



Research on the Image Tracking of Tennis Rotation Features Under Big Data Analysis

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Abstract. Aiming at the problem of large error in tracking image data analysis in traditional image tracking system of tennis rotation feature, an image tracking analysis system of tennis rotation feature is proposed. The data are processed by holographic projection, the average constant of motion angle is optimized, the gate tracking algorithm is introduced to track the national standard of the image, and the threshold is calculated to realize the image tracking of tennis rotation feature. The experimental data show that the designed method can effectively track and analyze the tennis image, and solve the problem of large error in image data analysis.

Keywords: Tennis rotation feature · Image tracking · Gate tracking algorithm · Holographic projection · Data processing

1 Introduction

In modern tennis games, when the players are in the game, they have to judge the position of the ball each time they hit the ball. It can be said that whether they accurately judge the position will affect the quality of the return stroke to a certain extent. Only with accurate judgment, he can use the most reasonable and effective return action to hit a return ball of the highest quality, he can make his level play incisively and vividly and win the game. Therefore, the accuracy of the player's judgment of the direction of the ball hit by the opponent directly affects how to catch the ball in the game.

In tennis match, the angle of hitting, the coefficient of the ball in high speed movement and the contact with the beat speed make the tennis rotation in the sport. The tennis rotation will show a unique arc parabola of jumping, which gives people the beautiful track of tennis hitting technology. Tennis can be divided into four categories according to rotation and trajectory: the different rotating track types of tennis, up spin ball, bottom line ball and cutting ball 6 will show different flight curve, beating frequency and rebound angle. Therefore, to play the backkick which the opponent can not take precautions, it is necessary to judge and use different hitting techniques.

In order to effectively solve the problem of large error in tracking image data analysis, 3DLAN holographic projection technology is used and verified by comparative simulation experiment [1]. The accuracy of the designed tennis motion prediction trajectory direction automatic detection software is proved by experimental verification.

2 Design of Image Tracking and Analysis System

2.1 Data Processing and Analysis

In order to improve the data analysis ability of the image tracking analysis system of tennis rotation characteristics designed in this paper, we can accurately measure the radius, mass, rotation angle, speed and other constants and variables of tennis in the process of movement through holographic projection, and calculate the friction, wind speed and other influencing factors. The essence of this technology is to transform the imported measured data into a nonlinear function equation, and substitute the momentum factors such as threshold, difference and ratio into the formula, so as to simulate the trend of tennis and let the players play high-quality return strokes according to the trend. The index forms of specific change parameters are as follows:

$$z \begin{bmatrix} u \\ v \\ l \end{bmatrix} = \begin{bmatrix} \frac{1}{d} & 0 & u \\ 0 & \frac{1}{d} & v \\ 0 & 0 & l \end{bmatrix} \begin{bmatrix} R & t \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ l \end{bmatrix} \quad (1)$$

Where: Z is the number of pixels of the target tennis; u is the tennis characteristic coefficient; V is the speed of the tennis movement; it is the horizontal distance of tennis; D and D1 are the tennis radius and the deformation radius respectively. If there are n such pixels, you can get:

$$S = \frac{D}{T} + \frac{D}{\frac{D}{B} + n\Delta t} \quad (2)$$

By measuring the repetition rate, the image tracking analysis system of tennis rotation features can keep stable running state, and the clarity of image pixels has increased. In this way, the future direction of tennis can be determined from the data source. The calculation formula of error friction is:

$$f = \eta \frac{s}{h} V \quad (3)$$

2.2 Analysis of the Disadvantages of Fingertip Dynamic Process

In the process of fingertip tracking, the most important thing is the dynamic feature detection of multi frame image of fingertip. In the process of fingertip tracking, the role of fingertip is to identify the direction of finger movement. Because of the shape of the fingertip, in the detection process, the fingertip shape is used as the feature to obtain the coordinate position of fingertip, complete the tracking, and convert the color space of finger image into HSV mode, which is more conducive to the effective feature extraction, The new H component is analyzed to obtain the corresponding chromaticity map of the image.

$$q_u = \sum_{i=1}^n \delta[c(x_i) - u] \quad (4)$$

3 Experimental Verification

In order to verify the accuracy of image tracking analysis of tennis rotation feature, a comparative simulation experiment is designed. In this paper, the image tracking analysis of tennis rotation characteristics in the process of hitting in a training ground is carried out [2]. In order to ensure the effectiveness of the experiment, the design method and the traditional method are used simultaneously.

3.1 Parameter Setting

In order to ensure the accuracy of image tracking analysis of tennis rotation characteristics, the fluctuation limit h is set to 65.32; the peripheral kinetic energy $D \times 1$ of tennis is set to 9.3; the saturation value ab of the captured motion area is set to 10 and t to 50 in the range of [0.66130]. According to the parameters set by the simulation, experiments are carried out, and the results are as follows.

3.2 Acquisition and Analysis of Experimental Data

As shown in Fig. 1, the percentage of data frequency hopping is very high in traditional methods, and some data are more than 2.0%, which seriously affects the ability of data analysis.

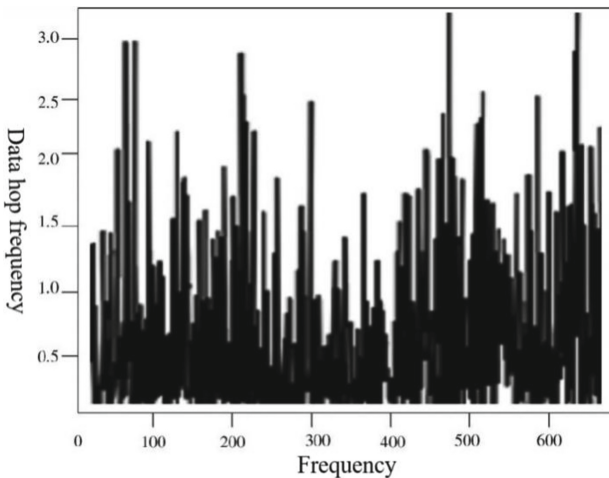


Fig. 1. Test results of traditional method

As shown in Fig. 1, the image tracking and analysis system of tennis rotation features designed in this paper can keep a low frequency hopping percentage of data, and the average data is below 0%, which indicates that the data is very stable and the analysis results are very stable, so the error will be very small.

4 Simulation of Fingertip Tracking Process Based on Image Processing

4.1 Introduction of Bayesian Classification Decision

In the current tracking process, multiple constraints are introduced, and there is a lag problem. Bayesian filtering method is used to filter the collected image features, that is, the known data information is used to construct the relevant posterior probability density of the state variables. According to Bayes' ability to simplify the multiple constraints, the optimal tracking process is completed. When the state of the fingers has different values, The confidence can be realized by observing data, so the optimal estimation of state is completed. It is assumed that the feature vector sequence of fingers is represented, K is used to describe the time series label, and the state vector is used to describe the time series. Then the spatial model of finger motion state can be described in the following formula. Corner is defined as the point with sharp brightness change or the point with maximum curvature on the edge curve of two-dimensional image. The detection algorithms include: corner detection method based on scale space, corner detection method based on multi-scale filtering, adaptive corner detection method, corner detection method based on template, corner detection method based on geometric features, and corner detection method based on minimum brightness change, There are four criteria to measure corner detection algorithm: accuracy, localization, stability and complexity.

4.2 Feature Extraction of Fingertip Detection and Tracking Process

Due to the consistency of human skin color, the probability of skin color can be calculated by constructing a color statistical model. Given that the likelihood distribution of fingertip skin color is represented by $P(R, G, B \text{ skin})$, and the distribution of non skin color pixels is represented by $P(R, G, B \text{ nonskin})$, then the probability of skin color of any pixel is calculated according to Bayesian law. The shape feature of an image is formed because the physical and geometric characteristics of the object make the gray level of the local area in the image change significantly [3]. The commonly used shape based feature extraction and matching methods can be divided into two categories: boundary feature, region feature and point feature. The boundary feature mainly aims at the outer boundary of the object, that is, the image edge, which refers to the set of pixels with step change or roof change in the gray level of the surrounding pixels; while the region feature is related to the whole shape region.

5 System Feature Model in the Field of Motion Tracking

5.1 Principle Explanation of Motion Characteristic Model

In software design of domain engineering, feature and feature model are used to capture the commonness and difference of systems in a domain in domain analysis. Feature refers to an eye-catching aspect, quality or feature of a software system or system that is

visible to the end user. Feature model consists of four parts: feature graph, feature definition, combination rules for features, and feature principle. Feature model in domain engineering is obtained by feature modeling, Feature modeling is the activity of modeling the common and variable attributes of concepts and their interdependencies, and organizing them into a consistent model, namely feature model. One of the characteristics of software engineering modeling is its representativeness in the field of software engineering modeling. The result of feature modeling is to generate a domain feature graph. The idea of feature graph is to explicitly represent the configurable aspect, and leave other aspects, such as structural modeling, to more appropriate symbols, such as entity relationship graph or object graph.

5.2 Domain Architecture Approach

In domain architecture, a full description of the software architecture requires multiple views. For example, the software architecture “4 + 1 view model”, which was promoted by rational methodology Philippe kruchten, contains a logical view (class diagram, sequence diagram, collaboration diagram, activity diagram, and state transformation diagram), a process view (process diagram), a physical view (package diagram), a deployment view (deployment diagram), and a use case model. When designing a software architecture, not only the functional requirements of the domain, but also the robustness, adaptability, scalability, reusability, etc. The practical purpose of domain oriented software architecture is to quickly answer how feature nodes in feature models are reflected as components, and clearly reflect the relationship between components, including the differences (configurable) covered by feature models. This paper will design the domain software architecture based on the domain model diagram, mainly including the component diagram, the domain configuration generator, the running process view of the system architecture, and the class diagram designed with MVC mode. Finally, through the above design aspects, a hierarchical structure diagram showing the whole software hierarchy is obtained, It provides a clear and accurate description for the reuse of the whole architecture.

6 Multi Point Fusion Correlation Tracking Algorithm

6.1 Research Status of Correlation Tracking Algorithm

In the field of motion tracking algorithm, correlation tracking algorithm is the focus of the research, and it is also a tracking algorithm with a wide range of application. The image sequence in motion tracking has temporal correlation and spatial correlation. The adjacent two frames have little change. The motion of the target is reflected as the change of the image. The relative position change of the target can be obtained from the change of the image. Therefore, it is an ideal method to track the moving target in the image by using correlation tracking.

Correlation tracking takes the region image containing the tracking target as the template, and then searches the sub image region specified by the wave gate to judge whether to find the matching region with the template according to some similarity

criteria. Because correlation tracking algorithm is a tracking method to directly find the closest region of the target template image in the image sequence, it directly performs the operation in the original image sequence, It can be used without the process of image segmentation and feature extraction, and is not limited by the shape, size and brightness of the target [4]. As long as the target has features, that is, the image has obvious gray changes in the region, it can be used, especially for large targets with obvious features and complex background.

6.2 Control Processing Explanation

In the control layer, the user generates the component configuration and sends it to the component function configuration generator of the model layer. In the control layer, the user sends the control command to the message manager through the tracking control command tool. If the message manager finds that it is a component function message, it sends the message to the component function executor of the model layer. In the model layer, the component configured by the user is called by the component function executor. When the component function executor calls the function of the corresponding component, it will call the component function configurator to determine whether the component function can be executed legally. If it can, it will call the specific component in the component library to respond to the specific message. In the model layer, tracking the component group will generate the moving object image data, The data needs to be transmitted to the tracking process display component in the view layer for tracking process display. The parameter solution component will generate the result data of the moving target parameter solution [5]. The data needs to be transmitted to the data table display, parameter curve display, data printing display and other components in the view layer for display or printing, Then new components can be added to the component library, so that the component library can be extended and reused.

7 Conclusion

In the process of fingertip tracking, it is necessary to set a large number of constraints on the background and foreground. The accuracy and efficiency of fingertip tracking using traditional algorithms are low. Therefore, a fingertip tracking method based on image processing is proposed. According to the Bayesian principle, the collected image is filtered, the posterior probability is calculated according to the Bayesian rules, and the constant is normalized, And through the establishment of color statistical model to calculate the skin color probability information, the fingertip tracking in the image region is completed. According to the relevant theory, the fingertip dynamic equation is constructed, so as to complete the fingertip tracking process. The experimental results show that the improved algorithm can improve the tracking accuracy and robustness, and provide strong technical support for the realization of human-computer interaction, It has great advantages.

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