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Handwritten Signature Recognition System Using Euler Number

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Abstract : This paper reports the design, implementation, and evaluation of a research work for developing an digital handwritten signature identification system using binary image analysis. The developed signature identification system mainly used binary image analysis provided by MATLAB environment. In order to train and test the developed signature identification system, an in-house hand signatures database is created, which contains hand signatures of 5 persons (2 males and 3 females) each of
which is repeated 10 times. Therefore, a total of 50 hand signatures are collected. The collected hand signatures have gone
through pre-processing steps such as producing a digitized version of the signatures using a scanner, converting input
images type to a standard binary images type, cropping, normalizing images size, and reshaping in order to produce a ready-to-use hand signatures database for training and testing the signature identification system. Feature such as EULER NUMBER is
then selected to be used in the system, which reflects information about the structure of the hand signature image. Overall, the handwritten signatures based system obtained an average recognition rate of 80% for all persons.

Keywords : Signature Recognition, Binary image analysis, Euler Number

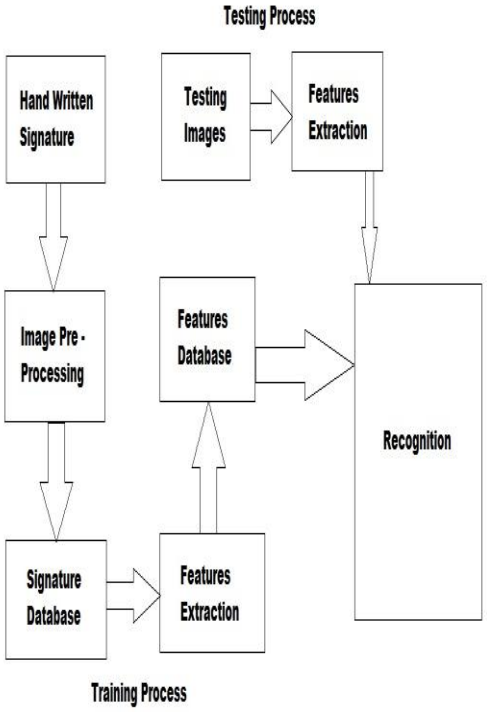
1. Introduction

Handwritten signature is one of the most widely accepted personal attributes for identity verification. As a symbol of consent and authorization, especially in the
prevalence of credit cards and bank cheques, handwritten signature has long been the target of fraudulence. Therefore, with the growing demand for processing of individual identification faster and more
accurately, the design of an automatic signature verification system faces a real challenge. Recognition can be
performed either Offline or Online based on the application. Online systems use dynamic information of a signature captured at the time the signature is made.
Offline systems work on the scanned image of a signature. In this paper we present a method for Offline recognition and

verification signatures using analysis of that collected binary image.

2. System Design & Architecture

The architecture of the handwritten signature identification system using handwritten signatures is divided into two main phases. During the first phase, all training steps are performed, whereas during the second phase of the system's architecture all testing/matching steps are performed.
Following figure shows the main architecture of the system.
In order to use the system, hand
signature images database must be collected. Details on the hand signature images database are discussed in the next
section.



Architecture of the System

3. Database

In order to develop the handwritten signatures-based automatic signature identification system, a handwritten signature database is required. An in-house handwritten signature database is collected, which contains images of 5 persons (2 males and 3 females). Each person was asked to sign on a white sheet that contains a table with 10 cells for 5 times. It is important to highlight that all participants used a black colored (same) pen to sign on the white sheet. Therefore, the total number of handwritten signature images in this handwritten signature database is 50.

These 50 images are distributed into training and testing data sets, whereby the training data set contains 5 repetitions

per person, whereas the testing data set contains the remaining 5 repetitions per person. Therefore, a total of 25 images are

used to train the handwritten signature-based system, whereas a total of 25 images are used to test the system.

Once all persons finished signing on the white paper, the paper is scanned using the

scanner in order to produce a digitized version of the hand signatures.

Each cell is cropped and saved into a separate (.jpg) file and then converted to a binary image using MATLAB command.

Signature sample before processing

Binary form of that signature

4. System Development

The training set has 5 classes each having 5 sample signatures. Euler number of those 5 binary images are computed and thereafter average of 5 values is computed. It would work as the feature vector of that class. All the 5 vectors are stored in a array(Features Database).

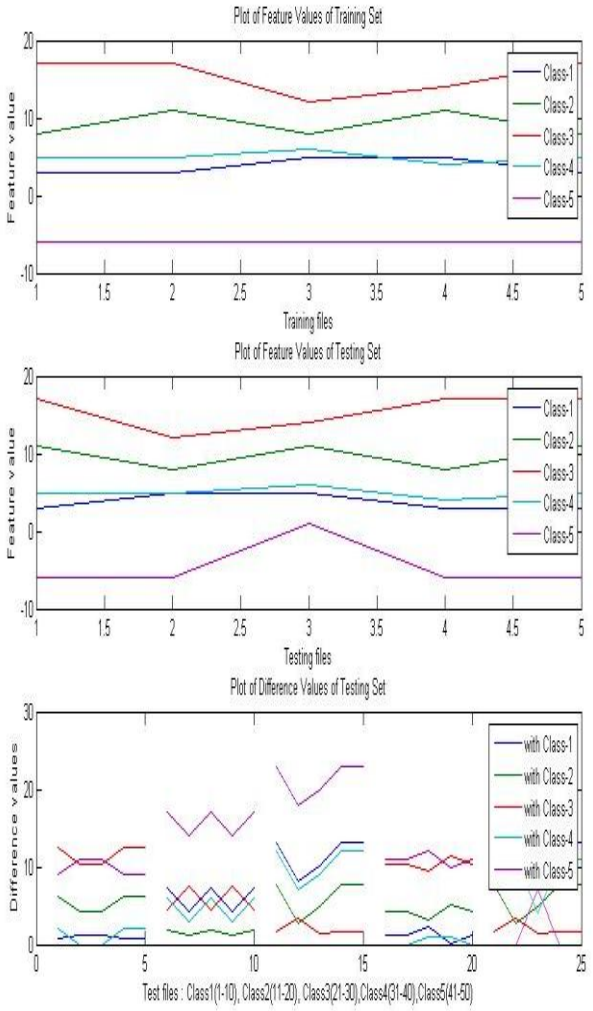
Same process is repeated at the time of testing. Instead of computing their average, each testing value is compared with the mean value of each class in training set.

Hence the accuracy is computed on correct recognition.

5. EXPERIMENTAL RESULTS AND DISCUSSION

The experimental work in this research is evaluated based on the number of correctly identified handwritten signature images. This number is then divided by the total number(number of class) of the testing handwritten signature images, and then multiplied by 100 in order to get the percentage of the accuracy.

Number of class = 5
Number of samples in training set = 5
Number of samples in testing set = 5
Combined accuracy = 80%
Plot :



6. Conclusion & Future Work

In this study, we presented an off-line signature recognition and verification system which is based on extract some signature image feature. In the future, this work can be expanded more as new features can be included to recognize image. And also it will the duty of expander to maintain the accuracy even if new features are included.
This algorithm is tested on the dataset where the train and test data are slightly
changed. This algorithm can be extended on the dataset where the train and test data
are vastly changed, not only in expression but also in illumination.

7. References

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