surrounding environment of water, water vapor and other reactions to form lead carbonate intensified the degree of glass weathering. [8]With respect to glass that has been corroded, quicklime CaCO_3 can generally be used as a cosolvent, and an appropriate amount of MnO_2 is added by the individual.

The significance of nano-oxide, potassium oxide, calcium oxide, iron oxide and phosphorus pentoxide are all less than 0.05, indicating that the classification of glass is determined by these five chemical elements.

This division is mainly based on the size of the glass chemical composition content, if the chemical composition has the highest proportion, removing the impact of the chemical composition, it can be used as the basis for the division.

The sensitivity results were obtained by one-way ANOVA and linear trends of the elbow rule.

Because already selected clusters maximize differences between cases in reciprocal clusters, the F test should only be used only for the purpose of describing the results. The measured significance level was not therefore corrected, so it cannot be interpreted as a test for the hypothesis that the cluster mean is equal. The images of the high potassium elbow rule are relatively flat after 3, so the clustering results are reasonable. According to ANOVA, the number of variables with by freedom of error is 15, so their sensitivity is low.

The image of lead and barium is relatively flat after 5, so the clustering result is reasonable. According to the ANOVA, judging from the error degree of freedom, the number of unrestricted variables is 44, which has a low sensitivity.

Below is a diagram of the three types of chemical elements after subdivision:

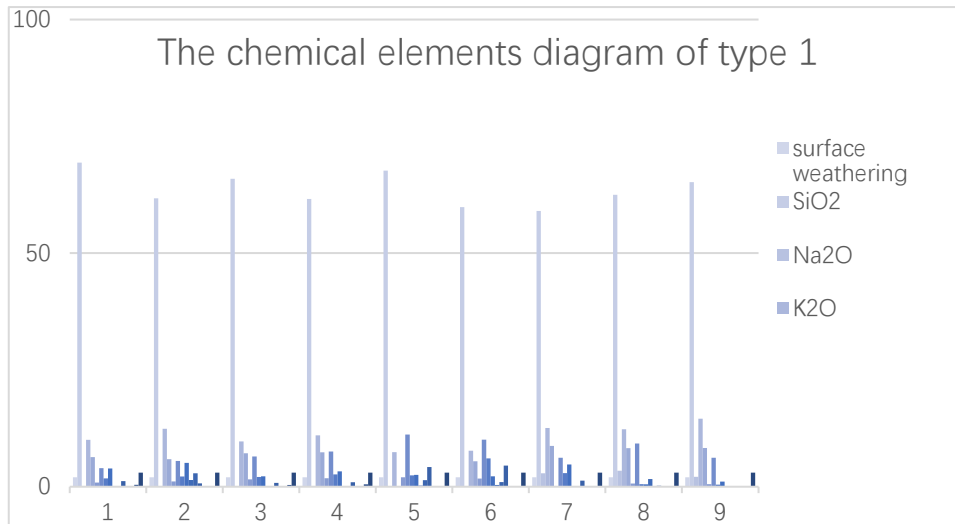


Figure 2. The chemical elements diagram of type 1

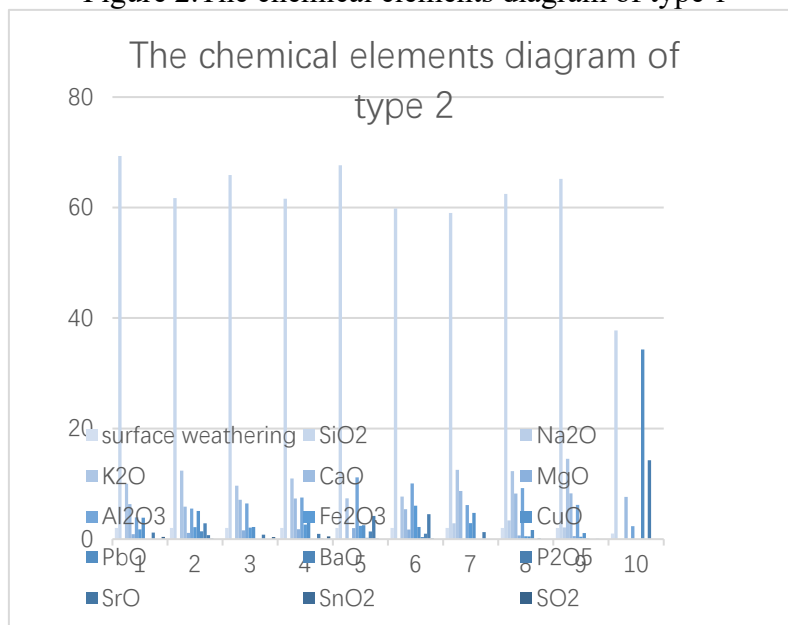


Figure 3. The chemical elements diagram of type 2

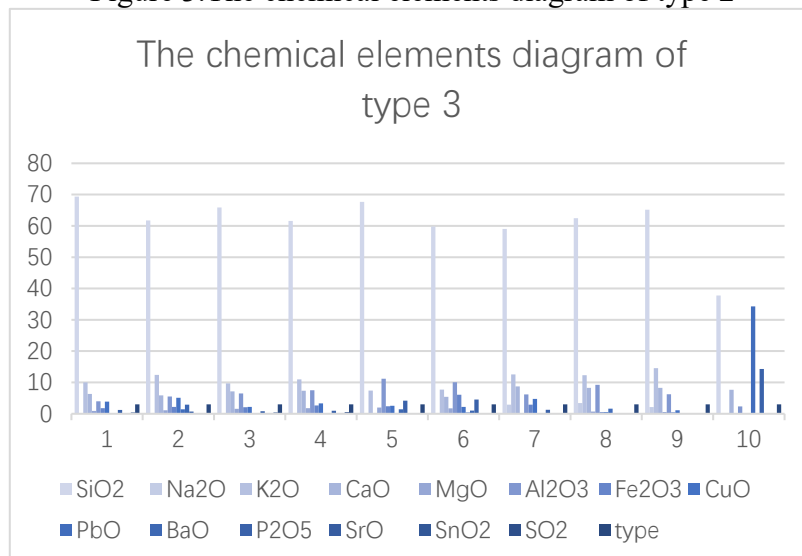


Figure 4. The chemical elements diagram of type 3

Based on the independent sample T test and correlation coefficient model, the following conclusions are drawn:

According to the correlation between the chemical components of high potassium: silica is closely related to potassium oxide, calcium oxide, aluminum oxide, copper oxide, copper oxide, calcium oxide, iron oxide, copper oxide, calcium oxide, potassium oxide, alumina, iron oxide, magnesium oxide, potassium oxide, magnesium oxide and alumina, iron oxide, iron oxide and lead oxide; Iron oxide is closely related to silica, copper oxide, potassium oxide, calcium oxide, oxidase, alumina, aluminum oxide, phosphorus pentoxide, barium oxide and other elements; strontium oxide and other elements; tin oxide and other elements; sulfur dioxide and other elements;

Any substance is made up of chemical elements, Including glass is also, By the question, The main component of glass is 22 silica, according to investigation, Very susceptible to environmental factors, Especially in the process of weathering, Much exchanges between the elements of glass and the elements possessed by the external environment, The main performance of its exchange is: the massive loss of silicon Si elements along the bending tendency of the glass surface, Barium Ba forms an invagination convex structure in the outermost layer, Sulfur S begins to accumulate in the outermost layer of the glass, Magnesium Mg and calcium Ca are already getting higher near the interior, Lead content has gradually decreased from the outside to the inside, The main color element of copper Cu began to lose, Iron Fe elements also accumulate in the outer layer. [9]The molecular arrangement of glass is irregular, and their molecules have strong homogeneous properties in space. Suppose that in an ideal state, the chemical and physical properties of the glass are extremely similar in many respects. Glass is a mixture, the non-crystalline material, so there is no fixed boiling point, and the conversion of glass from solid to liquid must be produced inside a temperature interval.[10]

5. Model evaluation and improvement

(1) The first and fourth questions establish statistical analysis models based on bivariate correlation analysis, chi-square test and independent sample T test, so that the relationship between variables is well established and the different relationship between variables is clearly obtained. The prediction model established based on multiple linear regression is more suitable for the reality. The results have strong visualization, which can clearly judge the prediction mode and the prediction results, but it cannot accurately predict the variables with gray attributes.

(2) The second question: The regression model established based on multiple linear regression analysis and correlation analysis can make an accurate judgment on the distribution pattern of glass types, and it can get the main factors affecting the glass classification. The clustering model is established based on system clustering, K-means clustering, elbow rule and one-way ANOVA. This model is partially optimized compared with the previous clustering model. It is feasible from the establishment to the final test, but the calculation method is complicated and the data requirements are high.

(3) The third question establishes a classification model based on multiple logistic regression, which can accurately identify unknown types and obtain relatively excellent results. The analysis of sensitivity is not perfect, so other optimization class methods can be used to improve this problem.

6. Model promotion

- (1) Bivariate correlation analysis model promotion: the status of student network addiction survey.
- (2) Promotion of chi-square test model: such as whether smoking is related to respiratory diseases; whether more categories of product raw materials are related to product qualified (dichotomy variables).
- (3) Promotion of independent sample T test model: mixed synchronous network classroom effectiveness.
- (4) Model promotion of multiple linear regression: to investigate the contribution of the three major industries to China's economy.

- (5) k Model promotion of people's income mean clustering model: enterprise information management.
- (6) System clustering method model promotion: accurate portrait of target customers.
- (7) Promotion of multiple logical regression model: automatic disease diagnosis; economic forecast.

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