SURVEILLANCE VIDEO PIXEL ANALYSIS VIA BLOCK-BASED PIXEL SUBTRACTION TECHNIQUE

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Abstract— Video is constructed based on sequence of frames which conveys different type of information based on the pixels values. Information of each frame changes from one frame to another frame which also is based on pixels values. These changes are referred as motion translation. This motion translation can be analyzed with comparing or subtracting both the current frame and subsequent frame pixels values. In this paper, a study is conducted to analyze the motion translation using the pixel subtracting technique. A video is processed to extract all the frames into sequences. Two targeted frames are selected from the extracted sequences of frames to be analyzed for motion translation. The two selected frames are divided into 16 × 16 block size for data analysis purposes. This technique is a fast and reduces the processing time due to only pixels values difference is analyzed for data processing purposes. It also saves memory space because it only involves values subtraction.

Keywords — Motion Translation; Block Positioning; Positioning Subtraction; Block of Interest.

I. INTRODUCTION

Video consist strings of frame which are visualized one after another to make it as a video [1, 2]. Each of this frames are a still picture image. The frames convey information in two dimensional changes rapidly so that the human visualization system sees the frames as continues moving images [1]. Same information produces the same pixels values whereas different information produces different pixels values. 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 [3, 4] or 8 × 8 pixels blocks [5, 6]. Each block is compared between both frames to analyze the motion translation.

In this paper, a simple block based pixel subtraction technique is applied to analyze the motion translation between both frames. Block size of 16 × 16 pixels from the current frame and subsequent frame is subtracted to analyze the motion changes. A non-zero pixels value represents the motion translation between the both frames while zero pixels values represent no motion translation.

II. PROPOSED EXPERIMENT

In determining motion translation between selected frames in a video sequences, the video is extracted into single frames as illustrated in Fig. 1. The video is extracted from the first frame (N frame) to the last frame (N+1 frame).

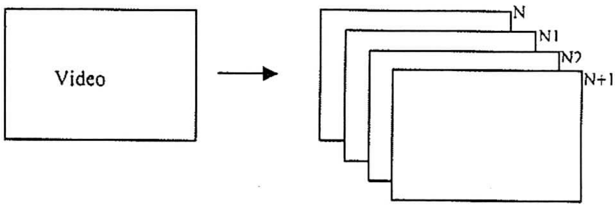


Figure 1. Video to frame extraction.

Two targeted frames (current frame and subsequent frame) are selected from the video sequences of frames. The current frame and subsequent frames is divided into small blocks size of 16 × 16 as shown in Fig. 2. Both selected frames are analyzed based on the pixels values.

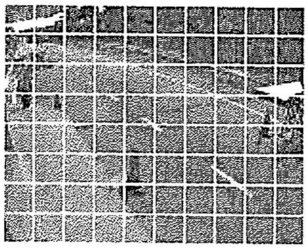


Figure 2. Block size 16 x 16.

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

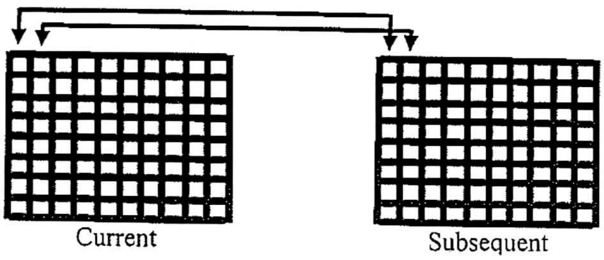


Figure 3. Block Comparison.

$$Block = current\_frame(1 + bsize \times (i-1) : bsize \times i, \ldots$$
$$\ldots 1 + bsize \times (j-1) : bsize \times j) \text{ --------------------- } (1)$$

$$Block2 = subsequent\_frame(1 + bsize \times (i-1) : bsize \times i, \ldots$$
$$\ldots 1 + bsize \times (j-1) : bsize \times j) \text{ ---------------------- } (2)$$

Where, bsize = 16
i = row coordinate
j = column coordinate

$$Subtraction = |Block2 - Block| \text{ ------------------- } (3)$$

III. Experiment Results and Data Analysis

Certain condition need to be persistent in order to analyze the changes of pixels values in the frames involved. This is to ensure that the same environment is used for each frame during motion translation search being conducted. The condition which is set constant is as follows;

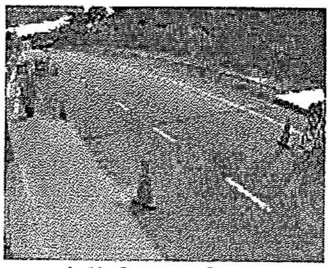
- Block size of 16 × 16 pixels
- Surveillance video (frame size of 128 x 160 pixels)

In this experiment, a surveillance video is applied to conduct the motion translation in image analysis. Fig. 4, Fig. 5 and Fig. 6 shows the extracted data of three different video sequences in the experiment.

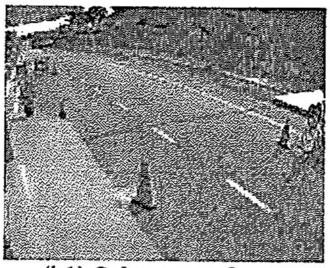
In the surveillance video sequences, three different frames are selected for data analysis. In the first frame, current frame (a1) and subsequent frame (b1) shows no motion translation information. The selected coordinate (4, 3) area of interest shows no motion translation as illustrated in c1. The subtracted result is presented in matrix form as shown in (d1).

In the second sequence, a static background is chosen for current frame (a2) while the subsequent frame (b2) shows a car passing through the surveillance video camera. A block is selected at coordinate (7, 4). 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 values at the left corner. These pixels values changes represent the front of the car.

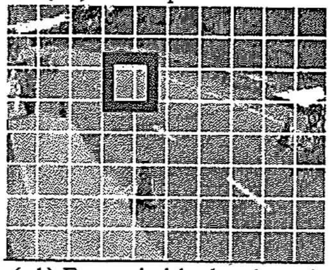
In the third sequence, current frame (a3) shows a static background while the subsequent frame (b3) shows lady guard walking passes the surveillance video camera. A block is selected at coordinate (8, 5) at both frames are subtracted. The result is presented in matrix form in (d3). The matrix (d3) shows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



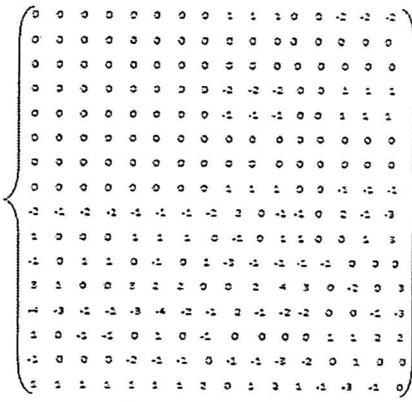
(a1) Current frame



(b1) Subsequent frame

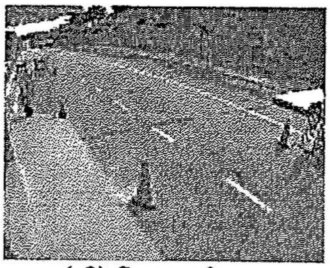


(c1) Example block selected

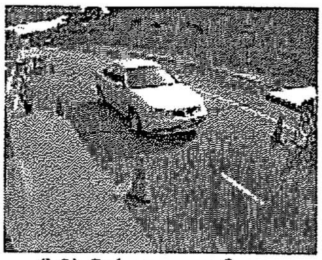


(d1) Location (4,3)

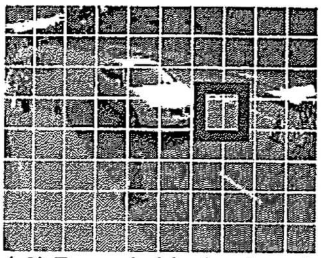
Figure 4. First sequence.



(a2) Current frame



(b2) Subsequent frame

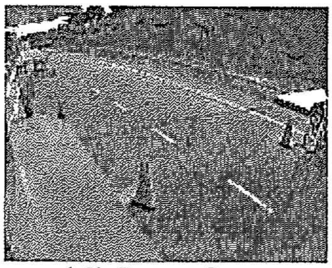


(c2) Example block selected

83	84	88	63	79	13	3	3	0	3	-6	-4	5	2	-9	-6
51	69	91	55	62	20	2	1	4	-2	-7	-1	-1	1	4	-6
93	95	88	83	65	64	5	4	-1	4	-3	-6	-1	-3	3	3
62	42	62	35	31	57	2	-5	-1	-1	0	-2	-1	-5	0	-5
-77	-79	0	-2	19	81	33	6	-4	-1	0	-4	5	-2	-1	15
-70	-58	-11	-4	82	57	93	12	-1	0	4	-3	-1	1	-4	3
-81	-6	35	22	70	111	122	30	3	0	-5	-6	-6	2	-1	-6
71	47	75	104	99	93	47	24	-2	0	-2	1	-2	-3	-6	1
-3	96	101	103	56	-33	12	-2	0	1	4	0	-2	-5	-3	-4
100	73	2	-33	-27	-48	-40	-9	0	0	-6	0	-1	-1	-1	-3
-51	-51	-54	-57	-43	-50	-81	6	-2	2	0	-2	-6	5	-1	2
-85	-69	-46	-76	-70	-72	2	1	0	0	-2	2	-7	-1	1	1
-50	-55	-55	-52	-60	-26	-9	-2	0	0	-6	-6	-5	-4	-3	-3
-64	-74	-78	-21	-32	-12	-8	3	-1	2	0	-7	-4	-3	-5	-4
-54	-25	-39	-26	-5	-11	-10	-6	2	0	0	5	-4	-3	2	-1
-53	-34	-26	-15	-12	-9	0	-1	-3	3	-1	-1	-1	5	-3	0

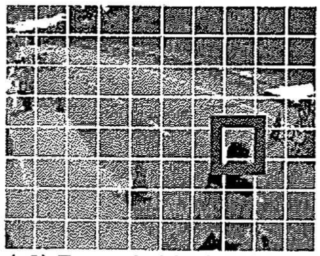
(d2) Location (7,4)

Figure 5. Second sequence.



(a3) Current frame

(b3) Subsequent frame



(c3) Example block selected

1	0	-1	0	5	1	6	2	5	4	-1	5	2	5	7	10
2	6	7	3	2	0	2	2	3	2	5	5	7	3	5	10
2	3	5	6	2	5	4	3	3	1	5	2	4	5	9	1
0	-1	-2	6	2	3	-3	5	2	12	3	12	7	6	4	9
10	5	3	4	0	1	-2	5	8	1	2	8	2	11	0	1
6	7	1	0	4	3	-3	5	0	2	2	5	10	2	2	3
9	7	4	5	5	-4	-9	-13	-14	-7	3	7	5	1	2	-1
5	5	-1	-11	-21	-52	-56	-58	-55	-57	-41	-12	-1	6	0	11
-2	5	3	-20	-75	-83	-80	-76	-75	-83	-63	-49	-15	1	2	7
1	-1	2	-74	-90	-92	-102	-97	-92	-104	-80	-65	-49	-9	7	5
2	5	-20	-93	-99	-100	-102	-105	-103	-108	-95	-92	-73	-29	5	11
4	6	-70	-101	-104	-99	-99	-95	-112	-109	-105	-104	-57	-54	0	4
3	-5	-100	-105	-104	-106	-102	-99	-99	-95	-106	-117	-108	-74	8	5
1	-1	-101	-101	-102	-111	-107	-110	-103	-102	-99	-107	-102	-65	6	-4
7	5	-103	-113	-109	-110	-113	-114	-110	-110	-102	-107	-101	-54	0	-2
8	0	-102	-112	-115	-115	-110	-110	-115	-113	-103	-106	-102	-31	5	1

(d3) Location (8,5)

Figure 6. Third sequence.

IV. DISCUSSION

Motion translation occurs when there are differences in the pixels values in a sequence of video frames. When the values of pixels are subtracted and produces zero values, no motion translation is detected. Thus, the frames are carrying the same information. This can be observed in the first sequence of the video surveillance. Some of the values in the first sequence do not give a zero value due to the light intensity occurs because of the sunny day. Even though it is not a zero value, the value is relatively small and does not give a drastic change of pixels values which represent no motion translation occurs. In the second and third sequence, there are car and lady guard respectively. A duo change happens in both of the frames, there is a obvious difference in the pixels values when both frames are subtracted. This happens because different value of pixel represents different information and color. As can be seen in the matrix result (d2 and d3), the areas which does not have an object (such as car and lady guard), the subtracted pixels values are relatively zeros or at minimal value (due to the intensity of light). The rest areas represent big different when pixel values are subtracted. Thus, motion translation happens in that area

V. CONCLUSION

Block based subtraction technique is a simple method in detecting, estimating and analyzing the motion translation that happens in a sequence of frames. This technique reduces the processing time and memory space used because it's process only involves the area of interest. This technique can be applied into video analyzing system such as video security system.

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