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Cultural Analysis of Music Development History Based on Pearson Correlation Coefficient

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Abstract: Music is an important part of human social and cultural heritage, which plays an important role in the process of human evolution and social development.In the process of music evolution, social characteristics are influenced by musical emotions, musicians'creativity or political events, thus quantifying the innovation and development of musical instruments. Music can analyze various factors of music development.By constructing networks instead of the relationship between music characteristics, music can explore the gradual evolution of music in social culture In order to explore music influence and construct directed network, we have established quantitative indicators of music influence, and constructed a two-way network of music genres and artists.Furthermore, based on topic method, we use three indicators of pop music persistence and faction achievement to construct network music influence, and explore the internal relationship between directed network and network.
Keywords: Factor analysis; Pearson correlation coefficient; Ideal point; Fitting; Music evolution

1. Introduction

Music is an important part of the cultural heritage of human society and plays an important role in the process of human evolution and social development.Music also evolves and evolves with the development of human society in all aspects.In the process of music evolution, new music and music artists are influenced by various factors, such as musicians'musical feelings and creativity, the characteristics of social innovation and development or musical instruments of political events.

As far as music works are concerned, enumerating some music artists can influence other artists, while music works can often reflect similar characteristics to influence other artists.As far as music genre is concerned, the influence of musicians and social external factors on its function will be reflected in the development of music genre.

Therefore, through the quantification of music, we can analyze the influence of various factors on new music and music artists. By establishing the relationship between music network and music characteristics, we can explore the influencing factors and process of music's gradual evolution in social culture.

In this paper, the influence data set is used to create a directional network of music influence, and an index to quantify music influence is created to explore the role of quantified music influence in the directional network.The whole music data is used to establish indicators, explore the similarities between artists and genres of the same genre and different genres, and analyze the changes of music genres over time and the interactions between genres.

2. Establish a directional network of music influence

In order to explore the music influence and build a directed network, we have established the quantitative music influence index, and built a two-way network-data set about music genres and artists'influence.We have counted the number of influencing artists and genres as indexes reflecting music influence[1].

In order to construct the directional network of music genres, we use blue dots to represent different genres, and the interaction between each genre is represented by the line segment between dots.The size of the line segment reflects the size of the influence, in which the greater the influence, the longer the line segment[2].

When the directional network establishes musicians'interaction, we select the Beatles with the greatest musical influence among artists, and three musicians with the greatest influence among them, and further find the most influential individual in each musician group, and establish the directional network in this way[3]

3. The creation of music influence parameters

Ideal solution is a multi-objective decision-making method in system engineering, which finds the best and the worst among the limited schemes.When the feasible solution is closest to the best scheme and far away from the worst scheme, the vector set of the scheme solution is the optimal impact evaluation index.TOPSIS is a commonly used comprehensive evaluation method, which can make full use of the information of original data, and its results can accurately reflect the gap between evaluation schemes[4].

Develop parameters that can capture the"music influence"in the network.The greater the final influence parameter, the greater the

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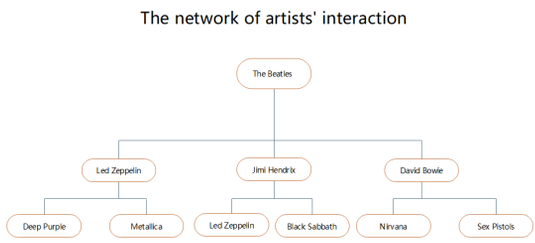
music influence, the better.

The influence of a faction on other music is mainly reflected in the size of the faction and the persistence of its popular influence



range.Under the condition of the same faction scale, the longer it prevails, the greater its influence.In addition, in a given period of time, the wider its influence, the greater its influence, which is mainly reflected in the number of schools and followers.

Based on qualitative analysis and data availability, we have established the following evaluation index system of music influence.

Since the four evaluation indicators are all positive indicators, but the dimensions of the four indicators are different, the influence of different indicators should be eliminated directly through standardization.

It is assumed that there are evaluation objects and m evaluation indicators are always positive.They form a positive matrix as follows:

$$X = \begin{bmatrix} x_{11} & \cdots & x_{1m} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{nm} \end{bmatrix}$$

The normalized forward matrix is represented by z, and each element of z:

$$z_{ij} = x_{ij} \Big/ \sqrt{\sum_{i=1}^{n} x_{ij}^2}$$

Finally, the scores are calculated and standardized, assuming that there are N evaluation objects and M evaluation indicators that have been normalized, and their standardized matrix is as follows:

$$Z = \begin{bmatrix} z_{11} & \cdots & z_{1m} \\ \vdots & \ddots & \vdots \\ z_{n1} & \cdots & z_{nm} \end{bmatrix}$$

Calculate I(I=1, 2, ...), n)evaluation object and maximum value:

$$D_i^+ = \sqrt{\sum_{j=1}^{\infty} \left(Z_j^+ - z_{ij}\right)^2}$$

Calculate the distance between i(i=1, 2, …, n)evaluation object and the minimum value:

$$D_i^- = \sqrt{\sum_{j=1}^{\infty} \left(Z_j^- - z_{ij}\right)^2}$$

4. Analysis of the importance of factors affecting music development

Because there are many factors affecting music, we first analyze and screen a large number of different types of data.There are 13 variables that affect music.Through factor analysis, the data are processed into six new comprehensive variable factors, and the relationship between the six comprehensive factors and the original 13 factors is obtained[5].

According to KMO test standard provided by Kaiser, KMO value in this factor analysis is 0.808, which is suitable for factor analysis[6].

The apvalue of Bartlett's spherical test is equal to 0.000 and less than 0.05, which shows that we reject the original hypothesis at 95%confidence level, that is, we think the data is suitable for factor analysis.

According to scree test, the number of factors can be determined by directly observing the change of eigenvalues.It can be seen from the gravel map that the eigenvalues corresponding to the first six factors change steeply.From the seventh factor, the change of eigenvalue is relatively gentle, so we should choose six factors to analyze.

By rotating the non-rotating factor load matrix, the load distribution on each common factor is clearer, and the meaning of each factor is clearer.Factor load is the correlation coefficient between variables and common factors.When the absolute value of the load of a variable in a common factor is larger, the variable is closer to the common factor, that is, the common factor can represent the variable better.According to the above analysis, the loads of four comprehensive factors, 1, 2, 3, 4, 5 and 6, are obtained.

	form					
	one	2	3	four	5	6
Dancing nature	0.074	0.538	0.1	0.125	0.019	-0.162
vitality	0.274	0.005	0.099	0.027	0.03	0.172
valence	0.059	0.554	0.046	0.113	0.006	0.183
rhythm	0.061	0.019	0.04	0.098	0.057	0.682

volume	0.295	0.017	0.047	0.058	0.018	-0.033
model	0.042	0.037	0.16	0.22	0.606	-0.233
key	0.051	0.036	0.171	0.268	0.709	-0.253
sound	0.299	0.059	0.064	0.01	-0.032	-0.081
instrumental	0.154	0.076	0.189	0.149	0.12	0.506
activity	0.009	0.091	0.674	0.078	-0.003	-0.057
eloquence	0.119	0.144	0.422	0.468	0.022	0.054
clear	0.03	0.066	0.077	0.677	-0.045	-0.069
The state of being agreeable	0.28	0.151	0.256	0.135	-0.002	-0.207

According to the results of the component score coefficient matrix, the factor scores of six comprehensive factors are analyzed, and new comprehensive independent variables are obtained from the score coefficient of the original value of each comprehensive variable, where:

$$f1 = -0.074 \times \text{danceability} + \cdots + 0.28 \times \text{popularity}$$
$$f2 = 0.538 \times \text{danceability} + \cdots - 0.151 \times \text{popularity}$$
$$f3 = -0.127 \times \text{danceability} + \cdots - 0.256 \times \text{popularity}$$
$$f4 = 0.125 \times \text{danceability} + \cdots + 0.135 \times \text{popularity}$$
$$f5 = 0.019 \times \text{danceability} + \cdots - 0.002 \times \text{popularity}$$
$$f6 = -0.162 \times \text{danceability} + \cdots - 0.207 \times \text{popularity}$$

In order to analyze the similarity of musicians and the relationship between factions, we need to establish the relationship between music characteristics and music factions.Therefore, combining impact_Data and data_by_Artist, we will find all the artists in data_by_Artist according to impact_Data, and remove 418 unknown data without genre.In the remaining 20 schools, Blue, Electronic, Jazz, Pop/rock, Latin and International were selected as experimental quantities for analysis.

Through the above factor analysis method, we determined six virtual variables f1, f2, f3, f4, f5, f6, and realized the dimension reduction of music features.According to the results of factor analysis, we calculated the f1-f6 of all artists in the experiment.The average value is taken according to the genre.Then we get six groups corresponding to different factions are obtained $\overline{f_1}, \overline{f_2}, \overline{f_3}, \overline{f_4}, \overline{f_5}, \overline{f_6}$。We take $\overline{f_1}, \overline{f_2}, \overline{f_3}, \overline{f_4}, \overline{f_5}, \overline{f_6}$ As a representative parameter, and on behalf of the corresponding factions, the relevant analysis was carried out.

$$\overline{f_i} = \frac{f_{i1} + f_{i2} + f_{i3} + \cdots + f_{in}}{n}$$

Generally speaking, the relationship between variables can be divided into two kinds, one is deterministic relationship, that is, the usual functional relationship, such as the relationship between circle area s and radius r, where s=πR2.The other is non-deterministic relationship, that is, correlation relationship.In statistics, correlation analysis is based on the analysis of the linear relationship between variables, and it is a statistical method to study the linear correlation between them.Pearson correlation coefficient is one of these statistics.Pearson correlation coefficient is usually expressed by R, which is used to measure whether two data sets are on the same line, that is, to measure the linear relationship between distance variables.When there is a linear relationship between them, Pearson correlation coefficient is usually used to describe the degree of correlation between them.

$$R_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})\sum_{i=1}^{n}(y_i - \bar{y})}}$$

5. Conclusion

In this paper, we build a model to analyze the similarities in many aspects of music.We use many simulations to analyze our model. Finally, we apply our model to different aspects of music data, find out their similarities, and draw many conclusions.Factor analysis still uses SPSS, but does not use SPSS's own data standardization method, but uses it, which is a normalization method to improve data standardization, and then makes factor analysis on standardized investment group indicators and output indicators respectively, and finally obtains group comprehensive scores and output comprehensive scores.The ratio between group comprehensive scores and output comprehensive scores is the required efficiency value.

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