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Discovering Anomalies Based on Saliency Detection and Segmentation in Surveillance System

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ABSTRACT

This paper proposes extracting salient objects from motion fields. Salient object detection is an important technique for many content-based applications, but it becomes a challenging work when handling the clustered saliency maps, which cannot completely highlight salient object regions and cannot suppress background regions. We present algorithms for recognizing activity in monocular video sequences, based on discriminative gradient Random Field. Surveillance videos capture the behavioral activities of the objects accessing the surveillance system. Some behavior is frequent sequence of events and some deviate from the known frequent sequences of events. These events are termed as anomalies and may be susceptible to criminal activities. In the past, work was based on discovering the known abnormal events. Here, the unknown abnormal activities are to be detected and alerted such that early actions are taken.

Keywords: *Gradient, Contrast, Anomalies, Background regions*

I. INTRODUCTION

Saliency detection plays an important role in a variety of applications including salient Object detection, content aware image and video. Generally, saliency is defined as the captures from human perceptual attention. Human vision system (HVS) has the ability to effortlessly identify salient objects even in a complex scene by exploiting the inherent visual attention [18] mechanism. Visual saliency detection was processed in various concurrent methods by applying different techniques of visual saliency detection were proposed by other researches. The basic idea underlying saliency detection is that ganglion cells are insensitive to uniform signals. Due to this reason color contrast, luminance contrast, as well as orientation dissimilarity are natural features for saliency detection [16], thereby they are employed by the majority of saliency detection models. These features are responsible for bottom-up attention model. In the model based on multi-scale contrast was proposed. The peculiarity of this method is that the final saliency map is created using a segmentation map, by assigning each segment a saliency value using thresholding. Another group of methods use statistics of the image to compute saliency.

This method computes saliency as a local likelihood of each image patch considering the basis function learned from natural images. The most recent methods take advantages of modern machine learning techniques and employ sophisticated feature spaces. There are four levels of features for saliency detection: low-level, mid-level, high-level and prior information. The low level employs features proposed; the mid-level includes a horizon line detector the high-level includes face and person detectors; prior information includes the dependence of saliency on the distance from the center of the image.

A. QUALITY IMPROVED VIDEO

The principal objective of image enhancement is to process a given image so that the result will be more suitable than the original image for a specific application. It accentuates or sharpens image features such as edges, boundaries or contrast [7] to make a graphic display more helpful for display and analysis. The enhancement doesn't increase the inherent information content of the data, but it increases the dynamic range of the chosen features so that they can be detected easily.

B. SPATIAL DOMAIN IMAGE ENHANCEMENT

Spatial domain techniques directly deal with the image pixels [9]. The pixel values are manipulated to achieve desired enhancement [19]. Spatial domain techniques like the logarithmic transforms, power law transforms, histogram equalization are based on the direct manipulation of the pixels in the image.

C. DETECTION AND TRACKING

Detection and Tracking is a common phenomenon in video motion analysis. Detection and tracking is for detect the moving object and to track the action of the moving object in the video using image frame sequence. Moving object detection in a video is the process of identifying different object regions which are moving with respect to the background and in action tracking method the movements of objects are constrained by environments [11]. In action tracking, the human motion analysis monitors the behavior, activities or other changing information. So it creates a need to develop the action tracking in video surveillance for security purpose.

II. METHODOLOGY

The proposed block diagram is shown in Fig (1).

- Video to frame conversion
- Calculate the moving region
- Recognize the action

Frames can be obtained from a video and converted into images. To convert a video frame into an image, the MATLAB function is used to convert the video to frame conversion. To read a video in .avi format, the function 'aviread' is used. The original format of the video that we are using as an example is .jpg file format. The .jpg file format image is converted into an .avi format video.

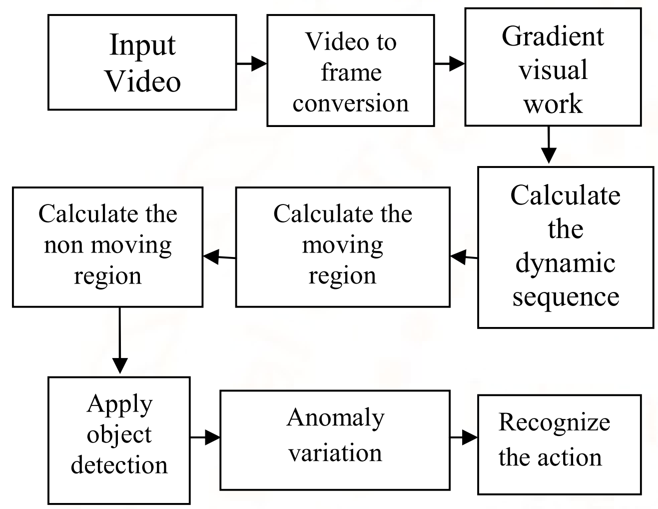

Figure 1: Proposed Block Diagram

A. IMAGE GRADIENT AND MAGNITUDE

For any edge detector, there is a trade–off between noise reduction and edge localization. The reduction is typically achieved at the expense of good localization and vice versa. The Sobel edge detector can be shown to provide the best possible compromise between these two conflicting requirements. The mask we want to use for edge detection should have certain desirable characteristics called Sobel's criteria[12] .The magnitude and orientation of the gradient can be also computed from the formulas

$$Magnitude(x, y) = |g| = \sqrt{g_x^2 + g_y^2}.$$

B. THRESHOLDING

The typical procedure used to reduce the number of false edge fragments in the non-maximal suppressed gradient magnitude is to apply a threshold to suppressed image. All values below the threshold are changed to zero [12].We have noted already the problems associates with applying a single, fixed threshold to gradient maxima. Choosing a low threshold ensures that we capture the weak yet meaningful edges in the image. Too high a threshold, on the other hand, will lead to excessive fragmentation of the chains of pixels that represent significant contours in the image. Hysteresis thresholding offers a solution to these problems. It uses two thresholds T_{low} and T_{high}, with $T_{high} = 2\ T_{low}$, T_{high} is use to mark the best edge pixel candidates.

C. *SOBEL EDGE DETECTOR*

- Smooth the input image with a Gaussian filter
- Compute the gradient magnitude and orientation using smoothed image and calculating finite – difference approximations for the partial derivatives [12].
- Apply non - maxima suppression to the gradient magnitude image.
- Use the double thresholding algorithm to detect and link edges.

The effect of the Sobel operator is determined by three parameters - the width of the Gaussian kernel used in the smoothing phase, the upper and lower thresholds used by the tracker. Increasing the width of the Gaussian kernel [8] reduces the detector's sensitivity to noise, at the expense of losing some details in the image. The localization error in the detected edges also increases slightly as the Gaussian width is increased. Usually, the upper tracking threshold can be set quite high and the lower threshold quite low for good results. Setting the lower threshold too high will cause noisy edges to break up. Setting the upper threshold [9] too low increases the number of spurious and undesirable edge fragments appearing in the output.

III. IMPLEMENTATION

A. *SUMMARY OF THE PROPOSED SYSTEM*

Steps that are involved in the proposed system is as follows:

1) Read input video.
2) To improve the quality of the video.
3) Frame to matrix format.
4) Generate Gradient visual work.
5) Train the dynamic changes image.
6) Calculate the dynamic sequence format and convert features into matrix format.
7) Calculate the gradient features.
8) Apply the correlation and image absolute difference.
9) Calculate the moving region.
10) Calculate the non moving region.
11) Detect the difference and compare the database.
12) Apply the Object Detection.
13) Calculate the background mask.
14) Estimate the anomaly variation.
15) Recognize the action

IV. EXPERIMENTAL RESULTS

Test Image 1

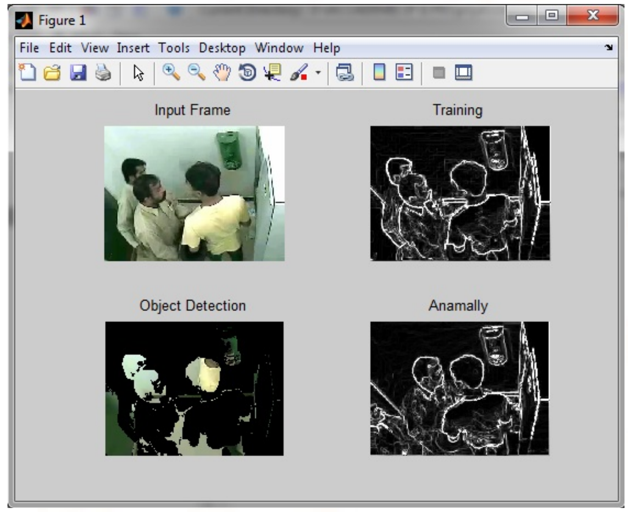

Figure 2 Input frames, Action grouping, Object detection and Anomalies, for Test Image 1

Test Image 2

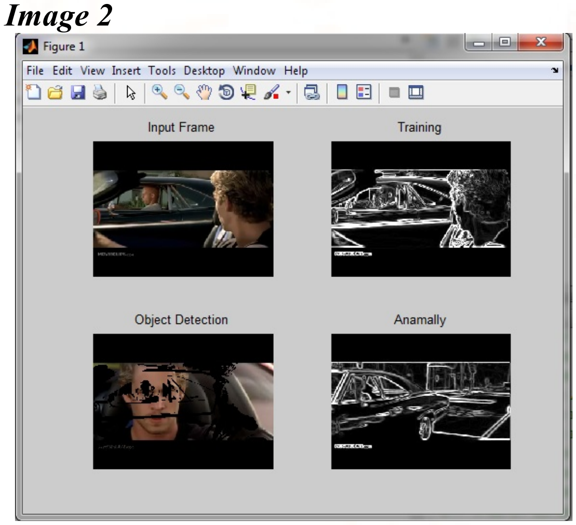

Figure 3 Input frames, Action grouping, Object detection and Anomalies, for Test Image 2

The gradient of an image is trained as shown in the figure which is used to measure how it is changing. It provides two pieces of information. The magnitude of the gradient tells us how quickly the image is changing, while the direction of the gradient tells us the direction in which the image is changing most rapidly. To illustrate this, think of an image as like a terrain, in which at each point we are given a height, rather than intensity. For any point in the terrain, the direction of the gradient would be the direction uphill.

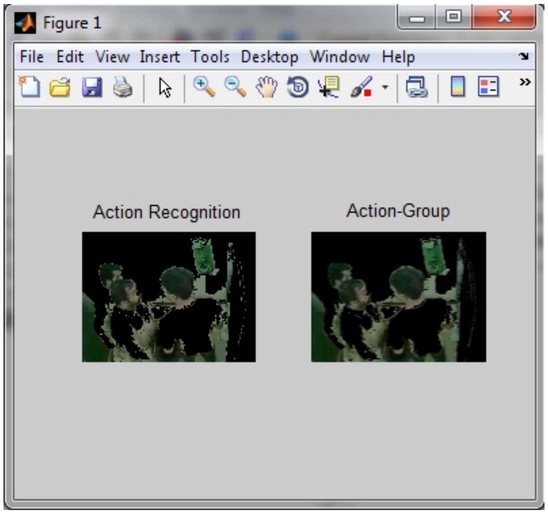

Figure 4 Test Image – 1 (Action Recognition and Action Group)

The magnitude of the gradient would tell us how rapidly our height increases when we take a very small step uphill.

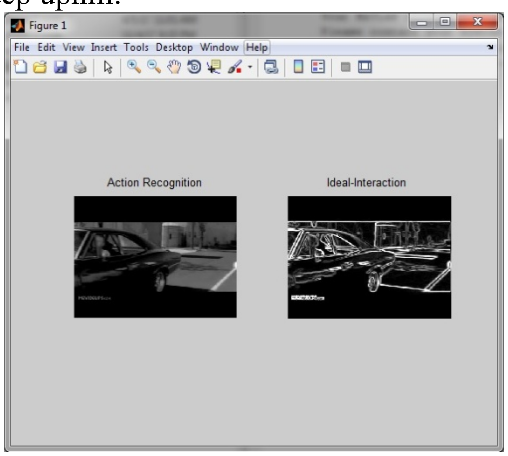

Figure 5 Test Image – 2 (Action Recognition and Action Group)

In this work, we propose to use attributes and parts for recognizing human actions in still images. We define action attributes as the verbs that describe the properties of human actions, while the parts of actions are objects and pose lets that are closely related to the actions. We jointly model the attributes and parts by learning a set of sparse bases that are shown to carry much semantic meaning. Then, the attributes and parts of an action image can be reconstructed from sparse coefficients with respect to the learned bases. The video segmentation step allows us to separate foreground objects from the scene background. However, we are still working with full videos, not the individual points of motion desired for human motion detection. The problem of computing the motion in an video is known as finding the optical flow of the video.

CONCLUSION

The proposed approach gives better results for object detection, moving object detection and tracking of that poignant object in video. Object detection in video labels that number of objects in that frame is detected and in moving object detection it is used to identify the moving object in that frame based on the boundary values and silhouette of the moving object. Motion tracking is compared with previous frame and current frame, so that the same object is moving along the frames can be determined. Thus the result analysis shows the accuracy of the number of frames, in which the objects are correctly segmented.

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