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Signature Verification for Bank Processing System

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Abstract: Signing documents is something that most everyone is familiar. The verification of handwritten signatures is one of the oldest and the most popular biometric authentication methods in our society. As technology improved, the different ways of comparing and analyzing signatures became more and more sophisticated. Since the early seventies, people have been exploring how computers may aid and –may be one day –fully take over the task of signature verification. Based on the acquisition process, the field is divided into online and offline parts. In online signature verification, the whole process of signing is captured using some kind of an acquisition device, while the offline approach relies merely on the scanned images of signatures. Feature extraction stage is the most vital and difficult stage of any offline signature verification system. The accuracy of the system depends mainly on the effectiveness of the signature features use in the system. Inability to extract robust features from a static image of signature has been contributing to higher verification error-rates particularly for skilled forgeries. The proposed system has 1% error in rejecting skilled forgeries and 0.5% error in accepting genuine signatures. These results are better in comparison with the results obtained from previous systems
Keywords: Verification, Signature, Signing, Forgeries, Genurine

1. INTRODUCTION

The widespread use of bank cheques in daily life makes the development of cheque processing systems of fundamental relevance to banks and other financial institutions. Bank transactions involving cheques are still increasing throughout the world in spite of the overall rapid emergence of electronic payments by credit cards. However, fraud committed in cheques is also growing at an equally alarming rate with consequent losses. Automatic bank cheque processing systems are hence needed not only to counter the growing cheque fraud menace but also to improve productivity and allow for advanced customer services. The automatic processing of a bank cheque involves extraction and recognition of handwritten or user entered information from different data fields on the cheque such as courtesy amount, legal amount, date, payee and signature. A system that is able to read cheque automatically would be very helpful, especially if it is fast and accurate. Even if misclassification occurs, the mistake could potentially be detected during the recognition process; however it is more desirable that the system rejects a cheque in case of doubt so that it can be directed to manual processing from the beginning. In order to produce a successful cheque processing system, many sub-problems have to be solved such as background and noise removal, recognition of the immense styles of handwriting and signatures, touching and overlapping data in various fields of information and errors in the recognition techniques.

The proposed scheme of the present research is to provide a system for verifying signature based on automatic bank cheque processing systems. Various methods have been proposed by different researchers. But this thesis described accurate signature preprocessing using color conversion methods and median filter method. The original image needs to be preprocessed.

The main purpose of this is to implement for Signature Verification using K-Nearest Neighbor Classification Algorithm applying MATLAB image processing functions. The name MATLAB stands for matrix laboratory. MATLAB is a high-performance language for technical computing. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. It integrates computing, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Different features extraction techniques have been reported for offline signature verification systems. Discrete Radon Transform (DRT) method [04JCo], Discrete Wavelet Transform (DWT) technique [09SGh] and Inverse Fourier Transform (IFT) [09JFV] are used to extract global features from a static image of signature in previous systems. Also graph metrics features: Axial slant angle, pixel distribution, pixel density, centre of gravity and stroke curvature are extracted from a static image of signature using grid segmentation method [03FVJ], [00EYa], [02EJR], [01EJu], [05EJu], [00EJu], [94RSa].In [06MBa], vertical and horizontal centre points are extracted from a static image of signature using vertical and horizontal points splitting technique whereas in [04KKM], gradient, structural and concavity features are extracted from a binary signature image for verification. Verification decision is usually based on local or global features extracted from signature under processing. Excellent verification results can be achieved by comparing the robust features of the test signature with that of the user's signature using appropriate classifier [00RPL], [94Fle]. Researches in online signature verification have been reported with high success rates. However, offline signature verification researches are relatively unexplored; this apathy can be attributed to the inherent limitation of available features from a static image of signatures. Nevertheless, offline signature verification systems are still largely in use; major areas of application of offline signature verification systems include: authentication of bank cheques, attendance register monitoring and visa application [97RSa], and [02JPE].

2. SYSTEM DESIGN

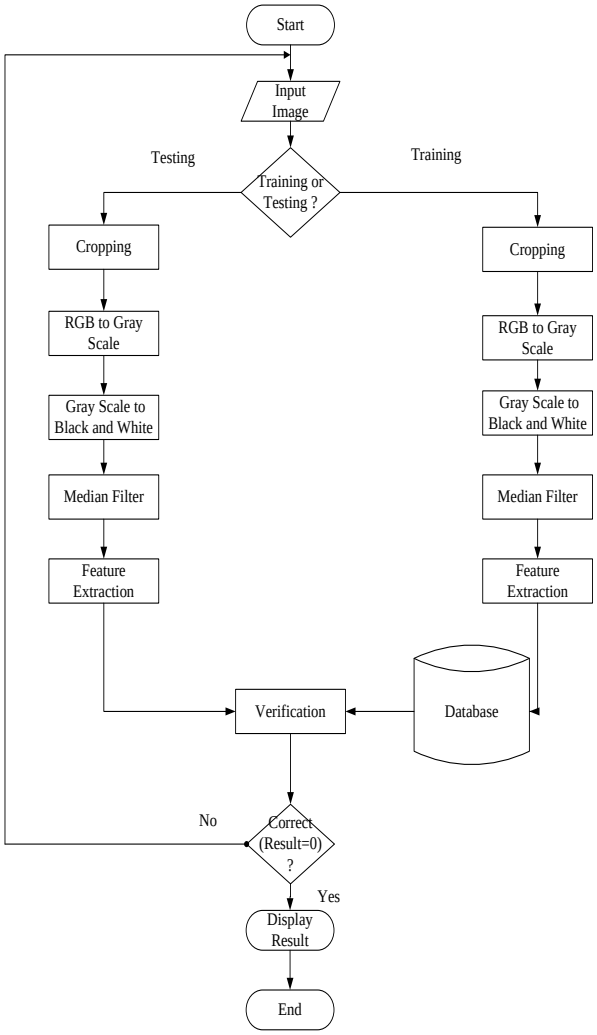


Figure. 1 System Design for Signature Identification System

2.1 Image Acquisition

Image acquisition is the first phase in bank cheques signature begins with the image acquisition. The acquisition step converts a number of paper sheets to a set of digital images, each of them containing one or more signatures. Image acquisition is the process of obtaining or capturing image before image will be process to another stage. There are several ways to obtain image. The followings are the ways to acquire image of signature:

Using a conventional analogue camera and scanner.

Using the digital camera.

Using a video camera and frame grabber (capture card to select).

Image can be acquired using an analog camera with scanner. Using a conventional analogue camera and scanner method is clearly not appropriate for verification system. It is due to the procedure to follow need a lot of time or on other words, its time consuming. It is also tedious and impractical. Using a video camera with frame grabber is the one that has been applied in the real life system as everything can be automated through the computer and it suitable for the real time processing. But that method is expensive. Using a digital camera is more convenient, cost effective and reliable. The proposed system uses a high resolution digital camera. In general, the acquisition step converts a number of paper sheets to a set of digital images, each of them containing one or more signatures. It is essential to note that scanning paper sheets with written signatures is not the only way to acquire digital images.

2.2 Data Area Cropping

In this stage the Region of Interest (ROI) is determined using auto cropping approach. Region of Interest (ROI) is the signature object itself. Signature cropping process is less complexity in process and time, since the area under process will be reduced. Two types of cropping technique were used; manual and automatic cropping. Manual cropping is achieved using Matlab® function (imcrop), but it may cause false cropping rectangle and it is tedious work. While automatic cropping is saving more work and it is reducing a processing time over and above the cropping rectangle is truly detecting.

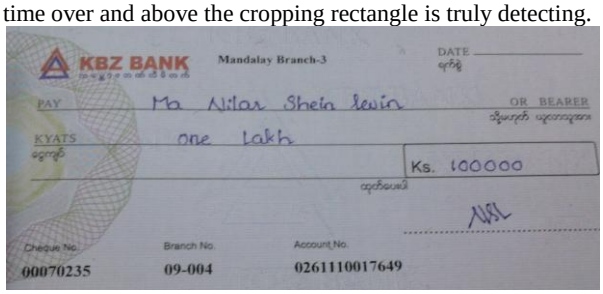


Figure. 2 Input Image

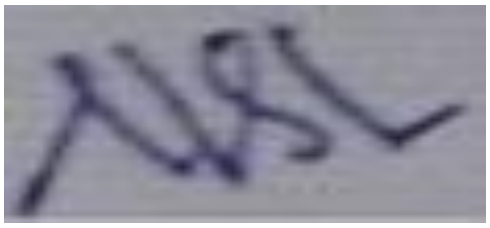


Figure. 2 Cross Image

2.3 Image Pre-processing

2.3.1 Grey Scale Image

A grayscale or grey scale digital image is an image in which the value of each pixel is a single sample, that is, it carries only intensity information. Images of this sort, also known as black-and-white, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest. The range of pixel values is from 0 to 255. These images can provide some sorts of noise [09Sat].

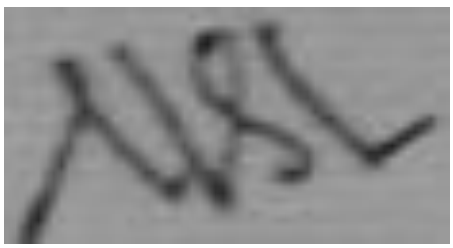


Figure. 3 Grey Scale Image

2.3.2 Binary Image

A binary image is a digital image that has only two possible values for each pixel. Typically the two colors used for a binary image are black and white though any two colors can be used. The color used for the object(s) in the image is the

foreground color while the rest of the image is the background color. Binary images are also called *bi-level* or *two-level*. This means that each pixel is stored as a single bit (0 or 1). In a binary image, each pixel assumes one of only two discrete values. Essentially, these two values correspond to on and off. A binary image is stored as a two-dimensional matrix of 0's (off pixels) and 1's (on pixels).

A binary image can be considered a special kind of intensity image, containing only black and white. Other interpretations are possible, however; you can also think of a binary image as an indexed image with only two colors. A binary image can be stored in an array of class double or uint8. An array of class uint8 is generally preferable to an array of class double, because a uint8 array uses far less memory. In the Image Processing Toolbox, any function that returns a binary image returns it as a uint8 logical array. The toolbox uses a logical flag to indicate the data range of a uint8 logical array: if the logical flag is "on" the data range is [0, 1]; if the logical flag is off, the toolbox assumes the data range is [0,255].

Figure. 4 Black and White Image

2.4 Feature Extraction

The purpose of feature extraction is to extract information about the environment from an image or sequence of images. Feature extraction is the most important stage of signature verification system. The success or failure of identification system highly depends on the utility of the information that the feature extraction stage provides. Feature extraction involves selecting the significant features from an input pattern, and transforming them through some function that can provide some informative measurements for the input pattern. There are many different methods in feature extraction. Various methods have been proposed by different researchers. Important features are extracted from a bank cheque signature images.The extraction of features can be implemented through several different techniques. However, the choice of the feature, as well as of the technique to be used, should take into account the contribution in terms of information that can be obtained from it.

After preprocessing step is finished, the next step of the work is feature extraction. In the proposed system the segment signature portion in bank cheque image with angle orientation. And the system extracted t values (Magnitude and Orientation Values) are shown in Fig. 5 and Fig. 6.

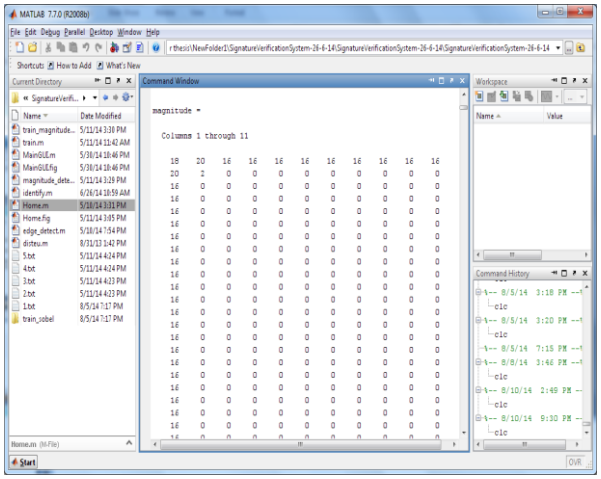


Figure. 5 Magnitude Values of Signature

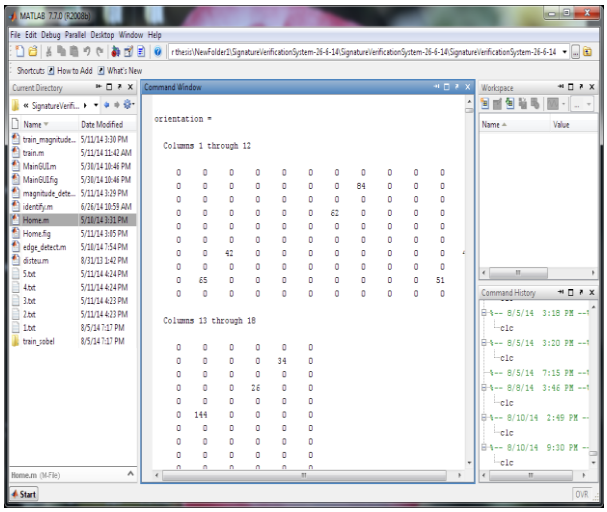
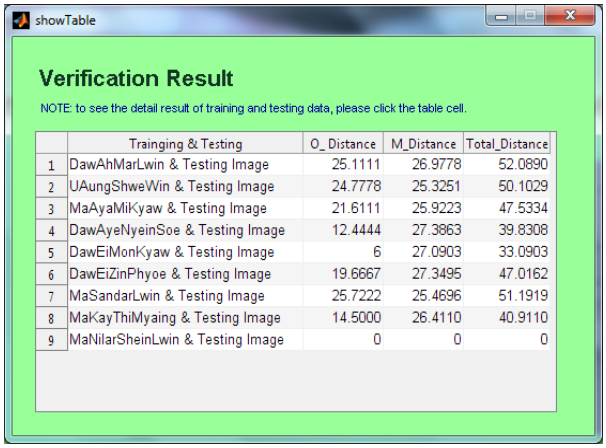


Figure. 6 Orientation Values of Signature

3. VERIFICATION

After feature extraction, a signature image is represented as a feature vector of complex valued coefficients. Two signatures are determined whether from the same class by comparing the similarity between the corresponding feature vectors. In the literature review of the signature recognition system, there is a need to match the calculated signature template with the stored template to identify a person. It is a trivial task for image matching.

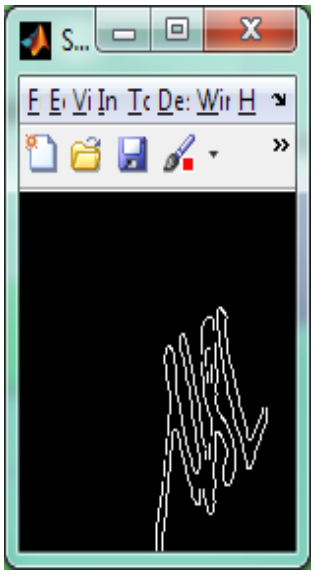


	Trainging & Testing	O_Distance	M_Distance	Total_Distance
1	DawAhMarLwin & Testing Image	25.1111	26.9778	52.0890
2	UAungShweWin & Testing Image	24.7778	25.3251	50.1029
3	MaAyaMiKyaw & Testing Image	21.6111	25.9223	47.5334
4	DawAyeNyeinSoe & Testing Image	12.4444	27.3863	39.8308
5	DawEiMonKyaw & Testing Image	6	27.0903	33.0903
6	DawEiZinPhyoe & Testing Image	19.6667	27.3495	47.0162
7	MaSandarLwin & Testing Image	25.7222	25.4696	51.1919
8	MaKayThiMyaing & Testing Image	14.5000	26.4110	40.9110
9	MaNilarSheinLwin & Testing Image	0	0	0

Figure 7. Verification Results

4. OUTPUT RESULT FORM

This is the result of output windows form for signature identification system. In this form testing stage expresses with detail signture information. The testing process matches an incoming input signature image with feature database signature image. The output result shows the same signature.



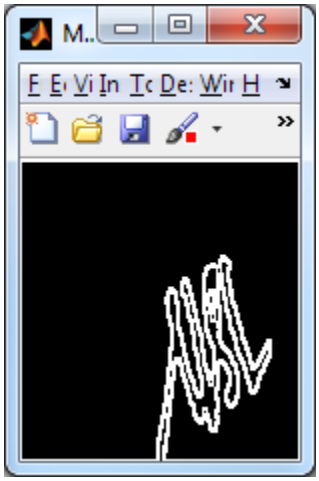


Figure 8. Output signature

5. Conclusion

Typical signature verification using implement of sobel edge detection method and k nearest neighbor algorithm is designed. The first part is a feature extractor that finds features within the data which are specific to the task being solved (finding pixels within an image for signature verification).). When the feature extract program is tested with various operators, implement of sobel edge operator is found that it is the best one for Digitized Signature. In order to verify a new point, the distance to the nearest training point is calculated. The class of this nearest point determines the verification of the new point.

It may be concluded that the results which was tested using database give good results. In the experiments, the images from signatures of 150 writers were tested, the result is absolutely true. Then the image from signatures of more than 150 writers are tested, the result is accurately given.

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