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Motion Detection Based on Frame Difference Method

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Abstract

Recent research in computer vision has increasingly focused on building systems for observing humans and understanding their look, activities, and behavior providing advanced interfaces for interacting with humans, and creating sensible models of humans for various purposes. This paper presents a new algorithm for detecting moving objects from a static background scene based on frame difference. Firstly, the first frame is captured through the static camera and after that sequence of frames is captured at regular intervals. Secondly, the absolute difference is calculated between the consecutive frames and the difference image is stored in the system. Thirdly, the difference image is converted into gray image and then translated into binary image. Finally, morphological filtering is done to remove noise.

Keywords: Motion detection; Temporal Difference

INTRODUCTION

An important stream of research within a computer vision, which has gained a lot of importance in the last few years, is the understanding of human activity from a video. The growing interest in human motion analysis is strongly motivated by recent improvements in computer vision the availability of low cost hardware such as video cameras and a variety of new promising applications such as personal identification and visual surveillances. The goal of motion detection is to recognize motion of objects found in the two given images. Moreover, finding objects motion can contribute to objects recognition. Thus, the main objective of the research is to recognize pixels belonging to the same object. However, the present research is based on the following assumptions:

- A well fixed camera –stability is key if you want to isolate motion.
- Stable light, no flickering
- Contrasting background
- High camera frame rate and resolution

Human body motion analysis has been an interesting research for its various applications, such as physical performance, evaluation, medical diagnostics, virtual reality. At present methods used in moving object detection are mainly the frame subtraction method, the background subtraction method and the optical flow method. Optical flow method is to calculate the image optical flow field, and do cluster processing according to the optical flow distribution characteristics of image.

This method can get the complete movement information and detect the moving object from the background better. The background subtraction method is to use the difference method of the current image and background image to detect moving objects, with simple algorithm, but very sensitive to the changes in the external environment and has poor anti-interference ability. In the frame subtraction method the presence of moving objects is determined by calculating the difference between two consecutive images. Any motion detection system based on background subtraction needs to handle a number of critical situations such as:

- Image noise, due to a poor quality image source;
- Gradual variations of the lighting conditions in the scene
- Small movements of non-static objects such as tree branches and bushes blowing in the wind;
- Shadow regions are projected by foreground objects and are detected as moving objects.

The main objective of the present research is to develop an algorithm that can detect moving object at certain distance for object tracking applications. The rest of the paper has been organized as follows: section 2 covers literature survey, section 3 covers detection of moving object, section 4 presents the experimental results, section 5 concludes the paper and references are given at the end.

LITERATURE SURVEY

The importance and popularity of motion analysis has led to several previous surveys: Wang and Zhao[1] proposed a motion detection by using background subtraction technique. In this video sequence is composed of a series of video images which contains the features of geometry information of the target, extract relevant information to analyze the motion of targets then get detection results. The compression ratio was greatly improved.

Rakibe and Patil[2] presented motion detection by developing a new algorithm based upon the background subtraction algorithm. In this firstly reliable background model based upon statistical is used. After that subtraction between the current image and background image is done based upon threshold. And then detection of moving object is done. After that, morphological filtering is initiated to remove the noise and solve the background interruption difficulty.

Kavitha and Tejaswini[3] presented motion detection by overcoming the disadvantages of background subtraction algorithm. In this robust an efficiently computed background subtraction algorithm has been used, which is able to cope with the problem of local illumination changes such as shadows and highlights as well as

global illumination changes.

Shafie et al. [4] presented motion detection using optical flow method. Optical flow can arise from the relative motion of objects and the viewer so it can give important information about the spatial arrangement of the objects viewed and the rate of change of this arrangement. Discontinuities in the optical flow can help in segmenting images in to regions that correspond to different objects.

Shuigen et al. [5]developed motion detection by using a method based on temporal difference and optical flow field. It is good at adapting to the dynamic environment. Firstly, an absolute differential image is calculated from two consecutive gray images. The absolute differential image is filtered by low pass filter and translated into binary image. Secondly optical flow field is calculated from image sequences by Hron's algorithm. Thirdly, moving object area is found out by indexed edge and optical flow field..

Devi et al.[6] presented motion detection using background frame matching. This method is very efficient method of comparing image pixel values in subsequent still frames captured after every two seconds from the camera. Two frames are required to detect movement. First frame is called reference frame and the second frame, which is called the input frame contains the moving object. The two frames are compared and the differences in pixel values are determined.

Lu et al.[7] presented motion detection by proposing a real time detection algorithm. In this the algorithm integrates the temporal differencing method, optical flow method and double background filtering (DBF) method and morphological processing methods to achieve better performance.

PROPOSED METHOD

Detection of moving object from a sequence of frames captured from a static camera is widely performed by frame difference method. The objective of the approach is to detect the moving objects from the difference between the existing frame and the reference frame. The frame difference method is the common method of motion detection. This method adopts pixel-based difference to find the moving object.

Difference of Two Consecutive Frames

$I_k$is supposed to be the value of the k^{th} frame in image sequences. $I_{k+1}$is the value of the $(k+1)^{th}$ frame in image sequences. The absolute differential image is defined as follows:

$$I_{d(k,\,k+1)} = |I_{k+1} - I_k| \quad (1)$$

Transformation of absolute differential image to Gray Image

There are holes in moving object area, and contour of moving object is not closed. The absolute differential image is transformed to gray image to facilitate further operations.

RGB To Gray :

$$Y \leftarrow 0.299*R + 0.587*G + 0.114*B \quad (2)$$

Filtering and Binarizing Transformed Gray Image

In order to remove the holes, the image is passed through the Gauss low pass filter.

I_{d1} is got by filtering the gray image. Now I_{d1} image is binarized using binary threshold and got I_{d2} binary image.

$I_{d2}(x, y)=$ (3)

Where (x, y) is a pixel coordinates in image.

EXPERIMENTAL RESULT

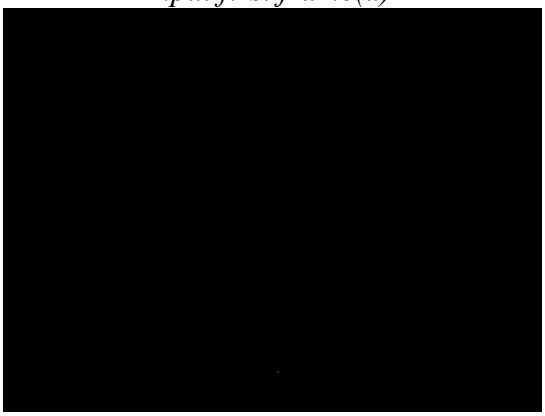
The result of image sequences computed by the method here is in the following figures.

When there is no movement in the frames

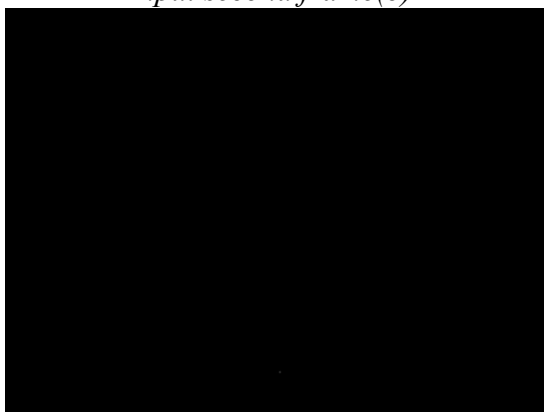
When there is no movement in the image sequences then the difference between the two images shows a black binary output image shows there is no difference in a single pixel.

Input first frame(a)

Input second frame(b)



Difference between two frame showing moving object



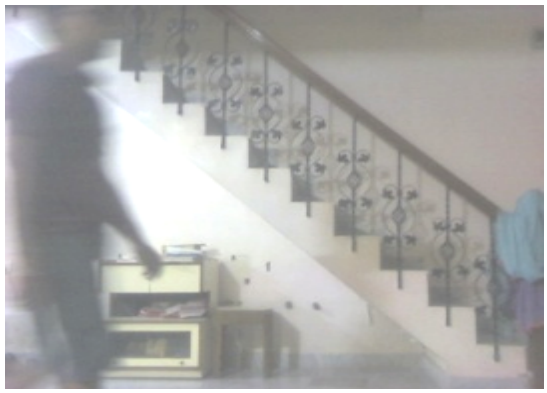
Binary image of difference image.

Fig(i)

When there is movement in the frame.

When there is movement in the scenes then the binary image of the difference between the two frames shows motion having white color and where there is no change shows black color.

Input first frame(a)



Input second frame(b)

Difference between two frame showing moving object

Binary image of difference image.

Fig(ii)

Limitations

The proposed method also detects the motion due to the movement in air. As the air moves, the camera not remains in the position of static so when there is no movement of object then also it results motion and shows holes in the binary output image.

Input first frame(a)

Input second frame(b)

Binary difference between the two frames showing holes.

Fig(iii)

CONCLUSION

In the present research, moving object is detected by the method of motion detection, which composes of frame difference method and morphological operations. The obvious keystone of the work is studying the principle of frame difference method and to resolve the various problems. The experiment shows that the method has good performance and efficiency. Future enhancement may include alerting the user by sending multimedia SMS, by email or by capturing video and streaming it online.

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