

IMPLEMENTATION OF CNN CLASSIFIER IN PERSONAL AUTHENTICATION USING FINGER KNUCKLE PATTERN

¹S. Jansi Nivetha,²B.S.Sathishkumar

¹PG Student, Department of ECE, A.V.C College of Engineering, Mannampandal

²Associate Professor, Department of ECE, A.V.C College of Engineering, Mannampandal

¹jansiswaminathan@gmail.com, ²bssathishkumar.79@gmail.com

Abstract Human hand poses anatomical features used for biometric authentication. One of the emerging biometric traits is finger knuckle pattern. Biometric feature is highly unique to each person. This paper proposes an automated biometric authentication using finger dorsal image. From the finger dorsal surface, the major and minor finger knuckle patterns are automatically extracted and segmented. Segmented images are fused and fed into classifier to classify the user convolutional neural network. CNN classifier consist of three major layers convolutional layer, pooling layer, fully- connected layer. These layers are automatically segment and enhance the features of image. Then, extract different level of features from the input. Each layer is followed one by one. Output of these layers are combined and classified. These process are simulate in Matlab platform. Finally, the fused image of knuckle pattern in single network of CNN classifier achieves high accuracy rate in automatic personal authentication.

Keywords- Finger knuckle, CNN, Biometric fusion, Major and minor knuckle pattern.

1. INTRODUCTION

Authentication is basically identification or recognition. We commonly using authentication factors are passwords or pin numbers. They may be easily stolen or forgotten. To overcome these limitations biometric is used as an authentication factor. Biometrics are related to human characteristics.

Biometrics is automated methods of recognizing a person based on physiological or behavioural characteristic. The behavioural characteristics refer to the behaviour of a person which includes rhythm, voice, gait etc and physiological characteristics refers to the feature or shape of the human body which includes finger print, iris, ear, DNA, palm print, face etc. Biometric feature of a user is so unique. Even twins cannot have same biometrics. It provides high security and safer transactions.

This paper is focusing on personal authentication using automated method for extracting major and minor finger knuckle patterns from finger dorsal image. Authentication is done using finger knuckle pattern which is the bending of finger back surface.

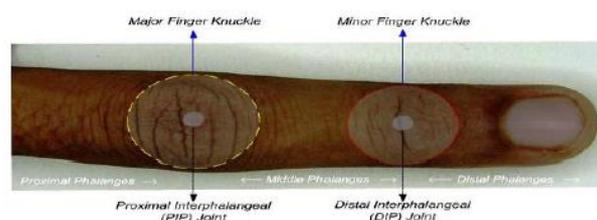


Fig 1: Finger Dorsal Image

On the back side of fingers there are three joints named as Metacarpophalangeal (MCP) joint, Proximal InterPhalangeal (PIP) joint, distal InterPhalangeal (DIP) joint. Each finger in human hand consist of three bone segments and two joints. The segments are called phalanges. From these joints the major and minor knuckle images are segmented and combined. Then, the combined images are fed into classifier to match input image with database images to provide better accurate identification.

2. RELATED WORK

In biometric authentication Knuckle images are used as biometric identifier. Input images are captured by camera. Segment the major and minor knuckle patterns for identification. Then enhance and extract the features of image to classify the user and obtains high accuracy.

Lalithamani et al. [1] proposed the biometric authentication using convolution neural network (CNN) by finger knuckle pattern to enhance the security of system. Here, the major finger knuckle is used in CNN to classify the authorized user for accurate output. Veluchamy et al.[2] described multimodal biometric recognition system using feature level fusion and K-SVM by integrating finger knuckle and finger vein. The features of both pattern are extracted using repeated line tracking method.The images are compared by K-SVM classifier and obtains 96% accuracy.

Dhanwate Hrishikesh et al. [3] developed the human identification using LBP-Haar and 1-D log gabor filter method. Both major and minor knuckle are extracted using local binary pattern (LBP), Haar and PCA. The ANN classifier is used to match the input with database to provide accurate output. Prithi shende et al. [4] proposed personal authentication by finger knuckle pattern. The knuckle features are extracted based on SIFT algorithm and compare the images by centroid values of keypoints for requires output. Only major knuckles images are used for matching.

Adithi et al.[5] developed human identification using both major and minor knuckle pattern. They input image is acquired and extract 1-D log gabor and band limited method.Then, match the scores by spatial and spectral domain by LBP pattern. Diviya et al.[6] proposed biometric fusion using finger knuckle identification. The input image is captured, segmented and enhanced. The matching is done by comparing the hamming distance method for identification.

3. PROPOSED SYSTEM

In our proposed system the combined image of major and minor finger knuckle patterns are used for biometric identification. Finger dorsal Pattern is used as a biometric tool. Knuckle recognition is done using the finger knuckle pattern. Texture pattern finger knuckle is highly unique. The knuckle patterns are unique under varying age. Each biometric identifier has interference during identification. The finger knuckle pattern has no interference compared to existing biometrics based on their parameter. The input images are captured and segmented then fed into classifier to identify the output as authorized user . The block diagram of proposed system is given below.

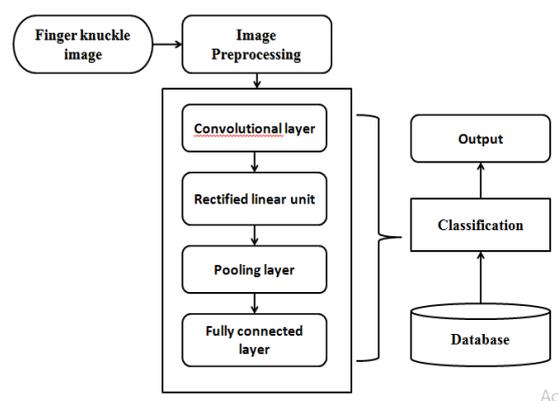


Fig 2: Block Diagram Of Proposed System

3.1 IMAGE ACQUISITION

In finger image acquisition the back surface of finger is acquired using web camera or smart phones, digital camera or sensor, etc. Acquisition system has been developed for collection of finger back images. Each of the acquired hand images are used for further processing.

3.2 Image Preprocessing

The important process such as normalization, filtering, resizing, segmentation are carried out under preprocessing. which makes the input images to increase its contrast and reduce the noise in input. In this paper the major and minor knuckle patterns from the finger back surface are automatically extracted and segmented. The required portion can be segmented and combine both knuckle patterns. Fused images are fed into CNN classifier.

Some of the finger dorsal images are shown below:



Fig 3: Input Finger Dorsal Images



Fig 4: Segmented Major Finger Knuckle Images



Fig 5: Segmented Minor Finger Knuckle Images

3.3 CNN CLASSIFIER

Convolution neural network (CNN) classifier is a deep learning network. The CNN algorithm processes both forward and backward propagation. A convolutional neural network consists of input, output and multiple

hidden layers. The hidden layers of a CNN consist of convolutional layers, RELU layer, pooling layers, fully connected layers and normalization layers.

3.3.1 CONVOLUTIONAL LAYER

The convolution operation is done in convolutional layer to the input. Output of this layer follows to next layer. This Layer includes two features namely 'Filters' and 'Strides'. It reduces noise and detect the local features of image such as curves edges etc.

3.3.2 RLEU LAYER

The rectified linear unit layer follows the output of CONV layer. This layer finds the pixel value of input. If the values are less than zero it change all negative value into zero.

3.3.3 POOLING LAYER

The pooling layer follows the output of RELU layer. It is a down sampling layer. There are three pooling operations in this layer namely max pooling, avg pooling, min pooling .But max pooling is most commonly used to contro the over fitting.

3.3.4 Fully connected layer

This layers takes the output of CONV ,RELU and POOL layer.All the output are connected to this single layer. It calculates the value from the extracted features of image .This layer used to classify the image by compute their particular weights or class and gives accurate output .

4 MATCHING AND RESULTS

Matching is done by using their featuresof fused major and minor knuckle images. The randon texture of knuckle image matched with database image using convolutional neural network based on their accuracy rate.

. Table 1: Matching accuracy of Finger Dorsal Image

Finger surface	CNN Classifier
First person	99.92%
Second person	98.96%
Third person	99.95%

5 CONCLUSION

This paper successfully investigates the use of combined major and minor finger knuckle images by convolutional neural network for biometric authentication. In CNN classifier it extracts different levels of features from the fused image and compare their values with database images . The simulatenous use of major and minor knuckle achieves high matching accuracy.

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