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Offline Signature Verification using Local Binary Pattern

Prakash Patki[1], Nandini Dhole[2]
PG Scholar, Dept. of Electronics and Telecommunication, RMD Sinhgad School of Engineering,Pune, India[1]
Professor, Dept. of Electronics and Telecommunication, RMD Sinhgad School of Engineering,Pune, India[2]

ABSTRACT— Several papers have appeared in literatures which propose features for offline signature verification. In this paper local binary pattern of signature is used as one of the feature for verification purpose. The histograms of original signature and forgery signature are calculated and chi-square distance of them is used as input to the classifier. Before classification signature image goes throw several steps as pre-processing, feature extraction and classification. Pre-processing includes thresholding, skeletonization and binarization in this paper Otsu thresholding is used and skeletonization of the thresholded image is used for feature calculation. The local binary pattern (LBP) of an image is calculated then histogram of the LBP

KEYWORDS— Biometrics, Local binary pattern, offline signature verification, histogram, chi-square distance.

I. INTRODUCTION

Now a day biometric play very important role in daily life of a person. Biometric is used for person verification. There are different types of biometric physiological and behavioral. Physiological includes fingerprints, iris, face and hand, while behavioral include voice and hand written signature.

Hand written signature is behavioral so it can change according to the behavior of the person and cannot be stolen. The Physiological biometric can be stolen by drugging the person or the tokens, keys can be forgotten, so hand written signature is most widely accepted biological trait.

A wide set of biometrics is considered so far, it is important to know that no trait is able to satisfy all the characteristics essential for a biometric system[1].Thus, the biometric traits are application dependent because they involve technical, social as well as cultural aspects.

There are two main approach for offline signature verification, static and pseudo dynamic approach. The static approach measures the static parameters like length, width, height while pseudo dynamic approach measures dynamic information from static image [2].

Different methods are used to extract dynamic information from static handwriting records. Microscopic inspection of hand written text is used in forensic document examination and assumptions [4]. Another paper from the same author [3] gives information on ink traces for signature verification.

Lv *et al.* [5] divide the gray level values of signature image into 12 segments to segment the foreground and edge points. The number of pixels in each segment is added to the feature vector which also contains a stroke width distribution. Franke in [4] and [3] study ink- trace characteristics affected by the dealings of biomechanical writing and physical ink-deposition processes. The selected characteristic is measured using texture features such as local binary pattern which has already been applied in face and hand biometrics [6], [7].

In preprocessing phase technique used are thresholding, skeletonization, binarization, size normalization, noise removal. Preprocessing is main challenge while verifying the signature from bank checks, because it contains

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the color pictorial background so development of signature verification systems with the accuracy required of banks and other financial institutions is an area of continued research [2].

The microscopic inspection of available written traces is done in forensics which needs high accuracy biometric systems are costly and also difficult to design. As the accuracy increases the cost of the system also increases so depending on the application the biometric system must be designed.

In this paper local binary pattern of signature image is used to classify the signature, chi-square distance of genuine and forgery are compared using different classifiers and the results are evaluated. The section II consists of perprocessing of the signature image. Section III consists of feature extraction, section IV comprises of classifiers used for classification and section V consists of the results.

II. PREPROCESSING

A. *otsu Thresholding*

Thresholding is done to differentiate the image from background to eliminate gray level distortion. This is done by selecting adequate threshold value, so that image can be extracted from background. In this algorithm the threshold value is obtained by considering two groups of pixels foreground and background and threshold value is calculated such that their inter class variance is maximum.

Where σ_{ω}^2 is variance, $\omega_{0,1}$ are probabilities separated by threshold t in equation (1).

$$\sigma_{\omega}^2(t) = \omega_0(t)\sigma_0^2(t) + \omega_1(t)\sigma_1^2(t) \qquad (1)$$

B. *Skeletanization*

Skeletonization is the process of reducing the original image to its subset and this subset can be used to reconstruct the original image. This is one of the thinning algorithms, while implementing thinning algorithm it takes care that joints are preserved.

C. *Binarization*

After thresholding and thinning the image is binarized and pixels are changed to black and white pixels. Thus now the image contains only black and the gray scale pixels are also converted into black pixels.

III. FEATURE EXTRACTION

A. *Local BinaryPattern*

It is one of the very robust features of an image. This feature compares the pixel intensity with respect to its neighbor pixels. The Local Binary Pattern (LBP) of a pixel is calculated using equation (2) of the image. Here we consider LBP of 3X3 block of pixels.

$$LBP(Z_c) = \sum_{p=0}^{7} (I(Z_p) - I(Z_c)) * 2^p \qquad (2)$$

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B. Histogram similarity measurement

Histogram is a graph which represents number of pixels of same intensity in an image whereas bins represent intensity of pixels. Equation (3) below represent the chi-square distance formula.

$$\chi^2 = \sum_{i=1}^{B} \frac{(H_i - S_i)^2}{(H_i + S_i)} \qquad (3)$$

H and S are the two histograms whose difference is calculated and i represent number of samples of the signature. Instead of giving two histograms to classifier, the difference of two histogram is given to classifier which will improve the performance of the classifier.

IV. CLASSIFIER

The classifier is used to classify the signature image is genuine or forgery. The nearest neighbor classifier uses the previously calculated measure X^2 to classify the signature. We have also used a support vector machine as a classifier which perform implicit mapping into a higher dimensional feature space. When mapping is completed support vector machine finds a linear separating it is a margine to separate two classes in higher dimensional space. The support vector machine uses Gaussian kernel function to classify the signature whether it is genuine or forgery.

V. RESULTS

The result here obtained is whether the questioned signature is authentic signature or forgery this classification is done by the classifier. There are some errors while classifying the signature like false acceptance and false rejection. The table (1) below shows accuracy of KNN and SVM classifier.

TABLE 1 ACCURACY AND FAR VALUE OF CLASSIFIERS

Classifier	*Accuracy*	*FAR*
KNN	95.9293%	0.0407
SVM	94.8788%	0.0512

REFERENCES

[1] **A. K. Jain, L. Hong, and S. Pankanti, "Biometric identification," Commun. ACM, vol.43, no.2, pp.91–98, Feb.2000**

[2] **Miguel A. Ferrer, J. Francisco Vargas, Aythami Morales, and Aaron Ordonez "robustness of offline signature verification based on gray level features", IEEE Transactions on Information Forensics and Security, Vol.7, No.3, June2012.**

[3] **K. Franke, O. Bunnemeyer, T. Sy, Ink texture analysis foe writer identification in IWFHR '02: processes of Eighth International workshop on frontiers in handwriting recognition (IWFHR'02), IEEE Computer society, Washington, DC, USA, 2002, PP.268-273.**

[4] **K. Franke, s. Rose, Ink-deposition model: the relation of writing & ink deposition processes, in IWFHR '04: proceeding the ninth International workshop on Frontiers in Handwriting Recognition, IEEE computer society, Washington, DC, USA, 2004, PP.173-178.**

[5] **H. Lv, W. Wang, C. Wang, and Q. Zhuo, "Off-line Chinese signature verification based on support vector machine," Pattern Recognition Lett., vol. 26, pp. 2390–2399, 2005.**

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Volume 2, Issue 7, July 2016

[6] **T. Maenpand, M. Pietikainen, C. H. Chenand, P. S. P. Wang, Eds., "Handbook of pattern recognition and computer vision," in Texture Analysis With Local Binary Patterns, 3rd ed. Singapore: World Scientific, 2005, pp. 197–216.**

[7] T. Ahonen, A. Hadid, and M. Pietikainen, "Face description with local binary patterns: Application to face recognition," IEEE Trans. Pattern Anal.MachineIntell., vol.28, no.12, pp.2037–2041, Dec.2006.

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