



# **RECOGNITION OF AMHARIC BRAILLE USING DIRECTION FIELDS**

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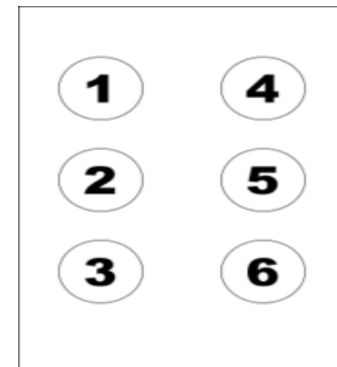
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# Outline

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# Background

- Braille is a means of written communication for the blind people
- A braille character is a rectangular array of six points arranged in two columns of three
- Each point is either raised or flat resulting in 64 ( $2^6$ ) possible braille character combinations
- Grade 1
- Grade 2
- Amharic braille representation



# Cont'd..

- Braille is usually read and written by blind people
- Conversion of braille documents into their equivalent print text documents is difficult
- There is a written communication gap
- A research that focuses on bridging this gap is indispensable

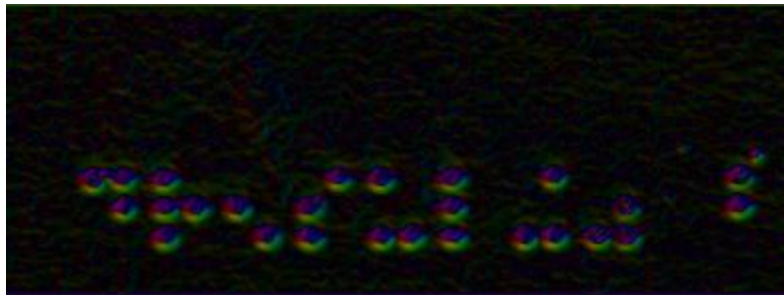
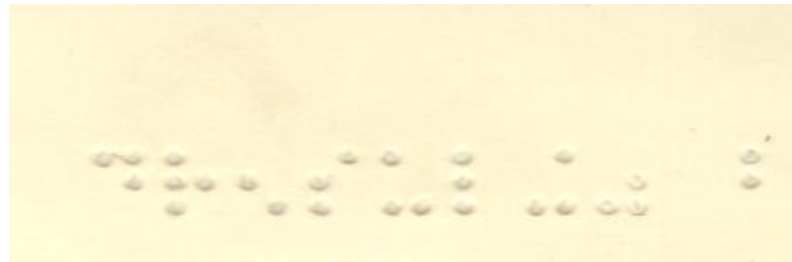
# Previous works on Braille Recognition

- Different researches have been undertaken for automatic recognition of braille documents for languages like English, Arabic and others.
- Two attempts at Addis Ababa University by Teshome Alemu and Ebrahim Chekol were done for Amharic braille recognition.

# Approach of the current work: preprocessing

- **Gradient Field:** is basically the change in gray level with direction
- **Direction Field:** represents the local direction of pixels. Unlike gradient field, direction field is able to amplify linear structures and suppresses non-linear structures
- **Thresholding:** is a simple mechanism to separate objects from the background the output of which is a binary/logical image
- **Skewness Correction:** is very important in cases where there is image tilting

# Comparison of Gradient field and Direction Field



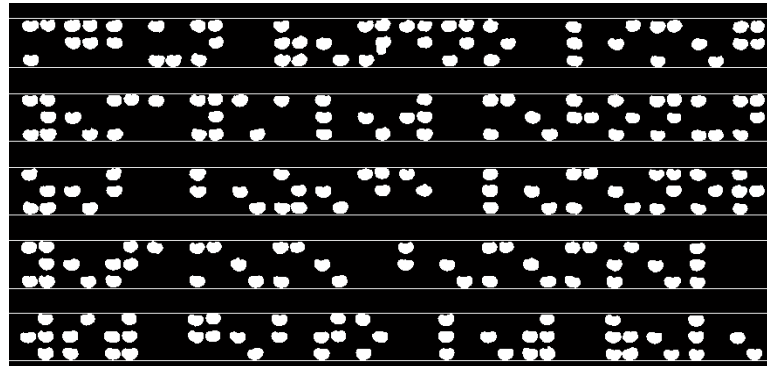
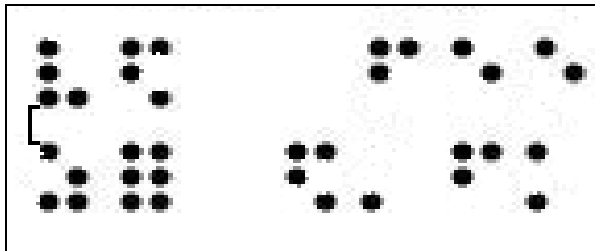


# Analysis of Important Braille Cell Values

- Dot height
- Dot width
- Two dot height
- Three dot height (braille character height)
- Inter-cell space
- Intra-cell space

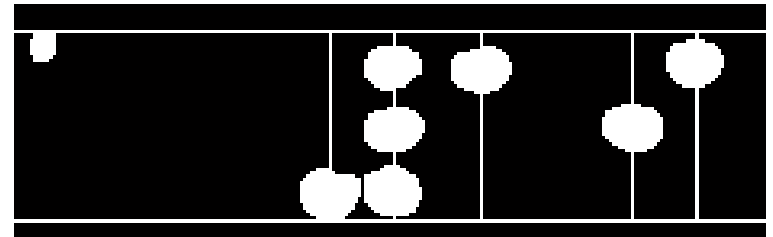
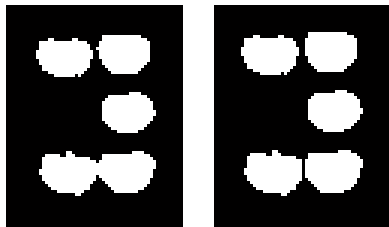


# Braille Character Line Identification



# Half-character Detection

- Half character refers to half of the braille cell, which is a column consisting of three dot positions
- Half character detection requires connected dots to be separated

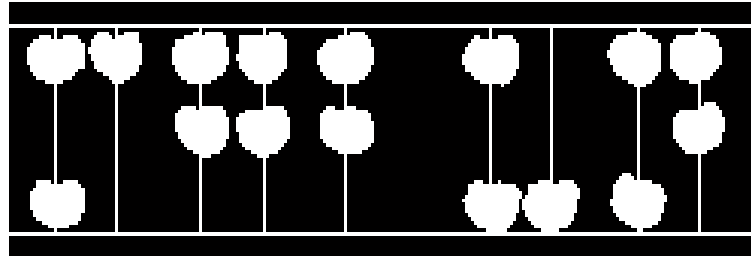


# Half-character Recognition

Half character	Value
○ ○ ●	1
○ ● ○	2
○ ● ●	3
● ○ ○	4
● ○ ●	5
● ● ○	6
● ● ●	7

- Analysis of the position of braille dots is used for recognition of the half characters

# Cont'd...



5 4 6 6 6 5 1 5 6

# Braille Cell Formulation

- Braille cell formulation refers to pairing half characters to form a braille cell



5 4 6 6 6 5 1 5 6 7 3

5	4
6	6
6	0
5	1
5	6
-1	-1
7	3
2	1

# Translation

- Analysis of the neighboring braille cells is the approach followed to differentiate braille cells that in group represent a print text from those that individually represent a print character
- Look up tables are prepared for Amharic letters, numbers, punctuation marks, and labializations
- The braille cells that are formulated are finally translated into their corresponding print text equivalents.

# Performance Evaluation

- Different braille documents (skewed, worn-out, and different contents) are used for evaluation of the system.
- Previous test documents are used for comparison purpose
- Our system achieved an average of 98.5% accuracy.
- We managed to achieve 99.9% and 96.5% accuracy for good quality and poor quality documents respectively.

# Application of the research

- The outcome of the research is believed to be instrumental for:
  - Bridging the written communication gap between the sighted and the blind people
  - Different libraries where braille documents reside
  - Non-governmental organizations that closely work with the blind people
  - Enabling the society to benefit from the knowledge and experience of the visually impaired people



# Conclusion

- In this study, an attempt has been made to design an automatic braille recognition system for Amharic language using direction field and other techniques.
- The result achieved for our Amharic braille recognition is encouraging.



# Future Works

- More criterions to examine dots
- Dealing with two-sided braille documents
- Post-processing activity
- Word and sentence level analysis to include some of the punctuation marks excluded in this study
- Keeping the format of the braille documents for duplication purpose



***Thank You!***