IMPROVED METHOD FOR GENDER CLASSIFICATION USING FINGERPRINT

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ABSTRACT

Gender classification from a fingerprint is an important step in medical studies,it reduce the effort in find out the person.In this paper we are giving the relationship between the gender and the fingerprint based on the some special features like ridge density,ridge thickness,and ridge width. We used the DWT and SVD are the two feature extraction methods. Stored these Extracting features and using the SVM classifier we are classified the Gender. Up to 98% we achieve the classification result using the SVM classifier.

Keywords: Gender Classification, Fingerprint, Descrete Wavelet Transform, Singular Value Decomposition, Support Vector Machine

I. INTRODUCTION

Gender and Age information is important to provide investigative leads for finding unknown persons. Existing methods for gender classification have limited use for crime scene investigation because they depend on the availability of teeth, bones, or other identifiable body parts having physical features that allow gender and age estimation by conventional methods. Various methodologies has been used to identify the gender using different biometrics traits such as face, gait, iris, hand shape, speech and fingerprint. In this work, gender and age of a person is identified from the fingerprint using DWT and SVD. Fingerprint has been used as a biometric for the gender and age identification because of its unique nature and do not change throughout the life of an individual .In fingerprint, the primary dermal ridges (ridge counts) are formed during the gestational weeks and the resulting fingerprint ridge configuration (fingerprint) is fixed permanently.Ridges and their patterns exhibit number of properties that reflect the biology of individuals.Fingerprints are static and its size and shape changes may vary with age but basic pattern of the fingerprint remains unchanged. Also, the variability of epidermal ridge breadth in humans is substantial . Dermatoglyphic features statistically differ between the sexes, ethnic groups and age categories. It is proved by various researchers; a fingerprint can be processed for the sex determination. Thus the variability in sex and age with size, shape and the ridge width of fingerprints helps for the study. Gender and age determination of unknown can guide investigators to the correct identity among the large number of possible matches. Figure 1 illustrates the process of DWT and SVD based gender and classification system.

II. FINGERPRINT FEATURE EXTRACTION

Feature extraction is a fundamental pre-processing step for pattern recognition and machine learning problems. In the proposed method, the energy of all DWT sub-bands and non-zero singular values obtained from the SVD of fingerprint image are used as features for the classification of gender. In this section, DWT and SVD based fingerprint feature extractions are described. DWT Based Fingerprint Feature extraction Wavelets have been used frequently in image processing and used for feature extraction, de-noising, compression,face recognition, and image super-resolution. Two dimensional DWT decomposes an image into sub-bands that are localized in frequency and orientation. The decomposition of images into different frequency ranges permits the isolation of the frequency components introduced by "intrinsic deformations" or "extrinsic factors"into certain sub-bands. This process results in isolating small changes in an image mainly in high frequency subband images.

Hence, DWT is a suitable tool to be used for designing a classification system. The 2-D wavelet decomposition of an image is results in four decomposed sub-band images referred to as low–low (LL), low–high (LH), high–low (HL), and high–high (HH).Each of these subbands represents different image properties. Typically, most of the energy in images is in the low frequencies and hence decomposition is generally repeated on the LL sub band only (dyadic decomposition).For k level DWT, there are (3*k) + 1 sub-bands available.The energy of all the sub-band coefficients is used as feature vectors individually which is called as sub-band energy vector (E). The energy of each sub-band is calculated by using the equation (1).

Ek=1/RC∑∑!x_k(I,j)! Where x_k(I,j is the pixel value of the kth sub-band and R, C is width and height of the sub-band respectively.Figure 2 shows the block diagram of the frequency feature extraction by using DWT. The input fingerprint image is first cropped and then decomposed by using the DWT. For level 1, number of subbands are 4 and 3 subbands are added for each next levels Thus the increase in levels of DWT increases the features.

III. SVD BASED FINGERPRINT FEATURE EXTRACTION

The Singular Value Decomposition (SVD) is an algebraic technique for factoring any rectangular matrix into the product of three other matrices. Mathematically and historically, it is closely related to Principal Components Analysis (PCA). In addition it provides insight into the geometric interpretation of PCA. As noted previously, the SVD has long been considered fundamental to the understanding of PCA.

The SVD is the factorization of any k X p matrix into three matrices, each of which has important properties.That is, any rectangular matrix A of k rows by p columns can be factored into U, S and V by using the equation (2).

$A=USV^T$ --------- > (2)

Where

$U=AA^T$ --------- > (3)

$V=A^TA$ --------- > (4)

And S is a k_X_p diagonal matrix with r non-zero singular values on the diagonal, where r is the rank of A. Each singular value is the square root of one of the Eigen values of both AA%and_A%A. The singular values are ordered so that the largest singular values are at the top left and the smallest singular values are at the bottom right, i.e., $s_{1,1} \geq s_{2,2} \geq s_{3,3}$) etc.

Among the three rectangular matrices, S is a diagonal matrix which contains the square root Eigen values from U or V in descending order. These values are stored in a vector called Eigen vector (V). As the internal database contains images of size 260x300 pixels, the feature vector of SVD is of the size 1x260.

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IV. FINGERPRINT GENDER CLASSIFICATION

The proposed system for gender classification is built based on the fusion of fingerprint features obtained by using DWT and SVD. This section describes two different stages named as learning stage and classification stage and the KNN classifier used for the gender classification.

4.1 Learning Stage

The feature vector V of size 1x260 obtained by SVD and the sub band energy vector E of size 1x19 obtained by DWT are fused to form the feature vector and used in the learning stage. The fusion of feature vector V and E is done by concatenation of features that are widely used for feature level fusion. The resulting feature vector is of the size 1x279 (1x260 +1x19).

V. IMPLEMENTATION

5.1 Snapshots

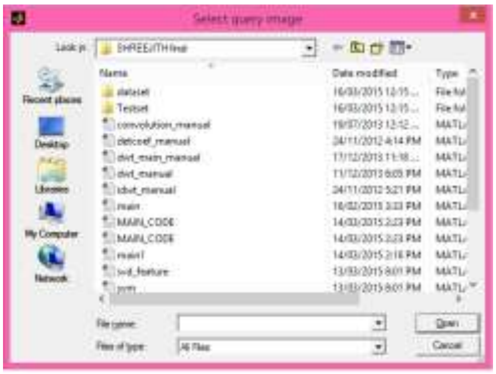

Fig. Selecting The Fingerprint To Classify

Fig Training The Data And Loading The Image

Fig. Applying DWT

Fig.Recognizing the Gender

VI. CONCLUSION

In this work, we have proposed a new method for gender classification of fingerprint images based on level 6 DWT and SVD. This method considered the frequency features of the wavelet domain and the spatial features of the singular value decomposition. The spatial features include the internal structure of the fingerprint images and the fusion of these features with the frequency features produces improved performance in gender classification.The level 6 DWT is selected as optimum level for the gender classification by analysing the results obtained for the database used for training and testing and the database used other than the training and testing. By the proposed method, the gender classification rate achieved is 91.67% for male and 84.89% for female.

For the finger-wise gender classification, the success rate is higher for the little fingers and decreases from little fingers to thumb fingers. The success rates falls at the rate of 2.56% minimum to 8.05% maximum from the finger 1 to 5 and rises at the rate of 1.32% to 8% from finger 6 to 10. Thus the result pattern shown in line diagrams formed like a valley. Similarly among the male fingers the success rate is

higher for the thumb fingers and index fingers and decreases from the thumb to little fingers. The success rates rises at the rate of 0.77% minimum to 7.8% maximum from the finger 1 to 5 and falls at the rate of 0.75% minimum to 4.38% maximum from finger 6 to 10. Thus the result patterns shown in line diagrams are slightly projected at the middle.

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BIOGRAPHICAL NOTES

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