Medical Research-Informed Automatic Classification of National Dances Integrating Emotion and National Characteristics

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Abstract. This paper integrates emotion and national characteristics into the classification model to improve the automatic classification effect of national dances. It proposes a new design method of curved lenses for dual-free dance classification. Moreover, diffuse free-form surfaces are introduced into the design of dual free-dance classification curved lenses. At the same time, this paper obtains lenses that generate illumination areas of other shapes by the double free-form surface method and the SMS method. In addition, light with small angles is projected directly onto the target plane through the refracting surface, and light with large angles is first projected onto the diffuse free surface and then refracted from the refracting surface to the target plane. Finally, this paper constructs an automatic classification method system for national dances. The experimental results verify that the automatic classification method of national dances integrating emotion and national characteristics proposed in this paper has a specific effect.

Keywords: emotion; national characteristics; national dances; automatic classification; Medical Research.
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1 INTRODUCTION

Culture is the foundation of a nation's survival and the cornerstone of a country's development. The existence of each country is based on its unique culture, and culture is an essential symbol of a country. Moreover, cultural manifestations and differences are significant throughout the country and crucial symbols of differences in other countries. Therefore, promoting cultural development can also promote national development. In addition, cultural prosperity can also promote the prosperity and cultural progress of various ethnic groups. The more prosperous the national culture, the more it can improve national cohesion and national pride and promote the prosperity and development of the country [3].

Conversely, a decline in culture will weaken the country's momentum. Therefore, one must understand the country's culture to understand a nation. To respect a nation, we must first appreciate the nation's culture: as a nation, we must develop our own culture. As the primary carrier of culture, national dance is significant to the inheritance and development of tradition and culture. The socialist culture, national dance, is integral to the nation's precious cultural heritage [17]. At the same time, the culture of national dance, especially an important part of its artistic tradition, must delineate its characteristics and the essential characteristics of traditional culture. As a part of traditional culture, dance culture carries information about the nation's psychology, temperament, economy, culture, ethics, and social organization. It is an analysis of the origin of dance and the development of various forms, representing a part of the living fossils of multiple stages, a dance work that has been discovered and innovated, and an extraordinary wealth. After thousands of years of history, the national dance has gradually formed with the characteristics of diversity and richness [13]. The process of cultural heritage has a weighty and very distinctive national character. The deterioration of the ecological environment has taught us many profound lessons. When a species disappears, we lose the possibility of future development [5]. Therefore, as a culture, the disappearance of the national dance of human culture will suffer huge losses. Thus, strengthening the compilation of ethnic minority dances has become the focus of cultural work [14].

In the long history, the ruling class did not pay attention to the folk dance, which had no room for survival and was even suppressed artificially. So many good folk dances are close to destruction. With the rapid development of society and the improvement of people's living standards, the needs of the country and people's culture continue to increase, and the improvement of cultural and entertainment content is also more colorful [10]. Many believe "ethnic dance is primitive, but modern dance is exciting and interesting." To meet the needs of development, folk dances have lost their national characteristics. People don't even know the national dance. Although these "foreign" dances are imported from abroad, although the investment is significant and the consumption is high, more and more people like to make them very popular [7]. A unique folk dance website does not exist; folk dance is very little known or even forgotten. The development of ethnic dance is complex. Therefore, as a member of the ethnic group as a teacher of ethnic dance, it is obligatory to undertake the historical mission of developing ethnic dance, strengthening the inheritance of ethnic culture, protecting traditional dance, and making the traditional dance of ethnic minorities. The inheritance and development of the dance can be better continued by letting more people know about folk dance, letting people have the right to see the culture, and participating in the traditional dance and folk dance of ethnic minorities to revitalize the development of their cultural undertaking activities. It belongs to the world." With the development of Internet technology, websites have become more and more platforms for people's daily communication[16], and bringing folk dances into the Internet has become a unique and pioneering event in the protection and inheritance of folk dances[18]. When the website platform is built, no matter where you are in the world, as long as you connect to the Internet, you will realize your desire to learn and watch folk dances, which will significantly increase the popularity of folk dances. Improve the level of dance education. This is a milestone in the development of folk dance. The design of the teaching website integrates the online learning mode, which makes traditional classroom learning and online learning complement each other's advantages and improves the enthusiasm for learning dance [12].

From its formation to its development, folk dance has always reflected the production, life, thoughts, and emotions of people in each era [8]. The social practice provides rich resources for creating folk dances, creating different national characteristics and regional colors. Part of the reason why ethnic dances have created different ethnic colors is the combination of local customs and customs, which makes ethnic dance techniques and skills innovative, provides various forms of expression for ethnic dance performances, and paints a thick layer for depicting diverse ethnic customs. A stroke of [2]. Given the further changes and development of the current social development level, education and teaching, and public needs, teaching folk dance techniques and skills should keep pace with the times, reform the past, and make new ones [1]. By studying the problems existing in ethnic dance technical skills in dance training, integrating the technical skills resources of various ethnic groups, analyzing the issues of the training process from multiple aspects, starting from the characteristics of technical skills, researching strategies for solving problems, summarizing the results[11]. The more distinctive teaching and training content and methods provide a reference value for analyzing folk dance career and dance talent training and realizing the multi-field and multi-level development requirements of folk dance teaching[19].

Whether it is dance technology or dance skills, in most cases, we will cover dance skills and skills, but in terms of the two concepts, the content of each is different [15]. There needs to be an explanation for these two concepts in previous research materials. Most of them are dance teachers who, through consultation, express their opinions on their interpretations. The author can only start from a single definition of "technique" and "skill," summarize the views of many dance teachers and deduce the concepts of "dance technique" and "dance technique" [4].

Each ethnic group has different freehand technical skills. Combined with the dance style and rhythm of their ethnic groups, various technical skills show other aesthetic characteristics [6]. For example, the unarmed technical skills of Korean dance include continuous left and right turn and fall dance posture, bird jump, turn over with skirt up, single-leg dance jump, and back-kick idling. Lightweight and graceful, it reflects the Korean dance's elegant style of "stillness in motion, swimming in stillness, firmness in softness, and rigidity"; "rotation" is Uyghur dance's most typical freehand technique. The rapid rotation stops abruptly, reflecting the superb skills of Uyghur dance. In addition, the freehand technical skills in Uyghur dance also include three-legged stomping and turning, the front pair of flying swallows kneeling on the ground, and one step covering the feet and sucking the legs. As well as kneeling and softening the waist, etc.; Mongolian dance freehand techniques include reining in horse turns and reining in jumps, etc.; Tibetan dance freehand techniques include flat-footed point turns, single-handed alternate flat turns, etc.: Dai dance freehand Such technical skills include in-situ foot-covering and turning, single-leg center-of-gravity dance rotation, kneeling rotation in flat-passing palm dance, and back-to-back dance rotation, etc. Feng nodded, turned around, knelt on his waist, and turned over in situ, etc. [9].

This paper proposes an automatic classification method of national dances integrating emotion and national characteristics, studies the automatic classification of national dances, builds a model, and performs effect verification to improve the mechanical classification effect of national dances.

2 DESIGN OF DOUBLE FREE DANCE CLASSIFICATION LENS BASED ON REFRACTION AND DIFFUSE REFLECTION

2.1 Theoretical Analysis of Reflect Array Phase Compensation

In the classical planar phased array antenna, the maximum radiation direction is changed by adjusting the excitation phase of each radiating element. For reflect array antennas, the basic working principle is similar. The difference is that the feeding network does not provide the phase of each radiating element on the reflective array antenna. Still, the phase compensation function of the reflective element is used to obtain the desired phase distribution. The incident wave emitted by the feed antenna propagates in the form of a spherical wave originating from the phase center of the feed antenna. The phase of the incident wave of each element on the reflect array is proportional to the distance it travels, called the spatial phase delay.

Figure 1 shows the geometric model of the reflect array antenna and establishes the three-dimensional coordinate system shown in the figure. Taking the coordinate origin as the phase reference point, the coordinationcoordinate($_{s\,f}x, y_f, z_f$) of the equivalent phase center of the feed can be obtained first; the coordinate of the center of the i-th unit is $(x_i, y_i, 0)$, and the main beam pointing is (θ_0, φ_0). We get the distance d from the feed phase center to the i-th element as:

$$d_i = \sqrt{(x_f - x_i)^2 + (y_f - y_i)^2 + (z_f - 0)^2} \quad (1)$$

It can also be obtained that the spatial phase delay ϕ_{fi} from the feed phase center to the i-th unit is:

$$\phi_{fi} = -k_0 d_i = -k_0\sqrt{(x_f - x_i)^2 + (y_f - y_i)^2 + (z_f - 0)^2} \quad (2)$$

To obtain the main beam of the reflected wave pointing to (θ_0, φ_0), the reflector array must satisfy a specific phase distribution. According to the array theory, the expression of ϕ_{ri} in the reflection phase of the i-th unit is:

$$\phi_{ri} = -k_0 \sin\theta_0 (x_i \cos\varphi_0 + y_i \sin\varphi_0) + 2N\pi \quad (3)$$

The reflection phase of the i-th unit is obtained by the spatial phase delay ϕ_{fi} after the phase of the reflection unit is compensated so that it can be got:

$$\phi_{ri} = \phi_{fi} + \phi(x_i, y_i) \quad (4)$$

By combining formula (2) and formula (3), the phase compensation value provided by the i-th reflection unit can be obtained as:

$$\phi(x_i, y_i) = \phi_{ri} - \phi_{fi} \quad (5)$$

That is:

$$\phi(x_i, y_i) = 2N\pi - k_0 \sin\theta_0 (x_i \cos\varphi_0 + y_i \sin\varphi_0) + k_0\sqrt{(x_f - x_i)^2 + (y_f - y_i)^2 + (z_f - 0)^2} \quad (6)$$

The reflectarray can form the main beam in the desired direction if each element provides the required compensation phase.

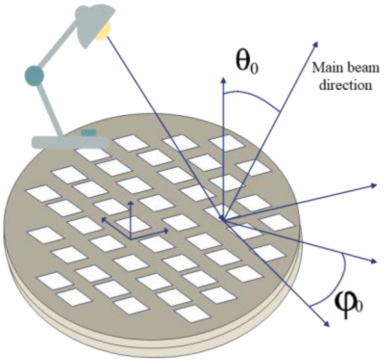
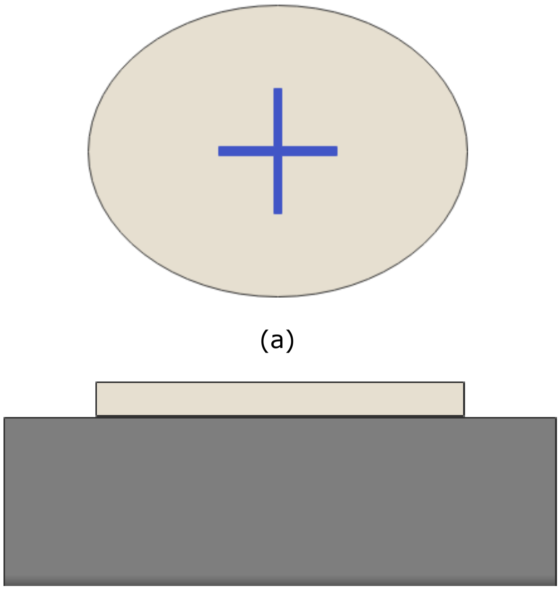


Figure 1: Geometry model of reflecting array antenna.

2.2 Design Requirements for Broad and Reflector Units

Before the unit is designed, it must clarify what conditions it should meet to achieve broadband phase shift characteristics.



(a)

(b)

Figure 2: Reflecting unit structure (a) front (b) side.

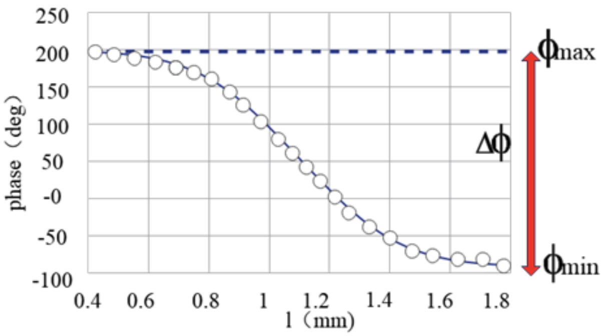


Figure 3: Element phase shift curve.

First, the cross-shaped patch is used as the basic reflection unit, and the master-slave boundary method is used to establish a model under the environment of electromagnetic simulation software HESS. The unit structure is shown in Figure 2. The element parameters are set: the operating frequency is f_0= 90 GHz, the element side length is p = 2.1 mm, the dielectric material is Roger 5880, the dielectric constant ε_r is = 2.2, and the thickness is h = 0.508 mm. The relationship between the phase of the reflection coefficient S11 of the reflection unit and the size l of the cross patch unit is obtained through HFSS simulation analysis, as shown in Figure 3.

1. Phase shift range

From the unit phase shift curve, the maximum value ϕ_{max} and minimum value ϕ_{min} of the reflection phase can be read out, so the phase shift range is expressed as:

$$\Delta\phi = \phi min_{max} \tag{7}$$

According to the realization principle of the reflection array, the planar reflection array antenna mainly relies on the phase compensation ability of the reflection unit to convert the spherical wave emitted by the feed source into a plane wave, reflect it, and form a pencil beam in a specified direction. The path delay phase from the feed to various planar remember array points may be between 0° and 360°. Therefore, the phase shift range of the reflection unit must reach at least 360° to achieve accurate phase compensation and avoid phase blind spots, which will affect the radiation performance of the antenna.

2. The slope of the phase shift curve

The slope of the phase shift curve of the reflective element reflects the sensitivity of the element's phase shift value to the size change of the reflective element. Therefore, the maximum value of the slope of the phase shift curve is used as a measure of the machining error, which is called the machining tolerance sensitivity. The formula is quantitatively expressed as:

$$\xi = max\left|\frac{\partial\phi}{\partial L}\right| \tag{8}$$

Even if the unit is machined with a dimensional error, the effect on its reflection phase will not be too significant. At the same time, when the slope of the phase shift curve is slight, its sensitivity to frequency changes will not be too large, thus broadening the antenna bandwidth.

3. Linearity of the phase shift curve

The degree of linearity of the phase shift curve of the reflection element determines the uniformity of the phase shift value and size change of the element. The phase shift curve of most planar reflect array elements is an inverted S-shaped trend rather than an ideal linear curve. The two ends of the phase shift curve are flat, and the middle is steep, which causes most of the phase shift values to fall in the center region of the phase shift curve, quickly causing processing errors and affecting the antenna radiation characteristics and frequency band performance. Suppose the linearity of the phase shift curve of the unit is high. In that case, the sensitive points of the phase shift curve can be effectively dispersed, and the unit can uniformly realize phase compensation at each end within the effective range of its size change.

In the design of the reflect array unit, as long as the phase shift range exceeds 360°, the phase shift curve is flat, and the linearity is good, the antenna bandwidth can be effectively widened. The direction for the design of the next broadband reflection unit is clarified.

2.3 The Basic Theory of Circular Polarization

If the trajectory of the end of the electric field vector of the electromagnetic wave is a straight line, it is called linear polarization. If the trajectory is an ellipse, it is called elliptical circular polarization. If it is a circle, it is circularly polarized.

We assume that a plane wave propagating in the +Z direction is:

$$\vec{E} = (\vec{e}_x\vec{E}_{x0} + \vec{e}_y\vec{E}_{y0})e^{-jkz} \tag{9}$$

Its instant expression is:

$$E(z,t) = e_xE_x(t) + e_yE_y(t) \tag{10}$$

Among them,

$$E_x(t) = E_{x0}\cos(\omega t - kz + \varphi_x) \tag{11}$$

$$E_y(t) = E_{y0}\cos(\omega t - kz + \varphi_y) \tag{12}$$

Simultaneously combining formula (11) and formula (12) and eliminating $cos(\omega t - kz)$, the electric field vector trajectory equation can be obtained:

$$\frac{E_x^2}{E_{x0}^2} - \frac{2E_xE_y}{E_{x0}E_{y0}}cos(\varphi_y - \varphi_x) + \frac{E_y^2}{E_{y0}^2} = sin^2(\varphi_y - \varphi_x) \tag{13}$$

This is the general form of the ellipse equation. Therefore, two linearly polarized waves orthogonal to each other in space can synthesize any elliptically polarized wave. If the conditions $E_{x0} = E_{y0} = E_0$ and $\varphi_y - \varphi_x = \pm\frac{\pi}{2}$ are satisfied, it is found that:

$$E_x^2 + E_y^2 = E_0^2 \tag{14}$$

Its electric field vector locus is a circle. According to their handedness, circularly polarized waves are divided into left-handed and right-handed. Suppose the handedness of the electric field vector satisfies the right-handed spiral rule concerning the propagation direction. In that case, the circularly polarized wave is a right-handed circularly polarized wave. If the handedness meets the left-handed helical law, it is a left-handed circularly polarized wave.

The circularly polarized wave is only a particular case of the elliptically polarized wave, and the axial ratio can judge the performance of the circularly polarized wave. Axial ratio is the concept of elliptically polarized waves, and the ratio of the central axis to the minor axis of the polarization ellipse is defined as the axial ratio. For an elliptically polarized wave, we must first find the major and minor axes of the polarization ellipse to obtain the expression of the axial ratio. Equation (13) expresses the elliptic equation for an arbitrary elliptically polarized wave. The angle between the long axis of the polarization ellipse and the x-axis of the coordinate system is defined as the inclination angle of the elliptically polarized wave, then

$$\tau = \frac{1}{2}tg^{-1}\frac{2E_{x0}E_{y0}\cos(\delta)}{E_{x0}^2 - E_{y0}^2} \tag{15}$$

Among them, $\delta = \varphi_y - \varphi_x$ is the phase difference between the y-direction component $E_y(t)$ and the x-direction component $E_x(t)$. Then, the axial ratio expression can be obtained as:

$$r_A = \sqrt{\frac{E_{x0}^2\cos^2\tau + E_{x0}E_{y0}\sin 2\tau\cos\delta + E_{y0}^2\sin^2\tau}{E_{x0}^2\sin^2\tau - E_{x0}E_{y0}\sin 2\tau\cos\delta + E_{y0}^2\cos^2\tau}} \tag{16}$$

The value range of the axial ratio r_A is $1 \leq r_A < \infty$, which is commonly expressed in decibels in engineering:

$$AR = 20\,lg\,r_A \tag{17}$$

2.4 The Realization Principle of Circularly Polarized Planar Reflect Array Antenna

Some fundamental theories of circular polarization are introduced, and it is learned that a circularly polarized wave can be synthesized by two spatially orthogonal linearly polarized waves with the same amplitude and a phase difference of 90°. The principle of transition from linear to circular polarization is shown in Figure 4. The polarization direction of the linearly polarized feed is set at an angle of 45° with the two arrangement directions of the reflecting elements so that it can be decomposed into the x-direction component E_x and the y-direction component E_y, which are orthogonal in space and have the same amplitude and phase. As long as the phase difference between the E_x and E_y components of the reflected wave is 90° based on phase compensation, the three conditions of space orthogonality, equal amplitude, and 90° phase difference are satisfied. The transformation of the linearly polarized incident wave to a circularly polarized reflected wave is realized.

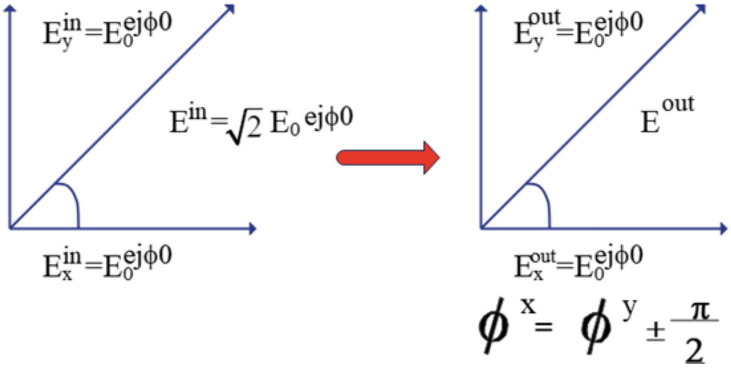


Figure 4: Schematic diagram of polarization conversion of reflection unit.

Chapter 2 deduces that the phase that needs to be compensated for the i-th unit is:

$$\phi(x_i, y_i) = 2N\pi - k_0 \sin\theta_0 (x_i \cos\varphi_0 + y_i \sin\varphi_0) + k_0\sqrt{(x_f - x_i)^2 + (y_f - y_i)^2 + (z_f - 0)^2} \tag{18}$$

Only the compensating phase in the x-direction of the i-th unit and the compensating phase in the x-direction satisfy:

$$\phi_x(x_i, y_i) = \phi(x_i, y_i) \text{ and } \phi_y(x_i, y_i) = \phi(x_i, y_i) \pm \frac{\pi}{2} \tag{19}$$

The conversion of the linearly polarized incident wave to a circularly polarized reflected wave can be realized.

Taking the W-band broadband reflection element as an example, the phase of the reflection element in the x-polarization direction and the y-polarization direction can be independently adjusted by adjusting the parameters L_x and L_y in the x-direction and y-direction. Due to the symmetry of the reflection unit, the phase shift curves in the two directions are the same. Therefore, only the phase shift curve in one direction is needed to calculate the size of the cell in both directions. As long as $\phi_x(x_i, y_i) = \phi(x_i, y_i)$ and $\phi_y(x_i, y_i) = \phi(x_i, y_i) \pm \frac{\pi}{2}$ are found and the corresponding size value is located on the phase shift curve, the size of each element can be calculated.

Although the phase shift in the two polarization directions of the broadband reflective element designed above can be almost independently controlled by the parameters in the same direction, due to the existence of mutual coupling inside the unit, the parameters in its orthogonal direction still have a particular influence on its phase shift value. Independently performing phase compensation on the two polarization directions will still cause a specific phase error. To realize the phase compensation of the unit more accurately. Taking the incident wave polarized in the x-direction as an example, the relationship between the reflected phase of the unit and the dimension L_x in the x-direction and the dimension L_x in the y-direction is established. The result is a three-dimensional curved surface, as shown in Figure 5.

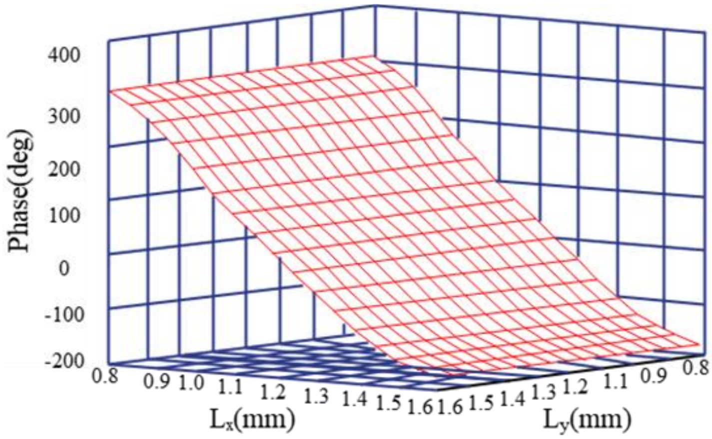


Figure 5: Relationship diagram between element reflection phase and parameters L_x and L_y.

Next, we define an optimization objective function:

$$\Delta\phi_i(L_x, L_y) = |f_x(L_x, L_y) - phase_i| + \left|f_y(L_x, L_y) - phase_i \pm \frac{\pi}{2}\right| \quad (20)$$

Among them, $f_x(L_x,\ L_y)$ refers to the mapping of the relationship between the reflection phase of the unit and the dimension L_x in the x direction and the dimension L_y in the y direction under the irradiation of the x-polarized incident wave. $f_y(L_x,\ )$ Ly refers to mapping the relationship between the reflection phase of the unit and the dimension L_x in the x direction and the dimension L_y in the y direction under the irradiation of the y-polarized incident wave. Due to the symmetry of the unit structure, there is $f_y(L_x,\ L_y) = f_x(L_x,\ L_y)$. $Phase_i$ refers to the phase that needs to be compensated theoretically for the i-th unit along the x-axis to achieve the specified beam. $phase_i \pm \frac{\pi}{2}$ refers to the phase that needs to be paid for the i-th unit along the y-axis direction, which is 90° different from the compensated phase in the x-axis direction to achieve circular polarization. When the objective function f$\Delta\phi_i(L_x,\ L_y)$ is the ith unit size $(L_x,\ L_y)$, the sum of the difference between the actual compensation phase and the theoretical value in both directions.

As long as the exhaustive value of $(L_x,\ L_y)$ makes the objective function $\Delta\phi_i(L_x,\ L_y)$ the smallest, the actual compensation phase is most comparable to the theoretical compensation phase. Therefore, the problem can be transformed into a constrained optimization problem:

$$min\,\Delta\,\phi_i(L_x, L_y) \quad (21)$$

$$St.\,Lxy_{ymax}ymin_{xmax}{}_{xmin} \quad (22)$$

3 SYSTEM CONSTRUCTION AND SIMULATION

According to the algorithm proposed in the second part, Figure 6 shows the automatic classification method of national dances integrating emotion and national characteristics proposed in this paper. The research process framework is shown in Figure 7.

Taking the dynamic image of dance as the starting point, a comprehensive and general division method is adopted. It uses the methodology of Chinese national dance culture discipline - the

"Dynamic Intersection Method" to explore the particularity of Chinese national dance, "harmony but different," and the law of cultural inheritance.

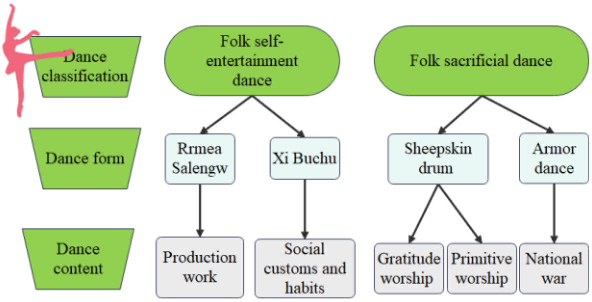


Figure 6: The automatic classification method of national dances integrating emotion and national characteristics.

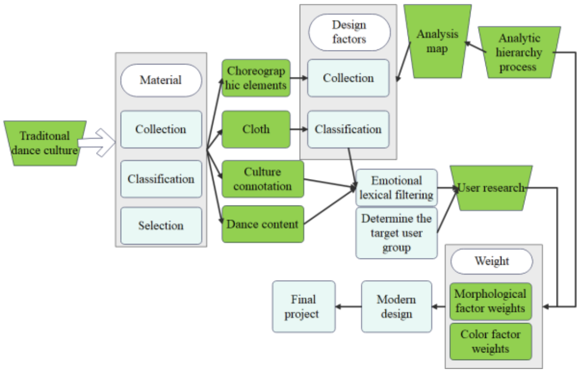


Figure 7: Research process framework.

All ethnic groups in China have jointly created a variety of dance forms in a specific environment, with unique production, labor, and way of life. Since China is an agriculture-oriented country, and a stable farming culture is the primary culture, all kinds of dances have elements of farming culture. China has a vast prairie, and ethnic groups engaged in nomadic herding, hunting, and fishing have created a mobile grassland culture. The exquisite and colorful farming culture and the broad and profound grassland culture have become the foundation of Chinese national dance culture. Historically, the ancient Qiang people and other ethnic groups in the Qinghai-Tibet Plateau and the Yunnan-Guizhou Plateau have created a farming and animal husbandry culture combining plateau farming and animal husbandry. In the coastal areas, the labor and life of various ethnic groups have the color of marine culture. The ancient peoples on the "Silk Road" merged Chinese and Western cultures to create an oasis culture that combines farming, grassland, and commercial elements. China's unique history, geography, nationality, society, economy, and other factors have formed the cultural phenomenon of "you have me, I have you" in the national dances of various ethnic groups. Given the particularity of the fusion of multiple cultures that are "harmonious but different," we believe that using a single category of division is inappropriate. Therefore, a dynamic and comprehensive division method is adopted based on the active image formed by the environment, labor, and dancers. According to the traditional concept of "synthesis" and "five" in Chinese culture, Chinese national dances are divided into five cultural types: farming, grassland, ocean, farming and animal husbandry, and oasis. Moreover, each type has become a new artistic concept integrating "environment, labor, and nation."

After obtaining the double free dance classification lens, it is imported into the optical simulation software TracePro to simulate and verify the effect of illumination on the target plane, proving the method's effectiveness. First, a single circular LED with a diameter $\sqrt{of\ 2}$mm is used as the light source; the power of the LED is set to $1W$, and its beam angle is set to $\theta_{1/2} = \frac{\pi}{3}$. That is, at this angle, the luminous intensity emitted by the light source is half of the average direction of the light source. Compared with the size of the double free dance classification lens (50mm×55mm×55mm).

As shown in Figure 8, the double-freedom dance classification shot is obtained by introducing the double-freedom curve into the modeling software for rotation. The lens material is Pmma (polymethyl methacrylate). Its light transmittance is 93%, and its refractive index is 7%.

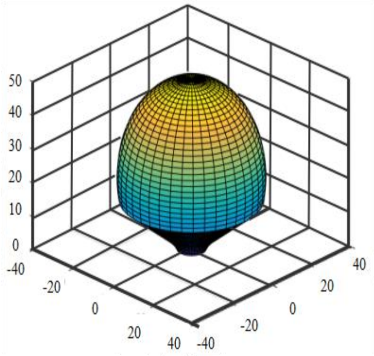
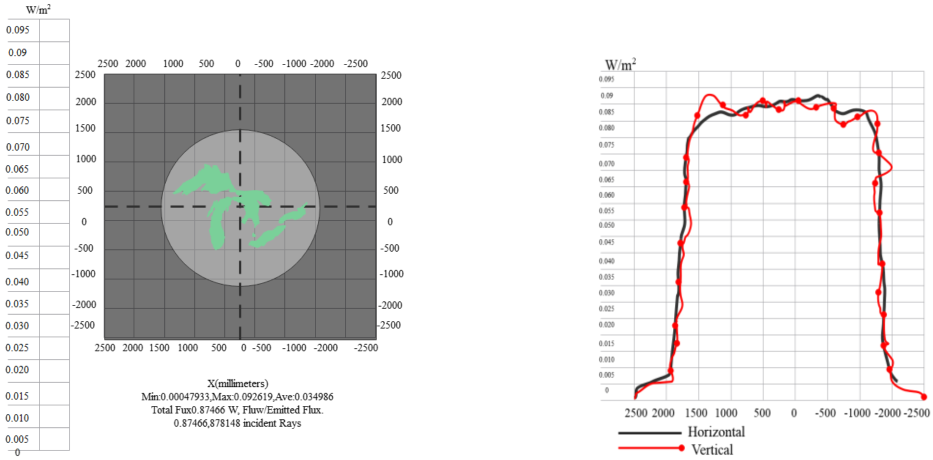


Figure 8: Rotation model of double free dance classification shots.

Figure 9 shows the simulation results of the irradiance distribution over the illuminated area.

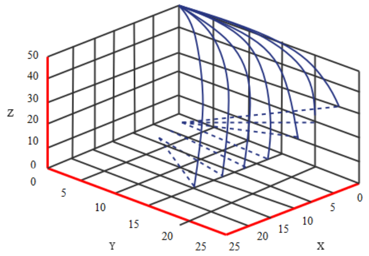


(a) (b)

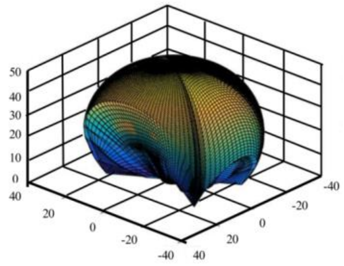
Figure 9: Irradiance distribution of the double free dance classification lens in the illuminated area.

In the ideal case, ignoring the loss of lens surface refraction and diffuse reflection, the irradiance distribution of the dual free dance classification lens is about 91% in the specified design area, and the efficiency reaches 81%. When the reflection losses of refractive surfaces and the refraction losses of diffuse surfaces are added to the simulation, the irradiance distribution of the dual-free dance classification lens is 90%, and the efficiency reaches 76%. The results show that this dual-free dance classification lens can produce highly uniform and efficient circular illuminated areas. Moreover, this result demonstrates the feasibility of the rotational symmetry of the design method.

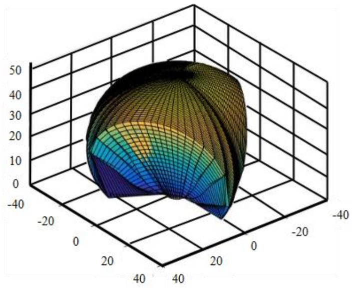
Based on this design method of the double free dance classification lens on the two-dimensional plane, as shown in Figure 10, the dual free dance classification lens of different angles is solved. Free dancing classification shots for illuminating rectangular and triangular surface areas can be obtained depending on the shape of the target plane and the SMS method.



(a) Dual freeform surfaces at different angles



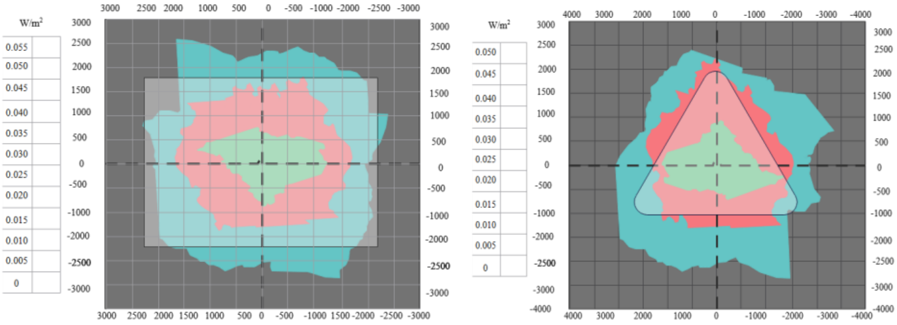
(b) Dual free dance classification lens for rectangular lighting



(c) Dual free dance classification lens for triangular lighting

Figure 10: Classification curve simulation diagram.

Figure 11 shows the irradiance distribution produced by the rectangular and triangular dual free dance classification lenses.



(a) (b)

Figure 11: Irradiance distribution of rectangular and triangular illumination of dual free dance classification lenses.

The system designed in this paper is applied to the automatic classification of national dance, and the statistical classification effect is shown in Table 1.

Number	*Classification effect*	*Number*	*Classification effect*
1	*85.04*	*17*	*87.60*
2	*89.85*	*18*	*89.12*
3	*91.04*	*19*	*89.48*
4	*84.90*	*20*	*88.60*
5	*91.48*	*21*	*89.90*
6	*84.42*	*22*	*86.11*
7	*86.82*	*23*	*90.95*
8	*87.66*	*24*	*91.65*
9	*86.48*	*25*	*87.17*
10	*86.06*	*26*	*89.53*
11	*85.84*	*27*	*88.27*
12	*87.08*	*28*	*90.06*
13	*86.83*	*29*	*90.92*
14	*88.26*	*30*	*90.31*
15	*91.59*	*31*	*88.03*
16	*89.04*	*32*	*88.99*

Table 1: The automatic classification effect of national dance.

The above verifies that the automatic classification method of national dances integrating emotion and national characteristics proposed in this paper has a specific effect.

4 CONCLUSIONS

Like any other social science, dance should seek an orderly framework to explain its subjects based on systematic observations. Moreover, the national dances of various ethnic groups have a long and colorful history. To conduct a comprehensive study, we must first work on scientific classification. In addition, the theories and research results of natural sciences, social sciences, and various arts, as well as their research results, are used as references to study different cultural factors displayed in dance. A new classification method has many shortcomings and inaccuracies, so it needs to be further demonstrated and improved. This paper proposes an automatic classification method of national dances integrating emotion and national characteristics, conducts research on the automatic classification of national dances, builds a model, and performs effect verification. The experimental results verify that the automatic classification method of national dances integrating emotion and national characteristics proposed in this paper has a specific effect. The synergy of medical research, AI technology, and cultural understanding in classifying national dances offers a pathway to explore and celebrate the rich tapestry of human expression. Ethical awareness and collaborative efforts across disciplines will be essential in harnessing the potential benefits of this innovative approach.

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REFERENCES

[1] Aristidou, A.; Stavrakis, E.; Papaefthimiou, M.; Papagiannakis, G.; Chrysanthou, Y.: Style-Based Motion Analysis for Dance Composition, The Visual Computer, 34(12), 2018, 1725-1737. https://doi.org/10.1007/s00371-017-1452-z

[2] Beni, S.; Ní, Chróinín D.; Fletcher, T.: A Focus on the How of Meaningful Physical Education in Primary Schools, Sport, Education, and Society, 24(6), 2019, 624-637. https://doi.org/10.1080/13573322.2019.1612349

[3] Bernstein, B.: Empowerment-Focused Dance/Movement Therapy for Trauma Recovery, American Journal of Dance Therapy, 41(2), 2019, 193-213. https://doi.org/10.1007/s10465-019-09310-w

[4] Bhat, A. N.: Is Motor Impairment in Autism Spectrum Disorder Distinct From Developmental Coordination Disorder? A Report from the SPARK Study, Physical Therapy, 100(4), 2020, 633-644. https://doi.org/10.1093/ptj/pzz190

[5] Bryl, K.; Goodill, S.: Development, Execution, and Acceptance of a Manualized Dance/Movement Therapy Treatment Protocol for the Clinical Trial in the Treatment of Negative Symptoms and Psychosocial Functioning in Schizophrenia, American Journal of Dance Therapy, 42(2), 2020, 150-175. https://doi.org/10.1007/s10465-019-09312-8

[6] Capecci, M.; Ceravolo, M. G.; Ferracuti, F.; Iarlori, S.; Monteriu, A.; Romeo, L.; Verdini, F.: The KIMORE Dataset: KInematic Assessment of Movement and Clinical Scores for Remote Monitoring of Physical Rehabilitation, IEEE Transactions on Neural Systems and Rehabilitation Engineering, 27(7), 2019, 1436-1448. https://doi.org/10.1109/TNSRE.2019.2923060

[7] Dimitropoulos, K.; Tsalakanidou, F.; Nikolopoulos, S.; Kompatsiaris, I.; Grammalidis, N.; Manitsaris, S.; Manitsaris, A.: A Multimodal Approach for the Safeguarding and Transmission of Intangible Cultural Heritage: The Case of i-Treasures, IEEE Intelligent Systems, 33(6), 2018, 3-16. https://doi.org/10.1109/MIS.2018.111144858

[8] Gallese, V.; Rochat, M. J.: Forms of Vitality: Their Neural Bases, their Role in Social Cognition, and the Case of Autism Spectrum Disorder, Psychoanalytic Inquiry, 38(2), 2018, 154-164. https://doi.org/10.1080/07351690.2018.1405672

[9] Garcia-Agundez, A.; Folkerts, A. K.; Konrad, R.; Caserman, P.; Tregel, T.; Goossens, M.; Kalbe, E.: Recent Advances in Rehabilitation for Parkinson's Disease with Exergames: A Systematic Review, Journal of Neuroengineering and Rehabilitation, 16(1), 2019, 1-17. https://doi.org/10.1186/s12984-019-0492-1

[10] Georgios, L.: The Transformation of Traditional Dance from its First to its Second Existence: The Effectiveness of Music-Movement Education and Creative Dance in the Preservation of Our Cultural Heritage, Journal of Education and Training Studies, 6(1), 2018, 104-112. https://doi.org/10.11114/jets.v6i1.2879

[11] Grammatikopoulou, A.; Laraba, S.; Sahbenderoglu, O.; Dimitropoulos, K.; Douka, S.; Grammalidis, N.: An Adaptive Framework for the Creation of Exergames for Intangible Cultural Heritage (ICH) Education, Journal of Computers in Education, 6(3), 2019, 417-450. https://doi.org/10.1007/s40692-018-0115-z

[12] Grygus, I.; Nesterchuk, N.; Hrytseniuk, R.; Rabcheniuk, S.; Zukow, W.: Correction of Posture Disorders with Sport and Ballroom Dancing, Медичні перспективи, 25(1), 2020, 174-184. https://doi.org/10.26641/2307-0404.2020.1.200418

[13] Kawano, T.; Chang, M.: Applying Critical Consciousness to Dance/Movement Therapy Pedagogy and the Politics of the Body, American Journal of Dance Therapy, 41(2), 2019, 234-255. https://doi.org/10.1007/s10465-019-09315-5

[14] Lin, Y. N.; Hsia, L. H.; Sung, M. Y.; Hwang, G. H.: Effects of Integrating Mobile Technology-Assisted Peer Assessment into Flipped Learning on Students' Dance Skills and Self-Efficacy, Interactive Learning Environments, 27(8), 2019, 995-1010. https://doi.org/10.1080/10494820.2018.1461115

[15] Mathis, A.; Mamidanna, P.; Cury, K. M.; Abe, T.; Murthy, V. N.; Mathis, M. W.; Bethge, M.: DeepLabCut: Markerless Pose Estimation of User-Defined Body Parts with Deep Learning, Nature Neuroscience, 21(9), 2018, 1281-1289. https://doi.org/10.1038/s41593-018-0209-y

[16] Newell, K. M.: What are Fundamental Motor Skills and What is Fundamental About Them?, Journal of Motor Learning and Development, 8(2), 2020, 280-314. https://doi.org/10.1123/jmld.2020-0013

[17] Raheb, K. E.; Stergiou, M.; Katifori, A.; Ioannidis, Y.: Dance Interactive Learning Systems: A Study on Interaction Workflow and Teaching Approaches, ACM Computing Surveys (CSUR), 52(3), 2019, 1-37. https://doi.org/10.1145/3323335

[18] Shimizu, D.; Okada, T.: How do Creative Experts Practice New Skills? Exploratory Practice in Breakdancers, Cognitive Science, 42(7), 2018, 2364-2396. https://doi.org/10.1111/cogs.12668

[19] Zulić, H.: How AI can Change/Improve/Influence Music Composition, Performance, and Education: Three Case Studies, INSAM Journal of Contemporary Music, Art, and Technology, 1(2), 2019, 100-114.