Implementation of Aadhaar Verified, face Recognition based Security Surveillance

Kartikeya P Malimath, Soumaya LG Joshi, Chethan M, Ravikumar H S, Divya C D

Abstract*: Security and Authentication is a basic piece of any industry. In Real time, Human face acknowledgment can be acted in two phases, for example, Face discovery and Face acknowledgment. This paper actualizes "Haar-Cascade calculation" to distinguish human faces which are sorted out in Open CV by Python language. Gathering with other existing calculations, this classifier creates a high acknowledgment rate even with shifting articulations, effective element determination and low combination of bogus positive highlights. Haar highlight based course classifier framework uses just 200 highlights out of 6000 highlights to yield an acknowledgment pace of 85-95%.

Keywords: Face recognition, Hear – Cascade, Open CV, LBPH, Criminal identification, Recognition rate

I. INTRODUCTION

Face acknowledgment is a biometric programming application adjusted to distinguish people by means of following and recognizing. The fundamental goal of this paper is to perceive the essences of individuals. This methodology can be executed for all intents and purposes in packed territories like air terminals, railroad stations, colleges and shopping centers for security. The principle focus of this paper is to upgrade the acknowledgment rate.

After the occasion of 9/11, creating security frameworks has become increasingly concerned significance to give well-being to the residents, especially in packed zones like air terminals, railroad stations, in fringes, associations where location and acknowledgment is imperative [1].

To distinguish the people, Surveillance camera with face acknowledgment framework can be given. Face acknowledgment framework has the smoothness to moderate the threat and eventually avert any future attack from occurring. There are incalculable applications for this Face acknowledgment framework over the world. It has additionally risen in applications like Facebook, Instagram and in numerous online life stages. It will propose the client to label the individual who has been identified in pictures.

The Fig.1 speaks to the means occurring in face acknowledgment. There are three stages: face detection, face extraction and face acknowledgment. Right now, Jones calculation is adjusted for face identification. Ada Boost calculation is joined with Viola Jones calculation to make a solid classifier. Haar like highlights are adjusted by Viola - Jones for face identification.

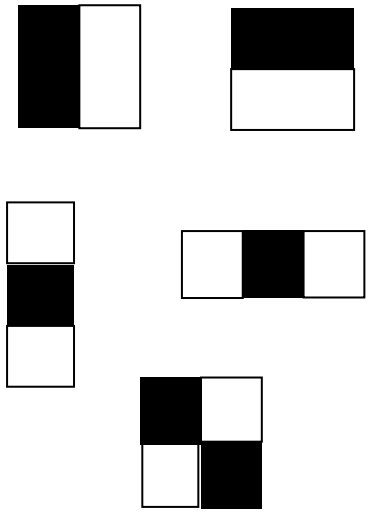

Fig. 1: Block Diagram

From this portrayal, light areas clarify "to include" and dull district is "to subtract".

Models for Haar-like highlights are shown in Fig.2, which is to recognize dissimilarities in dim and white areas of the pictures.

Fig. 2: Haar like Features

Straight parallel example histogram is for the most part favored for "Highlight extraction". It works with amazing segregation. The highlights from the picture will get removed in live stream utilizing this calculation [2].

Linear Binary Pattern Histogram calculation has two stages, preparing period and assessment period. The procedure in preparing period is to prepare the picture tests to be perceived and hence in estimation period, the picture to be tried will be contrasted and the examples prepared in informational index [1].

The double number is considered as a result in neighborhood paired example. Because of its amazing acumen and numerical straightforwardness, this calculation got well known in different face acknowledgment applications [3].

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The main target of this paper is to get high recognition rate and cost efficiency. In this paper, Section II deals with related work and Section III explains the methodology in detail and finally comes the results and discussion part.

II. RELATED WORK

In the year 2018, Suma S L [1] actualized a continuous face acknowledgment calculation utilizing Linear Binary Pattern Histogram (LBPH) and Viola Jones calculation. This technique comprises of com combination and acknowledgment. is finished utilizing Viola Jones calculation is applied is for Face identification, highlight extraction is finished by LBPH procedure and Euclidean Distance Classifier is utilized for face acknowledgment.
These works have acknowledgment pace of about "85%-95%". This work can be additionally changed to support in all conditions, for example, brilliance, if there should arise an occurrence of twins, facial hair and wearing goggles.

In the year 2017, Li Cuimei [2] actualized a human face location calculation utilizing three frail classifiers including Haar cascade classifier. Skin tint histogram, Eye location and Mouth detection are the three classifiers received by this technique. This yields adequately high discovery. The proposed strategy produces a position forecast esteem (PPV) to about 78.18% - 98.01%. This can be corrected to distinguish human faces just of numerous races and diminish the deferral for identifying and perceiving different countenances among various pictures of individuals with variety in light and foundation conditions.

In the year 2017, Souhail Guennouni [4] execute a face recognition framework by ordering with Haar cascade classifiers and edge direction coordinating Edge direction coordinating calculation and Haar-like element choice joined course classifiers are the two procedures utilized right now. This calculation creates a superior coordinating however the recognition speed is nearly less.

In the year 2015, Jiwen Lu [5] utilizing learning CBFD proposed a face acknowledgment framework. The face portrayal and acknowledgment is actualized by means of Compact Binary Face Descriptor (CBFD) highlight learning technique while coupled CBFD is executed for heterogeneous face coordinating by limiting the methodology hole of highlight level. Grouping with other Binary Codes Learning methods, CBFD removes smaller and segregating highlight, henceforth delivers a superior acknowledgment pace of about 93.80% is acquired. Right now, is found out just from one single layer. This framework can accomplish better execution by Learning Hierarchical highlights in profound systems.

III. METHODOLOGY

A. System Implementation

In framework to stream a live stream video Web camera is associated. The caught picture from the web camera will get recognized first and afterward edited to arrive at the PC. This location is performed through Viola-Jones Haar course classifier. Utilizing a python-based Open CV programming, face is spared in framework and sent to the accessible servers which are Linux-based. At whatever point a picture shows up, the server begins LBPH calculation on this face, levels up the picture to limit the varieties lastly thinks about the exuded LBPH from identified picture with the pre-spared LBPH in the database. The aftereffect of correlation is created by sending a notice as approved.

B. Block diagram

As in Fig.3, the proposed system sends two advances of pictures, for example, the information pictures and the picture caught through live gushing. Both these procedure experiences four regular methodology to be specific, face procurement, pre-preparing, face location utilizing Haar-course classifier and highlight extraction utilizing Linear Binary Pattern calculation to register LBP values. These qualities are put away in the database just if there should arise an occurrence of preparing an information picture. At long last, correlation of the qualities in the database with the qualities processed through live gushing happens which perceives the human face as known or obscure dependent on the coordinating.

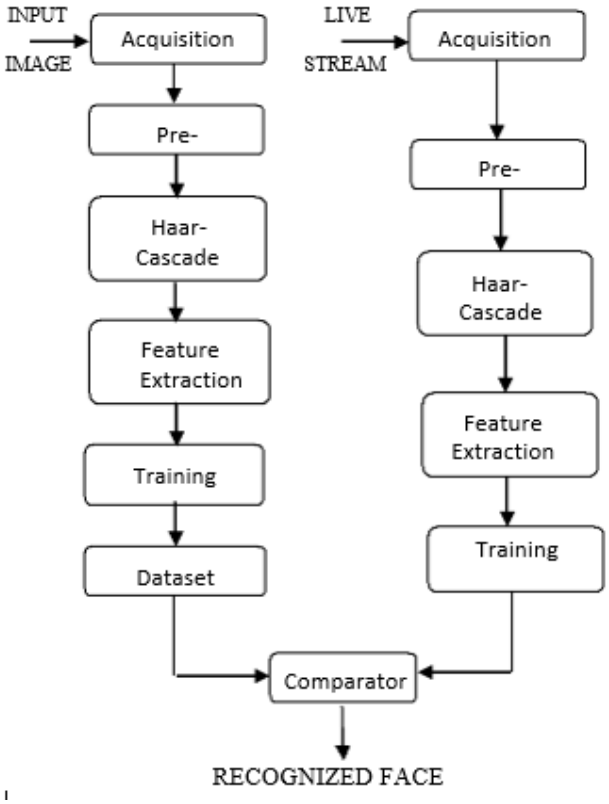

Fig.3: Proposed Block Diagram

C. Phases of recognition

The three primary procedure followed in face acknowledgment framework are Detection, Feature extraction and Comparison.

C.1. Face detection

For face identification, Viola Jones calculation is a useful technique. When all is said in done, this calculation can't restrict for face discovery yet can likewise be used for some inflexible organized article location undertakings.

The Viola-Jones calculation is made out of three fundamental ideas that make it conceivable to build up a continuous face identifier: Haar-like highlights, Image vital, Ada support preparing and Cascading classifier. By applying these highlights, the framework can decide the nearness or the nonappearance of a human face [7].

C.1. 1. Haar-like features

Haar-like highlights is utilized by Haar course classifier for human face location. There are three developments of Haar-like highlights from the Fig.4, the principal position is the edge highlight, second sort is the line includes and the last kind is the four-square shape highlight. Utilizing the indispensable picture, Haar like guideline will give quick calculation. It's called Haar-like features [7].

The Algorithm searches for explicit haar highlight of a face. This recognition takes the picture and changes over it into 24X24 windows and spreads each Haar highlight to that window pixel by pixel. At first, the calculation requires a great deal of positive (pictures of appearances) and negative (pictures without faces) to prepare the classifier.

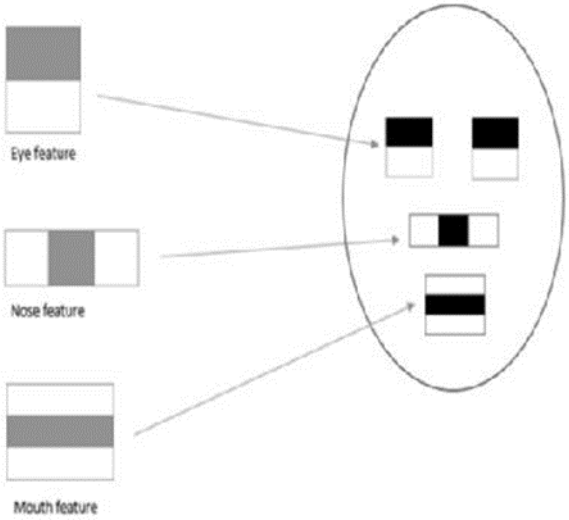

Fig. 4: Types of Haar- like features

At that point, these highlights are separated. Highlights are numerical qualities decided from pictures that are utilized to recognize one picture from another each element is a solitary worth procured by subtracting the entirety of the pixels underneath the white square shape from the whole of the pixels underneath the dark square shape [6].

$$\text{Feature} = \Sigma(\text{pixels in black area})_{\text{Dark}} - \Sigma(\text{pixels in white area})_{\text{white}} \quad (1)$$

Every single imaginable size and areas of every portion ascertain a lot of highlights. A 24×24 window results in more than 160,000 highlights. For each element figuring, it is important to discover the entirety of the pixels under the white and dark square shapes. To comprehend this, the idea of basic picture and AdaBoost calculation is used, which lessens 160000 highlights to 6000 highlights [7].

C.1.2. Integral Image

Square shape highlights can be resolved quickly by means of a transitional portrayal of the picture called the vital Image. The vital picture involves little unit's portrayal of a given picture.

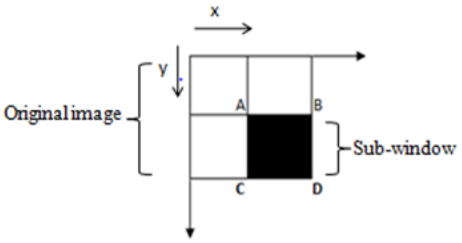

Fig. 5: Integral image schematic diagram

For instance, the estimation of this essential picture at position 1 is the total of pixels in rectangular A. The incentive at position 2 is A + B, etc. Along these lines, the aggregate of pixels in rectangular D is:

Where, S(D) is the entirety of pixels in the rectangular D just - which is the total of pixels in the square shape A + B + C + D, spoke to by ii(4); ii(3) is the basic picture of square shape A+C ; ii(2) is the indispensable picture of A+B lastly ii(1) is the essential picture of the square shape A (the expansion is executed since the district An is subtracted twice in ii(3)and ii(2)). The fundamental picture is sketched out as:

$$ii[x, y] = i[x', y'] \quad (3)$$

Where, ii[x, y] represents integral image, and
i [x', y'] represents original image. [7]

The pixel estimation of vital pictures at any (x, y) area is the aggregate of all pixel esteems showed before the present pixel. The necessary estimation of an individual pixel is the aggregate of pixels on the top and the pixel towards the left. For instance,

5	4	3	8	3
3	9	1	2	6
9	6	0	5	7
7	3	6	5	9
1	2	2	8	3

Fig. 6(a): Input image

5	9	12	20	23
8	21	25	35	44
17	36	40	55	71
24	46	56	76	101
25	49	61	89	117

Fig. 6(b): Integral image

The picture is incorporated in less pixel tasks, since the crossing starts from the upper left towards the base right. This makes the estimation of the expansion to the whole pixels inside any predefined square shape utilizing just four qualities. In the essential picture, these qualities are the pixels that look like with the edges of the square shape in the info picture.

C.1.3. AdaBoost Learning

Ada Boost is a satisfactory boosting calculation which joins frail classifiers while diminishing fundamentally the preparation blunder as well as the more slippery summed up mistake. The principle thought of Boosting lies in interfacing the straightforward classifiers which are known as powerless classifiers. Since the frail classifiers don't expect even the best order capacity to arrange the information well, they are called as powerless classifiers. Here a classifier is joined with a solitary element to effortlessly interface the Haar highlights with frail classifier. Haar-like component is utilized as an edge in Ada Boost learning calculation by Viola and Jones. The Haar-classifier is the most grounded classifier since it utilizes the most grounded highlights. The positive and negative examples are best isolated by the component. So as to manufacture a solid last classifier Ada Boost is utilized [8]. It lessens the highlights from 160000 to 6000, along these lines making the calculation easier and consequently it is less in computational intricacy.

C.1.4. Cascade Classifier:

Cascade classifier is a falling of powerless classifiers used to support the face recognition process and diminish the computational multifaceted nature. Every hub in the arrangement contains a powerless classifier and channel for one Haar include. Ada Boost gives loads to the hubs and the most elevated weighted hub fundamentally shows up. At the point when a channel overlooks to allow picture areas, that particular sub window of the picture is dispensed with for additional preparing. It is then considered as a non-face, which implies that the picture locales that are prepared don't contain the face to be identified. This is basic to the presentation of the classifier, since all or almost all negative picture sub-windows will be killed in the main stage.

Despite what might be expected, when picture areas effectively passed the channel, they go to the accompanying stage, which contains an increasingly mind boggling channel. Just areas that effectively pass all channels are considered to contain a match of the face. This implies districts of the picture contain the facial subject for recognition. The explanation for the multi-arrange classifier is to dispose of productively and quickly the non-face sub-windows. The classifier is utilized to dismiss all the more bogus positives (non-face districts) of the sub-windows. The quantity of bogus positive rate is definitely diminished after a few stages of handling [8].

C.2. Feature extraction and Comparison

After the face is recognized, following stage is to separate highlights this is finished utilizing straight parallel example calculation.

Starting advance of this calculation is to change over the test picture into dark scale. This L x M pixel size picture will get partitioned into areas. A similar pixel size is utilized for the areas, delivering n x n locales. Every locale will experience linear double example administrator.

Right now, will contrast the middle pixel and its Neighbor pixels. On the off chance that the pixel size is more noteworthy to focus pixel it is '1' or it is '0'.

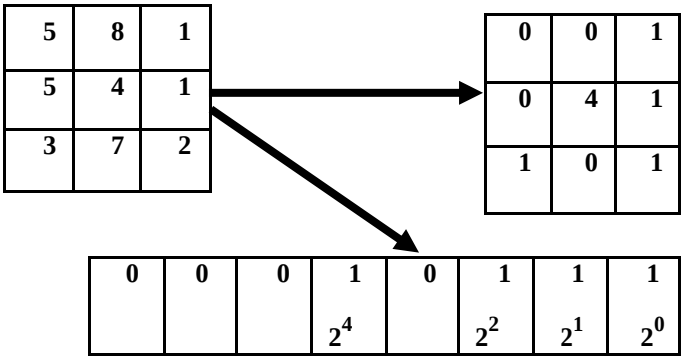

Fig. 7: LBPH algorithm example

Executing this procedure will bring about 8 twofold qualities. By connecting the twofold qualities, it brings about double number. The LBP esteem is gotten by making an interpretation of 8 paired number into a decimal number, it will be in the scope of 0-255. This calculation execution is appeared in the above Fig. 7.

The histogram for every area is drawn utilizing the LBP Values of every district. Every locale will contain 256 cases. This execution is appeared in the beneath condition:

$$Nx = \sum_{i,j} X\{LBP?(Y(i,j)) = x\} x = (0,\ldots, 255) \quad (4)$$

Where, Nx is an instance of significant worth x, Y (I, j) is the (I, j) pixel of Image and X is the contingent administrator, giving '1' when it is valid or '0'. In the wake of finding the histogram for every locale, the sole histogram is made by joining every area histogram. The last histogram is as 256 *n cases and it is resolved as the picture include vector [1]. The downside of this calculation is it has a fixed scale (3 x 3 scales). To conquer this, there is an augmentation of unique LBP usage to deal with numerous areas. There are two parameters: first is 'p' which is the quantity of focuses in the symmetric circle neighborhood, second is 'r' the circle span.

There is a significant idea called LBP consistency. A LBP is uniform on the off chance that it has all things considered two 1-0 or 0-1 advances,

For example: consider pattern 10000000(1 transition) when

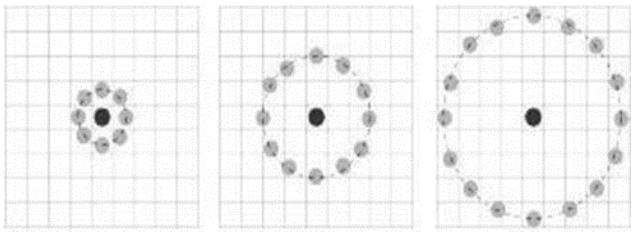

Fig. 8: Represents varying p and r to form Local Binary Patterns.

00100000(2 changes) the two of them are uniform, the example 00100100 (4 advances) is considered as uniform. LBP consistency totally relies on the ‘p’ esteem. At the point when p increments coming about histogram dimensionality increments [11].

IV. RESULTS AND DISCUSSIONS

At the hour of framing the informational collection, every individual will get assigned utilizing an id number. While acknowledgment, when the test individual picture matches with the informational index then a message will get send like an unapproved individual symbolizes criminal or cheat through web of things, if the test individual picture doesn't get coordinated with the informational collection at that point no message will get send symbolizes an ordinary person.

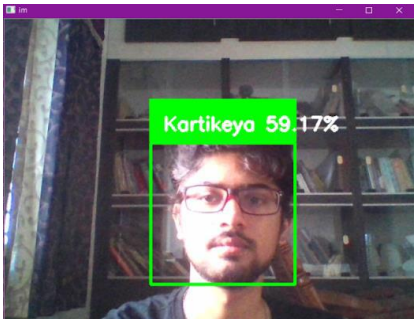

Fig. 9: Recognized Face

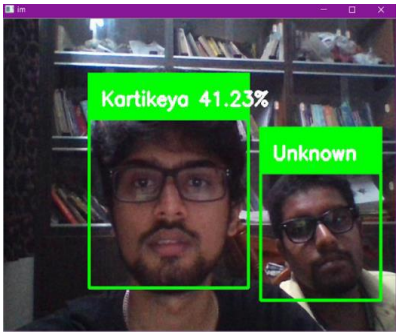

Fig. 10: Recognized Face and unknown face

Right now, identification is finished utilizing Viola-Jones calculation and face extraction is finished by LBPH calculation as said before right now. By following this procedure, there will be acknowledgment rate precision of 95%.

The Table I shows the deferral in timeframe when there is increment in number of pictures.

NO. OF IMAGES	1	4	8	10	16
TIME PERIOD (seconds)	2	4	10	16	25

Table 1: Processing time for recognition.

It is investigated from the above table that even with an expansion in the quantity of pictures, the timeframe won't produce a noteworthy increment since pictures are diminished in size. The framework productivity get supported and in this way quickens the preparing and lessens the slack.

Fig. 11 shows the similarity between caught pictures and time span taken for acknowledgment

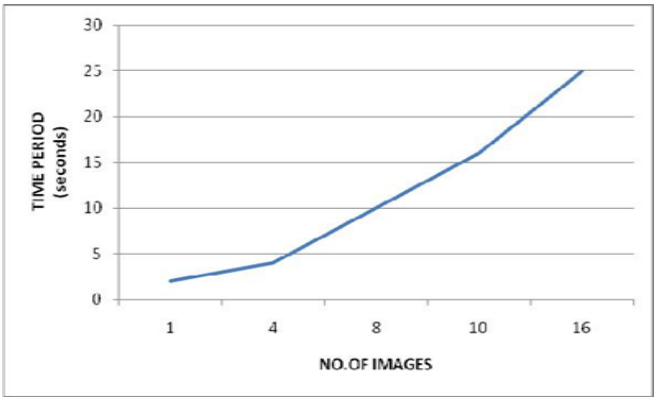

Fig. 11: Processing time for different images (No. of images vs. Time period)

Table II displays the increase in the training period when number of image increases.

NO.OF IMAGES	5	10	15	20	30
TRAINING PERIOD (second)	0.02	0.06	0.09	0.2	0.5

Table 2: Training period for various images

It is scrutinized from the above table that increasing the number of images will not induce any drastic increase in the training period. Fig. 12: shows the analogy between images and training period.

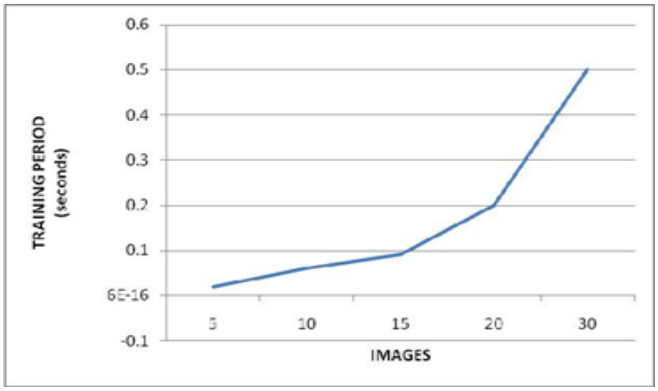

Fig. 12: Training period for different images (Images vs Training period)

Table 3: Performance Analysis

ALGORITHM	LDA	PCA	SVM with binary	CAMSHIFT	HAAR-CASCADE
RECOGNITION RATE	85%	88%	91.2%	93%	95%

Fig. 13 shows the performance analysis.

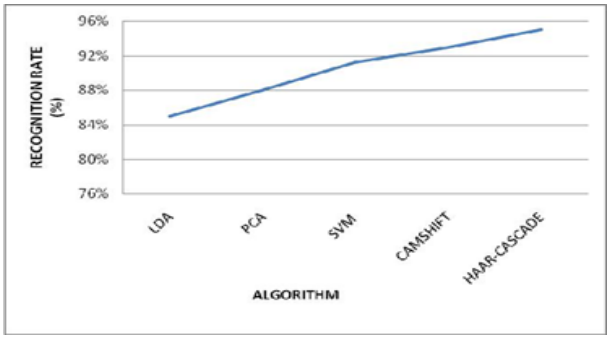

Fig.13: Performance analysis (Algorithm vs recognition rate)

V. TEST CASES

The two main modules in our system are registration module and recognition module.

Aadhaar number is taken during registration module which is to be verified before taking datasets for surveillance. It has 3 cases:

- Valid Aadhaar number, valid captcha
- Valid Aadhaar number, invalid captcha
- Invalid Aadhaar number

Real time face recognition module works on real time video stream input. The faces to be recognized will be previously registered via registration module. It has 3 cases:

- Registered face and high confidence
- Registered face and low confidence
- Unregistered face

VI. CONCLUSION AND FUTURE WORK

Security is a basic piece of any industry. This work is most especially for criminal ID. The calculations completed right now Viola-Jones calculation and linear double example calculation. The introduced framework will get executed utilizing Open CV and Raspberry pi. The acknowledgment rate accomplished by this procedure is 90%-98%. There will be deviation in the outcome by virtue of the separation, camera goals and lightning. Propelled processors can be put to use to lessen the preparing time. By attaching progressively number of acknowledgment servers to weaken the preparing time for assortment of pictures.

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