Offline Signature Verification Using Self Organizing Map

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Abstract— For identify and verify individual's handwritten signature the signature verification system is used. One of the most widely accepted personal aspects for identity proof is handwritten signature. Signature verification provides agreement in financial and business transaction. Signature verification finds its application in the field of net banking, passport verification system, provides authentication to a candidates in public examination from their signatures, credit cards, bank cheques. Therefore it has long been the target of duplicity. Therefore, with the rising demand for processing of individual identification faster and more correctly, the design of an automatic signature system is necessary.

Key words: Handwritten Signature, Business Transaction, Net Banking.

I. Introduction

A handwritten signature can be defined as the scripted name or legal mark of an individual, executed by hand for the purpose of authenticating writing in a permanent form. The acts of signing with a writing or marking instrument such as a pen or stylus is sealed on the paper. The scripted name or legal mark, while conventionally applied on paper, may also be accomplished using other devices that capture the signature process in digital format.

It is an automated method of verifying a signature with the actual authorized signature by capturing some of its unique features like, the shape of signature (i.e., static or off-line signature verification) or the parameters that can capture the unique features of how the authenticator signs his/her name in real-time (i.e., dynamic or on-line signature verification). In this paragraph, the basic structure of the proposed model is explained. In this work, off-line/static signature Verification is implemented by acquiring the digitized static image of a signature as the input to the verification system. For such applications, acquisition devices can be a camera or an optical scanner that captures static features like x-y coordinates of the signature.

The acquired raw data are pre-processed using image processing for obtaining relevant information. Further, some statistical unique features are extracted from the pre-processed data. This process is called feature extraction. Ideally, the feature extraction process creates a reference vector containing the selected parameters of the signature and a feature vector from the test signature. Finally, similarity of both vectors is determined by the matching process. This process is performed using a Single-Layered Neural Network model. The result of the matching process is threshold by an appropriate threshold of rejection versus acceptance to produce the final decision. Simulations are performed using different statistical, image processing and neural network toolkits that are readily available in the MATLAB [1].

A. Identification

Identification can be done using a person's identity based only on biometric measurements. The comparator matches the obtained biometric with the ones enrolled in the database using a 1: N matching algorithm for identification.

B. Verification

Verification involves the process of confirming or denying a person's claimed identity. When the user claims to be is already enrolled in the system (presents an ID card or login name). The biometric data obtained from the user is compared to the user's data already stored in the database [1].

C. Types of Signature verification

Signature verification classified into two categories that is:

(1) Off-line Signature Verification: Signature verification is performed off-line. Signature system acquiring data from scanned the signature. This signature image will be used for signature verification process [4].
(2) On-line Signature Verification: Signature verification is performed on-line. Signature system acquiring data directly from user through stylus, touch screen, or a digitizer that can generate dynamic values, such as coordinate values, time, or speed of signature [4].

II. Literature Survey

There are various techniques have been developed for signature verification (SV) and recognition. Here are some suitable approaches and optimized methods are discussed below. This paper characterizes a brief survey of current work on off-line signature verification and recognition system. Different existing approaches are discussed and compared.

(1) Feed Forward Method:
The quality of the images is improved by using image processing followed by further extracting certain unique standard statistical features in its feature extraction phase. This output is given as the input to the above proposed NN Model to further improve its decision making capabilities. The performance of the proposed model is evaluated by calculating the fault acceptance and rejection rates for a small set of data. Further possible developments of this model are also outlined [1].
(2) Back Propagation Method:
The system is based on the extraction of the characteristics of the neural network and its ability in distinguishing different patterns. Back-propagation algorithm has been specifically used as it provides the flexibility to use any number of layers. In order to test and evaluate the system, a set of 900 signatures were collected from various sources to train the system. The experimental results for the accuracy speed and throughput showed excellent measurements that are comparable to the benchmark algorithms in the domain.
(3) Virtual support vector machine:

Offline Signature Verification Using Virtual Support Vector Machines. Support Vector Machines (SVMs) are machine learning algorithms that use a high dimensional feature space and estimate differences between classes of given data to generalize unseen data [1].For virtual support vector machine, the support vectors found during the course of the training of an SVM classifier are sent back to the image processing module to undergo invariant transformation before retraining [6].

No.	Definition	Technique	Description
1	Offline Signature Verification Using Neural Networks[1]	Feed Forward Neural Network	Unsupervised learning method for verification. Disadvantage is that it works in only one direction
2	Signature Recognition & Verification System Using Back Propagation Neural Network[5]	Back Propagation NN	It works in Both directions. Disadvantage is that it is supervise learning.
3	Off-line Signature Verification with Concentric Squares and slope based Features using Support Vector Machines [6].	Support Vector Machine	It solve multi-class problem, The main task is to find a hyper plane between two classes.
4	Signature Verification Using the Discrete Radon Transform and a Hidden Markov Model [7].	Hidden markov method	Using Local and Global features extracted from the image

Table 1: Survey Table

III. PROPOSED METHOD

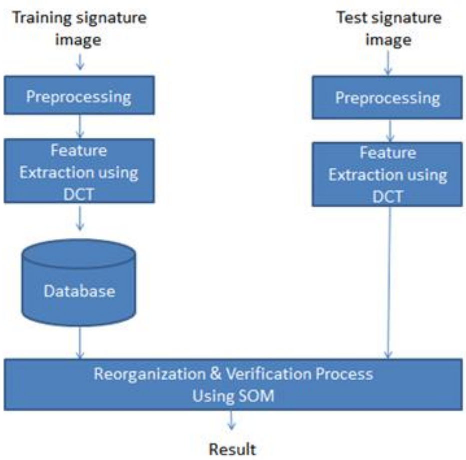


Fig. 1: Proposed Approach

A. *Pre-processing:*

The purpose in this phase is to make signature standard and ready for feature extraction.

It includes…

(1) Image Acquisition
(2) Converting image into 8 bit gray scale
(3) Image Resizing

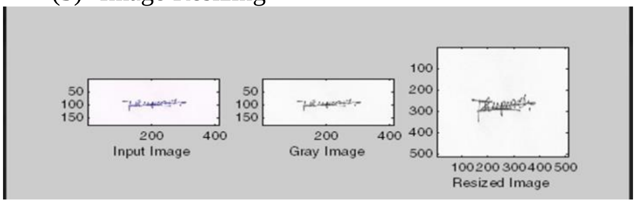


Fig. 2: Pre-Processing

B. *Feature Extraction:*

Some unique features are extracted from the pre-proceed data.

Compression:

Here compression of image is done using DCT (Discrete Cosine transformation).

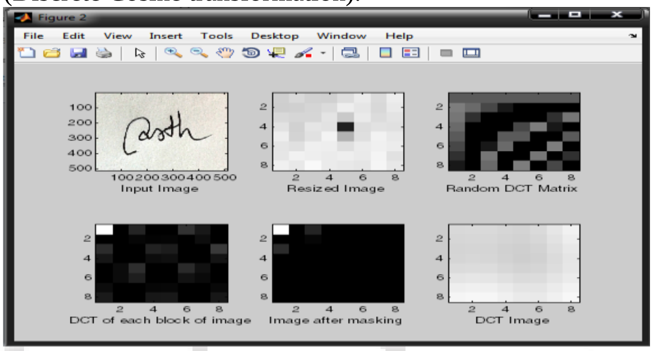


Fig. 3: Extraction and Compression Using DCT

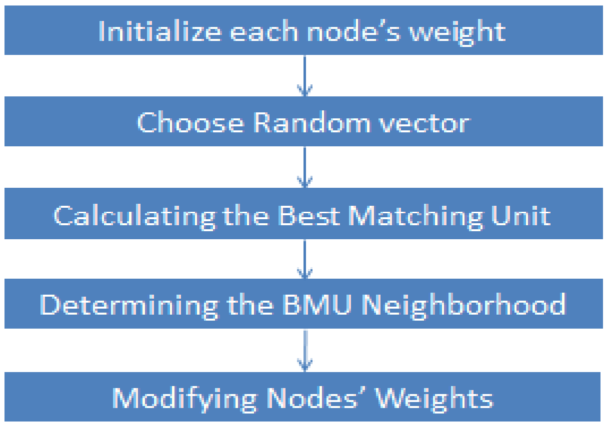
C. *Database:*

Training Image Database is created using multiple signature of the user.

D. *Decision Making:*

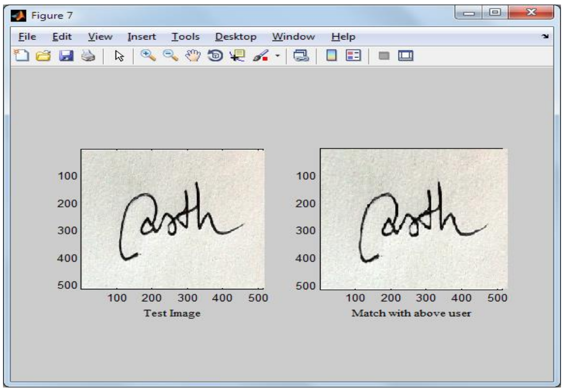
There are many methods for decision making. But here we use.SOM(Self Organizing Map):

With the use of **BMU** (Best Matching Unit) Decision making is done.



E. *Final Output:*

System specification for SOM:
No. of Iteration: 500
No. of NN layers: 1
No. of inputs n=1
No. of outputs =1
The algorithm takes Training time: 12.3474 sec



Training time	Execution time	Accuracy
12.3474 s	14.3896 s	Approximate 99 (After code running 100 times)

Table 2: Outcomes

IV. CONCLUSION

Signature verification becomes an attractive topic for computer vision community. Many researchers do a research in signature verification system to classify signature as valid or forgery. There are two phases for the project. First part is to detect the features from signature images and second part is a classification and verification of signature. There are many methods for signature feature detection and signature verification. In this project, for feature detection Discrete Cosine Transform (DCT) is used. For verification, a machine-learning single-layered Neural Network model (SOM) is discussed for signature Detection for 5 different users. The proposed concept can be extended in a more generalized form for any number of multiple users with a better tuned multilayered NN model.

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