Alexandria Engineering Journal (2022) 61, 5351–5359

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Intelligent sports prediction analysis system based on improved Gaussian fuzzy algorithm

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Received 14 July 2021; accepted 31 August 2021
Available online 30 November 2021

KEYWORD

Gaussian fuzzy algorithm;
Improved algorithm;
Intelligent system;
Sports prediction

Abstract In order to improve the effect of intelligent sports prediction and analysis, this paper analyzes the traditional high-speed model and proposes a reliable sports action recognition algorithm on this basis. With this algorithm as the core algorithm, sports action recognition can be performed. The paper mainly constructs a standard database structure, inputs a reliable standardized movement model into the database structure, and compares the identified sports movement model with the standard movement model to judge the accuracy of the sports movement. Moreover, this paper uses statistical analysis to study sports training and sports competitions, and obtains prediction results through multi-factor analysis and comparison. In addition, this paper uses statistical methods to process experimental data to draw graphs and tables that can visually observe the results of sports predictive analysis. From the experimental analysis, it can be seen that the algorithm model constructed in this paper has a significant effect.

1. Introduction

Machine Learning (ML) is currently the most popular computer intelligence algorithm. Through machine learning algorithms, data classification can be realized, including functions such as data mining and data association. Moreover, through data mining, the future trend of data can be effectively improved and effective predictions can be achieved. This process is supervised learning. In the prediction process, it is necessary to quote class variables for data processing, and the research of sports data also requires data training and data mining, data modeling and prediction.

The prediction and modeling of sports competitions and sports training processes need to be implemented through a developed exercise plan [1]. Moreover, the prediction and formulation of sports training plans through machine learning can effectively improve exercise efficiency [2]. Generally speaking, in the process of sports competitions, sports modeling can be used to predict the future period of intense sports plans. When the sports competition and sports training plan are regarded as time series, the prediction can be expanded through parameter estimation [3]. Traditional sports training prediction algorithms have natural drawbacks. With the continuous development of fuzzy theory in recent years, fuzzy theory and gray theory have become more commonly used intelligent algorithms in sports competitions [4].

The prediction process of machine learning has strong intelligence, and there are multiple rule constraints in sports games,

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Peer review under responsibility of Faculty of Engineering, Alexandria University.

https://doi.org/10.1016/j.aej.2021.08.084
1110-0168

so sports games can be regarded as a multi-factor prediction model with time series. Compared with traditional prediction algorithms, machine learning algorithms have certain organizational and adaptive capabilities. Moreover, it conducts data analysis through machine learning, and conducts data training on the basis of existing data, and can perform intelligent learning with the support of time series algorithms. On this basis, the effect of intelligent training can be effectively improved, and the future sports training and sports competitions can be predicted.

The society is changing rapidly, and sports competitions are also full of these various uncertain factors. How to predict sports competitions through uncertain factors is of great significance to the development of sports competitions. In the competitive sports arena, it is not only necessary to be soberly aware of the current problems, but also to predict the problems that may arise in the future, so that future sports training and sports competition plans can be made more accurately.

From the current situation, it can be seen that sports competitions are affected by a variety of subjective and objective factors, which makes it seem difficult to quantitatively handle sports competitions. At present, traditional sports analysis methods have certain drawbacks, and the accuracy of the analysis of a large amount of sports data is insufficient. Moreover, traditional statistical methods can only count sports games with obvious rules, and the effect of digging out sports data rules that are difficult to mine is not obvious enough.

Based on the above analysis, this paper improves the traditional Gaussian fuzzy algorithm, constructs an intelligent sports prediction analysis system based on the improved Gaussian fuzzy algorithm, and conducts system verification through experimental analysis. The research results show that the system performance is very good.

2. Related work

Prediction is essentially a discipline of statistics. The prediction process includes data collection, data processing, and data prediction, which are expressed through mathematical models [5]. Through data prediction, it is possible to effectively analyze the subjective development trend in the future and construct a mathematical model corresponding to the development of future events. The sports prediction model is also a kind of prediction model. The traditional sports prediction method is to predict the performance of sports competitions through mathematical statistics, which is mainly used in professional sports training and some gambling.

Effective sports prediction models can provide athletes with a more scientific and effective training plan, and ensure that athletes can improve their sports performance on the basis of ensuring their health. However, unscientific sports prediction will not only affect the performance of sports competitions, but it is also difficult to find safety hazards that affect the physical health of athletes, and it is difficult to effectively improve the enterprising motivation of athletes [6].

The use of machine learning to predict sports results is currently a common intelligent sports prediction method. Among them, the most common is the neural network prediction model [7]. The literature [8] studied the neural network system, built a neural network sports prediction model through neurons, and set up the corresponding node network, built a three-layer network structure of the system through the input layer, middle layer, and output layer, and applied the model to sports competitions and sports training predictions. The neural network model first extracts data features when processing sports data sets, and conducts mining of multiple data laws through network classification. Moreover, the system has a certain degree of autonomous learning ability, which can effectively cope with the prediction of various uncertain situations. If the neural network is directly applied to the prediction of sports games, it is impossible to achieve a high degree of data fitting, and it is prone to waste of system resources. Therefore, it is necessary to improve the traditional algorithm to meet the actual needs of sports prediction [9].

The literature [10] used statistical investigation methods and neural network algorithms to construct a neural network model, and input a large amount of sports data for data training to expand sports predictions. The results show that the prediction error of the algorithm is small. The literature [11] compared machine learning algorithms with regression analysis when studying sports competition prediction. The research results show that machine learning algorithms are significantly higher in prediction accuracy than regression analysis. The literature [12] emphasized the application of machine learning in the prediction and aggregation of future sports competitions. The main influencing factors were identified through multifactor analysis, and the system performance was verified through multiple predictions. From the research results, we can see that the algorithm model has a certain effect. The literature [13] built a machine learning sports prediction model, then applied the model to actual games, and used on-site prediction to predict the game score. The forecast results are also in line with expectations.

The literature [14] analyzed a variety of machine learning algorithms, and analyzed the effects of multiple algorithms in sports performance prediction through simulation experiments. In actual research, it used a matrix to display data, selected multiple rounds of scores as prediction objects, summarized the predictive factors, and used statistical methods to compare the effects of algorithms. The literature [15] used the network data model to process sports competition data, and compared the linear regression method and the Bayesian regression method model in the prediction of sports competitions. The results show that the prediction accuracy of both is relatively high.

According to the development of sports game prediction methods, the development process of sports game prediction can be divided into three aspects: manual collection, mathematical statistics prediction, and intelligent prediction. When a large amount of data is estimated based on sports competitions and sports training, especially in the analysis of massive sports competition data, traditional manual collection methods are obviously not practical. Moreover, the mathematical statistical model cannot accurately discover the laws in the data when processing a large amount of data analysis. Therefore, the most effective algorithm for future sports predictive analysis algorithms is machine learning intelligent algorithm [16]. The literature [17] used mathematical modeling methods to predict sports performances, and incorporated data training methods in its mathematical models. However, the intelligent prediction is rising or falling, and it cannot achieve accurate prediction. From the perspective of the development process of sports competitions, the process is essentially not a linear model, but a multi-factor influence model with multiple uncertain factors [18]. When establishing a sports game prediction model, it is necessary to formulate an adaptive learning algorithm according to the characteristics of the sports game itself, and construct a non-linear model to make the model have a certain autonomous learning ability, so as to achieve accurate prediction of the sports game model [19]. In essence, sports training is a complex network with many changes. In particular, in the analysis of a single factor, it is necessary to analyze the possible impact of other factors on a single factor [20].

3. Sports feature recognition camera model

The data collection in this paper is mainly carried out through the camera model, and the process includes the lens model and the stereo projection model.

The formula of the perspective model is [21]:

$$r(\alpha) = k\tan\alpha \tag{1}$$

Ideally, it can be equivalent to small hole imaging. This is also a basic assumption, and the following analysis can be made on this basis.

(1) Small hole model

As shown in Fig. 1, O_c is the center point of the optical axis of the camera, and Π_2' is the imaging plane of the camera.

According to the principle of small hole imaging, the image of the object on the imaging Π_2' is inverted. It can be considered that the conversion from the positive image of the imaging plane Π_2' to the digital image is equivalent to the enlargement link.

The coordinate of the scene point P_1 is (x_1, y_1, z_1), and the coordinate of the imaging point P_2 of P_1 on the imaging plane Π_2 is (x_2, y_2, z_2), then [22]:

$$\begin{cases} \frac{x_1}{z_1} = \frac{x_2}{z_2} = \frac{x_2}{f} \\ \frac{y_1}{z_1} = \frac{y_2}{z_2} = \frac{y_2}{f} \end{cases} \tag{2}$$

In the formula, f is the focal length of the camera, $f = z_2$.

(2) Parameter model in the camera

The imaging point (x_2, y_2) on the imaging plane is transformed into an image point (u, v). We can use (u_0, v_0) to represent the intersection point of the optical axis center line on the imaging plane, which is expressed in the form of coordinates in the model, then [23]:

$$\begin{cases} u - u_0 = \alpha_x x_2 \\ v - v_0 = \alpha_y y_2 \end{cases} \tag{3}$$

In the formula, α_x and α_y respectively represent the magnification factor from the imaging plane to the image plane. We get the following results:

$$\begin{cases} u - u_0 = a_x f \frac{x_1}{z_1} \\ v - v_0 = a_y f \frac{y_1}{z_1} \end{cases} \tag{4}$$

When the above formula is rewritten into a matrix form, there are:

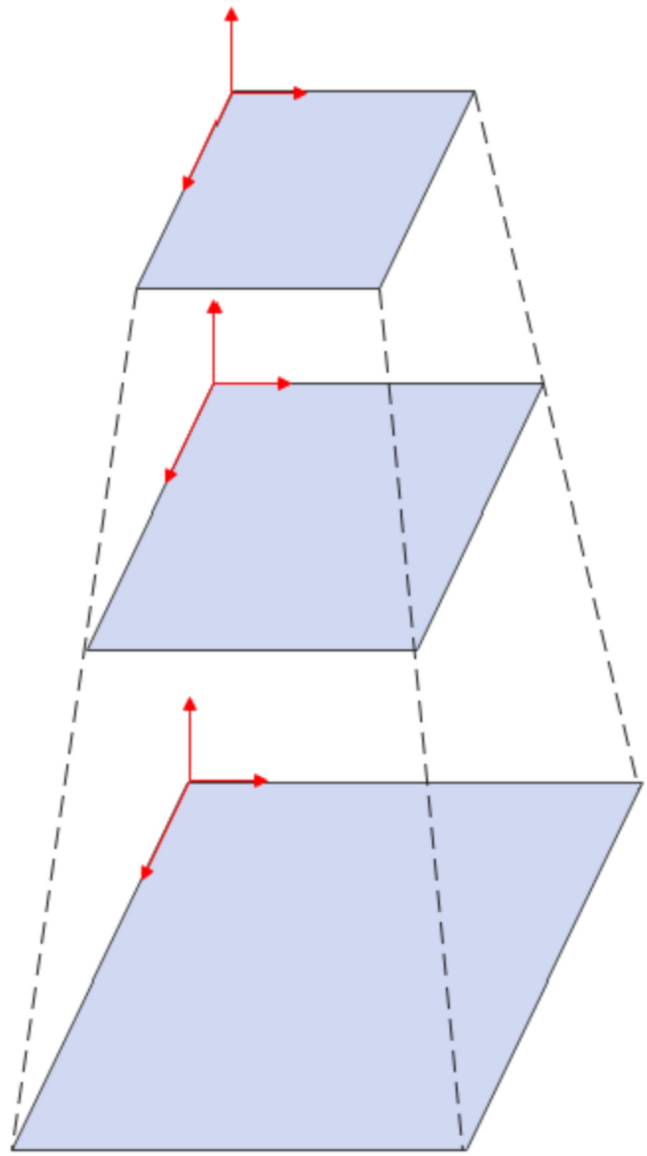

Fig. 1 Principle of small hole imaging.

$$\begin{bmatrix} u \\ v \\ 1 \end{bmatrix} \begin{bmatrix} k_x & 0 & u_0 \\ 0 & k_y & v_0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} x_1 z_1 \\ y_1 z_1 \\ 1 \end{bmatrix} = M_{in} \begin{bmatrix} x_1 z_1 \\ y_1 z_1 \\ 1 \end{bmatrix} \tag{5}$$

In the formula, $k_x = \alpha_x f$ is the magnification factor in the X-axis direction, and $k_y = \alpha_y f$ is the magnification factor in the Y-axis direction. M_{in} is called the internal parameter matrix, and (x_1, y_1, z_1) represents the coordinates of the shooting object in the camera coordinate system.

The internal parameter matrix M_{in} contains 4 parameters. Therefore, the above model is called the four-parameter model of the camera. On this basis, the camera coordinates can be expressed by (x_c, y_c, z_c), and the above formula can be rewritten as:

$$\begin{bmatrix} u \\ v \\ 1 \end{bmatrix} \begin{bmatrix} k_x & 0 & u_0 \\ 0 & k_y & v_0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} x_c z_c \\ y_c z_c \\ 1 \end{bmatrix} \tag{6}$$

$$\begin{bmatrix} u \\ v \\ 1 \end{bmatrix} \begin{bmatrix} k & 0 & u_0 \\ 0 & k & v_0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} x_c z_c \\ y_c z_c \\ 1 \end{bmatrix} \tag{7}$$

If the difference between the magnification coefficient k_x and k_y is not considered, there are three parameter variables, as shown in the above formula.

In the formula, k is the amplification factor.

Considering the difference between the amplification coefficients k_x and k_y and the coupling effect, the five-parameter model is shown in the following formula:

$$\begin{bmatrix} u \\ v \\ 1 \end{bmatrix} \begin{bmatrix} k & k_s & u_0 \\ 0 & k & v_0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} x_c z_c \\ y_c z_c \\ 1 \end{bmatrix} \tag{8}$$

In the formula, k_s is the magnification factor of the combination of the X-axis direction and the Y-axis direction. From the current image collection process of sports games, the most common model is the four-parameter model.

According to the photography principle, it is not difficult to conclude that for the same image point, it can produce several different spatial points in space, so the process can be expressed as the result shown in Fig. 2 below.

When $z = f$, point (x_{cf}, y_{cf}, f) is the coordinate point of the sample point on the corresponding imaging plane, and when $z = 1$, point (x_{cf}, y_{cf}, f) is the corresponding imaging point coordinate of the sample point on the focal length of the model. The solution to the model can be parameterized by the camera to calculate the normalized plane imaging point of the image point, and its coordinates can be expressed as:

$$\begin{bmatrix} x_{c1} \\ y_{c1} \\ 1 \end{bmatrix} = \begin{bmatrix} k_x & 0 & u_0 \\ 0 & k_y & v_0 \\ 0 & 0 & 1 \end{bmatrix}^{-1} \begin{bmatrix} u \\ v \\ 1 \end{bmatrix} \tag{9}$$

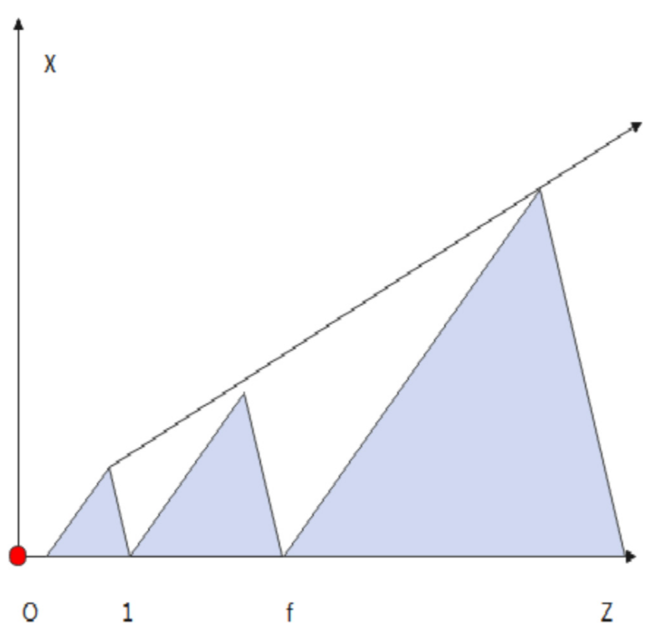

Fig. 2 The spatial coordinates corresponding to the image points.

The model in this paper is a camera model, which can be normalized with the focal length for the corresponding spatial coordinates of the model center point. Moreover, the camera model itself has a certain distortion, so it is necessary to study this distortion process and correct it through the distortion model. In the actual correction process, only the distortion of the second-order lens is considered, and its model can be expressed as:

$$\begin{cases} u - u_0 = (u' - u_0)\left(1 + k'_u r^2\right) \\ v - v_0 = (v' - v_0)\left(1 + k'_v r^2\right) \end{cases} \tag{10}$$

In the formula, (u', v') is the ideal image coordinate without distortion, $(u, v)$is the actual image coordinate, (u_0, v_0) is the image coordinate of the optical axis center point, and r is the distance from the image point to the reference point.

$$r = \sqrt{(u' - u_0)^2 + (v' - v_0)^2} \tag{11}$$

k'_u, k'_v is the second-order distortion coefficient in u and v respectively.

(3) Camera external parameter model

Generally speaking, the camera's external parameter model is a kind of model parameter, which mainly describes and analyzes the coordinates of the shooting object in the camera model. As shown in Fig. 2, the representation of coordinate system $O_w X_w Y_w Z_w$ in coordinate system $O_c X_c Y_c Z_c$ can be expressed as a matrix model.

$$\begin{bmatrix} x_c \\ y_c \\ z_c \\ 1 \end{bmatrix} = \begin{bmatrix} n_x & o_x & a_x & p_x \\ n_y & o_y & a_y & p_y \\ n_z & o_z & a_z & p_z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix} = \begin{bmatrix} R & P \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix} = {}^{c}M_w \begin{bmatrix} x_w \\ y_w \\ z_w \\ 1 \end{bmatrix} \tag{12}$$

In the formula, (x_c, y_c, z_c) represents the coordinate of the sample point in the camera model coordinate system $O_c X_c Y_c Z_c$, and ${}^{c}M_w$ is the external parameter matrix. $n = [n_x \quad n_y \quad n_z]^T$ is the direction vector of the X_w axis in the camera coordinate system $O_c X_c Y_c Z_c$, and $o = [o_x \quad o_y \quad o_z]^T$ is the direction vector of the Y_w axis in the camera coordinate system $O_c X_c Y_c Z_c$. $a = [a_x \quad a_y \quad a_z]^T$ is the direction vector of the Z_w axis in the camera coordinate system $O_c X_c Y_c Z_c$, and $p = [p_x \quad p_y \quad p_z]^T$ is the position of the coordinate origin of $O_w X_w Y_w Z_w$ in the camera coordinate system $O_w X_w Y_w Z_w$.

The stereogram projection model is:

$$r(\alpha) = k\tan(\alpha/2) \tag{13}$$

Fleck et al. believe that this projection model is a better and more widely applicable model. Moreover, its characteristic is that the spherical object remains spherical after being projected by the stereogram. The ideal stereographic projection model has only three degrees of freedom image center and focal length, and the shape of small objects will not change due to the position of the field of view. At present, there are not many calibration methods starting from this model. In addition, other projection models include equidistant projection, equal solid angle projection, and Sine law projection. The above two models have their own advantages and disadvantages. This paper uses the small hole imaging model as the basis for camera calibration.

Ignoring lens distortion means ignoring all optical distortions. The small hole imaging model is used as the mathematical model of the camera. The small hole imaging model can be expressed by the following formula:

$$\begin{cases} \frac{u}{f} = \frac{r - r_0}{f_N} = \frac{r_{1.1}x + r_{1.2}y + r_{1.3}z + t_1}{r_{3.1}x + r_{3.2}y + r_{3.3}z + t_3} \\ \frac{v}{f} = \frac{c - c_0}{f_V} = \frac{r_{2.1}x + r_{2.2}y + r_{2.3}z + t_2}{r_{3.1}x + r_{3.2}y + r_{3.3}z + t_3} \end{cases} \tag{14}$$

For the convenience of calculation and calibration, the internal and external parameters of the camera mentioned above are replaced here.

Among them, (u, v) is the image coordinate (unit, mm) of the spatial point, (r, c) is the corresponding image coordinate (unit: pixel), and $R = [r_{i,j}]$ is a rotating orthogonal matrix of 3×3 from the world coordinate system to the camera coordinate system. $T = (t_1.t_2, t_3)$ is a translation vector of 3×1, (r_0, c_0) is the coordinate of the image center of the computer frame, and f is the matrix of the camera.

$$\begin{aligned} f_N &= f \cdot s_N \\ f_V &= f \cdot s_V \end{aligned} \tag{15}$$

s_N, s_V is the number of pixels per unit distance in the u and v directions in the image plane, respectively.

The parameters that need to be calibrated under this model include internal parameters r_0, c_0, f_N, f_V and external parameters R and T.

Due to the assembly error and processing error of the camera optical system, there is optical distortion between the actual image of the object point on the camera image plane and the ideal image. The lens distortion error affects the coordinate value of the measured point in the image coordinate system, which can be corrected by the following formula.

$$\begin{aligned} u' &= u + \delta_N(u, v) \\ v' &= v + \delta_V(u, v) \end{aligned} \tag{16}$$

Among them, $\delta_N(u, v), \delta_V(u, v)$ is the error caused by lens distortion. In order to determine the error, the sources of various lens distortions and their error distortion models are first analyzed. The main distortion errors are divided into three types of radial distortion, eccentric distortion and thin prism distortion. The first type only produces radial position deviation, while the latter two types produce both radial deviation and tangential deviation. At the same time, the total distortion of u-axis and v-axis can be expressed by the following formula when considering radial distortion, decentering distortion and thin prism distortion:

$$\begin{cases} \delta_N(u, v) = s_1(u^2 + v^2) + 3p_1u^2 + p_1v^2 + 2p_2uv + k_1u(u^2 + v^2) \\ \delta_V(u, v) = s_2(u^2 + v^2) + 2p_1uv + p_2u^2 + 3p_2v^2 + k_1v(u^2 + v^2) \end{cases} \tag{17}$$

Set:

$$\begin{aligned} g_1 &= s_1 + p_1 \\ g_2 &= s_2 + p_2 \\ g_3 &= 2p_1 \\ g_4 &= 2p_2 \end{aligned} \tag{18}$$

Formula (17) can be expressed as:

$$\begin{cases} \delta_N(u, v) = (g_1 + g_3)u^2 + g_4uv + g_1v^2 + k_1u(u^2 + v^2) \\ \delta_V(u, v) = g_2u^2 + g_3uv + (g_2 + g_4)v^2 + k_1v(u^2 + v^2) \end{cases} \tag{19}$$

4. Intelligent sports prediction analysis system based on improved Gaussian fuzzy algorithm

This paper uses the improved high-speed fuzzy algorithm proposed in the previous article as the core to construct an intelligent sports predictive analysis system. The system in this paper mainly constructs a standard database structure, inputs reliable standardized action models into the database structure, and compares the identified sports action models with the standard action models to judge the accuracy of sports actions. Moreover, this paper uses statistical analysis to study sports training and sports competitions, and obtains prediction results through multi-factor analysis and comparison.

For the simulated sports action model, a space coordinate system is established based on the earth coordinate system, and matrix transformation is used to describe the relationship between the coordinate systems. In the calculation, it is very important to determine the direction of the robot's joint coordinate system and the rotation amount and direction of the adjacent joint coordinate system. The D-H link coordinate system parameter method is usually used. The D-H link coordinate system parameter method uses a 4-order matrix to calculate the spatial position of adjacent links, and determines the positional relationship between the robot body and the

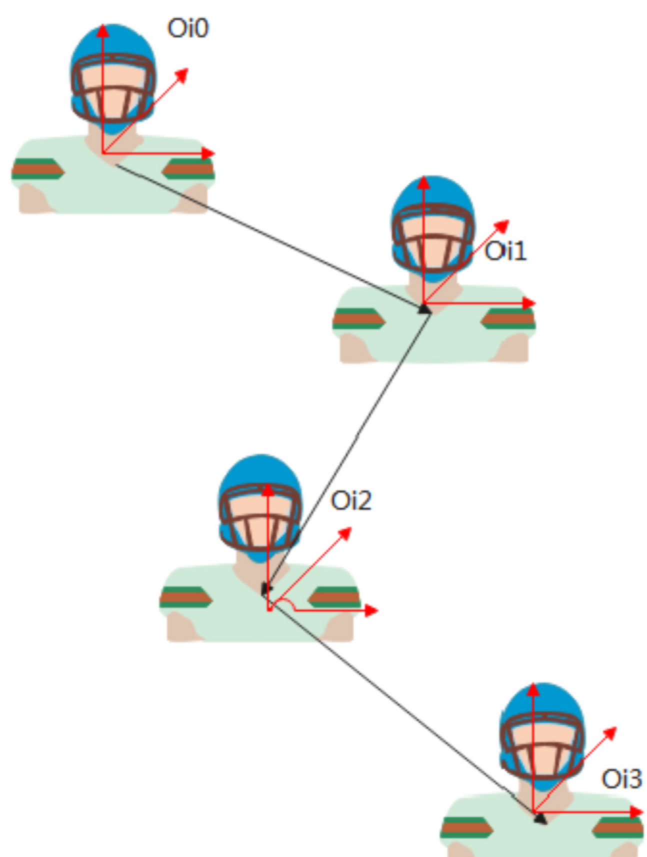

Fig. 3 Flow chart of spatial coordinate transformation.

foot end through multiple transformations. Fig. 3 shows the space coordinate transformation diagram of the bionic sports action model constructed in this paper.

The stability analysis and calculation of the simulated sports action model through mathematical description is shown in Fig. 4.

Before training the network, it is best to change the image data to LevelDB or LmDB. Caffe has two main threads, one of which mainly performs the task of loading data, and the other performs the two calculations in the Layer. After constructing the network, all forward calculations and reverse calculations are completed within the layer. For example, convolution is to input an image, and then convolve with the parameters of this layer (convolution kernel), and finally output the convolution result. The training process is the process of forward calculation and reverse calculation to optimize the network, and the classification process is the process of using the optimized network to predict a set of new data categories. In the entire process, the network construction process determines the pros and cons of the model. Fig. 5 shows the inter-layer connections of common networks. Among them, the dropout function randomly selects half of the neurons in the fully connected layer so that they do not participate in this iteration process. The purpose is to prevent overfitting and improve the generalization ability of the model.

There are currently a series of visualization solutions, but there are more or less situations that cannot meet our needs. Therefore, we developed our own 3D pose estimation visualization system. The main architecture diagram is shown in Fig. 6. The visualization system is mainly designed to meet the following requirements:

(1) It can draw 3D graphics efficiently, and the visualization of graphics should not slow down the performance of the entire system. (2) It can provide a simple and easy-to-use API, so that the subsequent work of the algorithm can be reused and extended. (3) It can support a larger number of human body drawings. (4) It can be debugged on low-end integrated graphics models, and it can test performance on high-end models with discrete graphics.

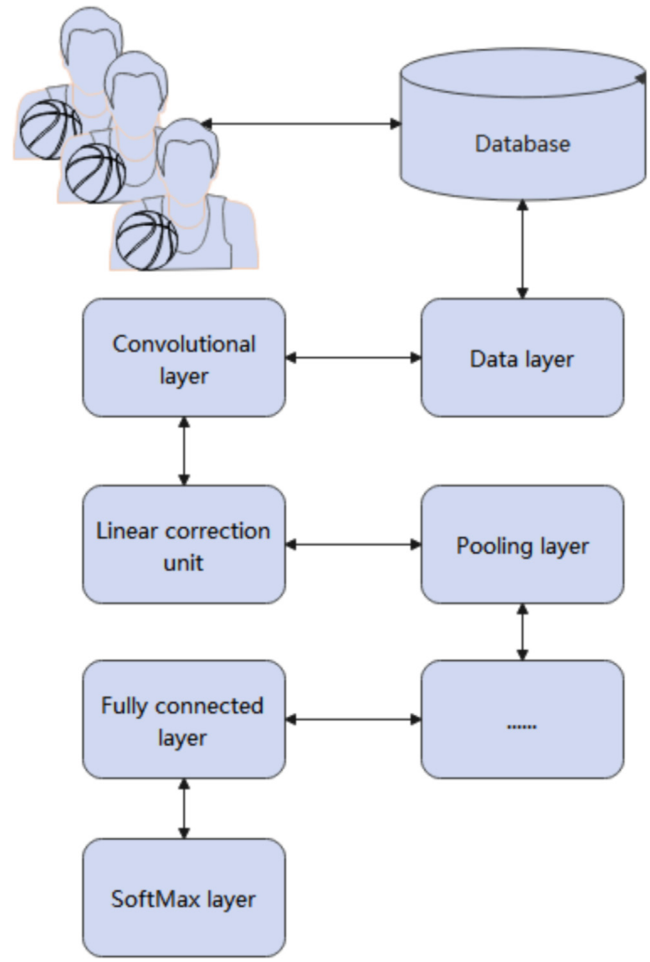

Fig. 5 Work flow of sports action recognition.

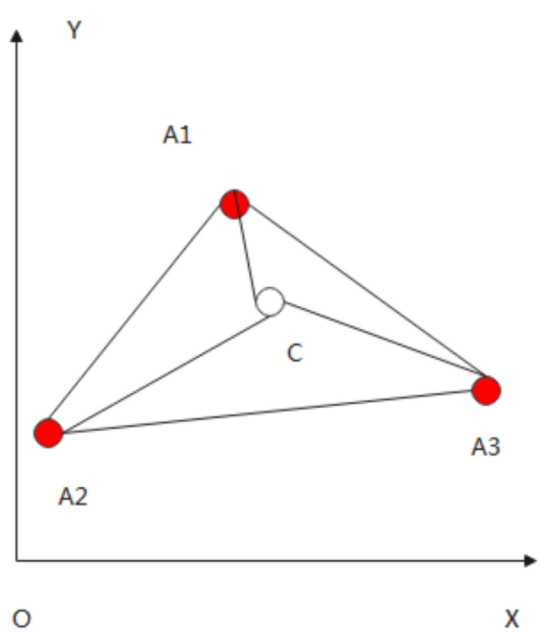

Fig. 4 Mathematical description of static stability.

For a given image input, we first use a convolutional neural network to process it. The three branches of the convolutional neural network will produce three different outputs, each of which encodes a type of information used to reconstruct the 3D pose. Subsequently, a fast post-processing process will use these three types of information as input to reconstruct the final 3D pose. The process is shown in Fig. 7.

First, the algorithm uses a 2D posture recognition network to process the input image to generate a 2D posture. Next, the 2D pose is handed over to the 3D pose estimation network to process one by one to generate the 3D pose of each person. This process involves two networks, 2D and 3D, and the second 3D pose estimation network will run more than once. This leads to the following problems. 1. The 2D posture network converts the input image into an abstract 2D posture. This process causes the loss of image information in the original image. Therefore, the accuracy of the 3D pose estimation network cannot be improved based on the pixel value and other information. 2. In the current situation, there are two networks that need to be running. In actual deployment, the first network is usually started first, and after the output is obtained, the first network is uninstalled and then the second network is started. This will bring a huge performance loss and limit

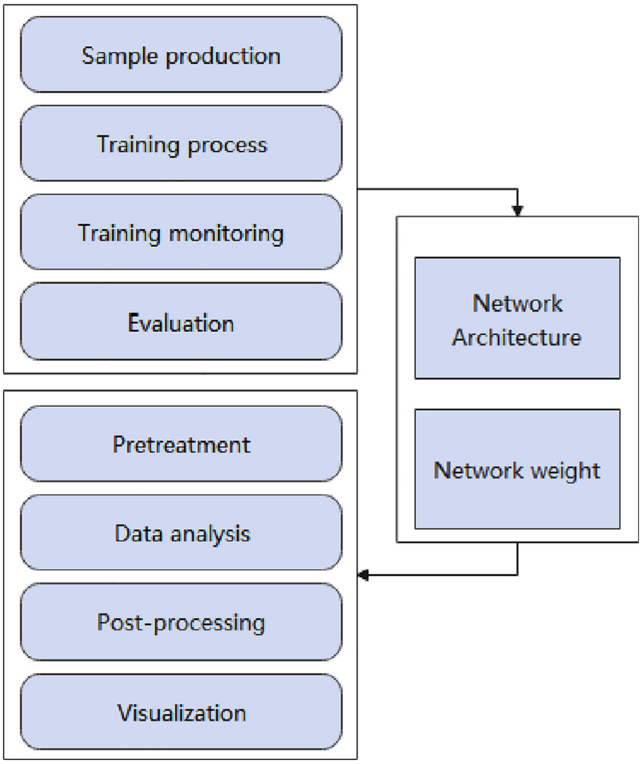

Fig. 6 Visual system architecture diagram.

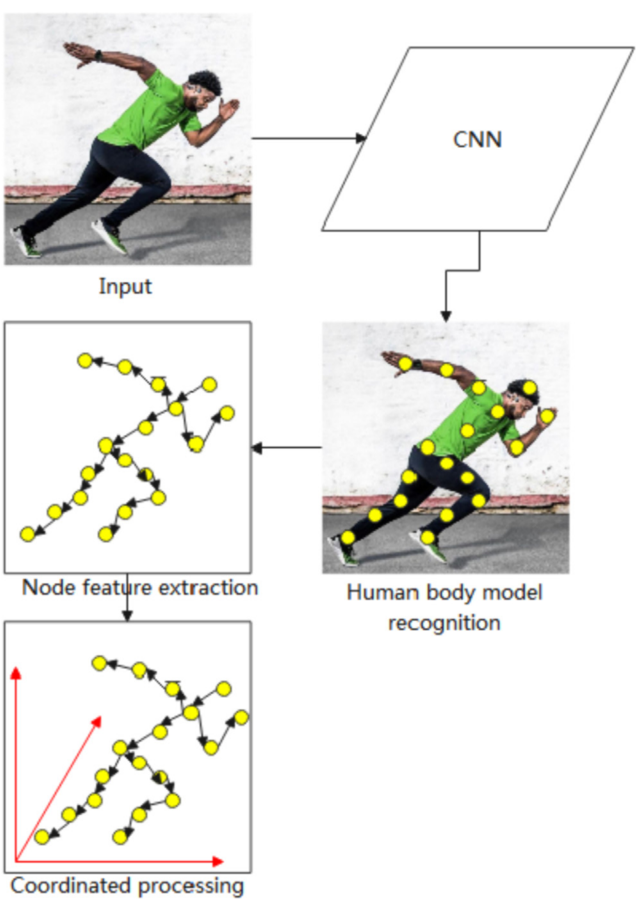

Fig. 7 The basic framework of the pose estimation algorithm.

Table 1 Statistical table of recognition effect of sports actions.

NO.	Action recognition	NO.	Action recognition	NO.	Action recognition
1	86.39	28	86.15	55	91.34
2	86.69	29	83.94	56	85.76
3	83.58	30	92.46	57	91.08
4	94.62	31	87.61	58	84.65
5	91.78	32	86.12	59	91.10
6	85.33	33	85.65	60	86.97
7	92.12	34	84.95	61	93.28
8	83.37	35	94.56	62	86.60
9	85.29	36	86.40	63	92.89
10	84.28	37	93.81	64	84.81
11	89.02	38	86.50	65	89.88
12	87.79	39	92.92	66	91.81
13	91.58	40	90.53	67	84.39
14	85.05	41	86.10	68	83.45
15	88.92	42	90.90	69	92.95
16	90.48	43	91.38	70	90.27
17	88.17	44	92.91	71	92.03
18	83.27	45	89.16	72	94.47
19	93.91	46	84.10	73	87.38
20	89.33	47	91.17	74	83.44
21	88.61	48	92.98	75	86.24
22	84.93	49	86.27	76	84.60
23	94.66	50	94.19	77	88.14
24	89.58	51	88.48	78	91.07
25	87.78	52	83.97	79	87.45
26	84.67	53	88.54	80	89.02
27	83.18	54	94.11	81	86.37

the possibility of performance improvement. In summary, the traditional 3D pose estimation system has a bottleneck in the further improvement of accuracy and operating speed. For this reason, we have proposed our own 3D pose estimation network scheme. This scheme does not have two steps, but completes the output of all the information required to assemble the 3D pose in one run. The program can realize the process control of 3D attitude estimation through Gaussian fuzzy

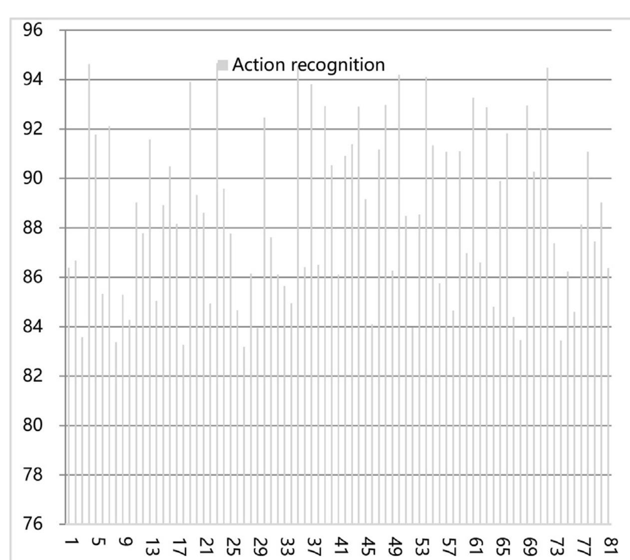

Fig. 8 Statistical diagram of recognition effect of sports actions.

algorithm, and can analyze multiple factors, and can perform sports prediction through the system.

5. System performance verification

This paper verifies the performance of the intelligent sports prediction analysis system based on the improved Gaussian fuzzy algorithm through experimental research. According to the actual demand of sports forecasting and analysis, the system constructed in this paper needs to accurately identify sports actions and make sports predictions. Therefore, this paper mainly analyzes the effect of sports action recognition and prediction in the experimental research. The results of sports action recognition are shown in Table 1 and Fig. 8.

After confirming that the action recognition effect is good, this paper conducts the sports prediction analysis effect detection on the system, and shows it through the scoring method. The results are shown in Table 2 and Fig. 9.

From the above analysis, we can see that the system constructed in this paper can basically meet the actual needs of sports predictive analysis.

Table 2 Statistical table of the evaluation of the effect of sports predictive analysis.

NO.	Predictive analysis	NO.	Predictive analysis	NO.	Predictive analysis
1	80.87	28	71.27	55	74.27
2	76.78	29	80.51	56	87.50
3	73.90	30	78.95	57	77.32
4	79.42	31	77.95	58	72.74
5	76.88	32	73.95	59	74.05
6	74.07	33	83.19	60	81.14
7	74.41	34	78.79	61	83.05
8	88.07	35	87.94	62	83.07
9	79.04	36	85.05	63	86.18
10	72.02	37	71.87	64	78.38
11	87.33	38	88.58	65	72.65
12	80.89	39	76.87	66	76.58
13	87.72	40	83.63	67	80.98
14	75.24	41	72.67	68	79.51
15	78.52	42	73.28	69	73.73
16	80.50	43	76.22	70	87.56
17	80.62	44	77.24	71	81.01
18	82.17	45	79.97	72	86.92
19	86.10	46	84.21	73	78.28
20	79.14	47	78.42	74	77.27
21	76.35	48	71.23	75	72.78
22	88.73	49	78.48	76	83.22
23	80.27	50	77.20	77	77.36
24	87.79	51	75.76	78	80.37
25	71.21	52	76.89	79	71.84
26	75.62	53	85.31	80	82.77
27	76.08	54	75.26	81	85.84

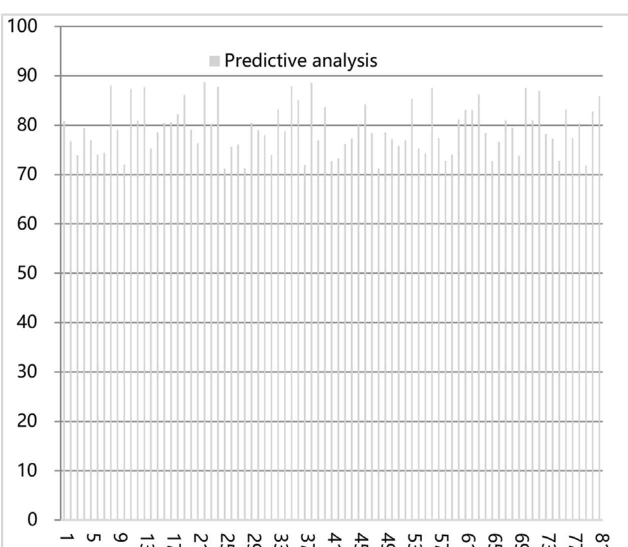

Fig. 9 Statistical diagram of the evaluation of the effect of sports predictive analysis.

6. Conclusion

In order to improve the effect of sports prediction analysis, this paper analyzes the movement recognition of sports and analyzes the traditional high-speed model. Moreover, on this basis, this paper proposes a reliable sports action recognition algorithm, which can be used as the core algorithm for sports action recognition. This paper mainly constructs a standard database structure, and enters a reliable standardized action model in the database structure. Moreover, this paper compares the identified sports action model with the standard action model to determine the accuracy of the sports action. In addition, this paper uses statistical analysis to study sports training and sports competitions, and obtains prediction results through multi-factor analysis and comparison. Finally, this paper uses experimental research to predict the accuracy of sports action recognition and the effect of sports prediction analysis on the system constructed in this paper. From the research results, we can see that the model constructed in this paper has certain effects.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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