SMART ATTENDANCE USING OPENCV FACIAL RECOGNITION

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Abstract

The technology is advancing day to day in every field, we believe that schools and colleges can also implement some of the new technology in their day-to-day activities. As taking attendance is important yet repetitive task, this can be tackled using some of the technologies, facial recognition being one of the technology. The aim of this paper is study of face detection using open CV to mark the attendance from the recognized faces in the image captured from any camera. The image of the classroom with all students will be captured, the image captured will be served as input for the facial recognition algorithm to recognize the faces of the students in the picture captured and mark their respective attendance. Open CV extracts countenance of the given images and retains a number of the variations within the image data. Currently, many techniques are available for the detection of faces, we will specifically focus on facial recognition using Open CV.

***Keywords*:** *Smart Attendance, Open Computer Vision (OpenCV), Facial recognition.*

1. INTRODUCTION

Facial recognition is a mechanism that calculates the locations and facial features in digital pictures. It identifies faces and ignores anything like buildings, trees and bodies. Human face perception is currently a lively research area within the computer vision community. Human face localization and detection is usually the initial step in applications like video monitoring, facial recognition and image management. Locating and tracking human faces may be a essential for face recognition. The library is supported across many platforms. It concentrates mainly on image processing implemented in real time. The OpenCV library was initially developed in C which makes it light weight resource to some specific platforms like digital signal processors. Wrappers for languages like C#, Python, Ruby and Java (using JavaCV) are developed to encourage adoption by a wider audience. Most of the recent developments and algorithms regarding OpenCV are developed using the C++ interface. In the proposed approach, the tools and methodology to implement and evaluate face detection and tracking using OpenCV are detailed.

2. SURVEY STUDY

Khumbhar et cetera all , presented a method in which Haar like features are used to detect faces. The proposed technique captures faces from different angles extracted from the HD video. Simple CV and Open CV are some of the framework libraries that are used along with the Raspberry Pi BCM283 CPU processor.

Abdul Mohsen Abdul Hossen et cetera all, proposed a method with the help of Open CV's Viola-Jones algorithm that discards incorrectly detected faces built on coding eyes. +ve and -ve images are taken as input and Adaboost algorithm is applied which converts weak classifier to strong classifier. The Classifier Cascade process is faster and provides a precision of 98.97%.

Mary Prasanna et cetera all, came up with an instantaneous GUI based biometric identification evolve using Open face. The three stages of Open face are: Localization, Feature extraction, and Recognition. HOG is used for altering the size of anterior part of the detected faces . In this all pixels are inspected with adjacent pixels which results in a image with 68 key features.

Kruti et cetera all, presented a method for face detection. It compares all the algorithms in terms of space and time and it identifies that Haar cascades is the most efficient for face detection. In this, the image subtraction morphological

process is used inorder to detect the face. The cascades of group of various images is taken and recorded in the database. All the pixels within the influence of white region are subtracted from all the pixels within the influence of black region. The subtraction method is applied on each image one by one. The result of all the images are added together. Therefore, it gives a better performance and a much more verified output.

Wu-Chih et cetera all, proposed a method which is a three-stage scheme. This was conducted on a computer with an Intel Core. First, skin regions are saved. In the next stage, a box is used to remove other regions. The FERET image database was used from which the faces of different poses and size were selected and was used to evaluate the performance.

Carlos et cetera all, presented a method which is a pupil detection technique for the multiple face detection. The pupil detector used active illumination scheme. This presented a multiple face detection system which was cheap and real time, combined with a single face tracking system using recursive estimators. It was implemented in a dual Pentium machine using a commercial frame grabber.

Zahra Sadri Tabatabaie et cetera all , set forward a paper expects to consolidate Viola and Jones face location strategy with a shading based technique to propose an improved face recognition strategy. Exploratory outcomes show that their strategy proficiently diminished bogus positive rate and therefore expanded exactness of the face recognition framework particularly in complex foundation pictures.

Henry A. Rowley and so on all, present a neural organization based face identification framework. A retinally associated neural organization looks at little windows of a picture, and chooses whether every window contains a face. they utilize a bootstrap calculation for preparing, which adds bogus discoveries into the preparation set as preparing advances. This wipes out the troublesome assignment of physically choosing non-face preparing models, which should be picked to traverse the whole space of non-face pictures. This framework has better execution regarding recognition and bogus positive rates.

Paul Viola and so on all, introduced a paper which portrays a face identification system that is equipped for handling pictures quickly while accomplishing high location rates. There are three key commitments.

The underlying is the presentation of another picture portrayal called the "Indispensable Picture" which permits the highlights utilized by our identifier to be processed rapidly. The succeeding is a straightforward and proficient classifier which is constructed utilizing the AdaBoost learning calculation to choose few basic visual highlights from an exceptionally enormous arrangement of likely highlights.

Ternary commitment is a technique for joining classifiers in a "course" which permits back-ground areas of the picture to be immediately disposed of while spending more calculation on promising face-like districts.

3. METHODOLOGY

3.1 DESCRIPTION OF TOOLS :

The base algorithm used to detect the face is discussed in this chapter. The AdaBoost algorithm is first discussed, then the collection of functions is mentioned.

3.2 OPEN CV :

OpenCV (Open Source Computer Vision Library) is a library of programming highlights predominantly dependent on PC vision progressively. The library is stage cross. It is principally focused on picture preparing progressively.

3.3 FACE DETECTION :

In this part, the base calculation used to distinguish the face is talked about. AdaBoost calculation is examined first at that point include choice is talked about.

3.4 ADABOOST

In 1995, Freund and Schapire previously presented the AdaBoost calculation . It was then generally utilized in example acknowledgment.

The AdaBoost Algorithm :

1.**Input**: Give sample set S **=** (x1, y1), ... (x n, y n) xiϵ X,Yi ϵ Y = {-1, +1}, number of iterations T.

2.**Initialize**: $w_{i,j} = \frac{1}{N} i = 1, \ldots N$

3. **For** t = 1, 2,…,T,

i. Train weak classifier using distribution Wt.

ii. Calculate the weight ( ) training error for each hypothesis. w_i

$$h_n \varepsilon_t = \sum_{i=1}^{N} W_{t,i} |k_i - y_i|$$

iii. Set: $a_t = \frac{1}{2} log \frac{1-\varepsilon t}{\varepsilon t}$

iv. Update the weights:

$$H(x) = sign\left(\sum_{t=1}^{T} a_t h_t(x)\right)$$

Output: the final hypothesis, also the stronger classifier.

$$W_{t+1,i} = 1 + \frac{W_{t,i}}{Z_t} \times \begin{cases} e^{-a_t} \\ e^{a_t} \end{cases}$$
$$= \frac{w_{t,i} \exp(-a_t y_i h_t(x_i))}{Z_t}$$

3.5 CAMSHIFT ALGORITHM :

The camshaft algorithm follows a series of steps performing the face detection:
a. Obtain the target.
b. Generate a histogram and the portion which needs to be be initially searched.
c. Determine the most populated pixelated region.
d. Determine the center position of the entire searched region.
e. Move the center of the searched region to the center of the entire region.
f. If you need to convert move forward else move back to step d.
g. Now, the new search window is established as the center is originated to the past center.
h. Determine the new area to be processed.
i. Choose the start of the new window.

3.6 FACE TRACKING:

To check the unwavering quality of the numerous face indicator, we have built up a connection based single face tracker that chooses the most striking face for following. This face is followed until it is lost. During following, the framework continues to distinguish different appearances, however it doesn't respond to them regardless of whether they become more striking than the followed face. The tracker additionally drives a pan- tilt mechanism that keeps the followed face focused in the picture.

When the face tracker is instated, it depends on two activity modes to keep following. One mode utilizes the data from the multi-face identifier, and the second is a component relationship tracker that utilizes the amount of total contrasts (SAD) as the item capacity to be limited. The condition of the followed face is spoken to by its size and position, which are dealt with autonomously by the two recursive assessors (one for the position what's more, another for the components of the face box).

A condition of each recursive assessor is characterized by a two boundary vector (the position (x, y) of the focal point of the face, and the width what's more, tallness (w, h) of the face box). Every vector is joined by a covariance. Developments of the subject's face is erratic, however expecting the edge rate is a lot quicker than the inflexible head movement, the anticipated state vector can be viewed as the last refreshed gauge

X = X

and the predicted covariance matrix is

C = C^ + (t)2W

where the uncertainty in position and size grows quadratically with the time interval t between the observation and the last estimation, and W captures the precision loss of each component, and depends on the properties of the underlying process.

New face observations (Y; C) are used to update the state of the estimators as follows:

C^ = [C1 + C1

X^ = C^ [C 1X + C]

The covariance matrix C^ is an estimation of the error of the estimated state vector X^ . The face detected closest to the estimated position, and within certain error boundaries, is used to update the state.

It is unimaginable to expect to get perceptions from the various face indicator for each casing on account of squinting and disappointments in the gathering cycle. At the point when no face is identified, or no face nearer than a specific limit in size and position to the anticipated face is distinguished, the SAD connection tracker is called to decide the 2D interpretation of the face last utilized as measurement. The interpreted face is then utilized as the new estimation to refreshed the position assessor.

The SAD correlation tracker determines the translation (i, j) of the feature point Ft1(x; y) to its corresponding tracked point Ft(x + i; y + j) in the current frame Ft by minimizing the SAD(i,j) function within a search neighbourhood defined by the region of support around the feature being tracked.

The SAD connection tracker utilizes a little district of help and search window around the left understudy, so it can free track without any problem. To try not to track of non-face objects, if the SAD relationship tracker gets called sequentially for in excess of a specific number of edges, without a face being identified inside the anticipated locale by the different face identifier, the cycle is re-introduced with the following generally remarkable. A shockingly strong tracker is gotten from the blend of the SAD connection tracker with the numerous face locator utilizing the recursive assessors, given that neither one of the modes could powerfully work without help from anyone else, and one mode needs to depend on the other to repay every others
weakness.

4.FACE DETECTION AND DESIGN ANALYSIS

4.1 Viola and Jones based face detection:

The fundamental rule of the Viola-Jones calculation is to filter a sub-window fit for identifying faces across a given information picture. The standard picture handling approach would be to rescale the info picture to various sizes and afterward run the fixed size indicator through these pictures. This procedure winds up being fairly dull because of the calculation of the unmistakable size pictures. In opposition to the standard methodology Viola-Jones rescale the finder all things being equal of the info picture and run the finder ordinarily through the picture – each time with an alternate size. From the start one might speculate the two ways to deal with be similarly time burning-through, yet Viola-Jones have concocted a scale invariant locator that requires similar number of counts whatever the size. This identifier is built utilizing a so called basic picture and some straightforward rectangular highlights suggestive of Haar wavelets. The following area expounds on this indicator.

The underlying advance of the Viola-Jones face area figuring is to change the information picture into a fundamental picture. This is finished by making every pixel equivalent to the whole amount, all things considered, above and to one side of the concerned pixel. This permits for the count of the amount of all pixels inside any given square shape utilizing just four qualities. These qualities are the pixels in the essential picture that match with the corners
of the square shape in the information picture.

Sum of grey rectangle = D - (B + C) + A

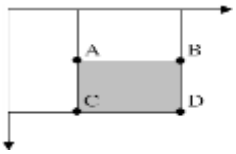


Fig.1 - Sum calculation

The Viola-Jones face locator investigations a given sub-window utilizing highlights comprising of at least two square shapes.

Fig.2 - Different types of features

Each element brings about a solitary worth which is determined by taking away the amount of the white rectangle(s) from the amount of the dark rectangle(s). Viola and Jones have exactly discovered that a identifier with a base goal of 24*24 pixels gives acceptable outcomes.

Viola and Jones utilized a basic and proficient classifier worked from computationally proficient highlights utilizing AdaBoost for include choice. AdaBoost is a AI boosting calculation prepared to do developing a solid classifier through a weighted blend of feeble classifiers. To coordinate this wording to the introduced hypothesis each component is viewed as an expected feeble classifier. A feeble classifier is numerically portrayed as:

$$h(x, f, p, \theta) = \begin{cases} 1 & \text{if } pf(x) > p\theta \\ 0 & \text{otherwise} \end{cases}$$

Where x is a 24*24 pixel sub-window, f is the applied element, p the extremity and θ the limit that chooses whether x ought to be named a positive (a face) or a negative (a non-face).

The fundamental rule of the Viola-Jones face location calculation is to check the finder ordinarily through a similar picture – each time with another size. Regardless of whether a picture ought to contain at least one faces it is evident that an unreasonable huge measure of the assessed sub-windows would at present be negatives (non-faces). This acknowledgment prompts an alternate plan of the issue:

Rather than discovering faces, the calculation should dispose of non-faces.

The idea behind this assertion is that it is quicker to dispose of a non-face than to discover a face. With this in mind an indicator comprising of just one (in number) classifier out of nowhere appears to be wasteful since the assessment time is steady regardless of the info. Thus the requirement for a fell classifier emerges. The fell classifier is made out of stages each containing a solid classifier.

The work of each stage is to decide if guaranteed sub-window is unquestionably not a face or possibly a face. Exactly when a sub-window is requested to be a non-face by a given stage it is expeditiously discarded. Then again a sub-window named a maybe face is given to the accompanying stage in the course. It follows that the more stages a given sub-window passes, the higher the chance the sub-window truly contains a face.

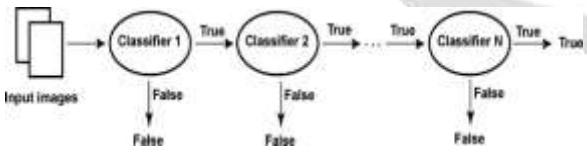


Fig.3 - the cascade classifier

4.2 Feature-based Face Detection

In element based methodologies scientists have been endeavoring to find invariant features of appearances for revelation. The basic notion that relies upon the discernment that individuals can undoubtedly recognize appearances and things in different positions and lighting conditions and, subsequently, there should exist properties or features, (for instance, eyebrows, eyes, nose, mouth, and skin tone) which are invariant over these irregularities. Various techniques have been proposed to first recognize facial highlights and afterward to induce the presence of a face. In light of the removed highlights, a measurable model is worked to portray their connections and to check the presence of a face. In this paper skin shading highlight will be examined and utilized.

4.3 Skin Color Classification:

The investigation on skin tone characterization has acquired expanding consideration in later a long time because of the dynamic examination in substance based picture portrayal. For example, the capacity to find picture object as a face can be misused for picture coding, altering, ordering or other client intelligence purposes. Besides, face restriction likewise gives a decent venturing stone in outward appearance examines.

It is reasonable for express that the most mainstream calculation to face restriction is the utilization of shading data, whereby assessing zones with skin tone is frequently the principal imperative advance of such methodology. Thus, skin shading characterization has become a significant undertaking. A large part of the examination in skin shading based face limitation and discovery depends on RGB, YCbCr and HSI shading spaces. This paper utilizes RGB shading space for skin shading order.

The RGB colors pace is a three-dimensional shading space whose segments are the red, green, and blue forces that make up a given tone. The tones red, green, and blue were picked in light of the fact that every one compares generally with one of the three kinds of shading delicate cones in the human eye. It is quite possibly the most generally utilized color spaces for handling and putting away of advanced picture information.

4.4 Hybrid Face Detection:

Our proposed approach for improving face identification frameworks is mix of an appearance-based and highlight based face location framework. Because of fast and exactness in identifying faces in a picture, we picked Viola furthermore, Jones proposed face location framework. To improve the face location speed rate and reduction bogus positive rate in this methodology we consolidated it with a (skin) shading based strategy. This methodology is extremely basic however it functions admirably.

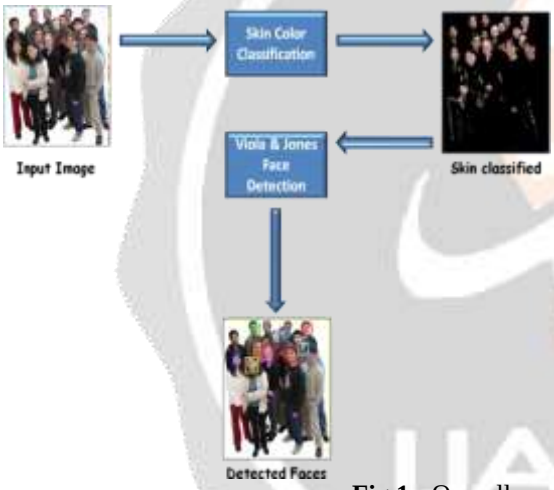


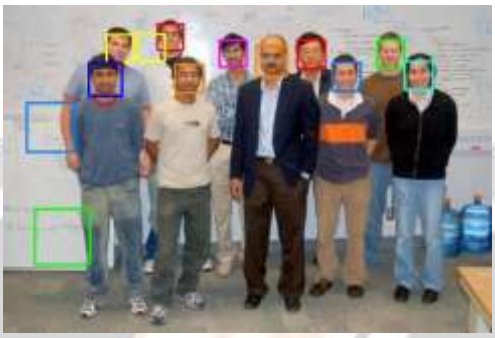
Fig.1 - Overall construction of our technique

One strategy to fabricate a skin classifier is to characterize expressly (through various guidelines) the limits skin group in some shading space..

(R,G,B) is classified as skin if:
R > 95 and G > 40 and B > 20 and
Max{R, G, B} −Min{R, G, B} > 15 and
|R−G| > 15 and R > G and R > B

In this methodology, first skin districts in the info picture are recognized utilizing previously mentioned strategy and afterward Viola and Jones calculation is applied for distinguishing faces. In the wake of applying skin shading classifier, all non-skin locales supplant with dark, though skin districts stay fixed. This encourages face identification calculation to rapidly distinguish non-faces which incorporate lion's share pixels of each picture. Likewise this technique effectively decreases bogus positive rate. Figure shows the results of face detection before and after applying our hybrid algorithm.

(a) Original image



(b) Faces detected by V&J face detector

z (c) Faces detected by our hybrid approach

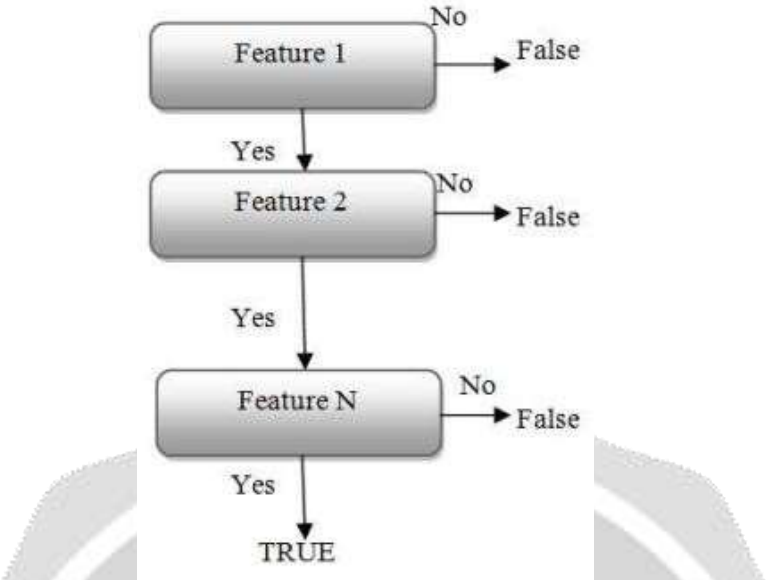
Fig.2 - Results of face detection with V&J and our approach

In this methodology, first skin districts in the information picture are distinguished utilizing previously mentioned strategy and afterward Viola and Jones calculation is applied for identifying faces. Subsequent to applying skin shading classifier, all non-skin locales supplant with dark, while skin districts stay fixed. This causes face recognition calculation to rapidly distinguish non-faces which incorporate greater part pixels of each picture. Moreover this strategy productively lessens bogus positive rate. Figure 5 shows the aftereffects of face identification prior and then afterward applying our crossover calculation.

4.5 Face detection :

With the end goal of investigation and ID of the face, this gadget can recognize the appearances from the caught picture from HD Video. Face recognition from Section IV above determines where a face is situated in a picture, and it is performed by filtering the different picture scales and separating the specific examples to recognize the face. The Prototype is planned with OpenCV's Haar-

Fig.1 - Decision tree based on Haar like features (Cascade of classifier)



Like Feature work. To assemble an inquiry window that slides through a picture, Haar classifier face recognition is used to check whether a specific area of a picture resembles a face or not. To group a specific picture as face or non-face, haar-like highlights and a wide assortment of frail classifiers utilize a solitary capacity. The format and its directions are characterized by each component relative to the inquiry window, which is the root of the component's size.

The pursuit window effectively checks the main classifier on the course, on the off chance that the classifier returns bogus, at that point the figuring on that window likewise finishes

and results no identified face (bogus). Furthermore, in the event that the classifier returns valid, at that point to do exactly the same thing, the window is passed down to the following classifier in the course. On the off chance that all classifiers return valid for that window, the outcome returns valid too. This detects a specific window face.

4.6 Software Required : OpenCV 2.3.1 super pack for windows.

Equipment Required:

Webcam: The webcam's USB goes to the pc. The code will recognize it through a number addressing the USB port its related.

Implementation :

After a classifier is prepared, it tends to be applied to a locale of interest (of a similar size as utilized during the preparation) in an information picture. The classifier yield is "1" if the area is probably going to show the face

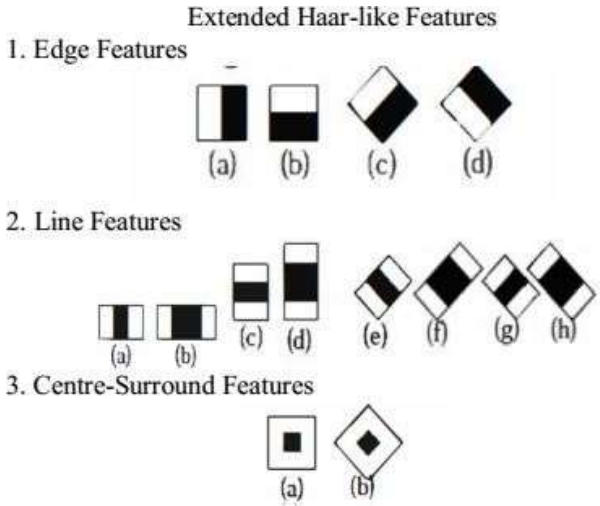


Fig.1 - Extended Haar-like Features

and "0" in any case. To look for the article in the entire picture one can get the inquiry window across the picture and check each area utilizing the classifier. Here we utilize two unique codes for face recognition and following separately. The calculation utilized for both the codes (Processing and Raspberry Pi).

5. RESULT AND ANALYSIS

The aftereffect of face discovery is appeared in Figure. Those are the edges separated from the HD video real time. Every so often, face area figuring may get more than one result even there is only one face in the edge. For this situation, a post picture preparing is been utilized for removing the specific face facilitates with OpenCV and SimpleCV Haar Classifier libraries. On the off chance that the framework yield gives more than one square shape, which demonstrates the situation of the face, the distance of focus purposes of these square shapes has been determined. On the off chance that this distance is more modest than a pre-set edge, the normal of these square shapes will be figured and set as the last situation of the distinguished face. In this paper we in like manner complete the face following application in Python language by using face recognizable proof. This technique is confirmed and the restrictions of the plan are seen through testing and troubleshooting our codes. What's more, a while later, confined by Python execution, we move to OpenCV to survey the speed of this face following arrangement, We found the Viola and Jones face acknowledgment is more sensible for ceaseless face revelation since they requires less CPU resource and costs more restricted time.

Fig-1: Output of Algorithm Showing the face detection

6.CONCLUSION

Facial recognition is the most popular field in the area of computer vision study, it is this technology that is used in most applications for detection of faces in soft images.From all the above papers, it is evident that the OpenCV algorithm is most efficient and suitable for our project.Open CV has many advantages like c/c++ library functions is been used, so machine learning code is directly provided to the computer and it will be executed faster. OpenCV provides additional edge over others and as it is a Berkeley Software Distribution's license it is cost free.

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