DETECTION MOTION OBJECT FROM THE VIDEO STREAM

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ABSTRACT

Detecting moving objects is very interested area in image processing. Motion can be detected by measuring changes in speed of an object or objects in the field of view. This system is connected with a fixed video camera and takes the video stream from it. Then the system compares the current image with a reference image and simply counts the number of different pixels. If the pixels of the resulted video frame are greater than the predefined alarm level, the system will fire the alarm event. The system use filters to implement the motion detection process. The main filters are difference filter – to find difference between two frames, threshold filter – to change the original frame to digital image, and erosion filter – to eliminate the noise. In this system, motion detector is implement to be very simple and efficiently. As the system doesn't use the complex mathematical calculation, the process is very fast.

1. INTRODUCTION

Motion detection is the challenging process in the image processing approach. As a subfield of digital signal processing, digital image processing has many advantages over analog image processing; it allows a much wider range of algorithms to be applied to the input data, and can avoid problems such as the build-up of noise and signal distortion during processing .In electrical engineering and computer science, image processing is any form of signal processing for which the input is an image, such as photographs or frame of video; the out put of image processing can be either an image or a set of characteristics or parameter related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Image processing usually refers to digital image processing in which various operations such as image editing (to increase the quality of a digital image), image segmentation, and two dimensional object recognition. Image processing can be used in many application contexts such as computer vision, face detection, feature detection, medical image processing, remote sensing, motion detection, warning system, visual surveillance, and automatic generation of video effects.

The system is implemented to detection motion object from the video stream. The Section 2 is related work and the proposed system overview is presented in Section 3. System architecture, grayscale methods are illustrated in Section 4. In Section 5, experimental results are shown and conclusion, limitation and further extensions are included in Section 6.

2. RELATED WORK

Several approaches have been considered for detecting motion until now. Various techniques and approach are applied to detect motion.

[5] presented an original method to estimate the displacement between two frames, based on multiscale local polynomial expansions of the images. When the displacement field has been computed, a plane + parallax approach is used to separate moving objects from the camera egomotion. [4]This paper demonstrates Detection and tracking of humans in video streams using data association and meanshift methods to track objects. There are many approaches for motion detection in a continuous video stream. All of them are based on comparing of the current video frame with one from the previous frame. In the proposed system, filters are mainly used to process in single and quick response than other methods. [10]

3. IMAGE FILTERING

In image processing, filters are mainly used to smooth the image or to enhance or to detect edges in the image. There are many filters used in digital image processing applications. It intends to detect the motion objects by using image processing filters. To do so, difference filter is used to compare the current frame to the previous one to get difference between two frames. In the case of motion, there is more than one image to be considered. If the system has two images obtained at different time, the way to detect motion is the use of image differencing. Changes of motion can be obtained by subtracting the intensity values. There is no motion; the subtraction gives a zero value. When an object in the images changes their pixel's intensity, the subtraction will give a different value between two frames. Threshold process is the simple shape extraction technique. This technique is used to separate the shape of motion object from the background by its brightness level. It can be used to find shape of objects within an image. In threshold process, pixels above a specified level are set to white and those below the specified level are set to black. Threshold provides an easy and convenient way to perform this segmentation on the basis of the difference intensities in the foreground and background regions of an image. [17]

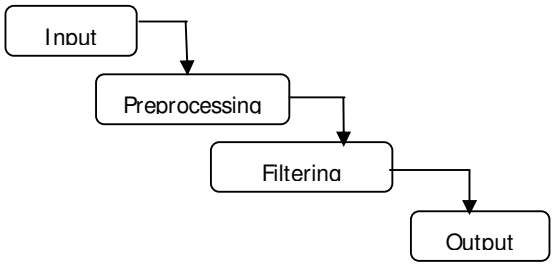

Figure 1. Block diagram of proposed system

3.1. Pixel difference

The pixel difference or pixel subtraction takes two images as input and produces as output a third whole pixel values are simply those of first image minus the corresponding pixel values from the second image. [11] In image difference process, if the image format does not support negative numbers then often such pixel are set to zero (black). The negative -30 appears in the output as 226.To overcome this problem, the different filter module calculates absolute differences and the two input images use the same pixel value type. The absolute difference between the two input images is calculated with the below formula [11]

$$Q = | P1 (i, j) – P2 (i, j)| \quad (1)$$

The pixel values in the input images are RGB vectors. The individual components (e.g. red, blue and green components) are simply subtracted separately to produce the output value. [11]

The algorithm is relatively simple.

1. Convert the incoming frame 'fr' to grayscale.
2. Subtract the current frame from the background model 'bg_bw' (in this case it's just the previous frame)
3. For each pixel, if the difference between the current frame and backround 'fr_diff (j,k)' is greater than a threshold 'thresh', the pixel is considered part of the foreground. [14]

3.2. Thresholding

Thresholding is used to segment an image by setting all pixels whose intensity values are above a threshold to a foreground value and all the remaining pixels to a background value. In this process, adaptive thresholding technique is used together with image difference process. Adaptive thresholding takes a grayscale image as input and outputs a binary image. For each pixel in the image, a threshold has to be calculated. If the pixel value is below the threshold, it is set to the background value (black).Otherwise it assumes the foreground value (white). Binary images are image whose pixels have only two possible intensity values. They are normally displayed as black and white. Numerically, the two values are often 0 for black and 1 for white. Binary images are produced by thresholding a grayscale image in order to separate an object in the image from the background. [16]

Algorithm for thresholding

int thres(a, b, t, N1, M1, N2, M2)

```
image a, b;
int t;
int N1, M1, N2, M2;
/* Subroutine to threshold an image
   a, b: buffers
    t: threshold (integer)
  N1, M1: start coordinates
  N2, M2: end coordinates  */
{ int i, j;
  for (i=N1; i<N2; i++)
    for (j=M1; j<M2; j++)
        if (a[i][j] <t) b[i][j]=0;
else      b[i][j]=1;
  return (0);
}    else            b [i][j]=1;
        return (0);
} [3]
```

3.3. Adaptive thresholding

Adaptive thresholding typically takes a grayscale or color image as input and, in the simplest implementation, outputs a binary image representing the segmentation

g(x,y)=1 if f(x,y) > T (2)
0 otherwise

The value of threshold T can be output with the following functions:

T = mean , mean values
T = median
T = $\frac{\max + \min}{2}$,

In the system, the choice of threshold T can be calculated using T = median. Adaptive thresholding selects an individual threshold for each pixel based on the range of intensity values in its local neighborhood. [13]

3.4. Erosion filter (Binary erosion)

Erosion process is used to reduce noise to get now mostly only the regions where the actual motion was. The basic effect of this operator on a binary image is to erode away the boundaries of regions of foreground pixels (white pixels). The erosion module takes two pieces of data as inputs. The first is the image which is to be eroded. The second is a set of coordinate points known as a structuring element (kernel). It is this structuring element that determines the precise effect of the erosion on the input image. The structuring element contains only foreground pixels (*i.e.* ones) which gives the shrinking effect. To compute the erosion of a binary input image by the structuring element, which consider each of the foreground pixels in the input image in turn. For each foreground pixel (input pixel) is superimposed the structuring element on top of the input image so that the origin of the structuring element coincides with the input pixel coordinates. [7]

If for every pixel in the structuring element, the corresponding pixel in the image underneath is a foreground pixel (1), then the input pixel is left as it is.

If any of the corresponding pixels in the image are background, the input pixel is also set to background vale (0). [7]

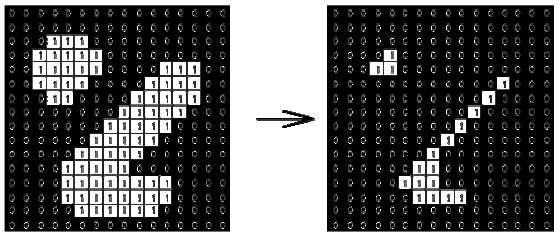

Figure 2. Demonstration of erosion process

The example figure is illustrated by using 3 * 3 structuring element

1	1	1
1	1	1
1	1	1

Set of coordinate points =

{ (-1,-1), (0,-1), (1,-1),
(-1, 0), (0, 0), (1, 0),
(-1, 1), (0,1), (1, 1) }

4. SYSTEM ARCHITECTURE

This system intends to detect the motion in video stream from the camera. Detecting moving objects is very interested area in image processing. The system takes images from video camera as its input. Then the system separates it as several frames. When the first frame is received, the system converts it as a gray scale image and then stores it as the previous frame. When the next frame is received, its gray scale copy is placed as a current frame. The system uses difference and threshold filters to find the difference between the bits of two frames. [7]

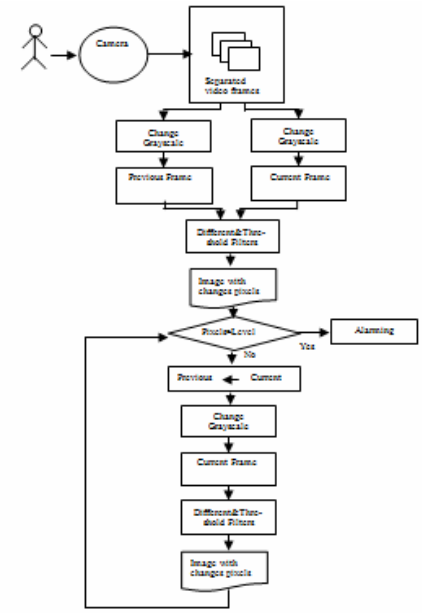

Figure 3. System flow diagram

In this step, the system produces an image with white pixels and counts the numbers of white pixels in it. If the number of white pixels counted will be greater than the predefined alarm level, the system will give alarm about a motion event. If the amount of white pixel's are less than that predefined alarm level, the process will be executed continuously.

For the next loop, the current frame will be the previous frame and the next received frame will be converted into a gray scale image and then stored it as the current frame. But most cameras produce a noisy image, so Erosion filter is used to remove random noisy pixels.

4.1. Image acquisition

Images from the camera are captured and changed to grayscale format. And then changed images are defined into frames as the image acquisition process.

4.1.1. Grayscale Converting

For a grayscale images, the pixel value is a single number that represents the brightness of the pixel. The most common pixel format is the byte image, where the number is stored as an 8-bit integer giving a range of possible values from 0 to 255. Typically zero is taken to be black, and 255 is taken to be white. Values in between them make up the different shades of gray.

The Grayscale module converts a color RGB image to grayscale values using the following formula technique. R (red), G (green), B (blue) represents the current pixels colors values. [15]

Pixel=0.299R+ 0.587G + 0.114B (3)

The "Pixel" value is then assigned to the Red, Green and Blue channels to create the final image using color matrix.

Red is converted to(R*0.299) + (G*0.587) + (B*0.114), Green is converted to (R*0.299) + (G*0.587) + (B*0.114) and Blue is converted to (R*0.299) + (G*0.587) + (B*0.114).

4.1.2. Noise Filtering

Noise filtering is needed in this system because images can be mixed with noise. In this step, noise filtering can be done by using erosion process.

For instance, in acquiring images with a camera, light levels and sensor temperature are major factors affecting the amount of noise in the resulting image.

Some noises are:

- Gaussian noise (also called normal noise)
- Rayleigh noise
- Exponential noise
- Uniform noise
- Impulse (salt-and-pepper) noise

4.1.3. Binarization

Grayscale image is converted into binary image using thresholding value. The output binary image has value of 1(black) and 0 (white) for all pixels.

Image Binarization converts an image of up to 256 gray levels to a black and white image. The simplest way to use image Binarization is to choose a threshold value, and classify all pixels with values above this threshold as white, and all other pixels as black. The problem then is how to select the correct threshold. In many cases, finding one threshold compatible to the entire image is very difficult, and in many cases even impossible. Therefore, adaptive image Binarization is needed where an optimal threshold is chosen for each image area.

5. EXPERIMENT RESULT

In the proposed system, Different filter is mainly used together with Threshold filter and erosion filter to implement the motion detection process.

The pixel difference or pixel subtraction takes two images as input and produces as output a third whole pixel values are simply those of first image minus the corresponding pixel values from the second image. Difference pixel in two images is illustrated in the following figure.

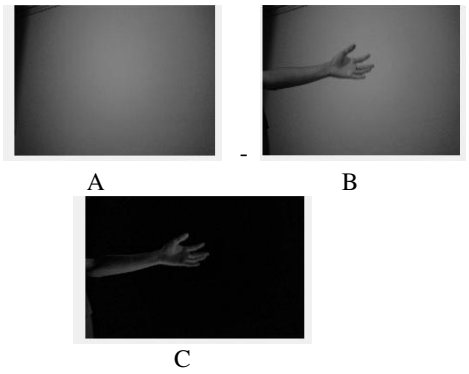

Figure 4.Pixel Difference between two images

Figure 5. Binary image using threshold process

The above figure is formed when the binary image from difference process is passed to the threshold process. Sometimes noises such as unnecessary pixels appear near the regions where the actual motion was. So, erosion filer is used to remove noises. The following figure is represented as the image result from erosion process.

Figure 6. Final image

This system counts the number of white pixels in the final image. If this range exceeds the predefined range, the alarm will be ringed.

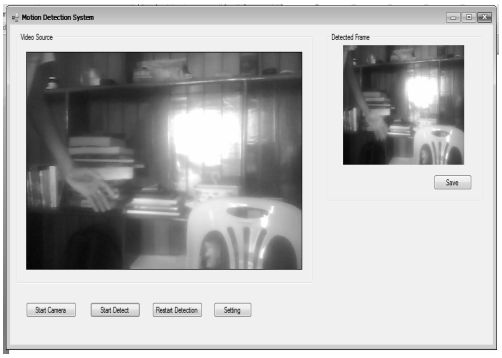

Figure 7. Start detection form

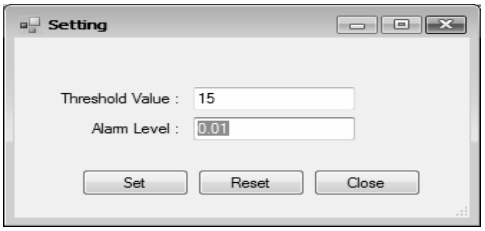

Figure 8. Setting form

In the system, the motion is detected in predefined alarm level of 0.01. The system beeps the alarm once in 5000 millisecond. The motion is also detected in changing threshold values 0.09, 0.2 and 0.3. In this system alarm level and threshold value are the only variable we can change. The value of the alarm level can be between 0 and 1. It is the percentage of the pixels. If its value is 0.01, at least one percent of the all pixels must be changed to be motion. We can use this to change the type of object to detect. Threshold value will effect while transforming the image to analog to digital. Its value can be between 1 and 255. If its value is large, the 1s in the resulted binary image will be small amount. So, threshold value should be cared to get the accurate result. The beep of the alarm of motion can be set that the system how many seconds to beep when the motion is detected. In the system, the timing of alarm is default set to 200 frequency 5000ms duration with default predefined alarm level 0.01. The user can change the various alarm level and threshold value to detect motion.

6. CONCLUSION

This system is implemented by using the filters only for the whole process of motion detection processing. And this system doesn't use the very complex and time-taken mathematical calculation. So, processing time is very fast and process is more efficient than other application. Moreover, the implementation is also very easy. This system will detect all motions. It doesn't control the type of motion to detect. But, we can manage the region to detect.

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