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SMART SURVEILLANCE SYSTEM

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Abstract: *Welfare and security are vital concerns in modernism. People recruit security mechanisms to shelter their belongings be it home or a company. In Normal surveillance system whatever happen they just sit and watch and required human interaction to work properly. The proposed system is Python GUI application built using latest programming Language and highly evolving Computer Science Field Which is "Computer Vision" Which means This allow computer to watch or in other words it gives vision capability to computers. The enlargement of Computer Vision hi -tech take in consideration precise application and aim of a better grasp of Computer Vision system still exists outside, for now at least in this paper we are mostly emphasize on the features of smart surveillance that are monitor feature, face identification, noise detection, visitors in room detection, and video recording.*

Index Terms – Computer Vision, Object Detection, Real Time Alerts, Face Identification

I. INTRODUCTION

Recent world events have created a shift in the security paradigm from "investigation of incidents" to "prevention of potentially catastrophic incidents". Existing digital CCTV surveillance systems provide the infrastructure only to capture, store and distribute video, while leaving the task of threat detection exclusively to human operators. Human monitoring of surveillance video is a very labour-intensive task. One of the conclusions of a recent study by the US National Institute of Justice, into the effectiveness of human monitoring of surveillance video, "These studies demonstrated that such a task [manually detecting events in CCTV surveillance video], even when assigned to a person who is dedicated and well-intentioned, will not support an effective security system. After only 20 minutes of watching and evaluating monitor screens, the attention of most individuals has degenerated to well below acceptable levels. Monitoring video screens is both boring and mesmerizing. "Clearly today's video surveillance systems while providing the basic functionality fall short of providing the level of information need to change the security paradigm from "investigation to pre-emption". Automatic visual analysis technologies can move today's video surveillance systems from the investigative to preventive paradigm [1]. The proposed system mainly focuses on by reducing human interaction and make system reliable and scalable with the help of machine learning techniques. Our project is divided into four modules which has "the ability to pre-empt incidents- through real time alarms for suspicious "Situational awareness-Through joint awareness of identity and activity of objects in the monitored space".

II. LITERATURE REVIEW

In the paper Rapid Object Detection using Boosted a cascade of simple features by Paul Viola Michael Jeffrey jones [7], they described *three* machine learning approaches "Integral Image", "AdaBoost", "cascade" for visual object detection which is capable of processing images extremely rapidly and achieving high detection rates.

In the paper "Smart surveillance system using deep learning" by Dayana r, Suganya M, Balaji P, Mohamed Thahir A, Arunkumar P [2], This paper discusses the detection and recognising the facial features of the persons using Principal component Analysis (PCA) Algorithm with the accuracy rate of 88.5%.

In the "Comparison of PCS and LBPH algorithm for future extraction on face recognition system" paper by Icshan taufic, Maya Mushtopa, Aldy Riadly, Muhamad Ali Ramahan, Yana Aditia Gerhana, Narang Ismail [3], in this paper the characteristic extraction algorithm such as Principal Component Analysis (PCA), Local Binary Pattern (LBP) is tested against several scenarios of different sunlight and lights, objects facing the camera and not facing the camera.

In the "Image Quality Assessment through FSIM, SSIM, MSE and PSNR – A comparative study paper by Umme Sara, Morium Akter, Mojammed Shorifuddin [9], in this paper they compared different image quality metrics such as FSIM, SSIM, MSE, PSNR to give a comprehensive view. Experimentation with these metrics using benchmark image is performed on through denoising for different sun lights and lights, objects facing the camera and not facing the camera.

In "convolution Neural Networks vs Cascade Classifier for object detection" by Ivan Ozhiganov [4]. They detected objects on car license plates and road signs using CNN and cascade classifiers and compared them in terms of precision and Recall, Scale Invariance, Number of Attempts Required to Receive a working Model, Processing Time, Consistency with tilting Objects.

III. REQUIREMENTS

As it is software-based project. It must run on some hardware and operating system following are the requirements to run this software

Windows/Linux/mac any version of python 3
Packages in Python
OpenCV
Ski-mage
Numpy
Skinter

In case of Hardware requirements, you don't need much but still some of the requirements are must as
Working PC or Laptop.
Flashlight/LED if using this at night.
Webcam with drivers installed.

IV. METHODOLOGY

In our project we have establish features like monitoring objects, noise detection, face identification, visitors in and out detection.
Below are the different features which can performed by using this project:
1. Monitor
2. Identify the person
3. Detect the noise
4. In and out Detection

1. Monitor Feature

This feature is used to find what is the thing which is stolen from the frame which is visible to webcam. It continually monitors the frames and checks which object or thing from the frame has been taken away by the thief and raise alarm. This uses Structural Similarity to find the difference in the two frames. The two frames are captured first when noise was not happened and second when noise ceased in the frame.
Structural Similarity Index Metrics (SSIM) is used as a metric to measure the similarity between two given images.
The structural Similarity Index (SSIM) metric extracts 3 key features from an image: Luminance, Contrast, Structure.

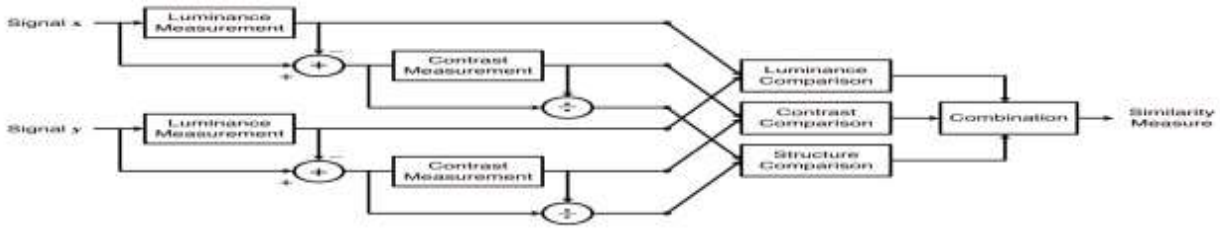

Figure 1: Structural Similarity Index Matrix Chart

Providentially, ski-mage package in python we don't have to replicate all mathematical calculation as python ski-mage has pre build feature that do all the tasks just calling its in-built function.

2. Identify Feature

This feature is use to find if the person in the Frame is known or unknown.
This is done in two steps:

2.1 Detect Faces in the Frames

This is done via Haarcascade classifiers which are built in openCV module of python.

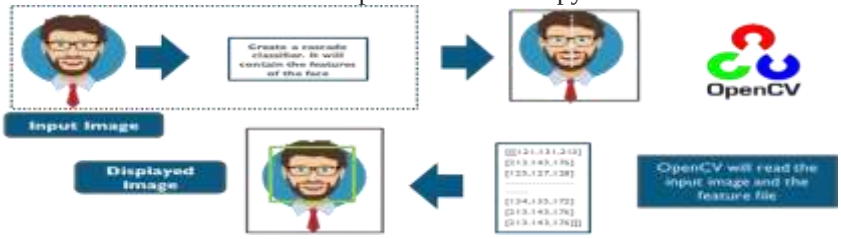

Figure 2: Working of Cascade Classifier

2.1 Use LBPH Algorithm for face recognition

The LBPH uses 4 Parameters Radius, Neighbours, Grid x, Grid y.

First LBPH Create an intermediate image that describes the original image using concept of sliding window based on the parameter's radius and neighbours.

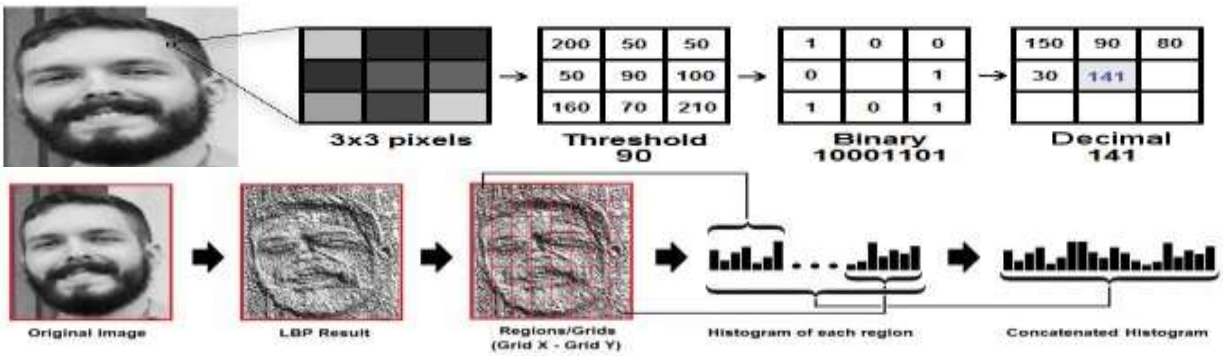

Figure 3: LBPH for Face Recognition

Now after getting generated image in last step, we can use Grid x, Grid y parameters to divide the image into multiple grids as shown in Figure 3. Make predictions what you desire apply same step and then Histograms are compared with trained model. In this way this module works.

3. Noise Detection in the frame

This feature is used to find the noises in the frames. It continuously analyzed and check for the noises in the consecutive frames. Simply do the Absolute difference between two frames and in this way the difference of two images is analyse and Outline (boundaries of the motion are detected) and if there are no boundaries then no motion and if then there is any there is motion. As all images are just integer/float values of pixels which determines brightness of pixel and equivalently every pixel has those values of brightness. So we just do simply absolute difference because negative will make no sense in any manner.

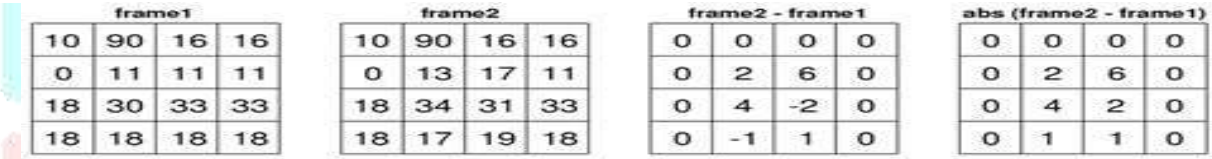

Figure 4: Noise detection Grid matrix

4. Visitors in/out detection

This feature is used to detect if someone has entered or gone out from the room

It works in following steps

1. It first detect for noises in the frame.
2. Then if any motion happen it find from which side does that happen either left or right.
3. Last if checks if motion from left ended to right then it will detect it as entered and capture the frame.

Or visa -versa.

So, there is not complex arithmetic functioning in this particular feature. So basically, to know from which side does the motion hit we first detect for motion and there on we draw rectangle over noise and lastly, we check the co-ordinates if those points recline on left side, then it is classified as left motion.

VI. RESULTS

Home Page

Figure 5: Home Page

Monitor Frame

It Constantly monitors the frames and detects which object or thing from the frame has been taken away be the thief.

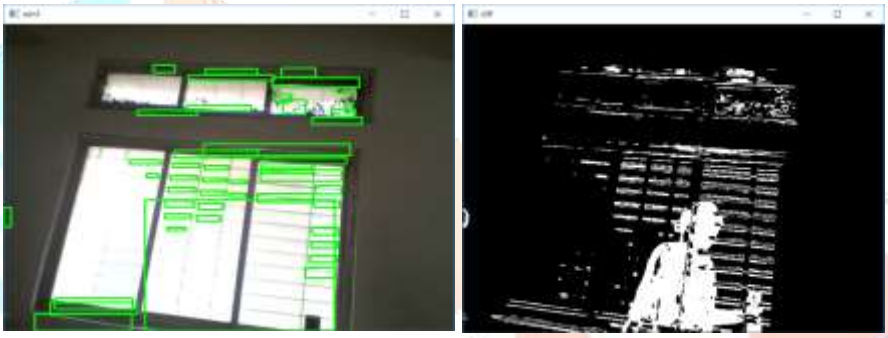

Figure 6: Monitor feature

Visitors In/Out

It detects if someone has entered in room or gone out.

Figure 7: Visitors In/Out feature

Noise Detection

Detects noises the fame and show it on the screen as there is any motion detected or not.

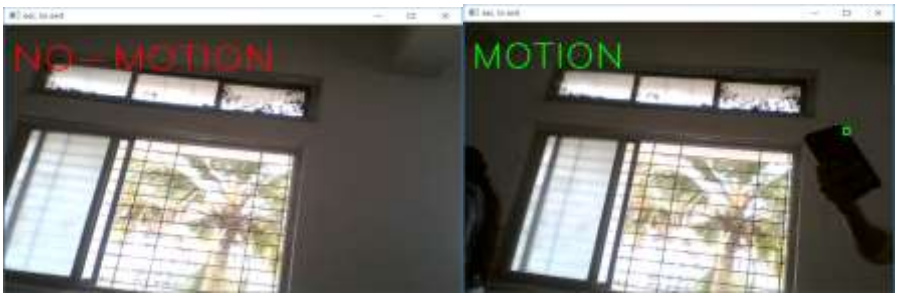

Figure 8: Noise Detection

Record Feature

It Simply captured the video of view area and save with current date and time.

Figure 9: Recording

Face Detection and Identification

It detects faces in the frames and predict the person from already trained model.

Figure 10: Face Identification

VII. FUTURE SCOPE

Due to highly advancement in technology this work can be broadly used. below are some utilizations on this project. Further feature such as fatal weapon detection, Misadventure's detection, Fire detection and much more. Make application that independently operate with no requirements such as python. Append DL support would create broad scope in this project as with DL and we can add on immeasurably more functionality.

VIII. CONCLUSION

Extensive research is going on in the field of computer vision. In this project we well completed the bit of work for carrying-on the project. The motive is to facial recognition, process these faces, and identify whether these faces match with the saved faces, exist in the database (the database contains pre-encoded training faces). Find motions in the frame and raise an alert if any suspicious behaviour is detected. Nevertheless, it is still challenging to enhance security and lower the fare of providing surveillance facility. Which is yet be difficult for exploration on modern computer eyesight technology.

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