Sports Video Moving Target Detection and Tracking Based on Improved Gaussian Mixture Model

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Keywords: Gaussian Mixture Model, Sports Video, Moving Target, Target Detection, Target Tracking

Abstract: Aiming At the Shortcomings of Current Sports Video Moving Target Detection, a Hybrid Model for Sports Video Moving Target Detection and Tracking is Proposed. by Analyzing the Shortcomings of Gaussian Mixture Model, the Original "Background Re Composition, Model Update, Background Update, Target Detection" Color Image Gray-Scale Image is Transformed into the Dynamic Background Field with Small Pixel Similarity. in Order to Improve the Efficiency and Accuracy of the Hybrid Model for Moving Video Targets, Gray Histogram Based Target Tracking is Added. Experimental Results Show That This Method Has Strong Interference Processing Ability for Sports Video, Large Detection Range, Good Detection and Tracking Effect.

1. Introduction

With the Frequent Development of Sports Events At Home and Abroad, Sports Teams Began to Use Information Technology to Improve the Competitive Level of Athletes. Detecting and Tracking Moving Video Target is One of the Most Common Methods. Target Detection is the Attribute Analysis of Moving Points in Video. This is Based on the Concept of Machine Vision, Which is the Main Condition of Tracking Target. However, Sports Videos Are Mostly Mixed with Instructions, Audience Voices, Natural Sounds, Strong Ambient Noise, and Many Moving Targets. Then, It is Difficult to Track the Moving Video Target.

From the Perspective of Sports Video Detection and Tracking, Relevant Research Institutions Have Conducted a Long-Term Study. in Reference, a Target Detection and Tracking Method is Proposed, Which is Based on Optical Flow Recognition Different from Acoustic and Field Closure. Analysis and Implementation of Tracking Strategy[1]. This Method is Suitable for Indoor Sports Competition, But Due to the Large Amount of Calculation and Long Detection Time, There Will Be Unclear Tracking in the Initial Stage. This Paper Introduces the Method of Adjacent Frame Difference Used in Moving Target Detection, Which is Small in Calculation But rough in Detection Result. the Tracking Process is Easy to Lose the Moving Target Point, Which is Often Used in Sports Events, with Simple Scenes; the Literature Uses the Background Difference Method to Act on the Time Domain of Sports Video, and Applies It to Sports Events in Simple Scenes with High Detection Efficiency and High Tracking Accuracy. the Advantages and Disadvantages of the Above Methods Are Great. Because It is Impossible to Extract the Attributes and Characteristics of Moving Objects Accurately through Light and Noise, It Needs Stable Algorithm and Mathematical Model to Extract the Attributes of Sports Images and Strengthen Them. Detection and Tracking Effect. the Hybrid Model Has the Ability of Self-Renewal, and Its Improvement is Consistent with Sports Video Mobile Target Attributes[2]. Based on the Improved Hybrid Model, a Method for Moving Video Target Detection and Tracking is Proposed.

2. Gaussian Mixture Model

Figure 1 is the Schematic Diagram of the Gaussian Mixture Model. It Can Be Seen That the Basic Process of the Model is Background Reconstruction, Model Updating, Background Updating, Target Detection, and the Allocation Rules of Multiple Gaussian Models of the Gaussian Mixture Model Are Collected. Then, the Image Pixel Attributes of Each Video Frame Are Extracted. Then,

  DOI: 10.25236/ISMHI.2019.038

the Similarity Test is Carried out. Target Square of Video Image.

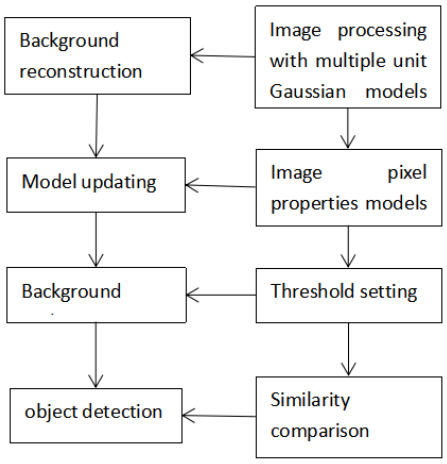

Fig.1 Working Principle of Gaussian Mixture Model

Suppose that there are K unit Gaussian models in the Gaussian mixture model, and each unit Gaussian model describes the motion trend of an image pixel X_t at the detection time t. The Gaussian distribution of image pixel x T is as follows:

$$P(X_t) = \sum_{i=1}^{K} w_{i,t}\eta(X_t, \mu_{i,t}\Sigma_{i,t})$$
$$\eta(X_t, \mu_{i,t}\Sigma_{i,t}) = \frac{e^{-\frac{(X_t-u_{i,t})\sum_{i,t}^{-1}(X_t-u_{i,t})}{2}}}{|\Sigma_{i,t}|^{\frac{1}{2}}(2\pi)^{\frac{n}{2}}} \quad (1)$$

Here, $w_{i,t}$ represents the allocation ratio of the ith Gaussian model at the detection time t. $\Sigma_{i,t}$ Gaussian mixture model is co dispersed. $\eta(X_{t,}u_{i,t}\Sigma_{i,t})$ is the Gauss probability distribution formula. Updating Gaussian mixture model means updating assignment ratio w_i and average I_t. The pixel coordinates of the image of the moving video are represented by the two-dimensional Cartesian coordinate system [3]. When I (x, y) satisfies the conditions given by equation , the image pixels of the point are considered. Coordinates accept Gaussian probability distribution.

D signa I_t Here, $\sigma_{i,t-1}$ represents the update rate of the Gaussian mixture model. If equation holds, then use equation to update the Gauss hybrid model, and $\sigma_{i,t-1}$ represents the learning parameters of the Gauss model.

If equation is not maintained, the Gauss hybrid model will directly delete the Gauss model whose similarity calculation result is the minimum. At this time, in $K_t = W_i$, t sports video, the mobile target occupies a small area. In general, the distribution ratio of background is larger than that of foreground. Therefore, the Gaussian mixture model has $W_{i,t}$ ratio. Then, the average UI and T are sorted by using the descending rule. Let B be the number of Gaussian distribution of the background, and let B be the number of frames. The formula of B is as follows.

$$B = \arg\min(\sum_{K=1}^{b} w_{i,t} > \xi) \quad (2)$$

3. Improvement of Gaussian Mixture Model

The Gaussian mixture model has the following defects: the model stops at the detection of sports video moving objects, does not describe the tracking process; the video image sequence and update rate are not considered carefully, and the interference of environmental noise and light cannot be excluded; the overall prior probability is inefficient for foreground detection.

Through the above analysis, the image sequence, update rate and background detection unit of Gaussian mixture model are improved, and tracking processing is added. The realization of sports video moving target tracking is very simple[4]. After detecting the foreground, the direction, volume and gray value distribution of the moving target are extracted and displayed on the gray histogram. The moving target is tracked in real time by using the global matching technology. Sports videos are usually color, large capacity and large amount of calculation. Displaying the moving video image on the gray scale is conducive to improving the update speed, so that the moving target can be found faster [8]. The ritual of transforming gray images into color images. Gray (x, y) = 0.11 R (x, y) + 0.59 g (x, y) + 0.3 B (x, y) (7): R (x, y), G (x, y), B (x, y) are the colors of the expression images on the red, green and blue channels respectively.

The moving target can not be detected in real time, and the tracking effect is limited. The premise of increasing the update rate $\eta(X_t, u_{i,t}\Sigma_{i,t})$ is not to disturb the accuracy of α, $\eta(X_t, u_{i,t}\Sigma_{i.t})$, i.e. dynamic expansion in the background area with small similarity difference of pixels, and to remove the foreground area from the background area. Extraction. After the dynamic expansion of the update rate ρ, the Gaussian mixture model with $\rho = \alpha X_t \eta(X_t, u_{i,t}\Sigma_{i,t})$ can be obtained, which can be improved by using the background detection method with all the prior probabilities. Background image updating method[5]. In the process of moving target detection and tracking in dynamic image, the background difference method of reference , high-precision and high-speed block is improved. Real time background comparison can be performed in background detection to reduce the occurrence of inter frame blur and detect moving targets quickly. In the improvement of the overall prior probability of the Gaussian mixture model based on the background image updating method, ξ is replaced by the pixel threshold θ of the background and the regular field. When θ is large, there are one or more peaks in the improved Gauss hybrid model, among which the peak gray values are generally different, and the interference of light and noise to the moving target can be seen.

4. Sports Video Moving Target Detection and Tracking Based on Improved Gaussian Mixture Model

4.1 Object Detection

In the improved Gaussian mixture model, in the unit , all pixels of the video image are detected for sports, and the final detection results are output from the initial successful detection results in descending order. The sports video is asymmetric, so the extraction uses the test results. At this time, the pixel thresholds θ of the background plate and the positive plate meet the count XT UI and t σ I θ to improve the average UI and T in the distribution ratio $W_{i,t}$ and Gauss hybrid model. The improved Gauss is based on the hybrid model of sports video moving target detection, and tracking, usually $W_{i,t}$ - specify $U_{i,t}$, but when the pixel value of sports video image is very high, it is the detection accuracy instead of efficiency must be centralized. At this point, t = UI, t = α.

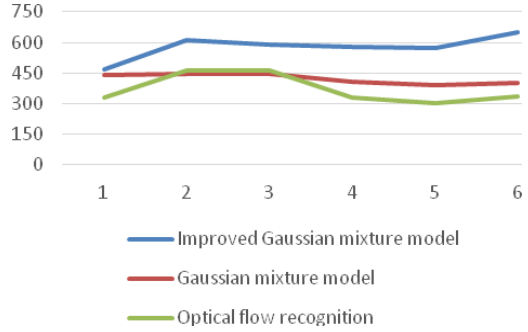

Fig.2 Interference Processing Capacity Verification Results

4.2 Target Tracking

Target detection results are input into gray histogram of target tracking. The simplest way to construct the gray histogram of moving objects is to sum up the total number of pixels occupied by moving objects[6]. However, this method can not accurately describe the contour of the moving target, can not obtain the specific behavior of the moving target, and the result has no tracking effect. User request . At this time, we need to increase the similarity between the moving object and the background of gray histogram, increase the gray scale of the background, and the proportion of the background close to the moving object is larger than the remote area. Here, the gray scale formula of background is expressed as $w^e = \sum_{i=1}^{B} \eta(X_t, u_{i,t}, \Sigma_{i,t}) \times x(r_i) / \sum_{i=1}^{B} \eta^{i-1}(X_t, u_{i,t}, \Sigma_{i,t})$, pixel distance function. $D_{\max}$: where is the distance between the middle point of the background pixel and the moving target pixel. After gray scale-up processing, in gray histogram, the moving video target detection and tracking method based on the improved Gauss hybrid model only needs to track the target with high similarity. This method is not complex and it is not easy to lose the moving target point. These similarities are calculated by $\varphi（w^e, k) = \sum_{i=1}^{B} (w^e k)^{\frac{1}{2}}$.

5. Experimental Verification

Taking the video of Tennis League as the experimental sample, the image resolution is multi-mode. Experiments related to the processing and display of images, data and icons are carried out on a computer. The computer is a dual core, 4GB RAM (run's rim access memory) and win 7 system. Vs uses programming 2010 and cv2.0 for data programming. Using photon flow recognition method, Gaussian mixture model method and improved Gaussian mixture model method, the moving target (tennis track, player behavior) is detected and tracked. As shown in Figure 2, the verification data of multiple methods of interference processing capability is extracted from the definition of moving target of tracking resul[7]t. The improved Gauss hybrid model has the highest image sharpness, and shows strong interference processing ability in the former Gauss hybrid model. The model saves the details of the moving target and eliminates the non moving target. Good tracking effect is obtained.

The verification of extracting the detection range from the position coordinates of the correct moving target in the detection results. it can be seen that the detection result of the moving object of the moving image in the method is complete, there is no blank point, and the detection range is large. The detection effect is good.

The experimental data in Fig. 1 and Fig. 2 show that 3D VR reconstruction of multiple image information feature points can achieve the accuracy and stability of high ground reconstruction related to the stability of the algorithm. There has been a lot of improvement.

6. Conclusion

In this paper, it is difficult to build the existing 3D reconstruction technology environment, which has high cost, low flexibility, and is difficult to adapt to the dynamic changes of building model objects[8]. The method of obtaining the device image through the camera is used to reconstruct the feature points of the small area target [9]. The method of extracting space calculation by matching and 3D VR reconstruction has the advantages of simple image acquisition, extracting feature point information and limited application range[10]. It has a broad application prospect in the field of small area target reconstruction using 3D VR technology.

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