

## LIST OF FIGURES

Figure	Title	Page
1.1	Numbered positions of dots on a Braille cell.....	1
1.2	Example of Grade 2 Braille .....	1
1.3	6 possible places of dots .....	5
1.4	Braille cell equivalent to letter A .....	5
1.5	Braille cell equivalent to letter B .....	5
2.1	Skewed image tilted 13 degrees to the left .....	8
2.2	An example of scanned double-sided Braille document.....	9
2.3	Example of a result of preprocessing.....	10
2.4	Example of thresholded image.....	11
2.5	Illustration of the quantities used for the determination of the pairwise blob saliency .....	14
2.6	Scanned Braille image with noise.....	15
2.7	Noise reduction of Braille scanned image .....	15
3.1	Grade 1 Braille Alphabet .....	19
4.1	Proposed System Architecture for Optical Braille Recognition .....	24
4.2	Illustration of perspective de-skew in documents and the linear Clues.....	27
4.3	Binarized image .....	27
4.4	Groups of compact blobs .....	27
4.5	Groups of elongated blobs .....	28
4.6	Formula for Slope Determination .....	28
4.7	Formula to convert slope to Angle.....	28
4.8	Gray Values .....	29
4.9	Impressed Braille dot in Grayscale .....	29
4.10	Embossed Braille dot in grayscale.....	29
4.11	Impressed Braille Dot pixels categorized by gray values .....	29
4.12	Embossed Braille Dot pixels categorized by gray level .....	29
4.13	Segmentation algorithm of the previous study .....	30
4.14	Preprocessed image to be used in the segmentation .....	31
4.15	Segmented Braille Character .....	31
4.16	Visual representation of the proposed segmentation algorithm.....	32
4.17	Illustration of Braille Codes and its equivalent letter .....	34
4.18	Braille Representation of the word “in” .....	34
4.19	“daddy” in Grade 1 Braille .....	35
4.20	“daddy” in Grade 2 Braille .....	35
4.21	“d” Braille contractions.....	35
4.22	“not” in Grade 2 Braille .....	36
4.23	“cannot” in Grade 2 Braille.....	36
4.24	“n” Braille Contractions.....	36
4.25	“still standing” in Grade 2 Braille.....	36

<b>Figure</b>	<b>Title</b>	<b>Page</b>
4.26	Preprocessing Phase.....	37
4.27	Example of a pre-cut scanned Braille document .....	38
4.28	Gray level of Figure 4.26.....	38
4.29	Threshold of Figure 4.27.....	38
4.30	Inverted Threshold Image of Figure 4.28 .....	38
4.31	Braille Image with noise .....	39
4.32	Braille image with no noise .....	39
4.33	Horizontal Illusory Lines .....	40
4.34	Slopes within the range .....	40
4.35	Mode of the Slopes .....	40
4.36	De-skewed Braille Image.....	41
4.37	Inverted Thresholded Braille Dot Image .....	41
4.38	Grayscale Braille Dot Image.....	41
4.39	Braille Image with Depressions .....	42
4.40	Braille Image without the Depressions .....	42
4.41	Example of Preprocessed Image.....	42
4.42	Braille Dot Pixel Distances .....	43
4.43	Example of Feature Extraction .....	43
4.44	Recognition Phase.....	44
4.45	Pseudo code for Optical Braille Recognition for Grade 2 Braille .....	47