Simulation Research on Optimized Recognition of Arm Movement Trajectory in Golf Training

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Abstract: in Recent Years, with the Rapid Development of the Economy, Golf Has Become Increasingly Important in Sports. Research on Golf Has Also Shown a Trend of Rapid Growth. Some Studies Have Shown That the Golfer's Arm Movement Track Can Effectively Improve the Athlete's Swinging Effect. Therefore, This Paper First Analyzes the Recognition Method of Arm Movement Track in Golf Training, and Simulates the Two Methods. the Result Shows That the Recognition of Arm Movement Track is Better When the Background Difference Method is Combined with Chaos Principle.

1. Introduction

1.1 Literature Review

In order to improve the skill level of athletes, relevant scholars have conducted in-depth research on the trajectory of athletes' arms. Luan Xiaofan pointed out that the CMOS camera and FPGA real-time video acquisition and processing display are used to track the movement track of the athlete's arm, and the three-frame method is used to further determine the athlete's arm movement trajectory. The comprehensive median filtering and simple spatial filtering are used to further solve the three-frame method and cannot overcome the random noise. Interference (Luan and Li, 2011). Zhou Feng et al. proposed a low-efficiency problem for large-scale complex blanks in CNC machine tools. An optimization NC program based on dynamic programming algorithm was proposed, and simulation software verification was carried out to improve the overall efficiency of CNC machine tools (Zhou et al., 2019). Wu Qiongxing pointed out that the three-dimensional garage is one of the main methods to solve the urban parking problem, so it can be optimized by establishing an optimized mathematical model. In this process, it is necessary to track the optimal turn-out trajectory of the single-dimensional garage, and then carry out the non-destructive expansion method of the parking space in a limited space. At the same time, Wu et al. used the trajectory tracking method for the best turn-out trajectory of the single-dimensional garage, which can also be used to identify the trajectory of the athlete's arm (Wu et al., 2017). Hu Fei et al. proposed a trajectory optimization algorithm based on vision guidance for the Delta-type parallel robot, which is used to capture the rapidity and stability of the robot during its operation (Hu et al., 2018). Fan Jiayu et al. optimized the path recognition algorithm based on infrared sensor smart car. It was found that the infrared sensor recognition can optimize the symmetry and approximate linear characteristics of the black trajectory characteristic curve, thus realize the recognition of the continuous path and enhance the recognition of the trajectory. The accuracy. At the same time, Fan et al. designed an improved PID algorithm that can control the trajectory and speed of the car, in view of the shortcomings of the traditional PID algorithm that cannot adjust parameters in real time. At the same time, the algorithm is tested. The results show that with the improved PID algorithm, the smart car can overcome the jitter phenomenon under high-speed operation, and the speed is also significantly improved, which indicates that the algorithm can effectively recognize the motion track of the object. (Fan et al., 2019). Xiao Yu used multimedia visual image to simulate the motion trajectory, and then proposed a multimedia visual motion trajectory recognition method based on artificial bee colony algorithm, which can binarize the moving target in the obtained image and can target the target image. The background is automatically updated to eliminate the effect of

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pseudo-targets on the trajectory (Xiao, 2018).

1.2 Purpose of Research

With the continuous development of computer information technology, image recognition technology has gained a lot of room for development and has a wide range of applications in sports. Among them, the application in identifying the movement track of athletes' arms in ball sports is more extensive. In golf, whether the athlete's arm movement is scientific or not will be related to the results of the golf competition. In order to improve the results of the golf game, it is necessary to identify and optimize the golfer's arm movement trajectory. In this context, the research on the recognition of golfer's arm trajectory has become a research focus in the field of golf. Previously, the relevant scholars pointed out that Kineet can obtain the three-dimensional data of the golfer's arm joint points, and judge and improve the data track. In the dynamic time regulation, the golfer's arm movement track is effectively recognized. However, this method is relatively simple and has large errors. Based on this, this paper combines relevant research to further study the identification of golfer's arm movement trajectory, in order to provide.

2. Athlete's Arm Movement Track in Golf Training

In order to obtain the golf player's movement process, it is necessary to obtain the key movements of the athlete's arm movement, and the value of each key trajectory feature trajectory, and draw it into the arm movement sequence diagram, and then construct the athlete's arm movement trajectory, and finally realize the athlete's arm movement trajectory. Identification map (Ding et al., 2018). In this process, you first need to obtain the distance between the different joints of the athlete's arm. Among them, a can be used to indicate the distance between the shoulder joint and the wrist joint, b is used to indicate the distance between the elbow joint and the wrist joint, and c is the distance between the shoulder joint and the wrist joint, and the following formula is further used to obtain different key points of the athlete's arm. The coordinates between (Wang and Chen, 2017).

$$\alpha^{\partial}(\Gamma) = \frac{\Phi(\partial) * X}{c * M(\alpha).b} * (\mathrm{Z}) \quad (1)$$

In formula (1), $M(\alpha)$ represents the distance between the athlete's left arm joint and the shoulder joint. $\Phi(\partial)$ represents the spatial variation range between the arm joint and the shoulder joint, X represents the vector between different joints, and Z represents the range of variation of the joint point when the athlete swings the arm. In order to accurately obtain the trajectory of the athlete's arm, it is necessary to assume a coordinate point $\eta(\mathrm{I}_d, \mathrm{I}_Y)$, which represents an arbitrary pixel of the athlete in a certain frame of the arm movement pixel map. Where I_d、I_Y represents the abscissa and the ordinate, respectively. In order to obtain the single-speed arm movement map of the golfer, the expression is represented by $\partial_n(\mathrm{I}_d, \mathrm{I}_Y)$, so that the corresponding data of the arm movement trajectory feature points of each subsequent frame of the athlete can be obtained by using formula (2).

$$\eta = \frac{\eta(\mathrm{I}_d, \mathrm{I}_Y) \otimes \partial_n(\mathrm{I}_d, \mathrm{I}_Y)}{\mathrm{I}_d \otimes \mathrm{I}_Y} * \alpha^{\partial}(\Gamma) \quad (2)$$

Among them, the focus of the end of the right arm is represented by (I_x, I_y), aiming at obtaining the image motion track feature point data of each frame of the right arm.

The above formula can explain that the athlete's arm movement trajectory can be recognized in golf training, and the mathematical formula can be used to identify the golf player's arm movement trajectory.

3. Using Chaos Theory to Identify the Track of Golf Teleporter Arm

3.1 Background Difference Principle

To identify the trajectory of the golf movement arm, it is necessary to combine the background difference principle to detect. In this process, the particle motion in the color histogram is mainly used to track the arm motion. First, u_t is used to represent the relative pixel point in the arm motion trajectory map, and u_{t+1} is the updated golf player's arm motion background image pixel point. The golfer arm motion sequence image can be detected by using formula (3).

$$u_{t+2} = \begin{cases} \mu_t, I_t(x,y) \\ \alpha\mu_{t+1} + (1-\alpha)I_t \otimes I_f \end{cases} \quad (3)$$

In formula (3), α represents the update speed of the updated background model, and I_f represents the corresponding pixel point mask value of the current frame of the updated golfer image. Among them, in the golf training, the athlete's arm movement track is in RGB, and when the arm skin color is yellow and skin color, the pixel points exhibit a large brightness. Therefore, the athlete's corresponding skin color brightness is indicated by v, and $x(p)$ is used to represent the back-projection image of the athlete's arm athlete's arm. In summary, the formula (4) is used to detect the two values of the golfer's arm movement trajectory.

$$v\_temp = \begin{cases} x(p) \otimes \eta(\beta) \\ v * \partial(\Upsilon) * r \end{cases} \quad (4)$$

In formula (4), it means that the images have different channels in RGB, $\partial(\Upsilon)$ represents the proportion coefficient of the skin color of the golfer's arm, and $\eta(\beta)$ represents the area where the skin color of the athlete's arm is located.

In summary, in the golf player's arm movement trajectory, it is necessary to combine the background difference principle to further detect the athlete's arm movement trajectory, and the particle tracking player's arm dynamics in the color histogram, which provides a sufficient reference for identifying the golfer's arm movement trajectory.

3.2 Chaotic Invariant

In the process of recognizing the golfer's arm movement trajectory, it is necessary to optimize on the basis of background difference theory. All the methods are named chaotic invariant principle. Specifically, in the process of recognizing the golfer's arm movement, it is necessary to spatially reconstruct the motion trajectory to extract the chaotic invariant of the athlete's motion process. The main step is to convert the motion trajectory of the three-dimensional space into a one-dimensional measurable variable. Use $\{x(i)\}$ to indicate the time required for the golfer's arm movement, τ to represent the time delay required for spatial reconstruction, and further calculate the delay and embedding dimension using equations (5) and (6):

$$\tau = \frac{\{x(i)\} \otimes N(\theta)}{\varpi.(\Sigma) * \Phi(\bar{\lambda})} \quad (5)$$

$$d = \frac{\{x(i)\} \otimes \xi}{\varpi.(\Sigma) * \tau} \quad (6)$$

In the above formula, $N(\theta)$ represents the separation speed between different actions of the athlete's arm movement trajectory in golf training, and ξ represents the norm between different actions. In order to obtain the trajectory map of the golfer's arm movement, it is necessary to reconstruct the phase space of the arm movement trajectory as follows.

$$X_i = \frac{(x_i + \tau) \in R_d(i) \otimes X_i}{\xi} \quad (7)$$

In formula (7), $R_d(i)$ represents the nearest neighbor point of the golfer's arm movement trajectory, indicating the distance between the arm movement trajectory point and the nearest neighbor.

3.3 Simulation Operation

In order to verify the background difference principle and chaos principle, the golfer's arm trajectory optimization method needs to be further verified by the test. Therefore, this paper constructs a golf player's arm movement recognition platform in the Matlab test environment. Among them, the test data is mainly from the 2012-2017 World Championships competition record. In order to obtain the golfer's arm movement track, the G.V16mm camera was used for the whole process recording. It can be seen from the photographs that the background difference principle and the chaotic principle are used to obtain the golfer's arm movement track recognition effect. Mainly due to the background difference principle and the chaotic principle, the particle filter of the color histogram is used to track the athlete's arm. In the tracking process, the background difference principle is integrated into the chaos theory, and the phase space of the golfer's arm movement track is reconstructed to ensure the effectiveness of the athlete's arm movement track recognition.

4. Conclusion

In summary, this paper mainly uses the background difference principle and chaos principle to identify the golfer's arm movement ghost. The test results show that the above two methods have a higher recognition degree of athletes' arm movement trajectory, which provides a strong scientific basis for improving the athletes' golfing skills in golf.

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