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A Review of Kannada Text to Braille Conversion

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Abstract:
Kannada is one of the ancient Dravidian languages in India. Braille is a boon for the visually impaired community and the only way for reading and writing communication. Due to the versatile nature of the Kannada script very moderate amount of research work is carried out in conversion of Kannada script to Braille. This paper emphasizes on the basics and the nature of Kannada script and Braille language. And it describes several researches carried out in converting different Indian languages to Braille. Attention drawn to various algorithms and techniques used for the conversion. It stresses on challenges and consideration related to the Kannada text into Braille conversion. If research work is carried out in this field, it would be possible to convert novels, newspapers, articles, etc. In Braille language for visually disabled people.

Keywords: Braille script conversion, OCR, Kannada.

I. INTRODUCTION

India is a multilingual country. There are various language scripts such as Hindi, Bangla, Punjabi, Rajasthan, Malayalam, Marathi etc. and Kannada is one of them. OCR is an important topic in pattern recognition and image processing for automatic document analysis and recognition. In general enormous amount of work has been done on OCR for various Indian languages. There are huge complex character sets in these languages.

Kannada Script:
Kannada script is written horizontally from left to right and the lower and upper case concept is absent. Language has 16 vowels and 34 consonants as the basic alphabet viz**.** swargalu and vyajangalu in Kannada. Vowels and Consonants of Kannada script are shown in Figure 1 and Figure 2.

ಅ ಆ ಇ ಈ ಉ ಊ ಋ ೠ ಎ ಏ ಐ ಒ ಓ ಔ ಅಂ ಅಃ

Figure.1. Vowels of Kannada Script

ಕ ಖ ಗ ಘ ಙ

ಚ ಛ ಜ ಝ ಞ

ಟ ಠ ಡ ಢ ಣ

ತ ಥ ದ ಧ ನ

ಪ ಫ ಬ ಭ ಮ

ಯ ರ ಲ ವ ಶ

ಷ ಸ ಹ ಳ ಕ್ಷ ಜ್ಞ

Figure.2. Consonants of Kannada Script

The possible consonant-vowel combinations are 16*34 =544 characters. And these characters can be one of the following,

1. Stand alone vowel or a consonant
2. Consonant with a vowel.
3. Consonant with same or other consonants.
4. Consonant- consonant with a vowel.

Ottaksharas can be formed by using above third or fourth combination. Some of the ottaksharas are given in figure 3.

ಲ್ಲ ಕ್ಕ ಳ್ಳ ಫ್ರಾ ಷ್ಣ ಡ್ಡ ಗ್ನ

Figure.3. Ottakshargalu in Kannada

Braille Language:
Braille was invented by Louis Braille in the year 1824. In Braille, an alphabet is made from a combination of six dots arranged in two columns and three rows as shown in figure 4. Each character in Braille consists of one or more raised dots. The position of the different dots represents the different letters of the alphabet. These dots are made by punching an all, a sharp pointed tool used for making holes in thick paper.

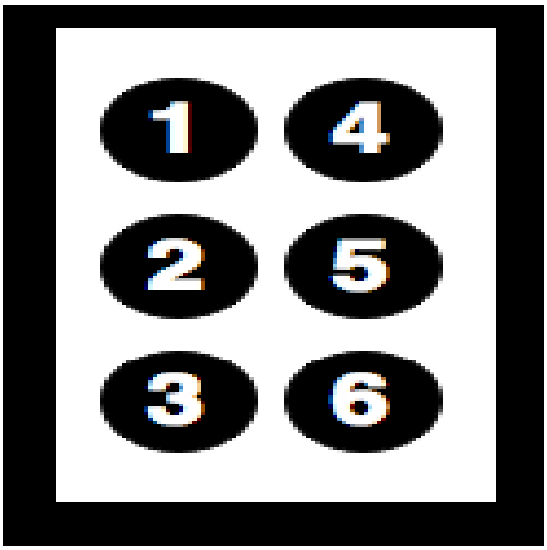


Figure.4. Braille Cell

A typical Braille page consists of about 25 lines and approximately 40 characters/line. This is about half of what fits onto a page written in other language text as standard typing fits approximately 80 characters per line and about 50 lines onto a

page. In addition to this, Braille pages are much heavier and thicker than standard print and they are much larger. As Braille takes so much space, some people choose to learn contracted Braille, which is a shortened version of Braille and is also known as Grade 2 Braille. Unlike the original, longer version of Braille called Grade 1 Braille, Grade 2 Braille uses single cells to represent entire words or phrases, instead of just a single letter. Some example words are shown in figure 5.

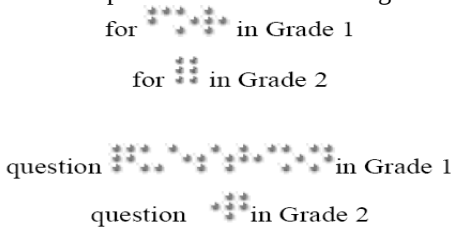


Figure.5. Examples of Grade1 and Grade2

A printed sheet of Braille normally contains upwards of twenty five rows of text with forty cells in each row. The physical dimensions of a standard Braille sheet are approximately 11 inches by 11 inches. The dimensions of the Braille cell are also standardized, but these may vary slightly depending on the country. The dimension of a Braille cell, as printed on an embosser is shown in figure 6.

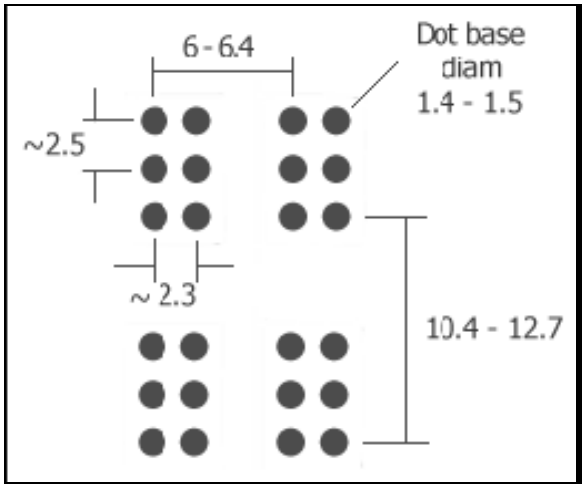


Figure.6. a Braille Cell Dimension (In Millimeters)

All dots of a Braille page should fall on the intersections of an orthogonal grid. When texts are printed double-sided (recto-verso), the grid of the verso text is shifted so that its dots fall in between the recto dots as shown in figure 7.

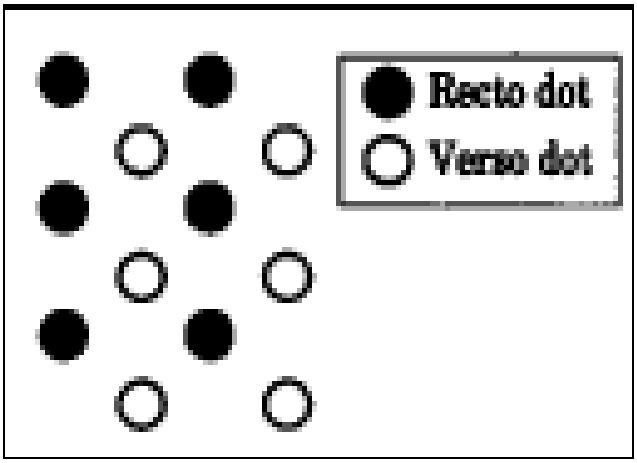


Figure.7. positioning of recto and verso braille.

II. LITERATURE REVIEW

The overview of some of the research work related to the conversion of various languages to Braille is as follows:

Kirti Nilesh Mahajan and Niket Pundlikrao Taine [1], presents research work in the area of pattern recognition. The main purpose of the paper is to study the appropriate identification of the Indian ancient script using pattern recognition techniques. MODI (Marathi) is an Indian ancient script which is normally preferred in western and southern part of India. It emphasis applying different pattern recognition techniques on MODI script and transliterate into readable and an audible format for visually impaired people.

Apoorva Raghunandan and Anuradha MR [2], paper objective is to design and develop a Braille System and output devices for the visually impaired individuals that enable them to interact and communicate. This study proposes an algorithm which enables the user to convert the text that we normally have in our day to day usage into a Braille Script and thus facilitate the visually impaired. The Product that has been created is an intuitive and simplistic design that will enable the end user to comfortably read. This method uses the microcontroller PIC16F877A, fewer components, is lightweight and flexible, requires less power and is easy to operate. Many languages can be used in it. It also uses Raspberry Pi, a Low-Cost Text to Braille Converter, it has a functionality of Text to Audio conversion to help the visually impaired in either reading books or listening to it. The low power consuming FPGA board is implemented to convert Braille to text very efficiently. One main advantage of the FPGA of Spartan 3 IC is that we can adjust the internal hardware circuitry according to the software coding.

Kaustubh Bawdekar, Ankit Kumar and Rajkrishna Das [3], have presented an algorithm which enables the user to convert the English text in Braille Script and thus gives impetus for the visually impaired to read that text. The Product will be very intuitive and simplistic in design that will enable the end user to feel familiar and at home with the product.

Mr. Vrushabh S. Dharme and Mrs. S. P. Camera [4], This paper is hammered out to concatenate the problem of blind people regarding their reading of e-book and e-text and the blind people will be beneficial to read the digital book in their English Braille language. They designed a hardware that accepts English text and converted into Braille with an automated value thresholding algorithm. This system is flexible, low cost and portable.

Salah C. and A. Ranjith Ram [5], Blind people disabilities made them to have less access to computers, study resources and higher quality educational software than the people with clear vision. This paper presented a brief survey of character recognition and transliteration of Malayalam scanned books and magazines in Braille. The printed Malayalam text to a Braille transliteration system using SVM is a fast, low cost and accurate solution.

Bijet Maynoher Samal, K.Parvathi, Jitendra Kumar Das [6], Introduces an algorithm that makes the best use of segmentation, histogram analysis, pattern recognition, letter arrays, database

generation with testing in software and dumping in using Spartan 3e FPGA kit. It also emphasis on the reverse conversion of native languages and English to Braille. This is a mean for a successful approach in both software and hardware.

Syed Akhter Hossain, Lora Annanya Biswas, and Md Iqbal Hossain [7], Implemented Bangla-2-Braille machine translator using a rule based DFA, facilitated the necessity of generating regular expression from the DFA in order to validate the language model for the Bangla Braille generation and extended the translator for better usability by the visually impaired people. They conducted experiments using structured and state elimination method to generate valid regular expressions from the DFA, designed for Bangla-2- Braille machine translator. The generated expressions were tested for language rules and the results were found satisfactory for Bangla-2- Braille machine translation. From the above survey, it is clear that enough work is done in conversion of different languages to Braille, but not much work is done in Kannada to Braille conversion.

III. CHALLENGES

Following are some of the challenges to be considered while converting Kannada to Braille. In Braille language, Braille characters are made up of cells with 6 dots, and total 64 characters can be formed from it. But in Kannada script there are total 544 characters with vowel and consonant combination. The complex words in Kannada are not having a separate Braille cell. Before converting complex words into Braille, they have to be rewritten in expanded from using vowels and consonants. Figure 8 and 9 shows the Kannada complex word and its expanded form respectively. The expanded form of Kannada is converted into Braille representation as shown in following figure 10.

ಕಿರುಚು

Figure.8. Kannada word in its normal form

ಕ್ ಇ ರ್ ಉ ಚ್ ಉ

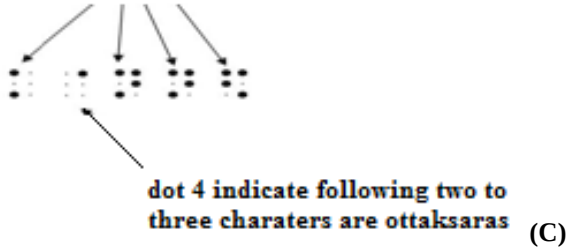
Figure.9. Expanded form

Figure .10. Kannada braille version

Similar to complex words for Ottakshara also, Braille makes use of expanded form as shown in figure 11. For this, a special Braille cell with dot 4 embossed is used to indicate that the following two or three characters are to be read together to represent Ottakshara in Kannada.

ಕನ್ನಡ **(A)**

ಕನನಡ **(B)**



(C)

Figure.11. ottakshara with combination of same consonant (a) normal kannada representation (b) expanded form (c) braille notation

Another important consideration is, the Braille word building also depends on the pronunciation of the words. It is spelled as it is pronounced in expanded form. So, to convert Kannada text into Braille above mentioned challenges are to be considered otherwise the meaning of the text may change. For representing 0-9 digits in Braille, the vowel cells themselves used along with digit identifier to indicate that the following character is digit as shown in figure 12 and figure13.

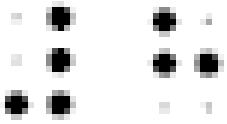


Figure.12. Braille equivalent for digit 8

Figure.13. Braille equivalent for digit 123

IV. APPLICATIONS

Knowledge resources available for blind people in Braille script are rare; they can only get their academic books. The printed Kannada text to Braille transliteration system finds interesting applications in various fields viz, libraries, offices where the instructions and notices are to be read, and in assisting filling of application forms. Novels and news sources are hardly available in Braille. With this system along with a Braille embosser, we can provide a large number of Kannada novels and literature in Braille. By this conversion system, it is possible that all the study material, such as an e-book, scanned papers etc., available to the blind people. The system will be used for reproducing most textbooks and publications.

V. CONCLUSION

The paper describes that a reasonable amount of work is done in various languages to Braille conversion. But still more and accurate work is required in the conversion of Kannada text to Braille. So, efficient technology should be developed to assist visually impaired people. If work is carried out in this domain, then literature will also increase for visually impaired people. It is also useful for associated people who want to learn about the Braille language.

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