

A Survey of Offline Handwriting Signature Recognition

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Abstract—Signature is a handwritten representation of someone's name, nickname or a mark that a person writes on a document as a proof of identity. Handwritten signature finds its application in many fields. The area of handwritten signature recognition has been explored extensively in the last decade. Signature recognition can be classified into two methods: online and offline. This paper shows the survey of two main feature extraction and verification techniques on offline handwritten signature recognition

Keywords— *image preprocessing; feature extraction; support vector machine; back propagation and signature verification*

I. INTRODUCTION

Signature is a handwritten document that an individual use for various purposes. In other words signature is a unique style of an individual to write his name for authentication purposes. Handwritten signature is a biometric measure. Biometric refers to the detailed information about someone's body such as pattern of color in the eyes, handwritten recognition and many more. Signature verification is a very important process as it verifies whether it is the actual signature of the owner or it has been manufactured. It plays an important role in banks, insurance claimers, document verification, employee verification, identity verification education verification and many more.

Firstly image is preprocessed and then the features are extracted using feature extraction techniques. The signature recognition can be done by support vector machine and back propagation neural network. These are the traditional techniques and very efficient. The support vector machine is capable of providing high accuracy. Back propagation neural network [1] is often used for signature recognition as it is easy

and maintains the efficiency. However traditional back propagation suffers from some drawbacks such as slow

learning rate and the solution may get stuck at local minima [2]. On the basis of data, signature verification can be classified into two categories:

Offline signature verification: It is actually performed offline. Signatures of different people are obtained on a piece of paper and it is scanned for verification purposes. Earlier Edson et al. proposed off line signature verification system using Hidden Markov Model [3].

Online signature verification: It is simply an online process. It recognizes signature through digitized tablet on which the person give his/her signature. The signature is then characterized by x-y coordinates and at last it is verified using a method called Support Vector Machine [4].

II. METHODOLOGIES

A. Data Acquisition and Image Processing

Signatures are taken from different people and then it is scanned to change it into a file which can be accessed by computers. Signatures were taken on a white piece of paper using black pen [5].

Image processing: It is mainly the lowest level of abstraction. It improves the image quality. Here it improves the quality of the signature file by suppressing all unwanted distortion. It is the primary and important task.

Different types of image processing techniques[6]:

- *Use RGB to GRAY Scale conversion*-This is done to improve the quality of signature image and eliminate noise. This is the preliminary step before feature extraction.
- *Noise reduction*-It actually removes noise from the image. In other words it can be also called smoothing.

As many times the image is disrupted by illumination and many other environmental factors.

- *Binarization*-It is the process in which the image is stored in the form of pixels.
- *Thinning*-It is a morphological operation. Here the signature is thinned which means that only the outline of the signature is taken and the rest is removed from the binary image. In other words it produces another binary image as output.
- *Bounding box*-It is the coordinates that fully encloses the digital image. Here the bounding box is used to bound the thinned signature image and makes it easy for feature extraction.

III. FEATURE EXTRACTION TECHNIQUES

Before you begin to format your paper, first write and save the content as a Feature extraction is a process in which features are extracted in order to differentiate between images. In other words feature extraction is the transformation of data into set of features. Here the signatures are extracted from the image file and it is recognized.

Fusion of grid and global features [7]:

- *Grid feature*: Firstly the image file is divided into 120 segments and then from each segment area is calculated. The results we get are Normalized like the region with less number of black pixels are considered as 0 and the region with more number of black pixels are considered as 1. From each block three components are extracted: Horizontal component. Vertical component. Diagonal component. So it is preferred to extract diagonally as it gives more accurate results
- *Global feature*: This are extracted from the whole image file which contains the handwritten signature. But it has been found that features can be globally extracted to make the recognition of handwritten signature easy. Hence, it extracts only the signature from the image file and removes all the blank spaces.

There are some common global features [8]:

- *Aspect ratio*: It is the ratio between signature pure heights to signature pure width.
- *Signature Height*: The height of signature image, after width normalization.
- *Image Area*: The number of black pixels in the image .In skeletonized signature images; image area represents a measure of density of the signature traces.
- *Pure Width*: It is the width of the image with horizontal blank spaces removed.
- *Pure height*: It is the height of the image with vertical blank space removed.

Therefore fusion of grid and global features are done to generate suitable features for verification.

IV. SIGNATURE VERIFICATION TECHNIQUES

There is several signature verification techniques described in different literatures.

A. Support Vector Machine

SVM is a machine learning technique which is used for pattern recognition and regression problem. It is very efficient as they provide good results for both online and offline signature recognition. They are time invariant so they can be applied to datasets containing feature vectors of fixed length.[9].In this paper the support vectors are classified using SVM and then it is sent back to the image pre-processing module[10] .

B. Back Propagation Neural Network

The extracted features are presented in back propagation neural network(BPNN) which recognizes different types of signature images. It is basically a supervised learning [11] in which the output of the network is compared with the expected target to obtain the error. Then the error is propagated back to repair the networks weights in order to minimizes the error. It mainly consists of three layers

- The subscript for the Input layer-which is the input of the image file.
- Hidden layer-which is mainly the activation layer. It mainly shows the relationship between the input and the output layer. The number of hidden layer effects the accuracy level[12].
- The output layer-which releases the output signal to output side.

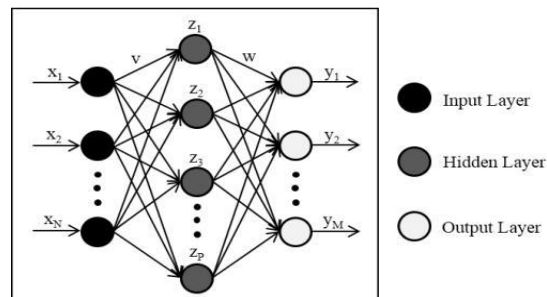


Fig. 1. Back Propagation Neural Network

V. CONCLUSION

Many researchers have been done in this field. Signature recognition is a very attractive field. Fusion of grid and global feature extraction and then training with support vector machine and BPNN gives more positive and highly accurate results but still there has been no record showing 100% accurate results. However the accuracy has been found to be

94.3% [13]. There are many feature detection methods and suitable training techniques which can improve in the future work and hence can increase the accuracy percentage.

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