Simulation Research Based on Ant Colony Theory of Music and Dance Technical Movement Matching Optimization

Bin Liu

Music and Dance school, Xu Chang University, Chongqing 461000, China

Abstract

The higher the matching degree between modern music and dance technical movement is, the more appealing dance choreography and stage presentation are, thus promoting their respective development. The basic connotation of ant colony theory is presented in this paper. At the same time, development situation of modern music and dance technical movement matching optimization is analyzed, and the simulation model of modern music and dance technical movement is further proposed. From aspects of implementation information collection and construction of modern music and dance technical movement matching optimization process, etc., it is aimed at improving the matching degree of modern music and dance movement skills, promoting the development of modern choreography.

Keywords: Ant Colony Theory, Modern Music, Dance Technical Movement.

1. RESEARCH BACKGROUND

1.1 Research overview

Music is one of the important elements of dance. It is found that the different music rhythms also affect dance skills (Yang, 2017). Different music rhythms are expressed in dance movements with different forms. Dance, during its presentation process, combined with different themes expressed by music, adjusts dance movements, which is called matching technique of modern music and dance technical movement (Chen, 2017). Matching technology of modern music and dance technical movement plays an important role in choreography. In the process of the development of dance technology and music, people are more and more demanding on matching of modern music and dance technical movements. More emphasis is placed on the degree of matching between modern music and dance technical movement in process of choreography (Tian, 2017). Dance technical movements in the matching process should be relevant to the theme of modern music, so that the viewers have a more profound understanding of music, enhancing the viewers' sense of substitution, enabling them to understand the emotions. Therefore, the modern dance in the choreography process should carry out tests on matching degree of modern music and dance technical movements through use of various models to find the most reasonable method for matching optimization of modern music and dance technical movement. Ant colony theory with regard to modern music and dance technical movement matching is used to construct the optimal model (Chen, 2017). Computer technology is combined to carry out ant colony algorithm, further optimizing the matching degree of modern music and dance technical movements. Use of ant colony algorithm provides a new way for matching optimization of modern music and dance technical movements, changes traditional matching method of modern music and dance technical movement and facilitates change of dance technical movements with change forms of music (Zhou, 2016). Matching optimization of modern music and dance technical movements has become the focus of the research. At present, researches on matching optimization of modern music and dance technical movements are mainly concentrated in model construction and use of algorithm, while it is aimed at providing new research ideas and directions for matching optimization of modern music and dance technical movements through research on these literatures.

1.2 Purpose

With the entry point as overview of ant colony theory, it is researched in this paper that the simulation model of modern music and dance technical movement is constructed based on the ant colony theory. Matching of modern music and dance technical movement plays a very important role in modern choreography. Therefore, it is of great significance to study the optimization model of modern music and dance technical movement. In this
context, the ant colony theory puts forward a new optimization approach for it; moreover, the simulation model of modern music and dance technology movement is constructed with help of ant colony theory, which promotes higher matching degree of modern music and dance technical movement. Application of ant colony algorithm theory has become the basic algorithm of the model. The ant colony algorithm is used to examine the matching degree of modern music and dance technical movement, thus promoting design of choreography (Xia and Zhou, 2016). At the same time, application of ant colony theory into matching of modern music and dance technical movements improves the matching degree, promoting better suitability of dance technical movements and music themes and facilitating better expression of music emotions in music technical movements, while modern music can also promote formation of dance technical movements, contributing more perfect presentation of music technical movement.

2. OVERVIEW OF ANT COLONY THEORY

The ant colony theory is an emerging simulation mimicry algorithm in recent years. Ant colony theory was first proposed by Italy scholars and was applied to other fields as soon as it was put forward (He, 215). Through careful observation and research on the ant colony, the bionic team found that an ant colony transmitted information between each other by means of a substance called pheromones. Moreover, it is found that ants in the course of action will leave ectohormone substance on the route, through the perception of which, ants can find the direction of action (Liu, 2015). It is found, during the process, through a large number of studies that, collective behavior of ants can form a positive feedback phenomenon. This is expressed in the phenomenon that when an ant passes through a certain path, the more pheromones it leaves, and the more likely ants passing by are to choose the path, based on which the ant colony theory is proposed. Ant colony theory was first applied to TSP problem. Ant colony algorithm, which is an algorithm based on pheromone model formed by ant colony programming route, is the most important in ant colony theory. Because ant colony algorithm belongs to random search algorithm, it has also been applied to construction of computer database, so the ant colony algorithm in the calculation process is regarded as basis of algorithm for many databases. At the same time, through the artificial simulation experiment, it is found that the ant colony in the process of looking for food uses hormones to communicate with each other and to understand the actual path conditions, so as to select the shortest path (Gong and Hu, 2015), which also shows that ant colony theory has the characteristics of selection optimality. With the development of ant colony theory, it has also been applied to database computing, so as to choose the best solution and improve efficiency, by combination with simulation mimicry, according to number of information circulation (Shi, 2015). At the same time, the ant colony theory is applied to various fields, where application of ant colony theory in modern music and dance technical movements provides optimal matching method for modern music and dance technical movement matching. Application of ant colony theory not only optimizes the matching method of modern music and dance technical movement, but also is capable of choosing the optimal output scheme compared with other matching methods. Advantages and disadvantages of ant colony theory’s algorithm are gradually found during its application (Meng, 2015). The advantage of ant colony theory refer to robust feature: the ant colony theory is a pseudo simulation algorithm, which can be combined with other algorithms in the application process, which shows its algorithm model can be applied into other fields if fine adjustment made to algorithm in the application process. At the same time, shortcomings of ant colony theory are gradually found in the application process, which are reflected in the fact that longer computing time is needed during application of the model, thus increasing pheromone for computers searching path, leading to suboptimal choice and affecting operation of the system. Besides, in this process, introduction of a large number of error information will have some adverse effects on the search system. Therefore, in the application of ant colony theory, the specific connotation of advantages and disadvantages of ant colony theory should be accurately grasped for better use of ant colony theory.

3. DEVELOPMENT SITUATION FOR MATCHING OPTIMIZATION OF MODERN MUSIC AND DANCE TECHNICAL MOVEMENT

There have been many changes to matching methods for modern music and dance technical movements in the process of development. And problems have been gradually caused during application of these methods, affecting the optimization process of modern music and dance technical movement matching (Xie, 2013). Firstly, in the process of modern music and dance technical movement matching, the genetic theory, which emphasized fixation of music style, was used. This refers to the conduct that modern music and dance technical movement matching should be carried out by using the genetic theory after specific style of modern music and dance technical movements is understood during modern music and dance technical movement matching by using of this method and choreography is designed according to the style (Chen, 2012). Though this matching method, due to large calculated quantity can obtain calculation results to measure matching efficiency of modern music
and dance technical movements, it is not conducive to the development of modern music and dance technical movement matching due to long computation time in the actual process. Secondly, in the process of matching, the machine theory, which could achieve the purpose by establishing information data sets from information collected based on historical record, was also used to carry out modern music and dance technical movement matching. Although the computation speed is increased compared with genetic theory matching, however, its low matching rate can not meet the purpose of modern music and dance technical movement matching (Guo and Cheng, 2011). Finally, in the process of modern music and dance technical movement matching, data theory which carried out search by combination of database through collection of music clips and dance technical movement clips was used. Though the matching rate has increased, but long time is still required. In spite of many methods adopted to enhance matching rate during development of modern music and dance technical movement matching, there are still some problems in the application process, affecting its application. Emergence and development of ant colony theory provides a new idea for the matching of modern music and dance technical movements, and the simulation model is built with the ant colony theory in the matching process of modern music and dance technical movements, which increases the matching efficiency.

4. CONSTRUCTION OF SIMULATION MODEL FOR MODERN MUSIC AND DANCE TECHNICAL MOVEMENTS

4.1 Implementation of information collection on modern music and dance technical movements

For construction of simulation model of modern music and dance technical movement matching based on the ant colony theory, information on modern music and dance technical movements should be collected (Li and Kuang, 2010). Therefore, before implementation of optimization matching work, the theory of music beat should be firstly mastered, based on which the music data and dance movements are arranged. Music and dance movement with similarities are integrated together to form music and dance clips, based on different length of clips, groups should be divided, at the same time, break points are detected during the process and each beat of dance technical movements in modern music is further predicated. The extraction process of music and dance movements is constructed by using the ant colony theory and computer technology (Figure of music and dance movement feature extraction is shown in Figure 1). Music clips and dance technique clips are collected and arranged with the help of computer technology, and the ant colony theory is used in this process to predict modern music and dance technique clips.

![Diagram of Music and Dance Movement Feature Extraction](image)

The matching optimization function is obtained by calculation of correlation coefficient of dance technical movements and modern music clips during the process. Firstly, the music files in the process are inputted to be transformed into the sampling specimens of musical and dance technical movements. And then, modern music clips and dance technical movement clips are assumed as 2h sampling specimens without a time course, but h sampling specimens are separated in different periods of time. Later on, Fourier coefficients \( e_0, e_1, \ldots, e_h, f_0(h) \) to represent the mutation function value at time course \( h \) is established by combining Fourier analysis theory. The formula \( G_f(h) = \sum_{h=0}^{k} |e_0[f_0(h)] \) is used to express the Fourier coefficient during time process. With the ant colony theory used, it is assumed that the next music beat \( k_{h+1} = k_h + k_{max} \) can be predicated through calculation of musical beats cycle, where \( k_{h+1} \) is value of the
music beat predicted and \( k_h \) is position of the real beat, through examination of which it can be found that the actual music beat positions are relatively close to the function value. Based on close results of \( k_{h+1} \) predicted and the adjacent value, the threshold \( \alpha \) which is within the scope of \([k_{h+1} - \beta, k_{h+1} + \beta]\) where all of matching values of modern music and dance technical movements are located is assumed in the design process. Suitable modern music clips and dance technical movement clips during matching process of modern music and dance technical movements can be chosen by applying \( \text{peak}(\epsilon) = \begin{cases} 1 \text{, } \epsilon \text{ as the extreme point} \\ 0 \text{, } \epsilon \text{ as extreme point} \end{cases} \) in the defined function with values obtained, while combination of the ant colony theory and computing technology speeds up the calculation process. Expression of this calculation process makes the matching action screening more reasonable and intelligent. Through the calculation formula, it can be summarized that a information database with basic information on modern music clips and dance technical movement clips should be built to provide the resource support for the information screening, that it is easy to find matching degrees through collection and organization of modern music clips and dance technical movement clips, that construction speed of the simulation system is sped up by screening of music dance clips by way of calculation, that matching degree can be found easily through research on matching value of modern music clips and dance technical movement clips.

4.2 Constructing optimization process of modern music and dance technical movements

In the process of modern music and dance technical movement matching, its optimization process is one of the most important links. The ant colony theory and computer technology are fused to optimize the optimization process (Figure for music and dance technical movement matching optimization is shown in Figure 2). The optimal solution is chosen through comparison of better combination of music and dance movements analyzed through the optimization platform of the ant colony algorithm on which music and dance clips are collected and organized.

![Figure 2. Music and Dance Technical Movement Matching Optimization](image)

In the process of optimization matching of modern music and dance technical movements, the objective function should be taken as the basis, which is combined with the algorithm of the ant colony theory to promote better matching of modern music techniques to dance technical movements. Therefore, smooth implementation of music choreography will be further promoted by optimization of modern music and dance technical movements by combination of information techniques based on the algorithm from the ant colony theory.
Besides, many methods for interosculation of modern music and dance technical movements will be clearly grasped. The matching process is as follows: \( L = (W, S) \), where \( m \) stands for city individuality, \( W \) represents the city set, \( S \) represents music cost. The optimal matching method can be found by combination the formula with the formula \( q(u + m) = (1 - q)q(u) + \theta_q \). In the calculation process, specific application methods of the formula should be reasonably mastered to present clips of modern music and dance technical movements. So in this case, the formula should be adopted to carry out tests so as to find the optimal matching method. In the process of constructing the simulation system of modern music and dance technical movements, the ant colony theory combined with computer technology provides a new idea for the choreography arrangement and promotes more consistence between modern music and dance techniques, driving their respective development and common progress.

4.3 Optimizing evaluation mechanism for modern music and dance techniques

During construction of simulation model for modern music and dance technical movement, not only the corresponding application mechanism should be established, but also use methods of the ant colony theory in actual situation should be tested by establishment of the evaluation system. Test processes should be constructed through combination of computing techniques (Flow chart for testing music and dance action matching is shown in Figure 3). Through collection of information on modern music and dance techniques, optimization needs are grasped which are compared in the process to optimize the output scheme.

![Figure 3. Test Music and Dance Action Matching Process](image)

As for construction of the evaluation system, a simulation investigation can be carried out combined with the actual situation to help choose optimal selection method and to reduce adverse effects in matching process of modern music and dance technical movements. At the same time, due to self-evaluation enables it to become more consistent with the actual situation in the process of using, innovation and development of music and dance techniques will be facilitated.

5. CONCLUSION

In the process of modern music and dance technical movement matching, a simulation system is constructed by applying ant colony theory learning and computer technology, etc. and used to enhance expressiveness of dance technical movements, drive dance technical movements to be more suitable to express emotions embodied in modern music and strenghten the effect of modern choreography through optimized matching methods of modern music and dance technical movement by the simulation system.

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