다중영역기반의 객체추적을 위한 고정형 카메라를 이용한 지능형 감시 시스템 개발

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Development of Intelligent Surveillance System Using Stationary Camera for Multi-Target-Based Object Tracking

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Abstract

In this paper, we introduce the multi-target-based auto surveillance algorithm. Multi-target-based surveillance system detects intrusion objects in the specified areas. The proposed algorithm can divide into two parts: i) background generation, ii) object extraction. In this paper, one of the optical flow equation methods for estimation of gradient method used to generate the background [2]. In addition, the objects and back- ground video images that are continually entering the differential extraction.

I. Introduction

Automatic visual surveillance systems is a user can specify the desired conditions for the surveillance, then the computer is automatically monitoring such conditions.

The proposed algorithm sets up the region for detection. It then makes a background image. Invading objects are extracted by using difference between the input and background images.

II. Proposed Algorithm

2.1 Background Generation

For robust estimation of the partial derivatives, we can compute the average of the forward and backward finite differences, called the average difference. Furthermore, we can compute a local average to eliminate the effects of observation noise. Horn and Schunck[1] proposed averaging four finite differences to obtain:

$$\begin{aligned}\frac{\partial s_c(x_1,x_2,t)}{\partial x_1} \approx \frac{1}{4}\{ & s(n_1+1,n_2,k)-s(n_1,n_2,k)+s(n_1+1,n_2+1,k) \\ & -s(n_1,n_2+1,k)+s(n_1+1,n_2,k+1)-s(n_1,n_2,k+1) \\ & +s(n_1+1,n_2+1,k+1)-s(n_1,n_2+1,k+1)\}\end{aligned} \quad , \quad (1)$$

$$\begin{aligned}\frac{\partial s_c(x_1,x_2,t)}{\partial x_2} \approx \frac{1}{4}\{ & s(n_1,n_2+1,k)-s(n_1,n_2,k)+s(n_1+1,n_2+1,k) \\ & -s(n_1+1,n_2,k)+s(n_1,n_2+1,k+1)-s(n_1,n_2,k+1) \\ & +s(n_1+1,n_2+1,k+1)-s(n_1+1,n_2,k+1)\}\end{aligned} \quad , \quad (2)$$

and

$$\begin{aligned}\frac{\partial s_c(x_1,x_2,t)}{\partial t} \approx \frac{1}{4}\{ & s(n_1,n_2,k+1)-s(n_1,n_2,k)+s(n_1+1,n_2,k+1) \\ & -s(n_1+1,n_2,k)+s(n_1,n_2+1,k+1)-s(n_1,n_2+1,k) \\ & +s(n_1+1,n_2+1,k+1)-s(n_1+1,n_2+1,k)\}\end{aligned} \quad . \quad (3)$$

The Horn-Schunck method imposes the smoothness constraints onto optical flow either globally or locally.

The directional smoothness constraint can be expressed as:

$$\varepsilon^2_{ds}(v(x,t)) = (\nabla v_1)^T W(\nabla v_1) + (\nabla v_2)^T W(\nabla v_2). \quad (4)$$

where W represents a weight matrix to penalize variations in the motion field depending on the spatial changes in gray-level content of the video. Then, the directional-smoothing method minimizes the criterion function to find an estimate of the motion field,

$$\min_{v(x,t)} \int_A (\varepsilon^2_{0f}(v) + \alpha^2 \varepsilon^2_{ds}(v))dx \quad . \quad (5)$$

where A denotes the image support and, α^2 is the smoothness parameter.

2.2 Object Tracking

For tracking an object, we must extract the location of an object from surveillance zone. Object is extracted by differencing background image and the input image.

Subtracted image is labeled by using 8-adjacent mask, and then we can know the number of objects in the surveillance zone. After labeling, we have to extract the shape of an object to calculate the size of the object. Finally, we compute the object's distance for representation moving object's trajectory. The object's distance is computed by using Euclidean distance. If the distance is the shortest one between adjacent frames, we consider the as the same one.

Ⅲ. Experimental Results

Multi-target-based surveillance is accomplished by background generation, setting up the surveillance region, and background subtraction. The surveillance region can be defined as either rectangular or polygonal shape as shown in Fig. 1. If an object enters the surveillance zone, it is extracted from background by using background subtraction and we can then trace the object as shown in Fig. 2.

Fig. 1. Multiple surveillance zone

(a) (b) (c)

Fig. 2. Object tracking: (a) Background image, (b) Difference image, (c) Result of tracking

Ⅳ. Conclusion

In this paper, we present a region-based automatic video surveillance algorithm using a CCD camera. A user can specify a rectangular or a polygonal region of interest.

Future research includes model-based object tracking using active contour model or active shape model.

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Reference

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