International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Implementation of Digital Signature Verification Using Relative Slope Algorithm

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Abstract: ***In the era of growing technology, security is the major concern to avoid fakes and forgeries. There are various biometric technique which help in personal identification, among those verification systems, one system is Signature Verification System, Signature is a behavioral biometric. It is not based on figure print ,retina or any facial expression, according to the data available in the input, signature verification split into two part: Online and Offline. It also referred as static and dynamic. Signature verification also used to provide authentication to user. The main advantages of signature verification are that it used for e-business which helps in banking applications. The proposed paper present slope based method to identify the signature using various parameters like speed, time, pressure, movement of signature, accuracy and matching percentage of two signature etc.***

Keywords: Segmentation, Hidden Marko Method, Support Vector Machine. Relative slope algorithm, signature verification, Gaussian elimination algorithm

1. Introduction

Human usually recognize each other by various ways like their voice when we speak them, by their eyes when we meet them. To achieve more reliable information for verification and identification we should use something that really recognize given person signature verification is one in that .Signature verification techniques utilize many different characteristics of an individual's signature in order to identify that individual. The advantages of using such an authentication techniques are signatures are widely accepted by society as a form of identification and verification. Information required is not sensitive. [2] So, signature verification is a very popular area for research now a days .Forging of one's signature does not mean a long-life loss of that one's identity. The basic idea is to investigate a signature verification technique which is not costly to develop, is reliable even if the individual is under different emotions, user friendly in terms of configuration. In signature verification application, the signatures are processed to extract features that are used for verification. [1]There are two stages called enrolment and verification. Two types of signature verification are offline and online also called static and dynamic signature based on data available in the input.

Offline signature (static): The input of offline signature verification is the image of signature and is useful in automatic verification signature found on bank check and account.

Online (Dynamic): Signatures that are captured by data acquisition devices like pressure-sensitive tablets and webcam that extract dynamic features of a signature in addition to its shape (static), and can be used in real time applications like credit card transactions, protection of small personal devices (e.g. PDA), authorization of computer users for accessing sensitive data or programs, and authentication of individuals for access to physical devices or buildings. In the point of view of adaption in the market place, signature verification presents three likely advantages over other biometrics techniques. First nowadays it is a socially accepted method already in use in banks and credit card transaction. Second, it is useful for most of the new generation of portable computers and personal digital assistants (PDAs) use and writing as the main input channel. Third, a signature may be changed by the user. Similarly to a password while it is not possible to change finger prints iris or retina patterns.

In this paper, section 2 present literature reviews of the project .section 3 present proposed systems, proposed architecture of the project. Section 4 represent methodology, algorithm used, section 5 represent result/analysis of the project ,section 6 represent conclusion and section 7 present references for the project.

2. Literature Review

S. Srihari. K. M. Kalera. And A. XU [1], proposed a system which represent Hidden Markov model is one of the widely used models for sequence analysis in signature verification techniques. Using optimized HMM we can calculate the segment of the signature. It also gives less error rate than other (18.4%).

Flor Ramírez Rioja, Mariko Nakano Miyatake, Héctor Pérez M., Karina Toscano M."[2], proposed that, In this field, three kinds of forgeries: random forgery, simple forgery and Expert forgery must consider. In this paper a dynamic features extraction for an on-line signature verification system is presented. The dynamic features are extracted from authentic and forged signatures witch relatively low cost. In the
proposed system, all kind of forgeries included expert forgeries are considered to detect as forged signatures. The computer simulation results show us a desirable performance of the proposed system

H. S. Sridhar and M. Beall [3], suggested that It extracts the set of feature representing the signature which provide different sample from several sample. Second step is for NN to learn the relationship between signature and its class either genuine or forgery. The proposed system highly suitable for global aspect of handwritten signature.

Ming Meng, Xugang Xi, Zhizeng Luo[4] proposed that With the development of pen-based mobile device, on-line signature verification is gradually becoming a promising kind of biometrics. A method for the verification of on-line handwritten signatures using both Support Vector Data Description (SVDD) and Genetic

Algorithm (GA) is described. A 27-parameter feature set including the shape and dynamic features was extracted from the on-line signatures data. The genuine signatures of each subject were treated as target data to train the SVDD classifier. As a kernel based one-class classifier, SVDD could accurately describe the feature distribution of the genuine signatures and detect the forgeries. To improve the performance of the verification, the feature subset selection and the parameters of classifier were jointly optimized by GA. Signature data from the SVC2004 database were used to carry out verification experiments. The proposed method has 4.93% average Equal Error Rate (EER) for skill forgery database

S.Srihari. K. M. Kalera. And A. XU [5], present a system the gives idea about proposed method used two techniques based on template matching. one of them is depend on the optimal matching and the other based on the elastic matching. The proposed system tested both the binary and gray signature every time.

Martinez, L.E., Treviso, C.M, Alonso, J.B., and Ferrer, M. [6] suggested that the proposed system uses global directional and grid features of the signature and SVM for classification and verification. Support vector machine used various techniques like **Lcss-Global and Lcss-Local**. Lcss is nothing but local common subsequence used to find the approximate value of verified signature.

3. Proposed System

3.1 Proposed Approach

This project proposes a new algorithm for slop calculation which uses digital pen input signature verification .The algorithm considers writer's signature in the form of slopes, The working of process is like, the slope value of input signature which is already present in the database and the slope value of signature taken by the digital pen is match. If the slope value match up to some approximation (i.e. approximate value decided by user, like 8o%, 70%), then the signature will be genuine otherwise forgery. In the verification phase, the scheme computes a difference between the slope value of signature which is already store in database and the current slope value of the pen input. Care needs to be taken in computing the different function because the length of the input signature different from that of the digital signature even if the signature is genuine. If the computed difference does not exceed a threshold value, the input signature is predicted to be genuine; otherwise it is predicted to be forgery. System uses various parameters to match both the signature. Like, threshold value, time of signing, speed of signing, pen pressure etc. The system take various stages to verify signature like data acquisition, prepossessing, feature extraction, relative slope extraction, two tier time metric extraction.

3.2 Proposed Architecture

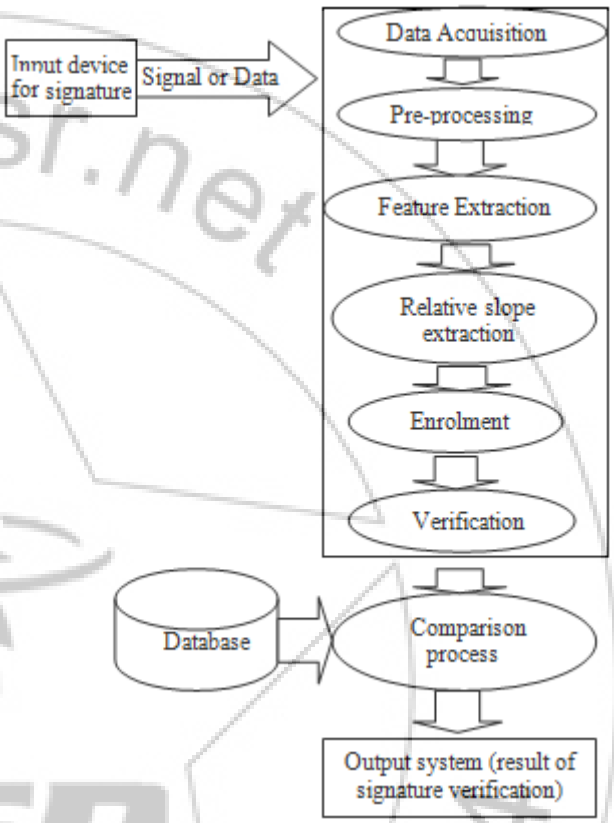

Figure 1: General Overview of System

4. Methodology

4.1 Moduls

1) **Database Module**
The first database module used to sore and represent all the slope value in the database form. In this module first system takes the signature through digital pen and pad .This signature get store in database with all the values like slope value ,theta value ,vector in the form of matrix, Eigenvector etc .System use dataset of vb.net to store the value.

2) **Relative Slope Algorithm**
In this module system calculate all the slope value of the store signature. This module helps to calculate all the parameters of the signature like pen pressure, threshold value ,time ,speed etc of the signature. This algorithm use optimized HMM method to calculate their values like slope of line, perpendicular, intersection, centroid of the circle etc.

3) **Comparison Module:**
This is the last module of the project .this module shows the comparison between two images or signature done by the pen in that first is already store signature and second

is real time signature. The comparison done by various parameter like pen pressure, location, threshold value, speed and time of the signature and if the both signature matches up to the mark or up to particular percentage then signature is genuine otherwise forgery.

4.2 Relative Slope Algorithm:

The proposed paper present relative slope method to provide input signature through digital pen to identify a person is genuine or Forgery based on their handwriting..Current technology in signature verification uses various algorithm for future point extraction like genetic algorithm, pattern matching, Markova method, this project proposed slope based method which divided a signature into various segment using optimized HMM method, and slope of every segment is calculated on based on previous segment and gives approximate result.

Steps:
1) Preprocess and normalize the algorithm.
2) Divide the signature into segment using optimized HMM method.
3) Based on requirement combine these segments into line segment.
4) Calculate the relative slope value of each segment with respect to previous segment.
5) Carry step (4) till all segment are processed else step (6).
6) Store the slope value of each segment which can be used for verification.
7) End

Using relative slope algorithm we can minimize the time and maintenance cost. For this purpose the system is classified in below
1) Data Acquisition
2) Preprocessing
3) Feature Extraction
4) Relative slope Extraction
5) Tier time metric extraction
6) Signature alignment and enrollment
7) Verification

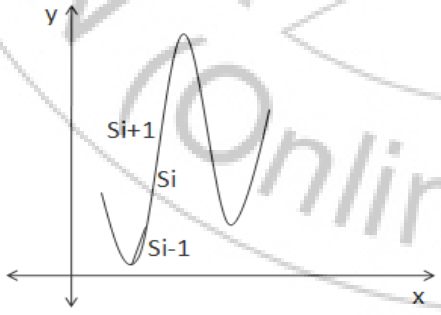

Figure 2: Here Si: =slope of segment i with respect to previous segment i-1.

Example: The Fig. Shows the Part of Signature

1. Using optimize HMM we can calculate the segment of the signature. Then segment can be combining to form a line segment.
2. After the line segment are obtained the relative slope are calculated.

Slope of line: S=**dy/dx**

3. Where: dx=x2-x1 dy= y2-y1
4. For the first segment we calculate the slope between the starting point of the first segment and the ending point of the last segment.
5. However, the for the further line segment the slope is calculated based on the previous line segment
6. In the first step global time required to put the signature and calculate.
7. The second step used to calculate the length of signature completed in unit time for this two tier time metric extraction algorithm is used.
8. And finally in verification step two level verification algorithm used in first level of verification relative slope value compare with previous value
9. And the second level extracts the global and local features consisting of relative slope value, total length and global time.
10. If the signature passes the second level of verification it considered as genuine signature

4.3 Contribution

Before using the method, the accuracy and some parameters like threshold value, pen pressure, speed, time of signature was not up to the mark but after using new this method with new concept and design method the project gives more accuracy, threshold value, pressure all are improved and gives approximate or satisfied result of the project

5. Result / Analysis

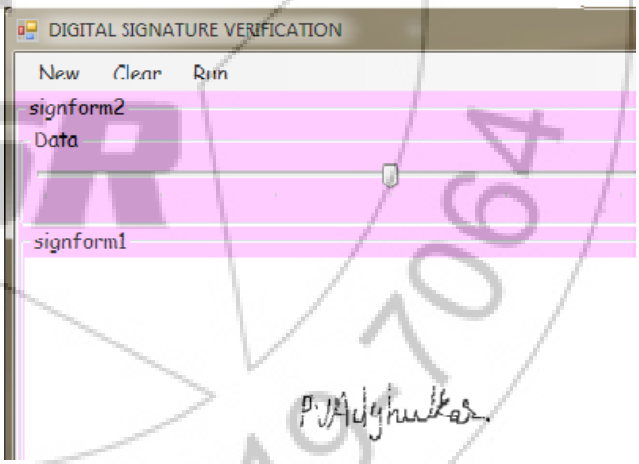

Figure 1: Screenshot Of Original Sign Taken By The Pen

The above figure shows the original signature taken by the pen 1st time.

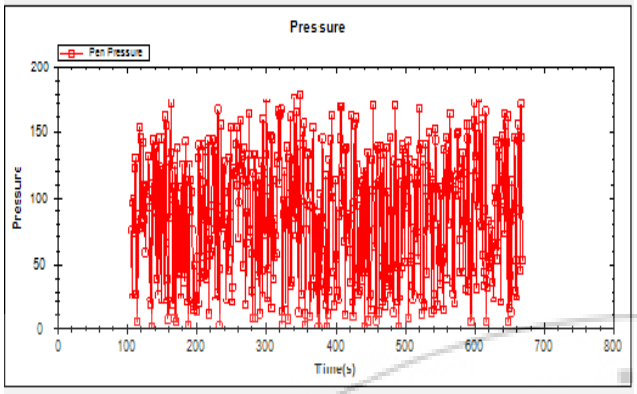

Figure 2: Graph Shows Pressure applied by pen

The above graph shows the pressure when signature taken by the pen 1st time.

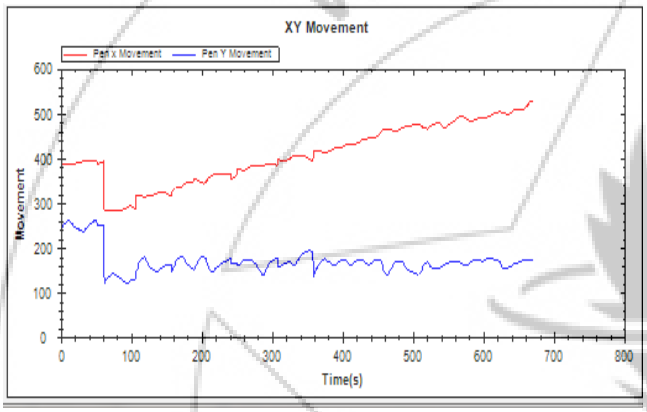

Figure 3: Graph shows XY movement applied by pen

The above graph shows the XY movement of pen when signature taken by 1st time by pen

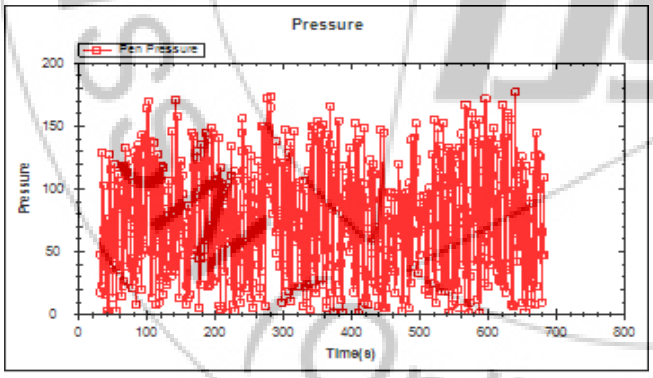

Figure 4: Graph shows pressure vurses time applied by the pen

The above graph shows the pressure and time applied by the pen 2nd time when \signature taken by the pen

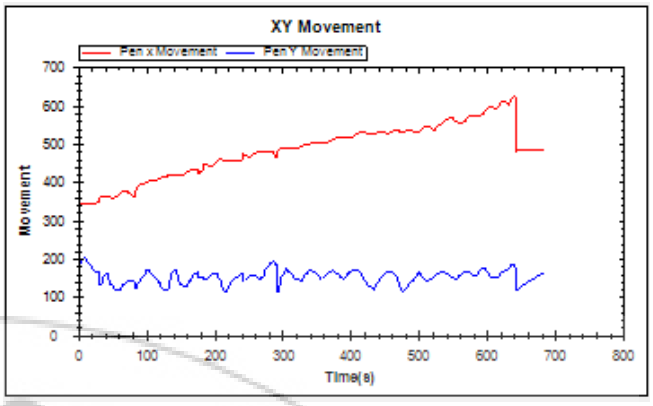

Figure 5: Graph Shows XY movement measured by the pen 2nd time

The above graph shows XY movement and time taken by the pen 2nd when signature taken by pen

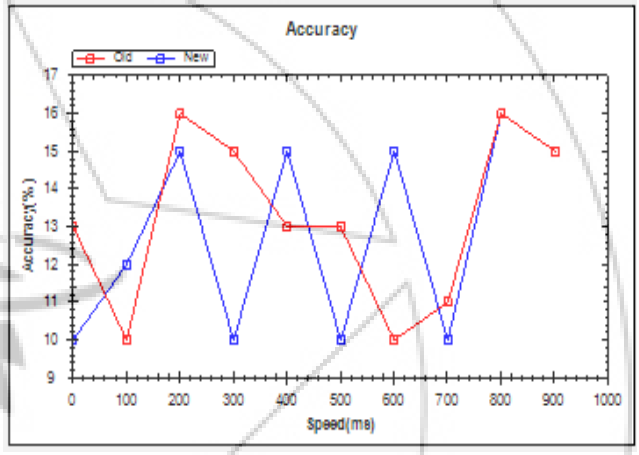

Figure 6: Graph shows comparison of two graph

The above graph shows the comparison between old and new graph i.e. comparison between two signature taken by the pen .if the signature taken by the up to some percentage then it is valid i.e. genuine otherwise forgery signature

The above fig shows the message box which gives the matching percentage between two signatures. The above signature matches upto 90% means it is genuine.

6. Future Scope

1) In current project system, the database matches the sign save by the same name i.e. both the sign saved by same name and if that matches up to particular percentage then it is genuine otherwise it is forgery.
2) This system considers limited i.e. capacity of storing signature which range system decided.
3) But in future the system matches the sigh saved by the different name in database; also there is no limitation of saved database.

7. Conclusion

The proposed paper presents the method to verify whether the given signature done by the digital pen is genuine or forgery. For that, system uses particular method i.e. relative slope method. Before this project the method gives the result but there are some parameters like pressure, time, speed, threshold value and accuracy of the project which gives less accuracy of the result and after using this project the method improves this parameter the above system increase the accuracy of the signature above 80% and more, which was less before this system. The level of accuracy increase with this project. The disadvantage of biometric can avoided by this project one can't sign of another person.

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