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Real Time Wireless Image Processing based Debit/Credit Card Authentication with Face Recognition

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Abstract: ***This paper is about wireless techniques used for authentication of Debit/Credit card using face recognition applications. This paper proposes a method for credit card transaction system which will integrate with the face detection and face recognition technology using 2-D cross correlation techniques with user control error allowing percentage. For Optical Character Recognition we use template matching technique.***

Keywords: Optical Character Recognition, Face Recognition, Templates, Debit/Credit card Authentication, 2-D Cross Correlation

I. INTRODUCTION

As we all know that in today's world demands for new inventions and technologies have been arrived so rapidly that it becomes very important to transform old technologies into new versions. As we know that in today's world digital technologies are rapidly increasing. This increases need for digital technology for reading characters from images. As the demand for high security is increasing, Face Recognition is becoming an essential technique for authentication.

These types of technologies are widely used in commercial applications as well as security application. As the demand for digital images are increasing, various techniques are established for character recognition. In the character recognition techniques images of documents are taken. Then those images are converted into digital image. From those digital images characters are read and recognized using various techniques.

Optical Character recognition is a promising technology that is used to convert the letters or words written using hand into a digital format.[1] It digitize the printed texts so that they can be electronically edited, searched, stored more compactly, displayed on-line. Optical Character Recognition consists of various stages includes preprocessing, Classification, Post-Acquisition, Pre-Level processing, Segmented Processing, Post-Level processing, Feature Extraction.[2] By making changes in various techniques used in each stages one can get a better results. There were numerous methods were adopted in each stages such as neural networks, fuzzy logic and so on.

With the support of Debit/Credit card, though banking becomes easier, it also became feeble. There has been countless gear of abuse that have in use in banking transactions. Thus there is an essential need to provide high security. This work proposes the amalgamation of Face Recognition System in the identity verification process engaged in Debit/Credit cards to enhance the security system.

II. LITERATURE SURVEY

A. Character Recognition from Image

[Chenqiang Gao, et-al,2014] According to Chenqiang Gao, a great success has been achieved for the situation of high quality images during the past decades, Character recognition in low quality images still remains a challenge. To handle with this challenge, he proposed, to recognize the characters in low quality document images by using local and global features. Firstly, a multi-scale sliding window strategy with a pruning method of character traits is adopted to generate potential character sub-regions. Then, the conventional global feature and state-of-art local feature, namely histogram of oriented gradients (HOG), are extracted to form the representation of the potential character sub-region. Finally, SVM is used to recognize characters with a late fusion strategy. Experimental results show that the proposed method has a better performance even in the situation of existing touched and broken character situation compared to the conventional method. The conventional global feature and state-of-art local feature are fused to recognize the characters in low quality document images in his paper. In order to avoid missing potential characters, he adopt the sliding window strategy to obtain the character sub-region with a good pruning method. Finally, the character recognition problem

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is completed in the SVM framework. Extensive experimental results show that his method can gain high accuracy than the conventional method. [3]

[Abin M Sabu, et-al, 2018] gives various optical character recognition techniques that is used for various character recognition. Optical character recognition is a technique in which a scanned images or handwritten notes are converted into digital format. Optical Character Recognition consists of various stages includes pre-processing, Classification, Post Acquisition, Pre-Level processing, Segmented Processing, Post-Level processing, Feature Extraction. His paper gives an insight to the various details about optical character recognition techniques. From the study of various optical character recognition technique, it is clear that by altering the various techniques used in it, he can achieve the maximum perfect results. His paper is arranged in a such a way that it will provide the details of each techniques as well as the results obtained by them. Various modern techniques were introduced to remove the noise and to recognize the characters. Each step in optical character recognition is important such that each steps are interrelated to one other and to obtain an accurate result, results at each stage should be observed. [4]

B. Face Recognition for Authentication

[Anastasios Tefas, et-al, 2000] proposes a novel method for enhancing the performance of elastic graph matching in face authentication. The initial point, is to weigh the local matching errors at the nodes of an elastic graph according to their discriminatory power. He proposes a novel approach for discriminating analysis that re-formulates Fisher's Linear Discriminant, ratio to a quadratic optimization problem subject to inequality constraints by combining statistical pattern recognition and support vector machines. To frontal face authentication, the method is applied on the M2VTS database. Novel methods for incorporating discriminant analysis into the elastic graph matching algorithm have been proposed. They are based on statistical learning theory. Starting from Fisher's discriminant ratio, a constrained least squares optimization problem was set up and solved. The constrained least, squares problem was further extended to a problem that can solved by the construction of a Support Vector Machine.[5]

[Gittipat Jetsiktat, et-al, 2015] proposes a new process with face matching verification to improve security of online payment system. The simulation of the online payment process is also created then performance of the new proposed process is evaluated. The experimental results show that the new proposed process with face matching verification can increase security as well as improve the usability, capability and user satisfaction of online transaction process. In his paper, a new verification process in online payment system is proposed. For EDC process, signature is not secure enough because it can be copied easily and not well investigated by merchants. For OTP process, there are too many steps which take a long time and SMS containing OTP may not arrive within 1 minute. All problems lead to requirement for designing new online payment process. Face matching verification method using MPEG-EHD is proposed to enhance the payment process. For performance evaluation, the results show that the proposed process can enhance authentication stage of traditional online payment transaction. Moreover, face matching verification can increase system performance in terms of usability, capability and user satisfaction while the system remains uncomplicated.[6]

[Hiroshi Sako, et-al, 2004] proposes several image-recognition techniques used to provide the important functions required by advanced intelligent automated teller machines. These functions are basic cash handling such as withdrawal and deposit of money, handling remittance forms and cheques, delivering information as an "information KIOSK," and security maintenance such as identification of users and surveillance of the ATM environment. The image recognition techniques for realizing these AI-ATM functions are banknote image processing, form processing and character recognition, intention recognition, and biometric techniques. Although the intention recognition is not completed the other image-recognition techniques can in the scope of the experimental data. Accordingly, to provide all the functions of the AI-ATM, the authors are now concentrating on developing the intention recognition.[7]

III. TRAINING SYSTEM

The meaning of training system is to prepare a system with stored data making database by which real time data gets compared. It is very important to keep updated information about user's profile for better functioning of our model. For training our system we follow certain process including storing card data with storing face image in database or disk. This stored data is get compared with real time data and face image taken from wireless camera for authentication if the credit and debit card using face recognition. Training the system includes the converting of face image into grayscale image, calculating mean and eigen value of individual image as well as combined image. Combined eigen value is used to identify whether real time image exists in our database or not. Finally, all the calculated data get stored on the disk in the form of a file containing all individual data and combined data. Fig.1 shows the training set window which contains all the images stored in our database.

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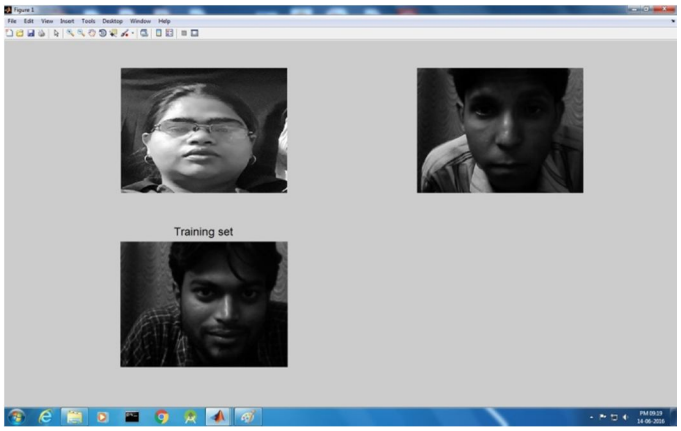


Fig. 1. Training set

IV. AUTHENTICATION OF DEBIT/CREDIT CARD

After training the system, main process of authenticating the payment of debit and credit card using face recognition started. This process consists of mainly two processes firstly, character recognition and secondly, face recognition. Character recognition is used for reading number and name from the card using template matching. While face recognition is used for authenticating the payment using 2-D cross correlation technique.

First of all, a wireless camera is used for capturing the image of the card used for payment. The card should be of light color with dark color characters. All the characters in the card should be visible properly. That captured image is then proceed for pre processing which includes converting to grayscale, selecting region of interest, converting selected region image into binary image and finally, reading characters shown in that binary image. Template matching is used for reading characters from image.[8] Fig. 2 shows a card used for payment which is of light background and dark colored characters. In Fig. 2 boundary for card is given as red box, boundary for card number is given as yellow box and boundary for card holder's name is given as blue box. These boxes are used to crop region of interest from the card for further preprocessing of images. Templates used for matching should also be stored in disk. Font of templates used for matching should be same as of used in card.[9]



Fig. 2 Capturing selected area from card

After that, face recognition is done. The same wireless camera is used to capture the image of face. The image should be captured with dark background to eliminate interference of background color.[10] That captured image of face then converted to grayscale following calculating mean and eigen value of the face image. After that, the calculated eigen value get compared with the stored eigen value, which we have calculate at the time of training the system.[11] If eigen value get matched with any stored value then comparison of the card number take place. If the Levenberg distance between stored number and recognized number is less than 5 than that number is considered to be right. While if Euclidean distance, between the eigen value of the stored image and the real time captured image, is less than $8.000e^{+004}$ then image is consider the right which means that the person using that card is the real owner of that card and thus payment get authenticate. But if any one parameter either Levenberg distance or Euclidean distance is greater than 5 or $8.000e^{+004}$ respectively, then payment get denied. Fig. 3 shows the comparison of real time face image with the database. This compares the eigen value of real time taken image with stored combined eigen value from database. If eigen value matches than it implies that real time image is one of the image stored in our database.

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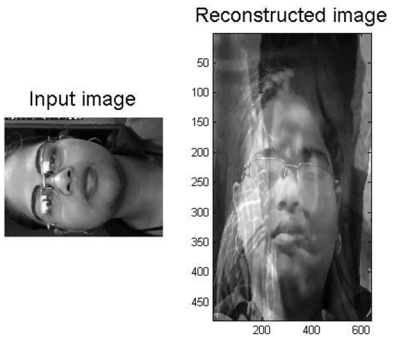


Fig. 3. Comparing real time face image with training set

V. RESULT ANALYSIS

This paper covered two areas. In our first area, we explored the role of character recognition in optical character recognition. We demonstrated that the performance of character recognition is drastically affected if proper light and image quality is presented for processing. In our second area, we looked at independent processing of facial features in face recognition. We use wireless camera for taking images of card for character recognition from card and for taking images of face for real time face recognition.

TABLE I
ACCURACY TABLE

Number Recognition		Alphabet Recognition	
Total Numbers	Numbers Recognized	Total Alphabets	Alphabets Recognized
480	468	370	362

Table 1 shows that our techniques for character recognition is good for our work. The accuracy for number recognition is 97.50 % while accuracy for alphabet recognition is 97.84 %. The error of approx. 2.5 % can be bearable as the error of one or two digits in character recognition is allowed in our work.

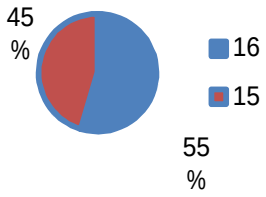


Fig. 4 Accuracy chart for Number Recognition

According to the graph shown above, we can analyze that accuracy of recognizing numbers is high. Normally card numbers are of 16 digits among which number recognition is 100 % for 55 % of cards and 93.75 % for 45 % of cards. This means that template matching for number recognition is working good.

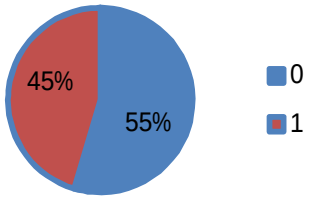


Fig. 5 Accuracy chart for Alphabetic Recognition

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According to the graph shown above, we can analyze that accuracy of recognizing alphabets is high. Card holder name can vary from user to user. So we calculate difference between real character and correctly recognized characters. Alphabet recognition is 100 % for 55 % of cards and 93.75 % for 45 % of cards. This means that template matching for alphabet recognition is working good.

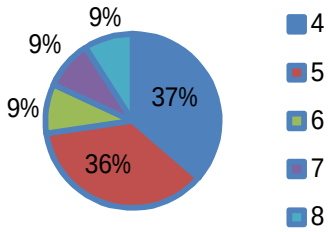


Fig. 6 Accuracy chart for Face Recognition

According to the graph shown above, we can analyze that accuracy of recognizing face is high. Eucledian distance between face images shows the accuracy of face recognition. Above graph specifies that 100 % accuracy is obtained for all face images. The difference is only that Eucledian distance vary from 4.000 e^{+004} to 8.000 e^{+004}. But all are in allowable range so, it give high accuracy rate for face recognition using 2-D cross correlation technique.

VI. CONCLUSION

In this paper we have taken a review of various techniques used for character and face recognition. We have studied about various conditions which an image has to be gone through. Thus by taking an overview of those conditions we can design a technique with high accuracy and high safety. In this paper we have studied that low resolution and low light image may degrade the performance of techniques and must be placed at a proper light place. This paper also concluded that for proper face recognition we need face capture device of proper configuration and light should be proper for high quality image.

VII. FUTURE SCOPE

A. This system only works for light background with dark character cards. Techniques for reading all type of cards should be analyzed.

B. Use of techniques for increasing face recognition accuracy should be introduced.

C. Quality of image captured by wireless camera should be increased.

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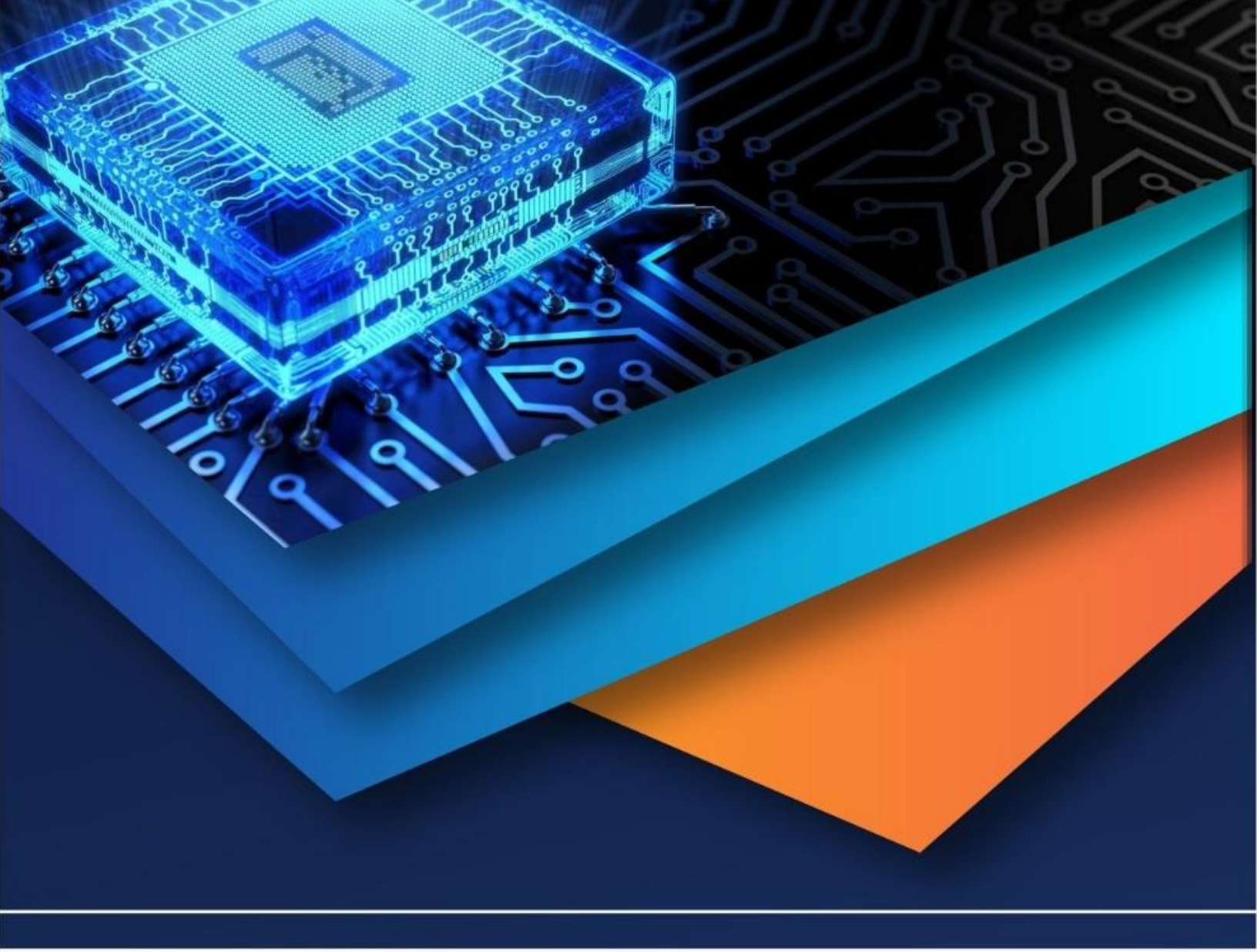
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