TRACKING PEOPLE USING HEAD MODEL

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Abstract: ***This paper describes a method for the robust tracking of people from video with the use of head model. Efficiently detecting and tracking people in the video can facilitate better video retrieval. Our algorithm is efficient and easy to implement for real-time monitoring systems.***

Keywords: Object tracking, Object detection, Object recognition, Video surveillance.

I. INTRODUCTION

Moving object detection has made many advances in the field of research. Some sensors are used to count people in a building such as laser beam, infra-red sensor, thermal sensor and recently video camera. In particular, our system addresses the problem of determining the number of people in a crowded environment by making use of circular head model.

The goal of our work is to develop a system that can accurately detect and track the person in conditions including large motions and low frame rates. There has been a considerable work in tracking humans, vehicles, animals and other objects in recent years. Nowadays, most shopping centers have installed different systems for people counting to track the sales record.

There are three key steps in video analysis: detection of moving objects, tracking of such objects from frame to frame, and analysis of object tracks to recognize their behavior.

II. OUR APPROACH

The incoming video is converted into a number of frames. These frames are taken with changing illumination. The uneven lighting makes it difficult to detect and affects accuracy. To fix this, we should take an image of the background (bright background) before we start. In this case, we have neither so we will look upon the first image for a bright background. Then, for bright background correction, we will divide the original image by the background as background image is our reference image. Brightness correction modifies the pixel brightness taking into account its original brightness and its position in the image. [1] This will eliminate most of the variations in the lighting. We will also invert the image so that the person appears bright. For dark background correction, the image background is uniform and near zero. Red regions are places where light is blocked (i.e., the person). Blue regions are places where the image is brighter (i.e., the footprints, where more light is coming through). We would like to normalize an image, in which the pixels of the person are 1 and the background is zero. If we have a dark image, we normalize it as follows:

$$C = \frac{B - I}{B - D} \tag{1}$$

Where C is the corrected image, I is the original image, B is the bright background, and D is the dark background. If a pixel in the original image is bright then the person is not present and the corrected image has a value of zero (i.e., I∼=B). If a pixel in the original image is dark then the person is there and the corrected image has a value of 1 (i.e., I∼=D). Assume D = 0 so that:

$$C = \frac{B - I}{B} = 1 - \frac{I}{B} \tag{2}$$

After the background correction, we need to locate the person, so we convert the image to binary image. Brightness histogram is used to segment objects from background.

$$h'_f(z) = \frac{1}{2K+1} \sum_{j=-k}^{k} h_f(z+j) \tag{3}$$

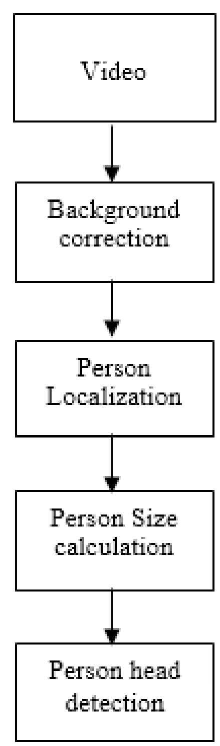

Figure 1: Block Diagram

This binary image consists of either zero or one. Since we have normalized the image it is easy to set a threshold at 1/2. If we sum this image over x (and y) then we can see a peak where the person is in y (and x). This also gives us an approximate size of person in each direction. With the crude position and size of the person determined, we try to find the best matching circular objects in image to track humans.

III. RESULTS

Our algorithm can efficiently handle variations of the lighting conditions in the monitoring scene. Moreover, it does not require frontal view of the person i.e. person's head to be facing the camera.

IV. CONCLUSIONS

The result is a robust, real-time system that is able to track a person's head with enough accuracy in the field of view. The effectiveness of our algorithm depends on the accuracy of the background image. We have tested the algorithm in a simulation environment based on Matlab.

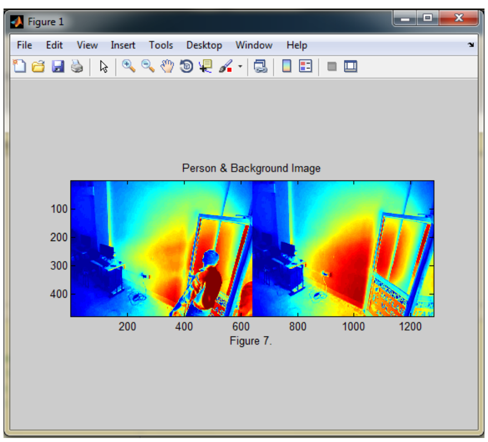

Figure 2: Comparison of image with person and background image

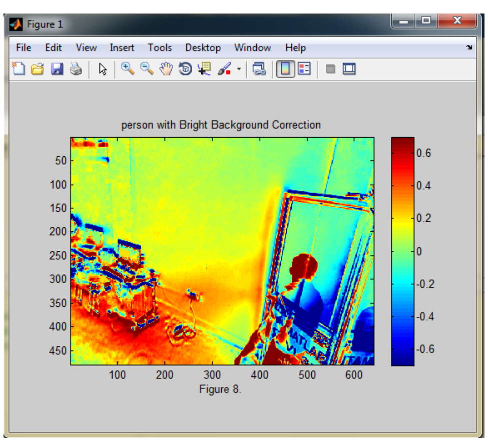

Figure 3: Person with bright background correction

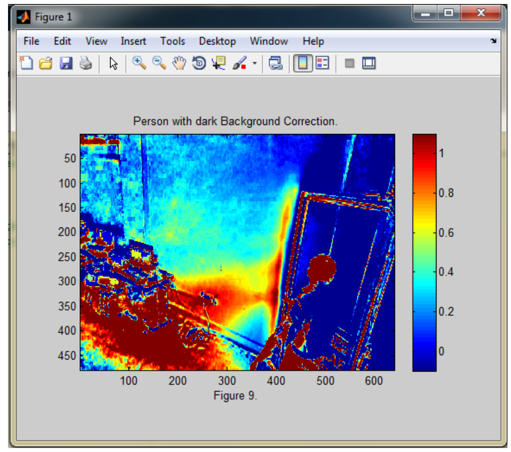

Figure 4: Person with dark background correction

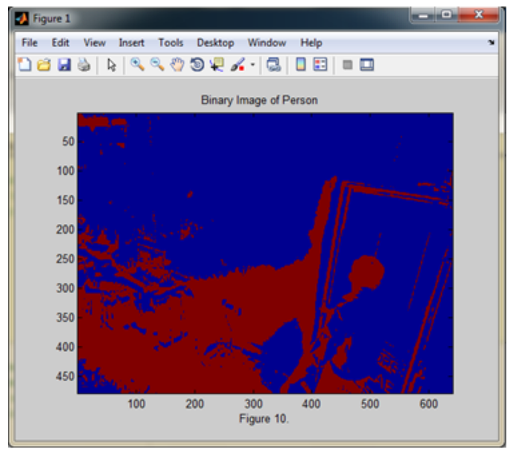

Figure 5: Binary image of a person

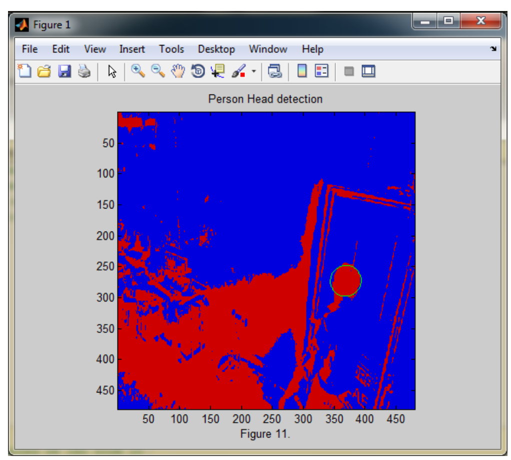

Figure 6: Person has been detected using circular head model

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