

Strength training technique for football players using image processing

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Abstract:

Artificial intelligence and Big data technologies are currently actively developing, which has a significant impact on various areas of activity, including the training of athletes. The article discusses the possibilities of using analysis of video images of the game process of football players and the development, based on the data obtained, of a strength training system to increase the efficiency of training young athletes

Keywords : Strength training, football, throwing power, image processing

تقنية تدريب القوة للاعبين كرة القدم باستخدام معالجة الصور

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خلاصة:

يتطور الذكاء الاصطناعي وتقنيات البيانات الضخمة حاليًا بشكل نشط، مما له تأثير كبير على مختلف مجالات النشاط، بما في ذلك تدريب الرياضيين. تتناول المقالة إمكانيات استخدام تحليل صور الفيديو لعملية لعب لاعبي كرة القدم وتطوير نظام تدريب القوة، بناءً على البيانات التي تم الحصول عليها، لزيادة كفاءة تدريب الرياضيين الشباب.

الكلمات المفتاحية: تدريبات القوة، كرة القدم، قوة الرمي، معالجة الصور

Introduction :

Currently, the active development of digital technologies has led to changes in various fields of activity, including in the process of training athletes. One of the promising areas of research that can be effective in building a training process is the analysis of images from football players' training and games using deep learning technology in order to identify possible areas for improvement.

Image analysis is used by coaches and players themselves to improve their skills and tactical preparation. It helps to identify weaknesses both in the individual play of an individual player and in the team as a whole. The use of such analysis training processes football players is one of modern innovative approaches that can increase the effectiveness of training and improve the team's performance results.

Modern technologies for analyzing images from game videos significantly improve the training efficiency of football players. They allow coaches and athletes to study and analyze every moment of the game, identify errors and find ways to correct them. One of the main analysis technologies is the use of specialized software that allows you to record and play back game situations at a slow pace, with different viewing angles and the ability to enlarge details. This allows football players to study their game in more detail, and coaches to identify the team's weaknesses and develop tactics.

In addition, image analysis technologies allow for comparative analysis of players, identifying their strengths and weaknesses, and generating detailed statistical reports. This helps coaches select the best team composition for each match and develop individual training programs for each player.

At present, this direction is quite new. It can be noted that studies on the recognition of human actions based on the analysis of video frames have been carried out previously, but in the field of sports such studies began to be carried out relatively recently. Most often, such studies are carried out in sports like basketball, badminton, field of football focused on way of movement of football players; not many studies are devoted to the study of images for the formation of a strength training system [10]. The complexity of such studies in football lies in the fact that there is no possibility during the gameplay to use special equipment through which movements will be recorded; in this regard, there is a need to use modern computer image recognition technologies to conduct a comprehensive analysis [8].

Within the framework of this study, the analysis of the practice of applying such analysis in the sports field available in the scientific literature is also of particular importance. This is an example of a recent study that was conducted by Z. Mei in 2023. The author presented the results of using an innovative approach, which is based on the analysis of 3D images based on artificial intelligence when studying the features of sports equipment, as well as training methodology [7]. As part of this study, the data of athletes was carefully studied, which made it possible to

form a deep understanding of sports technique and identify areas for increasing the effectiveness of the training process.

A similar problem was also addressed in the study conducted by Pastel et al. (2023) [9]. The authors presented convincing evidence of the effectiveness of training using virtual reality (VR) technology effectiveness mastering complex move. Using VR technology, researchers were able to successfully master quite a number of sports movements, thereby the authors presented innovative possibilities for modernizing the training process

P. Le Noury et al. (2022) [5] also contributed discussion possibilities of using digital technologies in sports training. In the study, the authors provide comprehensive review augmented reality (AR) technology use in sports. researchers examined current state development of AR technology its integration into sports. Based on the presented data, a forecast was made about the direction of further development of the designated technology in the sports industry.

A similar topic to this study is addressed in Deng et al. (2022). The authors attempted to intelligently process training process data using the capabilities of modern digital technologies [4]. The study showed the effectiveness of computer image and data processing technology, which led to the conclusion of its use for improved models of sports training.

Thus, the conducted research shows that the use of modern image processing and analysis technologies can be effective for modernizing the training process. In this regard, the possibility of using similar technologies in relation to the training of football players should be considered. Of particular interest is the application of the results of such studies to form a strength training system.

In all sports, movements are inextricably linked with the level of muscle development. Strong muscles play a critical role in stabilizing support body posture, motor skills, specific technical maneuvers in sports [6]. Thus, the main muscles take on a key function organiz harmonious integration of the actions of the upper and lower extremities [3]. In this regard, strength training of athletes in general and football players in particular is important for their successful sports activities.

artificial intelligence, problem training players effectively solved. Thus, based use image recognition technology, Training body strength functions based artificial

intelligence and CNN can be created, combining a network of temporal and spatial streams to create a system for positioning and movement of football players.

improve efficiency functional strength training for football players stability field detection football robots, first DL human action recognition are combined with background artificial intelligence to explore intelligent methods suitable football players.

As part of this study, to develop a special strength training program, an analysis of images from video of the gameplay of young football players was carried out in order to highlight the highest priority areas for additional work. Data collection was carried out using a special camera for video recording. After this, the video was converted into three-dimensional mode using a software package. The process of collecting a real-time video stream first required initializing a software development kit (SDK). Once video is obtained, computer used to compare the training actions video with the actions database obtain quantitative estimates of speed and strength.

In the field of image processing, there are currently several network architectures, convolutional neural networks (CNN), recurrent neural networks, and long short-term memory (LSTM) networks [1]. These architectures were used to conduct this study.

A CNN is a feedforward neural network that combines several different, including convolutional layers, fully connected layers, and pooling layers [2]. hierarchical feature extraction process inherent in CNNs unfolds through successive convolutional layers. complex mechanism captures local features images, evolving from elementary complex representations.

During processing, information about the actions of football players was collect and transmitted convert information into optical block diagrams action recognition, subsequent analysis [12]. Based on the results obtained during the study, the main directions of strength and speed development were identified for the experimental group. These studies made it possible to develop a strength training program for football players taking into account the results obtained. So the decision was made to conduct classes within the framework strength training.

Strength training approach training that aims improve individuals' strength muscular contraction based their specific. Unlike traditional training methods, target different areas body hips knees.

1- Purpose of study

The purpose the work was main goal strength training increase ability recruit more muscle fibers rather than focusing solely on muscle hypertrophy. approach uses elasticity body to create explosive force. By promoting activation multiple muscle groups optimizing neural coordination, strength training help improve maximal strength output.

concept training aims create a standardized training method can benefit athletes in a variety sports. It recognizes importance body's kinematic chain aims improve coordination functional performance. Through use strength training, individuals can reach their full potential improve physical performance in sports and other activities.

2- Method and Procedure:

The experimental method was used

2-1 Research Sample:

The study involved players of the Diwaniya football club aged 17-19 years. The experimental and control groups each included 10 football players from this club.

2-2 Tools and equipment used in the research:

- football stadium
- Footballs
- Metric tape measure
- Signs

- Colored adhesive tape
- A football goal with accuracy test squares on it
- Photography cameras
- var

2-5 main experiment

2.5-1 Pretest:

With the cooperation of the assistant team, study tests were conducted on Friday and Saturday at four in the afternoon at the Diwaniyah Club Stadium, and the study data was recorded.

2-5-2 Training Curriculum:

Functional training was carried out with football players from the experimental group for 4 months for 20 minutes as part of the training process. The following exercises were included in the training:

1. Lying on your back leg raises with your feet holding a soccer ball. purpose exercise work strengthen the rectus abdominis iliopsoas muscles.
2. Twist your hip while lying on your back, pressing your knees toward the ball. exercise strengthen hip flexors iliopsoas muscles.
3. One-sided plank. exercise work several muscle groups, including latissimus dorsi, erector spinae, gluteus maximus, deltoid, rectus abdominis, obliques.
4. Squats on one leg. exercise is work ' thigh muscles and quadriceps.
5. Leg swing while lying on your back with ball clamp. exercise rectus abdominis and iliopsoas muscles.
6. Leg crunches while lying on your back while grabbing a soccer ball with your feet. exercise train rectus abdominis iliopsoas muscles.

These exercises were included strength training program strengthen the rectus abdominis iliopsoas muscles. Participants can improve core stability, abdominal

strength, lower body muscular endurance by incorporating supine leg swings supine leg crunches head clasped feet.

To evaluate the effectiveness of the developed training system, control tests were carried out. Control tests were carried out before and after the pedagogical experiment in order to obtain quantitative information about the technical readiness of athletes. Before implementing the training program, control tests were conducted to determine the initial level of ability to perform lateral throws. After the pedagogical experiment was carried out, control tests revealed the presence or absence of positive dynamics.

2-3-2 Post-test:

when completing training curriculum components, research conducted the post-test for the experimental and control groups, in addition to taking performance data under the same conditions as the pre-test.

2-6 Statistical means:

The statistical package was used to analyze the sample data statistically

3- Present, analyze and discuss the results:

3-1 Discussing the results of the pre- and post-tests of the manuscript tests.

The results of control tests at the initial and control stages are presented in the table.

(Table 1)

Results of tests Dynamics of strength and speed testing indicators

Test	Group	Pretest	Posttest
30m high start run (s)	experimental	5,1	4,2
	control	5,2	5,1
Pistol squats (number of repetitions in 20 sec) on the opposite leg	experimental	32	38
	control	30	31

Pistol squats (number of repetitions in 20 sec on the left leg)	experimental	29	37
	control	28	31
Multiple jumps with change of legs by 20 m (s)	experimental	4,3	5,1
	control	4,2	4,5
“Squat rise” (number of repetitions in 20 s)	experimental	26	34
	control	27	29
Bending the torso from a lying position on the stomach (number of repetitions in 20 s)	experimental	25	37
	control	24	28

At the initial stage of the study, found indicators experimental control groups not have significant differences. At the same time, repeated diagnostics showed that in the control group no significant dynamics of improvement in indicators were identified. In the experimental group, positive dynamics can be noted after the implementation of the training program. Significant differences were identified in the following tests: 30 m run from a high start (Temp =10.7** at $P \leq 0.05$), multi-jump (Temp =11.2** at $P \leq 0.05$), bending the body from prone position (Temp =10.9** at $P \leq 0.05$).

4.1 Conclusions

Currently, digital technologies are actively developing, and the introduction of artificial intelligence systems into various fields of activity, including the field of sports training, has also been noted. The use of computer image analysis within the framework of the game and training process in football helps to increase the efficiency of training athletes and the formation of a training system in such a way as to take into account their abilities as much as possible and focus on the most problematic aspects. The results of control tests in the experimental and control groups showed that functional strength training, which was developed based on the data obtained during image analysis, is effective and helps to increase the effectiveness of the training process.

4.2 Recommendations

1. The use of image analysis technologies in the training process of football players significantly improves the quality of training and contributes to more effective development of players. Such technologies allow football players to quickly learn new skills, and coaches to better control the learning process and track the progress of each player.
2. Through the use of image analysis technologies, players can be more conscious of their play, and coaches gain valuable tools to analyze the team and develop effective strategies. These innovative approaches help you train at a higher level and achieve more meaningful results.
3. Development of functional training based on image analysis may include exercises to develop those skills that were identified as the most lagging during the analysis

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