ISSN 2618-1568 Vol. 3, Issue 2: 15-19, DOI: 10.25236/FAR.2021.030204

Analysis of Music Development in the Past 90 Years

Guanhan Li

School of Aeronautics, Northwestern Polytechnical University, Xi'an, Shaanxi 710000

Abstract: *From classicism to romanticism to the diverse development of today, music has become an inseparable part of human society. In fact, an artist will be affected by many factors when creating new music. It is undeniable that many songs have many similarities, and due to the mutual influence of artists, with the development of time, the music type has undergone a major change. In our Index Weight Analysis Model, we first analyzed the consistent relationship between music indicators and music influence. Then we use the extreme value method for dimensionless processing of the original data and calculate the correlation coefficient. In order to eliminate the impact of the resolution coefficient on the accuracy of our subsequent calculations, we use the distance between the two points to calculate the weight coefficient, and finally calculate the weighted correlation degree, which is Music Influence. In the end, we found the musicians with the highest musical influence among the 20 genres, and drew a directional network using a musician as an example. Also, we use the same method to analyze the contribution of each indicator to music influence and we find that the biggest contribution is Tempo.*

Keywords: *Grey Relational Analysis, Kendall Coefficient, Mahalanobis Distance, Correlation Analysis, Music Influence*

1. Introduction

From classicism to romanticism to the diverse development of today, music has become an inseparable part of human society. In fact, an artist will be affected by many factors when creating new music. It is undeniable that many songs have many similarities, and due to the mutual influence of artists, with the development of time, the music type has undergone a major change.

By studying the similarity of artist's songs, we can begin to understand the degree of mutual influence between musicians. And we can also better understand the development of music in human society throughout the ages. There are sometimes revolutionary changes in the development of music. Through research on past music development, we may be able to predict the future development of music.

2. Consistency Analysis of Factor Change Trends

A large amount of factors ought to take into account to quantify the music influence. In the process of music development, if the size of influence is consistent with the change of a certain factor, that is, the degree of synchronous change is higher, it means that the two have a higher degree of correlation, and vice versa.

The development of music was first influenced by religion, later by the Renaissance movement, and later by the social revolution movement. Music has experienced multiple developments from classical music to romanticism to today, we cannot deny that the social environment has played a vital role in the development of music. In addition, the subjective weighting method in the index evaluation method is subjective and arbitrary, and the objective weighting method often causes a certain degree of information loss. In order to solve this problem, we propose a subjective and objective integration method that uses the gray correlation degree to solve the index weight.

Therefore, we come up with an analysis model of index weight based on grey relational degree [1], social environment factors and Influencing factors among artists, which belongs to a complex network, to reflect the music influence more specifically. The factors we selected from the attached attachments and the degree of relevance given to them are as follows:

ISSN 2618-1568 Vol. 3, Issue 2: 15-19, DOI: 10.25236/FAR.2021.030204

Table 1: Consistency Analysis of Factor Change Trends

Factors	Relationship with degree of influence
Number of people directly affected X_{1j}	Proportional
Number of people indirectly affected X_{2j}	Proportional
Total popularity in main genre X_{3j}	Proportional
The popularity of influencers by year X_{4j}	Inversely proportional
Impact time range X_{5j}	Proportional
Ranking of influence in main genre by year X_{6j}	Inversely proportional
Total influence of artists in the year X_{7j}	Proportional

The calculation method of Ranking of influence in main genre by year is to first filter out all the artists in the genres in this year, and then rank according to the number of influencers. And Total influence of artists in the year means the total number of artists in all genres in this year.

3. The Calculation of the Influence Ranking of Musicians

The data sequence that reflects the system behavior characteristics is called the reference sequence. Based on the consistency analysis above, here we select the factor values that can make the musician the most influential. The reference sequence can be expressed by the following formula:

$$X_0 = (x_{01}, x_{02}, x_{03}, x_{04}, x_{05}, x_{06}, x_{07})$$

Because the measurement units in the original data are not uniform, in order to ensure the accuracy of data analysis, the original data needs to be processed without dimension to make it comparable. Our team selects the extreme value method, the formula is as follows:

$$x_{ij} = \frac{X_{ij}}{\max_j X_{ij}}$$

By analyzing the data given and removing the same data, we finally got a total of 5603 influencers and affected people, among which 3774 are influential musicians.

Then using X0 as the reference sequence, we can get the correlation coefficient between each influencing factor and the reference weight value. The calculation formula of the correlation coefficient is as follows:

$$\xi_{0i} = \frac{\min_i \min_j \mid x_{0j} - x_{ij} \mid + \rho \max_i \max_j \mid x_{0j} - x_{ij} \mid}{\mid x_{0j} - x_{ij} \mid + \rho \max_i \max_j \mid x_{0j} - x_{ij} \mid}$$

In the above formula, A is the resolution coefficient, ρ (0, 1), generally take ρ = 0.5 . The degree of relevance of each series directly reflects the relative importance (that is, the weight) of each evaluation index relative to the set series.

Find the distance D0i between each index sequence X1, X2 ⋯; Xn and the reference sequence X0, solve the weight wi of each indicator and perform normalization processing to obtain the final normalized weight w i. In this step n=7.

$$D_{0i} = \sum_{k=1}^{n} \left(x_{0j} - x_{ij}\right)^2$$

$$w_i = \frac{1}{1 + D_{0i}}$$

$$w_i^* = \frac{w_i}{\sum_{i=1}^{n} w_i}$$

Weighted relevance, which is the indicator of musician influence. The formula is as follows:

$$R_i = \frac{1}{n} \sum_{j=1}^{n} \xi_{ij} \times w_i$$

Until now, we have obtained the musician s influence index Ri. The larger this index means the greater the influence of musicians, so we can get the ranking of musician s influence. The most influential artists of each genre are shown in the table below:

ISSN 2618-1568 Vol. 3, Issue 2: 15-19, DOI: 10.25236/FAR.2021.030204

Table 2: The Most Inflfluential Artists

Name	Influencer ID	Genre	Music Influence
The Beatles	754032	Pop/Rock	0.6098
R. Kelly	319347	R&B	0.3916
Woody Guthrie	577531	Folk	0.3901
Pat Green	134761	Country	0.3867
Chantal Kreviazuk	199917	Easy Listening	0.3864
Skillet	749571	Religious	0.3852
Tippa Irie	931231	Reggae	0.3847
The Prodigy	492162	Electronic	0.3846
Medeski, Martin&Wood	406583	Jazz	0.3844
Daddy Yankee	559405	Latin	0.3834
Toumani DiabatÃ©	744075	International	0.3808
Madeleine Peyroux	193594	Vocal	0.3764
Howlin' Wolf	276085	Blues	0.3713
Denis Leary	238245	Comedy/Spoken	0.3707
Terry Riley	750519	Avant-Garde	0.3543
Arvo PÃ¤rt	929776	Classical	0.3508
John Tesh	190012	New Age	0.3504
Hans Zimmer	961427	Stage&Screen	0.3476
Alvin&the Chipmunks	744969	Children's	0.3149
The Bothy Band	620126	Unknown	0.3118

4. Contribution of Each Indicator to Music Influence

After deriving the influence of each musician and its ranking, we try to find out what kind of contribution each music index has in the influence, that is, the degree of influence of the music index on the music influence.

Similar to the influence calculation method in the previous step, we also use the gray correlation model to construct the contribution of factors such as the number of people directly affected, that is, the weighted correlation.

Based on the results obtained above, we select the influence of all musicians calculated by equation (7) as the reference sequence. In the following formula, the value range of j is 1, 2, 3 $\cdots$3774 and the value range of i is 1, 2, 3 $\cdots$7 .

$$Y_0 = (y_{01}, y_{02} \cdots, y_{0j}, \cdots, y_{03774})$$

Since the results obtained in the above steps have been dimensionlessly processed, we can directly calculate the correlation coefficient η0i and weight coefficient P_i .

$$\eta_{0i} = \frac{\min_i \min_j \mid y_{0j} - y_{ij} \mid + \rho \max_i \max_j \mid y_{0j} - y_{ij} \mid}{\mid y_{0j} - y_{ij} \mid + \rho \max_i \max_j \mid y_{0j} - y_{ij} \mid}$$

$$P_i = \frac{1}{n} \sum_{j=1}^{n} \quad \eta_{ij}$$

Through the analysis of the degree of contribution to music indicators, we have calculated the weight coefficients and we found that the the biggest contribution to music influence is Tempo. In addition, we took one of the musicians as an example to draw a directional network diagram of musical influence, which more intuitively expressed the indicator of musical influence:

ISSN 2618-1568 Vol. 3, Issue 2: 15-19, DOI: 10.25236/FAR.2021.030204

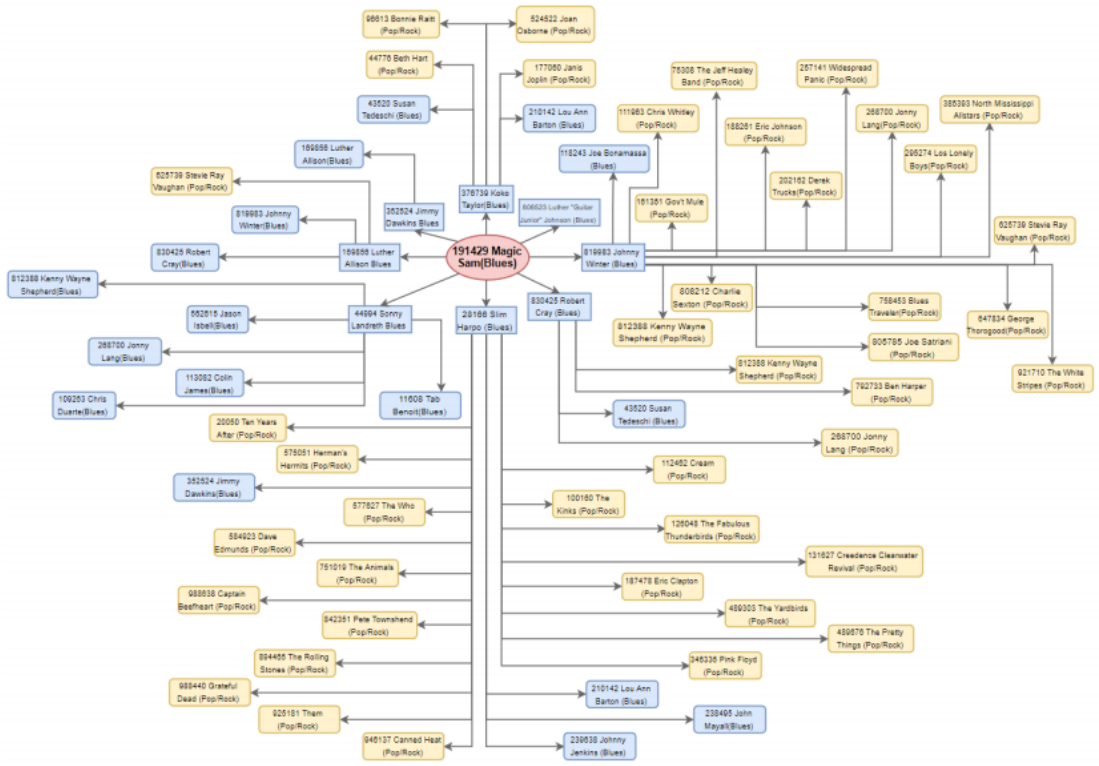

Figure 1: Directional Network Diagram

5. Contribution of Each Indicator to Music Influence

In our sensitivity analysis, we will select a few specific sample points in the attachment for research. For each data indicator, we adjust to a certain extent to explore how sensitive the model is to system data. The adjustment methods are as follows:

$$\rho_j = k(\rho)_{ij}$$

The variation range of the coefficient is from 0.25 to 0.75, using 0.01 as a step size, and gradually increasing the value of k. Under the condition of system data changes, we have obtained the weighted similarity changes under the following resolution coefficient settings:

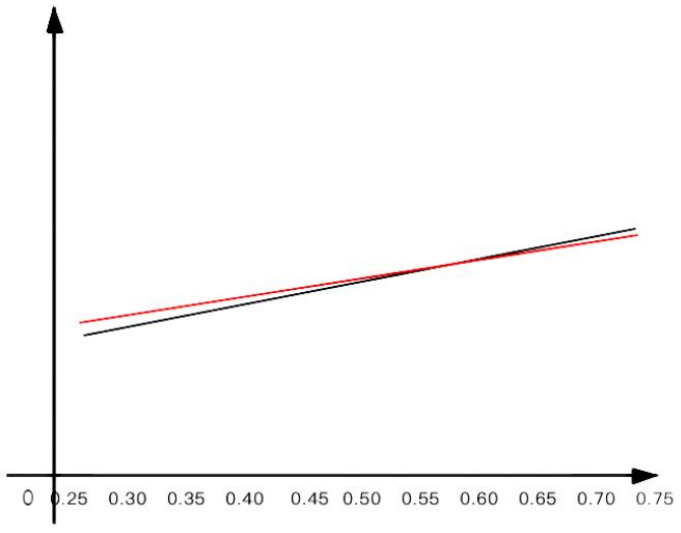

Figure 2: Sensitivity Analysis

ISSN 2618-1568 Vol. 3, Issue 2: 15-19, DOI: 10.25236/FAR.2021.030204

6. Conclusion

From the results of sensitivity analysis, it can be seen that the change in the value of the resolution coefficient has little effect on the measurement of music influence, which shows to a certain extent that we can think that the resolution coefficient related to the artificial value has a small effect on the final result, which proves The music influence measurement model we have established has high calculation accuracy.

References

[1] Zhou Qilong. Evaluation of the gray correlation degree of 19 introduced oat varieties in Ali, Tibet [J/OL]. Crop Magazine: 1-6 [2021-02-06]. http://kns.cnki.net/kcms/detail /11.1808.S.20210119.1610.012.html.
[2] Cui Jie, Dang Yaoguo, Liu Sifeng. An improved method for solving index weights based on gray correlation [J]. Chinese Management Science, 2008 (05): 141-145.
[3] Wang Hao, Wang Peng, Yu Jiahang,Zeng Xianming, Li Zhen,Shu Jingting,Zou Jianmin,Xu Xinglian.Sensory evaluation combined with principal component analysis and Mahalanobis distance analysis method to compare the volatile compounds of different chicken breeds [J/OL]. Food Industry Technology: 1-13 [2021-02- 07]. https://doi.org/10.13386/j.issn1002-0306.2020100031
[4] Zhao Xin. The influence of music in the 20th century on Western music traditions [J]. Northern Music, 2019, 39 (13): 10+16.
[5] Wang Yang. Thoughts on the Research Methods of Western Music History [J]. Music World, 2018 (12): 7-10.
[6] Wang Yu. Analysis of Academic Tradition and Contemporary Vision of Western Music History [J]. The Voice of the Yellow River, 2018 (13): 26-27.
[7] Zhou Yanxin. Analyze the characteristics of western music according to the theoretical positioning of western music historiography [J]. China National Expo, 2017 (04): 149-150
[8] https://blog.csdn.net/shuangyufrank/article/details/41981951
[9] https://www.pianshen.com/article/161851638/
[10] https://zhuanlan.zhihu.com/p/138107999