

# Optical Character Recognition for Braille



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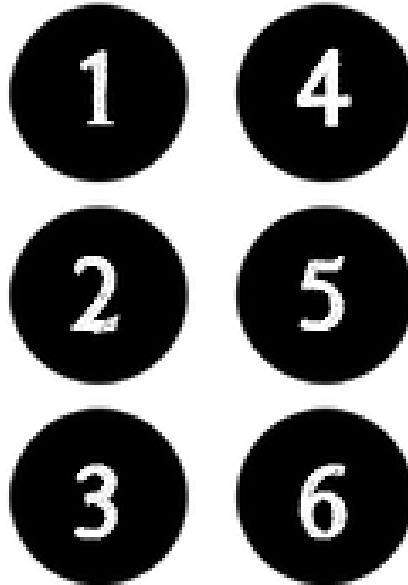
Date: 5 Dec, 2023

# Project Summary

1. **Key idea:** Convert images of hardcopy braille to electronic BRF files
2. **Stakeholders:** Teachers and students, Blind individuals, Historians
3. **Data used:** Labeled scanned images of braille characters
4. **Methods:** Search, Clustering, Convolutional Neural Network
5. **Evaluation:** Accuracy of character recognition
6. **Users:** Blind or sighted, braille reader or not
7. **Trust issues:** Accurate recognition, may recognize offensive text

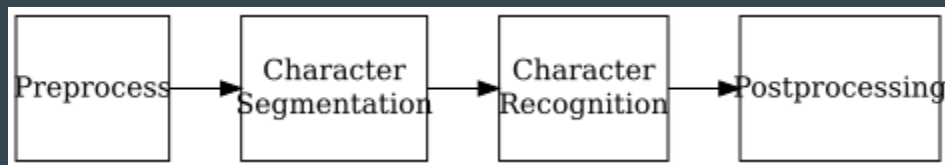
# Background Information

## The Braille Cell



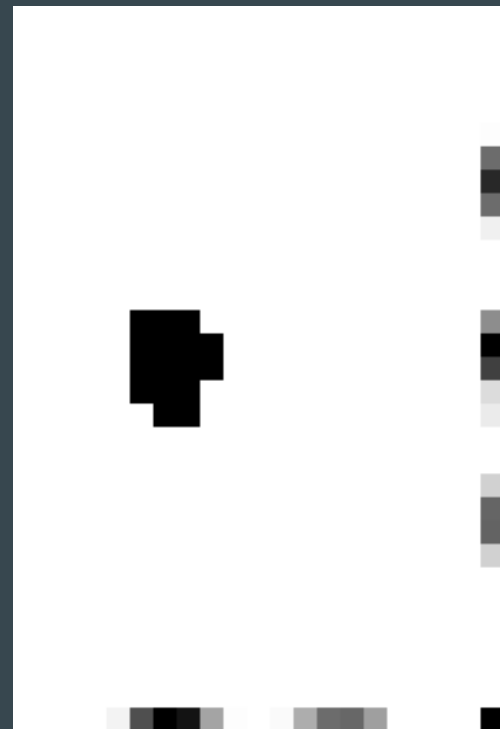
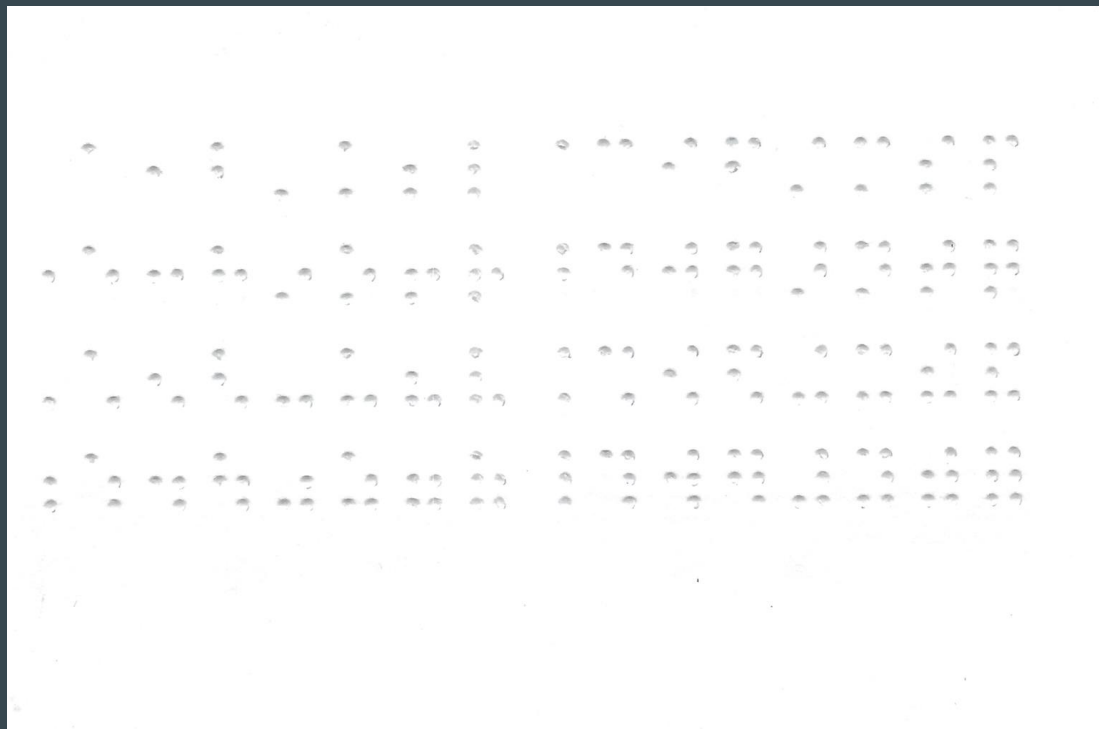
# Project Summary - Sprint 1

- Data: Produced by hand using slate and stylus and scanned using feeder scanner
- Method:



- Preprocessing: Filtering, Binarization, Deskew
  - Character Segmentation: Clustering, Linear Regression
  - Character Recognition: Convolutional Neural Network
  - Postprocessing: Lookup Table
- Chatbot: Basic rule based chatbot

# Data Example



# Project Summary - Sprint 2

## Evaluation:

- 100% accuracy on test set of the 64 characters
- 99.21% accuracy for realistic text block

## Limitations

- Requires consistent lighting over image
- Only corrects skew along rotational axis
- Requires multiple lines and columns of characters
- Assumes somewhat even distribution of dots
- Rule based chatbot with limited responses

# Project Summary - Sprint 3

- Compared with ChatGPT 3.5
- ChatGPT successfully answers general questions about braille
- ChatGPT could explain what a BRF file is when prompted that it is related to braille
- I did not get the chance to evaluate against GPT4 with image input capabilities

# Demonstration - Chatbot

User: Hello

Bot: Hello! I am a chat bot who can assist you in converting hard-copy braille into electronic braille.

User: What can you do?

Bot: I am your interface to perform Braille Optical Character Recognition (BOCR) on an image file. Ask me to OCR a file for you.

User: OCR a file for me.

Bot: What is the file path to the photo you wish to BOCR.

User: ../test/validation.png

Bot: Thank you, I will begin the BOCR process.

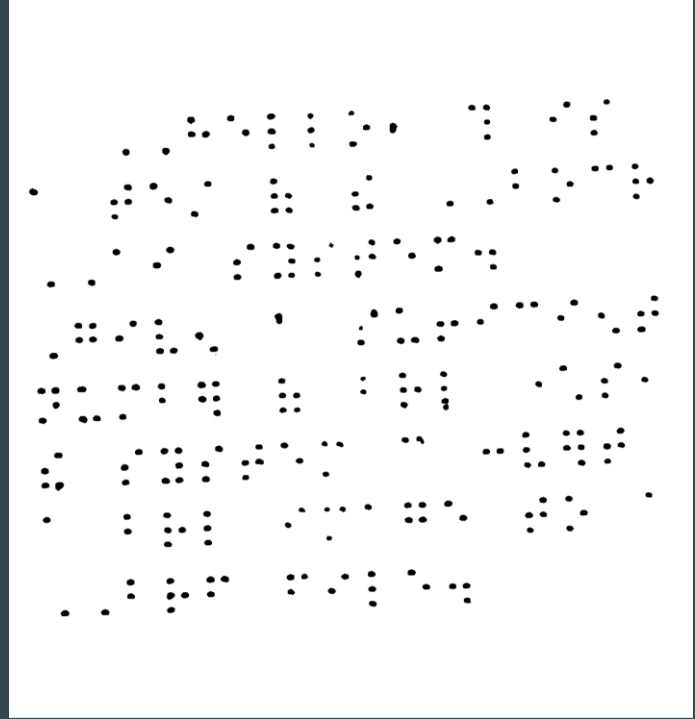
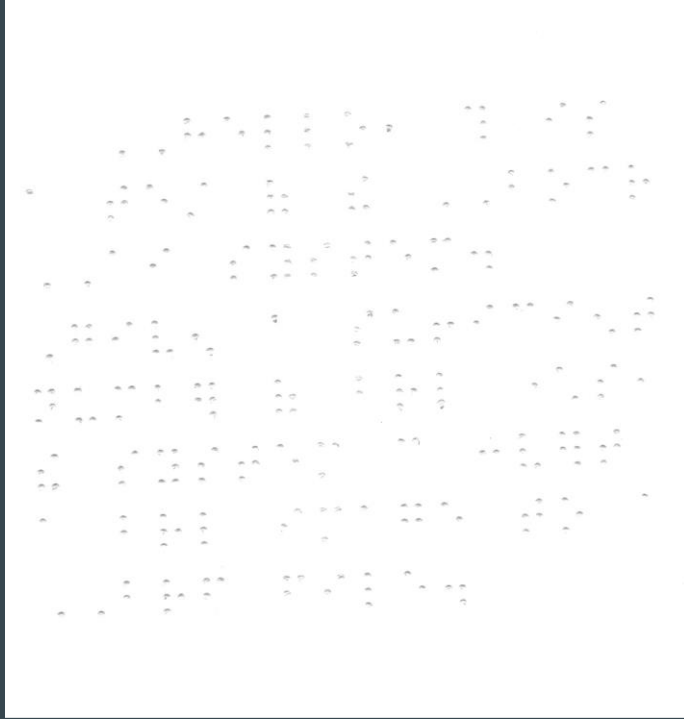
Bot: The BOCR process has finished. You can find the BRF file at: ../test/validation.brf

User: quit

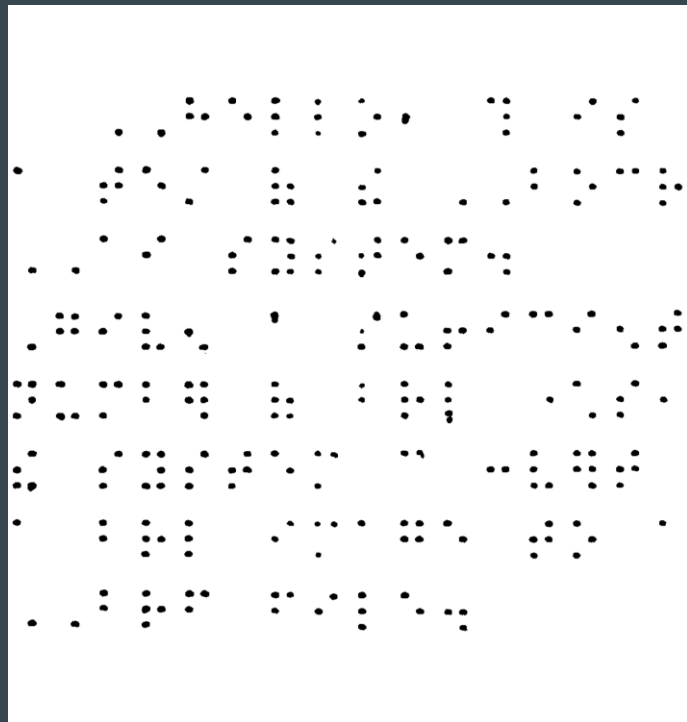
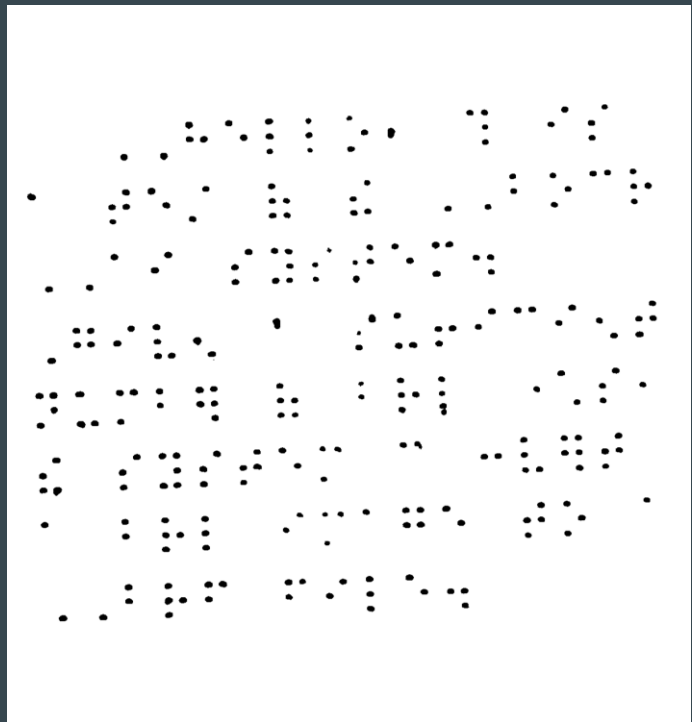
Bot: Goodbye!



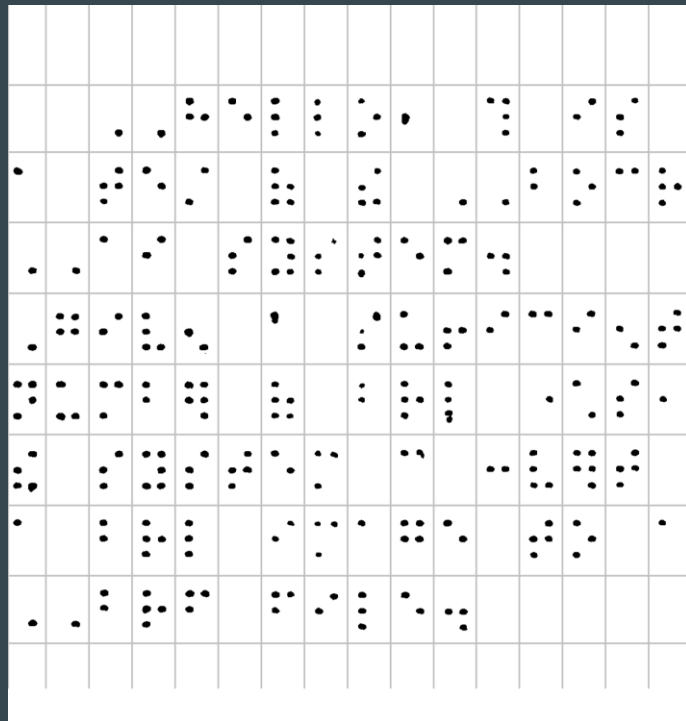
# Demonstration - Preprocessing - Filtering and Binarization



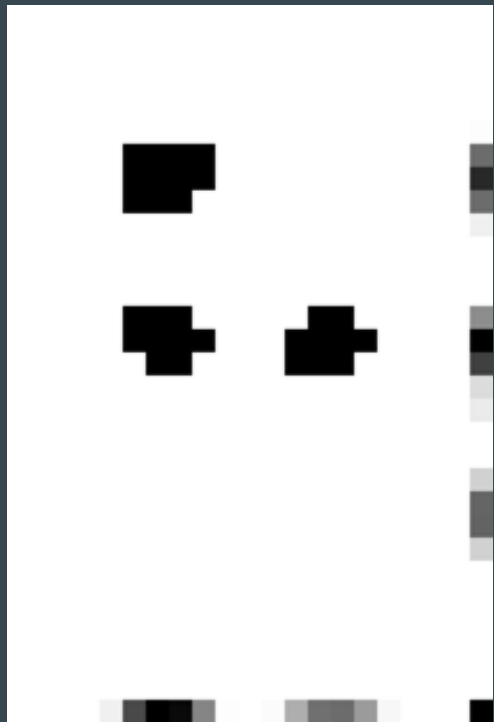
# Demonstration - Preprocessing - Deskew



# Demonstration - Segmentation



# Demonstration - Recognition



Multi-hot = [1, 1, 0, 0, 1, 0]

Int = 19

Ascii = 'h'

# Demonstration - BRF File

BRF Results:

```
„hello1 ? is  
a te/ ( ! „bocr  
„ai system4  
„giv5 b su6ici5t  
numb] ( brl "*s1  
! system c 3v]t  
a brl image to a  
„brf file4
```

Plain Text

HELLO, this is  
a test of the BOCR  
AI system.  
Given b sufficient  
number of braille characters,  
the system can convert  
a braille image to a  
BRF file.