Research on Input Sign Information Based on Braille Speech Recognition

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Keywords: Blind text editing, Braille Chinese Character Dot Coding(BCDC), Speech recognition, Text to speech convert.

Abstract. This article is about the software design method of Braille cross platform editing. First, we design Braille Chinese characters dot coding. And then we use Nondeterministic Finite Automaton (NFA) to describe the conversion process between Braille and Chinese words dot coding and use Reverse Order-Splitting-Sets(ROSS) to determine the NFA. Finally, the phonetic sequence of Braille Chinese characters point position coding is used as the phonetic notation of the Braille, in which case the algorithm of speech recognition. The software can enhance the blind human-computer interaction.

Introduction

Project instructors found that the ability of the blind to apply information technology is lower than the same grade students. Main problems:

Multi-version of Braille Font is not Compatible

China Braille Publishing House(CBPH) developed the sunshine software and produced a 6-point braille font. But the Yongde blind software also has its own blind text font, China Braille Publishing House Braille font is not compatible. The respective software can only be used in own font environment and different versions of the braille cannot be mixed with each other.

Lack of Braille Speech Recognition and Text Conversion Research

There’s no differences between braille input text information input method and ordinary input method and they both use Pinyin input method. Symbolic information cannot be entered in some areas such as mathematical formulas and so on. So it is also very difficult for the blind use of computer to learn the knowledge of these disciplines.

Braille is essentially a set of symbols that do not have their own pronunciation. There are many researches on speech recognition and grammatical conversion in Chinese, and no scholars have studied those of Braille.

If you can use the voice recognition technology to enter the braille and use the text conversion technology to output Braille, it will solve the above problems. Besides, it is meaningful for the blind to learn Braille and subject knowledge.

The Application of Blind Machine Translation is Inadequate

Braille has its own set of independent rules in the expression of information, especially the Braille ligatures. In the machine translation, it’s better to use rules for Braille word segmentation, and then converted to the corresponding pinyin. At present, China is using the current Braille, each Chinese character is expressed by two braille words that one side said the initials, one said the finals. The current Braille has inherent defects when it comes to expressing Chinese characters, making blind Chinese or Han blind conversion rate cannot reach 100% and the best is reach 98% [1][2]. Although
the correct rate of conversion has been very satisfactory, the braille reading habits are different from
Chinese characters’. Even if the individual Braille mistakes exist, they will accurately prevent
understanding the semantics.

**Software Design Feasibility Analysis**

**Put forward Braille Chinese Character Dot Coding (BCDC)**

To solve the problem in front, you ought to put forward the design of Chinese characters dot coding.
The six points in the braille, respectively, expressed with the number 1-6, such as the first row of
the first one point called 1:00, and so on. As shown in Figure 1, in the actual use, the computer with
black spots raises the point to read, for example,  
read as “one three five point”, and "one three
five point " as the Braille Of the Chinese characters dot coding(BCDC).

![Figure 1. six-point Braille position.](image)

Chinese character code design is also used in accordance with Braille reading habits. The design
of the Chinese characters dot coded as "one three five point". As shown in Table 1, a list of 64
braille and BCDC is listed. Among them, more than five points (including) are denoted by the
shortcomings, for example, expressed by “lack six side”, rather than “one two three four five
point”. The purpose is to reduce the number of Chinese characters in the braille, making it more
concise.

**Uncertainty of the Feasibility of whether Braille Trans-coding Can Make the Finite
Automaton Implements Machine Translation for Braille and Chinese Character Dot Coding
Come True or Not**

Assuming that L is a set accepted by an indeterminate finite automaton, there is a finite automaton
that accepts L.

Nondeterministic Finite Automaton can describe the process of converting the braille and the
Chinese character and the finite automaton must be certain. Determining the finite automaton is
able to achieve through programming. Therefore, Braille and Chinese character coding of the
machine translation theory is feasible.

The determination of uncertain Braille Trans-coding finite automaton is the basis and key to the
implementation of Braille Chinese character bit coding. In order to solve this problem quickly and
easily, the project proposes a reverse subset method to determine the finite automaton, realizing the
machine translation algorithm. In the implementation process, the conversion process needs to be
regular. Three rules are proposed: the principle of maximum reverse match, the principle of order
uniqueness and the principle of final state inequality. The specific steps of the ROSS we designed
and algorithms do not go here[9].

**Experimental Verification of the Feasible of Braille Chinese Character Code to Solve the
Blind Text Library Compatibility Issues**

The zip code of the braille is encoded as an intermediary between different brains. In a sense, the
braille font and the braille Chinese character coding is unified. Braille Chinese character coding can
eventually be converted to ordinary Chinese characters sequence. From the perspective of the blind
is Braille, but from the computer point of view, is a group of Chinese characters sequence. After
achieving the blind text of the machine code from different companies and conversion of the braille
to Braille Chinese characters, the storage, transmission, printing and other operations can be carried
out.
Table 1. Braille and Braille Point Chinese character comparison table.

<table>
<thead>
<tr>
<th>BCDC</th>
<th>Braille</th>
<th>BCDC</th>
<th>Braille</th>
<th>BCDC</th>
<th>Braille</th>
<th>BCDC</th>
<th>Braille</th>
</tr>
</thead>
<tbody>
<tr>
<td>one point</td>
<td>three five point</td>
<td>two three five point</td>
<td>one three four six point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>two point</td>
<td>three six point</td>
<td>two three six point</td>
<td>one three five six point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>three point</td>
<td>four five point</td>
<td>two four five point</td>
<td>one four five six point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>four point</td>
<td>four six point</td>
<td>two four six point</td>
<td>two three four five point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>five point</td>
<td>five six point</td>
<td>two five six point</td>
<td>two three four six point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>six point</td>
<td>one two three point</td>
<td>three four five point</td>
<td>two three five six point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one two point</td>
<td>one two four point</td>
<td>three four six point</td>
<td>two four five six point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one three point</td>
<td>one two five point</td>
<td>three five six point</td>
<td>three four five six point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one four point</td>
<td>one two six point</td>
<td>four five six point</td>
<td>lack six side</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one five point</td>
<td>one three four point</td>
<td>one two three four point</td>
<td>lack five side</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>one six point</td>
<td>one three five point</td>
<td>one two three five point</td>
<td>lack four side</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>two three point</td>
<td>one three six point</td>
<td>one two three six point</td>
<td>lack three side</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>two four point</td>
<td>one four five point</td>
<td>one two four five point</td>
<td>lack two side</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>two five point</td>
<td>one four six point</td>
<td>one two four six point</td>
<td>lack one side</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Feasible of Braille Recognition Speech Conversion Theory

To research on the braille for speech recognition and text conversion, we must first let the braille sound. It’s naturally to think of the Chinese phonetic as a braille sound. If the use of Chinese characters Pinyin only show the initials of the braille and the vowel of the rules, for example: “collapse”, pronunciation “beng”, expressed by the current Braille, the first party Braille means the initial "b", the second party Braille means the final "eng", the third party that the tone (the actual use of the tone is not marked). This way of the sound is too narrow, because the math, music, etc. cannot be converted into initials and vowels.

With Braille Chinese character coding as braille, the implementation of Braille recognition and text conversion is theoretically feasible. Current Chinese speech recognition technology has been able to identify Chinese characters and words. Braille Chinese character set $\Psi$ is a typed finite Chinese character table, $\Psi = \{\text{one, two, three, four, five, six, point, side, full, lack, null}\}$. Because of the $\Psi$ element combination of Braille, the number of Braille is 64, and then the number of braille characters coding is 64. So the bracelet Chinese word bit coding sequence is 64. Chinese pronunciation can be identified by the existing Chinese speech recognition technology $\Psi$ will be able to identify 64 braille Chinese characters coding sequence. So the speech recognition of Braille is theoretically feasible.

Summary

(I) Put forward Braille Chinese character coding ideas, enhance the compatibility of different Braille versions, and enhance the usability of Braille multi-platform.

Put forward the idea of Chinese characters in braille. Construct bridges between braille and Chinese characters. Realize conversion between Braille and Braille Chinese Characters. As Braille Chinese characters are converted to Braille, you cannot consider the Braille font version. It is still able to use Braille Chinese characters dot coding to express Braille even in the absence of blind text on the computer or electronic equipment so that the expression of Braille does not depend on the literal font, does not depend on the device difference. As long as you can display Chinese characters, you can express Braille, which enhances the availability of Braille multi-platform.

(II) Design and realize the algorithm of interdependence between braille and Chinese characters.

The correspondences between the zip code of the Braille and the Braille. Proposed the application of uncertain finite automaton to express the braille and the Chinese character dot coding process. A reverse subset subgroup algorithm is designed to determine the automaton and implement the algorithm.

(III) This paper puts forward the phonetic concept of Braille and establishes the research foundation of Braille language recognition and textual translation.

Braille itself has only symbolic features that do not have the language of pronunciation features. The pronunciation of the braille as a braille. The Braille sequence encoded by Braille Chinese characters is used as the braille so that the braille with symbolic features only has the pronunciation features. Besides, the research foundation of Braille language recognition and text conversion is established.
Acknowledgement

This research was financially supported by the University Science Research Project of Jiangsu Province (NO. 16KJB520026) and by Undergraduate Training Program for Innovation and Entrepreneurship of Jiangsu Province (NO. 201512048010Y).

References


