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Intelligent Criminal Exploration

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ABSTRACT: There is an abnormal increase in the crime rate and also the number of criminals is increasing, this leads towards a great concern about the security issues. Crime preventions and criminal identification are the primary issues before the police personnel, since property and lives protection are the basic concerns of the police but to combat the crime, the availability of police personnel is limited. With the advent of security technology, cameras especially CCTV have been installed in many public and private areas to provide surveillance activities. The footage of the CCTV can be used to identify suspects on scene. In this paper, an automated facial recognition system for criminal database was proposed using known Haar feature-based cascade classifier. This system will be able to detect face and recognize face automatically in real time. An accurate location of the face is still a challenging task.

KEYWORDS: criminal identification, surveillance, real time recognition .

I. INTRODUCTION

A. Background

The face is crucial for human identity. It is the feature which best distinguishes a person. Face recognition is an interesting and challenging problem and impacts important applications in many areas such as identification for law enforcement, authentication for banking and security system access [8], and personal identification among others. Face recognition is an easy task for humans but it's entirely different task for a computer. A very little is known about human recognition to date on How do we analyze an image and how does the brain encode it and Are inner features (eyes, nose, mouth) or outer features (head shape, hairline) used for a successful face recognition? Neurophysiologist David Hubel and Torsten Wiesel has shown that our brain has specialized nerve cells responding to specific local features of a scene, such as lines, edges, angles or movement. Since we don't see the world as scattered pieces, our visual cortex must somehow combine the different sources of information into useful patterns. Automatic face recognition is all about extracting those meaningful features from an image, putting them into a useful representation and performing some classifications on them. Face recognition based on the geometric features of a face is probably the most instinctive approach for Human identification.

B. Features

The proposed system aims for creating a criminal identification system for helping police authority in investigation process. The system is mainly developed based on face detection and face recognition technology along with a database for storing criminal details. This system will be able to detect face and recognize face automatically. This will help the law enforcements to detect or recognize suspect of the case if no thumbprint present on the scene. we are able to detect and recognize faces of the criminals in an image and in a video stream obtained from a camera in real time. The whole process can be divided in three major steps where the first step is to find a good database of faces with multiple images for each individual. The next step is to detect faces in the database images and use them to train the face recognizer and the final step is to test the face recognizer to recognize faces it was trained for

Advantages:

➢ It is more efficient and time consuming process for police authorities.

➢ Images and other records can be used for matching the profiles in the database.

➢ The police authority can create and control a central database of criminals for further investigations and can be accessed anytime easily. They can also reduce the use of third party medias thus keeping the confidentiality in investigation.

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C. Motivation

The footage of the CCTV can be used to identify suspects on scene. In this paper, an automated facial recognition system for criminal database was proposed using known Haar feature-based cascade classifier. This system will be able to detect face and recognize face automatically in real time. An accurate location of the face is still a challenging task. Viola-Jones framework has been widely used by researchers in order to detect the location of faces and objects in a given image. Face detection classifiers are shared by public communities, such as OpenCV..

II. LITERATURE SURVEY

This discusses about the various literatures and publications that are conceptually or technically related to the various aspects of this project, which are studied and analysed before the implementation of this project.

D. Related Papers

1)Face Detection and Recognition System using Digital Image Processing(IEEE 2020) Amit Kumar Goe ; Gurlove singh

2)Portable Biometric Attendance System Using IOT(IEEE 2019)Sebastian Chennattu ; Aditya Kelkar ; Aaron Anthony; Sushma Nagdeote Face Recognition: Features versus templates(IEEE 2015) Brunelli , R., & Poggio

3)Robust Real-time Object Detection. International Journal of Computer Vision(IEEE 2015) P. Viola and M. Jones

4) Belhumeur, P. N., Hespanha, J. P., & Kriegman, D. J. (1997). Eigenfaces vs. Fisherfaces: Recognition Using Class Specific Linear Projection. IEEE Transactions on Pattern Analysis and Machine Intelligence. 19, pp. 711-720. IEEE Computer Society

5) Viola, P. and Jones, M. Rapid object detection using boosted cascade of simple features. IEEE Conference on Computer Vision and Pattern Recognition, 2001

6) P. Viola and M. Jones. Robust Real-time Object Detection. International Journal of Computer Vision, 57(2):137–154,2002

E. Observation and Conclusion

In this project, we are able to detect and recognize faces of the criminals in an image and in a video stream obtained from a camera in real time. We have used Haar featurebased cascade classifiers in OpenCV approach for face detection. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Also, we have used Local Binary Patterns Histograms(LBPH) for face recognition. Several advantages of this algorithm are:

- Efficient feature selection, Scale and location invariant detector, instead of scaling the image itself, we scale the features Such a generic detection scheme can be trained for detection of other types of objects (e.g. cars, sign boards, number plates etc).
- LBPH recognizer can recognize faces in different lighting conditions with high accuracy. Also, LBPH can recognize efficiently even if single training image is used for each person.

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III.DESIGN AND IMPLEMENTATION

Design of the system includes waterfall methodology.

The waterfall model is a breakdown of project activities into linear sequential phases, where each phase depends on the deliverable s of the previous one and corresponds to a specialization of tasks. The approach is typical for certain areas of engineering design.

MODULAR DESCRIPTION

HOME PAGE(ADMIN)

Homepage is the main page of Criminal Identification System application. It contains three buttons for: Register Criminal, Detect Criminal and Video Surveillance.

CRIMINAL REGISTRATION

Criminal Registration page will ask the user to select atleast 5 images of the criminal that needs to be registered and also provides input form for providing various details of the criminal like his Name, DOB, Identification mark, Profile picture etc. After selecting images and filling details, user will click register. The criminal will be successfully registered if any error doesn't occur.

DETECT CRIMINAL PAGE

This page allows the user to browse an image from the system and helps in detecting one or more criminals in it. User can also see the profile of the criminal by clicking on detected criminal names.

CRIMINAL PROFILE PAGE

This page will show criminal profile after clicking criminal name from detect criminal or video surveillance page.

VIDEO SURVEILLANCE

This page will use the webcam to capture the video frames in real time. After this it will use face detection module on each frame to detect and recognize criminals in the video in real time. User can also see the profile of the criminal by clicking on detected criminal names.

A Data Flow Diagram (DFD) or a bubble chart is a graphical tool for structural analysis. DFD model a system transform the data and creates, output data-flows which go by using external entities or flies. Data in files many also flow to processes as inputs. The main merits of DFD is that it can provide an overview of what data a system would process, what transformation of data are done, what files are used, and what the result flow.

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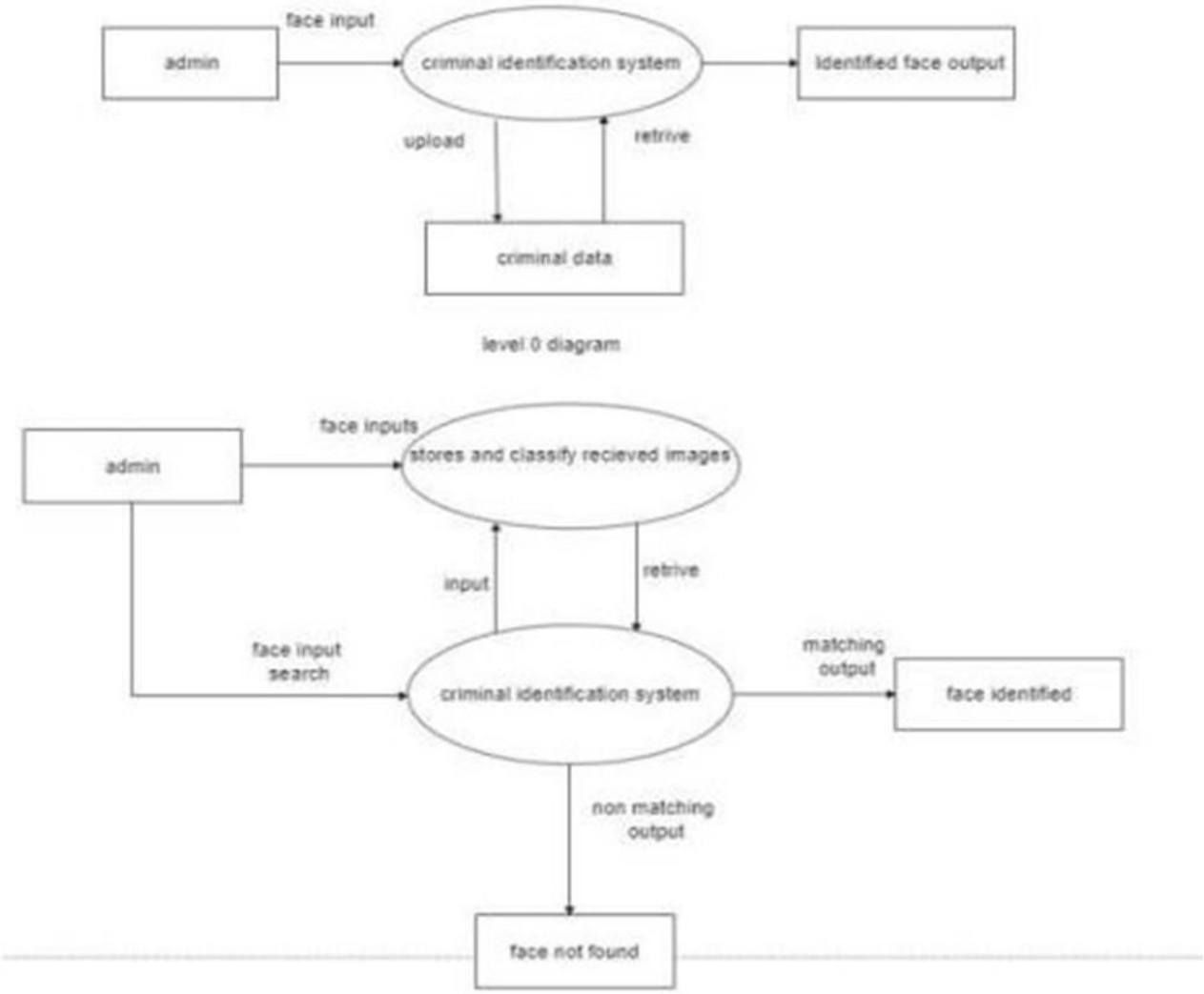

IV. THE WORKING SCENARIO

1. FACE DETECTION USING HAARCLASSIFIER ALGORITHM

The face detection algorithm proposed by Viola and Jones is used as the basis of our design . The face detection algorithm looks for specific Haar features and not pixels of a human face . When one of these features is found, the algorithm allows the face candidate to pass to the next stage of detection. A face candidate is a rectangular section of the original image which is called as a sub-window. Generally, these sub windows have a fixed size (typically 24×24 pixels). This sub-window is often scaled in order to obtain a variety of different size faces. The algorithm scans the entire image with this window and denotes each respective section a face candidate

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A. Integral Image

The integral image is defined as the summation of the pixel values of the original image. The value at any location (X, Y) of the integral image is the sum of the image's pixels above and to the left of location (X, Y). "Figure 1" illustrates the integral image generation.

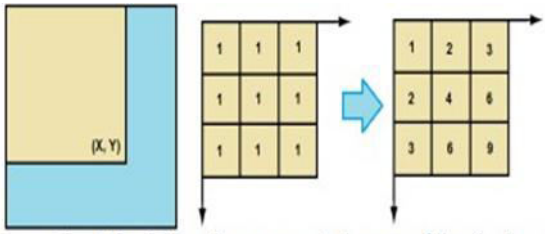

Figure 1: Integral image generation. The dark region represents the sum of the pixels up to position (X, Y) of the original image. It shows a 3×3 image and its corresponding integral image representation.

B. Haar Features

A simple rectangular Haar-like feature can be defined as the difference of the sum of pixels of areas inside the rectangle, which can be at any position and scale within the original image. This modified feature set is called 2-rectangle feature. Viola and Jones also defined 3-rectangle features and 4-rectangle features. Faces are scanned and searched for Haar features of the current stage. The weight and size of each feature and the features themselves are generated using a machine learning algorithm from AdaBoost [. The weights are constants generated by the learning algorithm.

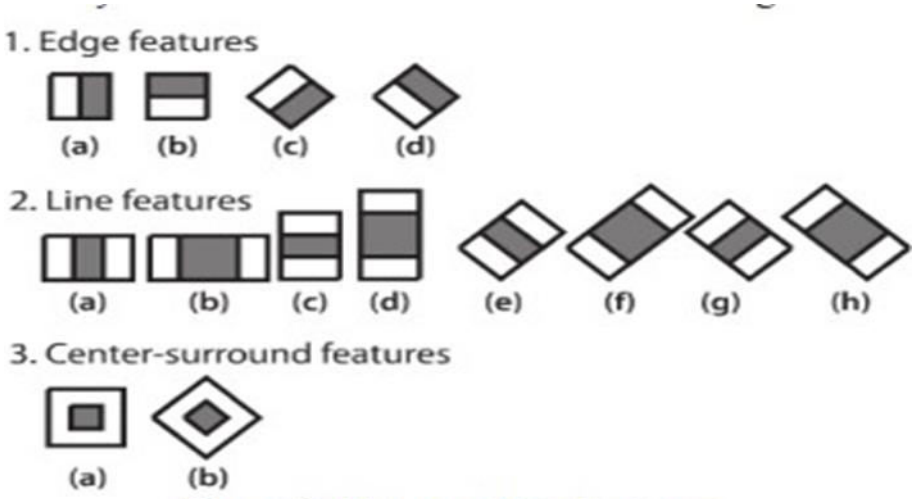

Figure 2: Common Haar Features

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Figure 3: Examples of Haar features. Areas of white and black regions are multiplied by their respective weights and then summed up to get the Haar feature value.

C. Haar Feature Classifier

The cascade classifier contains a list of stages, where each stage consists of a list of weak learners. The system detects the required object by moving a window over the image. Each stage of the classifier labels the specific region defined by the current location of the window as either positive or negative where positive means that an object was found and negative means that the specified object was not found in the image . If the labelling yields a negative result, then the classification of that particular region is over and the location of the window is moved to the next location. If the labelling gives a positive result, then the region moves to the next stage of classification. The classifier yields a final result as positive, when all the stages, including the last one, yield a positive result, which implies that the required object is found in the image.

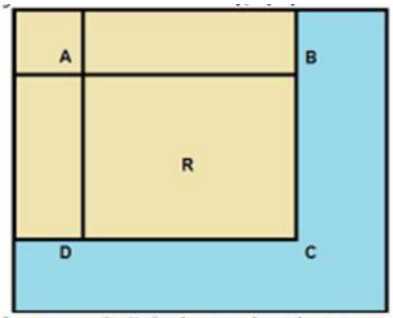

Figure 4: Calculating the area of a rectangle R is done using the corner of the rectangle: C + A - B - D.

D. Cascade

The Viola and Jones face detection algorithm eliminates face candidates quickly using a cascade of stages. The cascade eliminates candidates by making stricter requirements in each stage with later stages being much more difficult for a candidate to pass. Candidates exit the cascade if they pass all stages or fail any stage. A face is detected if a candidate passes all stages.

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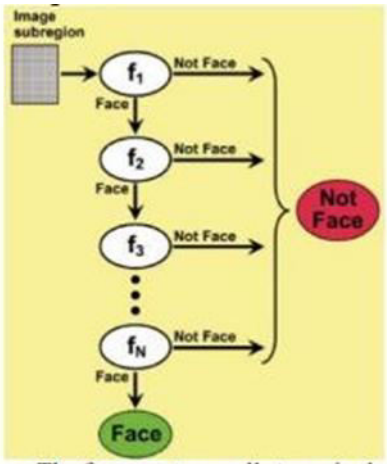

Figure 5: Cascade of stages. The face must pass all stages in the cascade to be conclude.

V. CONCLUSION

In this project, we are able to detect and recognize faces of the criminals in an image and in a video stream obtained from a camera in real time. We have used Haar feature- based cascade classifiers in OpenCV approach for face detection. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Also, we have used Local Binary Patterns Histograms(LBPH) for face recognition.

Several advantages of this algorithm are:

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- LBPH recognizer can recognize faces in different lighting conditions with high accuracy. Also, LBPH can recognize efficiently even if single training image is used for each person.

Our application has some disadvantages like: Detector is most effective only on frontal images of faces, it can hardly cope with 45° face rotation both around the vertical and horizontal axis.

REFERENCES

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