Fast moving Object Detection and Recognition in Surveillance videos

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Abstract - In this paper, we are detecting and recognizing the fast moving object in H.264 compressed domain. Compressed videos require less computation and memory requirements. Here the proposed method is the background subtraction and segmentation. As we know that background subtraction uses both pre-processing and post processing and it helps in producing an accurate results than other algorithms. Here the segmentation is done based on the threshold value. This method uses motion intensity, motion vectors and filtering technique to detect the moving object accurately. Background subtraction method is easy and simple to implement. This is an efficient algorithm and produces accurate detection results. It can be used without any additional features and without any special hardware support.

Keywords- H.264 compression, Background subtraction, Segmentation, MIC.

I. INTRODUCTION

At present applications of videos include television broadcasting, video streaming and video conferencing these applications need an efficient analysis of videos. In surveillance video applications, for efficient video analysis it is necessary to detect, track and recognize the fast moving object. For change detection different algorithms have been proposed. The proposed method is the background subtraction method. As we know that videos are a continuous moving images and images are divided into macro blocks. Here we are using the segmentation for moving object detection. Using some motion intensity calculation and making prediction for the subsequent frames to detect the motion. Macro blocks contain motion related data like DCT coefficients, motion vectors. Based on the information associated with the macro block they are filtered out. For pre-processing here the cascade filter is used. These techniques help in detecting the fast moving object in the video streams. The object can be detected by analyzing the frequency of occurrences in the images. The most likely appearing object is the real object. The detected objects are classified for recognition. There are many approaches have been proposed for moving object detection in pixel domain and in compressed domain approach. Pixel domain approach is independent of video compression standards and includes preprocessing of input images and post processing of output. Pixel domain requires reconstruction of image and full decoding. Compression domain approach is dependent of video coding standards, this approach needs to be decoded partially and there is no need of image reconstruction. Nowadays most of the videos are captured and transmitted in compressed domain. Uncompressed videos require more memory and transmission bandwidth. For video compression there are many video standards have been proposed like MPEG1 , MPEG2 , MPEG4 , H.261 , H.263 and H.264.These techniques have different advantages over video compression. Based on the performances the video coding standard can be selected where the video quality should not be affected.

In this project H.264 compression standard has been used as it produces best video quality compared to other video compression standards and also the size of the compressed video is less. H.264 does not affect the video quality though it consumes more time. Compressed videos need less storage space and can be transmitted with a low bandwidth.

II. PROPOSED METHOD

In this paper Background subtraction and image segmentation method is employed for object detection. This method subtracts the current image from reference image in compressed domain. Here current image consists of moving object scene and reference image consists of background. To subtract the current image from reference image one need to first initialize the background. After background subtraction the subtracted image is segmented to detect the moving object.

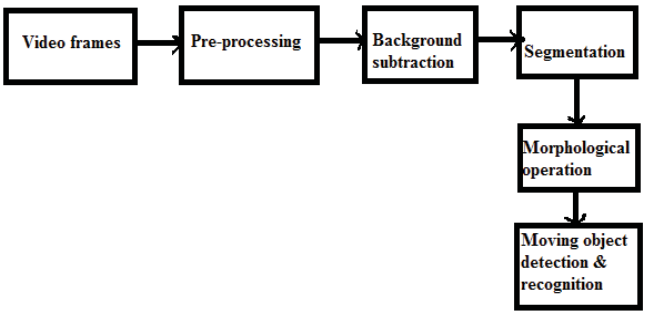

Figure 1: Block diagram

Above figure 1 shows the system block diagram where the H.264 videos are processed for detecting the moving object. This system has the following blocks:

A. Video frames

Video is nothing but continuously moving frames with time. Here we are taking h.264 video frames by processing these frames the moving objects can be detected. Directly captured videos are not processed they must be converted into frames. Then these frames are processed to detect the motion. Video can be expressed as a function f that is f(x, y) with time t. At different time instant frames are issued and processed [1].

B. Pre-processing of frames

After converting video into frames pre-processing is done on these frames. That is frames may contain noise in them so that one must remove that noise before proceeding further. We know that noise can be removed using some filtering techniques. Filtering techniques smoothens the motion vectors and reduces the noise. Here we are employing cascade filter which uses both Gaussian filter and median filter for removing noise. This is nothing but a pre-processing. MATLAB has some built in filter function which helps in filtering the noise from the frames.

C. Background subtraction

To use the background subtraction method we need to initialize the background first. Here taking the background frame as reference frame and the frame which contains moving object as a current frame. Then subtracting the current frame from the background frame. This is a pixel by pixel subtraction method.

$$| f(x, y) - B(x, y)| > Td \qquad (1)$$

Here f is the current frame and B is the background frame [1].

D. Image segmentation

Segmentation is done after subtracting the current frame from the reference frame. It is done based on the threshold value. This value can be obtained by taking the difference between the reference frame and current frame (Threshold value is practically set). As we know that the subtraction is done pixel by pixel, those subtracted frames give the subtracted value of each pixel. These values are compared with the threshold value. If value of the subtracted pixel

is greater than the practically set threshold value then it is represented by 1 and if pixel value is less than threshold value then it is represented by 0.

$$Dk(x,y)=1 \quad \text{if } |f(x,y) - B(x,y)| > Td$$

$$0, \quad \text{Otherwise} \qquad (2)$$

Here Dk is the subtracted pixel value [1].

E. MIC calculation

Figure2: LCU and PU units

There are many segmentation methods are employed for detecting the moving objects. Here we are using segmentation of image for calculating MIC for each frame block. MIC is the motion intensity count which is calculated for each block. First the frame is divided into LCU (large code unit) and PU (prediction unit). These blocks represent motion vectors. MIC represents the motion intensity; LCU with high motion intensity represents longer motion vectors. So here we are calculating the MIC for each LCU units.

MIC is defined as follows:

$$\text{MIC} = \sum_{i \in \sigma} (\|MV_i\| * area(PU_i)) \qquad (3)$$

Where MVi represents the motion vectors within the LCU unit and area PUi represents are of PU unit which contain the same motion vectors. Larger motion vectors within LCU unit represent higher MIC.

Here we are also predicting the MIC for subsequent frames if there is a nonlinear motion or nonlinear changes within the frames. If there is high frame rate we need to predict the MIC for subsequent frames. This will helps in detecting the moving object [2].

F. Morphological Operations

Morphological operation involves removing noise after segmentation and MIC calculation. This is the final process in detecting the moving object. This operation the noise and make moving object clearly visible. It will fill up unwanted region and extracts edges. It will help in detecting the moving object.

G. Object detection and recognition

After morphological operation the moving object is clearly visible. Finally with all the operations the moving objects are detected. These moving objects must be recognized for security purpose in surveillance videos. So that it is necessary to recognize the moving object after detection. Here we are taking those detected objects and comparing

them in terms of height and width. Every object has different height and width or different characteristics. In this project we are considering an example of traffic light system where the moving objects are vehicles. These vehicles can be recognized as car, bus and truck etc. Here we are practically setting the values of these vehicles. Based on that the vehicles are recognized.

III. RESULTS

Results are obtained from MATLAB software tool. Results of moving object detection and recognition are shown in a separate MATLAB window. Here Results of traffic system are shown:

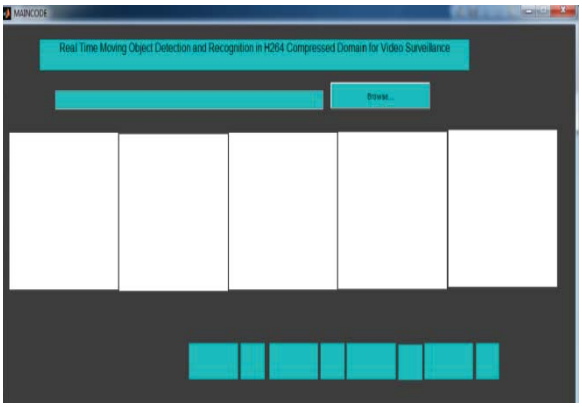

Figure 3: Output display

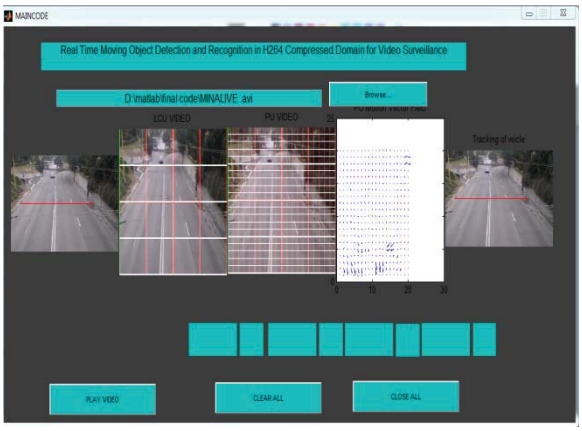

Figure 4: Traffic system result 2

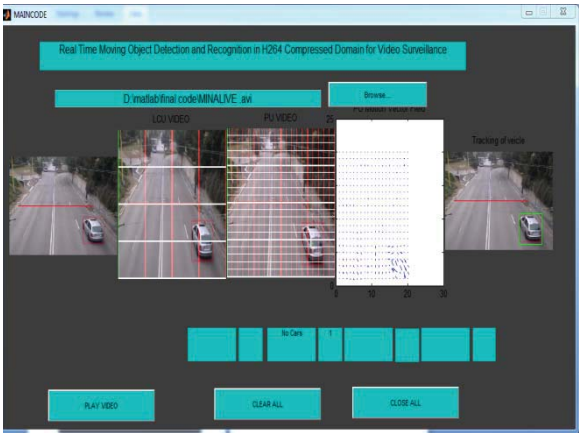

Figure 5: Output 3

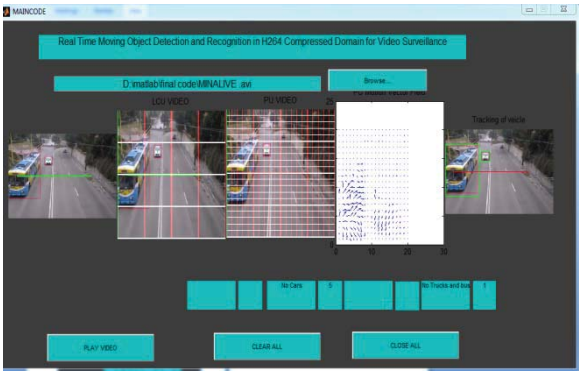

Figure 6: Result 4

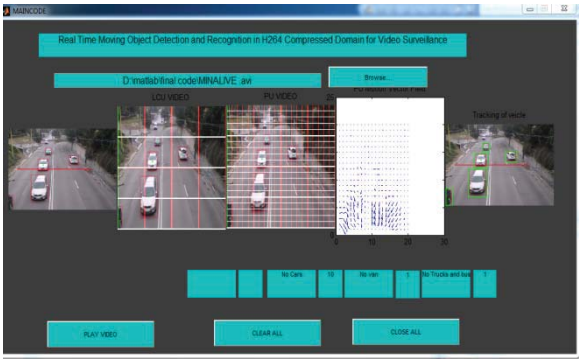

Figure 7: Final result 5

IV. CONCLUSION

In this paper, we have used background subtraction method and segmentation method. Based on the information like motion intensity, motion vectors and filtering the moving object can be detected accurately. Background subtraction

method is an easy and simple method to implement and produces accurate results. The moving object can be recognized by comparing their height and width parameters. Here we are taking traffic light system where moving vehicles are recognized.

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