

A New Background Updating Model for Motion Detection Considering Future Frame

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Abstract— Motion detection is now very much popular for its different type of applications. And the most important thing for motion detection is the background updating procedure. For background updating, all the existing work is done actually depend on the present and past frame. In this paper we proposed a new background updating model for motion detection which mainly differs by considering the future frame. This work is done by taking a number of frames initially to find median from these frames and stored as the past background. Then some frames are taken as future frames and computes a future background from these frames by finding the median. Now if motion occurs in any frame which lies between the past background and this updated future background can be detected easily and accurately by comparing the frames with both of these two updated background. And after some moment the updated future background will be the past background and again some of the frames will be considered as the future frames to calculate the new future background. Our proposed method can update the background accurately as well as can detect motion or moving object perfectly. We have applied this method on various real time data and got promising results.

Keywords-background updating; past and future background; motion detection; object detection.

I. INTRODUCTION

Motion detection is a process through which the moving object can be detected. This is actually done by finding the pixel value difference from frame to frame. This motion detection algorithm is used in many video surveillance systems for positive alarm of motion. Many restricted area where unauthenticated object should not be present there it has a great use. For the detection or observation of criminal activity video surveillance system is now used almost every crowded place. This has a wide use in military section. The electronic motion detection is basically based on the difference between pixel values in two consecutive video frames and that's why it is able to locate the motion when there is any change in pixel values. This is the simplest way for motion detection but for detecting motion more accurately there has been done many improved work in previous days. For motion detection there are mainly three basic methods present, first is background subtraction, the other is temporal differencing and the last is optical flow [1]. In temporal differencing the video frame is separated in a time scale and then find if there is any change [2]. Another method for motion detection is optical flow. It is a vector based method

which make point based analysis on multiple frames for motion detection [3]. Background subtraction is very popular for static background applications. Much work has been done in the basis of background subtraction [4], [5], [6]. One work showed the observation of motion in static camera scene, which is the main task in visual surveillance [7]. Also another work has done for automatically discovering key motion patterns happening in a scene by observing the scene for an extended period [8]. For 3D motion tracking motion detection is also important and for this purpose model based motion tracking system where distributed networks camera is used has been developed [9]. Also motion is detected along with video quality analysis for video surveillance systems in where three modules is used- a background modeling (BM) module, an alarm trigger (AT) module, and an object extraction (OE) module [10]. Motion detection is done for crowded analysis [11], on road vehicle detection systems [12] and intelligent distributed surveillance systems [13] etc. Motion detection is also applied for observation of object behavior [14] and observation of human behavior for homeland security applications [15]. One of our previous works has done on the basis of temporary background selection and then develops a permanent background through which motion can detect perfectly except some exceptional cases [16].

In this work we proposed a new method in where we consider number of future frames to model future background. The major feature is the past background and future background. Initially from some video frame the median is calculated and then these median pixel values are stored as the past background. After storing the past background then consider some frames as future frames which are lies ahead of time than the past. From these future frames another background is stored by finding the median of these frames. Now there remain some frames between the past background and the future background. If any positive motion occurs on these frames then simply by comparing with both the past background and future background this can be detected. Only if there finds any pixel value difference there a motion is detected. And for updating after a certain time instance it can update automatically. After some time the future background will be the updated past background and the updated future background will be calculated as explained before. In this method chance of a false positive alarm is very low. We have applied this method in different real time data and we observed promising results from this method.

The rest of the paper organized as follows. Section II briefly overviews of our proposed framework. Section III describes the proposed algorithm of our method. Experiments and result analysis are described in Section IV. Section V shows the discussion of this work. We conclude the paper in Section VI.

II. OVERVIEW OF OUR FRAME WORK

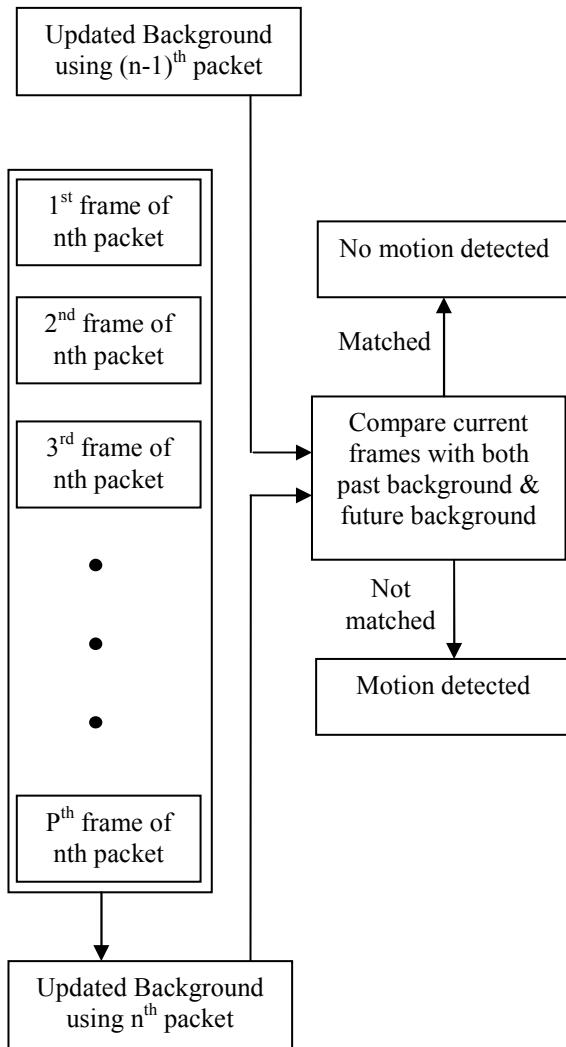


Fig 1. Block diagram for background modeling and motion detection

Fig. 1 describes the block diagram of the background modeling process of our proposed method. In this method we have initially updated a background from first 40 frames which lies in the (n-1)th frame. And then with the next 40 frames from nth packet another background is updated that we have defined as future background. Then with these two updated background the frames which lies on the nth packet is compared for motion detection. If any pixel values of these frames are mismatched with both of these two backgrounds then there a positive motion will be detected. If any frame's pixel value matches with any of the background then there will be no motion detected. After this when (n+1)th packet

comes then the nth will be the updated past background and the new future background will be updated from the (n+1)th packet. Here one of the backgrounds defined as the future background because the frames which are compared for motion detection comes first than the updated background in time scale. Mainly the future background comes later than the frames being compared. That's why here we have defined it as future background.

III. ALGORITHM OF OUR PROPOSED METHOD

1. Select a certain number of frames for making each packet.
2. For updating background and motion detection:

Step 1) Make an initial or past background by using first packet ((n-1)th packet) which contains initial frames.

Step 2) Create a future background by using the next packet (nth packet).

Step 3) Compare the nth packet's frames with both past background and future background consequently.

If both \square pixel value of any frame- pixel value of past background $\square >$ threshold and \square pixel value of any frame- pixel value of future background $\square >$ threshold then there detects a motion.

Otherwise there is no motion occurs.

Step 4) Now if the (n+1)th packet's all frames acquired then update the current past background with the previous future background and update the current future background by using (n+1)th packet's frames.

Step 5) Go to **Step 3** and set nth packet= (n+1)th packet.

3. If no more frames available for updating future background then **Stop**.

IV. EXPERIMENTAL STUDY

A. Acquisition of Image

The acquisition of video image was performed with the camera sth-dsg-9cm. The STH-DCSG is a revolutionary stereo head with a global shutter specially designed for machine vision tasks of scenes with motion, Pre-calibrated so it is plug-and-play, Global shutter, low-noise, high-sensitivity CMOS imager, Color or monochrome, uncompressed video at VGA resolution (15 fps), Includes miniature lenses and SRI Small Vision System software for real-time stereo analysis, Offering high performance and low power with motion capture in a compact package. Here the camera is interfaced with a video surveillance system. When the camera is calibrated, it will produce dynamic video images.



Fig 2. Pictorial view of a STH-DCSG - 9CM camera

B. Experimental Results

1. Indoor Small Object

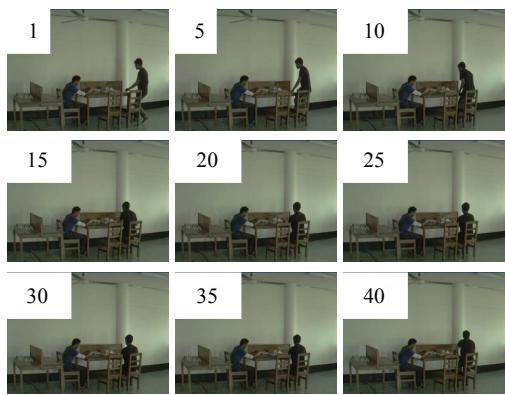


Fig 3. 1st packet of frames for indoor small object (frame 1-40)



Fig 4. Past background after first packet of frames acquired

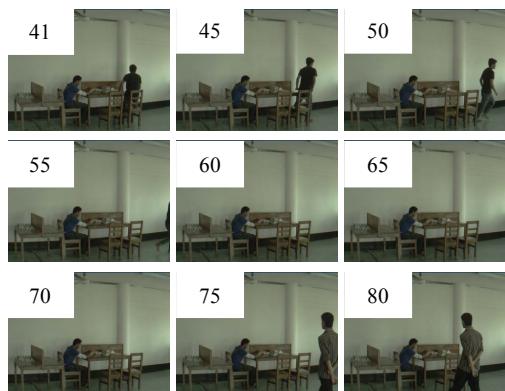


Fig 5. 2nd packet of frames for indoor small object (frame 41-80)



Fig 6. Detected future background

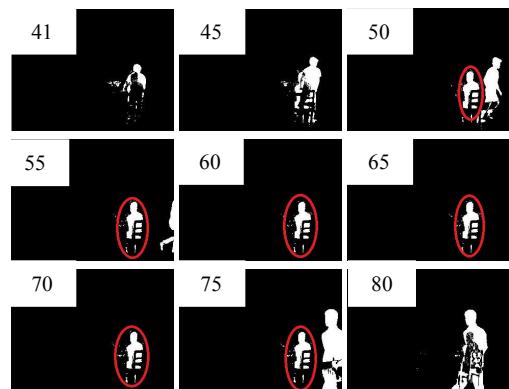


Fig 7. Motion detection using conventional process

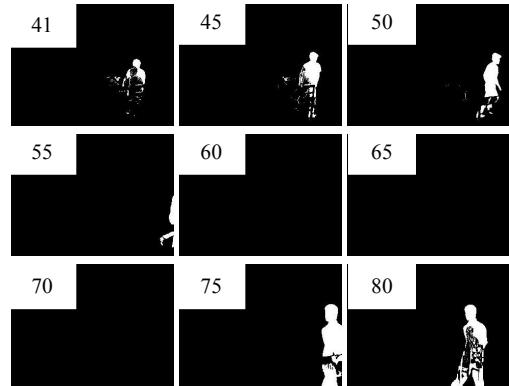


Fig 8. Motion detection using our proposed method

At first we consider indoor small object in real time data to observe the performance of our proposed method. First we consider the scenario which described on fig. 3. Here one object is reading in the reading room and another object is coming towards the first object and sits beside him, which occurs from frame 1 to frame 40. But in frame 41 the second object is started to leave the place and in frame 55 the second object is almost gone. From frame 56 to 70 the first object is only object present there without any motion. In frame 75 third object's entrance is occurred. And the only moving object is there is this third object which moves frame 75 to frame 80. Now in conventional process from the first 40 frames a background is updated for motion detection using the median from the frames. Then when this background is compared with the frames which come next to it, this method detects the stationary object as moving object. When the 1st background compared with frame 41, 45, 50 etc then there it finds the second object as moving because the pixel values differ from these frames. In the frame 65, there is no moving object but the conventional method still shows the 2nd object as a moving object which has no existence on this frame. The erroneous motion detection is shown on the fig. 7 by using a red circle. For this type of difficulty our proposed method reduces this false positive alarm. In our method first 40 frames (frame 1-frame 40) are taken to update the initial background which is shown on the fig. 4 and then the next 40 frames (frame 41-frame 80) are considered as future frame and then from these frame the future background is updated which is also shown in fig. 6. For this reason if we want to find the motion from frame

41 to frame 80 then these frames are compared both with the initial background and with the future background, if pixel value mismatches for both background then it detects a moving object there. The moving object detection by our proposed method is shown in fig. 8, where only the moving object is detected perfectly. And for next upcoming 40 frames the current future background will be the initial or past background and the future background will be updated from next 40 frames. In this process the motion detection or moving object detection is done perfectly.

2. Outdoor Small Object

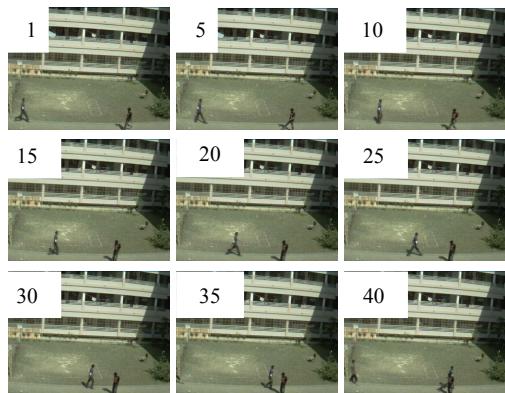


Fig 9. 1st packet of frames for outdoor small object (frame 1-40)



Fig 10. Background after first packet of Frames

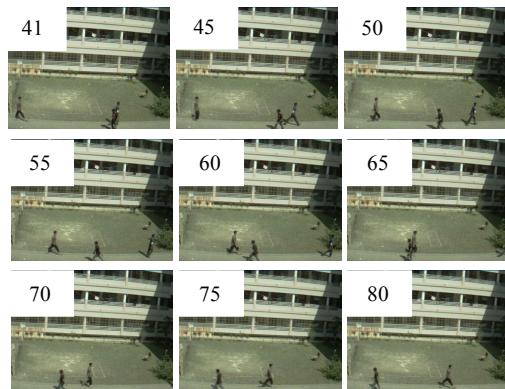


Fig 11. 2nd packet of frames for indoor small object (frame 41-80)



Fig 12. Detected background

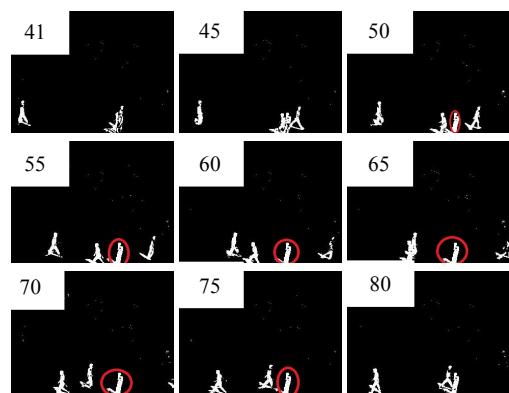


Fig 13. Using normal process

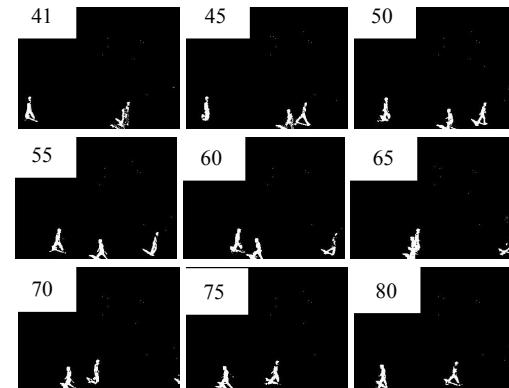


Fig 14. our proposed method

Here we have considered the scenario for outdoor small object. In this case two objects are walking in the road. The object which comes from the right side walks a little and then in a point it stands still and does not have any movement. But the object which enters from the left side it is continuously walking and crossing the first object. When crossing the man, another object also starts to enter in the road. This whole situation is described in fig. 9 through frame 1 to frame 40. At frame 45 the standing man started to move and frame 65 the first and third object crossed each other. Through frame 66 to 80 they walked away. This is described in the fig. 11. Now in the conventional background updating method from the first 40 frame a background will be updated by calculating the median from the frames. Then for detection of motion this background will be compared with the next coming frames, if it finds any difference on the pixel values then there it detects a motion. The initially updated background is shown on fig. 10. Let's see what's if we only consider this background to detect motion. When this background compared with frames 41 to 80 then in frame 50 it detects an extra object in the frame as moving object which is shown by a red circle. And this false positive alarm is appeared through the next frames. This erroneous picture is shown on the fig. 13. Now if we consider our proposed method in where a future background is found from next 40 frames (frame 41-frame 80) along with the past or initial background. And frames lies between these two

backgrounds are considered for motion detection. Each frame is compared with these two backgrounds and if pixel value mismatches for both background then it detects a moving object there otherwise there will be no moving object. After taken another 40 frames then the current future frame will be the updated past background and the future background will be updated by the newly taken frames. The experimental results by our proposed method is shown in fig. 14 where only the moving object is detected perfectly and this method shows no false positive alarm.

V. DISCUSSION

In this work our target is to develop a method through which motion can be detected perfectly. For this purpose we have considered two backgrounds one is past and another is future. And the frames which lies between the past background and future background is compared with both of these backgrounds to ensure the motion detection accuracy. We have applied this method on two real time video data and observed the performance. Our method has perfectly detected the motion when present in any frame but the traditional method has shown false positive alarm in some cases. Our proposed method may a little bit slow process because of updating the future background but in case of accuracy it shows high perfection.

VI. CONCLUSION

Motion detection is now very much popular due to its dynamic application. Many video surveillance systems use this feature for detection of motion and identification of object. It is also applied in traffic and human behavior recognition. So for all types of applications it is firstly recommended to detect the motion perfectly. And for motion detection by electronic way the background updating process is the most popular and important. Our proposed algorithm is tested on two real time data. Experimental study shows both the traditional method's motion detection result and our method's motion detection result. In some cases traditional method shows a moving object although there is no moving object present there. But our method removes this limitation and only shows the moving object if there is any. So in term of performance our proposed method shows better accuracy than the traditional method. It is also notable that our experimental results show better performance in noisy and open air environment.

ACKNOWLEDGMENT

Authors of this paper wish to gratefully acknowledge the project under HEQEP which is CP-2378 for the financial assistance of this work.

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