

Criminal Assault Analysis and Security Using Image Processing and Machine Learning

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ABSTRACT

The Criminal assault analysis and security project is based on observing through CCTV's and other surveillance systems nowadays present. This system takes in video as an input and gives alert if anything wrong happens. If any violent act or criminal activity is recognized the concerned authority is warned and they can follow up further. The system is designed in such a way that it detects human forms, recognise their crime actions and then recognise their faces. The warning system or alert system is made such that with that alert the authorities get the information about the location, involved people, time of occurrence etc. The system also includes details of some criminals who are already known and new individuals images are added automatically when required, the authorities can manually add their other details like previous records, address etc. The system uses Machine Learning technology and Image Processing for its smooth working.

Key words: Detection, image processing, machine learning, MATLAB, recognition

1. INTRODUCTION

It is not possible to find a nation which has a crime-free society. As long as human beings have feelings they incline on doing crimes. The current society is also filled with various kinds of crimes. Also the criminals in today's society use different advanced technologies and commit crimes in a really tricky ways. So that crime investigation is becoming a more difficult process than early days.

In many nations the amount of crime that is reported per day is increasing dramatically. Concerning about India, the Police department is the major organization for preventing crimes. In general, Indian police stations use paper-based information storing systems. Because of the utilization of paper-based systems police officers have to spend a lot of time as well as

man power to analyse existing crime information and to identify suspects for crime incidents. So the requirement of an efficient way for crime investigation has increased.

Crime detection and analysis is a very crucial work which is in the hands of police, law enforcement agencies and local government. Experts in crime analysing use crime scene evidences to capture unique ways a criminal has acted during a crime. Using these crime scenes as the main focus, the efforts taken in this research is to shortlist and predict criminals and criminal activities with the support of machine learning based algorithms.

Machine learning [1] is becoming a vital part of crime detection and analysis. Machine learning (ML) is the study that computers use to effectively perform a specific task by learning itself from past experience, relying on patterns and inference instead of explicit instructions. Machine learning algorithms build a model of data, known as "training set", in order to make predictions without explicitly programming to perform the task at hand. Machine learning algorithms are used in applications like detection of network intruders, and computer vision etc., here it is infeasible to develop an algorithm of special instructions for performing the task. Machine learning is closely related to computational statistics, which concentrates on making predictions or decisions using computer systems. Simply the machine learning provides the ability to automatically learn also improve from experience without being programmed. The accessed data are used to learn for themselves. The scope of this project is to prove how effective and accurate the machine learning algorithms and image processing in detecting and analysing violent crime actions.

2. RELATED WORK

Human activity recognition through computer vision techniques is important in research areas. This leads various applications like patient monitoring, fall detection, surveillance and human-computer interface. The [3] paper addresses various machine learning algorithms used for classifying various activities like Multi-Layer Perceptron, Random Forest, SVM algorithm and Naive Bayes. This will

provide general to complex human activities by comparing the study and performance analysis of those mentioned algorithms exploitation terribly massive set of pictures.

Intelligent Video Surveillance [4] helps users to eliminate the manual work and thus conserve huge monitoring cost by efficiently monitor the secure areas with surveillance cameras. In restricted areas, the activities are recognized by object tracking method. This is based on image segmentation. Thus it improves safety and security of restricted area by multiplexing video streams. The components of these systems includes background learning and updating, foreground segmentation, feature extraction, and decision making process. In order to handle illumination changes the system uses adaptive background subtraction techniques. Thus it improves performance of video surveillance.

In older days the forensic investigations are performed manually, but due to the increased growth of cameras and video records leads to use automatic analysis [5]. The forensic video analysis is performed to understanding what happened in scene in the past. This means that it is an offline analysis of video. Its key tasks are to recognize a specific action [8] and identification of specific person. It is an unsupervised retrieval system based on human action and appearance. For a given query, the system takes person performs the same action as the one in the query, any action performs same person, or the same person performs the same action. The system uses adaptive search algorithm. To extract the pedestrian in scene a pedestrian detector is used. It uses optical flow features for each detection to represent its action and color features. Its results are used for computing the action and probability appearance which appears in the test video. These algorithm performs on different people having different actions.

The [6] is a human activity recognition in smart environment. It use image processing [2] techniques combined with Artificial Neural Network for human poster classification. Background subtraction and skeletisation is used as image processing techniques. For activity interpretation Hidden Markov Models are used. By this method we recognized all basic actions like walking, sitting, rotating, bending up and down, lying and falling. The method is implemented in smart homes, mainly focus on old age people who live alone.

Human action recognition aims to identify the actions from set of observations. Human activity recognition increased its range with computers to ongoing visual monitoring, video Retrieval and human computer interaction. Recently more datasets are created for human action recognition. These datasets helps us to compare different recognition system with same data as input. This paper helps to solve the lack of description in databases for video based Human Action recognition [7].

3. PROPOSED SYSTEM

The proposed system is an advanced form of monitoring or surveillance, here the system gives alert if anything unwanted or any violent act occurs. The implementation is software based. Here it takes in a surveillance footage or video and it's put through the proposed algorithm. If an unwanted or violent act is detected and recognized an alert is given to whoever it may concern. The system makes use of image processing and machine learning.

The proposed Activity Recognition Flowchart and Face recognition Flowchart are shown in figure 1 and figure 2 respectively.

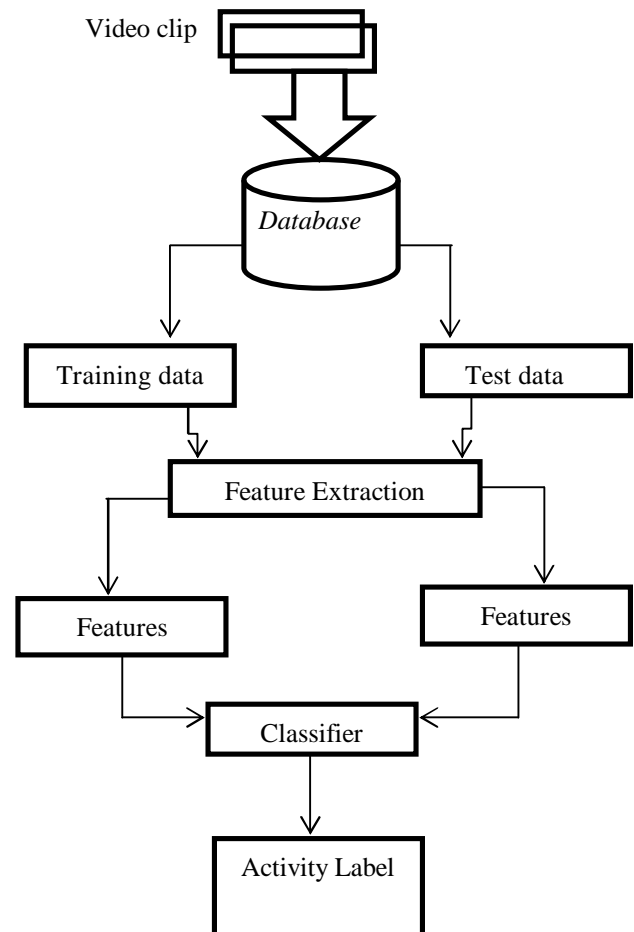


Figure 1: Proposed flowchart for Human Activity Recognition

3.1 Input Video

An input video can be taken from USB Cameras, IEEE 1394 (Fire wire) Cameras, or Video Cards with composite or S-video input devices attached to the system. They can also be loaded from any possible area like files in our system, internet etc.

Computer Vision System Toolbox provides algorithms and tools for video processing workflows. You can read and write from common video formats, perform common video processing algorithms such as de-interlacing and chroma resampling, and display results with text and graphics burnt in to the video. Video processing in MATLAB® [9] uses System objects, which avoids excessive memory uses System objects, which avoids excessive memory use by streaming data to and from video files. It also helps to convert video into frames for detecting and processing images.

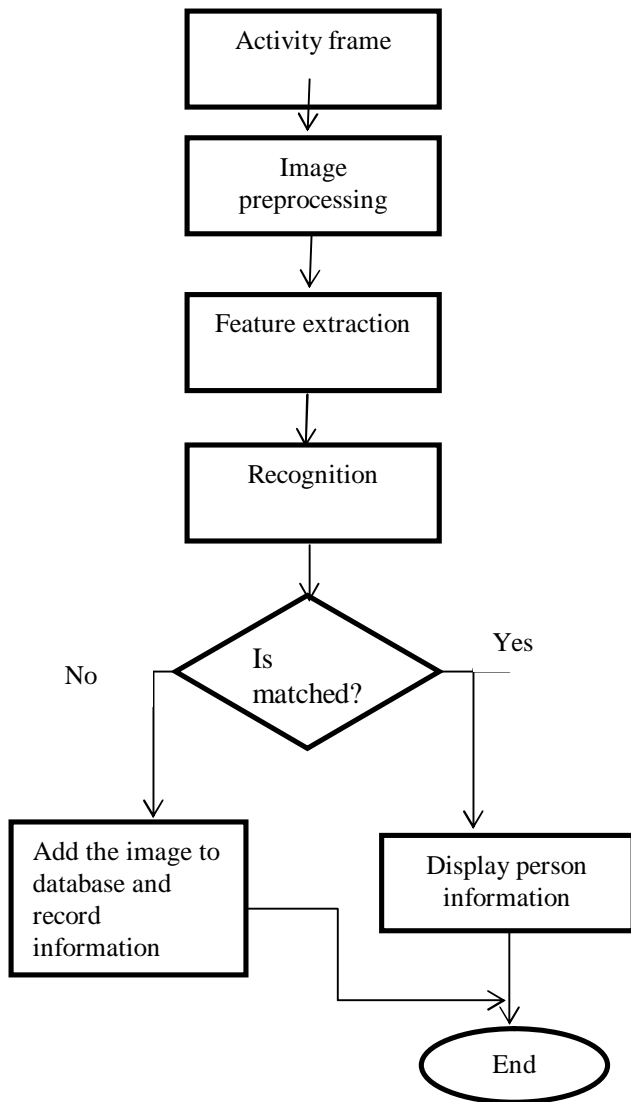


Figure 2: Proposed flowchart for Human Face Recognition

3.2 Detection

Detection is the process of outlining or understanding something from a given video or an image. In detection using MATLAB the video given as input is divided into frames. Then from these frames of images human forms or humans are detected. The video split will then be sequence of frames then these frames are processed. In many cases instead of

taking consecutive frames only some frames are taken for processing in a defined interval.

While converting a video to image it give an infinite number of frames. To avoid the excess use database or memory, these system converts to frames which include the presence of a person or an object. Detection is based on pixels, there will be certain data available that a human body or face structure is so and so accordingly it detects the face. Feature extraction is one of the methods which is carried out here. Also there are many methods used for face detection. MATLAB provides a platform for these working.

3.3. Recognition

Recognition is the next step of detection where it defines what have been detected. Recognition uses many technologies here we use machine learning for recognition of action and face and so on.

3.4 Action Recognition

In recognition the detected forms are compared with the database images and learned images. Using the tools in MATLAB and the data learned and stored in database we can recognize whether the given sequence belongs to a certain class which is a violent activity or criminal activity class. There will be a certain set of classes each for different actions like beating, kicking etc. A detected human form can either fit into these classes or not.

3.5 Face Recognition

As action recognition face recognition works in the same way but in this system face recognition is run if the detected human form fits into any of the criminal activity classes. Using the tools in MATLAB a face can be easily recognized from an image. Those images which fit into criminal activity are checked for face recognition unless specified otherwise.

After processing a face from an image the face is compared with that in the face database, if a match is found it will be of that class else it doesn't fit into to any class and a new class with that face is created. A request for faces in a video at a certain interval of time can also run a face recognition algorithm.

3.6 Alert

An alert is giving a warning to the people or some authority so that they can take necessary actions accordingly. An alert can be a simple text message, mms etc. based on the requirement. In this system an alert is given to the concerned authority in case of a criminal activity. With the help of detection and recognition the involved individual's image with the location and time of occurrence can be given as an alert. The details of the individual may or may not be available since the face maybe a new data to the database.

3.7 Image Processing

Image processing is the analysis and manipulation of digitized image, for the purpose of improving quality, identification etc. in this system image processing is widely used for face detection action detection and so on. Here MATLAB is used as a toolkit for image processing.

3.8 Machine Learning

Machine Learning [1] is self-learning where the machines act on a given input or situation according to the training it is given. In this system machine learning is used in many cases as is action recognition face recognition etc. Here MATLAB and a database is used as tools for implementing machine learning.

3.9 Image Acquisition Toolbox

Image Acquisition Toolbox™ provides functions and blocks that helps to connect industrial and scientific cameras to MATLAB and Simulink. It includes a MATLAB app that lets you interactively detect and configure hardware properties. The toolbox enables acquisition modes such as processing in-the-loop, hardware triggering, background acquisition, and synchronizing acquisition across multiple devices.

3.10 Database

In this system we have many classes which may be face classes or action classes. Action classes contain actions that are violent or have criminal nature. Each class in this will have a certain activity like fighting, beating, knife attack etc. as shown figure 3. Similarly the face classes are individual classes where each class represent an individual and his/her all required details. If a new face comes in it is also added as a new class with null details, further details are added after getting information about that individual. The database is initially started with details of known criminals and the added in the go. Similarly only certain actions will be present initially others are learned and added in the go.

The experiments divided into a training set, a validation set and a test set. The classifiers were trained on a training set and the validation set was used to optimize the parameters of each methods. The recognized result were obtained on the test set. The action can be take place in different scenarios, so need to create different sequences for same actions.



Figure 3 classes of activity.

4. RESULT

Criminal assault analysis and security project uses MATLAB 2018[9] for its implementation. A video or an ongoing surveillance is taken as an input. Human presence is detected using image processing [2]. The output frames are going to compare with the training set. The training set contains different criminal activities. If the activity in scene belongs to a violent activity class then the faces of the people involved in the scene are recognized by the system. The database is expanded according to requirement. An alert which include the image and other known details of the people involved in scene are sent to the concerned authority. The system fit to work properly in any given field.

5. CONCLUSIONS

The criminal activity detector and analyzer is a system of surveillance that can be implemented in any area which requires surveillance and constant observations such as theft prone areas and so. The system adds security to available security services in all areas. The system can be more advanced with high quality cameras or CCTV's. Since there are already surveillance present in many areas, it's easy to implement this project.

This system also provides a double check since the authorities can recheck whether it's actually a violent act or not since some actions or activities may seem violent to the system eye but they may be a part of normal human activity. The system also provides fast alerts so the authorities can act fast accordingly. This helps authorities to reach in rather than after the event have occurred. This system makes it easy for surveillance, security also accident management.

The system increases security, decreases violence and establishes more control. The system may eradicate violence due to fear of getting caught. With the use of a more larger database which have the details about each and every citizen as in Adhar it's easy to capture and get information about anyone caught in camera. It also becomes easier for the authorities to check even minute details as current location and so on. The system can be advantageous when put in a wider field like the country itself since it may make it a safe space for people because someone is watching always.

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