Hindawi
Mathematical Problems in Engineering
Volume 2022, Article ID 3028253, 11 pages
https://doi.org/10.1155/2022/3028253

Research Article

Application of Video Feedback System to Technical Analysis and Diagnosis of Throwing Athletes

Tan Mengchao[1,2] and Yan Chenqi[3]

[1]*China Athletics College, Beijing Sport University, Beijing 100084, China*
[2]*Department of Physical Education, Tangshan Normal University, Tangshan, Hebei 063000, China*
[3]*Tangshan Normal University, Tangshan, Hebei 063000, China*

Correspondence should be addressed to Yan Chenqi; tmc583188977@tstc.edu.cn

Received 27 June 2022; Revised 30 July 2022; Accepted 6 August 2022; Published 12 October 2022

Academic Editor: Baiyuan Ding

Throwing sports have high technical difficulties and requirements. The traditional learning and training methods require athletes to start from observation and imitation and constantly repeat mechanized training. Athletes have no intuitive comparison and understanding of the overall situation of their own movement technology. Video feedback systems can make up for the shortcomings of traditional methods, so that athletes can more intuitively observe the problems of their own actions. Therefore, this paper puts forward the application research of technical analysis and diagnosis of throwing athletes based on video feedback system, and uses random forest regression algorithm to construct video feedback system. The comparative experimental results show that the students who study and train the movement technology through the video feedback system have higher performance in javelin throwing than the students in the control group, and the performance improvement range is higher. The javelin throwing movement technology is closer to the requirements of the standard movement, which can reduce the wrong movements of javelin throwing. It is more conducive for students to achieve better javelin throwing results.

1. Introduction

In throwing events, whether it is a solid ball or other events, power is the basis of throwing. When throwing, the athlete should upload the strength of the lower limbs to the upper limbs, and then transfer it from the upper limbs to the arms. At the last moment, the maximum force generated by the whole body is applied to the missile. That is to say, it needs a strong explosive ability in throwing. Only when the explosive force reaches the limit and works perfectly on the projectile, can it reach a long distance. Therefore, in daily training, athletes must strengthen the practice of strength quality if they want to have good strength. In the process of training, we should grasp the characteristics of training and take targeted training. In throwing events, we should arrange appropriate training plans according to the characteristics of the events, and determine the training content by the training items. In throwing events, the most important thing in the competition is the longest distance that the athletes can throw. How to throw the missiles farther requires athletes to have better strength and speed.

Throwing sports in track and field have high technical difficulties and requirements. It is a great challenge for athletes to master or improve their skills and achievements in a short time. In the traditional track and field teaching, the main teaching means is that athletes understand, learn, and practice through the explanation and demonstration of coaches or teachers [1]. In teaching and training, coaches pay more attention to the physical exercise and repeated imitation of sports. In the process of a large number of mechanical training, athletes do not have a comprehensive and detailed understanding and cognition of their throwing techniques and movements. Once they develop wrong throwing movements, it is difficult to correct and change [2, 3]. With the reform of physical education, the traditional physical education teaching methods cannot meet the needs of athletes' training. It is of great significance to seek new physical education teaching methods combined with modern teaching means and technology to analyze and diagnose physical education teaching and athletes' technology [4]. Video feedback technology is a new educational concept, which mainly analyzes and diagnoses the movement and technology through video teaching in the process of teaching and training, and assists other training of athletes, so that athletes can refine the training content, observe their throwing technical movements, and improve and correct them in time [5, 6]. At the same time, it is conducive for coaches to better understand the technical state of sports, better analyze and diagnose athletes' throwing technology, and formulate targeted guidance suggestions and evaluation indicators [7].

This paper puts forward the application research on the technical analysis and diagnosis of throwing athletes based on video feedback system. The random forest regression method is used to construct the video feedback system model to analyze and diagnose the throwing athletes' technology. This paper is mainly divided into three parts. The first part expounds the application and research status of video feedback system in physical education teaching. The second part constructs the throwing athlete technology analysis system based on video feedback. The third part analyzes the experimental results and corresponding analysis of throwing mobilization technology based on video feedback system.

This paper is mainly divided into five parts. The first part analyzes the research background of throwing in track and field. The second part expounds the application and research status of video feedback system in physical education teaching. In the third part, a throwing athlete technology analysis system based on video feedback is constructed. The application principle of video feedback system in athletes' technical analysis is analyzed. The fourth part analyzes the experimental results and corresponding analysis of throwing mobilization technology based on video feedback system. The parameters of the video feedback system model based on random forest regression algorithm are optimized. Finally, the full text is summarized. Frequency feedback system can deepen athletes' cognition of throwing technology, reduce the probability of wrong actions, and effectively correct problematic actions.

2. Related Work

With the development of modern technology, video feedback technology has been paid more and more attention and applied. It is mainly based on feedback teaching, transforming the form of language feedback into the form of video feedback, and has been applied in the field of medicine and physical education [8]. In the field of physical education, video feedback technology is widely used in sports such as taekwondo, swimming, martial arts, aerobics, and table tennis. There are also some corresponding studies in track and field [9]. Video feedback teaching first photographed and recorded students' sports practice process through camera technology, and then made students observe and recognize their shortcomings in the practice process through continuous return visit to the camera content, and then improved their actions through multiple correction, projection, and comparison [10, 11]. On this basis, some scholars use three-dimensional camera equipment to record students' tennis classroom performance and feedback the recorded information to students, so as to enrich the teaching content and improve the teaching effect [12]. Other scholars have moved audiovisual technology into hurdle technology teaching, combined with teachers' explanation and collective feedback mechanism, so that students can master hurdle technology faster, impose cognitive thinking, and break the limitations of thinking [13]. Other scholars have emphasized the continuous shooting of the video feedback system, and believe that its continuous shooting can intuitively record and show the action details with strong complexity and continuity in Taekwondo, so that students and teachers can observe and find problems in the action more carefully, so as to make targeted correction and practice [14, 15]. Some scholars have conducted experimental analysis on the application of video feedback system in volleyball teaching. It is concluded that video feedback system helps students understand the essentials of action technology in the initial stage of volleyball learning. Through the freeze frame and slow playback of technical action video, students can observe and learn more intuitively and form a clear image. In the advanced stage of students' learning volleyball technology, video feedback can help students find their own problems and correct them in time [16, 17]. In addition, some scholars proposed the combination of bilateral feedback teaching method and video feedback system, which was applied to Javelin teaching and training, and found the movement transfer characteristics through the study of double limb training [18]. Other scholars applied the video feedback system to the field of action correction in throwing teaching, and analyzed the athletes' action error prone points and corresponding correction methods in combination with the athletes' throwing characteristics, learning state, psychological situation, and other factors [19, 20].

To sum up, the application of video feedback technology in physical education has been widely recognized. With the development of modern technology, it has gradually changed from video technology to modern mobile devices, such as mobile phones and computers, to record the teaching and training process, and then combined with the corresponding data analysis technology and software. It can effectively analyze and correct the problems and deficiencies of athletes and students in the process of sports, so as to improve students' innovative thinking and comprehensive ability, strengthen teaching effect, promote physical education teaching reform, and lay the foundation for the rapid development of physical education.

3. Technical Analysis System of Throwing Athletes Based on Video Feedbacks

3.1. Application Principle of Video Feedback Systems in Athlete Technical Analysis. The technical analysis of throwing athletes is essentially the analysis of athletes' action skills, and action skills are a kind of action mode with certain consolidation, automation, and perfection [21]. In the process of action, people include all kinds of actions that need the actions of different parts such as hands and feet. Therefore, when people learn new actions, the coordination between different parts is relatively poor. Only through contact can they consolidate and master the action skills, so as to realize the action automation [22]. According to relevant theories, the formation process of athletes' motor skills can be divided into four stages. The first stage is the initial stage of motor skills learning, in which athletes have a preliminary interest in throwing games; the second stage is the generalization stage, in which athletes will learn some primary skills of throwing; the third stage is the consolidation stage, in which athletes improve their motor skills through continuous learning and practice; and the fourth stage is the automation stage, that is, athletes can master the learned motor skills [23]. According to the four stages of the formation of motor skills, athletes' motor technology learning objectives can be divided into three different levels, namely cognitive level, emotional level, and motor skill level. Among them, the level of motor skills can be further divided into seven different angles, namely perception, set, mechanical action, guiding reflection, complex external reflection, adaptation, and innovation. Video feedback includes mechanical action, guiding reflection, complex external reflection, adaptation, and so on [6]. As shown in Figure 1, the application process of video feedback system in technical analysis of throwing athletes is shown.

The application of video feedback system in technical analysis and diagnosis of throwing athletes is to help athletes better understand the problems existing in their own movement skills and correct them in time, so as to improve their mastery of throwing technology and learning efficiency. Therefore, the application of video feedback system in technical analysis and diagnosis of throwing athletes should conform to the level of motor skill formation process and learning objectives, and also combine the following principles. The first principle is the comprehensive principle, that is, the coach should consider the basic situation of all athletes when formulating learning and practice objectives for throwing athletes. Different athletes have different degrees of learning and understanding of throwing skills [24].

The second principle is the principle of teaching students in accordance with their aptitude and timely motivation, that is, different athletes have differences in learning ability, personality characteristics, physical advantages, and ways of thinking. Watch the technical action videos of excellent throwing athletes from different angles, so as to deepen the athletes' comprehensive understanding of action technology and effectively find their own problems. When the coach explains the essentials of the throwing action, he should not only demonstrate the action, but also comprehensively explain the knowledge related to the action, so that the athletes can understand the principle of the throwing action. Intuition not only requires the demonstration action of the coach to make the athletes initially form the action image of the action, but also allows the athletes to observe their own actions through the video feedback system. The third principle is the intuitive principle, that is, when athletes learn and practice throwing movements, they can deepen their understanding of movement skills through their own sensory system and intuitive and vivid movement performance.

Therefore, in the process of training, we should emphasize teaching students in accordance with their aptitude, determine goals according to the characteristics of different athletes, and use different feedback languages to provide effective and targeted guidance to different athletes, so as to optimize the effect of athletes' learning and training. At the same time, we should also establish athletes' self-confidence, stimulate learning interest and enthusiasm, and timely affirm and encourage athletes. The fourth principle is the heuristic principle, that is, cultivate athletes' independent thinking and autonomous learning ability through video feedback system, let athletes find problems and put forward solutions through video observation and group discussion, and the coach gives certain guidance and reminder at the right time, so as to improve athletes' understanding and application ability of throwing skills.

3.2. Construction of the Video Feedback System Model Based on Random Forest Regression Algorithm

3.2. Construction of the Video Feedback System Model Based on Random Forest Regression Algorithm. Decision tree can easily deal with the interaction of features and is nonparametric, so there is no need to worry about outliers or whether the data is linearly separable. Before using the maximum number of votes or the average value to predict, you want to establish the number of subtrees. Generally speaking, the more the number of subtrees, the better the performance, and more stable the accuracy of prediction, but it will also slow down the calculation process. Random forest regression algorithm, or RFR algorithm in short, is an integrated learning algorithm based on decision tree. It has high accuracy and can avoid the shortcomings of single prediction or classification model. In the random forest regression algorithm, each decision tree will take the equal probability random sampling method to extract the corresponding training data from the original data. The training data of each individual classifier is different, and the majority or average of all individual classification results is the final result of the random forest regression algorithm. As shown in Figure 2, the principle diagram of random forest regression algorithm is shown.

The combination model of a group of decision subtrees constituting the random forest regression algorithm is $\{h(x,\theta_t), t = 1, 2, \ldots, T\}$, in which the random variable is θ_t and obeys the independent and identical distribution, the independent variable is x, and the number of decision trees is T. Take the mean value of each decision tree as the regression prediction result, as shown in the following:

$$\overline{h}(x) = \frac{1}{T}\sum_{t=1}^{T}\{h(x,\theta_t)\}, \tag{1}$$

where $\{h(x,\theta_t)\}$ is the output about x and θ.

Randomly select the training set vectors x and y, and the interval function is shown as follows:

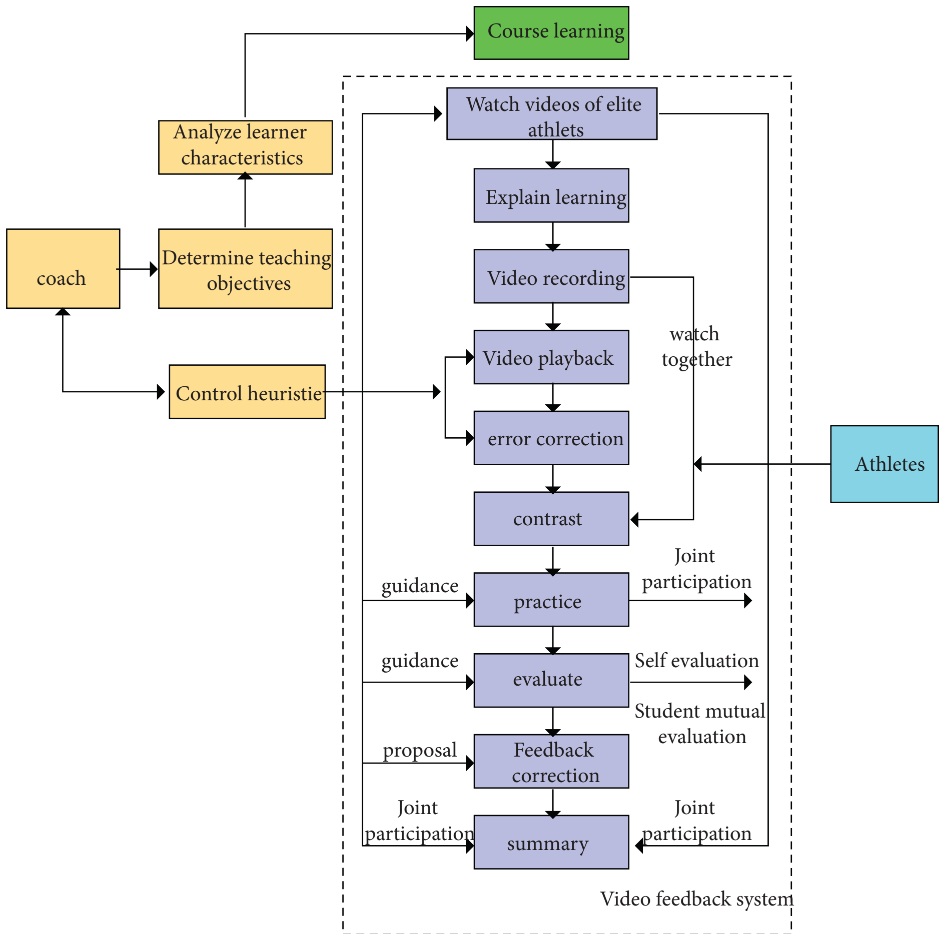


Figure 1: Application process of the video feedback system in technical analysis of throwing athletes.

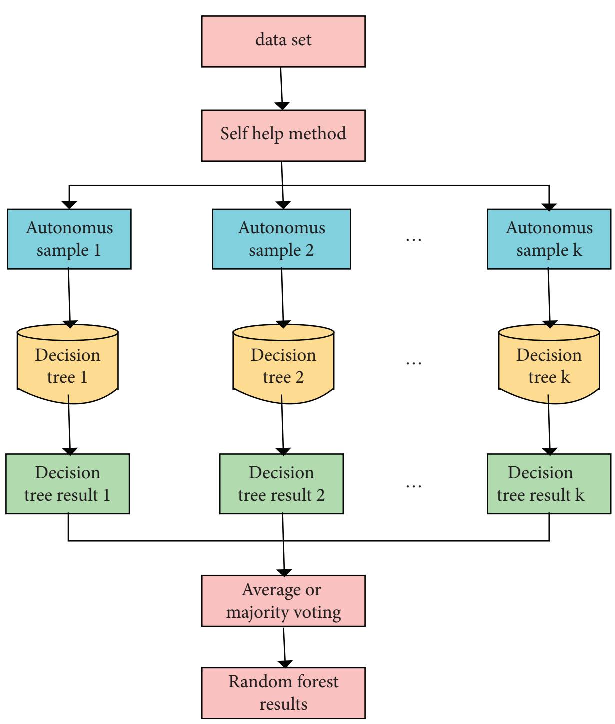


Figure 2: Schematic diagram of random forest regression algorithm.

$$mg(x,y) = av_t I(h(x,\theta_t) = y) - \max_{j\neq y} av_t I(h(x,\theta_t) = j). \tag{2}$$

The exponential function is expressed as I, and the corresponding classification result in the training set x is expressed as y.

In order to avoid the over fitting problem in the decision tree model, bagging and random subspace are integrated into the random forest regression algorithm. Bagging idea can increase the number of regression decision subtrees constructed by randomization, and keep them independent of each other. In the idea of random subspace, both the nodes between decision trees and their own nodes have different feature subsets. At the same time, the independence and diversity of decision trees can improve the randomness of node splitting of random forest regression algorithm. A reasonable and effective sampling can generate a decision tree, which contains a training set that can relatively reflect the business logic. You can also stop the growth of trees in advance by pruning or postprune the generated tree according to certain rules. Because of the overfitting of the training set, the validation set data can be corrected and the above operations can be repeated. From the bottom-up processing nodes, delete those nodes that can maximize the accuracy of the verification set until further pruning is harmful.

A plurality of training samples are randomly selected from the original samples, and the number of training samples is the same as that of the original samples. Then the regression decision tree T is constructed for each training sample, and the average value of each decision tree is taken as the final result. If the original sample is expressed as S and the number of samples is expressed as N, the probability ε of not being extracted in each sample is shown as follows:

$$\varepsilon = \left(1 - \frac{1}{N}\right)^N. \tag{3}$$

When $N \longrightarrow \infty$, we have

$$\varepsilon = \left(1 - \frac{1}{N}\right)^N \approx \frac{1}{e} \approx 0.368. \tag{4}$$

According to (4), 36.8% of the samples taken each time will not be taken, that is, out-of-bag data (OOB).

According to the generalization error of the model, the prediction ability of the model to the data outside the training set can be judged. The randomly selected training vector set is (X, Y) and the training sets are independent of each other. The $h(X)$ mean-square error output is shown as follows:

$$\text{PE}^* = E_{X,Y}(Y - h(X))^2. \tag{5}$$

When the number of regression decision trees reaches enough, (7) can be obtained according to (6) and $t \longrightarrow \infty$ condition:

$$h_t(X) = h(X, \theta_t), \tag{6}$$

$$E_{X,Y}\left(Y - \overline{h}(X, \theta_t)\right)^2 \longrightarrow E_{X,Y}(Y - E_\theta h(X, \theta))^2 = \text{PE}_b^*, \tag{7}$$

where E_θ represents the mathematical expectation and θ_t represents the random variable of the t decision tree.

The average generalization error of each regression decision tree $h(X, \theta)$ is shown in the following:

$$\text{PE}_c^* = E_\theta E_{X,Y}(Y - h(X, \theta))^2. \tag{8}$$

If the regression decision subtree is unbiased for all random variables θ, that is, as shown in the following:

$$\text{EY} = E_X h(X, \theta). \tag{9}$$

Then, (10) can be obtained:

$$\text{PE}_c^* \leq \overline{\rho}\text{PE}_b^*, \tag{10}$$

where $\overline{\rho}$ represents the correlation coefficient of the residual.

The data partition purity of random forest regression tree is measured by square error, and the data set D is divided into m subset, namely $D_1, D_2, \ldots, D_m$. The optimal output value is shown as follows:

$$\widehat{c}_m = \text{ave}(y_i | x_i \in D_m), \tag{11}$$

where ave represents the average value of output variables corresponding to all input variables in the subset.

When dividing v different continuous values in attribute B, after sorting the values in a certain order, select the focus of two adjacent values as the location of the possible splitting point of the attribute. Therefore, $v - 1$ methods can be obtained to divide the data set D into two different subsets, as shown in the following:

$$D_1(B, s) = \left\{x | x^{(B)} \leq s\right\}, \tag{12}$$

$$D_2(B, s) = \left\{x | x^{(B)} > s\right\}. \tag{13}$$

As shown in (14) and (15), it is the square error of the subset after division:

$$\text{SE}_1 = \sum_{x_i \in D_1(B,s)} (y_i - c_1)^2, \tag{14}$$

$$SE_2 = \sum_{x_i \in D_2(B,s)} (y_i - c_2)^2. \tag{15}$$

The optimal splitting attribute B and splitting point satisfy

$$\min_{B,s}\left(\min_{c_1}(\text{SE}_1) + \min_{c_2}(\text{SE}_2)\right). \tag{16}$$

The output value of the divided subset is shown in the following:

$$\widehat{c}_1 = \text{ave}(y_i | x_i \in D_1(B, s)), \tag{17}$$

$$\widehat{c}_2 = \text{ave}(y_i | x_i \in D_2(B, s)). \tag{18}$$

4. Experimental Results of Technical Analysis and Diagnosis of Throwing Athletes Based on the Video Feedback System

4.1. Model Parameter Optimization of the Video Feedback System Based on Random Forest Regression Algorithm. Random forest is a compositional supervised learning method. In the random forest, we generate multiple prediction models at the same time, and summarize the results of the model to improve the accuracy of the prediction model. Random forest algorithm (prediction and regression) mainly includes the following three aspects. (1) Randomly take n sample units from the original data and generate a decision or regression tree. (2) Randomly select $m < m$ variables at each node and take them as candidate variables for dividing nodes. The number of variables at each node should be consistent. (3) Finally, integrate the results of each decision or regression tree to generate predictive values. The advantages of random forests include: (1) When the data set is not verified, the out-of-pocket prediction error can be calculated (the category corresponding to the sample points not used in the spanning tree can be estimated by the generated tree, and the out-of-pocket prediction can be obtained by comparing it with the real category). (2)

Random forest can calculate the importance of variables. (3) Calculate the distance between different data points for unsupervised classification.

The video feedback system model based on random forest regression algorithm has two main parameters: the number of regression decision subtrees and the number of randomly selected feature splits. In this paper, the estimation of out-of-pocket data is used to estimate a single regression decision subtree, and its mean value is the generalization error of the model. Asshown in Figure 3, when the number of feature selections for randomly selected feature segmentation is 2 and 11, respectively, the data error and training time will change accordingly. It can be seen from the data in the figure that the variation trend of out-of-bag data error is different with the increase of the number of regression decision-makers. When the number of regression decision-makers is less than 20, the out-of-bag data error shows a sharp downward trend; when the number of regression decision-makers is greater than 20 and less than 60, the variation trend of out-of-bag data error is slow decline; and when the number of regression decision-makers is greater than 60, the out-of-bag data error is close to the convergence state. In addition, the training time of the model increases with the increase of the number of regression decision-makers.

Considering the error, efficiency and actual demand, the optimal value of the number of regression decision-makers is 60. Under this condition, the variation of out-of-bag data error and model running time with the number of feature selection is shown in Figure 4. It can be seen from the results in the figure that when the number of feature selection increases, the training time of the model is fluctuating and rising as a whole. The out-of-bag data error shows a downward trend. The decline speed is fast in the early stage, and then gradually becomes slow. When the number of feature selection increases to more than 18, the change range of out-of-bag data error is small, and the increase range of training time becomes larger. Therefore, the optimal value of feature selection is 18.

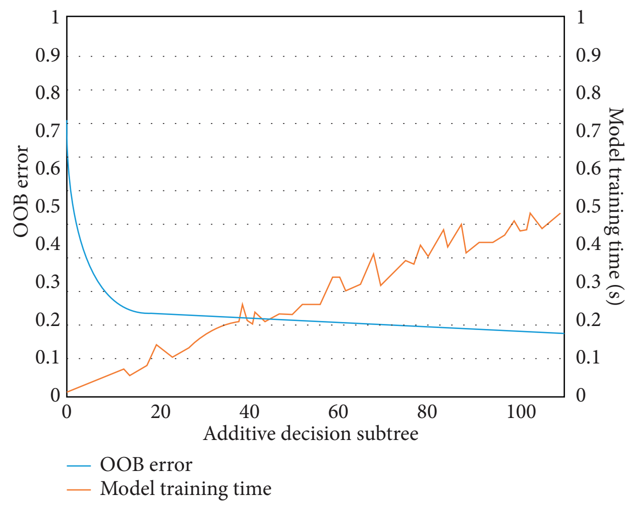


Figure 3: Changes of OOB error and model training time with the number of regression decision makers.

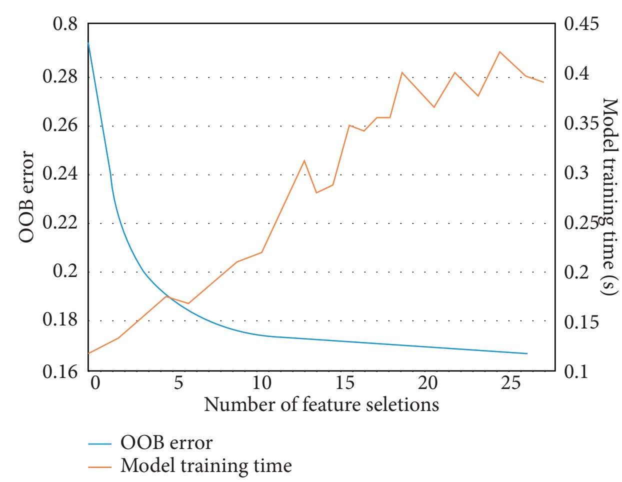


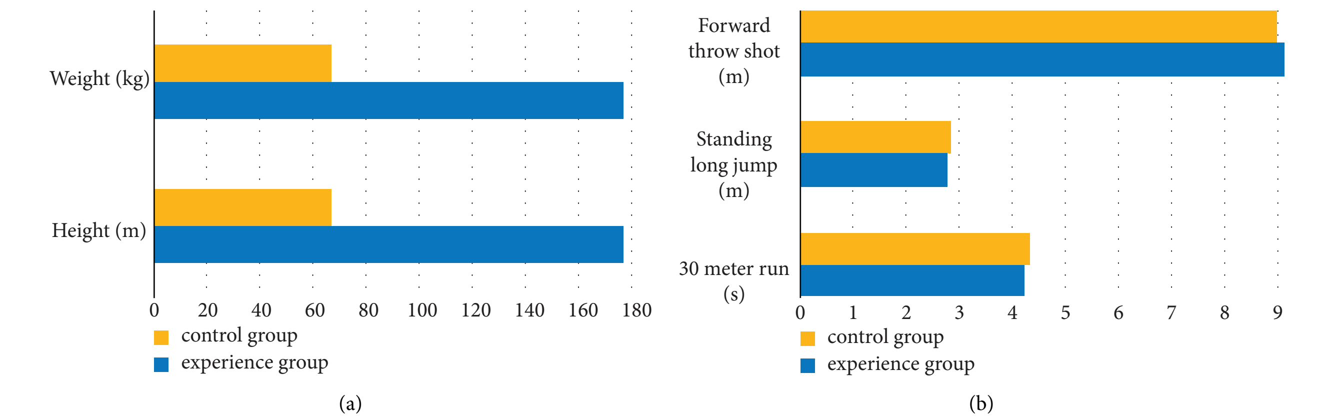
Figure 4: The variation of OOB error and model running time with the number of feature selections.

4.2. Technical Evaluation of Throwing Athletes Based on the Video Feedback System. In this paper, forty students from a sports university are divided into two groups for Javelin technology analysis and diagnosis control experiment. As shown in Figure 5, the average values of the body shape and physical quality of the two groups of students before the experiment are compared. As shown in Figure 6, the corresponding t and P values are shown. It can be seen from the data in the figure that there is no significant difference in body shape and physical quality between the experimental group and the control group, which is in line with the conditions of the control experiment.

After eight times of javelin throwing technical analysis and diagnosis, the students in the experimental group mainly observe, learn, compare, and correct the javelin throwing movements through the video feedback system. The results of the two groups were compared after the second, fifth, and eighth javelin throwing technical analysis and diagnosis, as shown in Tables 1–3.

As shown in Figures 7 and 8, there are three visual comparative changes of the two groups of standard achievement and technical achievement, respectively.

As can be seen from Figures 7 and 8, the three scores of the experimental group are higher than those of the control group in terms of both standard scores and technical scores, and the gap between the two groups is gradually increasing. In terms of performance change range, the performance change range of the experimental group is greater than that of the control group. This shows that the students in the experimental group can more effectively learn the javelin technical action through the video feedback system, improve the quality of action technology, reduce the generation of wrong action, effectively correct the existing action problems, understand and master the javelin action technology, and further improve the overall javelin throwing performance. The research needs to determine the respective



(a)

(b)

Figure 5: Before the experiment, the comparison of the average value of the body shape and physical quality of the two groups of students.

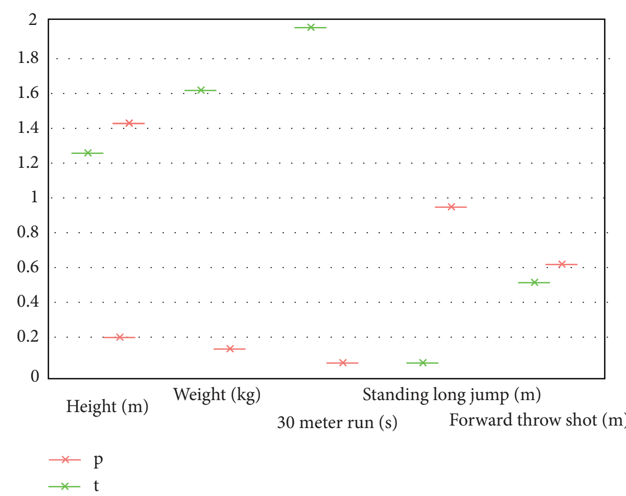


Figure 6: Before the experiment, the corresponding T and P values of the body shape and physical quality of the two groups of students.

Table 1: After the second javelin throwing technical analysis and diagnosis, the results of the experimental group and the control group were compared.

	Experience group	Control group	t	P
Achievement of standard throwing javelin in place (m) $\overline{x} \pm s$	19.94 ± 2.583	19.12 ± 1.791	1.628	0.109
Technical achievements of side throwing javelin in situ (points) $x \pm s$	68.55 ± 5.327	68.36 ± 6.059	0.409	0.678

Table 2: After the fifth javelin throwing technical analysis and diagnosis, the results of the experimental group and the control group were compared.

	Experience group	Control group	t	P
Achievement of javelin throwing in short run-up (m) $\overline{x} \pm s$	32.45 ± 3.755	77.23 ± 5.118	3.832	0.015
Technical results of javelin throwing in short run-up (points) $x \pm s$	29.32 ± 2.660	72.19 ± 3.203	3.514	0.020

Table 3: After the eighth javelin throwing technical analysis and diagnosis, the results of the experimental group and the control group were compared.

	Experience group	Control group	t	P
Complete shooting achievement (m) $\overline{x} \pm s$	41.28 ± 4.115	84.15 ± 5.150	7.241	0.017
Complete shooting technical achievements (points) $x \pm s$	32.8 ± 3.195	78.74 ± 3.610	3.665	0.10

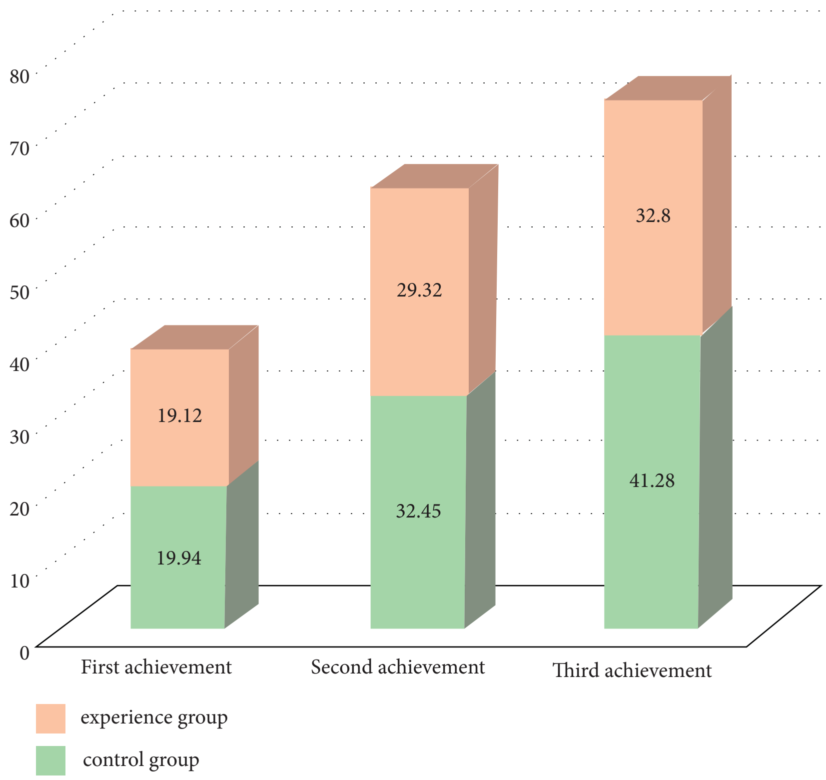


Figure 7: The results of the experimental group and the control group were compared and changed three times.

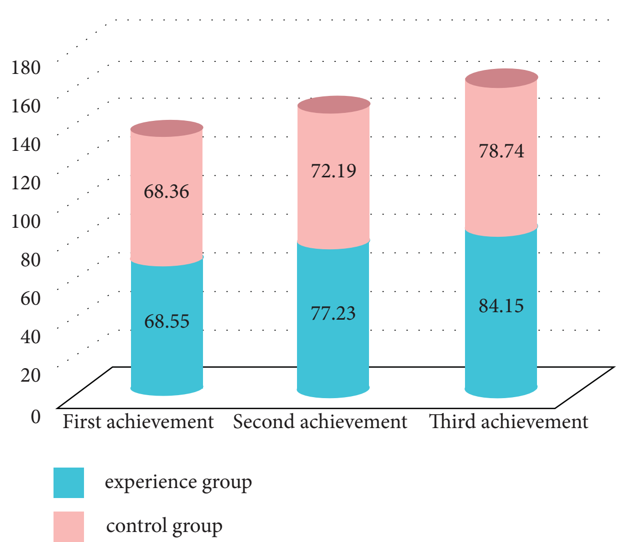


Figure 8: The technical scores of the experimental group and the control group were compared for three times.

ranges of the superparameters of the random forest model, and then we will determine the final optimal value of each superparameter in these ranges. In other words, we now delimit a large range for each superparameter that needs to be selected. Then, in the later stage, the optimization algorithm will be used to search within this range of each superparameter. After determining the respective ranges of each superparameter, then we will combine them separately. Compare the model results obtained by each combination of superparameter values, so as to determine the optimal combination of superparameters.

As shown in Figures 9 and 10, the technical analysis and comparison results and corresponding T and P values of javelin throwing in the experimental group and the control group are shown. The video feedback system mainly analyzes the angle, height, deviation angle, and the distance between the centers of gravity of the javelin. It can be seen from the results in the figure that the mean and standard deviation of the deviation angle of the experimental group are 25.08 and 4.068, respectively, and the mean and standard deviation of the deviation angle of the control group are 28.63 and 3.974, respectively, and the corresponding P value is less than 0.05, that is, there is an obvious difference between the deviation angle of the experimental group and the control group. The deviation angle can reflect the good and bad force in the longitudinal axis direction at the moment of throwing javelin, which has a great impact on the performance of javelin throwing. Therefore, compared with the control group, the deviation angle of the experimental group is smaller, which indicates that the students in the experimental group perform better in the longitudinal axis direction at the moment of throwing javelin.

The greater the distance between the body and the center of gravity of the javelin, the better the athletes can surpass the equipment. The average distance between the centers of gravity of the students in the experimental group is 71.09 cm, and the average distance between the centers of gravity of the students in the control group is 68.48 cm, with standard deviations of 1.278 and 1.654, respectively. From the P value

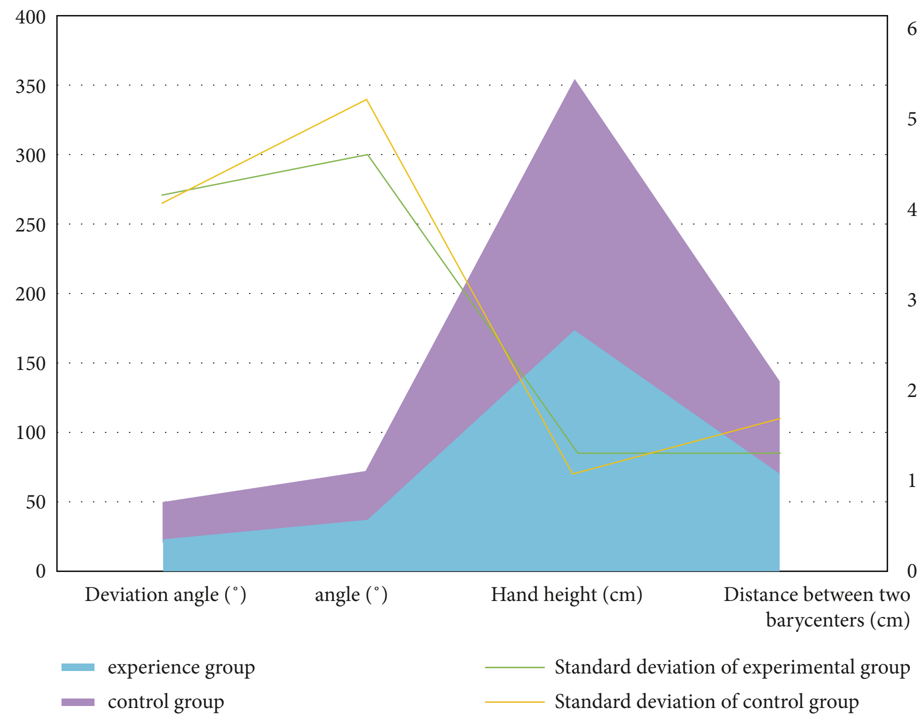


Figure 9: Analysis and comparison of javelin throwing techniques between the experimental group and the control group.

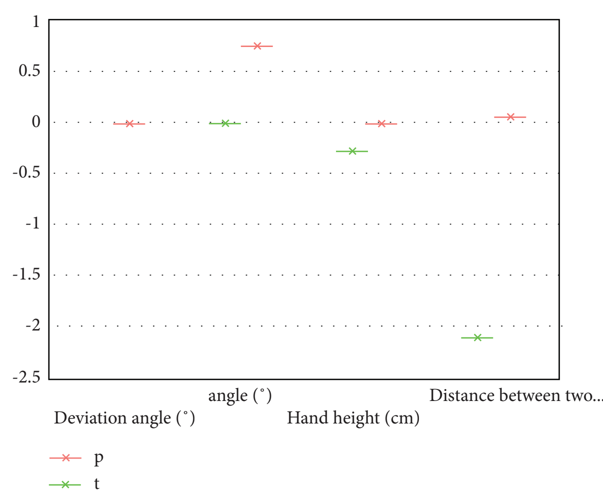


Figure 10: The corresponding T and P values of javelin throwing techniques in the experimental group and the control group.

results, there is no significant difference between the two groups, but the standard deviation of the students in the experimental group is smaller and the average value is higher, That means that the students in the experimental group surpass the equipment to complete better.

The position of these two figures has been adjusted. The test of T is a two-sided test. As long as the absolute value of T is greater than the critical value, the original hypothesis will not be rejected. P value is the probability of sample observations or more extreme results when the original hypothesis is true. If the P value is very small, it indicates that the probability of the occurrence of the original assumption is very small. If it occurs, according to the principle of small probability, we have reason to reject the original assumption. The smaller the P value is, the more sufficient the reason we reject the original assumption is. The release height and angle of javelin throwing are important factors that directly affect the final result of javelin throwing. Under the same conditions, the higher the release height and the closer the angle is to the best angle 32°, the better the final result. The hand heights of the experimental group and the control group were 174.48 cm and 173.65 cm, respectively, and the P value was less than 0.05, indicating that there were significant differences in hand heights between the two groups. The P value of the release angle of the two groups is greater than 0.05, that is, there is no significant difference in the release angle of javelin throwing between the two groups, but from the perspective of standard deviation, the standard deviation of the angle of the experimental group is smaller, the degree of dispersion is lower, and the gap between the students' release angle and the best angle is smaller.

5. Conclusion

Throwing sports have high requirements for athletes' movements and skills, while the traditional way of learning and training is mainly based on coaches' demonstration and explanation, and then athletes continue to carry out mechanized training. However, this training method is easy to cause athletes' throwing skills, action errors, lack of understanding of action skills, and so on. Video feedback system is the combination of modern equipment and feedback teaching theory, which can help athletes find the problems in the training process in time and correct them in time. Therefore, this paper proposes the application of video feedback system to the technical analysis and diagnosis of throwing athletes. Based on the formation principle of throwing athletes' action technology and the application principle of video feedback system, the random forest regression algorithm is used to construct the video feedback system. The experimental results show that the video feedback system can effectively help students improve their javelin throwing performance, and its performance growth rate is much higher than the traditional learning and training methods. At the same time, from the technical analysis results of javelin throwing movement, it is concluded that the javelin throwing movement formed by students' learning and correction through the video feedback system is more conducive to obtain higher throwing results, the javelin release angle is closer to the standard angle, and the release height, deviation angle, and center distance are more conducive to students' better throwing results. It further shows that the video feedback system can deepen the athletes' cognition of throwing skills, reduce the probability of wrong movements, and effectively correct the problematic movements. The video feedback system in this paper needs to be further improved. It is not discussed that students' forehand shots are prone to irregular movements, so as to analyze the throwing technology of athletes from more angles. With the development of modern equipment and technology, video feedback system can be gradually developed from single-line feedback system to multiangle feedback system in the future. Therefore, further research is needed.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this work.

Acknowledgments

This work was supported by Fundamental Research Project of Science and Technology Plan of Tangshan, Study on Planarization Technology of GLSI Multilayer Copper Interconnection, under 18130231a, and Doctoral Fund Project of Tangshan Normal University, Study on Planarization Technology of GLSI Multilayer Copper Interconnection, under 2018A02.

References

[1] F. J. D. H. V. Dorsser, W. F. Swanson, S. Lasano, and B. G. Steinetz, "Development, validation, and application of a urinary relaxin radioimmunoassay for the diagnosis and monitoring of pregnancy in Felids1," *Biology of Reproduction*, vol. 74, no. 6, pp. 1090–1095, 2006.

[2] M. J. J. V. Maarseveen, R. R. D. Oudejans, and G. J. P. Savelsbergh, "Self-controlled video feedback on tactical skills for soccer teams results in more active involvement of players," *Human Movement Science*, vol. 57, pp. 194–204, 2018.

[3] Y. Sun, L. Jiang, W. Chen, L. G. Cui, J. Jiang, and D. Ultrasound, "Application of case report evaluation and feedback system in ultrasonic resident training," *Basic & Clinical Medicine*, vol. 38, no. 10, p. 1502, 2018.

[4] S. E. Jordan, "The lacertus syndrome of the elbow in throwing athletes," *Clinics in Sports Medicine*, vol. 39, no. 3, pp. 589–596, 2020.

[5] Q. Z. Zhang, "Application of video feedback teaching method in senior high school sports specialized teaching," *Bulletin of Sport Science & Technology*, vol. 29, no. 6, p. 2, 2021.

[6] M. Kebin and L. Yan, "Research on the application of video feedback teaching method in the teaching of tennis elective courses in Colleges and universities," *Contemporary sports technology*, vol. 8, no. 32, pp. 170–172, 2018.

[7] J. J. Zeng and J. B. Lin, "Research and Analysis on strength training of middle school shot putters," *Sino foreign exchange*, vol. 7, no. 2, pp. 16–19, 2019.

[8] L. Han and J. Hu, "Construction and application of C language bug information collection and query feedback system," *Computer Era*, vol. 17, no. 3, pp. 80–86, 2019.

[9] H. Yuan, F. Liu, X. Li, Y. Guan, and M. Wang, *La Radiologia medica*, vol. 124, no. 1, pp. 1–7, 2019.

[10] X. Wang, "Application of video feedback in Taekwondo training and competition," *Contemporary Sports Technology*, vol. 9, no. 18, pp. 25–31, 2019.

[11] Y. Li, Z. Li, M. Ma, and M. Wang, "Generation of grid multi-wing chaotic attractors and its application in video secure communication system," *Multimedia Tools and Applications*, vol. 79, no. 39-40, Article ID 29177, 2020.

[12] F. Potdevin, O. Vors, A. Huchez, M. Lamour, K. Davids, and C. Schnitzler, "How can video feedback be used in physical education to support novice learning in gymnastics? Effects on motor learning, self-assessment and motivation," *Physical Education and Sport Pedagogy*, vol. 23, no. 6, pp. 559–574, 2018.

[13] J. D. Pang, "Research on the application of sports feedback system based on big data intelligent analysis in Middle," *School Physical Education*, vol. 11, no. 32, 2019.

[14] Y. Lu and Y. Li, "A novel fault diagnosis method for circuit breakers based on optimized affinity propagation clustering," *International Journal of Electrical Power & Energy Systems*, vol. 118, Article ID 105651, 2020.

[15] J. Qu, "Analysis on the application of video feedback in Taekwondo training and competition," *Sports fashion*, vol. 5, no. 12, pp. 1–6, 2018.

[16] H. Y. Meng, T. X. Lu, and D. H. Yang, "Design and application of sports training video analysis system," *Contemporary Sports Technology*, vol. 10, no. 35, p. 3, 2020.

[17] D. R. Bett, P. N. Burrows, and C. Perry, "A sub-micron resolution, dual-phase, bunch-by-bunch beam trajectory feedback system and its application to reducing wakefield effects in single-pass beamlines," 2020, https://arxiv.org/abs/2008.12738.

[18] Y. Z. Wang, "Research on the application of video feedback method to online teaching of tennis technology," *Sports research*, vol. 41, no. 5, p. 5, 2020.

[19] N. Li, H. Y. Zhang, and X. Y. Wei, "Application of mobile video feedback method in Football Teaching," *Journal of Hengshui University*, vol. 21, no. 4, p. 5, 2019.

[20] W. Wei and L. Yalong, "Study on treatment and rehabilitation training of ligament injury of javelin throwers based on sports

biomechanics," *Measurement*, vol. 171, no. 4, Article ID 108757, 2021.
[21] X. M. Lu, "Application significance of video feedback teaching method in basketball teaching and training," *Sports fashion*, vol. 8, no. 11, pp. 1–8, 2019.
[22] J. Zhang, "Application of video feedback training method in college tennis training," *Bulletin of Sport Science & Technology*, vol. 29, no. 5, pp. 21–31, 2021.
[23] T. Funakoshi, K. Furushima, H. Kusano et al., "First-rib stress fracture in overhead throwing athletes," *Journal of Bone and Joint Surgery*, vol. 101, no. 10, pp. 896–903, 2019.
[24] S. L. Zhang, B. Yin, and J. Y. Zhang, "Research on the role of video feedback teaching method in basketball teaching and training," *Sports World Scholarly*, vol. 7, no. 3, p. 2, 2019.