PERSONAL IDENTIFICATION BASED ON PALM PRINT IMAGES USING DCNN

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ABSTRACT: In recent times, automatic biometric authentication has emerged as the backbone of the new-age solutions to our society's ever increasing demand of improved security requirements. Palmprint recognition is a promising biometric system for forensic and commercial applications. The proposed work provides a novel technique for features extraction phase by using Speed Up Robust Features (SURF) algorithm, then 2D principal component analysis (2D PCA) and 2D linear discriminant analysis (2D LDA) are used for dimensionality reduction. Deep convolutional neural network is used for classification. The algorithms have been tested by using palmprint database. The recognition accuracy of the proposed approach with some existing approaches is taken. The simulation results show that the proposed approach gives good and comparable results with some other approaches.

Keywords –Palm printing, SURF, Deep convolution neural network, palm print recognition.

I. INTRODUCTION

A biometric system is a personal identification system which plays a significant role in daily life. There are two approaches of the personal identification: the first method is token-based such as a passport, a physical key and an ID card, and the second method is based on Knowledge such as a

Password. These two approaches have some drawbacks. The biometric personal identification systems concern with identifying persons by either Physiological characteristics such as fingerprints, palmprint, iris, face or by using some aspects such as the signature or the voice. Among various Biometric identifications technologies palmprint recognition system has been successful due to its simplicity, feature extraction, matching feature, small size, high precision, real time computation, and the resolution of used images. There are two types of 2 Palmprint features with reference to the field at which palmprint systems are used. The first type of features are the principal lines and wrinkles which could be extracted from low resolution images (100dpi) and it is used for forensic applications such as law enforcement application.

Palm Print Recognition:

Palm print recognition systems use a scanning device or a camera-based application, along with associated software that processes image data from a photograph of an individual's palm and compares it to a stored record for that person. Palm prints are counterparts to fingerprints, including similar details. As is the case with fingerprint scanning, palm scanners use optical, thermal or tactile methods to bring out the details in the pattern of raised areas (called ridges) and branches (called bifurcations) in an image of a human palm, along with other details including scars, creases and texture. Palm scanners may require that individuals touch their hands to a screen or may be contactless.

Speed Up Robust Features:

Speeded up robust features (SURF) is a patented local feature detector and descriptor. To detect interest points, SURF uses an integer approximation of the determinant of Hessian blob detector, which can be computed with 3 integer operations using a precomputed integral image. Its feature descriptor is based on the sum of the Haar wavelet response around the point of interest. These can also be computed with the aid of the integral image.

II. EXISISTING METHOD

The exisisting method deals with palm print identification using ROI extraction and edge detection. The block diagram of this approach is shown below:

1. Preprocessing:

Preprocessing is used to align palmprint images and to segment the central parts for feature extraction. Most of the preprocessing algorithms employ the key points between fingers to set up a coordinate system. Preprocessing involves ROI segmentation, binarizing the palm images, Edge Detection, Region of interest of palm.

2. ROI extraction:

The part of the image, on which you have interest to work out, is called Region of Interest (ROI). In another words, selected subset of image is called ROI. Some initial experiments with different palms provides a clue that we need to find the central location of "busyness" and "edgyness" of each palm and construct a suitable ROI around this location. Our aim is to use a method which will provide us a square or a rectangular ROI with maximum number of pixels. The acquired image has been divided into smaller horizontal and vertical strips and the statistical properties of the edgyness of these regions have been used to either select or reject the strips from the ROI. A comparison of Histogram of the original and extracted image is used to confirm the suitability of extracted region.

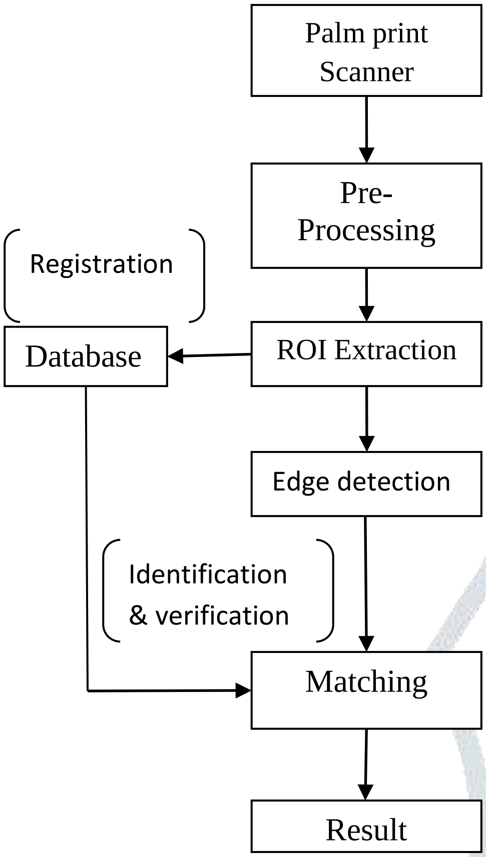

Figure 1: Block diagram of Existing method

3. **Edge detector:**

Edge detection includes a variety of mathematical methods that aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. Edge detection is a fundamental tool in the areas of feature detection and feature extraction. In this method we use canny edge detector. The Process of Canny edge detection algorithm can be broken down to 5 different steps:

1. Apply Gaussian filter to smooth the image in order to remove the noise.
2. Find the intensity gradients of the image.
3. Apply non-maximum suppression to get rid of spurious response to edge detection.
4. Apply double threshold to determine potential edges.
5. Track edge by hysteresis: Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges.

4. **Feature matching:**

The best candidate match for each keypoint is found by identifying its nearest neighbor in the database of keypoints from training images. The nearest neighbors are defined as the keypoints with minimum Euclidean distance from the given descriptor vector. The probability that a match is correct can be determined by taking the ratio of distance from the closest neighbor to the distance of the second closest. Finally the result is obtained.

DRAWBACKS OF THE SIFT ALGORITHM:

- If the images are of poor quality, it is difficult to extract ROI
- The accuracy is less.
- Generally doesn't work well with lighting changes and blur.

III. PROPOSED METHOD

The proposed algorithm is based on the palmprint identification based on SURF algorithm. The block diagram of the proposed method is shown below:

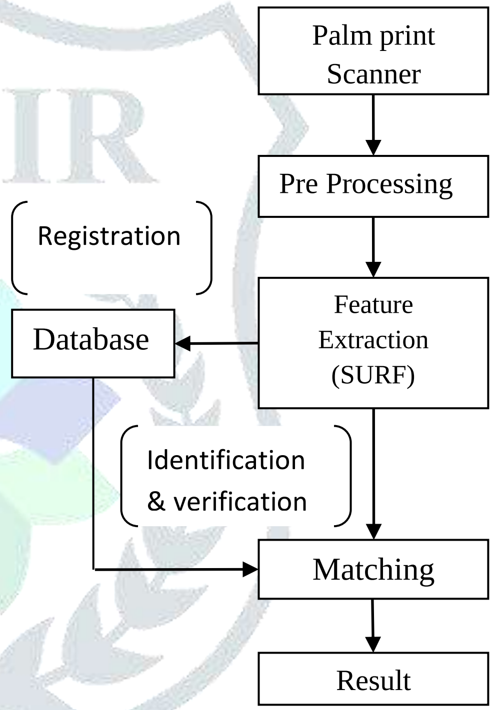

Figure 2: Block diagram of proposed method

In this the feature extraction is based on the surf algorithm. The basic steps of the SURF algorithm are shown below:

1. **Surf Feature Extraction:**

SURF (Speeded Up Robust Features) is a scale and in-plane rotation-invariant image features. By using integral images for image convolutions it is faster to compute than other state-of-the-art algorithms, yet produces comparable or even better results by means of repeatability, distinctiveness and robustness. This algorithm describes the keypoint detector and descriptor. The detector locates the keypoints in the image, and the descriptor describes the features of the keypoints and constructs the feature vectors of the keypoints.

1.1 Keypoint Detector:

SURF uses the determinant of the approximate Hessian matrix as the base of the detector. To Integral images are used in Hessian matrix approximation, which allows fast evaluation of box filters. The integral evolution is given as follows:

$J(x, y) = \sum_{i=0}^{x} \sum_{j=0}^{y} I(i.j)$

1.2 Keypoint descriptor:

The SURF used the sum of the Haar wavelet responses to describe the feature of a keypoint. Haar wavelets are used for the integral images to increase robustness and decrease computation time. We introduce geometric constraints into point-matching based on SURF features to increase the matching speed and robustness. Because in palm recognition, palm images are usually normalized, the matching points in two images must have the similar locations on the two palms. If the ratio of these two distances is smaller than a pre-defined threshold, the point-pair with the minimum distance is confirmed as a matched pair. Since location information is introduced in search of the minimum-distance point-pair, and the ratio of the minimum distance and next to minimum distance measures the matching reliability of two interest points.

2. Principle component analysis (PCA)

Principal component analysis (PCA) is probably the most popular multivariate statistical technique and it is used by almost all scientific disciplines. PCA analyzes a data table representing observations described by several dependent variables, which are, in general, inter-correlated. Its goal is to extract the important information from the data table and to express this information as a set of new orthogonal variables called principal components.

Implementing PCA:

Step 1: Normalize the data

Step 2: Calculate the covariance matrix

Step 3: calculate the Eigen values and Eigen vectors.
Step 4: Choosing components and forming a feature vector.
Step 5: forming principle components.

3. Linear Discriminant Analysis (LDA)

The main purposes of a principal component analysis are the analysis of data to identify patterns and finding patterns to reduce the dimensions of the dataset with minimal loss of information. The goal of the LDA technique is to project the original data matrix onto a lower dimensional space. To achieve this goal, three steps needed to be performed. The first step is to calculate the separability between different classes (i.e. the distance between the means of different classes), which is called the between-class variance or between-class matrix. The second step is to calculate the distance between the mean and the samples of each class, which is called the within-class variance or within-class matrix. The third step is to construct the lower dimensional space which maximizes the between-class variance and minimizes the within class variance.

4. Deep Convolution neural network (DCNN)

A convolutional neural network (CNN) is a special architecture of artificial neural networks, proposed by Yann LeCun in 1988. CNN uses some features of the visual cortex. In more detail: the image is passed through a series of convolutional, nonlinear, pooling layers and fully connected layers, and then generates the output. The Convolution layer is always the first. The image (matrix with pixel values) is entered into it. Then the filter produces convolution, i.e. moves along the input image. The filter's task is to multiply its values by the original pixel values. All these multiplications are summed up. One number is obtained in the end.

Advantages of Surf Algorithm:

- SURF is faster in real time application.
- It has low dimensionality as compared to all other approaches..
- It reduces the computation time.

Applications of Surf Algorithm:

- Vehicle detection
- Biometric applications.

IV. RESULTS AND DISCUSSIONS

The results obtained from the proposed method are presented here to prove that the proposed method is better compared with the existing algorithms. In Training phase we trained the images of palm print dataset. Here we presented the results for 3 instances. The train images from both left hand and right hand taken from the dataset are shown in figure 3 and figure 4

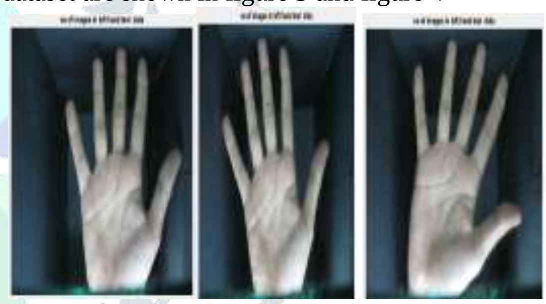

Figure 3: Left Hand Train Data

Figure 4: Right Hand Train Data

In the testing phase in order to approximate how well your model has been trained that is dependent upon the size of your data, the value you would like to predict, input etc and to estimate model properties like mean error for numeric predictors, classification errors for classifiers, recall and precision etc. the test images that are taken from left hand are represented in figure 5 and right hand test data is represented in figure 6

Figure 5: Left Hand Test Data

Figure 6: Right Hand Test Data

For route challenge, SURF uses wavelet responses in horizontal and vertical direction for a neighborhood of length 6s. Adequate gaussian weights are also implemented to it. The dominant orientation is anticipated by means of way of calculating the sum of all responses inside a sliding orientation window of attitude 60 tiers. Remarkable thing is that, wavelet reaction can be discovered out using essential imagegraphs very effortlessly at any scale. For many applications, rotation invariance isn't required, so no want of locating this orientation, which quickens the way. SURF offers this type of capability known as Upright-SURF or U-SURF. It improves pace and is strong as a great deal as. The surf capabilities of left and proper hand take a look at statistics is deimagested in figure 7.

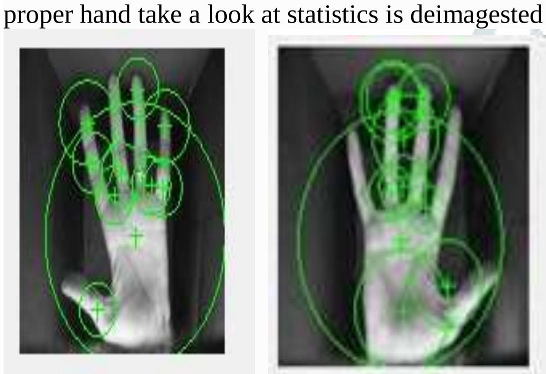

Figure 7: Extraction of Surf Features from Left and Right Hand Test Data

Convolutional neural networks are deep synthetic neural networks which might be used usually to classify image, cluster them via likeness, and carry out object recognition within scenes. They are algorithms which could apprehend faces, individuals, road signs and symptoms, tumors, platypuses and plenty of different factors of visible records. The effectiveness of convolutional nets (ConvNets or CNNs) in imagegraph detection is one of the primary reasons why the sector has woken up to the efficacy of deep learning to know. Once the network weights and biases have been initialized, the network is ready for training. The network can be trained for features approximation (nonlinear regression), pattern association, or pattern classification. The training process requires a set of examples of proper network behavior - network inputs p and target outputs t. During training the weights and biases of the network are iteratively accustomed to minimize the network performance features net through the neural network training which is represented in figure8. the network is trained up to 1000 iterations.

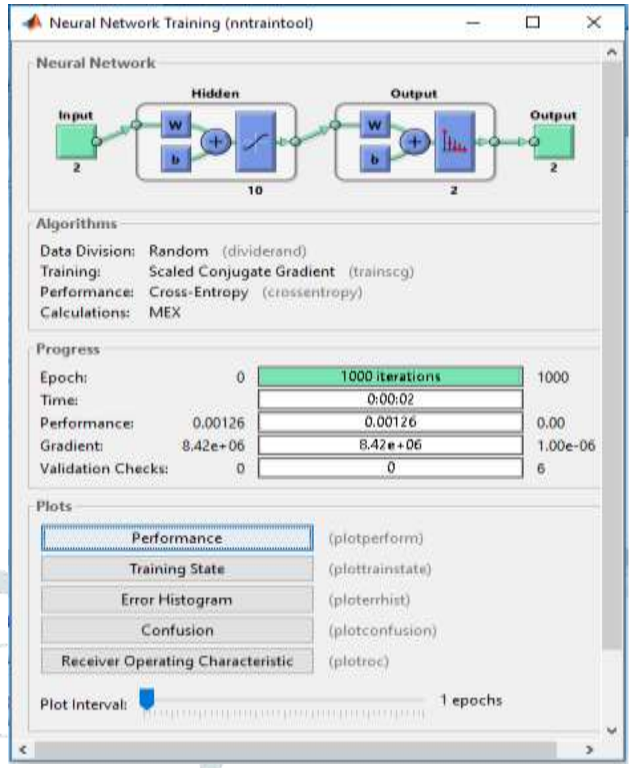

Figure 8: Neural Network Training Tool We Used

Each of the conjugate gradient algorithms used in neural network training requires a line search at each iteration. This line search is computationally expensive, since it requires that the network response to all training inputs be computed several times for each search. The scaled conjugate gradient algorithm (SCG), developed by Moller [Moll93], and was considered to avoid the time-consuming line search. This algorithm is too complex to explain in a few lines, but the basic idea is to merge the model-trust region approach, with the conjugate gradient approach.

In brief, we compute the fine available matching score among any two image pairs. This reduces the unevenness in authentic matching scores. However, it also improves the matching rankings of imposter pairs. The result of this bias toward higher fit is sincerely visible inside the outcomes. To healthy the images, we most effective focus on the overlapping parts of the 2 fingers. This is referred to as matching with overlaying, and the gap is computed because the sum of hamming distances among the binarized actual and imaginary filter out response. Matching the capabilities is represented in figure 9

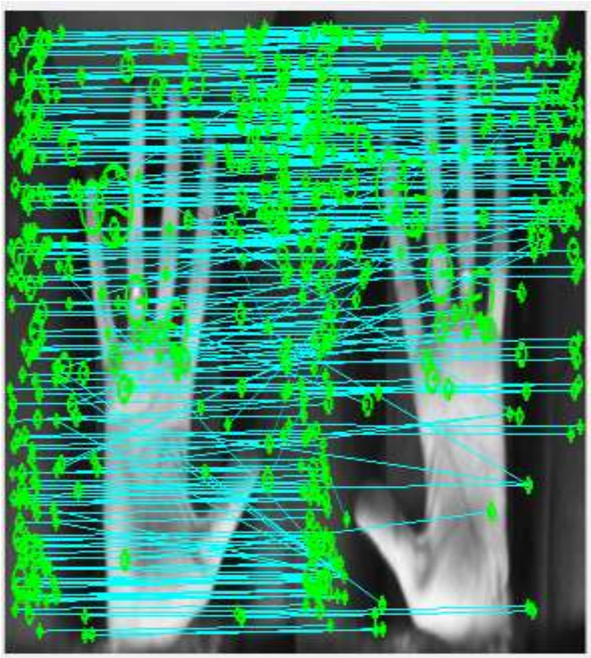

Figure 9: Representation of Matching Features

The dialog box presented in figure 10. Indicates that the images are matched. The matching is done based on a threshold value.

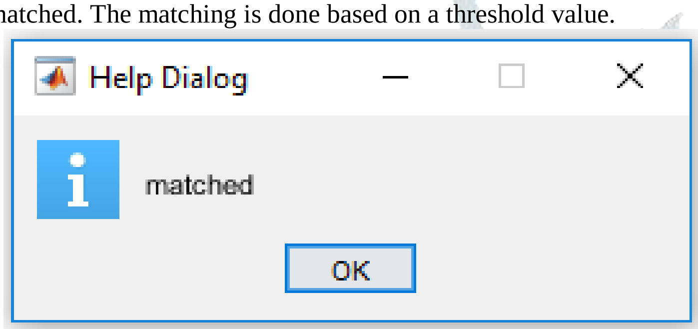

Figure 10: Representation of matching

If the measured left and right palm images are matched then result will show as left and right palm print matched otherwise it's a fake person palm print its shows as unauthorized palm print because the palm print does not match each other. Unmatched features is represented in figure 11

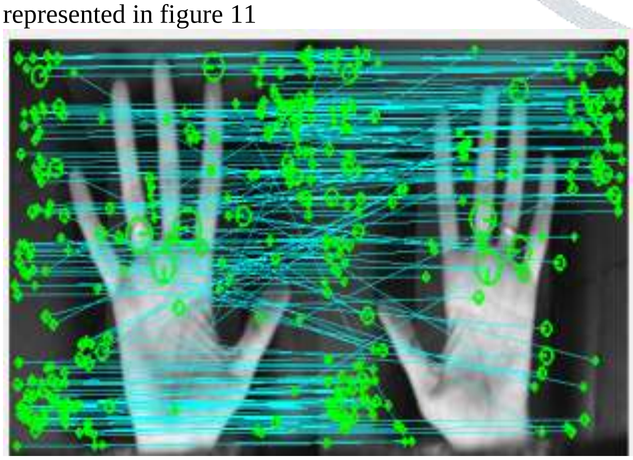

Figure 11: Representation of unmatched Features

The warning dialog box presented in figure 12 indicates that the images are not matched. By this we can come to know that the left and right palm prints does not belong to the same person.

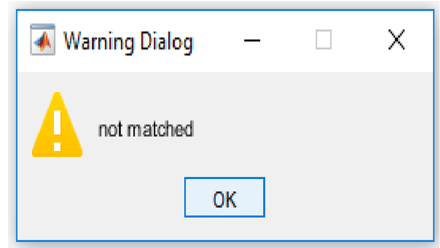

Figure 12: Representation of not matching

V. CONCLUSION

In this paper, we have proposed novel algorithms to identify individuals using palmprint that are invariant to pose, illumination and contrast changes. Palm print identification based on matching score is proposed in this paper. Proposed methodology takes account of left and right images into consideration and scoring level is calculated, based on threshold we are calculating similarity for images. A novel SURF algorithm is used for the feature extraction and then the features are reduced to fine features by using PCA and LDA approaches. Then we acquired a Deep Convolution Neural Network classifier for the classification. Here weighted fusion scheme method is proposed based on scoring level and images matched are considered based on weight fusion. Based on extensive experiments conducted on palm print database, we prove that our method yields better results compared with state-of-art scenario.

V. REFERENCES:

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