Research on Moving Object Detection Based On Probability Statistics Adaptive Background Model of VR Tech

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Abstract. The detection of moving objects often has a high value utilization demand in real life, but the current detection methods of moving objects still have some problems and shortcomings, which need to be further optimized and ameliorated. On account of this, this paper first analyses the common methods of moving object detection, then studies the probability statistics adaptive background threshold selection method on account of VR, and finally gives the construction strategy of background model on account of pixel statistics and probability.

Keywords: Moving Object Detection, Probability Statistics Adaptive, Background Model

1. Introduction

With the iterative progress and maturity of computer tech, it has been widely and deeply studied and popularized in many fields, especially the utilization of computer tech represented by VR in adaptive background model target detection, which greatly ameliorates the detection accuracy and level of probabilistic adaptive background model [1]. Adaptive background model, moving object detection, real-time detection and segmentation of moving objects and other key technologies have been gradually applied in several fields as shown in Figure 1.
| Methods       | Advantages                                                                 | Disadvantages                                   |
|---------------|-----------------------------------------------------------------------------|-------------------------------------------------|
| Time average  | Low memory requirement and fast processing speed                            | It will pollute the background                   |
| Inter frame difference | Multiple moving targets                                                     | Update rate is not easy to choose                |
| GMM           | The operation speed is ameliorated                                          | Multiple Gaussian mixture distributions are required |
| KDE           | Can adapt to different scenes                                               | A priori knowledge of the scene is required      |
| Adjust threshold | Get relatively good classification results                                 | It will bring classification error               |

**Figure 1.** Utilization scenarios of moving object detection on account of adaptive background model

The current moving target detection methods mainly include time difference, background subtraction, statistical features and optical flow, as shown in Table 1 below. Although these detection methods have their own multi characteristics, there are still some problems and shortcomings, which need to be further optimized and ameliorated, so as to ameliorate the accuracy and effect of adaptive background model moving target detection [2]. Draw support from VR tech, the method of detecting moving objects from video sequences has been widely used in the field of intelligent vision monitoring and human-computer interaction vision, which can realize the efficient detection of static and moving objects [3]. Usually, the moving object of adaptive background model usually uses background subtraction, and the moving object appears in the background.

**Table1.** The features of moving target detection methods

In addition, because the natural scene can be regarded as a continuous changing image sequence, the detection of moving objects often has a high value utilization demand in real life. Moving object detection on account of probability statistics adaptive background model of VR tech mainly uses computer vision to realize fast and accurate recognition and monitoring of moving objects [4]. Through the accurate recognition, extraction, tracking and analysis of moving objects from sequence images, it lays a foundation for the utilization in complex scenes.

In a word, the detection of moving objects on account of the probability statistics adaptive background model of VR tech can make a significant contribution to the scientific development and progress of social economy, and accelerate people's life order to be more harmonious and solve problems. Using VR tech to effectively distinguish meaningful moving objects from massive video images is mainly to use computer to simulate human vision to process video images, and extract complete and interested moving objects from the video images [5]. The tech also needs to minimize the interference of noise on moving target detection. Therefore, it is of great practical value to study the probability statistics adaptive background model for moving object detection on account of VR tech.
2. Common methods of moving object detection

2.1. Utilization value of moving object detection

Moving object detection and tracking has a strong practical value; especially the moving object detection which can adapt to the background model has been gradually applied in the fields of video surveillance, video image compression, intelligent transportation, human-computer interaction and industrial detection [6]. The general flow of moving object detection method is shown in Figure 2.

![Figure 2. The general flow of moving object detection method](image)

In the level of video image preprocessing, it mainly uses color image graying; image smoothing filtering, including median filtering, neighborhood mean filtering and Gaussian filtering.

2.2. Mean filtering method for moving target detection

The average filtering method uses the average value of the L frame before the current frame as the background [7]. First, it creates a storage space that can store the L frame image, and then calculates the average of the pixel values at the same position of the L frame image. Namely:

$$b(x, y, t) = \frac{1}{L} \sum_{l=0}^{L-1} I(x, y, t - l)$$  \hspace{1cm} (1)

The advantages of moving target detection mean filtering method are low computation and high speed. It is widely used when there are real-time requirements and accuracy requirements are not high. However, it has the disadvantages of high storage space requirements and low-speed objects may appear empty.

2.3. Moving object detection on account of adaptive background model

Adaptive background model moving object detection is to take the first frame of image $I_0$ without moving object as the background $B_0$, select the threshold $T$, and calculate the difference image of the current frame, as shown in the following formula 2.

$$f_t = \begin{cases} 
1, & |I_t - I_{t-1}| > T \\
0, & |I_t - I_{t-1}| \leq T 
\end{cases}$$  \hspace{1cm} (2)
Update background image $B_{t+1}$ from binary image to get the following formula $f_t$, where $\alpha$ is an arbitrarily selected adaptive parameter whose value directly affects the update quality of image background.

$$B_{t+1}(x, y) = \begin{cases} \alpha \cdot B_t(x, y) + (1-\alpha)I_t, & f_t = 0 \\ B_t(x, y), & f_t = 1 \end{cases}$$

(3)

2.4. Shadow removal method

For shadow elimination in RGB color space, any color in RGB color model space can be composed of $R$, $G$ and $B$ primary colors according to a certain proportion, and the pixel brightness value in shadow area is generally smaller than that in non-shadow area, especially the $R$ and $G$ color components are generally smaller, so shadow elimination can be carried out according to this difference. For shadow elimination in HSV color space, when image processing in HSV color space, the three values of $H$, $S$ and $V$ are not taken as the judgment parameters [8]. The brightness $V$ of the parameter image is mainly considered, and shadow elimination is carried out in turn, which can well reflect the corresponding info for the extremely bright and dark objects in the image. Shadows do not significantly change the chromaticity of background points, but usually reduce their brightness and saturation, as shown in equation 4 below.

$$\begin{cases} 1 & |H_t(i, j) - H_{bg}(i, j)| \leq T_h \\ \text{and} & (S_t(i, j) - S_{bg}(i, j)) \leq T_s \\ \text{and} & \beta \leq \frac{V_t(i, j)}{V_{bg}(i, j)} \leq \gamma \end{cases}$$

(4)

3. Probability statistics adaptive background threshold selection method on account of VR

3.1. Probability statistical histogram analysis

KDE probability histogram itself has regularity, which has nothing to do with the scene of the moving target and the difference between the moving targets itself. On account of the regularity of KDE probability histogram, the background threshold can be adaptively selected to calculate the pixel probability of the target image. First, the probability sum of a certain number of samples is calculated. Secondly, after determining the maximum and minimum possible values of the kernel width, the maximum and minimum values of the sum of multiple sampling probabilities at a certain time are determined, and the exponential term is determined [9]. Finally, by traversing the probability of moving target pixels, the probability distribution histogram of probabilistic moving target can be obtained.

In addition, the probability distribution of pixel value is an intuitive reflection of the similarity with the background. Generally speaking, pixels with the same motion characteristics should have the same
or similar probability. The probability value of pixels that are different from the background is low, and vice versa. And the peak value of probability histogram is directly related to foreground and background targets.

3.2. **Adaptive threshold selection method for foreground and background**

Firstly, in the process of adaptive foreground threshold selection on account of probability statistics, the regularity of probability histogram in the foreground can be used to guide the selection of background threshold, and vice versa [10]. If the probability of histogram pixel value is low, it means it belongs to foreground pixel; if the probability of histogram pixel value is high, it means it belongs to background pixel. For the case between the two, it shows that it is in the transition state from the foreground to the background. Secondly, in the transition state, the moving target is changed to the background, and the latter has the background to become the moving target.

In addition, in the process of adaptive background threshold selection on account of probability and statistics, the selection of adaptive background threshold cannot be too large or too small. If the threshold is too large, the pixels will be misjudged, and the pixels will not be updated to the background. If the background threshold is too small, the foreground pixels will be mistakenly used as the background, thus reducing the detection accuracy of moving objects. Therefore, we need to segment the background threshold to make the area of the background more fit with the real background.

4. **Construction of background model on account of pixel statistics and probability**

4.1. **Background updating model on account of pixel statistics**

By updating the historical statistics of pixels, the background changes caused by moving in and out objects can be effectively reduced. Secondly, the probability of the pixel value is positively related to the similarity of the background points, so the probability can be used to update the background model to better reflect the change of the background. When the moving object is in the state of moving in or moving out, the part will not be updated to the background. If it is not handled properly, the foreground will be missed detection. Therefore, we need to classify the pixels first, and count the probability of their occurrence, and update the pixels with higher probability as the background to the background sample.

4.2. **Innovation strategy of college art teaching on account of multimedia tech**

Draw support from super-pixel segmentation, the pixels with similar color, brightness, texture and other features in the image are divided into independent image blocks belonging to the same target. These adjacent super pixels have texture similarity. Through the super-pixel fusion of these image blocks, it is helpful to realize the integrity optimization of the moving target region. Firstly, it should to segment the super-pixels. Secondly, it should measure the similarity of the super-pixels. All the super-pixels are divided into two categories: moving object and background. The missing regions in the moving object are fused organically.

5. **Conclusion**
In summary, draw support from VR tech, the method of detecting moving objects from video sequences has been widely used in the field of intelligent vision monitoring and human-computer interaction vision, which can realize the efficient detection of static and moving objects. This paper analyzes the principle of adaptive background model moving target detection by studying the common methods of moving target detection. Through the analysis of the probability statistics adaptive background threshold selection method on account of VR, the adaptive foreground and background threshold selection method is studied. Through the research on the construction of background model on account of pixel statistics and probability, the strategy of background update model on account of pixel statistics is analyzed.

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