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Enhanced Face Matching Technique based on SURF and Neural Network

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Abstract: *Face recognition is one kind of biometric technology that can be used to monitor people without their interaction. Controlled environments such as banks and military installations and even airports need to be secure these days. And can able to identify threats and provide access to only authorized users. There are different biometrics present on the basis of which the security can be enhanced like finger scan, iris scan, palm print, face recognition, etc. Face recognition is a biometric, which offers the possibility to identification, without any co-operation from the person and does not require an expert to interpret the comparison results. This paper proposed new system for face recognition. In this method, firstly pre-processing is done on both the input image and on all the images stored in the database. Secondly, face feature from each image is extracted using image processing operation. At last neural network and SURF is used. We have made diverse model of neural network in view of hidden layer and SURFdetermination of preparing calculation and setting the distinctive parameter for preparing. Here all tests are done on face database. Diverse gatherings of preparing and testing dataset give distinctive results.*

Keywords: *Face Matching Technique, SURF and Neural Network.*

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I. INTRODUCTION

Digital Image Processing:
Digital image processing is defined as the processing digital images by means of a digital computer. Digital image is group of a finite number of elements and each of which has a particular location and values. These elements are known as picture elements, image elements, pels and pixels.

Image processing is any form of signal processing for which input is an image and the output of image processing may either be an image or a set of characteristics or parameters related to the image which is usually refers to the digital image processing but optical and analog image processing also are possible. It focuses on two major tasks:

- Improvement of pictorial information for human interpretation and high level processing.
- The processing of image data for storage and transmission.

Biometric Systems:
Biometrics methods are the methods used for identifying a person based on the physical or behavioral traits. There are two type of Biometric features; static or dynamic. Static features are used to characterize hand print; finger prints, face recognition, iris and retina scan whereas Dynamic features are used to characterize the signature, voice, typing patterns, etc. The main objective of face recognition is to recognize a person regardless of interference from background and clothing. Advantages include the fact that it does not require subject cooperation and the sensor may be located remotely. For instance identifying a terrorist in a busy Airport Terminal is one of the important applications of face recognition. In homeland security applications it is important to know what is happening in various areas and adapt the monitoring process to recognizing a person, and respond to emergencies. In this case the face recognition is valuable.

Face Recognition:
Facial recognition systems are computer-based security systems that are able to automatically detect and identify

human faces. Face Recognition consists of a set which involve two tasks:

- *Face Identification:* Given a face image that belongs to a person in a database tell whose image it is.
- *Face Verification:* Given a face image that might not belong to the database verify whether it is from the person it is claimed to be in the database.

Face Recognition Technology involves that the Analyzing facial Characteristics and Storing features in a database and then using them to identify users.

Firstly, a facial recognition system has to recognize a human face and extract it from the rest of the scene. Then, the system measures the nodal points on the face such as the distance between the eyes, the shape of the cheekbones and other distinguishable features. Finally, these nodal points are compared to the nodal points computed from a database of pictures in order to find a match.

Advantages of Face Recognition:

Face recognition is picked over different biometrics in view of taking after reasons:

- No physical association for the benefit of client or subject's co-operation and mindfulness is requiring.
- Accurate and takes into account high enrolment and check rates.
- A master to translate the examination results does not require.
- Only biometric that permit you to perform detached distinguishing proof for instance a recognizing a terrorist in a bustling Airport Terminal.

II. RELATED WORK

Related work introduces various investigates taking into account appearance-based and display based methodologies for Face Recognition. A brief depiction of those late critical looks into is exhibited underneath:

Gheorghita Ghinea, Suresh Kannaiyan and Rajkumar Kannan in 2014investigated a novel approach to recognize faces. The proposed work uses gradient orientation to handle some common issues in face images. Schur decomposition is utilized for matrices and afterward Schurvalues and Schurvectors are separated for subspace projection. Schurfaces are numerically steady and can deal with deficient frameworks. The Hausdorff distance is utilized with the neighbor classifier to measure the similarities between various faces. Tests are directed with Yale face database and ORL face database which displays that the proposed methodology is profoundly discriminant and accomplishes a promising precision for face recognition.

M. Singh, S. Nagpal and R. Singh in 2014 proposed a calculation which uses neural network system and random decision forest to encode age varieties crosswise over various weight classes and they arranged a database Who Is It which contains 1109 pictures from 110 people with age and weight varieties.

Hossein Sahoolizadeh, Zargham Heidari and Hamid Dehghani in 2013examined a strategy by Combining of PCA and LDA. The ability of LDA is enhanced when few examples of images are utilized and neural classifier is utilized to diminish number of misclassifications brought about by non straight divisible classes. Exploratory results on YALE B database demonstrates the achievement of the proposed technique for face acknowledgment with lesser misclassifications. Reproduction results utilizing YALE face datasets uncover the capacity of the proposed strategy for ideal component extraction and effective face arrangement. Their recreation demonstrates 10 persons and considered 40 preparing image and 20 test images for every individual (absolutely 400 preparing and 200 test face images).

III.PROPOSED WORK

There are some main phases of proposed work of this thesis. These phases are discussed in below points:

Phase 1:

In MATLAB firstly we build up a code for the loading the face image in the database.

Phase 2:

We perform pre-processing after loading the input image and the database.

Phase 3:

After that we build up a code for the utilizing the feature extraction strategies to separate the element of the image.

Phase 4:

We perform code for the recognition of the loaded face image by utilizing support vector machine method and spread a code for the choice on the base of the matching points by utilizing SURF feature strategy for the loaded face image.

Recognition using SURF and Neural Network which is basically consists of two different parts:-

1. Matching the database with the inputted data.
2. Testing the result.

IV. TECHNIQUES USED

The two main techniques are used for proposed work which is explained below:

SURF (Speeded Up Robust Feature):
SURF is the feature point extraction algorithm. It is accelerated version of SIFT having greater promotion in real-time. It is used:-

- For object recognition and target tracking.
- To detect and descript the interest points and match them by using high time efficient KD Tree nearest neighbor searching method.

It is composed of two parts:-

- ***Feature Point Detection:*** a process where we automatically examine an image to extract features that are unique to the objects in the image.
- ***Interest Point Descriptor:*** refers to the detection of interest points for subsequent processing.

NEURAL NETWORKS (NN):
Neural network is situated of interconnected neurons which are utilized for estimate of widespread. Artificial neural networks are made out of interconnecting neurons that are artificial or fake. Artificial neural networks might either be utilized to pick up an understanding of biological neural networks or for solving artificial intelligence issues without essentially making a model of a genuine biological system. The genuine or natural nervous system is exceptionally in which artificial neural network algorithms attempt to abstract this quality and concentrate on what might hypothetically matter most from a data handling perspective. Good performance or execution copying creature or human error patterns can then be utilized as one source of proof towards supporting the theory that thereflection truly caught something essential from the perspective of data. An alternate motivating force for these abstractions is to reduce the measure of processing needed to simulate artificial neural networks.

Architecture of artificial neural network:The fundamental architecture comprises of three types of neuron layers are input and hidden and output. In feed-forward networks the signal flow is from input data to output units entirely toward feed-forward. The data preparing can extend over multiple layers of units however no feedback connections. The recurrent networks contain some connections of feedback. In opposition to feed-forward networks the dynamical properties are crucial of the network. Now and again the activation values of the units undergo a relaxation process such that the network will develop to a stable state in which these activations don't change any longer.

Artificial Neural Networks:Artificial neural networks are made out of interconnecting artificial neurons. Artificial neural networks might either be utilized to gain an understanding of biological neural networks or for solving artificial intelligence issues without essentially creating a model of a system of genuine biological system. The real or biological nervous system is highly complex. The artificial neural network calculations attempt to extract this unpredictability and concentrate on what might hypothetically matter most from a data handling perspective. Great execution or execution impersonating creature or human error patterns and it can then be utilized as one source of confirmation towards supporting the speculation that the reflection truly caught something critical from the perspective of data preparing in the brain.

Delta Rule:The delta rule is a gradient descent learning rule for redesigning the weights of the artificial neurons in a single-layer perceptrons. It is an uncommon instance of the more general back propagation algorithm. For a neuron j with activation function g(x), the delta rule for j's, ithe weight is given by

$$\Delta W_{ij} = (t_j - y_j)\, g'(h_j) x_i \qquad (1)$$

In above equation the delta rule is generally expressed in simplified form for a perceptrons with a linear activation function as $\Delta W_{ij} = \alpha (t_j - y_j)\, x_i$, where α is known as the learning rate parameter.

V. METHODOLOGY

The initial face detection module scans the captured image and detects the human faces.In Face recognition module, for every detected face, BICA features are computed and minimum distance is calculated.The following figure shows that the methodology of proposed work of this research work. There are some steps of proposed methods are as follows:

Step 1:
This is the first step in the face recognition system. In this step first, upload the image from the database. This image is the original input image to be process for the accuracy.

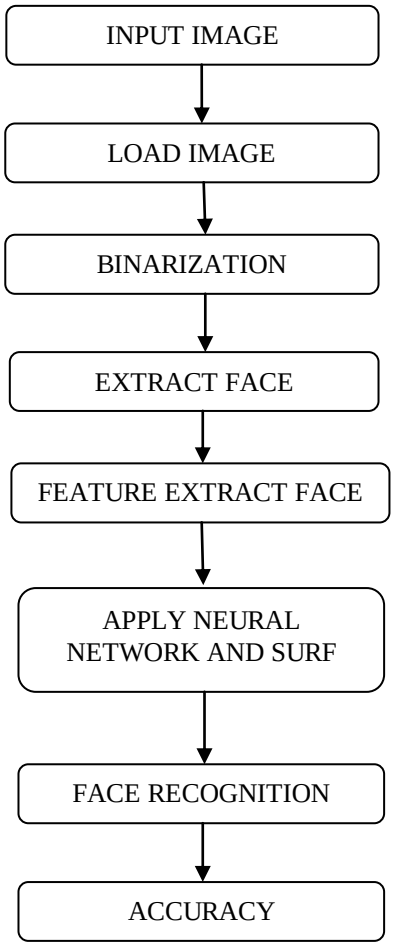

Figure 1: Methodology of proposed work

Step 2:
This is the second step. In this step the image is converted into the binary values to represent the image. Image binarization is usually performed in the pre-processing stage of different documents which converts a gray scale document image into binary document image and accordingly facilitates the ensuing tasks such as document skew estimation and document layout analysis.

Step 3:
In this step, find the location of the points in face images. We use the traditional face detection to extract face area from original image. Then to extract eyes, mouth and eyebrow outlines position from face area.

Step 4:
After detection of face, extract the features fromthe detect image for the matching of input image.

Step 5:
Applied the SURF and Neural Network image for face recognition after Feature Extract Face.

Step 6:
In this step we take the recognize image as the output from the database that is matched.

Step 7:
This is the final step of accuracy of the output image that gives some percentage value.

VI. RESULTS AND DISCUSSION

The following figures are highlighted the results of proposed work:

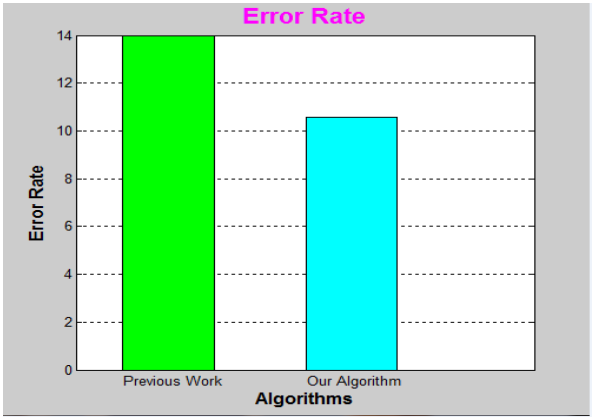

Figure 2: Error rate of previous and proposed work

Error Rate	Previous Work	Our Algorithm
	14	10.5856

Figure 3: Comparison of error rate values

Figure 4: Result of Matching Face

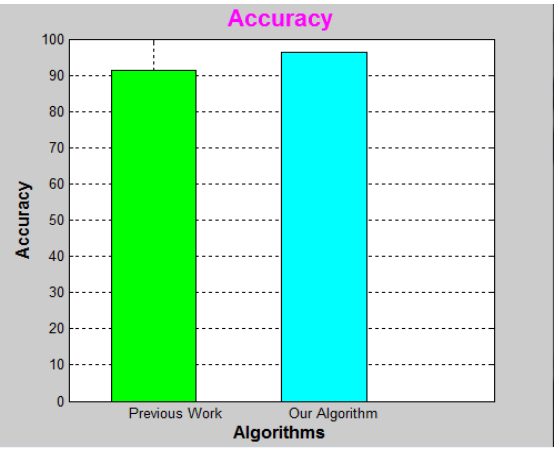

Figure 5: Accuracy of previous and proposed work

	Previous Work	Our Algorithm
Accuracy	91.2576	96.2576

Figure 6: Comparison of accuracy values

VII. CONCLUSION

A new facial image can also be simply added by attaching new feature vectors to reference gallery while such an operation might be quite time consuming for systems that need training. Feature points, found from NEURAL NETWORK AND SURF responses of the face image, can give small deviations between different conditions (expression, illumination, having glasses or not, rotation, etc.), for the same individual. Therefore, an exact measurement of corresponding distances is not possible unlike the geometrical feature based methods. Moreover, due to automatic feature detection, features represented by those points are not explicitly known, whether they belong to an eye or a mouth, etc. Giving information about the match of the overall facial structure, the locations of feature points are very important. However using such a topology cost amplifies the small deviations of the locations of feature points that are not a measure of match. Although detection performance of the proposed method is satisfactory by any means, it can further be improved with some small modifications and/or additional pre-processing of face images.

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