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Face Recognition Using Combined DRLBP & SIFT Features Using Arduino Uno 328

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Abstract—In this paper, face recognition is proposed using combined DRLBP and SIFT features with the help of ARDUINO UNO 328 for high efficient signal transfer system applications. The aim of this research is to develop a nonreal-life application of a security lock system employing a face recognition methodology. DRLBP is chosen for the face recognition algorithmic program. Arduino microcontroller is employed to represent the response to face identification. USB serial communication is employed to interface between the MATLAB and Arduino UNO Microcontroller. First, the image of the individual is captured then the captured image is then transferred to the information developed in MATLAB during this stage, the captured image compares to the training image within the database to see the individual standing. If the system acknowledges the individual as an authentication person or un-authentication person, the result is sent to the Arduino UNO microcontroller.

Index Terms- Facial Recognition, SIFT Features, DRLBP, Fuzzy Classifier, ARDUINO UNO 328

I. INTRODUCTION

Security is a final concern in our lifestyle. The protection for access management is extremely necessary as a high range of felony cases square measure reported once a year. The massive quantity of felony cases cause a large quantity of losses faced by the victims [1]. The massive quantity of losses emphasized that the protection system mustn't be taken gently.

The conventional security system for access management isn't reliable since it are often cast and stolen. For instance, the Arcanum is often disclosed to an unauthorized user and also the ID card is often stolen by a fraud. Except for that, the normal security strategies like keys and identity cards are often lost or misplaced simply [2]. Therefore, security system for access management ought to be progressive to boost the protection purpose. An additional reliable security system ought to be developed to avoid larger loss. Biometric technology is often enforced within the security system for access management because it offers a better degree of security.

Biometrics is the most secure and convenient authentication tool since it's much not possible to borrow, steal or forge ones identity.

The system is developed using the DRLBP algorithm and SIFT feature for the popularity method. The DRLBP algorithm is chosen because the main algorithm in face recognition method as a result of the simplicity of realization and also the speed of recognition with relevance the opposite technique. Besides, the potency of the system is increased as DRLBP reduced the information dimension and operate in smaller dimension [6]. After, the Fuzzy classifier method is used to classify

the human face images are Authenticate or Un-authenticate. Then the MATLAB result is send to ARDUINO micro-controller via serially and it will display the result on LCD.

A. Objectives

The objective is to design a security system for access management employing a face recognition system. The precise objectives that need to be achieved are as follows:

- To develop a security system supported face recognition.
- To design a face recognition security system victimization the DRLBP algorithm and SIFT features.

B. Significance

The main advantage of this project could be a higher degree of security system for access control system is developed. The matter encountered with typical existing security system like taken of ID card and keys is resolved. By implementing biometric technology supported face recognition system for access management, the losses attributable to felony cases is reduced.

II. REVIEW OF LITERATURE

This paper proposes a face recognition algorithm supported neural network. So as to cut back the interference of ground noise. scale back the post feature purpose location and recognition of the quality of the binarization image de-noising technique for face image de-noising, image noise reduction of output for feature extraction, extract the face price of the height and depression of two-dimensional options, will get the sting face regions round the border, BP neural network classifier technique is employed for information countenance batch scan, variations and classify countenance are created to realize correct face recognition. The simulation results show that the calculation face recognition technique will accurately extract countenance, the accuracy of face recognition is healthier, the anti-interference ability is stronger, and also the operation speed is higher, it will effectively get quick and economical face recognition. [1]

In recent years, deep learning has become a hot analysis space. The analysis on identity verification is progressing apace; however, facial features recognition faces several difficulties because of poor lustiness and time period performance. The feature of many totally different quite facial features is analogous, that is straight forward to confuse, and it became the key issue to have an effect on the accuracy of facial features recognition. At a similar time, Convolution Neural Network (CNN) has been wide employed in image classification tasks by its powerful ability on distributed abstract feature extraction within the field of image. This paper styles and realizes a discriminative learning convolution neural network. The network combines the central loss perform and also the verification-recognition model, that build the model have higher characteristics of the generalization and discrimination ability, and conjointly scale back the misclassification in facial features recognition. Experiments show that the accuracy of the designed facial features recognition network has been effectively improved. [3]

Automated face expression Recognition has remained a difficult and attention-grabbing downside in laptop vision. The popularity of facial expressions is troublesome downside for machine learning techniques; since folks will vary considerably within the means they show their expressions. Deep learning may be a new space of analysis among machine learning methodology which might classify pictures of human faces into feeling classes' exploitation Deep Neural Networks (DNN). Convolution neural networks (CNN) are wide wont to overcome the difficulties in face expression classification. During this paper, we have a tendency to present a new design network supported CNN for facial expressions recognition.

We have a tendency to fine tune our design with Visual pure mathematics cluster model (VGG) to boost results. To judge our design we have a tendency to test it with several mostly public databases (CK+, MUG, and RAFD). Obtained results show that the CNN approach is incredibly effective in image expression recognition on several public databases that succeed enhancements in face expression analysis. [4]

III. SYSTEM DESIGN

A. Software Development

In software system development, the face recognition method is completed in MATLAB. The system is developed victimization pc Vision tool case, applied mathematics and Image Acquisition tool case. Eigen faces methodology: an initial set of pictures of faces are accustomed produce a coaching set. The quantity of face shots of every person keep within the information depends on what quantity processing time they'll take. These faces are then de-escalated into individual vectors. The magnitude of every vector represents the brightness of individual sectors of the grey scale image. A variance matrix is created by normalizing these vectors. After this, eigenvectors are derived from this variance matrix and a collection of eigenvectors of a picture forms an Eigen face. Eigen face helps in precisely focusing at the most face features instead of the total face information. In different words, it permits to find the load of every face [9].

When a replacement face image is non-inheritable the load of that face is calculated then deducted from the every of the weights of different pictures within the information. Those distinction numbers represents what quantity completely different every image is from the initial image. The lower the quantity the nearer is that the match. This distinction is additionally referred to as the easy lay geometer distance.

Image acquisition: during this method, the input face image is captured via integrated digital camera. Once the input image is captured, the options information is extracted. The aim of image acquisition is to hunt and extract an area that contains solely the face.

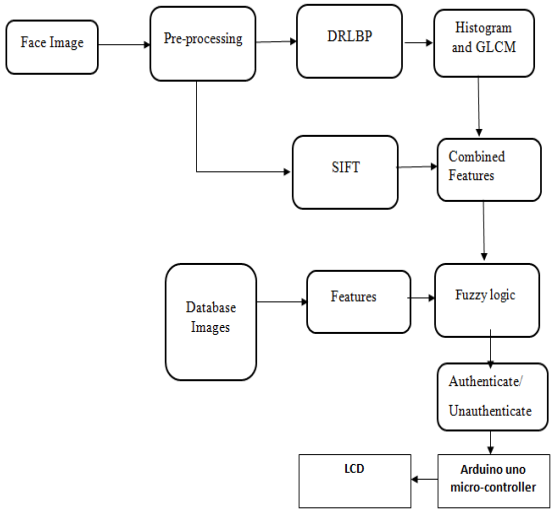

Fig. 1 Block diagram of Face recognition using combined DRLBP & SIFT features

Pre-processing: In pre-processing, the non-inheritable image is resized to a particular size and backbone. The image is resized to 180x200 pixels. Dimensionally reduction is completed by pressing the initial options while not destroying the necessary information from the image [9].

Feature Extraction: this technique used global options approached for feature choice. Global options approach weights every element equally regardless it's the face element or the background element. This approach will cipher the whole face and represent face as a code purpose in higher dimensional image area [3].

DRLBP: The descriptor local binary pattern is employed to check all the elements together with the middle pixel with the neighboring pixels within the kernel to boost the hardiness against the illumination variation. An LBP code for a neighborhood was created by multiplying the edge values with weights given to the corresponding

pixels, and summary the result [12]. LBP codes square measure weighed victimization gradient vector to come up with the bar chart LBP and discriminative options are determined from the robust native binary pattern codes [4]. DRLBP is drawn in terms of set of normalized bar chart bins as native texture options. it's wont to discriminate the native edge texture of face invariant to changes of distinction and form.

Sift features: The SIFT algorithmic rule takes an image and transforms it into a collection of native feature vectors. Each of these feature vectors is supposed to be distinctive and invariant to any scaling, rotation or translation of the image. Among the initial implementation, these choices are typically accustomed notice distinctive objects in several photos and so the retread square measure typically extended to match faces in photos. This report describes our own implementation of the SIFT rule and highlights potential direction for future analysis.

The SIFT choices represented in our implementation square measure computed at the perimeters which they're invariant to image scaling, rotation, addition of noise. They're useful owing to their distinctiveness that permits the proper match for key points between faces. These are achieved by victimization our Gradient-Based Edge Detector and so the native descriptors presented around the key points. Edges are poorly printed and usually exhausting to look at, but there square measure still big numbers of key points will be extracted from typical photos [7]. So we tend to square measure able to still perform the feature matching even the faces square measure tiny. Usually the images square measure too swishes to go looking out those lots of choices for a regular, and in this case little low face can be unrecognized from the employment photos.

In the next step, we are progressing to plan to perform some face identification, which we tend to choose the nearest neighbor or second-closest neighbor rule that might be a sensible technique to do to the key points matching. There's another useful technique to acknowledge faces by learning a applied math model. Throughout this method, a logic model is utilized to acknowledge the faces [11]. Associate in Nursing Expectation-Maximization (EM) rule is utilized to seek out the parameters in an passing most likelihood framework.[8] Hopefully, we tend to square measure able to limit the model to little low amount of elements that's economical for matching faces[10].

Fuzzy logic classification: In the section, Fuzzy rule primarily based system that's utilized for facial expression recognition from face. Fuzzy is one useful approach for fuzzy classification, which can verify the intrinsic division in an passing set of unlabeled information and spot representatives for solid groups. Fuzzy integrals were accustomed describe the uncertainty of facial expression. Facial expression house may be created automatically and compared for expression classification. The core of our system may be a Fuzzy Rule primarily based system that's utilized for facial expression recognition from face. Mathematical logic square measure usually accustomed kind linguistic models and comes with a solid qualitative base. Fuzzy systems square measure utilized in many classification and management problems further as facial expression recognition [5].

- Fuzzy Classification of Facial Attributes

Three basic facial action elements thought-about for expression output are eyes, eye brows and mouth. States of these facial elements act as input to the fuzzy system. The inputs are mapped to their re numerous fuzzy sets by input membership functions (MFs). The measurements we tend to tend to amass on eye gap, mouth gap, brow constriction and mouth constriction are encoded into 3 distinct fuzzy sets: LOW, MODERATE and HIGH. The quality membership operate that we've utilized in our simulation is man of science.[5]

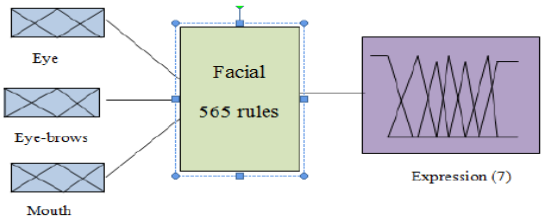

Fig. 2 Fuzzy system architecture

Fuzzy relative Model for facial features Recognition

Examination of an oversized facial data reveals that the degree of a selected human feeling, like happiness or anger, greatly depends on the degree of eye gap, mouth gap, hair constriction and mouth constriction. In planned methodology, 565 rules was printed for expression recognition, the next a pair of sample rules describe the matter of mapping from the fuzzy classified menstruation house of facial extracts to the fuzzy classified feeling house.

Rule 1: If (Eye-Opening is very High) and (Eyebrow- Constriction is very Low) and
(Mouth-Opening is very high) And (Mouth-Constriction is Low) Then Surprise

Rule 2: If (Eye-Opening is Low) and (Eyebrow-Constriction is very High) and
(Mouth-Opening is very Low) And (Mouth-Constriction is High) Then Disgust

B. Hardware Development using Arduino UNO Micro-
controller

For hardware development, it'll specialize in the micro controller employed in the system. The microcontroller employed in this project is an Arduino UNO micro controller. The Arduino UNO small controller is employed for access control that responds counting on the output of face recognition section. Arduino UNO small controller is an open supply hardware board that contains everything to support the small controller like fourteen digital input/output pins, a Universal Serial Bus (USB) affiliation, and an influence jack and push. Arduino UNO small controller is predicated on ATmega328 and may be merely connected to a laptop with a USB cable provided.

The Arduino UNO microcontroller is often battery-powered up either by mistreatment USB affiliation or external power provide. To communicate with the pc, the ATmega328 provides Universal Asynchronous Receiver Transmitter (UART) mistreatment transistor-transistor logic circuit (TTL) (5V) serial communication that is offered on digital pins zero and pins one.

The Arduino UNO small controller provides fourteen digital input/output pins that operate at five volts. Basically, the Digital pins default to inputs or the pins designed to be in high electrical phenomenon state. every pin has an enclosed pull-up electrical device wherever it's disconnected by default of 20-50 k Ohms.

Fig. 3 Arduino UNO micro controller

IV. RESULT AND DISCUSSION

In existing system we are using two databases one is input database and another one is storage database. In this technique we are using Gabor filter we can calculate the individual face and mark the key points after that we are applying LBA feature extraction we can get the output. The output result

should be come 75% of accuracy only. But in our proposed system we are introduce the detecting face using DRLBP, SIFT and Fuzzy Logic classification we can get the output. The output result should be come 92.5% of accuracy.

Fig. 4 Input Image

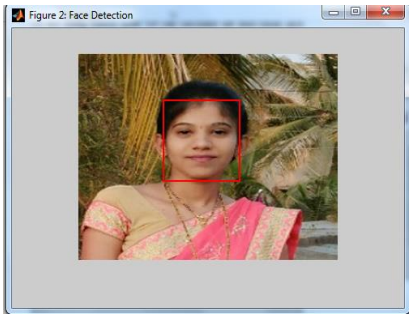

Fig 5: Detection of Face

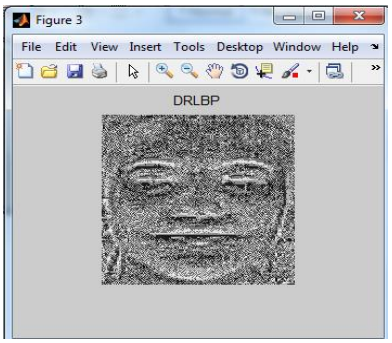

Fig. 6 DRLBP

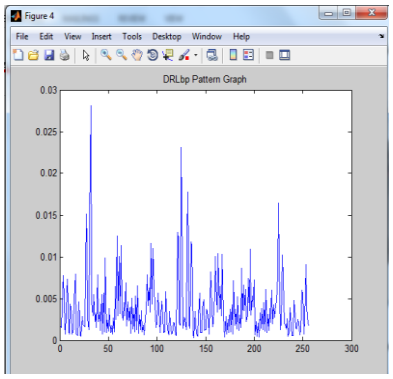

Fig. 7 Histogram of DRLBP

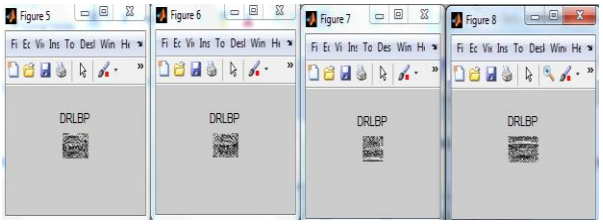

Fig. 8 DRLBP of R-Eye, L-Eye, Nose and Mouth

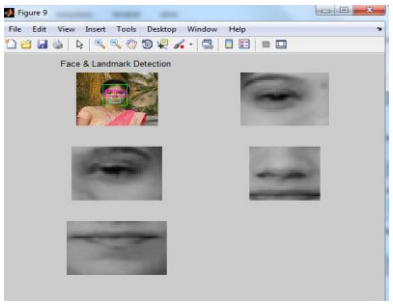

Fig. 9 Face Landmark Detection

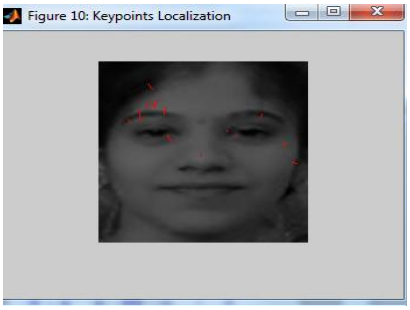

Fig. 10 Key points Localization using SIFT Features

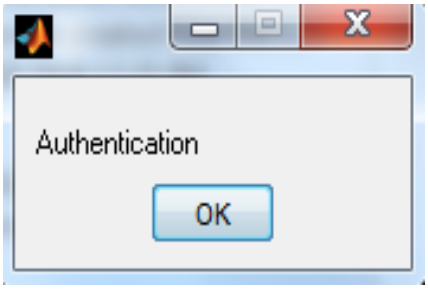

Fig. 11 Result

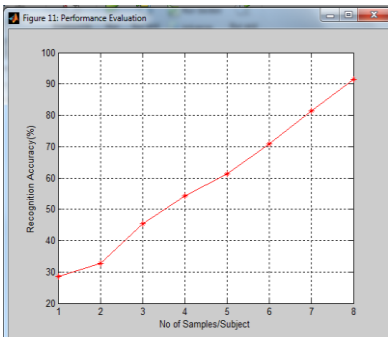

Fig. 12 Performance Analysis

TABLE I
COMPARISION BETWEEN EXISTING AND PROPOSED
PERFORMANCE PARAMETER

Sr. No.	Parameter	Existing Method	Proposed Method
1	Sensitivity	72.50%	91.67%
2	Specificity	71.89%	100%
3	Accuracy	75%	92.31%

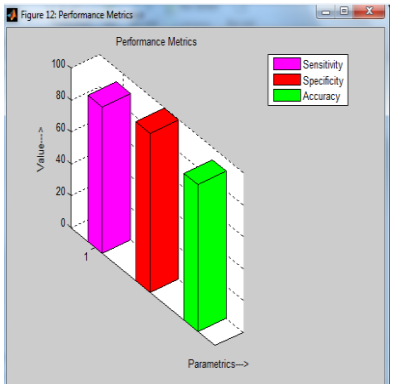

Fig. 13 Proposed Performance Parameter

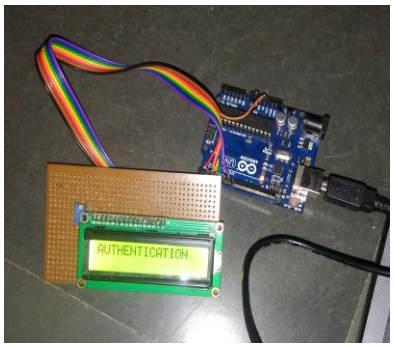

Fig. 14 Hardware result (Authentication)

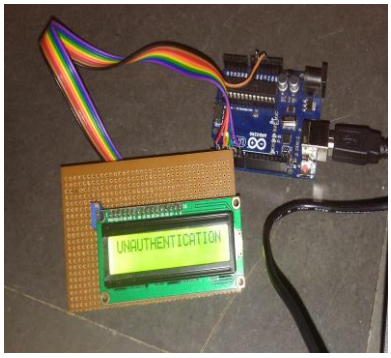

Fig. 15 Hardware result (Un-authentication)

V. CONCLUSION

The face detection module achieves a high correct detection rate. It's able to acknowledge multiple faces. So the system is in a position to tell apart between recognized and unrecognized faces and therefore the microcontroller connected to

alternative systems are able to take acceptable action in either of the situations.

The System provides correct results once the background conditions area unit set beneath controlled parameters instead of uncontrolled ones. The accuracy rate of the system is directly proportional to the amount of coaching image and because the variation in head position decrease, the accuracy rate increase. Therefore, so as to induce most accuracy rate of the system, all parameters ought to be set in controlled conditions. So, this method may be used for the safety applications. As a conclusion, DRLBP and SIFT could be a reliable formula to be employed in face recognition security system if the parameters are set within the controlled conditions. The target of developing a face recognition security system for access management is achieved.

VI. FUTURE SCOPE

During the event of the system several issues were faced. One amongst the most downside is that the microcontroller and MATLAB are connected asynchronous and another is while interfacing the microcontroller (Arduino UNO) and MATLAB the communication error downside happens.

The advantage of using Arduino UNO microcontroller within the project is it's simple to program and additionally a cheap controller. the most disadvantage is because of its low capability processor they're powerless to run durable and thus not appropriate for continuous system. Suggested alternate answer is to use Arduino microcontroller with higher capability like "Arduino Duemilanove" and "Arduino Mega". Another improvement of the algorithmic rule is to extend the scale of a information. High accuracy rate are often obtained by the combination of DRLBP and SIFT technique. Such a mixture of algorithmic rule makes the system additional appropriate and helpful since the combined algorithmic rule makes the system less sensitive to the involved parameter.

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