ISSN 2616-7433 Vol. 2, Issue 6: 88-92, DOI: 10.25236/FSST.2020.020619

Conception of Campus Security Surveillance and Alarm System Based on Moving Object Detection

Wang Qian

Xi'an Institute of Aeronautics, Xi'an 710077, China

ABSTRACT. *In the massive amount of surveillance video data, users only need to extract a small amount of useful information of key events, and these events are only small-probability events. How to obtain the information you want from a huge amount of data, or how to achieve intelligent monitoring of the events that have occurred, has become a new research direction for security surveillance systems. This article explores an optimized object search calculation method for a hybrid Gaussian model. This calculation method uses the background difference method to find moving objects, and uses an optimized hybrid Gaussian model to reconstruct the background picture, which significantly improves the recognition accuracy of moving target detection. In the past, monitoring only stored audio and video without alarming itself. The situation has changed, which makes the security monitoring system able to provide real-time alarm messages for the school's security staff on duty, and it is hoped that the campus's emergency response capabilities can be significantly improved.*

KEYWORDS: *Video surveillance, Hybrid gaussian model, Moving target detection*

1. Introduction

Campus security is an important project of the school. The security monitoring system is a very important part of the school security system. It is responsible for monitoring campus, accident alarm, PTZ control, historical video storage and other functions. It is an essential part of modern campus security. At present, the limitations of the traditional digital monitoring system in terms of function and performance cannot meet the requirements of campus security. This article studies more ideas for the design of campus security monitoring and alarm systems, according to the various security requirements of the system by users. To set up the general direction of a system, conceive and design a campus security surveillance alarm system based on moving target detection to improve the efficiency of monitoring.

2. Common Calculation Methods for Moving Object Search

2.1 Frame Difference Method

The frame difference method is to process two or three frames of monitoring images next to each other. It divides the image area by thresholding the image pixels and uses time difference to operate. A subtraction operation is performed on the next two frames of monitoring photos to obtain a difference image, and the image is binarized. When the light change is relatively small, the impact on the surrounding environment is not large. In this case, assuming that the preset threshold is greater than the corresponding pixel value change, the place is set as the background pixel; if the preset threshold corresponds to the corresponding The magnitude of the change in the pixel value is much different, so the place is determined as the foreground pixel. These areas are usually caused by the motion of the object and are also the range of motion of the moving target. These pixel regions are labeled to obtain the position of the moving target in the image. The frame difference method has many advantages: Generally, two adjacent frames are selected, so the time interval between the two frames is very short. For the next frame image, the previous frame image is its background model, so that the background model can Live Update. And because the background is constantly updated, and the speed is fast, the time overhead of the algorithm is small.

Of course, the frame difference method also has the following disadvantages: the threshold selection affects the efficiency of the algorithm. If the selected threshold is small, the background noise will be difficult to remove, and the final result will cause the false detection of the moving target. Easy to cause missed detection of moving targets. When the moving target is large in size and the color is the same, the frame target method is

ISSN 2616-7433 Vol. 2, Issue 6: 88-92, DOI: 10.25236/FSST.2020.020619

used to detect the moving target. There are many holes in the detected auto-standard, which causes the extracted moving target to be incomplete.

Kalimov, A.G., & Svedentsov, M.L.Proposed a three-frame differential moving object search calculation method based on OpenCV.[1] This algorithm can avoid the interference of lighting changes when searching for moving targets in the background difference method, and also solves the “double shadow” and The “hollow” problem has a strong anti-interference feature, which can more completely obtain the moving target, and find the moving target in a series of monitoring photos.

2.2 Optical Flow Method

The optical flow method can be considered to be mainly the calculation of the optical flow field. Under certain constraint conditions, this constraint condition is the appropriate smoothness of the motion field. The image sequence is analyzed to estimate the motion field of the spatiotemporal gradient. After obtaining the sports field, it is necessary to analyze the changes of the sports field, and then perform effective detection and correct segmentation of the image. In the absence of background information, the optical flow method can effectively detect moving targets and can process the moving background. However, if the detected background environment is more complicated, such as a lot of noise, multiple light sources, large shadow changes, and occlusions, these conditions will affect the calculation of the optical flow method, and the calculated results will be inaccurate. . In addition, the optical flow method calculation is relatively complicated, and the calculation amount is large, and the calculation result cannot be fed back in real time. The optical flow field is a vector field. Through calculation of the vector field, the vector describes the change in the intensity of the pixels of the detection image, and performs certain operations on the two adjacent frames, and finally calculates the optical flow field.

The L-K method proposed by BruceD. Lucas and TakeoKanade, this method makes an assumption that the optical flow value is fixed in a local area of the pixel, and a set of optical flow equations is established from this equation[2].

McCane and K. Novins proposed an algorithm to detect the effect of optical flow method. This algorithm synthesizes a series of image sequences to detect the effectiveness of optical flow method. This study tested a variety of optical flow methods, and the results proved The image sequence can verify the effectiveness of the optical flow algorithm [3].

Horn and Schimck proposed a new optical flow method. This algorithm used GPU parallelization to solve the problem of excessive calculation of the optical flow method and made effective improvements to the optical flow method [4].

MichaelTao and JiaminBai proposed a new method to estimate the optical flow field [5]. This method uses a sparse subset of samples to estimate the optical flow field. It also solves the problem of excessive calculation of the optical flow field. From the above, it can be seen that there are many shortcomings in using the optical flow field to calculate: the optical flow method only records the pixels in the image, and does not indicate the connection between the pixels of the observation target. The optical flow field locates the position of the moving target, and the position of the target pixel point that changes with time. All parts in the selected area are positioned as tracking targets, and rectangular windows are selected for overall tracking. For irregularly shaped moving targets, the tracking accuracy is not enough.

2.3 Background Subtraction

The background subtraction method is to distinguish moving objects through algorithm calculation from a picture taken as the background, and subtract the foreground image and the background image to obtain the moving target area. It uses a parameter model of the background. This model is similar to the pixel value contained in the picture used as the background. The current video frame picture and the background picture are used for differential calculation to obtain the purpose of detecting moving objects. The range of the moving object in the pixels of the picture is generally the pixel range that changes significantly, and the range that is not the moving target is generally the pixel area with less change. Background subtraction collects a specific image in advance as the background. During the running of the algorithm, the background image is constantly replaced by new images. This new image replacement is caused by the light exposure and the update of external factors. Therefore, Background modeling and his constant image substitution are very important. It is not easy to establish an adaptive background model. Many scholars are studying this aspect of the problem. They must adapt to real-time changes in various scenarios and be able to keep up with the changes themselves. There have

ISSN 2616-7433 Vol. 2, Issue 6: 88-92, DOI: 10.25236/FSST.2020.020619

been many improved algorithms that can be divided into two categories: non-regressive and recursive. The non-regressive recursive background modeling algorithm has its own characteristics. Using the data obtained over a period of time as a sample, you can use any time point as the starting point to the current time period, and then model the selected sample. . Non-regressive background modeling algorithms include two methods such as inter-frame difference and median filtering method.

Toyama proposed a linear filter based on the buffer to establish the background model of the pixel, and Elgamma et al proposed a non-parametric model [6]. This calculation method uses the information saved in a certain period of time to calculate the background pixel density. The regression algorithm has its advantages. It does not require a buffer, but updates the background model through regression. Update the background model at that point in time for all the frames written in. Update the background model at that point in time for all the frames written in. This calculation method includes the use of a very common linear Kalman filter method, a hybrid Gaussian model proposed by Stauffer and Grimson.

3. Computational Method of Object Search Based on Mixed Gaussian Model

3.1 Background Difference Method

The background difference method is also called background subtraction. The background difference method is to make a difference between the picture in front of the frame and the picture as the background, and then obtain the moving target area. It has high accuracy for moving target recognition and is a better moving target recognition algorithm. The algorithm needs to construct a background image, and the background image cannot contain moving targets, that is, to construct the original background image, and it must be continuously updated as the target background image changes. There are several methods for constructing the background image, which are the following background construction based on single Gaussian model, background construction based on mixed Gaussian model, background construction based on median filter, and so on.

The background difference method is the most commonly used calculation method in motion segmentation. However, background subtraction still has the following problems:

The background image is constantly updated. You can use the original image without a moving target as the background image, but it is not realistic in the actual environment, because the background image changes constantly with time, such as: light, environment, obstructions, and so on. Therefore, the background image cannot be static but changes with the changes of light, environment, and obstructions.

Interfering objects in the target scene, such as branches and leaves floating with the wind, will change as people move, the movement of water waves, etc. These interfering objects should be excluded from moving targets.

Changes in light (from dark to bright) and weather (from sunny to cloudy or rain) will affect the accuracy of moving object detection.

Changes in the background image, such as a stationary car leaving the original background, but it is not a moving target, it just changes its position.

The effect of the shadow of the moving target. The shadow of the moving target will continuously change with the movement of the target. At this time, the background image should be updated accordingly, otherwise the accuracy of the moving target detection will be affected.

3.2 Background Construction Based on Mixed Gaussian Model

Hybrid Gaussian background modeling is a background representation method, which is based on the statistical information of pixel samples. It collects statistical probability density, number of models, mean, standard deviation, etc. of samples over a period of time. The background image is constructed, and the target pixel area is obtained by using the difference method. The complex dynamic background is modeled using a hybrid Gaussian model, and the calculation amount is relatively large. In the mixed Gaussian background model, the color information between pixels is independent, there is no correlation between them, and the processing of each pixel is also independent of each other. The change of all pixels in the image of the video sequence is irrelevant, its value is random, and all pixels can be described by Gaussian distribution.

The mixed Gaussian model means that the distribution of the pixel values of one pixel can be described by multiple Gaussian distributions, and the distribution of its gray value can also be described by multiple Gaussian

ISSN 2616-7433 Vol. 2, Issue 6: 88-92, DOI: 10.25236/FSST.2020.020619

distributions.

4. Conception of Campus Security Surveillance and Alarm System Based on Moving Object Detection

4.1 Improved Ideas Based on Mixed Gaussian Model

The design and development of the campus security surveillance and alarm system, in terms of the monitoring mode, can adopt the target detection algorithm of the campus security surveillance and alarm system that can be used for the detection of moving objects given the Gaussian hybrid model. This calculation method uses an improved hybrid Gaussian model to detect moving targets, which improves the accuracy of moving target detection. It can change the situation that the previous monitoring equipment only recorded video monitoring data and no alarm function. The system can alarm automatically in real time and has good performance.

The purpose of the design is to hope that the hybrid Gaussian model can quickly detect the moving target after the initial value of the parameter is set, so we must accurately estimate the initial value of the background model. When using the previous hybrid Gaussian model to find moving objects, the background can be obtained well when the moving target does not exist, but when the moving target appears suddenly, due to the lack of training of the detected hybrid Gaussian model, the The rate of false positives suddenly increased. This requires further improvement of the algorithm in the specific design of the system. For example, based on the K-means clustering algorithm, a hybrid Gaussian model initialization calculation method, by clustering videos for a period of time, intercepting their brightness values for reasonable clustering, and then Perform an online update operation to obtain a clustering result with the highest frequency of detection. At the same time, the mean value and the number of samples in the target detection process are also updated in a timely manner. The update principle is based on the number of pixel book mapping clusters to determine the number of Gaussian distributions we need. During the update process, since each cluster The parameters of the class need to be initialized and updated, so the parameters of the Gaussian distribution will be obtained.

4.2 Selection of System Application Algorithm

Combined with the introduction of the above methods, in the campus security system with motion detection function, multiple methods can be used to detect moving targets, and judging whether these methods are superior can be performed from two aspects: real-time and reliability. The current mainstream judging methods are: optical flow method, which focuses on studying the optical flow in video images, and makes reasonable calculations of the optical flow changes in different frames of images to obtain corresponding target objects. This method has the characteristics of strong adaptability, and at the same time it is less affected by background changes, so it can achieve a good detection effect, but this method has complicated calculation time and poor efficiency, so the real-time detection is not high. Inter-frame difference method, which calculates the difference between two adjacent frames of images, and obtains the position information of the moving object through the calculation result. The advantage of this method is that it has high computational efficiency, so it has good real-time performance, and the detection target is less affected by the background value. The disadvantage is that the outline of the detection target is lacking, and the detection effect is poor when the detection target is stationary. The background difference method first determines its background image as a reference image after a difference operation, and uses the difference operation to calculate the difference between the instant frame and the background image in the background image library to calculate the position of the specific work object. This method has great advantages, high time efficiency, and can be calculated and detected in real time. The disadvantage is that the effect of illumination on the algorithm is large, and the camera position does not move, so that the background image does not change. In combination with reality, since the majority of surveillance cameras used in most campuses are fixed, the background difference method of the improved hybrid Gaussian model is discussed more in order to obtain better application results in practice. .

5. Summary and Outlook

This article proposes an automatic monitoring and alarm function that uses the background difference method to detect moving objects, learns and delves on relying on moving object search calculation methods. Through the improvement of the hybrid Gaussian model, the security surveillance alarm system reconstructs the background image, which significantly improves the accuracy of moving object detection in the security surveillance alarm system. This can improve the monitoring equipment's static recording of image data. Active

ISSN 2616-7433 Vol. 2, Issue 6: 88-92, DOI: 10.25236/FSST.2020.020619

alarm function in security monitoring system. By adding the active alarm function, it provides early warning function for the personnel on duty of the security surveillance alarm system, and can effectively improve the security technology of the security surveillance alarm system.

References

[1] Kalimov, A. G., Svedentsov, M. L (1996). Three-dimensional magnetostatic field calculation using integro-differential equation for scalar potential. IEEE Transactions on Magnetics, vol.32, no.3, pp.667-670.

[2] Bruce D. Lucas, & Takeo Kanade. (1985). Optical Navigation by the Method of Differences. Proceedings of the 9th international joint conference on Artificial intelligence, no.2, pp.12-13..

[3] B McCane, K Novins, D Crannitch, B Galvin (2001). On benchmarking optical flow. Computer Vision & Image Understanding, vol.84, no.1, pp.126-143.

[4] Letian Kang, Lanjun Wan, Kenli Li (2014). Efficient Parallelization of a Two-List Algorithm for the Subset-Sum Problem on a Hybrid CPU/GPU Cluster. 2014 Sixth International Symposium on Parallel Architectures, Algorithms and Programming (PAAP). IEEE.

[5] Tao, M., Bai, J., Kohli, P., et al (2012). Simpleflow: a non-iterative, sublinear optical flow algorithm. Computer Graphics Forum, no.31, pp.345-353.

[6] Islam, M. T , Chaudhry, A , Tang, S, et al (2018). A new method for estimating the effective poisson's ratio in ultrasound poroelastography. IEEE Transactions on Medical Imaging, pp.1-2.