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# Facial Recognition Using Machine Learning and OpenCV

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**ABSTRACT :** Because of the inherent nature of the problem, computer theory is not only the centerpiece of computer science research, but also the subject of neuro-science and psychological studies, largely due to the common view that develops in mathematics. This article provides a way to discover and identify a Person's Face, and to analyze emotions. This project basically uses Machine Learning and OpenCV as a core component. Face art is a revolution and makes many advances in the world. Face detection and recognition jumps from esoteric to the popular research space for computer visualization and one of the best and most effective image analysis and understanding algorithm-based applications.

**KEYWORDS:** emotions analysis, Face detection, Keras, Tensorflow.

## I. INTRODUCTION

From a computer perspective, Face recognition (FER) is a field of research that has been extensively researched because of its important applications for interoperability with a personal computer. a custom login screen capable of filtering user access based on user facial features will be upgraded. It is often described as seven emotional states, neutral, happy, sad, angry, nervous, surprised, and disgusting. With the use of a vector support machine (SVM) [8] it is used to detect the facial expression of an individual based on these extracted features. In the Learning Haar cascade classifier the method is used to train both good and bad pictures.

## II. PROPOSED SYSTEM

The facial area is characterized by features such as Haar. Then, the surface area of interest (ROI) is reset. new use of facial ROI to remove the HOG feature. FER is performed on extracted HOG components based on SVM Maintaining Integrity of Specified Objects [6].

The individual data set is made up of images of angry, happy, and neutral situations. The information processes are described as follows.

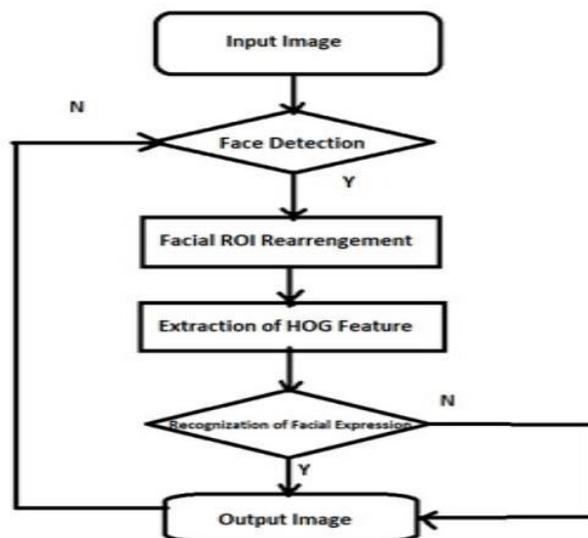


FIG. 1. OPTING Chart OF THE PROPOSAL SYSTEM AND THE RESULTS OF (A) FACE VISION, (B) FACING RENEWING OF FACE ROI, (C) PROVIDING A HOG CERTIFICATE, AND (D) AND FIGURE [2].

### III. RELATED WORKS

#### Image Processing

Image processing is set of computational techniques that is used to perform some operation on a picture for analyzing, enhancing, compressing, and reconstructing image, or to extract some useful information from it. Image processing is that the main work for detecting helmets of bike riders. A site called Digital Image Processing helps a machine to look at its surroundings. The photographs that are captured by the machine's camera are processed by the image processing algorithms, making it easier for the machine to detect, track and classify objects, etc. The image processing also helps in enhancing, restoring existing images. [1].

OpenCV [3] is that the huge open-source library for computer vision, machine learning, and image processing and now it plays a significant role in real-time image-data processing operation which is extremely important in today's systems. By using it, an objects, faces, or even handwriting of a personality can be identified. NumPy libraries are used to process the OpenCV array structure by using python.

#### Machine Learning

Machine learning is a domain focuses on two fundamental things: Firstly, How to construct computer systems that improves automatically through experience of a real-world? And second is related to the basic statistical computational-information-theoretic laws? The study of machine learning is very important in learning systems, including computers, humans, and organizations, both for addressing these fundamental scientific and engineering questions and for the highly practical computer software it has produced and fielded across many applications. [5]

Machine Learning comes under (AI) Artificial Intelligence which allows systems to find out from data and make decisions with minimal interventions. Machine Learning automates model building, it is possible to automatically produce models that can analyse complex data and deliver accurate results on a really large scale.

#### Deep learning

Deep learning is a sort of machine learning and computer science that is artificial intelligence (AI) that generally uses network to learn unsupervised data. It has many layered deep neural networks through which may learn different levels of representation and abstraction. Deep Learning recognizes objects in a picture by employing a CNN. In Deep Learning, a Convolutional Neural Network or CNN is one of the part of artificial neural network, for image/object recognition and classification CNN is widely used. Basically sliding a filter over the input is a convolution, thus creating a feature map that encapsulate the presence of detected features within the input.

Deep Layer Convolutional Neural Network model called AlexNet developed in 2010, which consisted of 60 million parameters and 650,000 neurons with five convolutional layers and 1000-way SoftMax layers, proved the numerous



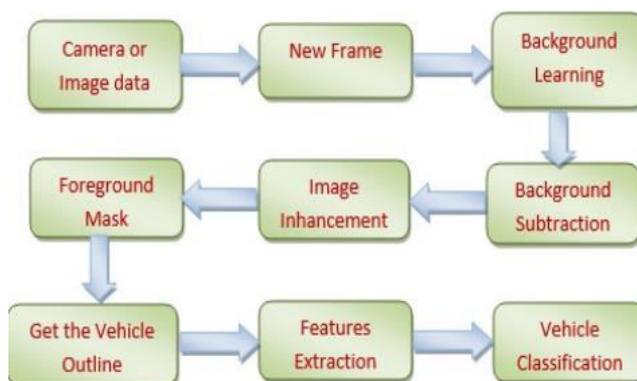
impact of this emerging technology with high future scope by winning the ImageNet Large-Scale Visual Recognition Challenge 2010. (ILSVRC10).

TensorFlow is an open-source library in python. It is mainly used for fast numerical computing of data. TensorFlow allows the developer a DataFlow graph or a flowchart of operations. Manipulations is performed by nodes and edges of graph. TensorFlow is currently being widely accustomed build complex Deep Learning models.

Keras is a neural network library that gives high-level APIs. It is designed in a way that it is to be modular, fast, and simple to use. Keras is an Open Source Neural Network library written in Python and supports multiple backend neural network computations which makes it way more user-friendly than TensorFlow. Also, TensorFlow and Keras will be used together to make complicated models easily.

**Helmet Detection Methodologies**

- Deep Networks for Object Detection. The R-CNN method trains CNN end-to-end to classify the proposal regions into object categories or backgrounds. R-CNN mainly plays as a classifier which helps in classification of vehicle, and it may not forecast object bounds (except for refining by bounding box regression).
- Detection of images is achieved through the concept of bounding boxes. Using the arrogance score of every bounding box will gives the knowledge that the box contains an object. PASCALVOC 2007 is a dataset which incorporates nearly 20 different classes of images. The CNN model as compared to RCNN and Faster RCNN is proved efficient because the number of bounding boxes produced by RCNN is almost 1800–1900 which is incredibly large compared to the CNN model which produces about 100 bounding boxes. Thus, this model enables detecting multiple objects. Henceforth, the Easynet model is easy to create and implement which may even be extended for detecting moving objects.



Block diagram for detection, counting, and classification of vehicles

- A fully convolutional network, Region Proposal Network (RPN) predicts object bounds and therefore the several objectiveness at every position. The RPN is trained persistent to bring about high-quality region proposals. Combining RPN and Fast R-CNN helps the unified network with where to look.
- YOLO (You Only Look Once) is an algorithm that uses neural networks to provide real-time object detection and location of the object. This algorithm is famous because of its speed as well as accuracy. YOLO algorithm has used by many professionals in many platform to detect traffic signals, human, parking meters, and animals.
- The YOLO Detection System. Processing images with YOLO is straightforward. system Firstly, resizes to 448 × 448 as input picture, Secondly, runs a single convolutional network on the picture, and Thirdly By the model's confidence the resulting detections is being threshold.
- SSD (Single Shot multi-box Detector) is a mainstream algorithm in object detection. It is a deep neural network model to accomplish both image segmentation and image classification at the exact time in precicely one execution. An objective of SSD is to observe a proper bounding box in every image that ought to be considered to detect an object and then use that area of the bounding box to organize the type of object. Additionally, the best part is



that it can detect numerous objects in the image executing only once and is significantly quicker and giving high accuracy. SSD object detection algorithm summarises out of 2 sections: Extraction of the feature maps and applying convolution filters for the detection of objects. SSD generally uses VGG16 to extract feature maps. SSD is more reliable than YOLO.



Fig. 2: Bounding Boxes using SSD Algorithm

Face detection using Haar cascades is a machine-based method in which the cascade function is trained with a set of input data. OpenCV already contains many pre-trained sections of face, eyes, smiles, etc.

**HAAR Cascade** : A. HAAR Cascade: Object Detection Algorithm used to identify the face in a photo or real-time video.

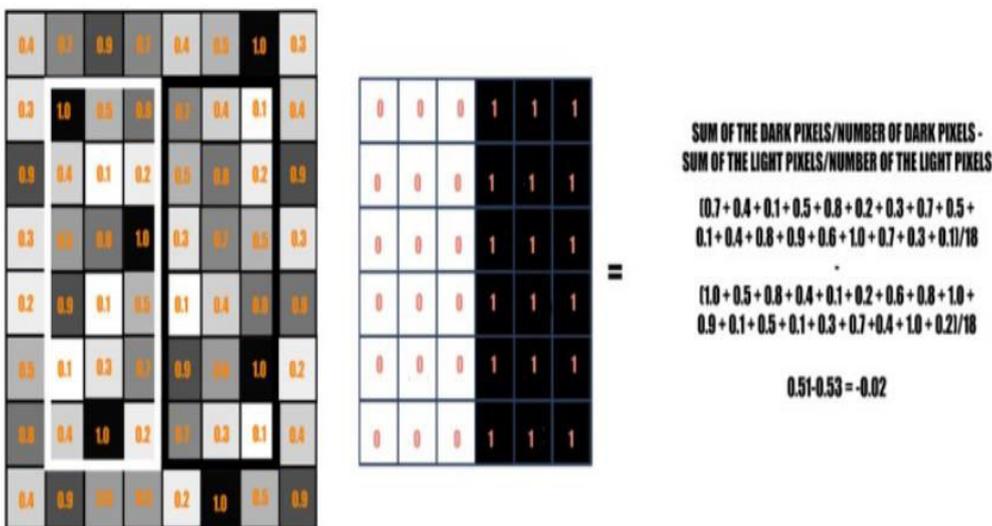


Fig 3: Example of pixel

A calculated sample of the Haar value from the rectangular image section is shown here. The dark areas on the haar feature are 1 pixels, and the light areas are 0 pixels. Each of these is responsible for finding one element in the image. Like the edge, a line or any structure in the image where there is a sudden change of intensity. the sum of all the pixels of the image lying in the dark area of the haar element and the sum of all the pixels of the image lying in the simple area of the haar element.

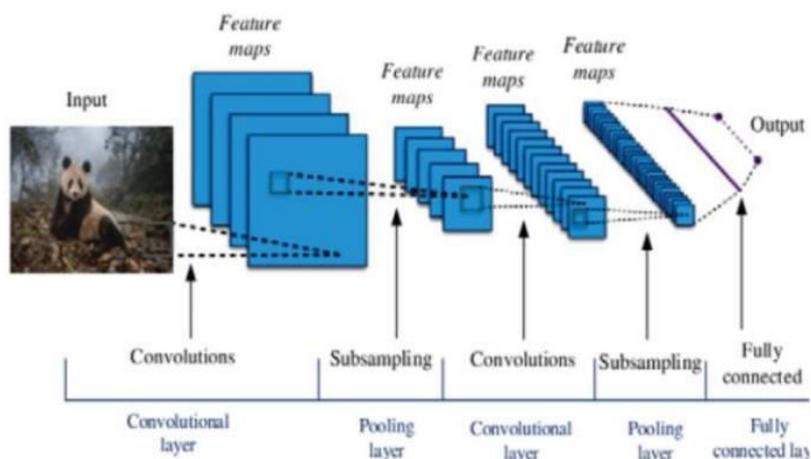


Fig.4. CNN

**Convolutional Neural Network (CNN)** : It is a type of neural network that transmits . The CNN image classification will take the inserted image and perform the processing and classification tasks. [9]Each image will go through a series of convolution layers with filters, mergers, and layers that are fully integrated and displayed in Fig.3.

Architecture Convolution is used to extract a feature from a given image. Lower the image for easy processing without losing its feature and can be done using filters or filters. In compound layers the number of parameters is reduced if the images are too large in size. Area integration is also called subsampling or downsampling which reduces the size of each map without interfering with important information. Fully Connected Layer (FC Layer), after the integration matrix, will be packaged into a vector and provide a fully integrated layer and resemble a neural network. defines a feature matrix matrix will be converted as a vector. With fully integrated layers the elements are combined to form a model. Lastly, an activation function such as softmax or sigmoid separates the output as a human.

**Tensorflow:** Google TensorFlow is a model for machine learning. It is widely used to develop emotional networks. In the latter case you have a rapidly growing community in the field of deep learning networks. [4] focuses on training and comprehension apart from other compelling areas where they can be used, such as performance, image processing, etc.

**OpenCV:**

OpenCV has the advantage of being a multi-platform framework; supports both Windows and Linux, and more recently, Mac OS X. OpenCV has so many capabilities that it may seem daunting at first. Understanding how these methods work is the key to getting good results when using OpenCV. Fortunately, only a select few need to be known in advance to get started. The OpenCV function to be used for face recognition is contained in a number of modules.

- CXCORE namespace contains basic definitions of data type, line algebra and mathematical methods, persistence functions and error holders. Strangely enough, photographic works of painting are found here as well. [7]
- CV namespace contains image processing and camera scaling methods. Calculation geometric functions are also available here. [7]
- The CVAUX word space is defined in OpenCV documents as containing invalid and test code. However, the simplest face recognition is in this module. The code behind them is special for face recognition, and it is widely used for that purpose. ML namespace contains machine-readable links. The top GUI name space contains basic I / O links and power to install windows on multiple platforms. [7]
- CVCAM namespace contains video access links via DirectX on 32-bit Windows platforms. There is no period after the word “et” in the Latin for “et al.” [7]



**EMOTIONS RECOGNIZATION**

“emotions”{ “anger”: value, “contempt”: value, “disgust”: value, “fear”: value, “Happiness”: value, “neutral”: value, “sadness: value”, “surprise”: value },

Sample: 8 emotions used in project[2]

Here the number of emotions is the result of self-confidence. Lowering the value indicates the higher the effect of confidence. By comparison (by taking the difference or root of a square distance) the differential model and the observed factor the effect of confidence is calculated.

The algorithm below shows how to send feedback about facial expressions after calculating threshold value.

**Algorithm:**

for Guidance Counselor Notification: Input: Array of 8 Emotion Averages Output: Guidance Counselor Notification

```
Calculate 8 emotion averages and store in emoAvg
for avg in emoAvg do
if (avg > threshold and (i = indexanger or i = indexsad)) then
send notification to Guidance Counselor end if
i ++ end for return
```

**IV. COMPARISON BETWEEN TENSORFLOW AND OPENCV**

OpenCV	Tensorflow
OpenCV is a library with huge number of tools and functions for a very wide range of Image Processing problems.	TensorFlow is a framework for machine learning
OpenCV is easier to start with	ensorFlow seems harder to get started with and understand
Effectively used in embedded image processing say on Raspberry Pi.	Less Convenient For embedded system
OpenCV library is written in C++ and its primary interface is C++. It also provides binding in Python, Java, and MATLAB/OCTAVE. According to a study, OpenCV is about 1.5 times faster than Keras.	Keras(high-level API of TensorFlow) deep learning framework is written in python. The pythonic nature gives Keras the ability of easy to code, easy to debug, and being modular but it also affects its performance.
OpenCV stands alone and is far the best library for realtime computer vision.	Though Keras has some competitors in the deep learning field like Tensorflow and Pytorch.

The most important point where OpenCV can be the best choice for production performance is. In fact, for some deep learning models, running them in OpenCV can be instantly sized and then used in Tensorflow (even if you use Tensorflow's C ++ API).

**V. CONCLUSION**

In this paper we discuss the use of Haas Cascading and OpenCV in facial reorganization. The scope of Hass Cascading includes object detection, Face detection and the use of OpenCV can detect faces. You can usually improve the accuracy of facial recognition by using additional input images, at least 50 per person, by taking multiple photographs of each individual, especially at different angles and lighting conditions, and we also studied tensorflow and OpenCV through Comparison.



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