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Palm Print Authentication using Neural Networks

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Abstract

Biometric can be a technology for verification or identification of folks by utilizing a person's physiological and behavioural traits. Several palm print representations happen to be proposed web hosting authentication, there may be little agreement which palm print representation can offer best representation for reliable authentication. In this particular paper, characterization of user's identity through the simultaneous usage of two major palm print representations is completed. This paper also investigates comparative performance between Gabor and SVD (Singular Value Decomposition) based palm print representations. A palm print recognition approach using neural net is proposed. Neural networks present you with a number of advantages, including requiring less formal statistical training, capability to implicitly detect complex nonlinear relationships between dependent and independent variables.

Keywords

SVD (Singular Value Decomposition), Gabor filter, palm print, Recognition.

Introduction

The widespread penetration of info technology into our daily lives has triggered the true requirement of reliable and simple to use mechanism to authenticate individuals. Personal authentication using palm print has emerged as a promising component of biometric study. While palm print based authentication approaches have demonstrated promising results, efforts are still needed to achieve higher performance for his or her used in high security applications. One of the possible approaches to achieve higher performance would be to integrate palm print for some other biometrics (multimodal systems) or combine various classifiers (intermodal systems) that have shown promising ends in palm print authentication. Secondly, this paper provides comparative performance between Gabor and SVD based palm print authentication approaches. Palm print contains mainly three sorts of information, i.e., texture information, line information, and search based information.

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Palm print authentication has several other advantages:

1. Low resolution imagery
2. Low intrusiveness
3. Stable features
4. High acceptance ratio
5. Low detail loss

Feature extraction can be done by different techniques i.e. either by using different feature extraction functions (Gabor function) or by SVD extraction technique. Each technique has its own advantages. The only concern is to minimize the data loss. The more the data loss, lesser is the chance of getting a match.

Literature Review

Personal authentication using palm print images has brought considerable attention in the last years and numerous approaches happen to be proposed inside literature. The accessible approaches for palm print authentication is usually split into three categories mainly on the foundation of extracted features; (I) texture-based approaches (ii) line-based approaches, and (iii) appearance-based approaches. Next Section describes the block diagram from the proposed system. It also details feature extraction methods doing work in the experiments. Palm prints are believed to hold the critical properties of universality, uniqueness, permanence and collect ability form of hosting authentication. Palms are large in size and contains abundant feature of numerous levels, for instance creases, palm lines, texture, ridges, delta points and minutiae.

There are many distinguishing traits used by personal identification, this research will give attention to using palm prints to more correctly and efficiently identify different personnel through classification in affordable costing.

Proposed Work

An alternative approach to palm print authentication by singular value detection (SVD) has been proposed. The hand image from every user is acquired from the scanner or charge coupled device (CCD). Each of these images is further used to extract texture-, line- and appearance-based features using SVD. These features are matched with respective template features stored during the training stage. Neural Network are used as classifiers, which is used to generate a class label, i.e., genuine or not genuine, for each of the user.

The features are further extracted by using the Gabor filter. Then both the results are matched and after further investigation the better method for palm print authentication is found. In Gabor filter images can be taken by using the digital camera.

Matching Criterion

Two matching criterions are to be used in the proposed paper, one by using SVD technique and other by using Gabor filter technique. Both have different ways of feature extraction.

Singular Value Detection Method

When an image is SVD transformed, it is not compressed, but the data take a form in which the first singular value has a great amount of the image information. With this, only a few singular values to represent the image with little differences from the original can be used.

The detailed procedure can be understood by the following block diagram, neural is used for pattern recognition in this procedure.

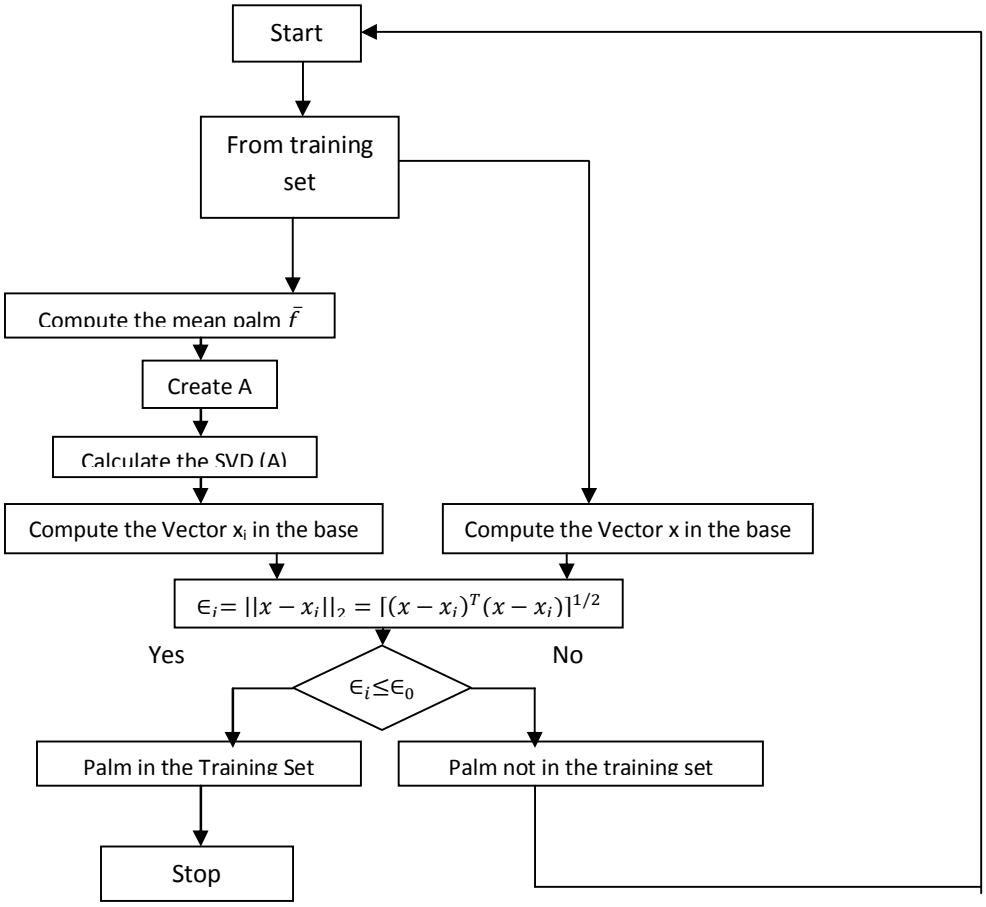

Figure 1: Flow chart for SVD technique

Gabor Filter Method

The texture features extracted using Gabor filters have been successfully employed in fingerprint classification, handwriting recognition and recently in Palm print verification. In spatial domain, an even-symmetric Gabor filter is a Gaussian function modulated by an oriented cosine function. The impulse response of even-symmetric Gabor filter in 2-D plane is following

$$h(x', y') = \exp\left[-\frac{1}{2}\left(\frac{x^2}{\sigma_x^2} + \frac{y^2}{\sigma_y^2}\right)\right]\cos(2\pi u_0 x),$$

Where x=$x\sin x + y\sin y$, y= $x\cos y - y\sin x$, In order to select Gabor filters for band pass filtering , three parameters have to be determined; frequency, orientation, and space constants X and Y. The values in the interval [0°, 180°] are considered, since other values are redundant due to symmetry.

$$I'_{\varphi}(i, j) = h_{\varphi}(i, j) * I'(i, j),$$
$$= \sum_{k=1}^{W}\sum_{l=1}^{W} h_{\varphi}(k, l) I'(i-k, j-l),$$

Where '$*$' denotes discrete convolution and the Gabor filter mask is of size W × W. Thus every palm print image is filtered with a bank of six Gabor filters to generate six filtered images. Each of the filtered images accentuates the prominent palm print lines and creases in corresponding direction i.e., while attenuating background noise and structures in other directions. The components of palm print creases and lines in six different directions are captured by each of these filters. Each of these images are filtered and divided into several overlapping blocks of same size. The feature vector from each of the six filtered images is formed by computing the standard deviation in each of these overlapping blocks. This feature vector is used to uniquely represent the palm- print image and evaluate the performance.

Results

Correlation graph using SVD technique is calculated below.

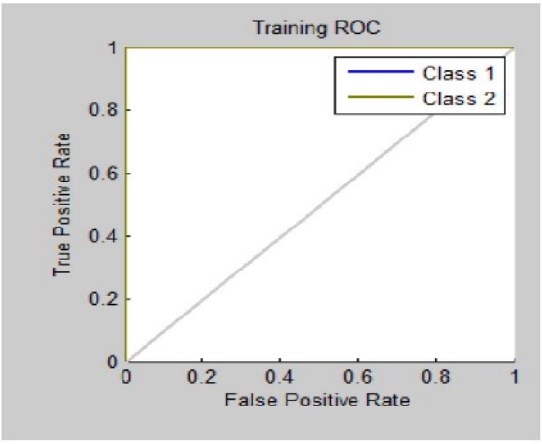

Figure 2: Correlation graph using SVD technique.

The above diagram shows that 99% correlation exists between actual and desired output. ROC stands for receiver operating characteristic.

Comparison of Receiver Characteristic of Gabor Filter and SVD Technique

The classification of extracted feature vectors using each of three methods is achieved by nearest neighbor (NN) classifier. The NN classifier is a simple classifier which computes the minimum distance between the feature vectors of unknown samples.

On the basis of comparing the values of true positive rate and false positive rate, we find the graph between true positive rate and false positive rate, which is given in the next page.

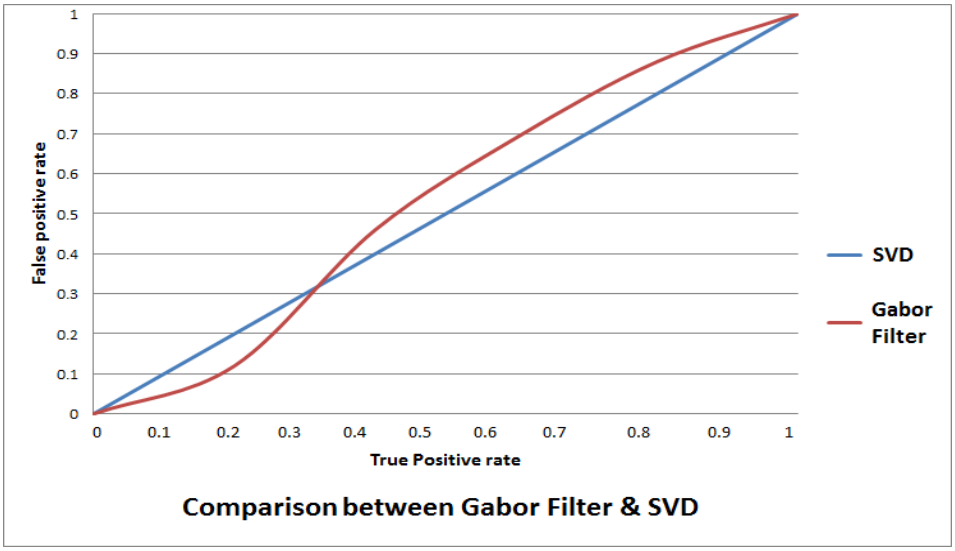

Figure 3: SVD Vs Gabor Filter.

After seeing the graph of comparative characteristic of SVD and Gabor filter, it is found that the graph of SVD is almost linear with respect to Gabor filter, which shows a better and stable characteristic for SVD. It increases the recognition rate.

Conclusion

After completion of this study, the first conclusion is that for extraction of features, SVD is one of the best approaches in terms of dimensionality reduction as well as in terms of stability of system. SVD is a stable and effective method for splitting the system into a set of linearly independent components, each of them is carrying own data (information) to contribute to the system of user. SVD is providing a good compression ratio, and that can be well adapted to the statistical variation of the image. SVD is a good technique for feature extraction as it removes the limitation of input image being square matrix. Neural networks are used as pattern classifiers.

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