



Braille to Speech Conversion using seam carving algorithm

Dr.V.B.Pagi¹, Pooja Desai²

¹Department of Computer Science and Engineering, Basaveshwar Engineering College, Bagalkot, Karnataka, India

²Department of Computer Science and Engineering, Basaveshwar Engineering College, Bagalkot, Karnataka, India

Abstract - The Braille is a form of written language for visually impaired people for writing and reading. Visual people not able to understand Braille hence to bridge the communication gap between visual and visually impaired people introducing a system Braille to speech conversion in this way blind people can improve their knowledge by communicating with outside world. In the proposed first the scanned Braille image is pre processed seam carving algorithm used for line segmentation and converted in to text using look table concept each alphabet is placed on different position based on their position in Braille cell and in the next step the extracted English text is converted in to speech by using speech synthesis.

Keywords- Braille Conversion; Seam carving algorithm; Look up table; text to speech conversion

I. INTRODUCTION

Braille is used by the blind people for reading and writing. By using Braille blind people can communicate and Interact. founder of the Braille language is Louis Braille he established in the year 1824. He was born on 1809 in a small town near Paris he attend school with sighted people for 2 years even though he was blind at the young age He comes to know that he is not able to learn more because he was not able to read or write. It's not like the script that used by the sighted people for reading this we need a sense of vision blind people can read Braille through sense of touch. Braille gives a different method of writing for visually challenged compare to others. Combination of six dots forms an alphabet where each character made of different raised dots and combination of six dots is called as Braille cell it is code through which we can write and read many languages like English, kannada ,Arabic etc. Letters of an alphabet is identified based on the different position of the dots and these dots are made by punching on thick paper. Braille makes the person who read they feel dots under their finger print based on that they recognize the word. In India around 15 million people are blind so its blindness is the one of the highest disability among other. Each character in Braille is six dots cell three tall and two wide in these six dots any dot may exist it forms 64 possible characters. Below Figure 1.1 shows the dimensions of Braille cell.

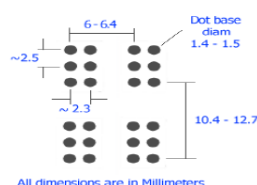


Figure 1.1: Braille cell

In Braille script the each cell meaning is depends on the language we are writing there are different types of code for the different language. In our project we are mainly concentrating on conversion of Braille in to English text then we will convert it

to speech. There exist three levels of coding in English Braille those are grade1 ,grade 2 and grade 3. In first level it includes character by character translation of each letter in English alphabet. The below figure shows the English Braille Alphabet from "a" to "z". Grade 2 Braille saves the space compare to grade 1. In Grade 2 each word is reduced into single character it contains the contraction or abbreviation of the word. The below Figure 1.2 shows the Braille alphabets.

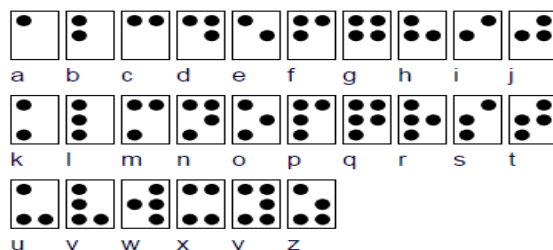


Figure 1.2: Braille Alphabet

The Braille scanned document is converted in to text next step is to convert the obtained text in to speech. It is done by using text to speech synthesizer this the technology by using the computer can speak the whatever input text is given. The text to speech conversion consists of main two stages. The first stage text is analyzed converted in to other linguistic representation or phonetic form and in next step speech wave forms are generated. These two steps are called high level and low level synthesis. Here input can be from scanned text from books , text messages in mobile , information in word processor.

II. LITERATURE SURVEY

Literature Survey gives the knowledge about different methods that are proposed to implement the defined problem.

The find counter method is used for recognizing the Braille character [1]. First webcam is used for capturing the Braille letters. To make the recognition easy Image processing is necessary image cropping is used to get the specific area from the captured image. Gray scaling converts original image in to gray image. Adaptive thresholding is used to make binary image. Count of the black dots are calculated using find counter method using opencv commands. segmentation of each Braille character is done. Look table is used for recognition of Braille character. This system gives 100% accuracy when the Braille image titled from 0.5 degree.

The implementation of Braille to English text and speech converter developed by FPGA method and hardware is developed by using FPGA [2]. FPGA play important role in this system. Though this system we can read or write English word. VHDL or embedded programming languages are can also be used for writing code. FPGA Spartan 3 IC is efficient, it uses less power and fast. Spartan 3 IC its internal hardware can be adjustable according to software coding.

The proposed method used to identify the Braille code from the Braille scanned sheet and convert in to text. Median filter is used reduce noise. Segmentation is done to extract the Braille cell based on 3*2 matrix of same size for each cell this step is done using histogram and region of interest and image enhanced by smoothing image. Patter recognition is done using dot patterns. The algorithm employed [3] here creates a Braille data base using MATLAB. The algorithm proposed here includes all the steps like segmentation, histogram analysis, pattern recognition based on dots and finally does the summation of all in the Data Base library.

The proposed method [4] it does the segmentation in two stage to calculate inter point Braille dots we need to identify recto and verso dots. In first stage horizontal projection method is used for Braille line segmentation and in second stage vertical projection profile is used for Braille word segmentation both these techniques are integrated with the distance threshold to segment Braille character. In this paper they maintained the quality printed Braille document which does not have any overlapping of dots.

The enhancement of Braille image by using Frequency domain filtering approach. Recognition of dots in Optical Braille Recognition system is important. It is necessary to reduce the amount of noise present while taking the image of Braille. Thus to overcome this problem author proposed [5] unsharp masking, high-boost filtering and Homomorphic these are frequency

domain enhancement technique filtering for Braille Image enhancement. High boost filtering is better than the Gaussian filter high pass filter when we compare through performance wise.

The proposed method which is used to convert Kannada Braille character in to Kannada speech or text [6]. Here for segmenting Braille dots thresholding automatically algorithm is used and a novel algorithm is used to identify characters. These algorithms were developed based on and dev Xilinx Spartan 3E FPGA and for these execution is done in real time. Braille detection and segmentation has around 94% of accuracy. The Kannada Braille character identification algorithm is much better than existing method which are based on FPGA.

The accomplishment for converting Braille to text and speech based on FPGA Spartan3 kit. Braille keypad is used to give input that consists of combination of different cells. The input is given to FPGA Spartan3 Kit. Based on the combination of dots within each cell FPGA kit converts in to English text it is done through the decoding logic in VHDL language. After converting in to English text we need to convert in to speech by using algorithm [7]. By using LCD data is displayed it can be done by interfacing with the LCD to the Spartan 3 kit. The whole system is given through the IOB, CLB, Block RAM, Multiplier blocks, DCM of the FPGA simulation is being carried on Xilinx Impact software.

The author proposed [8] method which converts scanned Braille image in to equivalent text in English language and other Hindi and Tamil languages. Each Braille cell is segmented when it identifies the start of the Braille sentence for this projection profiling is used and after this grids are drawn by using cells measurement here dots present in each cell is extracted. Based on pattern of binary we can convert in to corresponding letter. Speech synthesizer is used for speaking the text which is identified in first stage. From language to language the mapping differs.

The author proposed method for which image of Braille is segmented using new method that is Between-Class Variance with the Gamma distribution [9]. Here the computational time is reduced by using optimal threshold value. All histogram modes are Braille image is captured by using this Between-Class Variance and with the Gaussian distribution. These histogram modes are separated by using threshold. A very good result gave by experimenting different images. In future enhancement they will propose method to detect Braille dots also from the Braille images.

The author proposed method for the recognition of double sided embossed Braille document, with simple Braille dot analysis. The algorithm employed [10] has two main tasks, printed Braille dots recognition and other is to differentiate them as recto and verso dots. Thresholding, mask design, centroid detection, placement of designed mask on the centroid detected dots and differentiating recto dots from verso dots like processes is involved.

The author proposed some of image processing techniques which are used for conversion of an imprinted Braille image in to character. Without losing any information colored image is converted in to binary image and Median filter is used to remove impulse noise. The concept of divide and rule adapted [11] is used for patten extraction in first step image is segmented in to lines then every line is segmented in to Urdu character. Through this issues of white pixel unsymmetrical shape and misalignment is overcome.

The text is converted in to speech by using Text-to-speech synthesizer by processing and analyzing text based on Natural Language Processing and to convert obtained text in to synthesized speech Digital Signal Processing technology in [12]. Many steps are used in text-to-speech synthesis first it takes the text for the input after that transform in to phonetic description in the next step it generates the prosody after getting this information speech signals are generated.

The text is converted in to speech using different speech synthesis proposed in [13]. It consist of two main steps. In first step input text is converted in to phonetic form and in second step speech waveforms are generated. Here the concatenation of speech is done using domain specific speech synthesis for converting numerical text to speech, phoneme based synthesis it consider the input text as word and produces the speech and unit selection speech synthesis is used for sentence input. These systems are mainly useful to handicapped and visual impairments.

III. PROPOSED SCHEME FOR BRAILLE TO SPEECH CONVERSION

The proposed model is shown in the below Figure 3.1 first the scanned Braille image is converted in to text then obtained text is converted in to speech by using speech synthesis.

Procedure of the proposed system:

1. Scanned Braille document : The Braille documents are collected and scanned using flatbed scanner these scanned document image is taken as the input for the further processing. It goes through pre-processing.
2. Conversion of scanned image to Binary image: Convert the scanned Braille image to binary image, based on the threshold and the output image replaces all pixels in the input image with luminance greater than level with value 0 (white) and replaces all other pixel with value 1 (black) here the compliment of binary image is taken.
3. Image enhancement: Dots in the background are can not be differentiated clearly from the background due to scanning noise will be present in the image. It erodes the binary image gives the eroded image. Erosion makes boundary of the binary image to shrink.
4. Line segmentation: Seam curving algorithm is used to extract dots present in a line from the Braille scanned document. It is one of the important step in pre processing for recognition Braille. Seam curving resize the image by taking the content present in the image in to consideration. Here seam is path from right to left through the image and it finds the optimal seam which contain less information so that we can concentrate on Braille dots remove the content which contain less information. In our project we used this concept to get starting point of Braille and segment the Braille image in via lines the dots present next line also extracted.

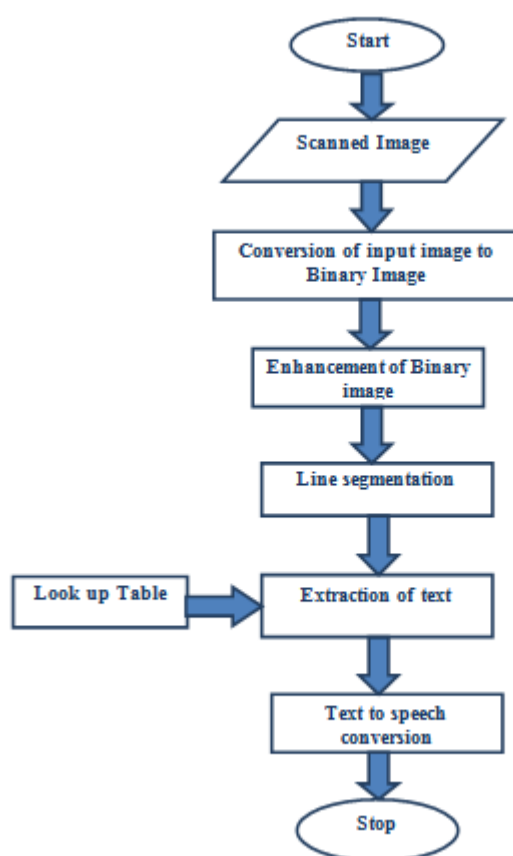


Figure 3.1: Flow chart for Proposed Model

5. Extraction of character from Look-up Table : This table is used to extract character. Here according dots present in the place three rows and two column cell. where ever 1 present in the cell taken and calculate the value. For example the letter "a" is present in first position in look up table "a" is present in the first table and "b" is present 1st and 2nd position in the Braille cell for that we calculate decimal value after this "b" is placed in the 3rd position the procedure continued until we find the positions of all the alphabets. This process is used to extract character from the table.

6.Text to Speech Conversion : The conversion of text to speech is done using speech synthesizer. It is the artificial production of human speech matlab function is used for this. A computer system used for this purpose is called a speech synthesizer, and can be implemented in software or hardware. A text-to-speech (TTS) system converts normal language text, into speech.

IV. RESULTS

In this proposed system the English characters are extracted from the scanned Braille image. Here the below Table 6.1 shows the accuracy result of character and word present in a sentence it is tested on 10 different image of Braille.

Table 4.1: Accuracy of words and characters

Input	Accuracy Word(%)	Accuracy Character(%)
1	66.66	86.333
2	84.62	92.12
3	75	93.75
4	66.66	94.45
5	66.66	91.66
6	80	95.46
7	80	95.86
8	83.33	95.65
9	87.5	94.29
10	86.55	95.49
Total Accuracy	77.70	93.51

The Figure 4.1 below shows the accuracy result in bar graph. It is based on the accuracy of character and words calculated on 10 different input images.

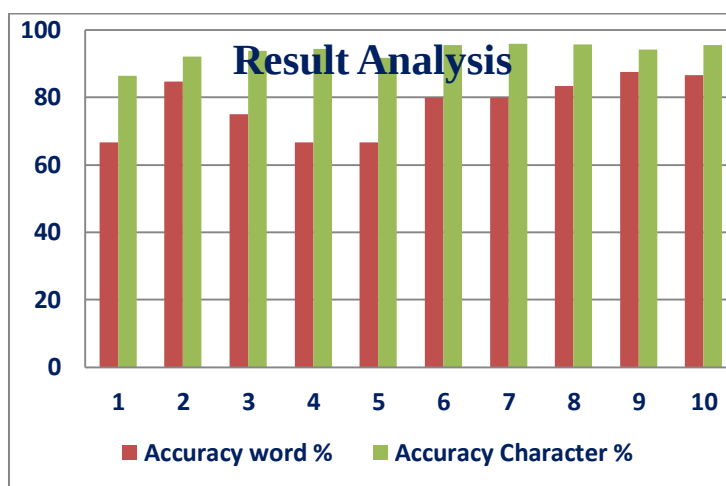


Figure 4.1: Bar graph for accuracy

V. CONCLUSIONS

The proposed system is used to extract the corresponding English letters from scanned Braille Image. After extracting text from Braille document it is converted in to speech using speech synthesizer. The proposed approach uses seam carving algorithm for

text line segmentation and it does not consider unwanted space between two lines. Look up table is used to extract the characters. The extraction of dot is difficult if noise present during scanning is of same size compare to Braille dots. Here the experiment is conducted on different set of Braille images among them 93.51% of characters are recognized correctly some letters are wrongly detected. In future scope we can try to recognize characters of different language and also need to get higher accuracy by using other techniques.

REFERENCES

- [1]. Joko Subur, Tri Arief Sardjono, Ronny Mardiyanto, "Braille Character Recognition Using Find Contour Method", The 5th International Conference on Electrical Engineering and Informatics 2015 August 10-11, 2015, Bali, Indonesia.
- [2]. P. P. Chitte, Y. A. Pimpalkar, P. B. Nair, S. A. Thombe, "BRAILLE TO TEXT AND SPEECH FOR CECITY PERSONS", IJRET: International Journal of Research in Engineering and Technology, eISSN: 2319-1163 | pISSN: 2321-7308.
- [3]. K.Parvathi et al.(2015). Odia Braille:Text Transcription via Image Processing. International Conference On Futuristic Trends in Computational Analysis and Knowledge Management, IEEE
- [4]. Shreekanth.T 1 and V.Udayashankara2, " Braille Image Enhancement using Frequency Domain Filtering Approach for Optical Braille Character Recognition", *Proc. of Int. Conf. on Recent Trends in Signal Processing, Image Processing and VLSI, ICrtSIV*.
- [5]. Shreekanth.T, V.Udayashankara, "A Two stage Braille Character segmentation approach for Embossed double sided Hindi Devanagari Braille documents", 978-1-4799-6629-5/14/\$31.00_c 2014 IEEE.
- [6]. Sudhir Rao Rupanagudi, Sushma Huddar, Varsha G. Bhat, Suman S. Patil, "Novel Methodology for Kannada Braille to Speech Translation using Image Processing on FPGA". 2014.
- [7]. Prof. P.R.Rodge, Rejan Thomas, Suyog Pawar, Ashish Rai," Braille to English Converter" International Journal of Advance Foundation And Research In Science & Engineering (IJAFRSE) Volume 2, Special Issue , Vivruti 2016. Impact Factor: 1.036, Science Central Value: 26.54
- [8]. 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, June 2013.
- [9]. Sudhir Rao Rupanagudi, Sushma Huddar, Varsha G. Bhat, Suman S. Patil, "Novel Methodology for Kannada Braille to Speech Translation using Image Processing on FPGA". 2014
- [10].AbdulMalik AlSalman, 2Ali El-Zaart, 3Saleh Al-Salman, 4Abdu Gumaei, "A Novel Approach for Braille Images Segmentation", 978-1-4673-1520-3/12/\$31.00 ©2012 IEEE.
- [11]. Mohd Wajid, Mohammad Waris Abdullah, Dr. Omar Farooq, "Imprinted Braille-Character Pattern Recognition using Image Processing Techniques", 2011 International Conference on Image Information Processing (ICIIP 2011).
- [12]. Hay Mar Htun, Theingi Zin, Hla Myo Tun " Text To Speech Conversion Using Different Speech Synthesis",INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 4, ISSUE 07, JULY 2015
- [13]. Kaladharan N " An English Text to Speech Conversion System" Volume 5, Issue 10,International Journal of Advanced Research in Computer Science and Software Engineering