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Accuracy Improvement in Signature Verification in Addition with Encryption Mechanism

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Abstract: A signature is treated as an image carrying a certain no of pixels that belong to different individual. Signature verification method concerned with analyzing and determining whether a particular signature truly belongs to a person or not. In signature verification no two genuine signatures of a person are precisely the same. Many methods are used for detection of forged signatures. We provide a different approach to determine whether a particular signature truly belongs to a person or not by extracting the features of signatures which are used by the classifiers i.e. DTI and Guided DTI. With addition of that encryption is also implemented to encrypt the signature to ensure the security purpose so that no one can copy the signature of another person. We provide Matlab as a simulation tool for implemented this method.
Index Terms: Accuracy, Decision Tree Induction, Guided Decision Tree Induction, Encryption.

INTRODUCTION:

The aim of the signature verification system is to differentiate between two types of signatures: the genuine and the forged, that depends upon intra-class and inter-class variability[12]. There exists some variation among signatures of the same person which might be due to stress and this is called Intra Personal Variation. The variation caused by forging a genuine signature by another person is called Inter Personal Variation of two types i.e. offline signature verification and online verification. We have working on the offline signature mechanism where handwritten signatures are used for verification process. Offline signature verification using dynamic features which are used for further classification. Biometrics have many advantages over other authentication methods. A biometric system is essentially a pattern recognition system that operates by acquiring biometric data from an individual, extracting a feature set from the acquired data, and comparing this feature set against the template set in the database.

The purpose of this work is to determine whether a particular signature truly belongs to a person or not by using two classifiers i.e. DTI and Guided DTI. Decision Tree Induction i.e. DTI uses a tree like structure to have and process the information that is given as input to it. It uses the concept that for a particular thing to match the other thing it is not mandatory that all the features of one thing are dead similar to the other. It takes the minute changes and dissimilarities into its stride. DTI often does a wonderful processing and classification of different objects in image processing. But with sometime the changes are overlooked due to which the performance of the system is degraded. In Guided DTI we are trying to enhance the performance of the DTI by deciding previously which features are absolutely mandatory and which features not absolutely mandatory. By doing that we are actually reducing or rather eliminating the chances of faulty classification because when the main and the most important features are matched or mismatched the chances of wrong classification are almost zero.

The main aim of encryption is that it encrypts signature digitally by making use of RSA algorithm with private and public keys because if any person have seen the signature of another person then he can easily copy that signatures and can misuse that signatures for unauthorized actions. So with the use of encryption we can hide the person's signature digitally and make it secure.

PROPOSED WORK:

Reliable authentication and authorization becoming necessary for many basic activities such as boarding an aircraft, crossing international borders, entering a secure physical location, and performing financial transactions. Biometrics is a useful method to verify identity. Signature verification is a valid approach because when messages are send to any person they contain information about the sender but it may not be correct. Identity of a person is detected with the help of digital signatures.

A. Database Management: This part handles the process of data acquisition and maintenance of signature images. We have 400 images in our database for verification method.

B. Noise Removal and Preprocessing: This part involves removal of noise using mean filter and also converting colored image into black white image.

C. Feature Extraction for classification: In this part features are extracted of all signatures so that we can used it for further verification.]. Similar characteristics of a signature are called features of that signature and accurately extract those features called extraction. This process identifies and differentiates a person's signature

from another. There are two types of features i.e. local features and global features. Local features are defined for a particular area but global features describe a signature as a whole. Four global features are extracted in this part i.e. Area, Convex Area, Normalized Area, Aspect Ratio.

D. Classifiers:

Classification is a mechanism by which identifiers are attached to the pixels for a particular image on the basis of their features. These features are generally used for further classification. Classifier basically classifies a particular signature by analyzing it properly on the basis of characteristics that whether this signature is forged or original.

Decision tree induction is a self-investigated method which makes a tree like processing. Guided DTI is a manual classifier which uses the base of DTI but some faults are occurred in DTI to avoid that faults we have worked on the new classifier in which some features are mandatory and some are not.

- **Decision Tree Induction:**

An efficient approach is hierarchical decision scheme. The basic method involved in any hierarchical scheme is to classify a decision into multiple decisions, hoping the final solution achieved.Decision tree works as:

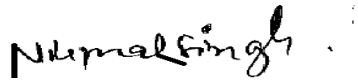
Data Set (Learning Set)
Each example = Attributes + Class
Induced description = Decision tree

- **Guided Decision Tree Induction:**

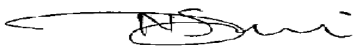
In Guided DTI we are trying to enhance the performance of the DTI by deciding previously which features are absolutely mandatory. In Guided DTI we have a different mechanism that those features which are necessary matches with the features of original signature it means signature is original otherwise it is forged.

Classification Code:

Step 1. Browse or input a particular signature
Input signature=is
Step 2.Cropped signature for verification.
Step 3.Noise Removal using mean filter.
Step 4.Preprocessing of signatures using open and close operation.
Step 5. Feature Extraction
Step 6. Classification begins on the basis of features by using DTI and guided DTI
Step 7. Repeat steps for all signatures.



a.



b.

Figure1 (a) and (b) input image 1 and 2

Figure 2. Result of DTI

Figure 3. Result of Guided DTI

In above figure 1(a) and 1(b) are the input images on which signature verification is implemented. Result is shown in figure 2 and 3 using DTI and Guided DTI. Guided DTI is more efficient as compared to DTI as in Guided DTI the chances of selection reduces or removed as the faulty or unnecessary selection measures are left behind. In Guided DTI the selection measures are only the required one not like DTI in which the selection is done on the basis of present features. In DTI the selection is done on the basis that minimum four features are available but in Guided DTI selection is done on the basis of features required.

Results and Simulation:

In order to take results we have to create our database with various combinations of signatures. We have a database of 400 signature images for our experiment. The system was given a task to classify the Image as Original Signature or Forged Signature. This was performed 50 times with 50 Signatures in one set in a similar manner. In the first 25 attempts the Original conditions were kept and in the last 25 Forged conditions were kept. Because we already knew the nature of the Signature i.e. Original or Forged, we were able to find out how many times out of 50 the system was giving the right results. This was done with all 50 sets to get the results shown. We have recorded the results of each case. Performance has been measured by using two parameters- Favorable Results and total no of tests where

$$\textbf{Accuracy} = \frac{\textbf{No of favorable Results* 100}}{\textbf{Total no of tests}}$$

Result table of Guided DTI: The overall result of Guided DTI is shown in table 1.

Table 1 : Result Layout of Guided DTI

Test no	No. of Favorable Results (NFR)	Total Result(TR)	ACC= (NFR/TR)*100
1	39	50	78
2	46	50	92
3	41	50	82
4	40	50	80
5	35	50	70
6	39	50	78
7	41	50	82
8	40	50	80

In the above table we can see the accuracy of Guided DTI by taking an average of result of all the sets.78+92+82+80+70+78+82+80/8= 80.25%. So the accuracy of Guided DTI is 80.25%

Result table of DTI: The result of DTI is shown in table no 2.

Table 2 : Result Layout of DTI

Test no	No. of Favorable Results (NFR)	Total Result(TR)	ACC= (NFR/TR)*100
1	24	50	48
2	31	50	62
3	26	50	52
4	20	50	40
5	34	50	68
6	30	50	60
7	27	50	54
8	24	50	48

In the above table we can see the accuracy of DTI by taking an averageresult.48+62+52+40+68+60+54+48/8=54%. So the accuracy of DTI is 54%**.**

Comparison: Guided DTI is more efficient as compared to DTI as in Guided DTI the chances of selection reduces or removed as the faulty or unnecessary selection measures are left behind. In Guided DTI the selection measures are only based on the single feature matched with the original signature as in case of DTI. The accuracy of both the classifiers are shown in the graph. It is more clearly explained as follows:

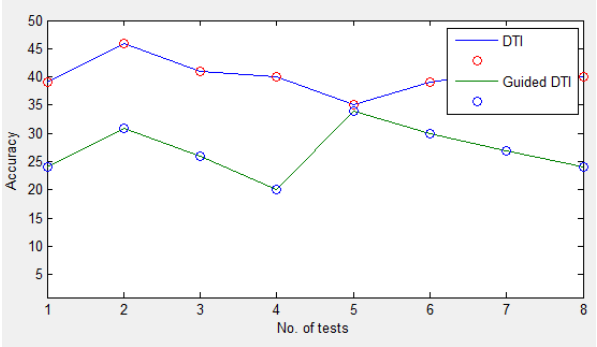


Figure 4: Accuracy Graph of DTI and Guided DTI

In Figure 4 the blue line shows the accuracy of DTI and green line shows the accuracy of Guided DTI. The graph is made on the basis of number of tests of sample images with the original images. As we seen in the table no 2 the average accuracy of DTI is 54% and in table no 1 accuracy of Guided DTI is 80.25%. So we can say that the Guided DTI gives the better result than the DTI and also from the previous methods.

Encryption

To perform encryption we have used RSA algorithm which is used to encrypt and decrypt the signatures.

RSA Algorithm:RSA is a cryptosystem for public-key encryption, and is widely used for securing sensitive data, particularly when being sent over an insecure network such as the Internet. In such a cryptosystem, the encryption key is public and differs from the decryption key which is kept secret. RSA was first described in 1977 by Ron Rivest, Adi Shamir and Leonard Adleman of the Massachusetts Institute of Technology. Public-key cryptography, also known as asymmetric cryptography, uses two different but mathematically linked keys, one public and one private. The public key can be shared with everyone, whereas the private key must be kept secret. In RSA cryptography, both the public and the private keys can encrypt a message; the opposite key from the one used to encrypt a message is used to decrypt it. This attribute is one reason why RSA has become the most widely used asymmetric algorithm: It provides a method of assuring the confidentiality, integrity, authenticity and non-reputability of electronic communications and data storage.

The original signatures are encrypted such that the original signatures are safely managed in database and can be utilized whenever required. The main aim of digital encryption is that it encrypts signature digitally by using encryption algorithm i.e. RSA algorithm so that it has to store in a new encrypted image because if any person have seen the signature of another person then he can easily copy that signatures and can misuse that signatures for unauthorized actions. In order to encrypt the image we use a public key 1234 to encrypt the image and private key 5678 to decrypt the image. When anyone click on the encryption button and save button it will ask for keys in the commandwindow. Encrypted signature will saved as ensig.mat in the code folder. So with the use of encryption we can hide the person's signature digitally and make it secure.

CONCLUSION:

In this study we have elaborated the two classifiers to verify the signatures on the checks as it is very significant requirement to find the forged signatures. So the verification of signatures is done by classifiers. These classifiers are very efficient but Guided DTI is more reliable as compared to previous DTI as it is more precise in detecting the forged signature. Preprocessing the image on the basis of morphological operations are completely done in this project, along with the calculating the features of the image i.e. Area, Convex area, Normalized area and Aspect Ratio. Encryption of the original image is also successfully done.

FUTURESCOPE:

In this research we presented two classifiers for signature verification. These classifiers are very precise and with the help of guided DTI we can get more precise result. We presented the comparison among both the classifiers. In future the verification can be enhanced by bringing advancement in the classifiers.

Future scope of this project is also that, as the signature is more precisely checked and verified so we can use them for security purposes like:

- System Lock
- Door open close
- File security
- All such security measures can be taken with signature also.

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