Application of Segmentation and Tracking Algorithm in Basketball Video Image Processing

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Abstract: Segmentation and tracking are always hot issues in video image processing. Aiming at the fierce movement of basketball video, a real-time segmentation and tracking algorithm is implemented. First of all, the general partition method is different. The real-time partition and background update of the two levels (pixel level and frame level) are based on the background subtraction method, and the player partition is implemented. Please use the core based target tracking method to identify team members of athletes, and then achieve accurate tracking of athletes in the fierce competition. The proposed algorithm shows that it can fully identify the team problems of each player, track multiple players without complete blocking, and track stably when the shape of player changes greatly.

1. Introduction

Tracking multiple video sequences is very important in many areas, such as video surveillance and sports video, because people are the main actors in daily activities[1]. The processing of ball games (football, basketball, etc.), through interactive TV broadcasting, auxiliary training, automatic analysis of ball video, solution of misuse, generation of 3D animation, etc., in order to be able to use.The court's players are non rigid bodies with different postures. Moreover, players often have conflicts and block each other during the competition. It's hard to complicate and solve the tracking problems of all these players. In football video clips and tracking players, firstly, according to the statistical information of color component differences of players from video clips, the literature automatically makes statistics according to the function of green special color on the football field. But the color of the basketball court is different. On the contrary, the court has several colors. In the same court, the third line, the third second zone, and the center of the court are very different[2]. At the same time, the fans will appear in the video picture, because the fan seat is close to the stadium, so as to better carry out the fierce competition. Their clothes may be the same color as the player's Jersey, and their movement makes it difficult to distinguish between the background and the foreground. It is difficult to track video images of all of the above clips. The background difference method is used. This method is based on background modeling of mixture or pixel value distribution, but real-time division and background update level 2 (pixel level and frame level). This is to avoid the problem of high computational complexity and low adaptability caused by the change of background model caused by Gaussian mixture background modeling. Identifying team members is also a basic step in basketball video processing. It plays an important role in studying the game of strategy and tactics and grasping the players. In this paper, groups are identified by comparing the distance between groups and templates. The method is simple and effective. Secondly, the kernel based target tracking algorithm is used to track players in the game[3]. The kernel based target tracking method is an effective non rigid target tracking method. This is the similarity measure between the target reference template and the target in the current frame image

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as the Bhattacharyya coefficient. The target in the current frame is used for the repeatability detection of the local maximum value of the actual position distance function. In this way, players can track with the right intense basketball game.

2. Player Segmentation

For player segmentation in dynamic background, background subtraction is used. This method is not a background modeling method based on Gaussian mixture model or pixel value distribution, but a two-level (pixel level and frame level) background maintenance algorithm for real-time segmentation and background update. This is to avoid the problem of high computational complexity and poor adaptability to the background model[4]. The basic idea of pixel level background update is based on the assumption that the pixel value of the moving object changes faster than the actual background object. Fortunately, in the fierce basketball game, this assumption is feasible[5]. Dynamic matrix D (k) is introduced to analyze the change detection results of frame difference method. The motion state of each pixel is stored in a matrix. Only those pixels whose values do not change much will be updated to the background. Although the pixel level background update method can deal with many problems mentioned above, it ignores the motion information in the frame. Framework level updates are used to solve this problem. In the case of sudden scene changes (such as light changes), the mechanism uses the transmission characteristics of the entire image a to complete fast background update.

$$A = \frac{\sum_{j=1}^{n}\sum_{i=1}^{m} F_{i,j}(k)}{m \times n} \tag{1}$$

Where m, n represent the width and height of the image. Once it is less than the design threshold, it is determined that there is no moving object in the current image, and the background is to immediately update the fixed pixel of the current frame using formula (3), pixel level fusion and frame level detection results, and the background update process maintains a good background model under different circumstances. In the background subtraction phase, each video frame is compared with the reference background model. In the current frame, those pixels that deviate significantly from the background will be detected. Then we use morphological filter to remove the noise, get the position of the moving object, and transform it into the original subtraction image to get the accurate final segmentation results.

Figure 1 Background clipping image using morphological filter

3. Team Identification

When the player first appears in the video sequence, identify and identify which team he belongs to, and then add it to the tracking queue. Because the dress of the referee is different from that of other players, when determining the identity of the players, the referee can be dealt with individually. Apart from the referee, the players on the field are divided into two teams. In the same match, the color of the clothes of the two teams is very different[6]. There are many ways to

identify team members. This paper adopts a very simple method, which has been proved to be very effective by experiments. For each team, select a typical player oval area as team template Q through human interaction from a certain frame of video sequence. Compare the distance DM of player I with template Q to get player I. The distance between Q and I is defined as:

$$D_{Q,I}^{M} = | f_Q - f_I | = \sum_{R,G,B} | \mu_Q - \mu_I | \quad (2)$$

If DM is less than a specific threshold T, then DM is determined to belong to the group. When the candidate block includes two different groups of athletes, the templates of the two groups are used for template matching of the oval area where the candidate block is located.

4. Player Tracking

Basketball video is shot from a fixed position, where you can turn left and right. In addition, the players are non rigid body, and their posture will also change[7]. All of these make the shape of the player of video image variable, and it is difficult to find the consistent and correct template. To simplify the process, an elliptical region on the image corresponding to the player is used as a template.

4.1. Target Templates and Candidate Blocks

It is assumed that the point set of the target region is N, the center of the target region is X_0, and normalized according to the region size H. The color distribution is divided into B bins, histogram function $B(X_i) = R_2 \rightarrow \{1,2,m\}$, quantizing the pixel color value at the pixel x I and assigning it to the corresponding bin. Then for the reference target template whose center is X_0 the color probability distribution $Q_u = \{1,2,m\}$ expressed.

Where h is the target area size and δ is the Kronecker function. Kernel function K_X is a monotonically decreasing convex function used to assign weighting factors to N pixels in the target region[8]. The further away from the center, the lower the weight. In the actual tracking, the similarity relationship between the target template and the candidate template can be established by using the similarity measure of the color probability distribution P and Q. The most effective measure of similarity is Bhattacharyya coefficient. Repeat the average displacement process to find the maximum value of the nearby density estimate to indicate the maximum direction of the density that the average displacement vector always increases.

4.2. Tracking Algorithm

According to the description of the above algorithm, for a given target model, the target position of the current frame is the maximum value of Bhattacharyya coefficient in the last position estimation field. However, the size of the target often changes in real time. Therefore, the kernel function of bandwidth h of formula (8) must adapt to this situation.

4.3. Experimental Results

The system is written with VC and runs on 512MB memory and 2.8GhZ Intel Pentium 4 computer. The video image size is 640 × 480, a total of 132 frames. In the second chapter, the system uses methods to correctly identify the problems of each player team[9]. When the player enters the video again, the system can recognize it again, but when the player is completely annihilated by other players, the system cannot recognize the team of the player. The system uses player tracking algorithm to track multiple players more accurately in the fierce basketball game[10]. At frame 112, as the game entered its strongest stage, the system lost some targets, and computer resources were consumed continuously.

5. Conclusion

2 level (pixel level and frame) level background maintenance algorithm is used for real-time

division and background update, complex high-speed mobile players for frequency band, and horse like distance on specific template player comparison according to the team's decision. The core based athlete tracking algorithm can track more than one basketball player more accurately, but if the player is completely blocked, the system can not recognize and track the player. Considering the spatial relationship between players, the next work of FGT is to identify and track players. Meanwhile, FGT is used to reduce the calculation of the system and improve the tracking performance of the system. It doesn't need to be completely closed. It can track multiple players. It can track players when their shapes change greatly.

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