Detection And Tracking Of Facial Expression To Make Driving Safer

Using OpenCV

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Abstract— **Face detection and recognition from an image or a video is a popular topic in biometrics research. We design a real-time face recognition system based on IP camera and image set algorithm by way of OpenCV and Python programming development. The solution to the problem is use of face and eye detection technique in which a framework is employed to map the user's eyes and facial gestures for recognition of drowsiness and can prevent probable accidents. The system includes three parts: Detection module, training module and recognition modules. It talks about various algorithms like Adaboost, Haar cascades.**

Keywords— *Adaboost (adaptive boost), open computer vision (OpenCV), Haar Cascades.*

I. INTRODUCTION

Face detection is the most popular area of research in the vision of computer science. It is a computer technology which is being used in a variety of applications that identifies human faces in digital images. Localization of human faces is considered as the primary and the initial stage in study of face detection. The growing interest in computer vision of the past decade fuelled by the steady doubling rate of computing power, face detection and recognition has transcended from an esoteric to a popular area of research in computer vision and one of the better and successful applications of image analysis and algorithm based understanding. Tired driving is a noteworthy issue in the United States. The hazard, peril, and frequently unfortunate consequences of sleepy driving are disturbing. Tired driving is the perilous blend of driving and lethargy or weariness. Both MATLAB and Open CV can be used for creating such prototypes and systems. In this paper we have carried out our research using Open CV. A logical solution to the problem is use of face and eye detection technique in which a framework is employed to map the user's eyes and facial gestures for recognition of drowsiness and can prevent probable accidents.
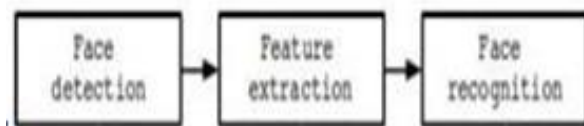

Fig 1.   A generic face recognition system

II. RELATED WORK

The prescribed system presents us with a means to observe and put into practice an efficient accident management system while driving.

There are many systems currently in use for purposes ranging from face detection in digital cameras to finding patterns in aerial and satellite imagery. The different algorithms which exists for face detection and processing works on different methods and techniques with each having their own set of advantages as well as disadvantages.

• Hidden Markov Model :- A concealed Markov display (HMM) is a measurable model that can be utilized to portray the advancement of noticeable occasions that rely upon inner components, which are not straightforwardly recognizable. The watched occasion is called as an 'image' and the factor basic the perception is a 'state'. Covered up Markov models are particularly known for their applications in worldly example acknowledgment, for example, discourse, penmanship, motion acknowledgment, grammatical feature labelling, incomplete releases, and bioinformatics.

• Linear Discriminate Analysis :- LDA is a strategy to locate a straight mix of highlights which portray or separate at least two classes of items or occasions. The straight classifier can be acquired from the resultant. A vast number of pixels are utilized to confront in automated face acknowledgment. Prior to order direct discriminant examination is utilized to diminish highlights and makes it progressively sensible. New measurements are a direct mix of pixel esteems which shapes a layout.

• Principal Component Analysis PCA includes a scientific strategy that changes a number of potentially associated factors into a little number of uncorrelated factors called essential segments. The fluctuation in the information is accounted for by the primary essential parts and the succeeding parts represent further changeability. For exploratory information investigation and for making prescient models PCA is the most utilized method. The computation of the eigen esteem decay of an information covariance network or particular esteem deterioration of an information grid is finished with the assistance of PCA. The eigenvector-based multivariate investigation is made simple with the assistance of PCA. The fluctuation present in the information is ideally clarified by uncovering the structure of the information which is viewed as one of the critical tasks. On the off chance that a multivariate dataset is imagined as a lot of directions in a

high-dimensional information space (one pivot for each factor, a lower-dimensional picture is provided by PCA, a "shadow" of this item is noticeable.

III. HARDWARE COMPONENTS

A. Dash Camera

Dash camera or Dashboard camera is a type of event recorder on a car system that continuously records the data of the windscreen or the person in the driving seat through the rear view and front mirrors of the car. It has such a capable camera that can record the 360` view of the car interior. The resolution will determine the overall quality of the video. Full HD or 1080p is standard for Dash HD cams. Front cameras may have 1080p, 1296p, 1440p, or higher definition for a front camera and 720p for a back camera and include f/1.8 aperture and night vision mode. Dashcams usually use class 10 or above MicroSDHC or MicroSDXC cards. 4G is used to send messages, calls, pictures, and videos in parking surveillance mode. Usually a second 360° camera is employed to record the car's sides (front doors and windows) and inside.

Fig 2. A Dash camera fitted onto a rear view mirror of the car

IV. SOFTWARE COMPONENTS

A. OpenCV

OpenCV is the main open source library for PC vision, picture preparing and machine learning . It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. OpenCV was intended for computational effectiveness and with a solid spotlight on ongoing applications. OpenCV is a library of programming functions mainly aimed at real-time computer vision. Written in optimized C/C++, the library can take advantage of multi-core processing. Enabled with OpenCL, it can take advantage of the hardware acceleration of the underlying heterogeneous compute platform. Adopted all around the world, OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 14 million. Usage ranges from interactive art, to mines inspection, stitching maps on the web or through advanced robotics.

B. Adaboost

Each learning calculation will in general suit some issue types superior to other people, and commonly has a wide range of parameters and arrangements to alter before it accomplishes ideal execution on a dataset, AdaBoost (with decision trees as the powerless students) is frequently alluded to as the best out-of-the-case classifier. When utilized with decision tree learning, data assembled at each phase of the AdaBoost calculation about the relative 'hardness' of each training example is fed into the tree growing algorithm to such an extent that later trees will in general spotlight on harder-to-classify examples.

C. Python

Python is a translated, object-oriented programming language with dynamic semantics. Its high level worked in information structures, joined with dynamic typing and dynamic binding, make it alluring for Rapid Application Development, just as for use as a scripting or glue language to associate existing parts together. Every Machine Learning calculation takes a dataset as information and gains from this information. The calculation experiences the information and distinguishes designs and patterns in the information. Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales.

V. FINDING FACES

Finding faces is the most integral part in face detection. There are various techniques from which faces could be found. In this paper, we will be comparing the various algorithms used previously by implementing them and analyzing them. Even though face detection is the most important step in the area of image processing still the techniques used for its implementation need to be reworked .

1) FINDING FACES VIA COLOR

A. Images having a definite backgroud .

One procedure is to find images in which we have a mono- chromatic background containing only grey scale pixels. These images have wavelength of narrow band. While using these images when we eliminate the background from the foreground we get the boundaries of the face. This is by far the easiest technique used for face detection.

B. Images having a coloured background.

The system in which a face is to be detected for coloured images is based on two procedural steps

1. By applying a skin filter

Skin filter is applied for skin detection. The skin filter process- es and defines the texture of image part that is being masked. After the initial masking the output generated contains discrete areas of human skin. Various morphological techniques such as dilation and erosion are used to develop this kind of filter.

1) FINDING FACES VIA MOTION

A. Use of Blink Detection Techniques

Blinking is an involuntary task functioned by a human. It is a very hasty process. Some humans might not even detect blinking in the daily procedures but blinking as a process has be proved to detect the presence of a human significantly at any frame of time. Blinking provides a non- periodic time and space signal which is unique to every other person. Therefore, the blinking process can equivalently act as a biometric means of measure to detect the presence. An algorithm is used to make blinking make sense to a computer.
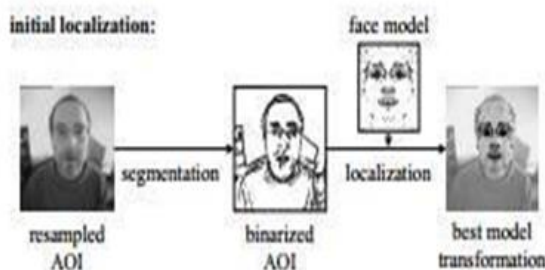

Fig 3. Localization of an image using blink detection techniques

VI. PROPOSED SYSTEM

Our main aim for this system is to bring down the cost of face tracking systems in vehicles so that every commercial and private vehicle can be equipped with one, this will result is safer roads and alert drivers. We propose to use Machine Learning to train an exclusive Face Training model which can be used in this system.
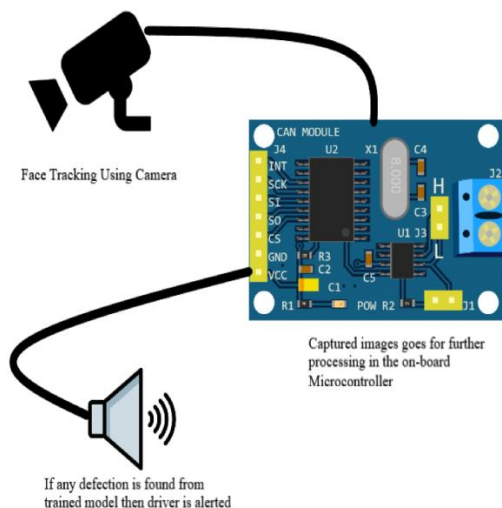

Fig 4. System Design

- Use of Blink Detection Techniques

Flickering is an automatic errand worked by a human. It is an extremely rushed procedure. A few people probably won't distinguish flickering in the day by day systems however squinting as a procedure has been demonstrated to identify the nearness of a human altogether at any time. Flickering gives a non-periodic existence flag which is special to each other individual. In this way, the flickering procedure can proportionately go about as a biometric method for a measure to distinguish the nearness. A calculation is utilized to make flickering make sense to a computer system.

- By applying a skin filter

Skin filter is connected for skin discovery. The skin channel forms and characterizes the surface of the picture's part that is being concealed. After the underlying covering, the yield produced contains discrete regions of human skin. Different morphological systems, for example, expansion and disintegration are utilized to build up this sort of channel.

- Extracting Masked Features

Amid this progression, the different segments of the picture which are dark or extremely exposed are subtracted from the picture. These incorporate the areas around the eyes, the skin under the nostrils or the zone beneath the mouth. By subtracting these parts, we get the most pertinent area which is secured by the skin and viable identification should be possible. The main problem of this method is the variability of light source which may create extreme high and low exposures.

- CAMSHIFT ALGORITHM

CAMSHIFT Algorithm is nothing but an algorithm which finding modes in a set of data samples representing an underlying probability density function (PDF) in R^N. It is a nonparametric clustering technique which does not require prior knowledge of the number of clusters, and does not constrain the shape of the clusters.

- HAAR CASCADES

Haar cascades makes use of the image subtraction morphological process to detect the face. In this the cascades of different images of the same person is taken and recorded in the database. This method of subtraction is performed on each of the image in the cascade but all the images might not give us the best results. Many of the images have a lot of errors. The image with the least error is selected.

Applying the image processing methods, a machine learning model can be built and trained to effectively and efficiently determine the facial expression of the driver. This solution will allow budget restrained consumers such as commercial vehicles like trucks and buses, which constitute majority of road accidents to get an advanced face detection system at low price.
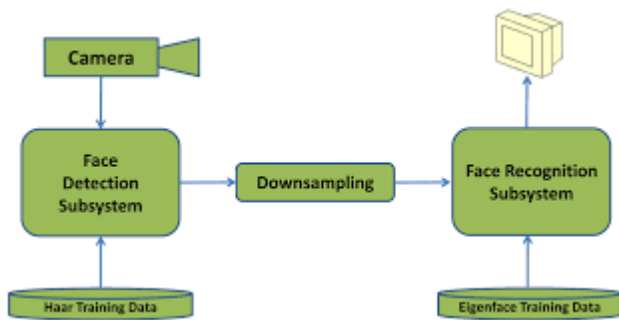

Fig 5. System Architecture

The primary USP of this system is its low cost and simple yet functional design which makes installation and maintenance of this device easy.

VII. CONCLUSION AND FUTURE WORK

To further improve accuracy and speed of the above purposed system several changes can be made which requires additional hardware which could handle and process data from an high definition camera which will result in greater image resolution hence more detail can be processed.

It is imperative to have a variety of conditions for every individual so that the classifier will almost certainly perceive the individual in various lighting conditions also, positions, rather than searching for explicit conditions. But at the same time, it's essential to ensure that a lot of pictures for an individual isn't excessively fluctuated. This would make the classifier to be excessively conventional and furthermore give extremely terrible outcomes, so on the off chance that you figure you will have a lot of pictures with something over the top fluctuation, (for example, revolution more than 20 degrees), at that point you could make separate arrangements of preparing pictures for each individual.

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