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Features Extraction of Moving Target Image Based on Nuclear Method and Spatio-Temporal Correlation Theory

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For the detection of moving targets, we firstly discuss the background difference method, inter frame difference method, optical flow method to the traditional detection method, and points out their respective scope of application and the advantages and disadvantages, and in this foundation proposed moving target detection scheme based on temporal and spatial correlation to better solves the traditional moving object detection methods have some defects, improve the quality of target detection. This paper described the background estimation of target detection and extraction method and several common background estimation algorithm based on, through multi frame combined to achieve the fixed scene under the background of the recovery algorithm, gives the corresponding experimental results. By tracking template and consecutive frames difference profile of coarse contour tracking, to avoid the traditional tracking method to match and search the large computational problems and fixed size matching template for non rigid object tracking the false detection problem.

1. Introduction

With the rapid development of the network, the video has gradually become one of the main information dissemination. Because of the special status of vision in human perception, the video has been the focus of research. And video moving target detection and tracking is the basis for other studies, is a kind of pattern recognition, image processing, comprehensive application in the field of computer vision and artificial intelligence, with a strong theoretical research value. In visual motion analysis, object detection and segmentation is in image sequence will be moving target from the background separated. The principle is relevant characteristics of the moving target, for example, image edge, shape, texture and a variety of moment features. In several processes involved in visual motion analysis and moving object detection and segmentation in the bottom of the visual surveillance system, all subsequent processing such as target classification, behavior understanding. Therefore, it has very prominent importance.

Moving target detection algorithm in accordance with the relationship between the target and the camera can be divided into static background motion detection and dynamic background motion detection. The so-called static background motion detection is the camera in the monitoring process does not move, only the monitored target in the field of vision of the camera motion, the process only the target relative to the camera movement. Dynamic background motion detection is the camera in the monitoring process occurs (such as translation, rotation or multi freedom degree movement) movement, the monitored target in the field of vision of the camera moved, the process produced between the target and the camera complex relative movement.

The location of the target tracking, the traditional region based image matching algorithm although higher accuracy, but very time-consuming, a compromise is to extract the target contour information from an image region, then the contour of object matching, this method will bring matching quality decline, but can greatly reduce the track of spent time. At the same time, to calculate the motion area can improve the effect of contour matching, and can further reduce the computation time of search. The contour matching location tracking scheme in no great mass loss can quickly extract the moving object based on spatial and temporal correlation of motion target detection and differential and the location tracking, can meet the requirements of real-time in practical application.

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2. Related theory

2.1 Morphological and sequence analysis of digital image

Image sequence which is composed of a series of relative with the given or assumption of the composition, and gives the adjacent image acquisition time interval between the generally can be expressed as follows:

$$B_0(x,y) : N(m_0, s^2) \tag{1}$$

$$\sigma_0^2(x,y) = \frac{1}{M}\sum_{k=0}^{M-1}\left[f_k(x,y) - \mu_0(x,y)\right]^2 \tag{2}$$

$$\mu_0(x,y) = \frac{1}{M}\sum_{k=0}^{M-1} f_k(x,y) \tag{3}$$

Moving target tracking is the use of one or more can only said effective target characteristics, using appropriate matching algorithm, in continuous image sequence for and target template in position, velocity, shape and other aspects of the most similar to the candidate target, it simply is the continuous image sequence for moving target positioning.

2.2 Moving target detection and tracking

a. Background compensation method

The specific approach is to select the motion picture at K (a), which contains the moving target and background, and then K+1 (a) and the time of moving image is obtained by subtracting a contour map (b), the gray area at time K map is a moving target, but at the moment of K+1 is the background region, background region if K+1 moment K moment is here instead of target coverage, can reduce the K time in the background of target coverage, and so on, through the N frame, when the target area is completely removed detected The target in the current frame (Figure 1) and area (a) in the target area is completely coincident (b).

(a) (b)

Figure 1: The target in the current frame and area

b. The statistical average method

Statistical average method based on the continuous image sequence pixel by pixel statistical average, the average values to approximate the background image, both continuous acquisition of N image cumulative average:

$$B_k = \frac{1}{N}(f_k + f_{k-1} + \cdots f_{k-N-1}) \tag{4}$$

Where N is the image frames, motion velocity value and moving target N and target size, moving faster, more small, can obtain the background with fewer frames, general N bigger and more beneficial to get more realistic background estimation. If the value of N at 25 frames per second calculation, 250 frames to 10 seconds of time, so real-time requirements limit the use of statistical average method.

3. Kernel function and common kernel method

3.1 Kernel function

Kernel function is one of an important part of the theory of support vector machine attracted many researchers interest. The kernel function is often used to satisfy the Mercer condition are linear, polynomial and radial

Sigmoid function, select different kernel can construct support vector machine function, the simple introduction to the four kinds of kernel functions:

Linear function $$K(x, x_i) = \langle x, x_i \rangle \tag{5}$$

moid function $$K(x, x_i) = \tanh[v\langle x, x_i \rangle + a] \tag{6}$$

Linear separable problem mapping to 3D feature space linear separable was shown in Figure 2.

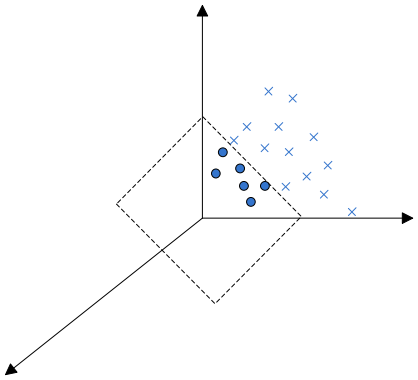

Figure 2: Linear separable problem mapping to 3D feature space linear separable

The discriminant function is normalized, so that the two types of all samples are satisfied: | f(x) | $\geqslant$ 1, then from the surface, near the sample has | f(x) |=1. If all samples classified correctly to meet:

$$y_i[(w * x) + b] - 1 \geq 0, i = 1, 2, \cdots N \tag{7}$$

The optimal classification face problems can be expressed as the following constraints:

$$Min\ \Phi(w) = \frac{1}{2} \| w \|^2 \tag{8}$$

3.2 GF space and new polynomial kernel

Let P_1^n is real polynomial series of n-vertices single variable u, then arbitrary polynomial f in P_1^n can be uniquely determined by n+1 coefficients: $f(u) = \sum_{k=0}^{n} \frac{f_k}{k!} u^k$. That is, polynomial f is completely defined by the n+1 coefficient.

Construction of GF space F_1^n containing P_1^n requires the following two steps:

(a) Let $\rho = (\rho_0, \rho_1, ..., \rho_n)$ is a set of positive weighted bounded constant, the prior information of the problem to be solved is determined.

(b) f and g are any member of the GF space F_1^n, and g_k for the g parameter. Then the F_1^n dot product can be defined as:

$$\langle f, g \rangle_{F_1^n} = \sum_{k=0}^{n} \frac{\rho_k}{k!} f_k g_k \tag{9}$$

The real kernel K of two real variables u, v can be expressed as:

$$K(u, v) = \sum_{k=0}^{n} \frac{1}{k! \rho_k} (uv)^k \tag{10}$$

The kernel function K has two important properties.

4. The experiment and analysis

4.1 Indoor scene experiment

The experimental data for the image size is 240x320, frame rate of 10 frames per second video in indoor environment. There are windows in the video, and the indoor illumination is influenced by the outdoor natural light and the change of the indoor light. Outdoor natural light in different time on the Illuminati gradually changing, and indoor illumination is affected by light can switch different number of lights to change light, create a light changes of the scene and to test the algorithm under different light illumination of indoor environment in detecting foreground objects.

In the training phase, the reference background image and the known image of the indoor lighting are used as the training image. In order to facilitate the comparison and operation of the algorithm, the nuclear function of the default KICA is Gauss core, the kernel width is 1, the normalized estimate is 0.02. The background image training phase was shown in Figure 3. (a) was the reference background, (b) for known contains foreground image, (c) albino after reference to the background, and (d) for whitened the foreground image, (e) for the KICA isolated, (f) for KICA isolated from the foreground image binarization is obtained after the foreground object.

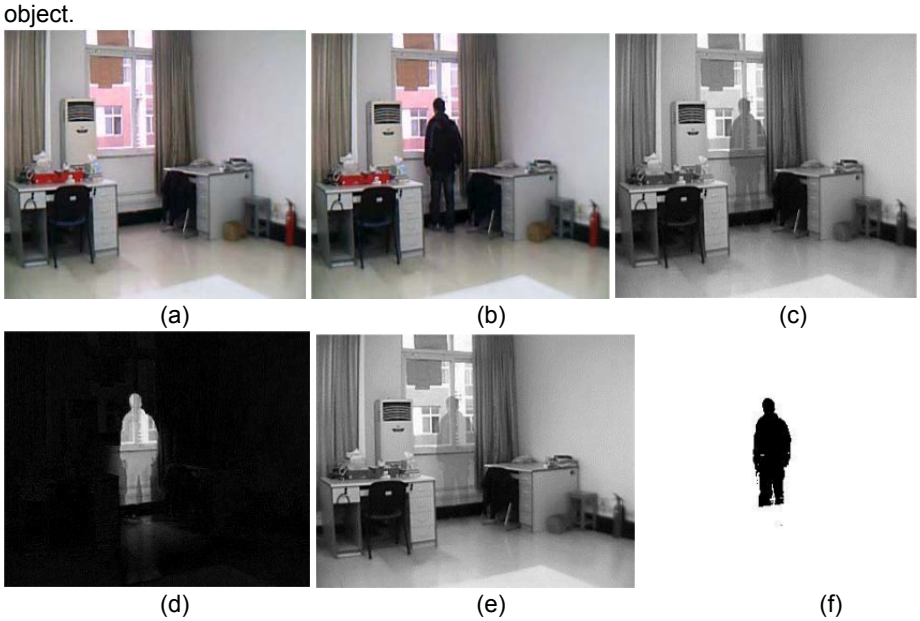

Figure 3: Indoor training phase image

The motion of the image area in addition to including the movement of the object itself, but also includes new obscured or revealed background area, combined with the change in the motion picture area other features can effectively extract moving target. The key to this class method is the first to detect the motion of the region, and motion - changed region detection accurate or not will determine the accuracy of the final generation of the moving object. Bit-level analysis, noise filter, composed of moving target area image generator of bit difference operation and binarization shown in Figure 4.

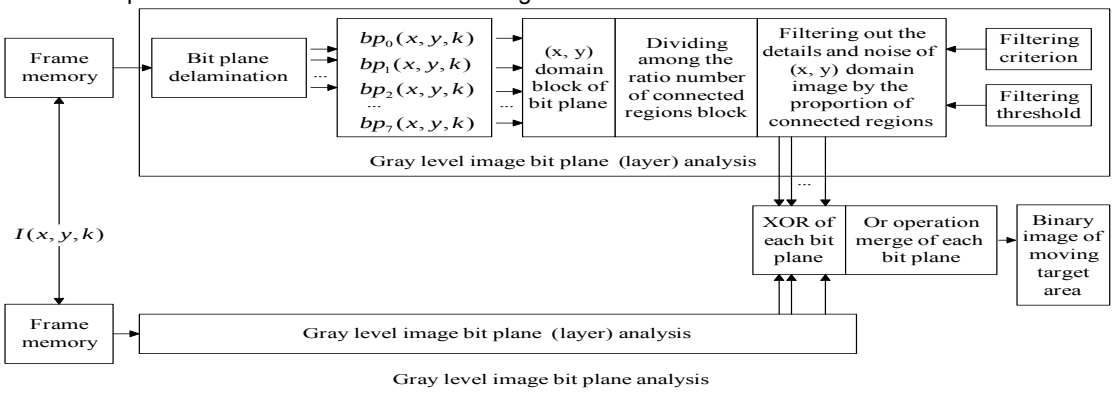

Figure 4: The image generator of bit difference operation

System is the most important step is to extract motion of sub-regions, and the contribution of this paper is to propose a method based on the parameters α bit image layer to filter out noise, thereby automatically detect the motion of the region.

4.2 Outdoor scene experiment

Table 1 uses a database of infrared image recognition database for vehicle identification. The database by using infrared camera equipment on the road for image acquisition, Figure 5 is the two images, is a car free of infrared image, there is a car of infrared image.

Then, the feature extraction of the collected images is extracted, and a sample has 10 feature attributes. The first property is the goal and the width ratio, because according to the far small big visual characteristics, have the demand; the second property is on the gray value, because the vehicle friction with the ground and the wheel turns fast, feel the wheels of the infrared energy is larger than the body, so set up here two a value of 0 and 1, if the dark light, is 0, if the dark or light gray on almost 1; third to six properties is the speed characteristic, also is to choose the image easier selection of 4 feature points, and then calculate the number of pixels adjacent two frames of these feature points mobile; 4 is the final attribute of shape characteristics, calculation of horizontal, vertical, 45 degrees and 135 degrees direction histogram proportion, because the car is generally four square, relatively more in the horizontal and vertical direction, according to this characteristic, can easily distinguish between cars and other objects. There are 548 samples in the database, and there are 83 positive samples of the automobile, and there are 465 negative samples of the automobile. Take 17 positive samples and 93 negative samples to sample the sample set, and the remaining 438 samples as the test sample set.

Figure 5: The two images of infrared image

Table 1: Database classification of infrared image recognition

Kernel function	Gauss kernel	Conventional polynomial kernel	MKL	GF Space polynomial kernel (limit 1)	GF Space polynomial kernel (limit 2)
Kernel parameters	94	9		β	r
Positive detection rate	0.8563	0.8522	0.8702	0.8644	0.8699
Support vector number	8	8	62	88	23
Training time	9.1409	7.2446	1.7369	37.7623	1.1787

In which $\beta=10^{-8}\times 1$, $r=[0.1927\ 0.1407\ 0.1009\ 0.2813\ 0.2844]$

The time of the polynomial kernel function of GF space is more, and the computational complexity is higher. Especially to limit the conditions of 1 space GF polynomial kernel function, because there is no determine the convex problem, using PSO update, computational complexity with the pre-set update relevant algebraic, but can only get a suboptimal solution. But the positive rate of the complexity of the sacrifice is slightly higher than that of the Gauss kernel and the conventional polynomial kernel. The positive detection rate of GF space polynomial kernel function under the limit condition 1 and 2 can only be said to be due to the different order or the same order of the database.

For any one through the origin line can reflect the information characteristics of frequency domain, see Figure 6, although local jitter badly, but the overall trend is still with the increasing of. Another improvement idea is put forward in this paper likely to appear deviation, if make full use of the fitting error through the origin line balance of information, that can improve the precision of parameters.

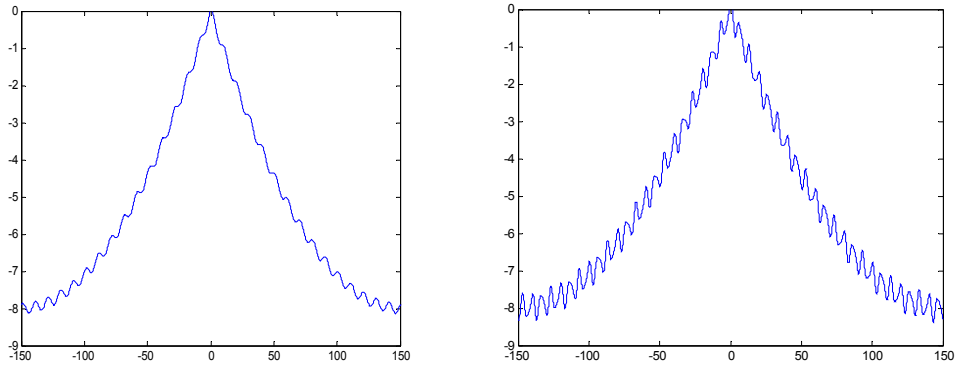

Figure 6. The information characteristics of frequency domain

5. Conclusions

How robust recovery of the body's movement information from the video, is an important area of human motion analysis research. Since the human body is non-rigid structure, dynamics model of its movement is very complex, and there are video body self-occlusion and mutual occlusion, which makes video-based human motion tracking and the reconstruction is very difficult, it is difficult to ensure its accuracy. At present research results have simplified a lot of problem: only under certain conditions acquisition process of motion video, and most of them only simple periodic motion type for example walking, jogging and so on. In this paper, we propose and implement a new video-based human motion reconstruction, reconstruction of a 3D human body posture, body posture based video content refinement, key temporal modeling based on the motion libraries and other sports Reconstruction Research and Implementation of the technical steps, we can learn from any given field-based motion video recovered accurate 3D motion information.

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