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Detection And Tracking Of Multiple Moving Objects Based On DWT

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Abstract

Automated video surveillance is an important research area in the commercial sector. Visual surveillance and monitoring of human activity requires people to be tracked as they move through a scene. Autonomous video surveillance and monitoring has a rich history. A new method for detecting and tracking multiple moving objects based on discrete wavelet transform and identifying the moving objects by their color and spatial information is proposed in this paper. Discrete wavelet transform can divide a frame into four different frequency bands without loss of the spatial information. Localization in both frequency and time/spatial domains is the greatest advantage of discrete wavelet transform over Fourier transform-based methods. The algorithm uses Background Subtraction and Boxed Based tracking for aforementioned goals. The proposed model has proved to be robust in different types of static background scenes. The Experimental results prove the feasibility of the proposed methods.

1. Introduction

Autonomous video surveillance and monitoring has a rich history [1]. Technology has reached a stage where mounting cameras to capture video imagery is cheap, but finding available human resources to sit and watch that imagery is expensive. Surveillance cameras are already common in commercial establishments. After a crime occurs, a store is robbed or car is stolen, investigators can reach the place but then of course it is too late. What is needed is a 24-hour monitoring and analysis of video surveillance data to alert security officers to a burglary in progress. Keeping the track of people, vehicles, and their interactions in an urban or battlefield environment is a difficult task [3]. Multiple objects tracking represent the essence of any video surveillance system. The knowledge of the positions of the moving objects is mandatory to understand the situations in the visual environment of the surveillance system. Therefore, the tracker requires the analysis of video sequences in order to trace the evolving position of each object in each frame [2].

In this paper, a new method for detecting and tracking multiple moving objects based on discrete wav elet transform is proposed. Discrete wavelet transform has a nice property that it decompose original image into four-sub band images. The four-sub images that wavelet transform preserves not only the frequency features but also spatial features. After discrete wavelet transform take place, spatial localization implies that coefficients in a certain position at the wavelet sub-images correspond to the details of different frequencies in the corresponding spatial location. When original image is decomposed into four sub band images, it has to deal with row and column separately.

2. Moving Object Detection and Tracking

2.1 Discrete wavelet transform selecting a template

Discrete Wavelet Transform (DWT) based on sub-band coding is found to yield a fast computation of Wavelet Transform [4]. Wavelet transform provides a special basis that a signal can express easily and efficiently [1]. The two-dimensional (2-D) DWT has a gained popularity in the field of image and video coding since it allows good complexity –performance tradeoffs [5]. A 2-D DWT of an image is shown in Fig. 1.

If image size is less than 320 proposed methods used one-dimensional (1-D) DWT but if image size is greater than equal to 320 and less than 640 proposed methods used 2-D dimensional DWT otherwise three dimensional (3-D) DWT is used. Figure 2 shows original image which has size less than 320 and figure 3 shows 1-D DWT of original image.

Two dimensional DWT can be used to decompose an image into four sub-images. The four sub images that the wavelet transform preserves not only the frequency features but also spatial features. Filters are applied in one dimension first, vertically or horizontally and then in other dimension as shown in fig. 1.

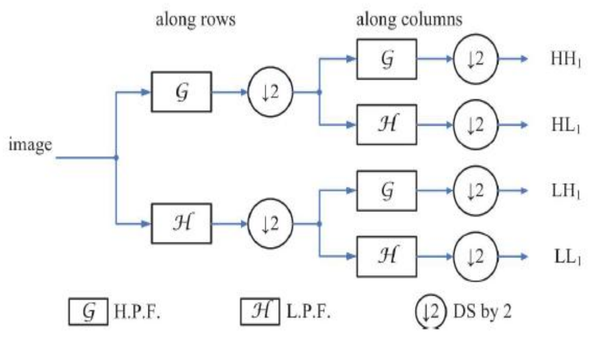


Figure 1. DWT image decomposition

Figure 2. Original image

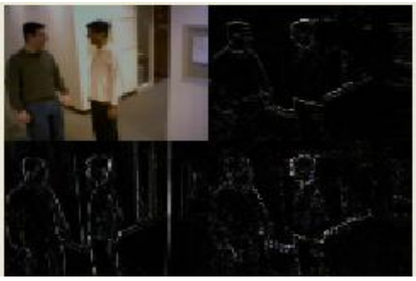


Figure 3. First level transform

When the original image decomposed into four-sub band images it has to deal with row and column separately. First, the high-pass filter G and low pass filter H are exploited for each row data, and then down sampled by 2 to get high and low frequency components of the row. Next, the high and the low pass filters are applied again for each high- and low- frequency components of the column, and then are down-sampled by 2. By way of above processing, the four sub band images are generated: HH, HL, LH, and LL. Each sub band image has its own features, such as the low-frequency information is preserved in the LL-band and the high frequency information is almost preserved in the HH-, HL-, and LH-bands. The LL-sub band image can be further decomposed in the same way for the second level sub band image. In the proposed method, only low frequency information is used for processing due to the consideration of low computing cost and noise reduction.

2.2 Background subtraction

Object detection can be achieved by building a representation of the scene called the background model and then finding deviations from the model for each incoming frame. Any significant change in an image region from the background model signifies a moving object. The pixels constituting the regions undergoing change are marked for further processing [6].

Figure 4. Background Subtraction

2.3 Normalization

In the image processing, normalization is a process that changes the range of pixels intensity values. Normalization is sometimes called contrast stretching. Firstly, normalize the first frame which is the background frame (NBG) then get normalization of second frame which is the foreground frame (NFG) . N(i , j) defines the normalized image which is defined as follows where M and V defines estimated mean and variant of image [7].

$$N(i.j) = M_0 + \sqrt{\frac{V0(I(i.j) - M)^2}{V}}$$

Apply the median filter to each normalized frame to reduce noise effect and to preserve edges. Take the absolute difference of normalized background image and normalized foreground image which is defined as Frame Norm(i, j) and enhance that difference by 1.6. Figure 5 shows the normalization of original frame.

Frame Norm(i, j) = abs (NBG-NFG) * 1.6

If Frame Norm (i, j) absolute difference is greater than 4 then Frame Norm (i, j) =255.

Divide each normalized frame into 8*8 standard overlapped blocks and get sum of all pixels of each block and get standard deviation of each block and if sum exceed 32 and standard deviation exceed 0.5 then assign white color to each pixel of all blocks.

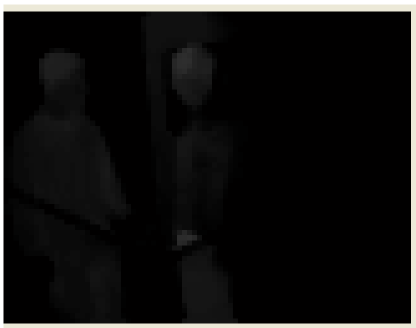


Figure 5. Difference image after thresholding process

2.4 Image Restoration Process

After thresholding the difference image as it can been seen in figure 5. A moving object may split into two different objects. To overcome this problem, an image restoration process is performed on the difference image to restore some missing pixels of moving object back by filling the image region and holes.

2.5 Object Labelling

For labelling the objects compare the object region with 400 pixels. If so, then create connected components and label all objects by creating the label structure. After the process is completed all objects are labelled.

2.6 Bounding Box of Moving Objects

The labelled difference image is scanned pixel by pixel from right to left, left to right, top to bottom, bottom to top to find bounding box of moving objects. After the scanning process is completed, the top left coordinates height, and width of each bounding box is calculated.

2.7 Analyse Object

Analyse the detected object by creating the RGB histogram of original objects. If first detected object is
not tracked then track that object by using the RGB histogram information.

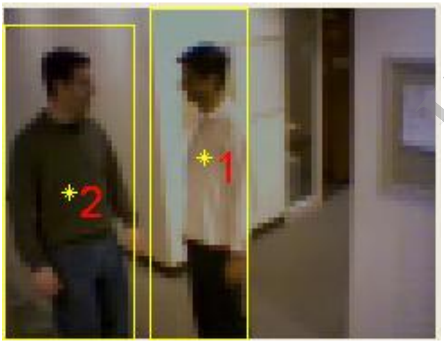
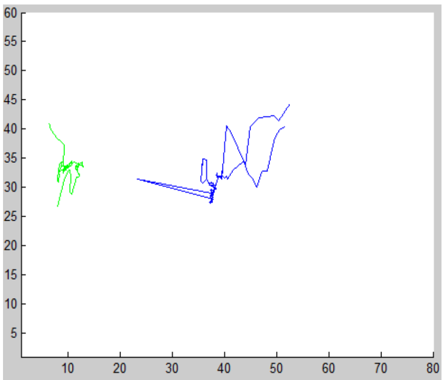


Figure 6. Object Identification

2.8 Experimental Result



In this section, we did several experiments to prove the feasibility of the proposed tracking and identification method. We used matlab video and also simulated several cases of condition of moving objects. All test sequences are stored in Microsoft AVI format with raw data of different resolution and frame rate of 30 frames/second.

3. Conclusion

A new method for detecting and tracking multiple moving objects is proposed. Multiple moving objects are identified by their color and spatial information based on discrete wavelet transform. The reason why we use discrete wavelet transform is its noise resistant ability. Multiple moving objects are tracked using boxed based tracking. The proposed method works for static background. The experimental results prove the feasibility and usefulness of the proposed methods. The correct identification rate highly depends on the correctness of the moving object detection and feature representation.

4. References

[1] Sherin M.Yousef, Meer A. Hamza, Arige F. Fayed, "Detection and tracking of multiple moving objects with occlusion in smart video surveillance systems".
[2] Falah E. Alsaqre, Yuan Baozong, "Multiple moving objects tracking for video surveillance systems", ICSP'04 Proceedings
[3] Kaiqi Huanga, LiangshengWanga, Tieniu Tana and Steve Maybankb, "A real-time object detecting and tracking system for outdoor night surveillance," Pattern Recognition, 2008, pp. 432 – 444.
[4] http://etd.lib.fsu.edu/theses/available/etd-11242003-185039/unrestricted/09_ds_chapter2.pdf
[5] Francescomaria Marino,"Two fast architectures for the direct 2-D discrete wavelet transform", IEEE transaction on signal processing, vol.49, No.6, June 2001
[6] Alper Yilmaz, Omar Javed, and Mubarak Shah, "Object tracking: A survey".
[7] Thien Hoang van, Hoang Thai Le, "An efficient algorithm for fingerprint references-point detection", computing and communication technologies, 2009.RIVF,'09 .
[8] R.C Gonzalez and R.E. Woods, Digital image processing, Addision Wesley, Reading M.A, 1992.
[9] I. Daubechies, Orthonormal bases of compactly supported wavelets, comm pure Appl, math, 1988, pp. 909-996