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Motion Analysis for Real-Time Surveillance Video via Block Pixel Analysis Technique

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Abstract. Video is constructed based on combination of frames sequence which conveys different type of information via an image pixel values. A change of information from one frame to another frame is presented with different pixel values and this can be referred as motion translation. Motion translation can be studied via comparing and subtracting the pixels of both, the previous frame and current frame. This paper presets a study about motion translation using the comparing and subtracting technique to analyze motion of real surveillance video images. Two images are extracted, each image is divided into 16 × 16 block size to select the area of interest and analyze the motion translation of the selected area of interest. This method is fast and reduces the processing time due to only selected block pixels are analyzed for motion translation purposes. Addition to that, it also memory saving because only selected block pixels value are subtracted and compared to perform the area of interest.

Keywords: motion translation; block positioning; positioning subtraction; block of interest

1. Introduction

Video sequence consist of still picture images which are visualized and interlaced one after another to make it as a video [1, 2]. The images changes convey different information in two dimensional are produce rapidly which unable the human's naked visualization system to detect or track the motion translation in the moving images [3]. Due to this reason, there is a necessity to analyze the image sequences which are taken using a camera. To analyze the motion translation, Block Matching Algorithm (BMA) is the simplest technique used where a frame is divided into small block size 16 × 16 [4, 5] or 8 × 8 pixels blocks [6]. Each blocks from both, current image and previous image is compared based on the pixels value to analyze the motion translation.

This paper presents a simple block based pixel subtraction technique to analyze the motion translation between both images based on area of interest. The motion translation analysis is conducted based on 16 × 16 block size. Block of area of interest from each image is selected and pixels value of both selected blocks is subtracted to analyze the motion translation between two selected blocks. Non-zero pixels value represents the motion translation and zero pixels value represents no motion translation in the analyzed blocks.

2. Proposed Experiment

Motion translation is rapidly evolving field for several applications which include remote surveillance, remote working and learning and etc. It is also can be defined as an upcoming information and technology based research in image processing area. Motion translation also helps into conducting motion analysis in terms of providing information in video processing and computer vision applications. In competitive schemes, many motion estimation algorithms are developed to analyze the images from video sequences. In this paper, the proposed idea is to determine the motion translation between two selected blocks of current image and previous image in a video sequences, the video is extracted into single image as illustrated in Fig. 1. The video is extracted from the first image (N image) to the last image (N+1 image).

Two targeted images (current image and previous image) are selected from a video sequences which consists of many images. The current image and previous image is then divided into small blocks size of 16 × 16 as shown in Fig. 2. Both selected images are analyzed based on the pixels values.

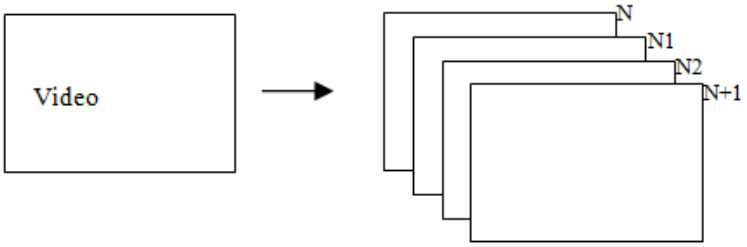


Fig. 1: Video to image extraction.

Fig. 2: Block size 16 × 16.

The small blocks at the current image and previous image is compared with each other as illustrated in Fig. 3. Equation (1) is applied into current image and Equation (2) is applied into previous image is used to compare each block division. Each divided block is used to subtraction between the current image and previous image. Each block's pixels are subtracted to analyze the pixels values by using Equation (3).

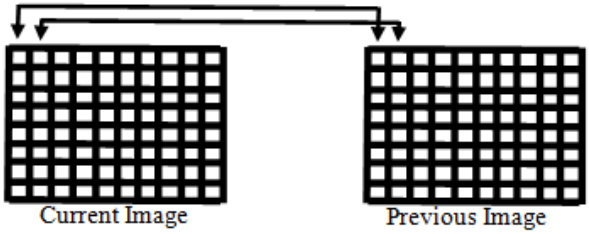


Fig. 3: Block Comparison.

$$Block = current\_frame(1 + bsize \times (i-1) : bsize \times i, 1 + bsize \times (j-1) : bsize \times j) \quad (1)$$

$$Block2 = subsequent\_frame(1 + bsize \times (i-1) : bsize \times i, 1 + bsize \times (j-1) : bsize \times j) \quad (2)$$

Where, bsize = 16

i = row coordinate

j = column coordinate

$$Subtraction = |Block2 - Block| \quad (3)$$

Fig. 4 explains the proposed experiment in flowchart. A surveillance video is possessed from the Security Department of Universiti Teknikal Malaysia Melaka to test run the developed video coding. The

flowchart explains the full experiment setup step by step. The flowchart can also be the reference to develop the pixel subtraction technique for future extension.

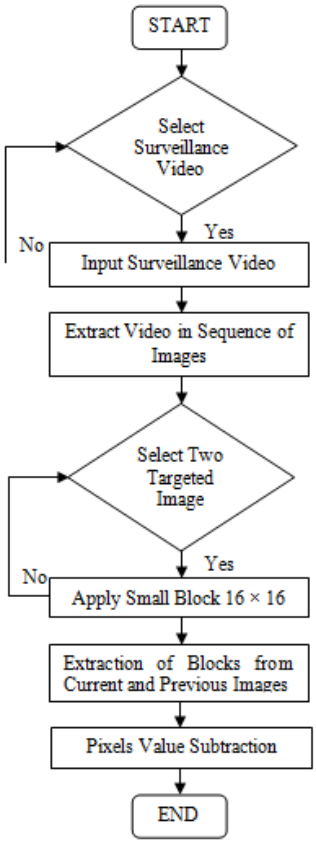


Fig. 4: Current Image and Previous Image Block Subtraction Technique.

3. Experiment Result and Data

Certain condition need to be persistent in order to analyze the changes of pixels value in the selected images. This is to ensure that the same environment and condition is used for each image during the conduct of motion translation. The condition which is set constant is as follows:

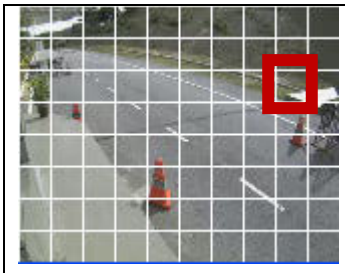
- Block size of 16 × 16 pixels
- Surveillance video (frame size of 128 × 160 pixels

In this experiment, a surveillance video is applied to conduct the motion translation analysis in an image. Fig. 5, Fig. 6 and Fig. 7 shows the extracted data of three different types of images in the experiment.

In the surveillance video sequences in Fig. 5, three different images are selected for data analysis. In the first analysis, previous image (a1) and current image (b1) shows no motion translation information. The selected coordinate block at (4, 3) area of interest shows no motion translation as depicted in c1. The subtracted result is presented in matrix form as shown in (d1).

(a1) Current frame

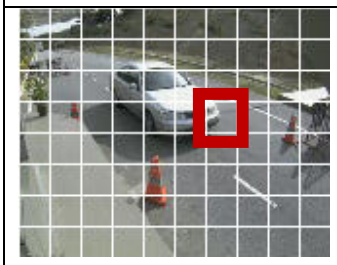
(b1) Subsequent frame



(c1) Example block selected	(d1) Location (4,3)

Fig. 5: No Motion Translation

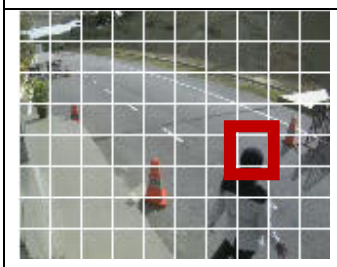
(a2) Previous Image	(b2) Current Image



(c2) Example selected block	(d1) Location (7,4)

Fig. 6: Motion Translation of Car Front

(a2) Previous Image	(b2) Current Image



(c2) Example selected block	(d1) Location (8,5)

Fig. 7: Motion Translation of Lady Guard Head

In the second sequence, a static background is chosen for previous image (a2) while the current image (b2) shows a car passing through the surveillance video camera. A block is selected at coordinate (7, 4) as an area of interest to analyze. Both selected blocks are subtracted and the result is presented in matrix form as shown in (d2). Presented result in (d2) matrix shows a drastic motion changes in the pixels value at the left corner. This pixels value change represents the front portion of the moving car.

In the third sequence, previous image (a3) shows a static background while the current image (b3) shows lady guard walking passes the surveillance video camera. A block is selected at coordinate (8, 5) at both images are subtracted. The result is presented in matrix form in (d3). The matrix (d3) shows that there is a high increment in the pixels value which is located at the bottom of the matrix. The changes occur represent the head of the lady guard.

4. Discussion

When the value of pixels is subtracted and produces zero values, no motion translation is detected. Thus, the images are carrying the same information as resultant in Fig. 5. Some of the pixels in the first sequence is not zero value due to the light intensity occurrence due to the sunny day. This reading can be ignore sue to the sun light intensity and there is no drastic impact towards the motion translation in the image. In Fig. 6 and Fig. 7, the pixels change represents the front portion of car and head of lady guard respectively. There is difference in the pixels value when both images are subtracted. This happens because different value of pixels represents different information and color. The matrix result (d2 and d3) presents areas with no object detected (such as car and lady guard), the subtracted pixels value are relatively zeros or at minimal value (due to the intensity of light). The rest of the area represented with pixels value is subtracted and motion translation occurs in that area.

5. Conclusion

Block based subtraction technique is a simple method in detecting, estimating and analyzing the motion translation that happens in a sequence of images. This technique reduces the processing time and memory saving because its only processes the area of interest.

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