Handwritten Signature Verification using Instance Based Learning

Priya Metri , Ashwinder Kaur

Department of Computer Engineering

MIT COE , Pune

Abstract

For authentication and authorization in legal matter humans are recognized by their Signature. Every human being has their own writing style and hence their signature is used in the financial domain for identity verification. So it is necessary to develop a technique which is efficient in verifying the Handwritten Signature is correct or forge . This paper presents a technique of Handwritten Signature Verification based on Correlation between Handwritten Signature images using feature extracted from it. In this paper we have proposed a method to extract features from scanned image of signatures store it in database. We correlate features of all sample signatures for each person . Then we have to find a mean value from the correlation value of one person signature then compute deviation from it which is used for verification.

Keywords

Instance-Based Learning Algorithms, Correlation, Normalization, Signature verification, Feature extraction, Vertical Projection , Horizontal Projection , Diagonal Projection.

I. INTRODUCTION

Biometrics can be categorized as behavioral and physiological. Handwritten signature belongs to behavioral biometric. In most of the places the verification is done manually either by a person who is familiar to the signature or by matching it against a few signature templates handwritten signature verification can be classified into offline signature recognition system and online signature recognition system. Between the two, online signature recognition systems are more reliable because of its higher efficiency in terms of accuracy and time than offline . However, offline signature recognition systems cannot be ignored, since its applicability and ease of use are more in comparison to online signature recognition systems in many parts of the world .

There are many approaches discussed earlier . Our approach contain five major phases for verifying a signature .These are Data gathering, Preprocessing, Training, and Testing. Data gathering is nothing but collecting sample signature of each person. For this we take a sample of 10 signatures of one person on a paper . These scanned images are then preprocessed . Preprocessing is required for making signature image compatible with the requirement of our approch.Feature extraction is a phase in which we extract various features from signature like its projection ,local point density ,spatial frequency distribution etc. Training is a phase in which we will find correlation between the features of signature then we find the mean and deviation from correlation values and save them in database. Testing is done to test the input image is correct or forge .

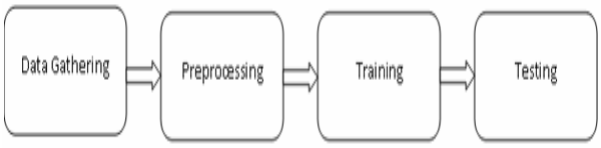

Figure 1. Block diagram of handwritten signature verification system

II.INSTANCE-BASED LEARNING ALGORITHMS

Instance-based learning or **memory-based learning** is a family of learning algorithms that,

instead of performing explicit generalization, compare new problem instances with instances seen in training, which have been stored in memory.

One advantage that instance-based learning has over other methods of machine learning is its ability to adapt its model to previously unseen data. Where other methods generally require the entire set of training data to be re-examined when one instance is changed, instance-based learners may simply store a new instance or throw an old instance away.

III. METHODOLOGY

The algorithm used for the implementation of offline signature verification systems consist of five major modules

A. Data gathering

Basically in this phase we collect the 10 scanned images of signature of one person .These images are stored in a database which we are going to use in training of our software, but not for actual matching. In our proposed work we have to use an interface with scanner for getting an image and storing it in desired database. Here we have used twain interface for this purpose.

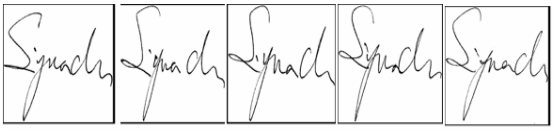

Figure2. Database of Signature

The above figure shows a sample signature database for a person .

B. Preprocessing

Preprocessing is again have following steps as mentioned in figure

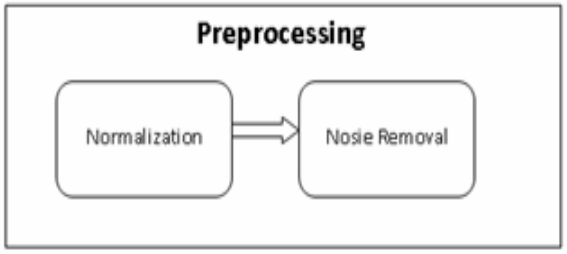

Figure 3. Preprocessing

1) Normalization to gray scale values

Normalization is a process that changes the range of pixel intensity values . Normalization is sometimes called contrast stretching. Image contains gray scale values for each pixel . There is a variance in lightness and brightness of pixel value may causes difficulty in finding difference in image and background. So we need to normalize our image to differtiate it from background. In our approach we check each pixel value in image and replace it with a threshold value which we set for that particular range . The method used is given below

For each pixel value

If pixel value is near to 0 or in between 0 to 80 then assign 0 value to it

If pixel value is near to 255 or in between 81 to 255 then assign 255 to it.

2) Noise Removal

Image noise appears as random extraneous pixels that aren't part of the image detail. Image noise can appear in two forms: luminance (grayscale) noise, which makes an image look grainy or patchy, and color noise, which is usually visible as colored artifacts in the image. Scanned images may have image noise caused by the scanning sensor. Often, the film's grain pattern appears in the scanned image. Most scanned images contain noise in form of darker dots and disturbances caused by the scanning process. If these are not removed before the feature extraction and classification, the image may mistakenly be interpreted wrong. As we use a scanner for collecting images, noise is present in the images .We have keep our background in contrast with the image for getting the correct image of signature .

3) Normalization with respect to height and width

As we store scanned signature in our database, normalization of these images with respect to their height and width is necessary because we store our image with fixed height and width. So we decide some fix height and width of our database images by stretching or cropping respectively

C. Training

Training contains different module or processes to which all images of our signature are given as input to get desired training data. Below we have explained all the modules proposed in training phase.

1)Feature Extraction:

In this module we extract various features from our signature such as Feature Vector, Projection, Localization of Point Density, and Spatial Frequency Distribution.

2) Feature vector

A **feature vector** is an n-dimensional vector of numerical features that represent some object. When representing images, the feature values correspond to the pixels of an image.

3) Projection

We use different projection of a signature such as Vertical Projection, Horizontal Projection, and Diagonal Projection. Sum of pixels in each row of an image is called the vertical projection. And sum of pixel value in each column of an image is called Horizontal Projection. Formula for calculating these values is given below

$$\text{Projection(Horizontal)} = \sum_{j} X(i,j)$$

$$\text{Projection(Vertical)} = \sum_{i} X(i,j)$$

Where i and j are coordinates in image for X-axis (row) and Y-axis(column) respectively.

4)Correlation

In this module we correlate all the features of an image which we have extracted in feature extraction phase. The concept of Correlation is used to compare the genuine signature with the test signature. If the value of Correlation Coefficient is greater than the predefined, the test signature is verified to be that of the claimed subject else detected as a forgery

5)Calculate Mean and deviation

We calculate mean and deviation value for each person using the correlation values of his signature present in our database store these values in database for testing the signatures.

D. Testing

This is the last module which is used for verifying an input signature . In this module we accept a new signature then extract its features find it correlation, mean and deviation values . Then we compare it with the values present in our database for that person .

IV.CONCLUSION

In this paper we discussed method for verifying off-line handwritten signature. Here we have used an Instance Based Learning algorithm. We have proposed this method which has an advantage of small database storage. We have proposed different phases through which we are able to identify the forgery in handwritten signature.

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