

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/321126474>

Security System using Motion Detection and Face Recognition

Article in "Imperial Journal of Interdisciplinary Research (IJIR)" · November 2017

CITATIONS

2

READS

2,916

4 authors, including:



Aju D

VIT University

48 PUBLICATIONS 62 CITATIONS

[SEE PROFILE](#)



Ashwani Agarwal

VIT University

1 PUBLICATION 2 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Medical Image Fusion [View project](#)

Security System Using Motion Detection and Face Recognition

D.Aju¹, Ashwani Agarwal², Himanshu Jain³, Divyanshu Bhati⁴
^{1,2,3,4}SCOPE, VIT University, Vellore

Abstract: *In Today's world, security is one of the major concerns of every household owner, shop owner or any office owner. The acts of theft and robbery are growing each day resulting in huge loss to such owners. The use of CCTV cameras has played a huge role in helping the owners to know who the intruder was. The potential of image processing can be used to enhance the role of CCTV cameras to generate an alert to the concerned owners or the police officials whenever an intruder is detected in the owners' area. The project aims at developing a security alert system based on motion detection and face recognition techniques in image processing. The frames captured by the camera are analysed to detect the presence of any motion and if the motion is detected for a particular time frame, the intruder's face is matched with the authorised database of persons provided by the owner of the place using face recognition techniques. If the intruder's face is not matched with any other in the database, an alarm is generated and the intruder's image is sent to the concerned owners and security officials.*

1. Introduction

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. Image Processing is a humungous field and has variety of applications in different disciplines of technology such as Artificial Intelligence, medical sciences, forensics, robotics etc. We targeted a daily life problem which we thought if solved could be of major use to people.

2. Keywords

Image Processing, Intrusion Detection, Motion Detection, Sum of Absolute Difference, Image Recognition, Real Time Motion Detection, Feature Selection, Pixel Intensity.

3. Organization of the document

We review 10 research paper in the following paragraphs and finally summarize our findings in the conclusion followed by acknowledgement. The methodology implemented to detect intrusion has been clearly defined and explained.

4. Literature Review

The paper [1] discusses about the detection of motion in a monitored area by using the frame difference methods. The technique discussed in the paper is based upon the combination of two different frame differencing methods which are the Background subtraction method and Consecutive frame subtraction method. The technique is based upon the background images acquired from the previously captured frames. The current image is compared pixel by pixel to an image which is actually the mean of the background images taken. The motion is detected by analyzing the difference in the pixel value of the current image with respect to the background images and the difference in pixel values is then checked against a threshold value. If the difference is greater than the threshold value set by the user, it can be inferred that the motion is detected in the current camera frame else if the difference is less than the threshold, the current image is not detected with the presence of any motion and the system analyzes the next image for motion. Finally the motion detection is indicated by an alarm or by using a graphical method. The technique is implemented using Matlab and the results obtained depicts that the methods leads to avoidance of false positive alarms but the amount of time required to train the system to avoid false alarms is very high which is a limitation to this technique. The improvement that can be done is to use machine learning algorithms which can help learn the system at a faster pace and the limitation to this system is overcome. The paper [2] proposes computer vision techniques that can be used to design a visual surveillance home

security system to protect against intrusions and theft. The paper discusses about using the combination of motion detection and face recognition techniques to build the system. The motion detection module uses frame difference methods to detect the presence of motion in the frame. The current frame is compared with the previous frames pixel wise. The difference in pixel values is noted and used to detect motion. If the difference is greater than 15 percent from a set threshold value, then it indicates that the motion has been detected and it triggers the face recognition module. The face recognition module uses the Eigen face recognition algorithm to recognize faces. The face detection module differentiates the intruders from the authorized users. A database of authorized users is provided by the owners of the property. If a person is detected and his face is not recognized in the authorized person's database, it indicates that the person can be an intruder or thief and alarm is triggered and an email is generated to notify the owners about the intrusion. The system is tested during day and night at various times and it was noted that the system is less responsive during night time to capture motion and the recognition rate is not high enough. Still the system is highly robust, reliable and efficient. The system can be improved by making the face recognition module less sensitive to variations in light intensity and increasing the recognition ratio. The paper [3] aims at using facial expression and biometrics technologies to build an intelligent surveillance system that identifies and recognizes the intentions of a person to commit any act of theft, robbery or any other criminal activity. The system uses the Collaborative Waterfall Software Development Life Cycle (C-WF-SDLC) as its development methodology. The system is designed in such a way so as to analyze a person's facial expressions and helps the guards to know well in advance about the wrong intentions of the person to commit any crime or if the person can cause harm to other people around. The development methodology is divided into six phases which are: Planning, Analysis, Design, Implementation and Maintenance. The camera detects the motion mainly focusing on the head and the motion is detected using the head pose estimation technique. Then the behavior understanding of the facial expressions is performed which consists of two phases : verification and identification. During verification, system analyzes expressions through reading action units. During identification, it is matched that the verified expression is depicting any feeling or any intentions of performing any criminal activity. The major advantage about the system is its real time working which helps to prevent crimes before they are committed. But the

system can also lead to generation of false positive alarms because in reality the expressions of a person can sometimes fool others about his intentions. A person with wrong facial expressions can sometimes be innocent. This limitation of the system can be overcome by using a large training set of different facial expressions of various people. The paper [4] presents a methodology to use android platform to develop a system that uses face detection and face recognition modules to allow the opening and closing of doors in a protected place by using on and off relays. The hardware used in the system is the ARM11 based development board. The person coming to the area is detected using a video stream and if the person is identified in the database, the door opens and the person's name is displayed on a LCD with a 'Welcome' message. The face detection module uses a Haar feature based Cascade classifier that stores the features of the faces of the people present in the database. This classifier is then used to analyze the test image to detect that there is a face in the current frame. Once it is detected the frame has a face in it, it then triggers the face recognition module that matches the person against the persons that are already present in the database and if the person is matched within the database, the relay is switch ON and the door opens for the person. The system also has a provision to add new people in the database very easily without having to redesign the complete database again. The system is implemented using Matlab and the system is found reliable and effective in real time. The limitation to the system is its inadequacy to identify a person on more number of parameters such as fingerprint recognition and iris based recognition and hence the system can be forged easily to let an intruder inside the restricted property. The paper [5] discusses about a project that is dealing with providing security system for banks. The project uses image processing techniques and OpenCV operations to design the system. The system is divided into different modules. The first module asks for the authentication of the user to login on the server and get registered. The second module deals with the authenticate users starting the cameras of the system and storing the template in the file. This image is the part of the sensitive area used as reference in the system. This system is completely responsible for alert procedure. The third module works with the authenticate users starting the system and our system starts executing the module. In this module CCTV camera continuously sends the footage to the alert module. The fourth module displays an alert message to the concerned authenticate personnel if any intrusion is detected in the template image. The alert is also forwarded as a message to the nearest police station. After the alarm is blown, a live streaming

starts in the android cell phone of the administrator regarding the activity taking place. The smart surveillance system is very helpful to take immediate action even prior to the completion of the intrusion or the attack. The only limitation is the fact that the system is completely dependent upon the video surveillance, hence even a slight interrupt can affect the normal working of the system and the alarm system is needed to be regularly observed. This system is very helpful for remote monitoring of the confidential area. The webcam, even without the presence of motion sensors, records the video if an intrusion is detected in the room. The paper [6] discusses SECURITY SYSTEM WITH FACE RECOGNITION, SMS ALERT AND EMBEDDED NETWORK VIDEO MONITORING TERMINAL. There are a variety of ways to protect robbery but in spite of that the robbery rate is high. The normal cameras consume large amount of electricity, large amount of bandwidth is consumed to translate video to the client. In the proposed method we save electricity by using an external sensor to detect the movement. If some movement is detected outside the area then through a path with the help of sensors the camera is turned on. Rest of the time when no movement has been detected the camera is in off state. The overall architecture is divided into two parts namely the ISS and ESS. ISS stands for internal subsystem and ESS stands for external subsystem. The hardware design has been shown and the components used in both the subparts have been explained. The ESS architecture is made up of 4 parts namely the external sensor, the 8 bit microcontroller, face recognition module and primary camera. ISS architecture is made up of 5 parts namely internal sensor, 8 bit microcontroller, GSM modem, entry button switch, 2 exit button switch and the ENMVT with a stationary camera. The software design is of three components. The Microcontroller 1 and 2, face recognition and 32bit embedded processor. The processes of software design are explained here. The practical testing of this model has been done at the engineering college. The paper [7] discusses Real-time motion-sensitive image recognition system. This paper is basically concerned at an effective motion analysis for security system with the help of image processing. Image processing is the transfer of an image from a device such as camera to be processed by devices such as computers to do various activities on the image such as image enhancing, finding the position of object in the image. The demand and interest of the people in tracking mobility has started increasing after the late 1970. The detection of motion happens via differentiation of movement area from the rest of the areas. The algorithm which are used to detect the motion are divided into 3 groups. First one

being the background difference method while II and III are statistical method and visual flow method namely. Background difference method is a very famous method in which we compare the difference in pixels of observed image and the reference image. The face recognition is a challenging area because it is difficult to accurately identify the faces that are there. In the RGB the different components are as follows R stands for the red component in the pixel in the RGB image G stands for the green component in the pixel in the RGB image B stands for the blue component in the pixel in the RGB image. In the YCbCr code technique five component stands for the information in brightness Cb and Ch components present the colour information in the YCbCr colour space. The security application has been developed and whose figure has been shown. The details of the security application has been explained the programming language used to develop this software has been told. The application of the motion sensor has been explain. The skin colour algorithms used to detect the face of the human object the steps used in the tracking mobile objects also been explained. The paper [8] discusses AUTOMATED VIDEO SURVEILLANCE SYSTEM FOR HUMAN MOTION DETECTION. The primary aim of this paper is used to analyse the techniques being used in the video surveillance. The video surveillance is an important security near to control cough trespassing banks. The video surveillance is being used everywhere from small houses to big corporate houses. Because of the important it is been given in the world the number of researches in the fields has increased in a lot. The various methods like statistical method Alpha metals which are used in video surveillance have been discussed in the paper. In the foreground extraction method the images made up of a stationary and another part which is stable during the video Sequencing. HSC of the histogram of oriented gradients is used for human detection algorithm. As per the algorithm the images divided into small special regions call cells. The importance of neural networks in the field of video surveillance has also been discussed. The neural networks store the knowledge about some unwanted movements as unknown and allowed moments as known. Motion detection is said to occur when some physical movement is detected the security agencies which use video surveillance as the means to protect customers from various types of Miss happening period a lot more than the ones which use manpower to do. Some applications which are useful help us to differentiate between the allowed actions and the unwanted actions all the suspicious activities. The paper [9] discusses Real Time Vision Based Security System. The increase in the crime rate is the main motivation for

the all-time vision based security system. The cost of systems is a great matter of concern. In this paper we have talked about an inner space target board and with the help of other devices such as web camera and Indicator to alert the concerned user we have to basically make home made work areas smarter the time when no one is present in the area is used to capture the image and this image is used as a background or reference image. The model can also did the reference image during different parts of the day. If it makes out model better the vision based security systems that we have discussed has got a lot of advantages the installation of this is very easy and other big advantage is that it can be easily integrated with an existing system. The hardware design has been explain further in the paper. The software designing is divided in the following strap cross compilation platform in debugging and LINUX debugging and open we putting afterwards in the paper the algorithm has been discuss. The algorithm uses the human motion to recognise human after the process of image acquisition has been discussed after the forming of an image of coloured RGB image of 640 into 480 pixel is formed afterwards in the paper some technique searches image segmentation image thresholding image processing area calculation control has been discussed. Towards the end of the paper the experiment in results have been discussed. The range of different values are tested for different experiments. The motion is made at different distances. A graph is drawn from various different measurement the communication between different camera can happen through Internet or Wi-Fi. The paper [10] presents a review of Securing Home Using Video Surveillance. There is a need of replacement of the Olden methods such as CCTV and the burglar alarm by Computer Based system because the Computer Based system which are smarter and have better detection and alert system. Despite the presence of the current Home system whose role is to provide protection from including control system expected error defect surgery consumer must have Cooperative relations with the security personnel. This has resulted in expenditure for service quality. The present working system can be divided into two types microcontroller circuit based and the other one is Microprocessor. The video surveillance which is used in smartphones can be divided into various categories such as centralised system. Our human activity analysis is performed on a centralised server and distributed system. We are analysing is performed on distributed camera night falls. The detection and Solutions are very accurate and the possibility of a false alarm is very less. The output of video surveillance can be communicated to you via a cellular or Internet monitoring. As a sub part of

security system the traditional requirements have been discussed and the non factorial requirements have been discussed. There a variety of approaches such as background subtraction temporal dispensing and the optical flow. There is motion detection module which transform the object locations into 3D coordinates we need to develop method to share information that we gather.

5. Methodology

It begins with the general initialization of the software parameters and the configuration of the objects. Then, once the program has started, the value of the indicator indicates whether the stop button has been pressed or not checked. If the stop button is not pressed, it starts to read the images and then processes them using one of the two algorithms when the operator is selected. If a motion is detected, it triggers a series of actions, then restarts the next images, otherwise it will directly read the following images. Each time you press the stop button, the indicator value will be reset and the program will stop, the memory will be erased and the required results will be recorded. This terminates the program and returns the control to the operator to collect the results.

Motion detection by Absolute Difference Sum (SAD):

This algorithm is based on image differentiation techniques. This is mathematically represented by the following equation: What is the number of pixels in the image used as scale factor

$I(t_i)$ is the image I at the moment when I ,

$I(t_j)$ is the image I at time j and

$D(t)$ is the normalized sum of the absolute difference for this moment.

In an ideal case when there is no movement

$I(t_i) = I(t_j)$

and $D(t)$. However, the noise is always present in the images and a better model of images in the lack of movement

$I(t_i) = I(t_j) + n(p)$

When $n(p)$ is a noise signal.

The value $D(t)$ representing the normalized sum of the absolute difference can be used as a reference for comparison with a threshold value. Detection and tracking of objects are important in many artificial vision applications, including activity recognition, safety and automotive monitoring. In this example, you will develop a simple system to track a single face in a live video sequence captured by a webcam. The face

the tracking system in this example can be in one of two modes: detection or tracking. In detection mode, you can use a vision.CascadeObjectDetector object to detect a face in the current frame. If a face is detected, you should detect corner points on the

face, initialize a vision.PointTracker object, and then switch to plot mode.

In tracking mode, you must follow the points with the pointer. By following the points, some of them will be lost due to the occlusion. If the number of points being tracked drops below a threshold, the face is no longer tracked. You should then return to the detection mode to try to find the face.

6. Result

We successfully implemented the code for our project and it shows a good accuracy for different conditions we tested it for. The code makes use of laptop's webcam and detects the intruders.

7. Conclusion

Our goal to achieve the solution for the problem statement mentioned was partially achieved and there is still lot to be completed. In our whole project, we got to learn about various aspects of the field and its method of implementation. The project also displays the great potential in the field of image processing not just in the computer vision industry but also in the field of intrusion detection which in future can be used for other purposes as well. We hope to continue our work and devise the full solution in future.

8. References

[1] Chowdhry, D. A., Hussain, A., Rehman, M. Z. U., Ahmad, F., Ahmad, A., & Pervaiz, M. (2013, May). Smart security system for sensitive area using face recognition. In 2013 IEEE Conference on Sustainable Utilization and Development in Engineering and Technology (CSUDET) (pp. 11-14). IEEE.

[2] Shingne, S. S., & Krishnamurthy, V. Security System Design Based on Human Face Detection and Recognition on Android Platform.

[3] Al-modwahi, A. A. M., Sebetela, O., Batleng, L. N., Parhizkar, B., & Lashkari, A. H. (2012, January). Facial expression recognition intelligent security system for real time surveillance. In Proceedings of the International Conference on Computer Graphics and Virtual Reality (CGVR) (p. 1). The Steering Committee of The World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp).

[4] Sameerchand Pudaruth, Faugoo Indiwarsingh & Nandrakant Bhugun A Unified Intrusion Alert

System using Motion Detection and Face Recognition.

[5] Suresh, D. S., & Lavanya, M. P. (2014). Motion Detection and Tracking using Background Subtraction and Consecutive Frames Difference Method. International Journal of Research Studies in Science, Engineering and Technology, 1(5), 16-22.

[6] Kartik, J. S., Kumar, K. R., & Srimadhavan, V. S. (2013). Security System with Face Recognition, SMS Alert And Embedded Network Video Monitoring Terminal. International Journal of Security, Privacy and Trust Management (IJSPTM) Vol, 2.

[7] Peker, M., & Zengin, A. (2010). Real-time motion-sensitive image recognition system. Scientific Research and Essays, 5(15), 2044-2050.

[8] JOSHI, H. H., SHAH, N., & RAVAL, P. AUTOMATED VIDEO SURVEILLANCE SYSTEM FOR HUMAN MOTION DETECTION.

[9] Patidar, S., Pandey, A. P., Ketan, K., & Rushi, G. Real Time Vision Based Security System.

[10] Kale, P. V., & Sharma, S. D. (2012). A Review of Securing Home Using Video Surveillance. International Journal of Science and Research (IJSR), 3.