Design of Dance Data Management System Based on Computer-Aided Technology Under the Background of Internet of Things

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Abstract. Internet of Things technology has brought convenience to people's lives. For dance data management, the construction of Internet of Things is essential. The construction of Internet of Things can not only promote the development and progress of dance data management with higher quality, but also provide new requirements and standards for dance teaching in social development. Based on computer-aided technology, this paper analyzes the biomechanical parameters of dance movements, analyzes the captured data of dance movements based on rotation movements, establishes a description model of human dance movements, and further extracts the limb posture characteristics of dance movements from four force effects: time, space, gravity and fluency, so as to define the formal description language of dance movements, lay a theoretical foundation with reference value for analyzing dance rotation movements, seek innovative training methods, and provide relevant theoretical basis for scientific training of dance rotation movements.

Keywords: Internet of Things; Computer Complexity; Dance Data Management; Rotation; Lower Limb Balance; Biomechanical Parameters
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1 INTRODUCTION

The information provided by dance data can not only be used to analyze movements, but also be used to understand the sequence of muscle exertion, the interaction between the body parts and the whole body, the force and control of the body, and so on. Dance data analysis plays an important role in understanding dance, applying teaching, improving skills and preventing injuries. Among the important techniques of sports dance, rotation plays an important role. The level of this kind of technique can measure a dancer's professional level and professional accomplishment. Not only that, but this technique may also become the winning factor of athletes in big competitions, Owen et al. [1] almost no athlete's competition combination does not have rotating movements. Without such movements, the competition or performance will be boring, not easy to attract the

audience's attention, and the referee will not feel the difficulty of the combination, and will not feel comfortable. Therefore, the turning movement is an extremely important link in the combination of sports dance. The quality of technical completion is an important index to consider the professional accomplishment level of dance performers. Rotation-like movements can enhance the diversity, continuity and difficulty of dance routines, which is a necessary link in routine arrangement. Therefore, it is of great value and significance to know the dance data principle of rotating movements in sports dance to improve sports dance techniques, improve the combination difficulty, and then improve competition results.

Based on the digital image processing and computer-aided analysis of computer-aided technology, Li [2] provides an accurate and simple method for the establishment of biological finite element model. Dance is a complicated process, and the data modeling and analysis of dance movements has important application value in guiding sports training, computer game development, virtual reality simulation, special effects performance of movies and TV shows, etc. This paper designs a dance data management system based on computer-aided technology. Through this system, the biomechanical parameters of human body in dance can be analyzed at home. In order to establish dance movement data parameters, it is not enough to change the spatial position of the root joint, but also to modify the orientation transformation of the performer according to the change of the path. It will be simpler and more practical to evaluate the physiological and biochemical indexes of dancers' physical functions and the indexes of their physical functions by computer-aided technology. As well as digital telemetry technology, it will make the assessment of physical function easier, and the diagnosis and monitoring of physical state will be more-timely, and accurate during dance training. With the further improvement of research level, Sullivan et al. [3] believes that the research on dance data management will be more perfect and make greater contributions to the development of dance.

The human body is mainly responsible for supporting the lower limbs. Among the muscles of the lower limbs, the muscle strength and explosive force of triceps surae and quadriceps femoris are very important for sports dancers. It will be directly related to the movement speed of sports dancers, and it is the key factor to keep dancing rhythm. Therefore, the leg muscle strength training is essential for sports dancers in daily training. By forcefully stretching the body on one side of the power leg, in the process of moving on one side of the power leg, except the crotch, other parts of the body are kept in the original state and do not change at will, and the center of gravity below the crotch remains unchanged on the whole sole of the foot, so that the center of gravity of the body is better in a stable state. Rotation is the bridge between all dance movements, and it is required to be fast and stable. The body center of gravity of students majoring in sports dance will directly affect the stability of rotation. By studying the correlation between the stability of dance rotation and the biomechanical indexes of the main joints of lower limbs, this paper puts forward the corresponding countermeasures for the training of dance students, and provides a theoretical basis for the diagnosis and analysis of dancers' technical movements.

2 RELATED WORK

Dance data management system is developed under the premise of computer-aided technology. In order to achieve better artistic performance, Tan and Yang [4] timely introduced the three-dimensional computer-aided dance creation system to continuously provide diversified visual modes for dance creators and optimize the interactive communication platform between actors and choreographers.

Koulouris et al. [5] use the cascaded hidden Markov model to model the human body. Its special feature is that the expectation maximization algorithm is used for learning, which can improve the accuracy and stability of the model. Finally, the particle filter algorithm is used to reason the human body movement, which can effectively estimate the human body's movement and dance data. Wang [6] get the depth information of human body through Kinect, and estimate the data of human dance based on the prior knowledge of human anatomy. The geodesic distance

is used to calculate the distance between joints of human body. Guo and Chen [7] think that applying computer-aided design function to the practical workflow of dance design is an inevitable trend for dance design to gradually move towards modern design mode. Workers should flexibly master the computer information technology processing methods, based on the analysis data of human movements of various dance design movements, Combining the unique calculation formula of computer design, we can finally get a more scientific and reasonable dance design. Through the application of various functional sections. Cui and Guo [8] thinks that the locality of dance makes the system have to realize effective local feature extraction to support local similar motion retrieval. Because the dance language system contains many kinds of subdivided movements, the subdivision of dance movements makes the extracted movement features fully describe the details of the movement, so as to further distinguish the subdivided movements. Zhai [9] applies the theoretical research methods and experimental research methods of sports biomechanics to the teaching and training of sports dance. Studying sports biomechanics can greatly reduce the probability of sports injuries. We can improve the sports equipment of sports dance, design dance shoes with the characteristics of dance movement mechanics, and reduce the probability of injury. With the deepening of the research on sports dance injuries, the research on foot biomechanics will surely play an important role in sports dance injuries. Chen [10] think that the performance of dance technique has not only the functions of hearing and vision, but also the joint participation of proprioception and vestibular perception, and the comprehensive analysis of perception and control, which is to maintain the balance of the body. Therefore, it is suggested that the contact area between the sole of the main support leg and the ground should be increased to obtain enough friction and improve the balance ability.

Under the background of Internet of Things, computer technology has been widely used, and it has the characteristics of integrating pictures, texts and sounds. The three-dimensional computer aided system of dance data management has created a broad space for the sustainable development of dance art, which helps dancers and related researchers to deepen their understanding of this field. It is also an important platform and idea to promote the development of dance creation, which means that the integration of dance and technology has gone to another height.

3 ANALYSIS OF DANCE ACTION PARAMETERS BASED ON COMPUTER AIDED TECHNOLOGY

3.1 Structural Design of Human Action Model

In this paper, motion capture equipment is used to collect dance motion data, and a human motion description model is established from two aspects: initial posture and joint motion plane. The posture features of dance motion are extracted from four force effects: space, time, gravity and fluency, and the formal description language of dance motion is defined. Finally, a dance motion data analysis and management system is implemented and developed. Different people's initial postures will be different due to factors such as height and limb length. Therefore, this paper defines the human body structure as a three-dimensional hierarchical structure. By establishing a three-dimensional hierarchical structure of human bones with 26 skeletal nodes, the relative relationship between the nodes is studied to eliminate the structural differences of human bodies, as shown in Figure 1 and Table 1.

Sports in different planes lead to different behaviors of joint mechanics and muscle movements, and biomechanical rules are not considered when calculating joint angles. Driven and influenced by the computer-aided function, the implementation and execution of the corresponding dance action design actually refers to the designer's body action language that is more realistic to dancers. By combining different forms of emotional integration, the goal of integrating dance action design with emotional content can be achieved. It is an inevitable trend for dance design to develop towards modern design mode by applying the computer-aided design function to the practical workflow of dance design.

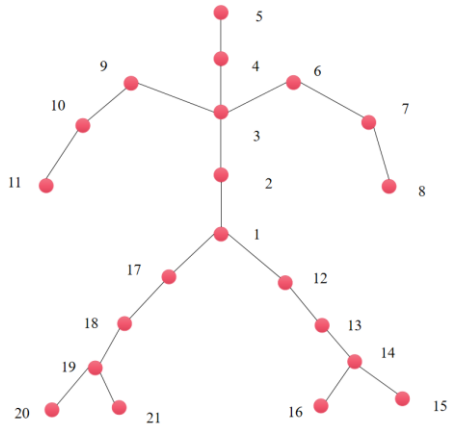

Figure 1: Three-dimensional human skeleton hierarchy.

1	Buttock	12	Left buttock
2	Spine	13	Left thigh
3	Spine	14	Left leg
4	Neck	15	Left crus
5	Head	16	Left heel
6	Left shoulder	17	Right buttock
7	Left arm	18	Right thigh
8	Left hand	19	Right leg
9	Right shoulder	20	Right foot
10	Right arm	21	Right heel
11	Right hand		

Table 1: Three-dimensional human skeleton structure limb names.

Under the information technology processing mode, on the basis of the analysis data of various dance design movements, combined with the unique calculation formula of computer design, a more scientific and reasonable dance design scheme can be finally obtained through the application of various functional sections. The process of dance data management and description system is shown in Figure 2.

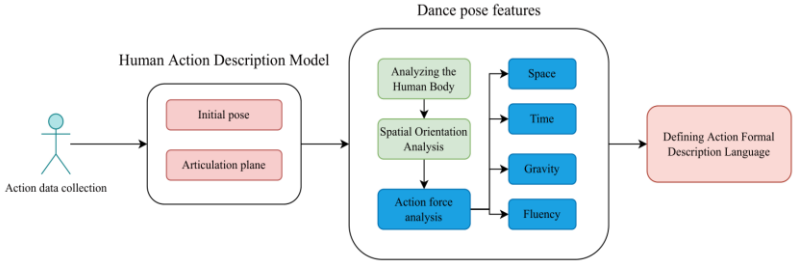

Figure 2: Flow of dance data management system.

The purpose of the combination of dance data segments is to combine several existing action segments into a continuous action according to the sequence and repetition times set by the choreographer. In the process of straight forward, the performer's body is constantly twisting, and the movement track of its root joint is an oscillating curve. Generally, the audience will think that the performer is marching along a straight path, that is to say, the performer's movement path is abstracted into a straight line by the audience.

3.2 Analysis of Dance Biomechanical Parameters

The specific research contents of dance biomechanics include the bones, joints and muscles of dance sports system and the load, strain and stress of dance sports system. The exercise system of human body consists of three parts: bones, joints and muscles, which constitute the support and basic form of human body. Under the control of nervous system, muscles are the power, joints are the hub and bones are the levers, which jointly complete the movements of limbs in human life, including various movements such as labor and dance. Only by quantitatively understanding all kinds of mechanical behaviors of the human body's exercise system, especially the main joints (neck, shoulder, elbow, wrist, hip and knee), can we better analyze the movement mechanism of the dance exercise system and provide guidance for dance. The points and parts of dancing are distributed all over the limbs and joints of the whole body. The trunk can be divided into head, neck, shoulder, chest, waist, abdomen, hip and hip; Include upper limb fingers, hand, wrist, forearm, elbow and forearm; There are toes, feet, ankles, calves, knees and thighs in the lower limbs. If subdivided, the head can also include eyes and neck; Hands can also be divided into palm and fist. Feet can also be divided into toes, heels, soles and instep. According to the requirements of movement changes, the strength, amplitude, rhythm and gravity of each movement form various movement forms. These movements are smoothly connected and connected through ten lines of movement, such as straight line, flat line, oblique line, arc line, broken line, round line, parallel line and wavy line helix, thus forming a graceful, varied and beautiful dance. For the trajectory data of dance, it is necessary to scale and establish a mapping relationship, as shown in formula (1).

$$L=\sum_{i+1}^{n-1}S(i+1)-S(i) \tag{1}$$

The distance from the starting point to the end point on the original trajectory is shown in formula (2).

$$L(k)=\sum_{i+1}^{n-1}\left\|S(i)-S(i-1)\right\| \tag{2}$$

In order to establish a new dance track, it is not enough to just change the spatial position of the root joint. It is also necessary to modify the orientation of the performer according to the change of the path and the position of the corresponding point on the dance track. The corresponding transformation matrix after the track transformation is shown in formula (3).

$$M(k)=R'R^{-1}M(k) \tag{3}$$

The probability of visible state sequence generated by this model is shown in formula (4).

$$P(O)=\sum_{r=1}^{r\max}P(O|Q_r)P(O_r) \tag{4}$$

In order to get the included angle of any joint of the human body, it can be obtained by the three-point coordinates of the joint, as shown in Formula (5) and Formula (6).

$$\begin{cases}a=D(B,C)\\b=D(A,C)\\c=D(A,B)\end{cases} \tag{5}$$

$$\theta = \cos^{-1}\frac{(c^2 - b^2 - a^2)}{2ba} \tag{6}$$

In practical application, because the joints are unstable with each other, the error of the results obtained is very large, and it can't be directly used for gesture recognition. Therefore, this paper proposes an angle representation method based on a fixed axis, in which the connecting line between two joint points is taken as the line to be measured, the line to be measured is oriented outward with the central axis of the human body and outward with the transverse axis of the shoulder as the center, and the angle between the line to be measured and the reference line is calculated in counterclockwise order, which is defined as the angle of these two joint points. In this way, the line to be measured and the datum line can be relatively stable, and the accuracy of angle measurement can be ensured. The definition of joint angle is shown in (7).

$$P = \{p_1, p_1, \theta, \lambda\} \tag{7}$$

The definition of different postures can be transformed into the definition of the angle of joint points, and the angle adjustment threshold can be used to control different precision requirements. The definition of upper body posture is shown in Table 2.

Posture	Left shoulder, Left elbow	Left elbow, Left wrist	Right shoulder and elbow	Right elbow, Right wrist
Hands up	180	90	0	90
Hands down	270	270	270	270
Stretch your arms out	180	180	0	0
Raise your left hand and stretch your right hand flat	180	90	0	0
Raise your left hand and lower your right hand	180	90	270	270
Raise your right hand and stretch your left hand flat	180	180	0	90
Raise your right hand and lower your left hand	270	270	0	90

Table 2: Posture angle comparison table.

According to human physiological structure, the degrees of freedom of human joints are also different. Take the neck of the human body as an example. The neck can move back and forth, left and right, and can rotate freely, so the neck has three degrees of freedom. The chest can only move back and forth, left and right, so the chest has only two degrees of freedom. In this paper,

the relevant joints of human body are classified into three categories, namely, one-degree-of-freedom, two-degree-of-freedom and three-degree-of-freedom joints. A joint with only one degree of freedom is called a one-degree-of-freedom joint, which can only be one of three situations: front and back, left and right, and rotation. A joint with only two degrees of freedom is called a two-degree-of-freedom joint, and there are three situations. A joint with three degrees of freedom is called a three-degree-of-freedom joint, and it can move back and forth, left and right, and rotate, such as the neck joint of the human body. Because the degrees of freedom of different joints are different, a database of degrees of freedom information that can save the degrees of freedom of each joint and the range of swinging and rotating angles in all directions is established for use.

4 EXPERIMENTAL ANALYSIS OF DANCE DATA SIMULATION

4.1 Rotation Motion Data Simulation

Rotation is an essential and important part of all dance routines. Rotation can not only increase the communication between partners, but also make dance routines more beautiful, improve the appreciation and increase the difficulty of dance routines. After adding a large number of rotating movements, sports dancers must improve their physical fitness and dance skills if they want to perfectly present high-quality dance routines in the competition, otherwise it will be difficult to complete difficult dance routines; If you can barely complete the dance routine, it will directly lead to a big discount in the artistic expression of dance. Therefore, stability is essential for every sports dancer.

When the dance starts the preparatory posture, the hip joint of the main leg should be slightly bent to keep the pelvis perpendicular to the ground. The angle of the hip joint of the main leg in the preparatory posture stage is too small, which may cause the center of gravity of the body to stay, and cannot accumulate energy for the next action stage. In the preparation stage, the angle of the hip joint of the main leg is too large, which may cause the body to lean back and affect the forward speed of the body. The rotation parameters of 30 dancers are analyzed, as shown in Figure 3.

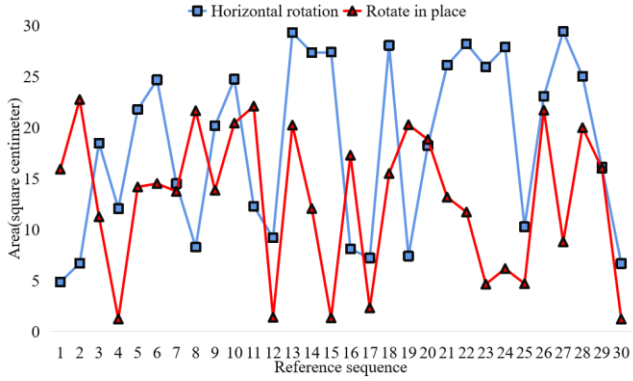

Figure 3: dance rotation data.

In order to make all indexes comparable, the muscle parameter data of all raw data are simulated and analyzed, as shown in Figure 4. Proprioception refers to the organizational structure of muscles, tendons, joints and other parts in the deep part of the body, which is the main feeling of the body's spatial position, posture, movement state and movement direction.

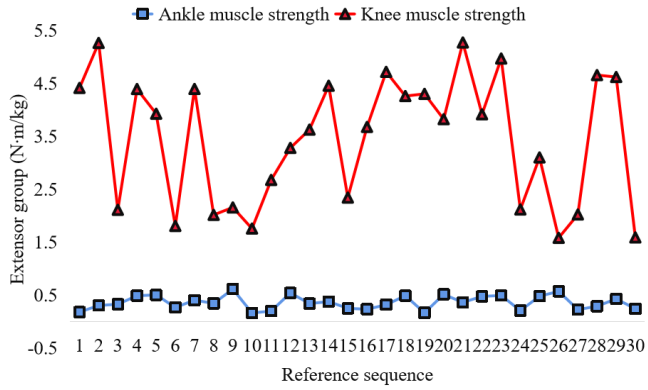

Figure 4: Proprioception parameters in dance movements.

Compared with visual afferent information and proprioception afferent information, proprioception information is more accurate and faster, and proprioception is very sensitive to mechanical stimulation. Propioception can quickly respond to the expansion and flexion of joints and the relaxation and contraction of skeletal muscles, and change this stimulation into nerve impulse, and transmit this process to the brain. In the whole process, it is used to regulate the central system of human muscles and drive the activities of various bones. The sense of position and force of the joints provided by the noumenon senses are necessary information. Only a certain amount of practice can acquire and stabilize dance skills. In the classical conditioned reflex theory, this repeated practice is reinforcement. All skills can only be learned through practice and reinforcement, which is the only way. If you want to really master a skill, it is impossible to achieve it without a certain amount of practice and reinforcement. This is the main method of skills learning. The common characteristics of the angle of the main leg in the end stage of the dance rotation are as follows: the angle of the hip joint is from big to small in the preparation stage to the preparation stage for moving forward, from small to big in the preparation stage to the main leg exchange stage, and from big to small in the main leg exchange stage to the end stage. During the whole dance rotation movement, the angle of the main leg changes from big to small, and the change data of the angle of the knee joint is shown in Figure 5.

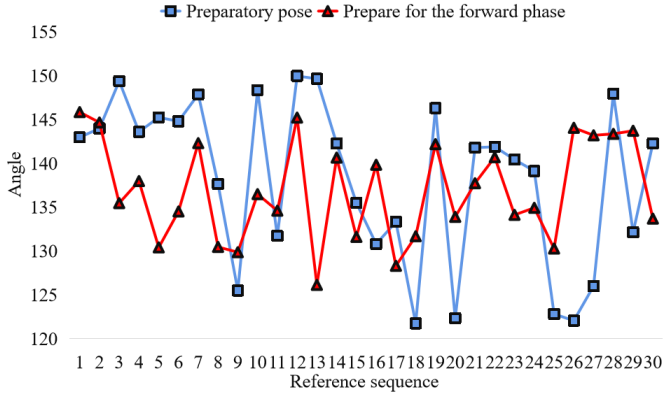

Figure 5: Data of knee joint angle change of dance movement legs.

In the dance forward movement, the stage of preparing to move forward is the key technical link. The middle part of the body is tightened, the center of the body is pried forward, the center of

gravity of the body shifts from the center of the main leg to the position of the forefoot, and the middle part of the body feels tense and contracted. One side of the main leg moves the middle part of the body to drive the power leg forward, and the twisting and squeezing energy of the center of the body is at the maximum, thus preparing for the exchange stage of the main power leg.

The circular motion around a fixed axis is called the rotation of an object. Both the rotation of the human body and the rotation of the object follow this scientific rule, but there are many differences between the rotation of the human body and the rotation of the object. For example, when the axis of human body rotation is the trunk of human body, the supporting legs are single or separated, and the center of the shaft body changes. The axis can be divided into transverse potential energy and longitudinal potential energy. Taking the upright leg tuck as an example, the longitudinal potential energy means that the rotation axis is combined by the dancer's torso and its supporting legs during the rotation process. In the combination process, the dancer has to change the center of gravity. Lateral potential energy refers to the grasp of athletes' torso rotation in lateral starting. Most of the weight, volume and center of gravity of a comrade-in-arms' torso will be transmitted to the whole-body during rotation, which will affect the stability of rotation. Therefore, the stability of the torso is the key to keep the stability of the whole rotation. In the dance rotation, attention should be paid to the change of the center of gravity of the main leg. Sticking is a dance movement in which the main leg stands with half of the foot. It is necessary to coordinate the physical exertion to keep the stability of standing with half of the foot. The larger the contact area between the sole and the ground, the higher the stability. The technical effect of rotating to achieve high difficulty is to combine difficulty with beauty in the process of realization, and to reduce the contact area between feet and the ground, thus enhancing artistry.

4.2 Analysis of Biomechanical Parameters of Dance Lower Limbs

Most of the dance moves are done with the knee joint straight, and some with the knee joint bent by 90. Dancers want to improve the stability of the rotation, so they must promote the thigh strength and the knee joint strength. The leg movements and techniques laid the foundation for the whole-body movements. The legs are responsible for supporting the body. Therefore, the strength of the legs will affect the quality of movements. At the same time, increasing the strength of the legs can also avoid diseases and injuries. By combining one's own feelings with exercise methods such as bicycle, balance board, and one-legged squat, the stability of the legs can be improved. In this way, during exercise, the knee joint's ability to respond to speed can also be improved. At the same time, it is necessary to cooperate with the connection of leg strength, improve muscle strength and promote the stability of movement.

The direct transmission of the anterior and posterior horns of the spinal cord can directly transmit the instructions to the muscles around the joint, and the transmission speed is the fastest, so as to adjust the tension of each antagonistic muscle and ensure the stability of the joint. Cerebellum belongs to the low-level center, which can integrate proprioception and trunk perception, and is responsible for the unconscious control of the neuromuscular system on joints. The highest-level nerve center is the cerebral cortex, which is responsible for consciously controlling and regulating athletes' joints and muscles, and perceiving their sense of movement and position. There are abundant proprioceptors in the ankle joint, which have high flexibility. The effects of ankle proprioception on body control mainly include participation in the integration of high-level commands of the central nervous system and the appropriate response of the body after the change of external environment. Participating in the integration of advanced instructions of the central nervous system means that during the Latin dance rotation, it is necessary to exercise the central nervous system to control the activities of bones and muscles, adjust the necessary information of power perception and position perception, and analyze the activation time of gluteus maximus and lateral femoral muscles of dancers, as shown in Figure 6 and Figure 7.

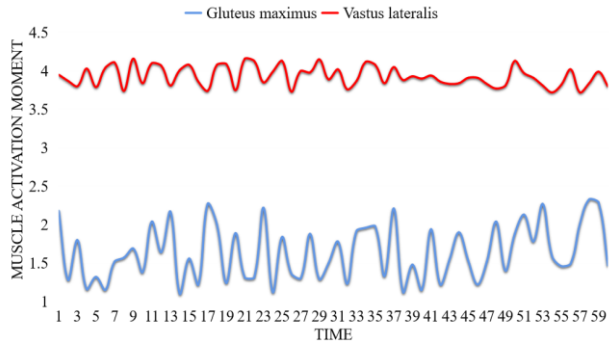

Figure 6: Dance movement, muscle activity moment.

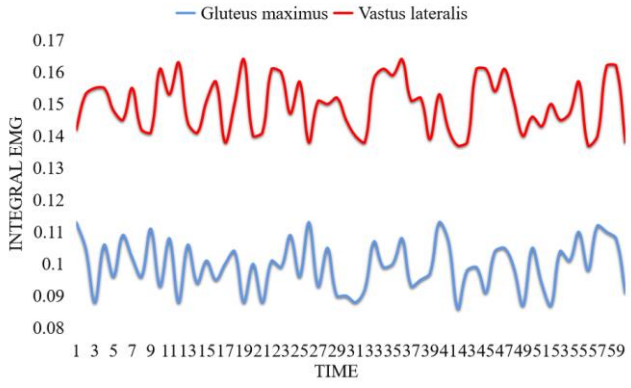

Figure 7: Electric value of muscle integral of dance movement.

The integral EMG value of surface electromyography refers to the total discharge of exercise units in which muscles take part in work in a certain time, that is to say, on the premise of constant time, its value reflects to some extent the number of exercise units participating in work and the total discharge of muscle groups. That is, the area under the envelope is determined by integration. After the original EMG signal is filtered, DC removed, full-wave rectified and smoothed, the integral value always increases. Through quantitative analysis, the strength of muscle work in exercise can be found.

The integral EMG value specifically quantifies the amount of work done by each muscle during a period of technical action, and reflects the number of sports units recruited by each muscle. It is understandable that the duration of gluteus maximus is short, but the duration of rectus femoris is the shortest, because rectus femoris is mainly pulled by quadriceps femoris, which is a shallow muscle in front of thigh. When the center of gravity of the body drops, and the rectus femoris acts as a shallow muscle in the hip joint and ankle joint, the work time is short. To improve the stability of rotation, it is indispensable to improve athletes' muscle strength, especially leg muscle strength. At the same time, ankle training and core strength should be strengthened. In the upright and dancing rotation, in order to ensure the stability, it is necessary to give sufficient support from the back and waist.

5 CONCLUSIONS

It will be simpler and more practical to use computer-aided technology to evaluate the physiological and biochemical indexes of dancers' physical functions and the indexes of their physical functions. As well as the digital telemetry technology, it will make the physical function

evaluation more simple, scientific and accurate. To do a good job in the selection, training, teaching and management of athletes and dancers, it is necessary to know and master the characteristics of the human body at various developmental stages, and make the selection of dancers more scientific, standardized and data-oriented.

The human body is mainly responsible for supporting the lower limbs. Among the muscles of the lower limbs, the muscle strength and explosive force of triceps surae and quadriceps femoris are very important for sports dancers. It will be directly related to the movement speed of sports dancers, and it is the key factor to keep dancing rhythm. Therefore, the leg muscle strength training is essential for sports dancers in daily training. From the perspective of sports biomechanics, this paper analyzes the athletes' rotation, combines the biomechanical knowledge principle with the characteristics of dance rotation, sums up the factors that affect the rotation, such as mechanical principle, characteristics of main joints of lower limbs, proprioception and tibialis anterior's unbalanced reaction time, analyzes the relationship between stability and various test indexes, judges the muscle strength and proprioception of main joints of lower limbs, lays a valuable theoretical foundation for analyzing sports dance rotation, seeks innovative training methods, and provides relevant theories for scientific training of dance rotation.

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REFERENCES

[1] Owen, C.-B.; Dillon, L.; Dobbins, A.; Rhodes, M.; Levinson, M.; Keppers, N.: Computer literacy through dance: the dancing computer project, International Journal of Pervasive Computing & Communications, 13(1), 2017, 26-40. https://doi.org/10.1108/IJPCC-02-2017-0012

[2] Li, Y.: Dance Motion Capture Based on Data Fusion Algorithm and Wearable Sensor Network, Complexity, 2021(1), 2021, 1-11. https://doi.org/10.1155/2021/2656275

[3] Sullivan, R.-M.; Wallace, A.-L.; Wade, N.-E.; Swartz, A.-M.; Lisdahl, K.-M.: Cannabis use and brain volume in adolescent and young adult cannabis users: effects moderated by sex and aerobic fitness, Journal of the International Neuropsychological Society, 27(6), 2021, 607-620. https://doi.org/10.1017/S135561772100062X

[4] Tan, B.; Yang, F.: Dance Movement Design Based on Computer Three-dimensional Auxiliary System, Computer-Aided Design and Applications, 19(S3), 2021, 108-118. https://doi.org/10.14733/cadaps.2022.S3.108-118

[5] Koulouris, D.; Menychtas, A.; Maglogiannis, I.: An IoT-Enabled Platform for the Assessment of Physical and Mental Activities Utilizing Augmented Reality Exergaming, Sensors, 22(9), 2022, 3181. https://doi.org/10.3390/s22093181

[6] Wang, Z.: Evaluating creativity in contemporary dance: a consensual approach towards research on the practice in China, Interdisciplinary Science Reviews, 47(1), 2022, i-xiv. https://doi.org/10.1080/03080188.2021.1921441

[7] Guo, G.; Chen, L.: Evolutionary Computation with User's Preference for Solving Fuzzy Fitness Forecasting Problems, International Journal of Pattern Recognition and Artificial Intelligence, 35(01), 2021, 2159001. https://doi.org/10.1142/S0218001421590011

[8] Cui, Y.; Guo, B.: Video analysis and intelligent signal processing and diagnosis system for sports dance training items, Journal of Electronic Imaging, 32(1), 2022, 011204. https://doi.org/10.1117/1.JEI.32.1.011204

[9] Zhai, X.: Dance Movement Recognition Based on Feature Expression and Attribute Mining, Complexity, 2021(21), 2021, 1-12. https://doi.org/10.1155/2021/9935900

[10] Chen, W.: A Novel Long Short-Term Memory Network Model For Multimodal Music Emotion Analysis In Affective Computing, Journal of Applied Science and Engineering, 26(3), 2022, 367-376. https://doi.org/10.6180/jase.202303_26(3).0008