ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 6, Issue 12, December 2019

Real -Time Moving Object Segmentation And Classification from HEVC Compressed Surveillance Video

L.Megala[1], B.Devanathan[2]

Assistant Professor[1], Lecturer[2]
Department of ECE[1,2]
V.R.S. College of Engineering & Technology[1], University College of Engineering[2]
Arasur, Villupuram, Tamilnadu, India[1].
Villupuram, Tamilnadu, India[2].

Abstract: Moving object segmentation and classification from compressed video plays an important role for intelligent video surveillance. Compared with H.264/AVC, HEVC introduces a host of new coding features which can be further exploited for moving object segmentation and classification. In this paper, we present a real-time approach to segment and classify moving object using unique features directly extracted from the HEVC compressed domain for video surveillance. In the proposed method, firstly, motion vector interpolation for intra- coded prediction unit and MV outlier removal are employed for preprocessing. Secondly, blocks with non-zero motion vectors are clustered into the connected foreground regions using the four connectivity component labeling algorithm. Thirdly, object region tracking based on temporal consistency is applied to the connected foreground regions to remove the noise regions. The boundary of moving object region is further refined by the coding unit size and prediction unit size. Finally, a person-vehicle classification model using bag of spatial-temporal HEVC syntax words is trained to classify the moving objects, either persons or vehicles. The experimental results demonstrate that the proposed method provides the solid performance and can classify moving persons and vehicles accurately.

I. Introduction

The term digital image refers to processing of a two dimensional picture by a digital computer. In a broader context, it implies digital processing of any two dimensional data. A digital image is an array of real or complex numbers represented by a finite number of bits. An image given in the form of a transparency, slide, photograph or an X-ray is first digitized and stored as a matrix of binary digits in computer memory. This digitized image can then be processed and/or displayed on a high-resolution television monitor. For display, the image is stored in a rapid- access buffer memory.

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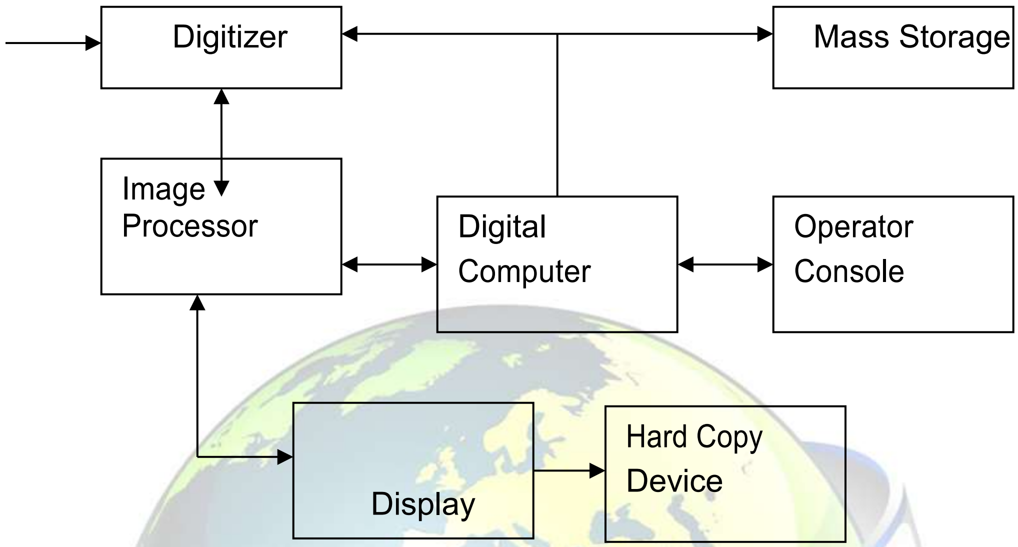

Fig 1.1 Block Diagram for Image Processing System

Image Processor:

An image processor does the functions of image acquisition, storage, preprocessing, segmentation, representation, recognition and interpretation and finally displays or records the resulting image. The following block diagram gives the fundamental sequence involved in an image processing system.

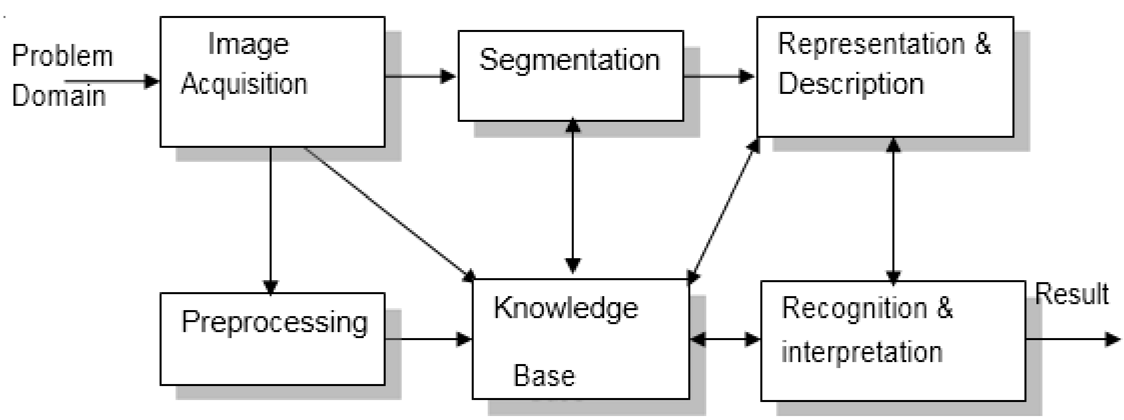

Fig 1.2 Block Diagram of Image Processing System

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Image Enhancement:

Image enhancement operations improve the qualities of an image like improving the image's contrast and brightness characteristics, reducing its noise content, or sharpen the details. This just enhances the image and reveals the same information in more understandable image. It does not add any information to it.

Image Restoration:

Image restoration like enhancement improves the qualities of image but all the operations are mainly based on known, measured, or degradations of the original image. Image restorations are used to restore images with problems such as geometric distortion, improper focus, repetitive noise, and camera motion. It is used to correct images for known degradations.

Image Analysis:

Image analysis operations produce numerical or graphical information based on characteristics of the original image. They break into objects and then classify them. They depend on the image statistics. Common operations are extraction and description of scene and image features, automated measurements, and object classification. Image analyze are mainly used in machine vision applications.

Image Compression:

Image compression and decompression reduce the data content necessary to describe the image. Most of the images contain lot of redundant information, compression removes all the redundancies. Because of the compression the size is reduced, so efficiently stored or transported. The compressed image is decompressed when displayed. Lossless compression preserves the exact data in the original image, but Lossy compression does not represent the original image but provide excellent compression.

Objective and Scope:

We develop a framework for moving object segmentation and classification by using the motion vectors and associated modes directly extracted from HEVC compressed video. Specifically, we focus on surveillance videos whose cameras are stationary. Compared to existing methods in the literature, our work has the following unique aspects and innovations: the unique features in the HEVC compressed domain, such as coding unit and prediction unit, are employed to refine the moving object boundary; the bag of words representation in the HEVC compressed domain is applied to classify the moving persons and vehicles.

II. PROPOSED SYSTEM

The overall framework of our system is illustrated in Fig. 1. It consists of two stages: moving object segmentation and person-vehicle classification. For moving object segmentation, firstly, MV interpolation for intra-coded prediction unit (PU) and MV outlier removal are employed for preprocessing. Then, blocks with non- zero motion vectors are clustered into the connected foreground regions by using the four-connectivity component labeling algorithm. Finally, object region tracking with temporal consistency is applied to the connected foreground regions to remove the noise regions. The boundary of moving object region is further refined by using the coding unit (CU) and PU sizes of the blocks.

For person-vehicle classification, it involves a training phase to learn the person-vehicle model using "bag of spatiotemporal HEVC syntax words" and a testing phase to apply the learned model to test videos. For the testing phase, we first extract the spatial and temporal information of each 4×4 block to obtain the feature descriptor. Then, the descriptors of all blocks are clustered into a number of code word. The foreground object is represented by a histogram of the code word. Finally, for the segmented moving object, we apply the learned person-vehicle model to determine which category to assign.

Proposed System Technique Explanation:

This reliability information along with the MV magnitude is used to segment foreground objects from the background. MVs are classified into multiple types, such as background, edge, foreground, and noise. Then, the MVs and their associated class information are used to segment each blocks. Global

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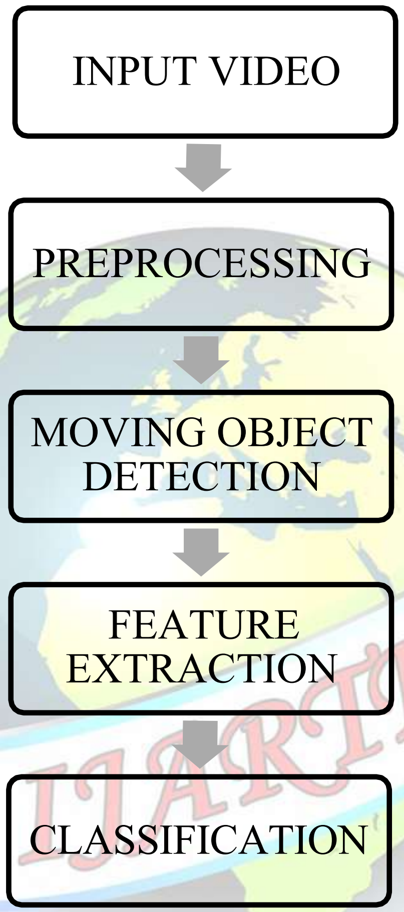
motion is first removed from the motion vector field, and moving object segmentation process is performed on the compensated motion vector filed.

BLOCK DIAGRAM:



Proposed System Advantage:

- The computational complexity is so low, many in the Video Coding field have used the technique to estimate a motion vector at each pixel.

- This is done so that there is less chance of the 'motion averaging' effect of block wise manipulations. The approach is of limited use because some finite support region must always be employed to set up the necessary equat

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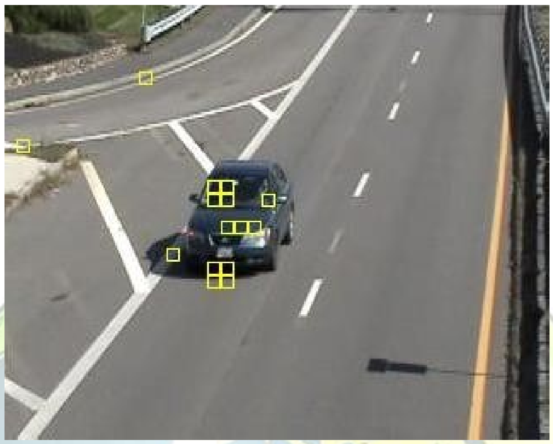
SNAPSHOT:

1. **Preprocessing:**



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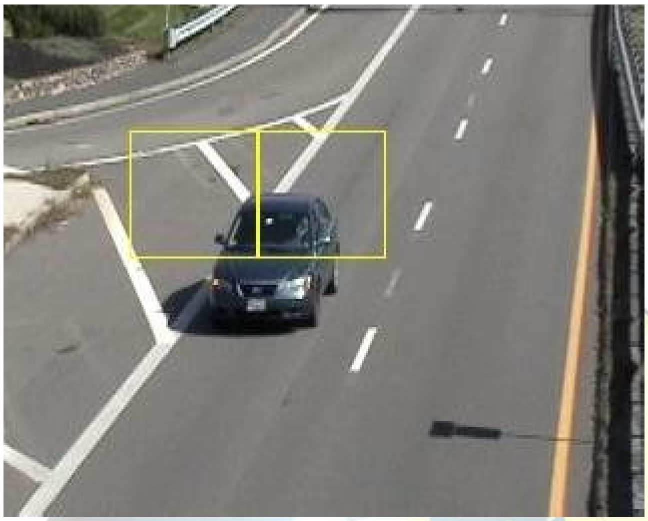
2. **Object region tracking:**



3. **Object Boundary Refinement:**

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4. Object Segmentation:

5. Output:

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III. Conclusion

In this paper, we have presented a novel approach to segment and classify the moving objects from HEVC compressed surveillance video. Only the motion vectors and the associated coding modes from the compressed stream are used in the proposed method. In the proposed method, firstly, MV interpolation forintra-coded PU and MV outlier removal are employed for preprocessing. Secondly, blockswith non-zero motion vectors are clustered into connected foreground regions by the four-connectivity component labeling algorithm. Thirdly, object region tracking based on temporal consistency is applied to the connected foreground regions to remove the noise regions. The boundary of moving object region is further refined by the coding unit size and prediction unit size. Finally, a person vehicle classification model using bags of spatial-temporal HEVC syntax words is trained to classify the moving objects, either persons or vehicles. The proposed method has a fairly low processing time, yet still provides high accuracy.

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