IMPLEMENTATION AUTOMATIC DATA ENTRY OF PASSPORT WITH HANDWRITTEN RECOGNITION SYSTEM

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Abstract

The objective of this paper is to develop an automatic data entry system of passport for security system. A passport contains the important personal information of holder such as photo, name, date of birth and place, nationality, date of issue, date of expiry, authority and so on. The proposed system is provided to prevent mistakes of writing in personal information and to obtain the true information from the passport in short time. It is also easy and convenience for passport holders and immigrating staff. Especially, Myanmar passport is used in experiments. Region based segmentation process has been done for extracting the information separately. The handwritten character recognition algorithm is extended by Gaussian elimination method. The handwritten character A to Z and digits 0 to 9 are convert to the printed form. Once the passport is scanned, the proposed system is executed automatically the data extraction, converting to printed form and entry the data and facts to worksheet. Pre-limitary investigation is performed to confirm the effectiveness of the proposed approach.

Keywords: Hand written recognition, passport, security system, character recognition, Automatic Data Entry System.

1. Introduction

The term biometrics refers to the science of measuring identifying features or attributes of human beings. We distinguish two approaches: passive and active schemes. Example of passive biometric is face recognition. Handwritten recognition is one of an example of the behavioral biometrics. By using biometric data, officials can determine whether someone making a new passport has ever been issued a passport under another identity. A typical identity certification such as a driver's licenses, passport, or visa, consists of a personal portrait photo, an arbitrary message, and one or more feature whose purpose is to guarantee authenticity. To achieve the security criterion of non-transferability, most documents contain a photograph and an image of the handwritten signature of the legitimate holder and some cases some information on the holder's appearance, like date of birth, eye color, nationality. We describe a system to recognize characters such as name, date of birth, Nationality, passport number, date of issue, place of issue, date of expiry, etc.

Stefan Hellkvist [1] studied the system designed in this project recognizes single characters that are written on either a touch pad or a touch screen. The recognition method used is called elastic matching, which is a rather robust technique to calculate distances between strokes. Handwriting recognition of Arabic script is presented by *Fadi Biadsy*, *Jihad El-Sana* and *Nizar Habash*. Hidden Markov Model (HMM) based system to provide solutions for most of the difficulties inherent in recognizing Arabic script including: letter connectivity, position-dependent letter shaping, and delayed strokes [2].

The main objectives of this paper are developed a simple and fast data entry system for information of passport holder and an algorithm for handwritten character recognition. The system includes preprocessing step, foreground extraction, character segmentation, feature extraction, transforming printed character, matching with database information. Foreground extraction is performed to obtain handwritten characters in the passport. Region-based segmentation and following detection methods are used in the segmentation system. Thinning and skeleton methods are needed in the feature extraction system. Retransforming to the printed character is also needed. Recognition algorithm is extended from the Gaussian Elimination Method for recognizing the capital letter A to Z and 0 to 9 digits. Recognizing which is included matching with the database information. Finally, data is automatically entered as a text file. The block diagram of the proposed system is shown in fig1.

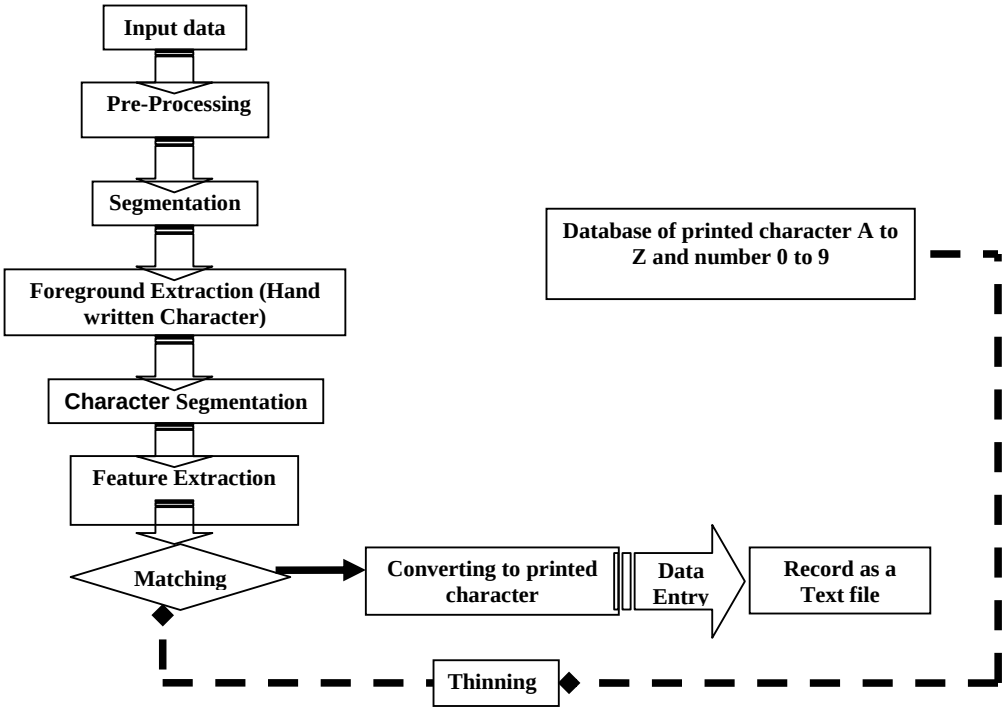


Fig.1. Block Diagram of the Proposed System

2. Pre-processing

In pre-processing step, skewing angle which may be appeared due to the user scanning is performed. Each document is moved from an automatic feeder into a scanner and angle of skew is sometimes introduced. So that the input image is tested for skewed angle detection algorithm has been developed using the equation.

$$P = x \cos \alpha + y \sin \alpha$$

The size of input image is rather so that it may cause the performance of the system slow down and sometimes may cause the system hang. Therefore the image is resized. Resizing is to reduce the processing time and

to convenience for thinning method. Noise filtering step are included in the pre-processing step.

The process of scanning is not exact. Even bi-level documents that are scanned, when digitized as grayscale or color, show more then two levels of darkness. This may be due to variances in the painting or reflectance of the document, or imprecision in the scanner itself. Because of factors such as these, it is difficult to pick a good threshold. The extraction of the foreground textual matter by removing such as textured background, salt and pepper noise and interfering strokes. The effect of setting the threshold too low is the presence of spurious black pixels throughout the image, often known as *speckle* noise. This noise should be eliminated from the image as much as possible so as not to cause confusion recognition.

3. Document Segmentation

To extract the personalization data from a passport, words and documents segmentation process are performed by the mean positions of training sets. Figure (3) shows the registered regions of hand written characters sets. Mean position of each word or document can be derived from the following relation:

$$\text{Mean Registered Position} = \frac{\text{Total of register positions}}{\text{Number of test images}}.$$

Fourteen documents are extracted from a passport image separately. Some extracted documents are illustrated in fig.3.

Fig.3. Registered Handwritten Character's Regions and Segmented DocumentsData

4. Feature Extraction

After data segmentation is performed, foreground words are extracted from the segmented parts. The foreground is obtained by eliminating the background based on the color range. RGB color segmentation approach is applied to get the word and character written by black color.

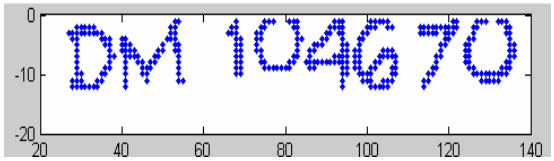
i. e. For any image,

If the R, G, B color values of a pixel are less than or equal 100 then each color component value is set to 0.

And, the R, G, B color values of a pixel are greater than 100, then each color component value is set to 255.

Then, convert the gray scale and the extract the black pixel. Figure (5) shows a segmented part and its extracted feature points, respectively.

(a) Segmented Parts



(b) Feature Points Extraction

Fig.5. Extracted Featured Points

5. Character Segmentation

Image segmentation is one of the most important steps leading to the analysis of processed image. Segmentation methods can be divided into three groups, these are global knowledge about, edge based segmentation and region based segmentation. Region based segmentation method is easy to construct regions from the borders, and it is easy to detect borders of existing regions.

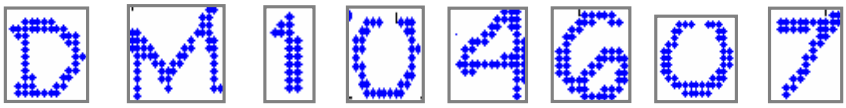


Fig.6. Segmented Characters

6. Estimating the corresponding region

The successive images are obtained by capturing from scanned image. The can be considering as the off-line character images. Then the corresponding regions of each character in successive images are detected by the Gaussian elimination method. Let ***I*** and ***J*** be two images, containing *m* features *Ii*(*i*=1….*m*) and *n* features *Jj* (*j*=1….*n*),respectively. A brief description of the algorithm is described in the following:

(1)A proximity matrix ***G*** is build by the two sets of feature points and computed the Gaussain weighted distance between two features *Ii* and *Jj*:

$$G_{ij} = e^{-r_{ij}^2 / 2\sigma^2} \quad i=1...m, j=.1....n \qquad (1)$$

Where $r_{ij}=\|I_i - J_j\|$ is their Euclidean distance if we regard them as lying on the same plane.

(2) Decompose the matrix into the multiple of orthogonal matrices *T, U* and diagonal matrix *D* as following,

$$G \in TDU^T \qquad (2)$$

Its diagonal elements D_{ii} in descending numerical order.

(3) Convert ***D*** to a new matrix ***E*** obtained by replacing every Diagonal element D_{ii} with ***1*** and then computes the product.

$$P = TEU^T \tag{3}$$

Rogue points cause lots of ambiguous, equally good matching possibilities *I* the space of paring *s*, and the sole proximity used to build G in Equation (1) does not have enough "character" to discriminate amongst them.

(4) If we represent two W* W areas centered on features Ii and Jj as two W*W arrays of pixel intensities A and B, respectively, the normalized correlation is defined as

$$C_{ij} = \frac{\sum_{u=1}^{w}\sum_{y=1}^{w}(A_{uv} - \overline{A}).(B_{uv} - \overline{B})}{W^2.\sigma(A).\sigma(B)} \tag{4}$$

Where $\overline{A}(\overline{B})$ is the average and σ(A)(σ(B)) the standard deviation of all the elements of A (B) C_{ij} varies from -1 for completely uncorrelated patches to 1 for identical patches.

(5) One way of including this correlation information into the proximity matrix is to transform the elements *G* as follows:

$$G_{ij} = \frac{(C_{ij} + 1)}{2} e^{-r_{ij}^2 / 2\sigma^2} \tag{5}$$

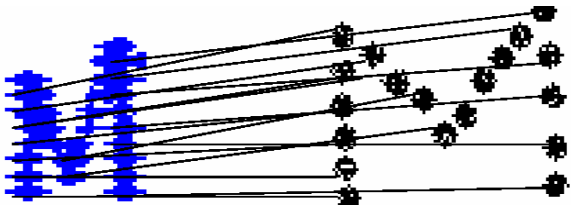


Fig.7**.** Two scale and translated "Sign" Pattern

7. Experimental Result

We first created a large database which includes classified printed character. Using this database, we have conducted several experiments to access the performance under know variations of lighting, scale and

orientation.

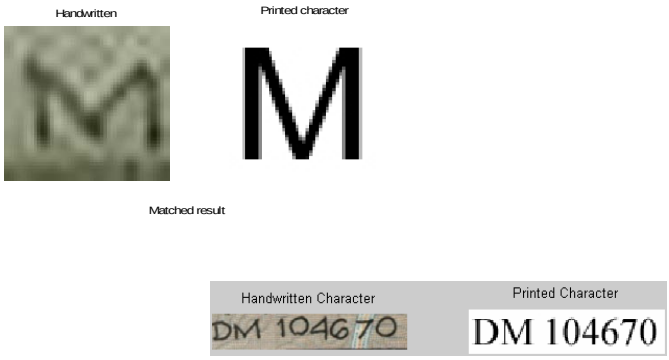


Fig.8**.** Transforming of Printed character

Transformed printed characters are matched with the A to Z characters and 0 to 9 digits into the database. If they are same, they will convert to text file by using automatic data entry system. The extracted characters are recognized with high data accuracy rate. There are fifty passport holders are used in this experiment.

8. Conclusion and Future Work

We have proposed a system of automatic data entry of passport and a printed character segmentation system to recognize character from the diplomatic passport. The personal information of passport holder described as a text file. In personal information of passport holder described as a text file. In future work, face and signature recognition will perform to the personal identification of passport holders. For connecting to the network of database, we will extend to search the personal identification from every where. We've tried our best to obtain the system with less error and more accuracy recognition.

Photo	
Passport Number	DM 104670
Name	Mya Mya Thinn
Nationality	Myanmar
Date of Birth	12/17/1982
Date of Issue	2/13/2004
Date of Expiry	2/13/2014

Fig.9**.** Output of the Proposed System

9. References

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