ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

Efficient Approach for English Braille to Text Conversion

Megha Gadag, Dr. V Udayashankara

Dept. of Biomedical Signal Processing and Instrumentation, Sri Jayachamarajendra college of Engineering Karnataka, India

Professor and HOD, Dept. of Instrumentation Technology, Sri Jayachamarajendra college of Engineering Karnataka, India

ABSTRACT: One of the medium of writing for communication for visually impaired people is Braille language. It helps in recognizing letters, sentences or words for low vision and blind people. It is usually written in embossed form. Braille can be written using stylus, Braille writers like computer with Braille embosser print and portable Braille note. Several researchers are carried out in different languages for Braille conversion. Various algorithms also have been proposed in the literature. This paper presents a novel method for Braille to English language conversion with the use of different pre-processing steps and SVM classifier to get the proper Braille character recognition. Improvement for each step starting from the image acquisition until the Braille character recognition is done. Proposed system includes an image pre-processing steps like noise removal, contrast enhancement after image Acquisition for noise removal and feature extraction before passing it to SVM classifier.

KEYWORDS: Braille, Support Vector Machine (SVM) classifier, Noise Removal, Contrast Enhancement.

I. INTRODUTION

It is necessary to help blind people by providing them with technologies and systems to allow them to interact and communicate among people and with each other without the vision problem. It is necessary to help blind people by providing them with technologies and systems to allow them to interact and communicate among people and with each other without the vision problem. Visual impaired people have got good senses for touch feeling and hearing. Hence depending on the sense of the touch of the finger they can easily make use of Braille system for communication. Braille character is nothing but collection of paper embossed on figure as shown in the Figure 1.

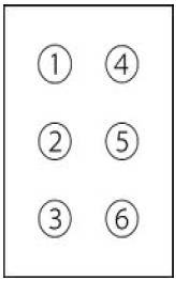

Figure 1: Braille 6 dots

These characters are then sensed by the blind people. A Braille character is made using a combination of 6 dots which is arranged in two columns and three rows [03], [06].

C.N. Ravi Kumar et.al [06] proposed an efficient method for optical Braille Character recognition system for both hand punched and machine punched Braille text documents in kannada. To segregate the dots in the Braille standard spacing between the Braille dots for segregation is done. Once the identification of the character box is done the efficient look

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

up table approach is done to find the best match kannada character. Samer et.al [08] proposed an efficient system for converting Braille document into its equivalent natural language character which is called as Optical Braille Recognition (OBR). It involves two main steps like recognition of Braille cell and transcription of Braille cell. First step involved few pre-processing steps, dot and cell recognition etc. Second step aimed at converting the segmented Braille character into its natural language character.

Himali Parekh et.al [11] proposed a method which focussed on nature of the Braille language and Guajarati Script along with the approach of optical Braille characters recognition. Survey on different methods is also done. Hence it is very useful for researchers who work for Braille character recognition. Usually Braille recognition system consists of steps like Image acquisition, Pre-processing, Segmentation, Feature extraction and Interpretation [01], [02]. An efficient method for Braille character recognition in English language is proposed in this work. Which made use of different pre-processing steps like gray conversion, contrast enhancement, Noise reduction etc and no Pattern based feature extraction for Character recognition using SVM classifier to get the correct matched English character for the segmented Braille character.

II. METHODOLOGY

The proposed methodology is as shown in the Figure 2. The approach consists of two phases called testing phase and the training phase. In the testing phase the scanned Braille document is taken and passed to the pre-processing block. In the pre-processing block different pre-processing steps are followed. The obtained pre-processed image is segmented by converting it into binary after proper thresholding. Before the feature extraction approach the segmented image is again divided into horizontal and then vertical pattern to separate each character from the segmented image. 4 set of pattern having 6 values are taken as a feature for all the characters. These extracted features are then passed to SVM classifier for comparison.

In the training Phase the segmented Standard Braille images are undergone pre-processing for binary conversion. Once the binary image is extracted 4 set of patterns as in testing is extracted from the entire segmented image and stored in knowledge Base. Each Braille character will have 24 features extracted during the feature extraction. During the classification every time the extracted test feature is compared with the feature already stored in the knowledge base. Once the proper match for Braille character is found its respective English Alphabet is displayed and its unique code is stored in the text document.

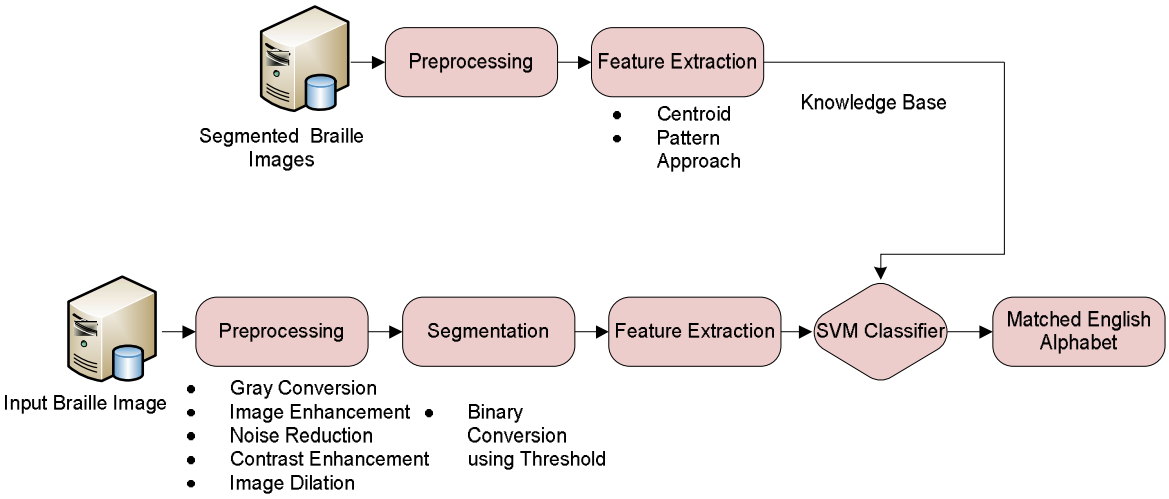

Figure 1: Block Diagram of the Proposed System

1.1 PRE-PROCESSING

Different pre-processing steps like image gray conversion, image enhancement, Noise reduction, Contrast enhancement and image dilation are followed. Gray conversion involves converting the input RGB image into Gray color plane as in eq. (1). Image enhancement involves finding the histogram equalisation of the input image for even

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

distribution of the pixel values to get better enhanced Image. By which the Braille dots are made bolder for easy identification. This approach also involves noise removal to get the noise free image by applying filter. Because of the uncontrolled scanning condition the brightness in the image may vary do to which the quality of the dot gets reduced hence adjusting the contrast to get the contrast enhancement is very necessary [05]. To the obtained enhanced image some kind of dilation is done to get proper circular dot present in the Braille character. Orientation of image is also adjusted for proper alignment of the scanned Image.

$$Grayscale = \left(\frac{R + G + B}{3}\right) \quad (1)$$

1.2 FEATURE EXTRACTION

Once the pre-processed image is obtained they are undergone horizontal and vertical dilation for proper segmentation of the segmented character. For the segmented character in the scanned document 4 set of pattern is calculated. I.e. they are divided into 6 quadrants. For a 60×30 image every 30×30 is considered as one quadrant. The centroid of the dot present in the quadrant is calculated. If the dot present in a quadrant then that quadrant no is put in the series of number from 1 to 6 [08]. For example if the dot is only present in the 1st, 2nd and 5th quadrant then the unique code becomes 1 2 0 0 5 0 and 4 different set of patterns are generated for the generated unique code. The code becomes 1 0 2 5 0 0 if the pattern is considered in a horizontal M shape, the code becomes 0 5 0 0 2 1 reversing the first code and the code becomes 0 0 5 2 0 1 reversing the second code. Total of 6 ×4 = 24 features are extracted every time both in testing phase and training phase.

1.3 SVM CLASSIFIER

In the proposed work SVM classifier is used for character matching to get the proper Braille to English converted text [10]. Usually there are two different types of SVM classifier called as supervised and unsupervised. We made use of unsupervised classification where it does not need any prior information, human annotation i.e. it is fully automated. Steps like clustering data, Classification of clusters based on the pixels, Cluster labelling, Mapping of informational class are carried out.

SVM gives better performance in classification compared to other classification algorithms. Using this in Character recognition is also a major aspect in recent years. Usually SVM performs pattern recognition for two class problems by finding the separating hyperplane with the maximum distance value to the closest points in the training set. These points are called as support vectors. In the input space if the data is not linearly separable a non linear transformation function $\varphi(.)$ is applied which then maps the data points $x \in IR^n$ to a high dimensional space H which is called a feature space.

With the help of optimal hyperplane data present in the feature space is separated. $\varphi(.)$ Mapping is represented in the SVM classifier by a kernel function given by $K(.,.)$ which usually defines the inner product in H. I.e. $K(x,t) = \varphi(X).\ \varphi(t)$. The decision function of the SVM is given by the eq. (2), where l denotes the number of data points x_j. By solving a quadratic programming problem with the liner constraints α_i coefficient is calculated. The support vectors are nothing but the nearest points to separate boundary and are the only ones for which these coefficients are non Zero.

$$f(x) = \sum_{i=1}^{l} \alpha_i y_i K(x_i, x) \quad (2)$$

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

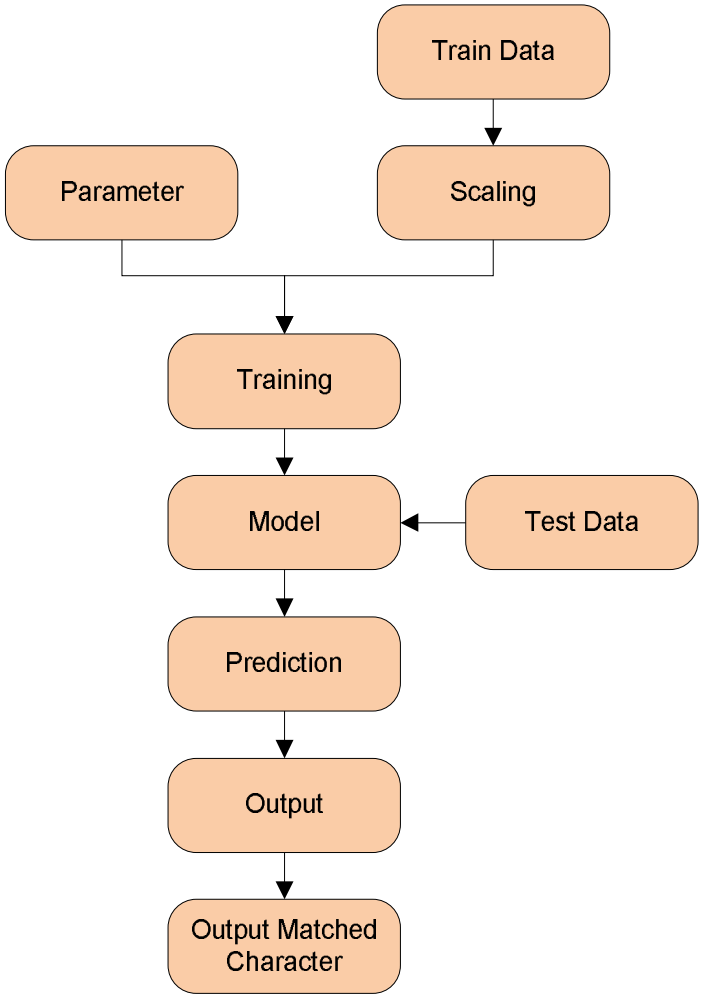

Figure 3: Block Diagram for SVM Classifier

Figure 3 depicts the overall flow of the SVM classifier. After training the data they are compared with the test data for matching. The prediction is done is such a way that the feature with maximum match is chosen to get the matched Character.

III. EXPERIMENTAL RESULT

Results obtained at every stage of the Braille character recognition is proposed in the paper below. Initially the input Braille document as in Figure 4(a) is taken. Certain pre-processing steps like noise removal, Contrast enhancement etc are carried out and the final binary image as in Figure (b) is obtained. Every time the horizontal and vertical dilation is applied to segment the Braille character from the document for better classification. (c) Depicts the Segmented characters present in the first Row of the document. (d) Depicts the Segmented characters present in the first second of the document. (e) Depicts the Segmented characters present in the third Row of the document. (f) Depicts the Segmented characters present in the fourth Row of the document. Segmented character is then converted into text using SVM classifier as in (g).

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

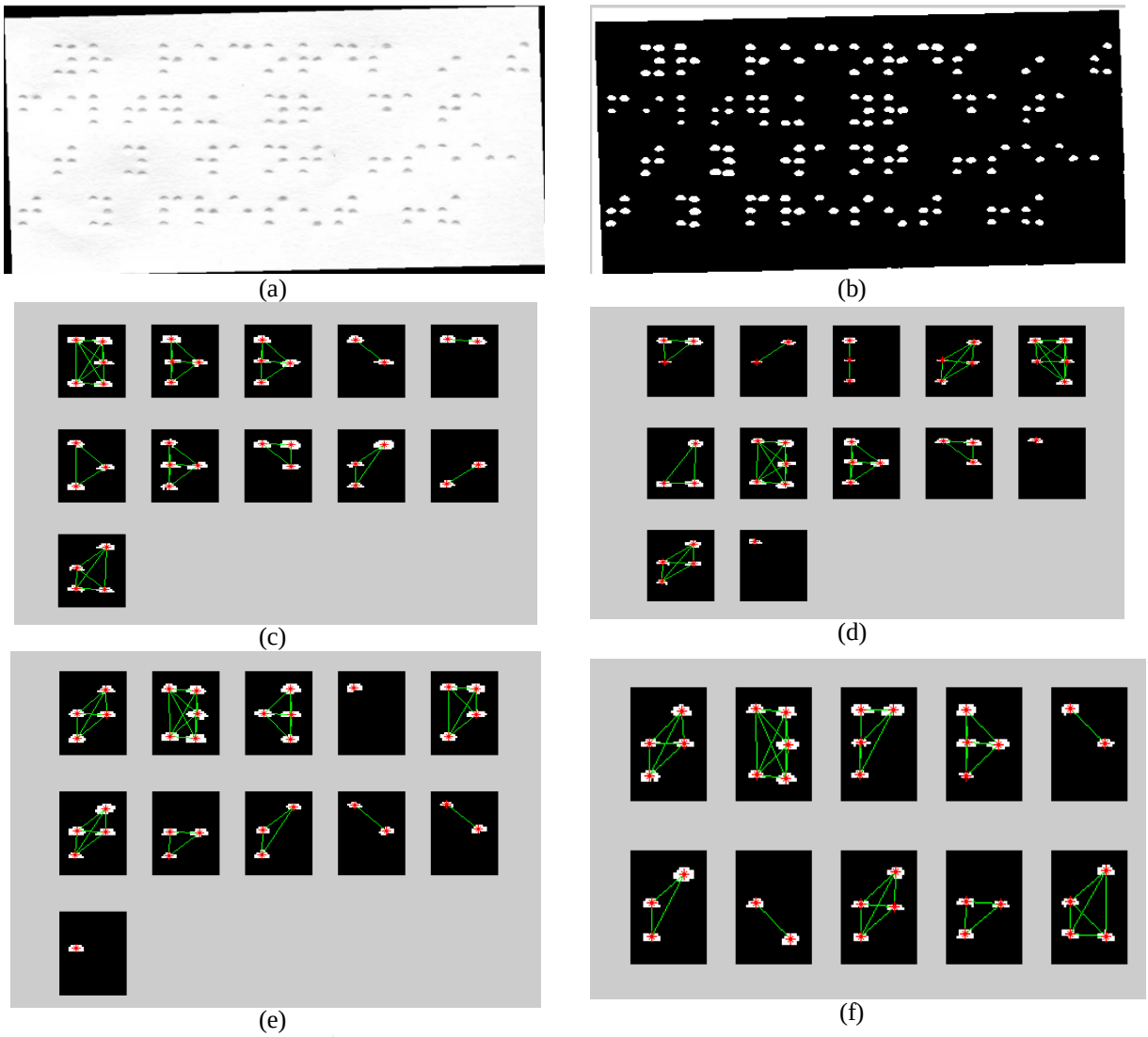

Figure 4: (a) Input Image of Braille Document; (b) Binary Image after Pre-processing; (c) Segmented Braille Characters for First Row; (d) Segmented Braille Characters for Second Row; (e) Segmented Braille Characters for Third Row; (f) Segmented Braille Characters for Fourth Row.

IV. CONCLUSION

Various efforts on research have been conducted in the literature for converting Braille Script to normal text. This could allow visually impaired people to communicate. In this paper we presented an extensive literature carried out in the Braille recognition system development. Braille has a standard pattern of alphabets and only the mapping differs

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

from language to language. Using appropriate mapping for each language the alphabets are identified and stored as text. This work focused on converting scanned Braille document to the corresponding text in English language. Initial pre-processing steps for the acquired Braille are carried out for the proper text conversion using SVM classifier. The proposed system gives accuracy of about 96% as shown in the Figure 5 when compared to the existing method.

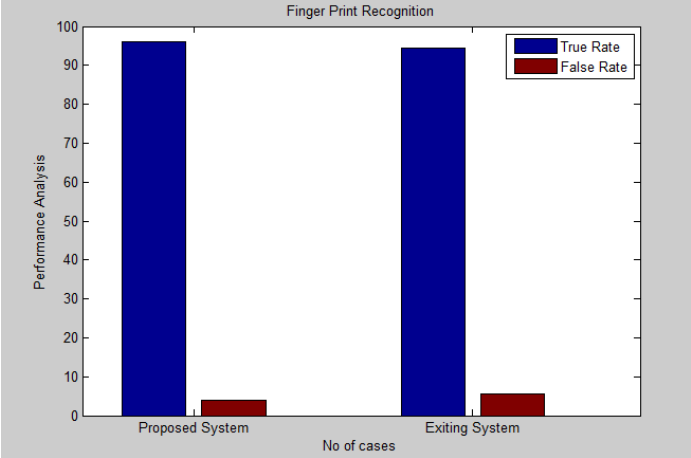

Figure 5: Comparison Graph for Existing and Proposed System

REFERENCES

[1] C M Ng, Vincent Ng and Y Lau, "Regular Feature Extraction for Recognition of Braille", IEEE, pp. 302 – 306, 1999.
[2] Jia Yin, Lirong Wang, "The Research on Paper-mediated Braille Automatic Recognition Method", Fifth International Conference on Frontier of Computer Science and Technology, 2010.
[3] Srinath.S and C.N. Ravi Kumar, "An Insight into Optical Braille Character Recognition since its Conceptualisation", International Journal of Computer Applications, Vol. 33, Issue 6, 2011.
[4] S.Padmavathi, Manojna K.S.S, Sphoorthy Reddy .S and Meenakshy.D, "Conversion of Braille to Text in English, Hindi and Tamil Languages", International Journal of Computer Science, Engineering and Applications (IJCSEA), Vol. 3, No.3, 2013.
[5] Aisha Mousa, Hazem Hiary, Raja Alomari, and Loai Alnemer, "Smart Braille System Recognizer", IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 6, 2013.
[6] C.N. Ravi Kumar, Srinath.S, "A Novel and Efficient Algorithm to Recognize any Universally Accepted Braille Characters: A Case with Kannada Language", 2014.
[7] Aisha Mousa, Hazem Hiary, Raja Alomari, and Loai Alnemer, "Smart Braille System Recognizer", Vol. 10, Issue 6, No. 1, 2013.
[8] Samer Isayed, Radwan R.Tanboub, "A Review of Optical Braille Recognition", IEEE, pp. 1 – 6, 2015.
[9] Salah C.and A. Ranjith Ram, "A Review Paper on Malayalam Text to Braille Transliteration", International Journal of Current Engineering and Technology, Vol. 5, No. 4, pp. 2347 – 5161, 2015.
[10] C. Vignesh and Mr. M. Senthil Kumaran "Optical Character Recognition For Visually Challenged Persons", International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE), Vol. 14, Issue 1, 2015.
[11] Himali Parekh, Stuti Shah, Feni Patel and Hardik Vyas, "Gujarati Braille Text Recognition: A Review", IJCSE, Vol. 7, No. 1, pp.19-24, 2016