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Evaluating the Influence and Evolution of Music Based on Complex Network

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Abstract: *For Task I, first we use "influence data" for network analysis, and conclude that influencers will have an impact on most followers. Then the weight of each index is obtained by using the grey comprehensive evaluation method, and the "music influence" evaluation model is obtained.Later, first, the data in "full_music_data" is screened; Principal component analysis is used to reduce the dimension and normalize the data; Pearson correlation analysis is used to get the correlation between each two songs. If the correlation degree is greater than 0.9, the two songs are considered to be similar. Taking three fields as the research object, the mapping analysis shows that there are great differences in the degree of internal and external similarity in different fields. For example, compared Country with R&B, the artists of the genres are more similar, and compared Country with Jazz, the artists of the genres are more similar.*

Keyword: *Complex Network Analysis, Principal Component Analysis, Pearson Correlation Analysis, Normalization Processing, Gantt Chart, Gephi*

1. Introduction

Music has been part of human societies since the beginning of time as an essential component of cultural heritage. As part of an effort to understand the role music has played in the collective human experience, we have been asked to develop a method to quantify musical evolution. There are many factors that can influence artists when they create a new piece of music, including their innate ingenuity, current social or political events, access to new instruments or tools, or other personal experiences. Our goal is to understand and measure the influence of previously produced music on new music and musical artists.

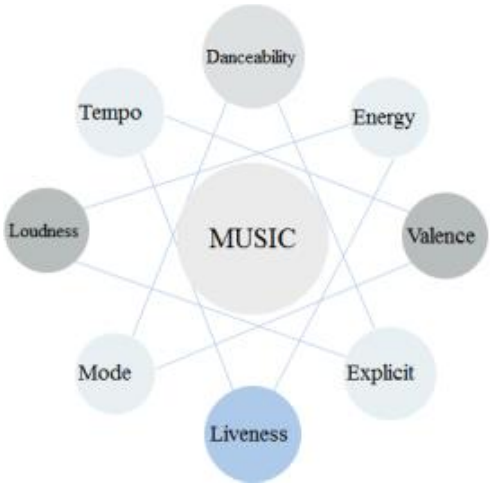

Figure 1: Characteristics of the music

Some artists can list a dozen or more other artists who they say influenced their own musical work. Many songs have similar sounds, and many artists have contributed to major shifts in a musical genre. Sometimes these shifts are due to one artist influencing another. Sometimes it is a change that emerges in response to external events (such as major world events or technological advances). By considering networks of songs and their musical characteristics, we can begin to capture the influence that musical

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artists have on each other. And, perhaps, we can also gain a better understanding of how music evolves through societies over time.

2. General Assumptions and Model creation flow chart

Music affects all aspects of human life, so it is impossible to get the influence on every aspect. At the same time, the amount of music data every year is also very large, so we have made some assumptions and simplifications.

●**Assumption 1:** It is assumed that the artistic creation of artists in the data is not affected by other than the given data.

⇨ **Justification:** In order to ensure that the influence between artists is accurate, if it is influenced by other factors, there will be too many influencing factors, and the model will become extremely complex, which is not conducive to modeling and solving problems.

●**Assumption 2:** It is assumed that the music in the data contains all the music in the world or can represent all the music in the world.

⇨ **Justification:** In order to ensure the accuracy of the evolution of music.

●**Assumption 3:** It is assumed that the data in the data is complete and missing for the previous year

⇨ **Justification :** In order to ensure the integrity of the data given when the model is built.

3. For Task Ⅰ: Music Influence Model

3.1 Directional Network Establishment

After processing the *influence_data* data, find out the sum of follower artists corresponding to each influential artist in the data, and select the top 18 influential followers from these influential artists. The corresponding numbers of the top 18 influential artists and the number of followers they influence are as follows:

Table 1: Main influencers and number of followers

Influencer id	Number of followers	Influencer id	Number of followers
423829	160	354105	193
66915	389	180228	166
771438	171	41874	180
631774	155	418740	152
100160	189	549797	184
754032	595	120521	157
894465	310	531986	238
840402	181	128099	152
139026	221	316834	169

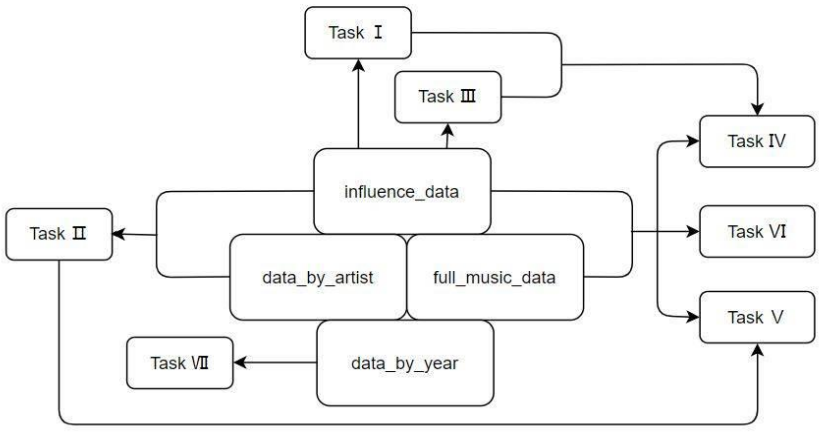

Figure 2: Model creation flow chart

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Using Gephi software to process the data in Table 1, we can get the network relationship diagram between the top 18 influential artists and their corresponding follower artists, as shown in Figure 3:

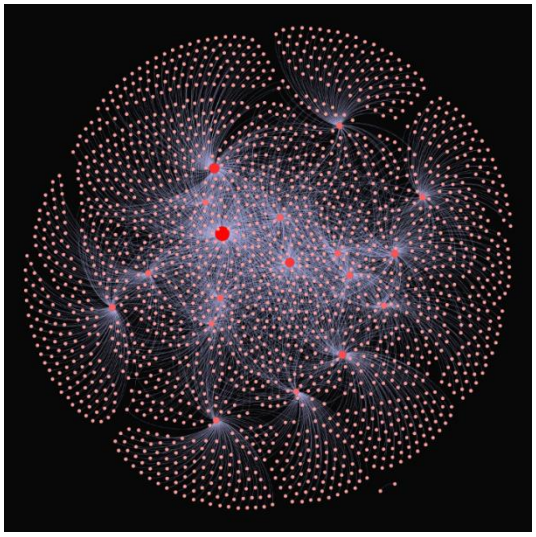

Figure 3: Artist network diagram

According to Figure 3, it can be seen that the prominent 18 red dots represent the top 18 influential artists. Among them, the more influential the number, the larger the red dots, and the other non-prominent dots are follower artists.

3.2 Grey Relational Analysis

Step 1: In *influence_data* data, all artists are selected as evaluation objects, and there are 7 evaluation indexes selected, namely, the number of people influenced by each artist, the number of people influenced by the genre, the number of followers in the genre, the total number of people in the genre, the number of people in the genre year, the ranking of influence in the genre year and the competitiveness in the year. The reference column is $x_0 = \{x_0(k) \mid k = 1, 2, \cdots, n\}$, and the comparison column is $x_i = \{x_i(k) \mid k = 1, 2, \cdots, n\}, i = 1, 2, \cdots, m.$

Step 2: Determine the weight corresponding to each index.

Step 3: Calculate the grey correlation coefficient:

$$\xi_i(k) = \frac{\min\limits_s \min\limits_t |x_0(t) - x_s(t)| + \rho \max\limits_s \max\limits_t |x_0(t) - x_s(t)|}{|x_0(t) - x_s(k)| + \rho \max\limits_s \max\limits_t |x_0(t) - x_s(t)|} \tag{1}$$

Where $\rho \in [0,1]$ is the resolution coefficient. Generally speaking, the greater the resolution coefficient ρ , the greater the resolution; The smaller the resolution coefficient ρ , the smaller the resolution.

Step 4: Calculate the grey weighted correlation degree. The calculation formula of grey weighted correlation degree is

$$r_i = \sum_{k=1}^{n} w_i \xi_i(k) \tag{2}$$

Where r_i is the grey weighted correlation degree of *i* evaluation objects to ideal objects.

Step 5: In evaluation analysis, according to the grey weighting degree, the evaluation objects are sorted, and the correlation order of evaluation objects is established. The greater the correlation degree, the better the evaluation result.

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3.3 Result

According to the directional network diagram and grey relational analysis of the influence and pursuer, the order of the weight of the influence index of the music model is obtained.as shown in Table 2 below

Table 2: Index weight table

Weight order	Weight	Indicator Name
1	0.9806	Yearly influence ranking in the genre
2	0.9733	Competitiveness in the year
3	0.9698	Followers
4	0.9697	Number of followers in the genre
5	0.9696	Total number of people in the genre
6	0.9683	Number of people affected in the genre
7	0.8567	Number of people in the genre year

4. Conclusion

Sensitivity analysis shows that our model has good robustness, and then we summarize the experimental model and conclusions in concise language, which is discussed in the final document to ICM Association.

References

[1] Han Zhi. On the influence of Internet on music communication [J]. Literature and art. 2010: 262.
[2] Fu Wenjuan. The influence of new media on music communication [J]. Journalistic front. 2015: 140-141.
[3] Roger Kamien. Music lesson [M]. Hainan Publishing House, 2004.3
[4] Si Shoukui, Shun Zhaoliang, Mathematical modeling algorithm and Application, National Defense Industry Press, Year 2017.