Article

Form of Shanxi folk dance from the perspective of semiotics

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Abstract: Among the many difficulties facing traditional folk dancing are the possibility of cultural homogenization and the disintegration of heritage. The impact of foreign culture weakens cultural distinctiveness, national identity in dance is lost, and movements and emotional expressions tend to be identical. It is becoming more difficult for the essence of many dances to survive as a result of the concurrent decline of inheritors, rise in senior artists, and fracture in the skills inheritance. This article took Shanxi folk dance as the research object and innovatively analyzed its dance form from a semiotic perspective. Taking Zuoquan Xiaohua Opera as an example, this article explored in detail the symbolic significance and cultural connotations of body posture, movement rhythm, and props such as colorful fans in dance, aiming to address the phenomenon of fading of Shanxi folk dance culture. This article used the histogram of oriented gradient (HOG) to accurately capture data from the database and analyze the symbolic features in dance forms. In Shanxi Province traditional dance analysis, HOG is essential for differentiating the various dance genres in addition to providing a correct depiction of the body characteristics. To successfully separate the stylistic characteristics of various dance forms, HOG can precisely identify the individual symbolic elements in the dance by extracting the direction information of the edges in the image. This method also offers great technological assistance for the research of dance morphology. At the same time, in order to better recognize the features of dance symbols, the transfer learning technology was creatively applied to accelerate the learning process of Shanxi dance form symbol recognition tasks. The research results showed that the semiotic perspective profoundly revealed the aesthetic value of Shanxi folk dance, helping to solve the problem of cultural fading. This study not only enriches the application of semiotic theory in the field of dance art, but also broadens the perspective of dance research, providing strong support for the inheritance and innovation of folk dance art in Shanxi.

Keywords: Shanxi folk dance; Zuoquan Xiaohua opera; folk dance science; semiotics theory; histogram of oriented gradient

1. Introduction

Shanxi, this ancient loess land, has nurtured a diverse range of folk dance arts. However, under the wave of modernization, these precious traditional arts are facing the dilemma of inheritance and the gradual fading of culture. How to protect and inherit these dances in the context of the new era has attracted more and more attention. Semiotics, a discipline that explores symbols and their deep meanings, provides a new path for research. Through the lens of semiotics, the symbolic elements and rich meanings contained in Shanxi folk dance can be further explored, revealing their unique cultural connotations and aesthetic values. This not only provides solid theoretical support for the sustainable development of dance art, but also points out the direction for practical guidance. Dance, as a special form of nonverbal culture, conveys profound emotions and thoughts through movements and forms. In the

brilliant Chinese culture, Shanxi folk dance has become an important field of intangible cultural heritage research with its unique charm and profound cultural heritage.

Against the backdrop of continuous globalization and increasing emphasis on cultural diversity, it is particularly urgent to better explore and inherit folk art forms. This article starts from a semiotic perspective and conducts in-depth and systematic research on the forms of Shanxi folk dance. Semiotics provides strong theoretical support for understanding and interpreting cultural symbols, emotional expressions, and aesthetic concepts in Shanxi folk dance. With the help of semiotic analysis, the morphological features, cultural connotations, and historical evolution of Shanxi folk dance can be more deeply explored, thus finding new breakthroughs for the inheritance and innovation of dance art. Traditional folk dances in Shanxi, like "drum music dance" and "Yangko dance" are struggling with both cultural deterioration and inheritance. Using "drum music and dance" as an example, this ancient art form that blends dance and percussion was formerly a significant representation of the local way of life due to its intricate drum beat and fast-paced dance moves. Nevertheless, as the more experienced artists age, fewer and fewer youth are eager to pick up and carry on these abilities, which puts a lot of distinctive drum beats and dance moves in danger of disappearing. Local dance culture is declining even further as a result of young people's increased openness to foreign cultures brought about by the effects of cultural globalization. The basis of Shanxi's indigenous culture is seriously threatened by this tendency, which also jeopardizes the diversity of dance forms, underscoring the seriousness of the issue.

Shanxi folk dance can be studied in a new way thanks to semiotics. By examining the symbolic components of dance and their profound connotations, it goes beyond the bounds of conventional dance analysis techniques and exposes the rich connotation of dance culture. While semiotics can delve into symbolic components like posture, rhythm, and props in dance and examine the cultural information and social value they contain, traditional dance analysis frequently focuses on movement abilities, rhythm, and choreography. This approach broadens the scope of dance studies while also helping scholars gain a deeper understanding of the aesthetic significance and cultural legacy of dance. Semiotics certainly offers a greater knowledge and a broader viewpoint for the study of Shanxi folk dance when compared to traditional methodologies. This study not only enriches the application of semiotics in dance art research theoretically, bringing new perspectives and dimensions of thinking to dance research, but also reveals the deep meaning and aesthetic value of symbolic elements in dance by integrating semiotic theory with Shanxi folk dance. In addition, this study also helps to deepen people's cultural identity and emotional belonging to Shanxi folk dance, and further promote the inheritance and prosperous development of traditional Chinese culture.

In the study of Shanxi folk dance, various proper nouns will be involved. Explaining these proper nouns can help others better understand the article. In order to more intuitively show the proper nouns of the dances, dance names, and methods involved in this article, we can refer to Appendix **Table A1** "Explanation of Proper nouns" for detailed information.

2. Related work

Shanxi folk dances have rich and diverse forms and concepts. These dances not only reflect the social life, customs, and spiritual temperament of Shanxi region, but also contain profound drama and artistry. Li (2020) believed that the "men dressed in women's clothing" in traditional Shanxi dance is an artistic form of men dressing up as women for performance, examined from the surface form of form. Dance is an art form that originates from life and transcends it. Yang (2024) found that incorporating traditional culture into dance teaching is very important through the use of teaching methods. This not only teaches dance skills, but also allows students to understand the traditional culture of the nation. There are various forms of folk dances in China, and ethnic minority dances in China originated from the folk. Li (2020) believed that the dance of ethnic minorities in Xiangxi originated from daily life, with millions of laboring people working on vast land as the main body. Influenced by the multi-ethnic culture of Xiangxi, it had a close relationship with surrounding cultures. Lucero (2021) used multimedia computer-aided teaching and demonstration methods to determine the performance level of second grade students in folk dance teaching . The unique artistic color of Shanxi folk dance has added a rich and colorful touch to the Three Jin culture. Yang (2021) believed that the fusion of folk dance movements, the use of props, and the presentation of dance charm in Shanxi are all the crystallization of the wisdom left by local people for thousands of years. Currently, study on Shanxi folk dance has advanced significantly, showcasing the richness and diversity of its social, cultural, and artistic aspects; yet, the majority of these studies have concentrated on folk representations and surface-level forms, leaving a dearth of understanding regarding the deep meaning inherent in dance symbols. The deeper interpretation of Shanxi traditional dance is restricted by this circumstance. Consequently, a clear research need exists at this point in the literature: a thorough examination of the semiotics of Shanxi folk dance forms. This involves a deficiency of research on the relationship between dance and society and historical context, as well as an inadequate in-depth interpretation of symbols such as dance moves and props. This article will examine the Shanxi folk dance's symbolic system from a variety of perspectives, including action, props, and spatial layout, using semiotic theory to uncover the intricate details of its cultural and social importance. This analysis seeks to address the limitations of previous research by offering fresh theoretical justification for Shanxi folk dance's originality and inheritance.

Semiotics is a discipline that studies the essence of symbols in things, the laws of their development and changes, the various meanings of symbols, and the relationships between symbols and various human activities (Hayles, 2019; Logi and Michele, 2023). Asyrafunnisa (2021) aimed to explore the function and symbolic significance of Bakarena dance in the Wujismaksha society, mainly based on semiotics, and believed that dance movements represent the main life. The research was mainly conducted in South Sulawesi, Makassar. Since ballet performance is not one of the key events of the audience's organism, not all viewers can perceive and interpret the physical signs that express the dancer's mental state. Kruk (2022) treated dancers as intimate individuals and activated carefully designed emotional neural circuits through semiotics, allowing the audience to feel the internal state of the dancers and enriching

the interpretation of landscape movements. From a cognitive perspective in the process of mathematical modeling, the application of semiotic tools has largely supplemented analysis. For this purpose, Ledezma et al. (2023) considered using semiotic methods to provide tools for the analysis of any mathematical activity. When explaining communication, people are often trapped in symbols and a set of symbols used. For this reason, Ibrahim and Sulaiman (2020) utilized semiotics, where the meaning of symbols or signs used to convey news heavily depends on the ideology of the media and the entire organization that manages it. Using semiotics, Yekini et al. (2021). explored another perspective on evaluating the quality and reliability of sustainability reports, and advanced research on corporate social responsibility communication by applying theoretical and methodological perspectives. Despite the impressive outcomes of applying semiotics in several domains as dance studies, communication, mathematical modeling, and corporate social responsibility, the current body of study still has major shortcomings. Asyrafunnisa (2021) explores the symbolic meaning of dance movements on Bacarena dance, but it primarily focuses on the life functions in a particular cultural context. As a result, it falls short of providing a complete explanation for how symbols interpret the intricacy of dance within a larger cultural or social framework. A common issue in semiotics research is that symbolic meaning is easily influenced by the communication environment and outside factors, making it challenging to form a universal interpretation. Ibrahim and Sulaiman (2020) research on news communication symbols also reveals the high dependence of symbolic interpretation on media ideology and organizational background. Given the aforementioned constraints, he creatively suggests a research methodology that blends technological instruments with semiotics. Technical technologies offer significant advantages in data gathering, analysis, and visualization, while semiotics offers a strong theoretical foundation for dissecting and evaluating cultural symbolic systems. By applying an all-encompassing approach, the research hopes to bridge the gaps left by previous studies and advance the field of semiotics.

3. Application of symbols in the form of Shanxi folk dance

Semiotics is a scientific field that focuses on the study of symbols and their meanings, covering a wide and profound range of content (Gretzel and Maria, 2019; Matthews and Marcel, 2019). Semiotics not only explores the essence and evolution laws of natural symbols, but also deeply analyzes the close connection between symbols and human activities and thinking (De, 2020; Wang and Saengchan, 2022). Its core lies in analyzing systems that express or imply functions through symbols. Ethnic folk dance, as a profound cultural phenomenon, reflects the social concepts and ideologies of the nation (Goldberg, 2019). The different expressions in dance vividly reflect the cultural features of different eras. The reputation of Shanxi folk dance has spread far and wide, owing to the beautiful dance posture, varied scenes, distinctive local features, as well as the rich flavor of life and cheerful and rich connotations. As a shining pearl of the Yellow River song and dance culture, Shanxi folk dance carries a profound cultural heritage of the Loess Plateau, showcasing unique regional charm and cultural charm.

Dance, an art form that uses dynamic human movements, expressions, and postures as a medium, is a bridge for conveying emotions and ideas (Henderson, 2019). Symbols, as elements that can convey a certain meaning or inner meaning, constitute the information link between the sender and the receiver. In dance, movements and forms become the medium of symbols, and the deep meaning conveyed by the combination of these movements is the core content that symbols want to express. From the perspective of semiotics, it can be observed that although dance postures are illusory, body movements are real and perceptible, forming a system of expressive symbols composed of emotions and forms (Dandekar, 2021; Feng, 2022). As a symbolic form of dance, it can not only be externalized as an intuitive representation of the dance work, but also deeply reveal the inherent meaning of the work. Shanxi folk dance, as an indispensable part of traditional Chinese culture, has a long history and rich variety. It carries profound social and cultural connotations and exhibits unique artistic charm. The diversity of folk dances in Shanxi is breathtaking. These dances not only have different forms, but also have rich and colorful content, vividly reflecting the social life, customs, and aesthetic pursuits of the Shanxi people. The schematic diagram of Shanxi folk dance types is shown in **Figure 1**.

Dragon dance   Early boat

Stilts   Back stick

Figure 1. Schematic diagram of Shanxi folk dance types.
Source: https://www.fengsuwang.com/minjian/shanximinsuwenhua.asp.

In in-depth interviews, many senior dancers mentioned that Shanxi folk dance not only demonstrates artistic charm, but also is a key link to maintain community cohesion and inherit culture. They vividly described the indispensable role of dance in various festivals, weddings and other occasions, and how dance subtly conveys emotions and tells stories. Cultural historians further explained that these dances also carried the heavy responsibility of political propaganda and moral education at a

specific stage of history, and became an important window for the display of social order and values. Through these precious interview materials, people can gain a deeper understanding of the complexity and diversity of Shanxi folk dance as a cultural symbol, as well as its irreplaceable role in maintaining the common understanding of the community and promoting cultural exchanges. This integration of interdisciplinary research perspectives not only infuses new vitality into our semiotic analysis, but also provides a more solid theoretical support for the protection and inheritance of these brilliant intangible cultural heritage.

3.1. Body symbols

Body symbols play a crucial role in Shanxi folk dance. Taking Zuoquan Xiaohua Opera as an example, the widely used body symbols such as twisting hips, protruding cheeks, and protruding buttocks not only vividly shape the dance image, but also deeply convey specific emotions and artistic conception. In the dance work "On the Sunshine Road", these body symbols are carefully extracted and cleverly used to showcase the arduous journey of grassroots farmers on the road to poverty alleviation and prosperity, as well as their fervent desire for a happy life. At the same time, in the creation process, the work cleverly integrates the dance symbols of Shanxi folk dance, such as Kicking drums and yangko in northern Shanxi and Zuoquan Xiaohua Opera, and carefully extracts and applies the typical body symbols of Shanxi folk dance, "Three Bends" (Xiaomo and Shi, 2023). At the same time, body symbols such as twisting hips, protruding cheeks, pouting buttocks, and standing chest are extracted from Shanxi Zuoquan Xiaohua Opera, and these symbols are cleverly integrated into the dance by fully utilizing the plasticity and variability of the dance body. In terms of dance character modeling, the use of postures such as sitting, standing, relying, and leaning further highlights the artistic charm of the "Three Bends" body symbol (Reinders et al., 2019). Through interviews with local dance practitioners and cultural historians, we deeply realized that these dances not only show the rhythmic beauty of body language, but more importantly, they are like vivid pictures depicting the historical evolution, social life and people's aesthetic pursuits in Shanxi. Among them, the posture symbols such as "crotch twisting" and "shy cheeks" not only reflect the exquisite dance skills, but also deeply reflect the local people's attitude to life and the unique charm of regional culture. The schematic diagram of body symbols in Shanxi folk dance is shown in **Figure 2**.

Figure 2. Schematic diagram of body symbols in Shanxi folk dance.
Source: http://www.chnjinju.com/index.html.

3.2. Dynamic symbols

The upper body motions and other rhythmic symbols used in Shanxi traditional dance, such as twisting and swinging, have rich cultural and historical significance. These symbols represent the Shanxi people's way of life and spirituality in addition to the art form of dancing. Their religious rites and the old farming civilization of the north are the sources of their culture. More specifically, Shanxi's traditional farming practices have had a significant influence on these dynamic symbols. The fundamentals of dance have progressively developed from long-term agricultural production actions like bending over to plow and swinging a sickle to harvest. Through their sense of rhythm, these motions convey not just the farmers' labor stance but also their adaptability and wonder at the natural world. These rhythmic motifs are also strongly associated with the sacrificial culture and religion of Shanxi. Taoism and Buddhism have a long history in Shanxi, one of the birthplaces of religious culture. Dance has grown in importance as a means of expressing reverence for the gods during customary celebrations like temple fairs and ancestor worship. To convey their respect and gratitude for heaven and earth, ancestors, and gods, dancers mimic natural events through precise motions, such as the movement of heaven and earth and the alternation of yin and yang. These deeds signify the cycle and boundlessness of existence in addition to the meaning of religious rites. Generally speaking, the rhythmic elements of Shanxi folk dance represent the history, culture, and spirit of the area. The themes of labor, religion, and drama are all skillfully incorporated into dance, demonstrating both its artistic worth and deep cultural relevance. The schematic diagram of Shanxi folk dance rhythm symbols is shown in **Figure 3**.

Figure 3. Schematic diagram of Shanxi folk dance rhythm symbols.
Source: http://www.chnjinju.com/index.html.

As shown in **Figure 3**, taking Zuoquan Xiaohua Opera as an example, the exaggerated dance, fan raising, and expression in its dance all blend the unique lightness, liveliness, and exaggerated elasticity of Xiaohua Opera. Especially in dance steps, the tremors of the knees and the ups and downs of the footsteps are extremely exaggerated, making the dance steps full of elasticity. There are many types of footwork in Xiaohua Opera, among which the most distinctive and representative is

the "Three Steps". This footwork causes the body to tremble three times with each step, making the steps elastic and the body rise and fall noticeably, presenting a unique wave like forward effect. This footwork creates an exaggerated body shape, further showcasing the unique charm and artistic style of Shanxi folk dance. Overall, the dynamic symbols and distinctive footwork of Shanxi folk dance form a rich and diverse artistic expression.

3.3. Prop symbols

Props play a significant role in Shanxi folk dance. Taking Gaoshan Flower Drum Dance as an example, the drumming action and the special design of the drumsticks both constitute key symbolic elements; in Yangge Dance, the clever use of red silk further enhances the festive and enthusiastic atmosphere of the dance. These prop symbols not only add diverse expressive techniques to dance, but also deepen the cultural connotations and regional features of dance. When it comes to Zuoquan Xiaohua Opera, the colorful fan is undoubtedly the most iconic dance prop. The flexible use of colored fans in the hands of dancers showcases the ever-changing artistic charm, hence it is also known as the "fan dance". The constant changes in the speed, angle, strength, and form of fan movements together create the unique and versatile artistic style of fan flowers. Among them, the "butterfly fan" is highly favored due to its unique beauty and wide applicability. The schematic diagram of Shanxi folk dance props symbols is shown in **Figure 4**.

Figure 4. Schematic diagram of prop symbols for Shanxi folk dance.
Source: http://www.chnjinju.com/index.html.

The original "butterfly fan" movement is relatively simple, mainly based on the five finger insertion fan, with the wrist as the axis for small left and right flips, bringing a fancy visual experience to the audience. However, after several generations of artists' in-depth exploration and organization, the "butterfly fan" in Shanxi Zuoquan Xiaohua Opera has been further enhanced. The artists amplify the flipping amplitude of the fan, quickly flipping it with their wrists as the axis, causing the fan flower to flip up and down at an angle of over 180 degrees, and the speed is extremely fast. This action design makes the fan look like two fluttering butterflies when viewed from afar, hence the name "Butterfly Fan". The butterfly fan plays a crucial role in the dance of Shanxi Zuoquan Xiaohua Opera, almost running through the entire dance process. It is coordinated with the swaying hand route and swinging arm route of the arms, as well

as the "three steps" under the feet, to form the most classic combination of movements in Shanxi Zuoquan Xiaohua Opera.

3.4. Shanxi culture and emotional connotation of folk dance

When using semiotics to conduct in-depth research on Shanxi folk dance forms, the deep emotions and cultural values contained in dance cannot be ignored. Shanxi folk dance not only shows the artistic beauty of body language, but also the vivid inheritance of Shanxi people's emotions and culture. The symbols such as posture, rhythm, and props in the dance convey rich emotions. For example, the twisted crotch and shy cheeks in Zuo Quan Xiaohua's play not only show the beauty of rhythm, but also reveal the love and yearning of the people of Shanxi for life. These symbols make the audience deeply feel the emotional flow in the dance and resonate with the dancers. In addition, Shanxi folk dance carries a heavy history and culture and is a cultural treasure of the Yellow River. Every dance movement and scene depicts Shanxi's regional characteristics, folk customs and aesthetic pursuits. In-depth analysis of dance forms can give a glimpse into the historical life, values and beliefs of the Shanxi people. These cultural elements constitute the unique charm of dance and lay a solid foundation for its inheritance and development. At the same time, dance plays an important role in traditional festivals and celebrations in Shanxi. It is not only a form of entertainment, but also a link between history and reality and the inheritance of culture. Through dance, the people of Shanxi relive historical memories, inherit cultural genes, enhance community cohesion, and promote social and cultural prosperity and development. In summary, to balance technical analysis and humanistic care, it is necessary to deeply interpret the meaning, emotion and cultural value of Shanxi folk dance. This will help people comprehend the connotation of dance art more comprehensively, and provide a broader perspective and deep understanding for the inheritance and development of dance.

4. Extraction of symbols in Shanxi folk dance

4.1. Dance data collection and preprocessing

We are devoted to thoroughly documenting the various forms and profound cultural meanings of Shanxi folk dance as we build the database for this article. The traditional and cultural portrayal of the motions serves as the primary basis for the choosing of dance styles. Dances showcasing Shanxi's style are chosen with care. These dances, incorporating twisting, swinging, and other richly local rhythmic symbols, can be a powerful reflection of the ancient customs and way of life of the area. Innovatively, high-precision motion capture technology (MoCap) is employed to precisely record these dancing motions. The dancers' trajectories are tracked and recorded in real-time by the technology using sensors on their bodies, which subsequently transforms the movements into digital motion data. We may record the dancer's every nuanced movement using infrared cameras or inertial sensors, producing precise spatiotemporal data that offers solid data foundation for further investigation and analysis. The data constructed in this article utilizes cutting-edge motion capture technology to meticulously record various combinations of

movements in Shanxi folk dance. Each group incorporates five to ten typical dance movements, showcasing the diversity and complexity of Shanxi folk dance from all angles. In order to verify the wide applicability and practical effects of the model, a series of Shanxi folk dance videos are specifically selected from the internet as the test set. At the same time, through cooperation with the broader community, educational institutions and cultural organizations, the data collected expands, improves the richness of the data, and lays the foundation for the accuracy and applicability of the identification model. These videos cover a wide range of dance movements from basic to high difficulty. Part of data is shown in **Table 1**.

Table 1. Part of data display table.

Order number	Dance type	Action symbol	Action description	Level difficulty
1	Yangge	Twist step	Alternate your feet and twist quickly in small steps, swinging with your upper body	Primary
2	Fan Dance (Xiaohua Opera)	Open fan	Hold the fan in your right hand, flip your wrist to quickly open the fan	Intermediate level
3	Drum dance	Panlong	Multiplayer collaboration, use long dragon props to simulate the form of a dragon circling and rising	Advanced
4	Dragon dance	Drum turn around	Turn around quickly while drumming, with a strong rhythm and coordinated movements	Intermediate level
5	Early boat dance	Rocking boat	Imitate the action of rowing, with a light pace, showing the scene of working on the water	Primary
6	Back stick performance	Balanced walking	The back stick artist carries a stick frame with children on his back, walks steadily and coordinates his movements.	Advanced
7	Fengyang Flower Drum Dance	Hub strike	Holding a flower drum in his hand, he dances while hitting, with a bright rhythm	Intermediate level

The background subtraction technique aims to identify and separate foreground targets from videos (Kalsotra and Sakshi, 2022; Zhao and Anup, 2019). This technique typically involves building a background model and determining its parameters through learning. Once the parameters are determined, the current frame can be compared to this background model. The Gaussian mixture model considers video image sequences as a combination of multiple single Gaussian models, which establish a multi-distribution density function for each pixel in the image. Therefore, it can effectively address the problem of multi-model background distribution (Sun et al., 2019; Chen and Steven, 2021). If the value of a pixel at time t is A_t, the calculation formula for A_t is as follows:

$$Q(A_t) = \sum_{i=1}^{N} \gamma_{i,t} \times \alpha(A_t, \mu_{i,t}, \rho_{i,t}) \tag{1}$$

Among them, $\gamma_{i,t}$ is the weight of the i-th Gaussian distribution at time t; $\alpha(A_t, \mu_{i,t}, \rho_{i,t})$ is the corresponding probability density function; $\mu_{i,t}$ is the corresponding mean, and similarly, $\rho_{i,t}$ is the variance. Meanwhile, the expression for $\alpha(A_t, \mu_{i,t}, \rho_{i,t})$ is as follows:

$$\alpha\big(A_t, \mu_{i,t}, \rho_{i,t}\big) = \frac{1}{\sqrt{2\pi|\rho_{i,t}|}}\, e^{-\frac{1}{2}} \tag{2}$$

The pixel values of the first frame of the video are assigned to the mean of K Gaussian distributions, and their variances are assigned a larger initial value, with their weights set to be the same. The specific rendering is shown in **Figure 5**.
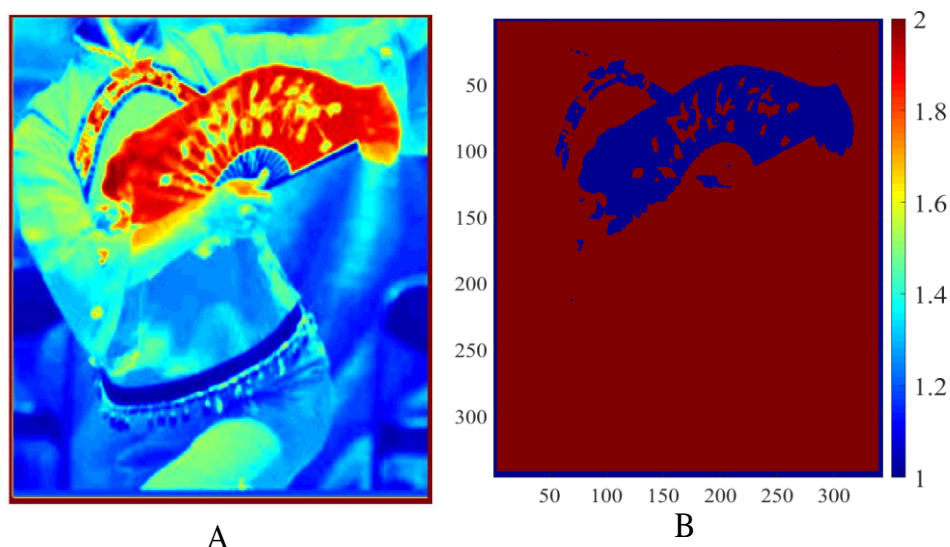

A   B

Figure 5. Processing effect based on gaussian mixture model. **(A)** Original image; **(B)** The effect after background subtraction.
Source: http://www.chnjinju.com/index.html.

As shown in **Figure 5**, **Figure 5A** is the original image, and **Figure 5B** is the effect after background subtraction. It can be clearly seen that the background subtraction method based on Gaussian mixture model performs well in image processing.

4.2. Features of Shanxi folk dance number symbols

Dance symbol coding is crucial to the communication of cultural knowledge, particularly for art forms such as Shanxi folk dance that have strong regional roots and a rich cultural history. The dancers' exquisite technique was matched with a more profound message for the audience: in addition to showcasing their amazing skills, they skillfully conveyed unseen emotions and culture through the use of gestures, costumes, props, and overall choreography. The semiotics theoretical framework of "encoding-decoding" is strongly related to this process. It shows how to effectively use dancing as an art form to disseminate abstract cultural knowledge by turning it into tangible, observable symbols. As the fundamental element of symbols, dance posture has significance that goes well beyond mere physical execution. In actuality, it is a profound transmission of cultural symbols. The dancers' distinct body language effectively conveyed the dance's emotions, narratives, and morals. In the process of decoding, the audience is able to fully experience the rich cultural connotation that underlies these meticulously crafted actions as they become the carriers of culture. Using the popular "twist," "swing," and other motions from Shanxi folk dance as an

example, these moves not only highlight the dancers' exceptional physical prowess but also effectively portray the distinctive way of life and spirituality of Shanxi. Furthermore, it is impossible to overlook the symbolic significance that props and costumes have in dance. Diverse costumes embody distinct historical eras, societal strata, or personal personas, whereas props substantially augment the storyline and expressive power of dance with their distinct symbolic connotations. The use of fans and flower sticks as props in Shanxi folk dance enhances the dance's visual appeal while also successfully conveying the distinctive details of the region's culture through a strong link to past customs. For a more thorough examination, this procedure can theoretically leverage the semiotic theory's relationship between "can refer" and "refers." Shanxi folk dance employs dance moves, props, costumes, and other elements as "energy fingers" to depict culture in an intuitive way. The historical context, cultural significance, and intense feelings these elements hold are utilized as "pointers," concealed behind symbols and awaiting the audience's attentive interpretation and understanding.

4.3. Methods for extracting symbol elements of Shanxi folk dance

From a semiotic perspective, when studying the forms of folk dance in Shanxi, it is necessary to fully consider the differences between dance videos and conventional action recognition video datasets, and combine the unique features of dance to extract relevant features from the dance dataset to accurately describe dance actions. Given that the movements in dance videos are composed of a series of frame images and have continuity, the shape of the movements between adjacent frames does not change much. Therefore, the method of accumulating edge features is used for research. Specifically, for a dance action video, it can be divided into several video segments. In each segmented video segment, the edge features of the target in each frame of the image are extracted and accumulated into one image. Then, Histogram of Oriented Gradient (HOG) features are extracted from this accumulated image (Zhou et al., 2020; Jumani et al., 2019). After all equal segments of the entire video have completed the accumulation of edge features and HOG feature extraction operations, a set of directional gradient histogram feature vectors can be obtained. This set of feature vectors can effectively characterize the local appearance and shape features of the dance movement.
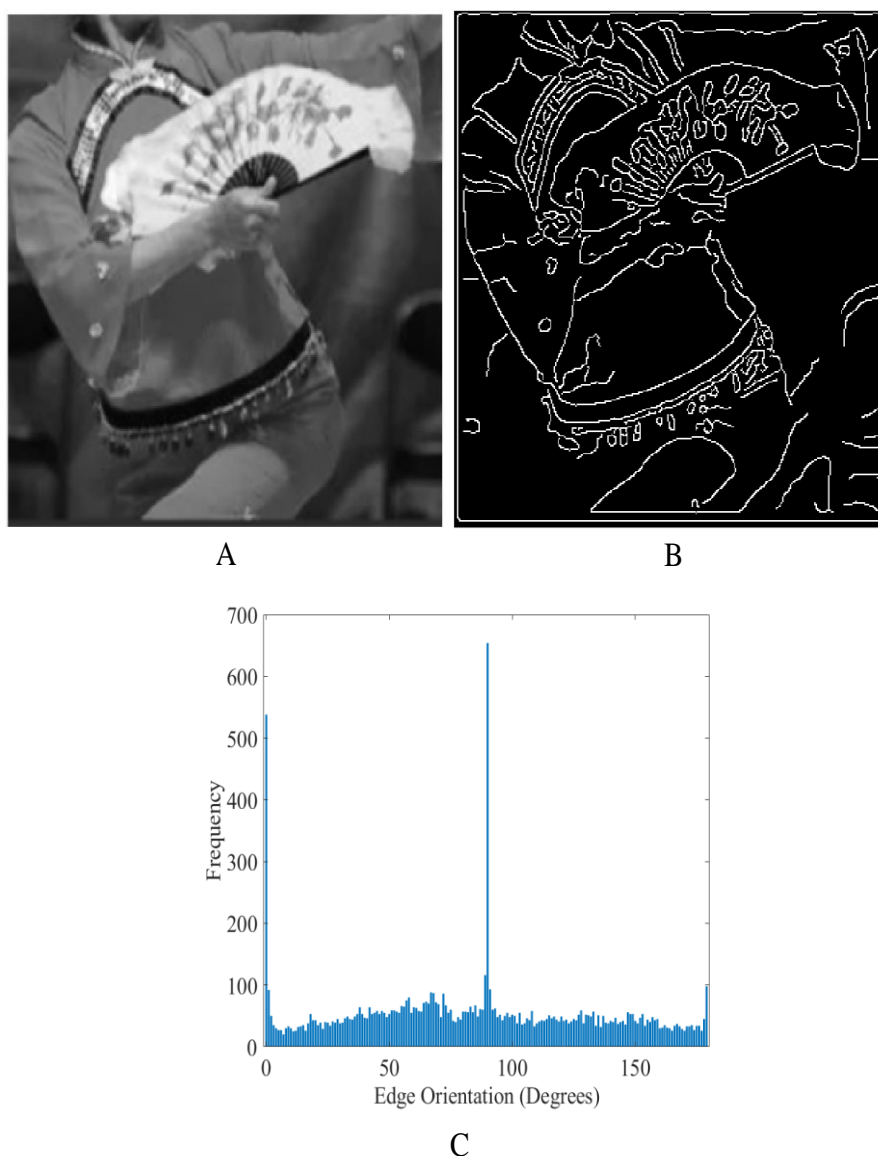
Figure 6. Effect diagram of HOG-based dance rhythm symbol feature extraction. **(A)** Original image; **(B)** The effectiveness of feature extraction; **(C)** HOG histogram.

Source: http://www.chnjinju.com/index.htm.

From the perspective of dance videos, different video frames are different, and even for the same dance step, everyone's performance is also different. To this end, this article first performs equidistant segmentation on the video, and then accumulates edge feature operations on each video in chronological order, accumulating the edge features of each frame image onto one image. Based on the accumulated edge features, the directional gradient histogram features of one image are obtained. On this basis, the accumulation operation of the next segment is performed until all segments are accumulated. The specific effect is shown in **Figure 6**.

As shown in **Figure 6**, **Figure 6A** is the original image; **Figure 6B** is the effect of feature extraction; **Figure 6**C is the HOG histogram. **Figure 6** shows the computational effect of cumulative boundary features.

Props are very important in dance performances, as they not only add diverse forms of expression to dance, but also often serve as cultural symbols to convey

specific information (Qing, 2023; Yang, 2024). From a semiotic perspective, HOG feature extraction techniques are used to analyze prop images in dance videos. Firstly, edge detection is applied to the prop image. Then, the gradient direction and intensity of each pixel are calculated, and a gradient histogram is constructed based on this. By using the sliding window method, these gradient histograms are accumulated in different regions of the image to generate feature descriptors. The specific effect is shown in **Figure 7**.
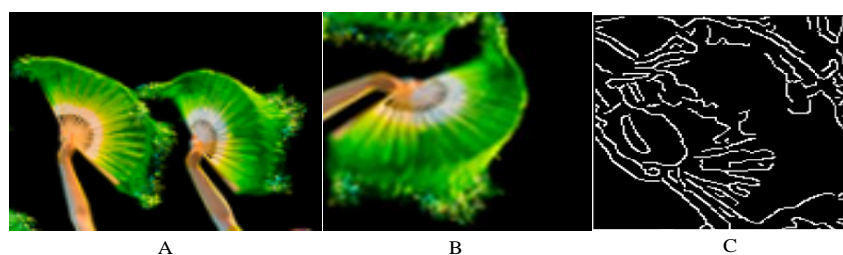

Figure 7. Effect diagram of feature extraction of dance props based on HOG. **(A)** Original image; **(B)** Captured fan prop image; **(C)** The effect of feature extraction of fan symbols.

Source: http://www.chnjinju.com/index.html.

As shown in **Figure 7**, **Figure 7A** is the original image; **Figure 7B** is a captured image of a fan prop; **Figure 7C** is the effect of extracting fan symbol features.

The HOG feature extraction method has achieved significant results in the recognition of prop symbols in Shanxi folk dance. This method not only accurately captures the shape of props and successfully extracts typical prop symbols such as fan opening and closing in Shanxi folk dance, but also enhances the visual expression of prop dynamic changes by accumulating directional gradients. This technology effectively distinguishes various prop symbols, providing a solid visual analysis foundation for in-depth exploration of the functions and meanings carried by props as cultural symbols in dance.

In the field of deep learning, complex and highly personalized tasks are processed, namely the recognition of Shanxi dance form symbols, which is the research object of this article. The quality and quantity of data have a crucial impact on the performance of the model. However, in practical research, especially when exploring specific cultures or regions, there are often issues with small self-made datasets and limited data diversity. In this context, transfer learning is particularly crucial as it can effectively transfer the knowledge learned by the research object from one task to another similar or related task, thereby accelerating the learning process of the new task. In the field of action recognition, although source and target tasks may involve different sets or scenarios of actions, their network architectures and underlying feature representations often have commonalities. Therefore, by transferring model parameters that have already been trained on the source task, the training cycle on the target task can be significantly shortened, and it is expected to achieve better performance with less data.

This article conducts in-depth feature extraction on dance video frames by applying HOG. HOG features perform well in describing local shape information of

images, especially suitable for capturing edge and texture details of dance movements. After obtaining these rich features, this article further utilizes transfer learning to optimize the network model. Specifically, a fully pre-trained model on a large dataset is selected as the starting point. This model has strong visual feature extraction capabilities and can recognize multiple common patterns in images. Subsequently, the last few layers closely related to specific classification tasks in the model are removed, while the previous convolutional and pooling layers are retained, which focus more on general feature extraction. Therefore, an efficient "feature extractor" is obtained. Next, this feature extractor is applied to a self-made Shanxi dance dataset. By training the remaining layers on a new dataset, the model is able to deeply learn and understand the unique features of Shanxi dance. This process not only enhances the adaptability of the model, but also enables it to more accurately capture and express the essence of Shanxi dance.

4.4. Experiments

In order to verify the practicality and superiority of the Shanxi dance form symbol extraction method based on HOG and transfer learning in this article, a series of experiments are carefully designed. In these experiments, a comprehensive comparison is made between the method proposed in this article and emerging research methods in the field of dance symbol feature extraction in recent years. These comparison methods mainly use different feature extraction techniques or advanced algorithm frameworks. By comparison, the unique advantages of the method presented in this article are understood when dealing with tasks with specific regional cultural features. The comparative experiments conducted are all conducted within the framework of transfer learning recognition model. Other extraction methods, such as combining convolutional neural network (CNN) with recurrent neural network (RNN) (CNN-RNN), 3D-CNN (3-dimensional convolutional neural network), and Histograms of Oriented Optical Flow (HOF), are compared and studied.

From a semiotic perspective and within the framework of transfer learning recognition models, HOG is used to study the data in this article's database, mainly including Yangge Dance, Fan Dance (Xiaohua Opera), Drum Dance, Dragon Dance, Early Boat Dance, Back Stick Performance, and Fengyang Flower Drum Dance. These 7 dances are numbered 1–7, and HOG is used to extract and recognize dance movements and symbols of dancers in the database. The accuracy results of extraction and recognition are compared with CNN-RNN, 3D-CNN, and HOF. The specific comparison results are shown in **Figure 8**.
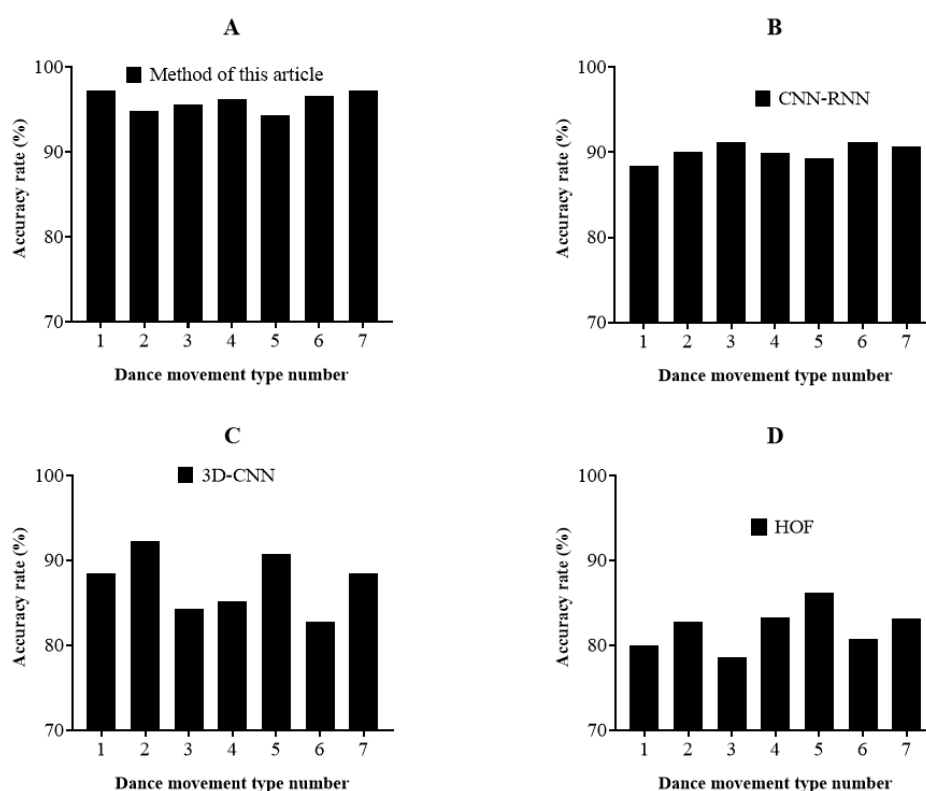
Figure 8. Comparison of accuracy in extracting and recognizing dance movements and symbols of dancers. **(A)** Extraction and recognition accuracy results based on the method proposed in this article; **(B)** Extraction and recognition accuracy results based on CNN-RNN; **(C)** Extraction and recognition accuracy results based on 3D-CNN; **(D)** Extraction and recognition accuracy results based on HOF.

As shown in **Figure 8**, from a semiotic perspective, the HOG method effectively extracts and recognizes the movement features and symbolic elements of dancers, demonstrating extremely high recognition accuracy, with an average recognition rate of 96%, significantly higher than the recognition accuracy of CNN-RNN, 3D-CNN, and HOF in the control group, which are 5.89%, 8.52%, and 13.85%, respectively. Especially for dance genres with complex movements and rich symbolic meanings, such as Yangge 1 and Fengyang Flower Drum 7, the HOG method performs well, with recognition accuracies of 97.21% and 97.31%, respectively, highlighting its advantages in handling complex dynamic scenes. CNN-RNN is primarily designed to process sequence data and excels at capturing dynamic properties in time series. However, while processing long-term complicated sequences, the RNN part is prone to gradient disappearance or explosion, which reduces the recognition effect. Furthermore, although though Shanxi folk dance has continuous motions, some important movements may only have fleeting symbolic qualities, making it difficult for RNN to accurately represent these fleeting movement symbols. To process video or spatiotemporal data, 3D-CNN was specifically created, and it can conduct convolution operations in both space and time. Shanxi folk dance is known for its rhythmic movement expressions that are repetitive and have a more solid framework rather than its constantly shifting, fast-paced movements. HOF is a useful tool for recording dynamic changes in video because it primarily describes the direction in which pixels move within an image sequence. But HOF depends a lot on mobility. If

a dancer's movement has a tiny dynamic amplitude or moves slowly, it could be challenging for HOF to extract significant characteristics. These data not only validate the effectiveness of HOG in the field of dance movement and symbol recognition, but also further emphasize the importance of combining computer vision technology from a semiotic perspective for the protection and research of intangible cultural heritage.

This article selects small flower opera dancers in Shanxi folk dance from the database for research, and studies the different parts of the upper and lower body as well as the entire body area of such performers in the database. The main purpose is to compare the research method of this article with CNN-RNN, 3D-CNN, and HOF. The specific results are shown in **Table 2**.

Table 2. Different feature recognition effects extracted from different human body regions.

Human body parts	HOG	CNN-RNN	3D-CNN	HOF
Upper body	47.6	33.2	30.1	22.1
Lower body	48.3	34.8	36.5	26.4
Upper body + lower body	58.7	45.9	44.2	32.7
Whole body	54.1	40.5	43.7	28.9

As shown in **Table 2**, the HOG method demonstrates superior recognition performance in all regions. Specifically, when only targeting the upper body area, the recognition accuracy of HOG reaches 47.6%, which is 14.4%, 17.5%, and 25.5% higher than CNN-RNN, 3D-CNN, and HOF, respectively, demonstrating advantages in capturing subtle movements and symbolic features of the upper body. Similarly, in the recognition of the lower body area, HOG also maintains a high accuracy rate of 48.3%, indicating its effectiveness in recognizing leg and foot movements in dance. When the upper and lower body are considered together, the recognition performance of HOG is further improved to 58.7%, far exceeding other methods, which reflects the powerful ability of HOG in comprehensive recognition of whole body motion features. Finally, in the recognition of whole body regions, HOG still maintains a high accuracy of 54.1%, once again proving its recognition advantage in complex dynamic scenes. These data not only highlight the effectiveness of HOG in recognizing dance movements and symbols in Xiaohua Opera, but also emphasize the importance of feature extraction for different human body regions in research.

From the recognition rates obtained by different methods, it can be seen that the recognition rate of dance symbols after feature extraction using the upper or lower body is relatively similar, but the recognition rate of the lower body slightly dominates. When combining multiple regions of the human body for recognition, the recognition rate reaches its highest level. In contrast, the recognition rate of directly using the entire body area of the human body for recognition is lower. This is mainly because in the selected action categories, there are more dances that focus on upper or lower body movements, and the dances that focus on lower body movements are the most common. Meanwhile, when the dance movement only involves the upper or lower body area, if the whole body area is used for recognition, the dynamic changes between the two areas may interfere with each other, affecting the accuracy of recognition.

In the previous text, the application of symbols in Shanxi folk dance is studied, mainly focusing on three types of symbol features: body posture, movement rhythm, and tools. The Shanxi dance database constructed in this article also contains these three types of symbol features, from which body symbols (twisting hips, protruding cheeks, pouting buttocks, and standing chest), movement symbols (twisting, rotating, rounding, jumping), and prop symbols (fans, handkerchiefs, drums, lanterns) are selected. The extracted symbols are studied. From a semiotic perspective, the accuracy of feature extraction using HOG is studied, and the results are compared with CNN-RNN, 3D-CNN, and HOF. The specific results are shown in **Figure 9**.
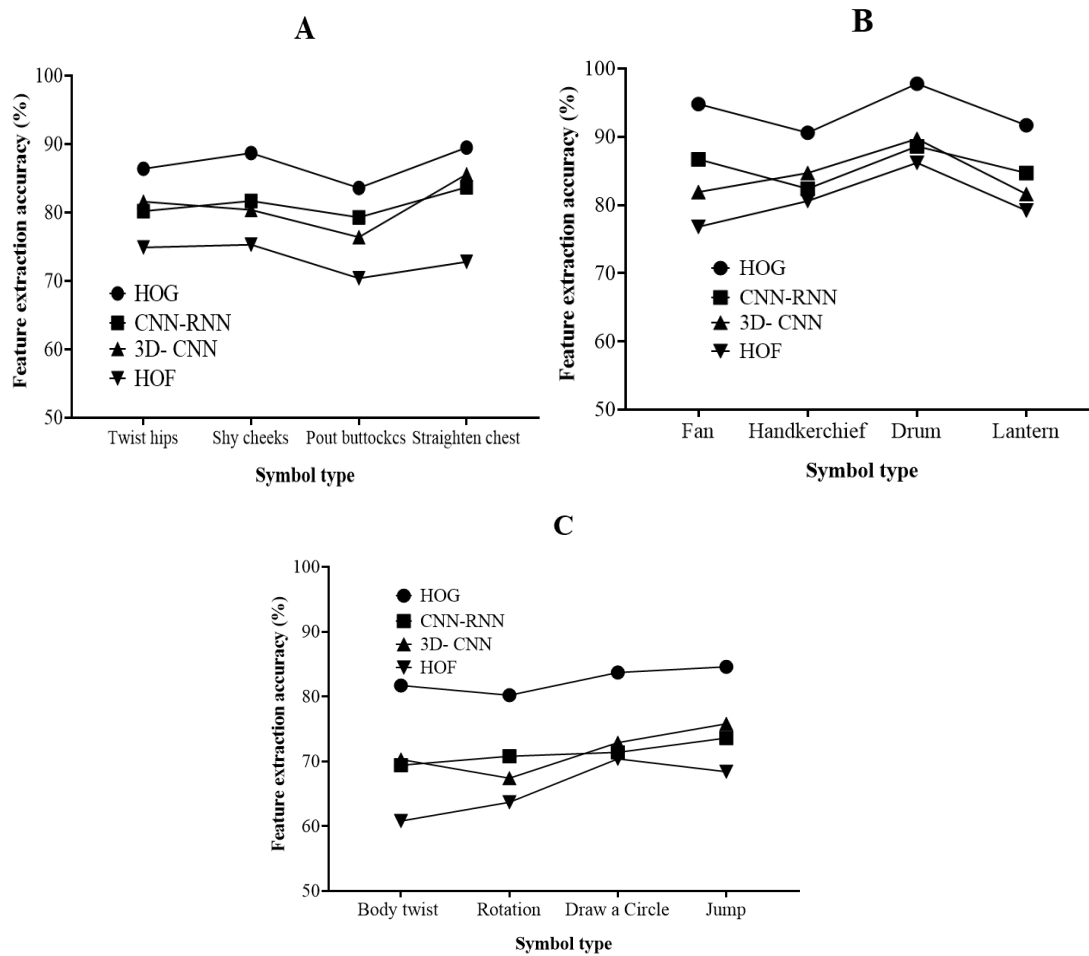

Figure 9. Comparison of accuracy in feature extraction of different symbols. **(A)** Accuracy of feature extraction based on body symbols; **(B)** Accuracy of feature extraction based on movement symbols; **(C)** Accuracy of feature extraction based on prop symbols.

As shown in **Figure 9**, the experimental results indicate that the HOG method performs well in body symbol recognition, with a recognition accuracy of 86.4% for hip twisting, which is much higher than other methods. This proves the advantages of HOG in handling complex body features and subtle motion changes. In the recognition of dynamic symbols, the HOG method also demonstrates its efficiency, with a recognition accuracy of 81.7% for body twisting, which is 12.3%, 11.4%, and 20.9% higher than CNN-RNN, 3D-CNN, and HOF, respectively, showing significant

improvement. The accuracy of HOG for jumping, a rapidly changing dynamic symbol, reaches 84.6%, further verifying its superiority in capturing dynamic changes. The HOG method also performs well in the recognition of prop symbols. Especially for the props of fans and drums, which have obvious features and high cultural symbolic significance, the recognition accuracy is as high as 94.8% and 97.8% respectively, far exceeding other comparison methods. This not only demonstrates the powerful ability of HOG in extracting prop features, but also reflects its potential in cultural symbol recognition. In summary, this article verifies the efficiency and accuracy of the HOG method in extracting body posture, movement rhythm, and prop symbols through the recognition of specific symbols in Shanxi folk dance, providing new technical means and research perspectives for the digital protection and inheritance of Shanxi folk dance.

The time required for different extraction methods is also different, and the extraction speed is also different. Research should be conducted on the extraction speed. Speed is especially important in real-time applications, such as motion recognition, automatic dance performance rating, and real-time monitoring systems. The system can quickly process large amounts of video or picture data by effectively performing motion recognition and analysis using fast feature extraction techniques. When working with large data sets—like numerous video snippets of Shanxi traditional dances—the extraction speed has a direct impact on how long the analysis takes overall. A sluggish extraction approach can take hours or even days to process all the data, which significantly limits the model's application in scenarios with a lot of data. Fast extraction techniques may handle larger data sets in less time, thus increasing total labor efficiency. This is especially crucial for application scenarios when multitasking or frequent data changes are required. The specific research results are shown in **Figure 10**.

As shown in **Figure 10**, the HOG method stands out significantly for its excellent efficiency in extracting body symbols. In terms of standing chest extraction, HOG only takes 1.2 seconds, which is 1.9 seconds, 2.1 seconds, and 3.1 seconds lower than CNN-RNN, 3D-CNN, and HOF, respectively. This data fully demonstrates the speed advantage of HOG in processing body details. In the extraction of dynamic symbols, HOG also shines brightly. In the face of dynamic kinematic symbols such as twisting and rotating, HOG maintains a relatively fast processing speed despite the increase in extraction time for all methods. Among them, in the extraction of the two actions of drawing circles and jumping, HOG completes the symbol extraction at a speed of 1.1 seconds and 0.8 seconds respectively, while the other three methods take significantly longer time. In addition, in terms of extracting prop symbols, although dance props often have complex shape and texture features, HOG, with its efficient feature extraction mechanism, can accurately capture these features in a very short time. In terms of fan extraction time, HOG only takes 1.7 seconds, which is 1.6 seconds, 1.9 seconds, and 3.7 seconds lower than CNN-RNN, 3D-CNN, and HOF, respectively. In summary, these data fully demonstrate the speed and efficiency advantages of HOG in extracting specific symbolic features of Shanxi folk dance.
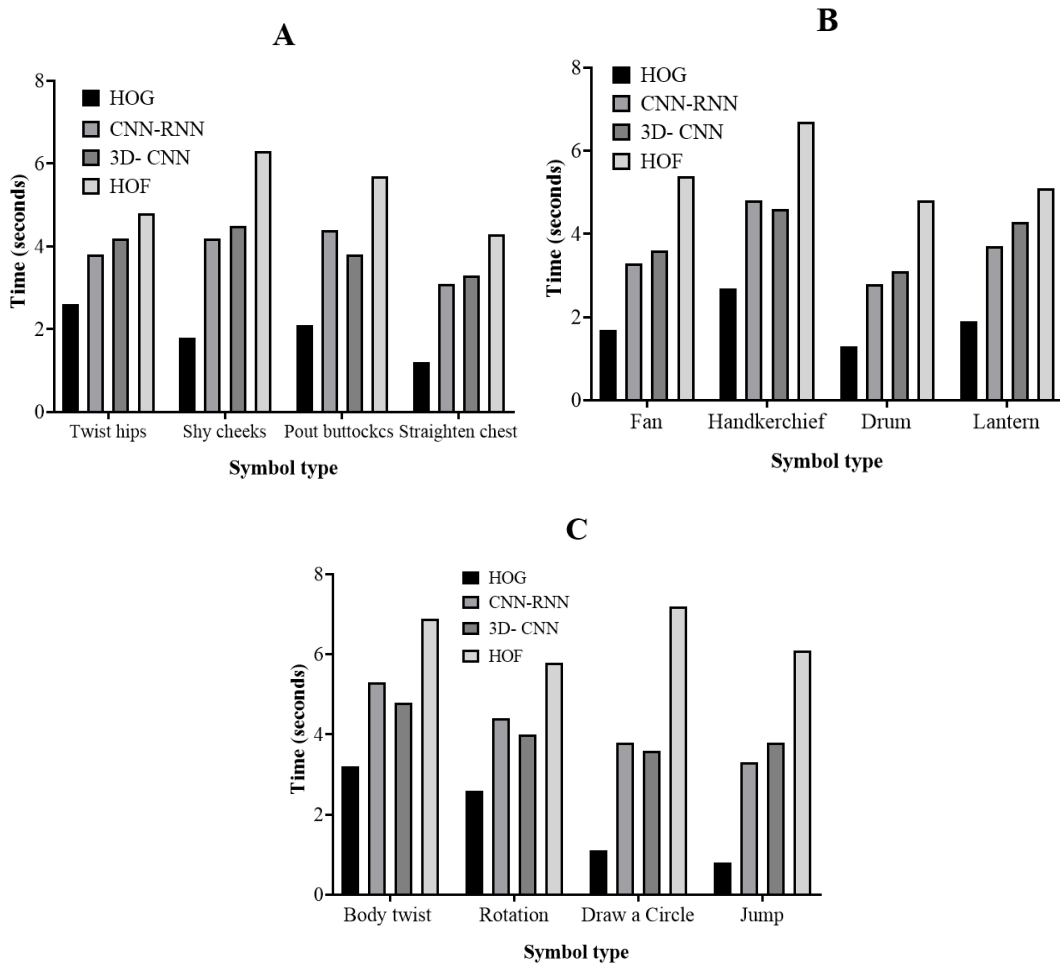
Figure 10. Comparison of feature extraction time for different symbols. **(A)** Feature extraction time based on body symbols; **(B)** feature extraction time based on dynamic law symbols; **(C)** Feature extraction time based on prop symbols.

5. Morphological significance of Shanxi folk dance from the perspective of semiotics

5.1. Cultural inheritance and identity

From a semiotic perspective, the form of Shanxi folk dance contains profound cultural heritage and a sense of identity. In this ancient and vibrant land, folk dances not only reflect people's celebration of festivals and worship of blessings, but also showcase the long-standing and vibrant Yellow River culture. Every movement, posture, prop, and rhythm of the music in dance constitute a carefully designed symbol system. These symbols together weave a colorful cultural network, conveying the Shanxi people's love for life, reverence for nature, and memory of history. The symbols in Shanxi folk dance first serve as a bridge connecting the past and present. These symbols often originate from a wide range and are reproduced through dance performances, allowing modern people to glimpse fragments of history and feel the wisdom and emotions of their predecessors. The twisting hips, protruding cheeks, and other postures in Yangge Dance not only showcase the beauty of dance rhythm, but

also reveal the diligence, resilience, and optimistic spirit of the people in the Yellow River region. These symbols transcend the boundaries of time and space, becoming an important link connecting ancient and modern cultures. In addition, the symbols in these dances also represent cultural identity. In the context of increasing globalization, regional cultural features have become a key symbol for distinguishing identity and showcasing individuality. Shanxi folk dance, with its unique regional features and symbol system, has become a symbol of Shanxi people's cultural identity. Whenever these dances appear in festivals or cultural exchanges, they can quickly trigger people's longing and pride for their hometown, thereby enhancing national pride and cultural confidence.

Dancing plays a significantly bigger function on the stage of cultural diplomacy than just performance. It is now a potent tool for telling Shanxi's cultural narrative. Through this vibrant art form, the outside world may truly appreciate Shanxi's cultural beauty. Folk dancing has greatly increased Shanxi's cultural influence in worldwide exchanges as a symbol of cultural identity. Shanxi folk dances have flourished on numerous international events as a result of the growing frequency of cross-cultural encounters. These dances have effectively drawn spectators from all over the world and piqued their intense curiosity in Shanxi culture with its own regional customs. These dances served as both international ambassadors for Shanxi culture and displays of exceptional creative skill when they toured the globe. This infectious method of showcasing culture has significantly aided in the outside world's recognition and comprehension of Shanxi culture and helped to create a favorable international perception of Shanxi. Furthermore, in the context of cultural diplomacy, Shanxi folk dancing is crucial in bridging gaps in cross-cultural understanding. Shanxi people have had deep cultural interactions with people from all over the world through dance. In this type of engagement, dancing serves as a vital bridge to foster cultural resonance and understanding in addition to showcasing the beauty of art. The audience can have a profound understanding of Shanxi's rich historical legacy, distinctive folk customs, and humanistic spirit while they enjoy the dance. Deeply rooted cultural exchanges like these promote mutual respect and understanding between various cultural groups and aid in the removal of cultural barriers.

Overall, symbols in Shanxi folk dance play a crucial role in cultural inheritance and identification. They are not only tools for spreading history and culture, but also the basis for national emotions and spirit. Through in-depth research and exploration of the cultural significance and aesthetic value of these symbols, the precious cultural heritage of Shanxi folk dance can be better understood and inherited, contributing to the prosperity and development of Chinese culture.

5.2. Enhancement of aesthetic value

Dance form is the aesthetic bridge of dance art, and "truth, goodness, and beauty" are the core values of humanity and the cornerstone of people's daily lives. Beauty is an indispensable element, and dance can create beauty. As an art form that creates and appreciates beauty for humanity, dance can also demonstrate its cultural level through the connotations of truth and goodness. The form of dance not only reflects the social culture and aesthetic concepts of a specific period, but also serves as a material means

of expressing life through dance art. It is also a form of artistic media in the history of human civilization that uses the body as a medium. The study of semiotics is of great significance in revealing the aesthetic value of Shanxi folk dance. By deeply analyzing the symbolic elements in dance, one can gain a deeper understanding of the artistic meaning and aesthetic features of dance, thereby enhancing their ability to appreciate dance. Taking the "Butterfly Fan" in Shanxi Zuoquan Xiaohua Opera as an example, its aesthetic value is particularly prominent in ethnic and folk dances. The "butterfly fan" waved by the dancers looks like a group of lightly dancing butterflies from afar, full of vitality and poetry, showcasing the vigorous vitality and profound emotions of the people of Zuoquan. The ever-changing fan flowers, undulating steps, and graceful dance movements collectively express the love of the people of Zuoquan for life, their aspirations for a better future, and their admiration for the current life.

Folk dance has substantial educational value in addition to its exceptional artistic charm. It is particularly useful in fostering an appreciation for cultural beauty and improving artistic literacy in the younger generation. It has a significant impact. Young people can develop a deeper appreciation for the rich cultural meaning of their country via dancing, which in turn fosters a love and pride in traditional culture. In particular, folk dancing has given young people a place to live where they can learn about culture. They developed their dancing abilities as well as their understanding of the rich cultural narratives and intense emotions that dance embodies through their participation in dance instruction and performance. Furthermore, folk dancing has a significant contribution to aesthetic education that cannot be overlooked. As a mode of expression that incorporates several artistic components including movement, melody, attire, and accessories, it teaches pupils to value the multiplicity of expressions that define beauty. They can develop a better aesthetic vision and be better able to see and create beauty in everyday life by critically analyzing and appreciating dance. It is noteworthy to emphasize that including folk dancing into the curriculum of schools contributes to the development of students' feeling of honor and teamwork. As they continue together on the dancing learning path, students not only practice their social skills but also virtually reinforce their sense of responsibility and belonging to the group.

5.3. Integrate into dance education and teaching strategies

On the basis of in-depth research on the influence of semiotics on Shanxi folk dance forms, this paper is committed to exploring practical strategies for effectively transforming these research results into dance teaching and heritage protection. From the perspective of dance education, the introduction of symbol recognition technology has brought revolutionary changes to the teaching field. With the help of algorithms such as HOG, it is possible to accurately capture and analyze various symbols such as posture, rhythm, and props in dance. These symbols constitute the core elements of dance art and are also the key content of teaching. In teaching practice, teachers can use these technical methods to perform detailed disassembly and precise demonstration of dance movements. Taking the "crotch twisting" action in *Zuo Quan Xiaohua*'s play as an example, teachers can use video analysis tools to show the posture characteristics and subtle differences of different dancers in the action, to help

students more intuitively understand the essentials and aesthetic standards of the action. At the same time, symbol recognition technology also plays an important role in the evaluation and feedback of dance teaching. By capturing and analyzing students' dance movements in real time, teachers can quickly identify students' shortcomings in movement completion, rhythm, and expressiveness, and provide targeted guidance and suggestions.

5.4. Digital platform and heritage protection strategies

To better protect and inherit Shanxi folk dance, a comprehensive digital platform can be built, which will deeply integrate symbol recognition technology and digital protection methods. This platform will cover a number of core functional modules, including but not limited to dance databases, online teaching, performance displays, and interactive communities. In terms of dance database, it will be committed to collecting and collating various symbolic elements and movement data of Shanxi folk dance, aiming to provide a comprehensive and rich resource support for the majority of audiences. The online teaching system will break the traditional learning boundaries and provide a convenient and efficient learning platform for dance lovers. The performance exhibition area will be used as a window to show the unique charm of Shanxi folk dance, and the dance performance scene will be reproduced in high definition, so that the audience can feel the deep heritage and infinite charm of dance art in an immersive situation. In addition, various online dance competitions, theme exhibitions, academic forums and other activities will be held regularly on the platform, aiming to attract the attention of more audiences and participants, and jointly help the protection and inheritance of Shanxi folk dance.

6. Conclusions

This article provided a comprehensive and in-depth exploration of the forms of Shanxi folk dance from a semiotic perspective. Using the theoretical tools of semiotics, this article deeply analyzed the cultural connotations and aesthetic values carried by symbolic elements in Shanxi folk dance, and traced their evolution process in the long river of history. The research found that the body posture symbols in Shanxi folk dance not only vividly shaped the dance image, but also deeply interpreted the theme and emotional core of the dance. The dynamic rhythm symbol can create a unique stage effect and dynamic rhythm beauty, greatly enhancing the ornamental value and technicality of dance. In terms of symbol recognition and extraction, a unique database was specifically constructed, and high-precision motion capture devices were used to collect video data of Shanxi folk dance, accurately capturing and analyzing the symbol features of dance movements. By utilizing advanced dance data collection techniques and background subtraction methods, the core symbolic elements in dance were successfully extracted, and a detailed classification and description of them was provided. In summary, this article's study of the form of Shanxi folk dance from a semiotic perspective not only provides a new application perspective for the field of dance art research, expands research horizons and ideas, but also injects new vitality into the inheritance and innovation of Shanxi folk dance. More broadly, the results of this paper will help enhance the public's cultural identity and pride in Shanxi folk

dance, and promote the inheritance and promotion of traditional Chinese culture. This research is not only an exploration of dance art, but also an important contribution to the protection and development of cultural heritage.

For further research in the realm of dance, particularly in the application of semiotic theory to a thorough examination of dance, this study offers a crucial theoretical framework and empirical basis. The present analysis methodology is not limited to Shanxi folk dances; it can be expanded to encompass dance forms from other regions or ethnic groups. This would facilitate cross-cultural comparative research and enhance people's comprehension of dance as a means of cultural transmission. The findings of this study provide decision makers solid statistical support and emphasize dance as a significant component of intangible cultural asset at the level of cultural heritage preservation decision-making. When developing methods for the preservation and transfer of cultural heritage, this enables them to take into account the diversity of dance forms and the cultural symbolic meanings they contain in a more thorough manner. Overall, the study not only brought a fresh viewpoint to the field of dance research, but it also had a significant influence on cultural heritage protection and practice, encouraged interdisciplinary collaboration among scholars, decision-makers, and dance practitioners, and established a strong framework for the preservation and advancement of national culture.

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Appendix

To make the research content of this paper more easily understood, the following is a simplified technical explanation table.

Table A1. Explanation of proper nouns.

Concept	Simplified explanation
Semiotics	A discipline that studies symbols and their deep meanings. In dance, symbols can be movements, posture, props, etc., they convey specific emotions and cultural connotations.
HOG(Histogram of Oriented Gradients)	An image feature extraction method constructs feature descriptors by calculating the gradient direction and intensity of local areas in the image. In dance videos, it is used to identify dance movements and symbols.
Background subtraction technology	The technique of separating foreground targets (such as dancers) from the video is achieved by constructing a background model and comparing the current frame with the background model.
Migration learning	Migrate the knowledge learned in one task to another similar or related task to accelerate the learning process of the new task. In dance movement recognition, the trained model parameters are used to optimize the recognition of new dance types.
Body symbol	Symbols conveyed through body posture in dance. These symbols shape the image of dance and convey emotions and artistic conception.
Rhythm symbol	The symbols conveyed in the dance through the rhythm and dynamic changes of movements, these symbols enhance the movement and expressiveness of the dance.
Prop symbol	The props used in dance are not only performance tools, but also serve as cultural symbols to convey information.