Computer Vision

ENGI 9805

Project on

Motion Detection Using Webcam

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ABSTRACT

One's possession, be it real or digital, has been one of the most important elements in today's competitive world. And to protect safeguard the belongings is one of the greatest concerns right now. As the technology right now is ever changing, hence, the vulnerability factors also change continually and so does the safeguarding technology. With the advancement of surveillance techniques and various forms of communication, monitoring and controlling the area in interest can be done much more easily. One of the technologies in this field is motion detection. In this project, a monitoring system that uses motion detection has been implemented in python. The aim of this system is to detect motion in live videos and display a counter on the screen and upon motion detection, the counter increases and store the date, time and counter value.

Chapter1 INTRODUCTION

The technology of using a camera for surveillance purpose goes very far back in time as early as the mid 1960s when police forces of various countries were using it for surveillance in public places. But this was limited due to the technology present back then. The need of better storing technology and compression techniques was felt. And around the turn of the millennia, this technology grew better with Charged Coupled Device cameras and digital multiplexing. And with the current enhancement of computer vision and machine learning technologies and techniques, the surveillance sector is growing exponentially with better tools at their disposal.

Motion detection is a technology based on computer vision where identifying the change of image and detecting movements of objects in a continuous video stream is the intention. This is done by comparing the current frame of a video with one from the previous frames or with the background. In this project, initially the live stream video is captured by a webcam. This live video is converted into grayscale. The grayscale output can have distortions from the captured frames. To counter this, Gaussian blur is applied to reduce the distortions. And finally use delta frame to distinguish between the previous frame and the current frame, hence detecting any sort of movement happening of the screen. This is the overview of the techniques for motion detection applied in this project which are explained in the sections below.

1.1 PURPOSE OF THE PROJECT

Moving Object Detection of human or animal has a vast area of applications. This is an interesting and useful topic as it can be used in many sectors like security, safety, and tracking. Almost every person has a computer of their own. This project can be helpful to track motion at any time at home. Not all can afford a security camera, but this small project can be beneficial. Also, this project can be helpful for new researchers to learn and for their further research on their topic of interest, which in this case is the Motion Detection system. Over the years, research is flowing towards innovating new concepts and improving or extending the established research for performance improvement of object detection and tracking. Various object detection approaches have been developed based on statistics, fuzzy, neural networks, etc. Most methods involve complex theory. These approaches can be evolved further by a thorough understanding, implementation, and experimentation.

Chapter2 PROBLEM DEFINITION

Video analytics is a popular segment of computer vision. For our computer, one of the central parts of video analytics is to detect objects. It must detect objects and moving objects through the camera. The same can be used to identify motion of any kind in any aspect. Once a camera or a webcam is looking at the feed whenever any moving object is there in it, which can be any animal or human, it must be recognized by the detection. Such a concept can be helpful in various aspects of day to day life. One such great example is security. Over the years, research is flowing towards innovating new concepts and improving or extending the established research for performance improvement of object and motion detection. As proposed, this project is identifying moving objects and motion in front of the computer webcam. This project would be focused on object detection as well as any moving object detection like an animal where we would perform detail techniques and methodology to detect objects and to develop a module for a method that will detect motion of that object in front of the webcam. This project is to come up with a solution that detects movements of the objects effectively and record it down with a time frame and end up making a motion graph.

Chapter3 BRIEF DISCUSSION TO SOLUTION

At first, a standard static image frame will be set for the standard. The camera will start recording the predetermined area set to capture the video. All kinds of motions will be recorded in that area frame. The camera will be just recording the video but, in the background, filtering will be done in order to check whether there is motion in that frame. The whole video would be analyzed using RGB, and in the end, a filtered bokeh effect graph will be prepared to show the motion detected in the timeline of the captured video. Assuming all these facts, Python is found as a better platform to design and implement the algorithm. It is an interpreted, high-level, general-purpose programming language that supports multiple programming paradigms.

Chapter4 METHODOLOGIES

4.1 SYSTEM MODEL

This section explains the general solution of our proposed object detection and moving object detection as well as soring the data using a time frame. In this project, we are going to establish an application that will identify moving objects through the webcam of our computer and store the

information of how long the moving object appeared in front of the camera using a datasheet that will create a graph.

The significance of the whole process of motion detection using a webcam is given below as a block diagram:

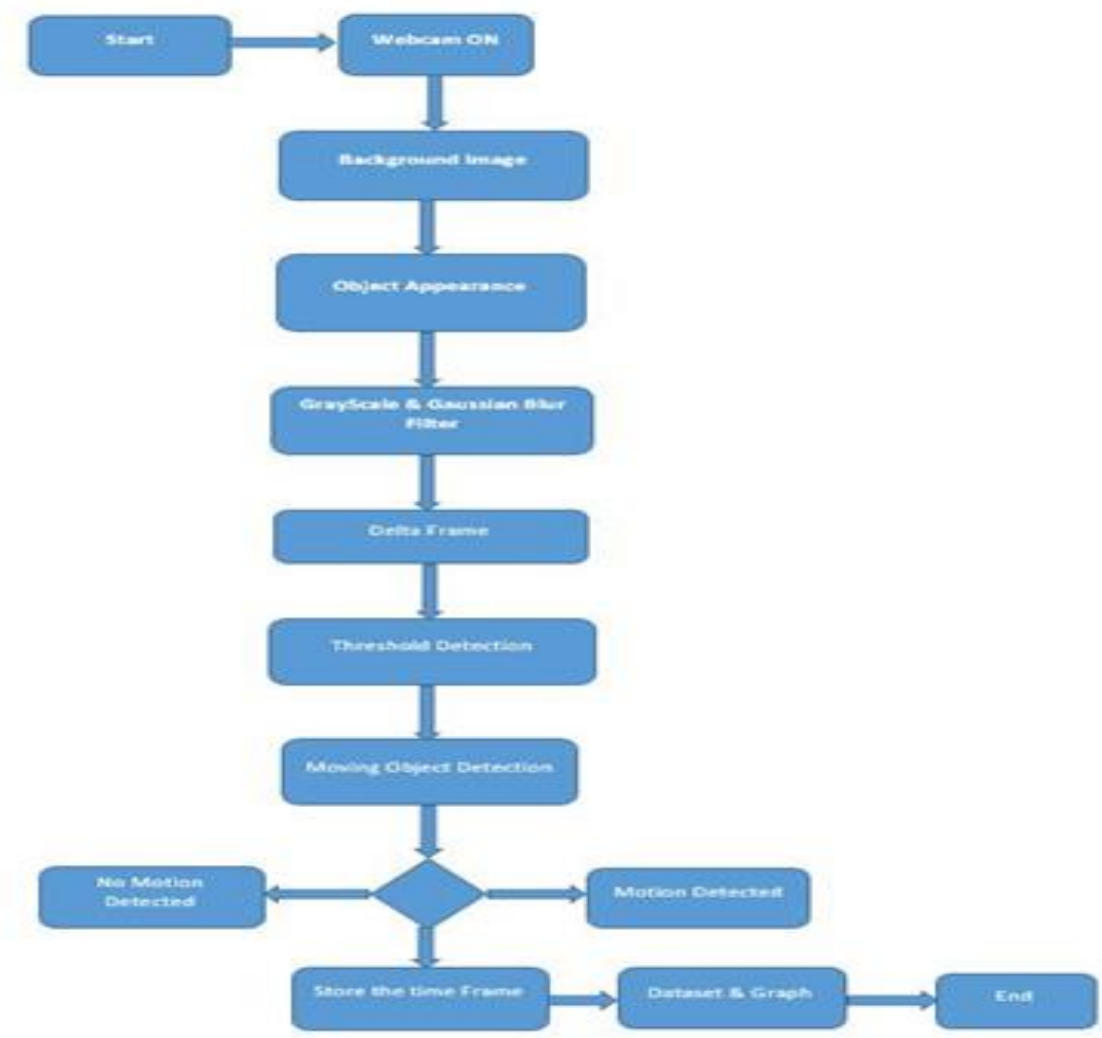


Figure 1: Flowchart of Motion Detection using webcam

4.2 PROPOSED APPROACH

This section explains the details procedure and solution of this project as well as a general block diagram of our proposed object detection and moving object detection and soring the data using a time frame. At first, we open the webcam from our computer. Once we trigger the webcam, the first frame of the video should be a static background. For using this application in the webcam,

this will be our first step. To detect the movement of a particular animal or human in an area, first, it will capture when the camera has been triggered while the background is static. This static background is going to be used as a base image so that it can be compared with the other images. Then python will detect if there is a chance of motion between the first frame and the next frame. Following are the steps for motion detection using Webcam (Figure 1).

4.2.1 GRAYSCALE CONVERSION

When an animal or a human comes inside the frame, the system will gray out the image. In order to remove noise in the grayscale, the Gaussian blur has applied. In digital photography, computer-generated imagery, and colorimetry, a grayscale or greyscale image is one in which the value of each pixel is a single sample representing only an amount of light, that is, it carries only intensity information. Grayscale images can be the result of measuring the intensity of light at each pixel. So, the first frame of the video capture can be stored in a variable, and then it will convert the frame to a grayscale image. After that, the while loop will go through the current frames, and this will continue for the existing frames.

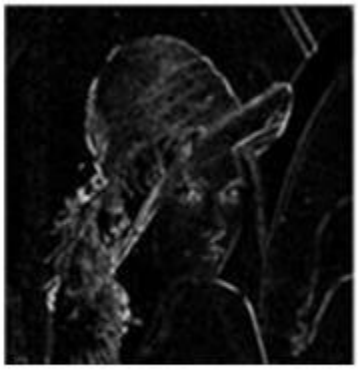
Figure 2: Grayscale conversion

4.2.2 DELTA FRAME

After converting them to grayscale, then those two grayscale images of the current iteration of the loop will apply the difference between them, which is called the delta frame. Delta frame compares the current frame(gray) with the background/first frame. It shows the difference from the original frame to the current frame.

4.2.3 THRESHOLDING

To find the difference between two frames or image threshold binary method is used using black and white color. Thresholding is the simplest method of segmenting images. From a grayscale image, thresholding can be used to create binary images. The simplest thresholding methods replace each pixel in an image with a black pixel if the image intensity Ii,j is less than some fixed constant T (that is, Ii,j < T), or a white pixel if the image intensity is higher than that constant. In the example image on the right, this results in the dark tree becoming completely black, and the white snow becoming completely white. The value initially was chosen 30 but made 25 for better accuracy to set threshold binary method. After applying the threshold method, the grayscale image will give an image with a black and white frame. Basically, more than intensity, the threshold will convert them to black and less then the intensity will be white as shown in the below image:



After Applying the Threshold Method

Figure 3: Thresholding

4.2.4 CONTOURS

After calculating the threshold frame for the current frame, the contours of the object will find out. A contour is simply the boundary of an object in an image. Various representations of contours (e.g., chain code, Fourier descriptors, shape context) are used to recognize or categorize objects.

This assumes that you have a way to segment out an object and find its boundary, which itself is not a trivial problem. Inside 8 the loop, it will check the contours, for example, if it is more than 2000 pixel's area, then that will be considered as moving object. If there is less than 2000 pixel's area, then that will not be considered as moving objects. Basically, the contour is a curve joining all the consecutive points (along the boundary), having the same color or intensity, and here it is making boundaries for the black and white threshold frame.

4.2.5 RECTANGLE FRAMES

After contouring, the next step will be to draw rectangles around the contours that are greater than the minimum area. It will draw rectangles around the big enough movements. This rectangle will be around the big enough movements.

4.2.6 THE TIME FRAME AND STORING DATA

Later on, we will detect the times that the motion of the object that entered in the video frame and the time it exited the frame or stopped moving. It will Whenever the moving object enters in the background, the frame captures movement, and it will detect the time frame to store it. This shorting data will create a graph that will be a projection of the total motion detection time.

4.2.7 COUNTER

In the project, a counter has been implemented. Initially, before detecting the motion of an object, it will start from 0. When there is no movement, it will begin counting and gradually, it will increase by one whenever it starts detecting movement. It will go back to the initial counter position, which is 0 when there is no motion detection. The counter can count from 0 to 100.

Chapter5 RESULTS AND DISCUSSION

In this section, the results of our implemented project and dataset we got using this process will be described briefly as well the outputs of the whole project, which is given below:

5.1 DATA SETS

In this project, a dataset is created by storing the timing information of motion detection using the webcam. This data set contains overall motion detection of any object that can be an animal or human. After implementation, a dataset will create to store the information, how long the moving object was in the frame. According to our dataset, we got the following graph that indicates moving object detection:

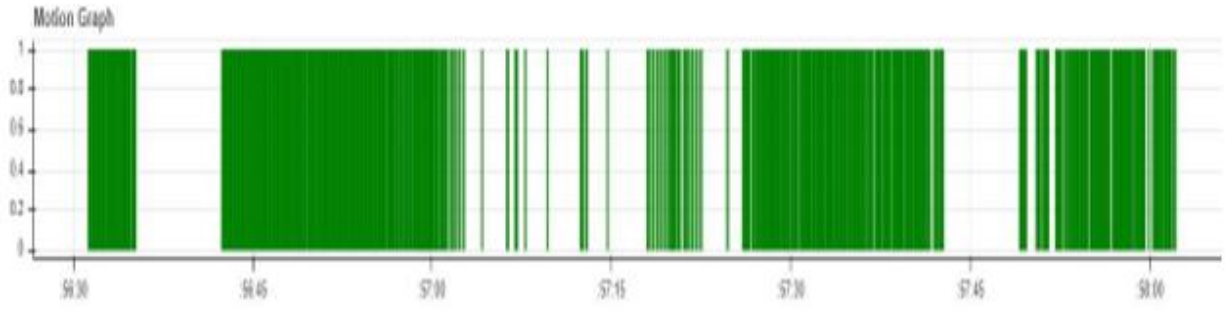


Figure 4: Motion Detection Graph

Here from the motion graph, the green line indicates motion detection in front of the webcam. It is a projection of the object is moving, not moving, or exiting the frame.

5.2 EXPERIMENTAL RESULTS

The proposed system was tested in a room environment using a laptop's 2MP webcam. After implementing the project, we got our expected results. It worked in the following ways, at first, we got our background image, as shown below:

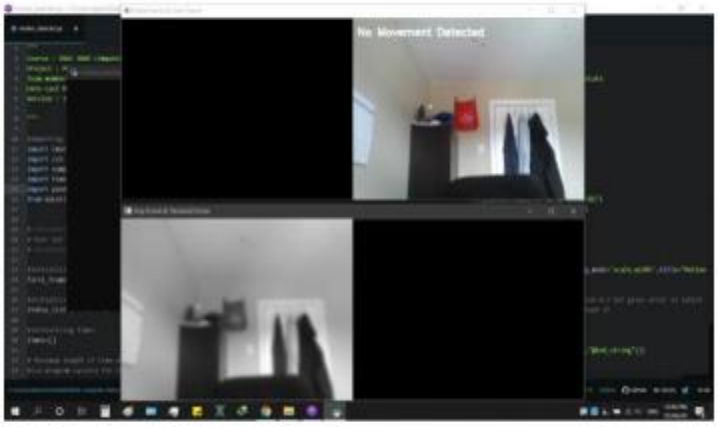


Figure 5: Webcam Startup Image

An object (A Person) came in front of the webcam. The webcam will capture it and convert it into grayscale. The frame will use Gaussian Blur to remove noises, and we got the output image as shown in the below:

Figure 6: Applying Gaussian blur

After applying the Gaussian Blur, the program will subtract the image from the background image, and the new image is called delta frame as we got the below image:

Figure 7: Delta Frame

To find the difference between two frames or image threshold binary method is used using black and white color. Thresholding is the simplest method of segmenting images. After applying the threshold method, the grayscale image will give an image with a black and white frame, as shown below:

Figure 8: Threshold Frame

After calculating the threshold frame for the current frame, the contours of the object will find out. A contour is simply the boundary of an object in an image. After contouring, the next step will be to draw rectangles around the contours that are greater than the minimum area. It will draw rectangles around the big enough movements. Our webcam has finally able to identify the movements of the object and gave the output of the following image using rectangle frame:

Figure 9: Final Detection of Moving Object

We got the result as we expected. The project is working correctly, and it can detect the motion of an object or human in front of the webcam as expected.

We have done several tests, as shown below:

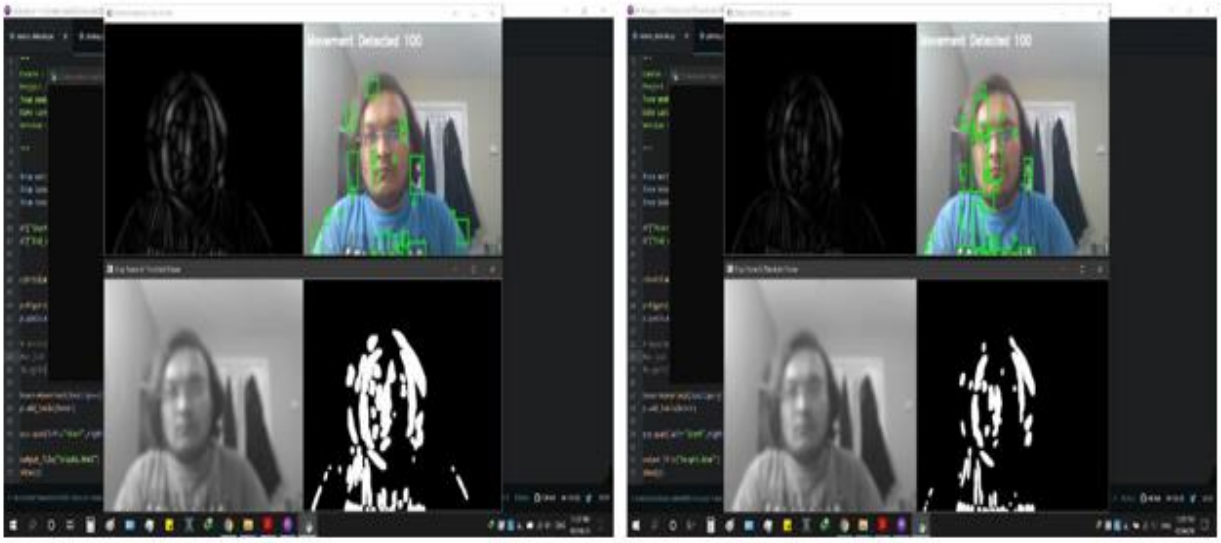


Figure 10: Results of test1

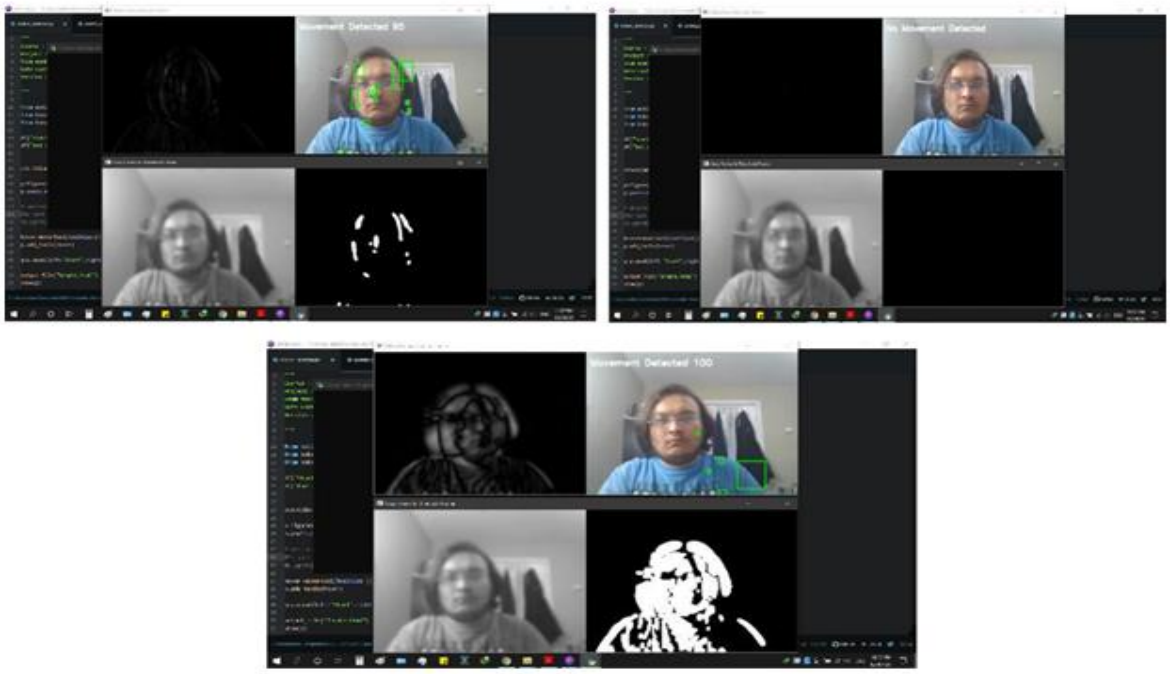


Figure 11: Compilation of test results

Chapter6 CONCLUSION AND FUTURE WORK

The final chapter would comment on the results obtained and discuss the several advantages and drawbacks of the project implementation. Here, we will also look into future works that can be carried out to further area or this topic.

Today in our social security is one of the significant issues and having a 24*7 human eye is just impossible. This project can be useful to be an eye for a human being for security issues. Our project is just one of the applications which help us to achieve this goal. Though this project is very small and has some boundaries like focusing on person detection and neglecting some motions detection like wind effect on objects is also important. However, still, it can be upgraded and useful.

REFERENCES

1. https://www.tutorialspoint.com/webcam-motion-detector-program-in-python
2. http://www.robindavid.fr/opencv-tutorial/motion-detection-with-opencv.html
3. https://stevepython.wordpress.com/2019/05/01/webcam-motion-detector/
4. https://docs.opencv.org/2.4/modules/video/doc/motion_analysis_and_object_tracking.html
5. https://www.researchgate.net/publication/260714774_HUMAN_MOTION_DETECTION_SYSTEM_VIDEO_MOTION_DETECTION_MODULE
6. https://www.geeksforgeeks.org/webcam-motion-detector-python/
7. https://en.wikipedia.org/wiki/Gaussian_blur
8. https://www.pyimagesearch.com/2015/05/25/basic-motion-detection-and-tracking-with-python-and-opencv/
9. https://www.edureka.co/blog/python-opencv-tutorial/
10. https://en.wikipedia.org/wiki/Thresholding_(image_processing)
11. http://www.ijmer.com/papers/(NCASG)%20-%202013/16.pdf
12. https://www.researchgate.net/publication/296703190_Real_Time_Motion_Detection_in_Surveillance_Camera_Using_MATLAB
13. https://patents.google.com/patent/US20050007454A1/en
14. https://ieeexplore.ieee.org/abstract/document/1033130
15. https://pdfs.semanticscholar.org/0371/d35c7aa2ae0da7966e010c37307b124d3226.pdf
16. https://pdfs.semanticscholar.org/991c/384f20fa4aa4c512e296eef56c56ef135e.pdf https://ieeexplore.ieee.org/document/6024613