

# Braille Character Recognition Using Artificial Neural Network

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**Abstract**—Braille letter is characters designed for the blind, consist of six embossed points, arranged in a standard braille character. Braille letters is touched and read using fingers, therefore the sensitivity of the fingers is important. Those characters need to be memorized, so it is very difficult to be learned. The aim of this research is to create a braille characters recognition system and translate it to alpha-numeric text. Webcam camera is used to capture braille image from braille characters on the paper sheet. Cropping, grayscale, thresholding, erosion, and dilation techniques are used for image preprocessing. Then, artificial neural network method are used to recognize the braille characters. The system can recognize braille characters with 99% accuracy even when the braille image is tilted up to 1 degrees.

**Index Terms**—Artificial neural network; Braille characters; Image processing; Webcam.

## INTRODUCTION

Reading is one way to get information, but for those who are blind it will be difficult if to read the regular letters. Therefore, letters for the blind people was specially designed, named braille letters. Braille letters consist of six points, which is three lines with two points. Six points can be arranged in such a way to create a variety of combinations. Usually, braille letters is read by touching the dot on the braille paper using fingers.

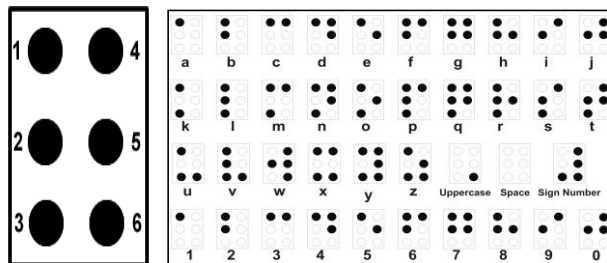


Figure 1. Dot braille character structure.

To be able to read braille by feeling, a person needs to learn it. This usually takes a long time, because the sensitivity of the hands should be trained. Besides that, the dots and the combinations that form a letter should be understood and memorized. Therefore, there are not many persons able to read braille. It is necessary to research assistive technology to translate braille into text to make it easier to read. Therefore, it will take a relatively shorter time compared to read it using finger.

In the previous research, a scanner is used to take pictures of braille, then image processing is done and output is generated in text. The scanner is also used as a tool to get braille pictures, as well as applying the

method of neural network in the recognition process of braille. From the results of previous research, it is known that most systems used a scanner to get braille pictures and the system is made to work offline. Therefore, this research aimed to make a real time braille recognition system. The system can be real time because a webcam is used to get braille pictures and webcam is connected to a computer system. From pictures obtained braille, then do image processing and artificial neural network method is used to recognize the letters. With so may make it easier for users to do the reading braille, without having to process through the scanner first.

## METHOD

The steps for braille letters recognition used in this research is shown in Fig. 2, such as:

- Capturing braille letters image using webcam,
- Image preprocessing
- Find coordinates x and y each dot braille
- Segmentation area braille characters
- Recognize braille characters

### A. Capturing Braille Image

To take braille images, braille paper is captured using a web camera with a resolution of 640 pixels x 480 pixels. The distance between the webcam and braille paper is  $\pm 15$ cm. Results from the capture process is generated as image files of \*.jpeg type and has an RGB color scale.

### B. Image Processing

This process is used to prepare the picture for the next process, to make it easier in the process of braille letters recognition. In this process including: crop image, grayscale, thresholding, erosion and dilation.

### C. Find Coordinates Each Dot Braille

Coordinate each dot of braille character can be detected using find contour technique. In this process will be result coordinates data of dot braille in rows and columns. After coordinates each dot is know, then can be next process is segmentation area a braille character.

### D. Segmentation Area Braille Character

Recognition braille character can be better if determine of area segmentation braille character is correct, Segmentation is done by making a small segment as many as 40 areas of segmentation, which consists of 5 columns and 8 rows. The result segmentation area process shown in Fig. 3.

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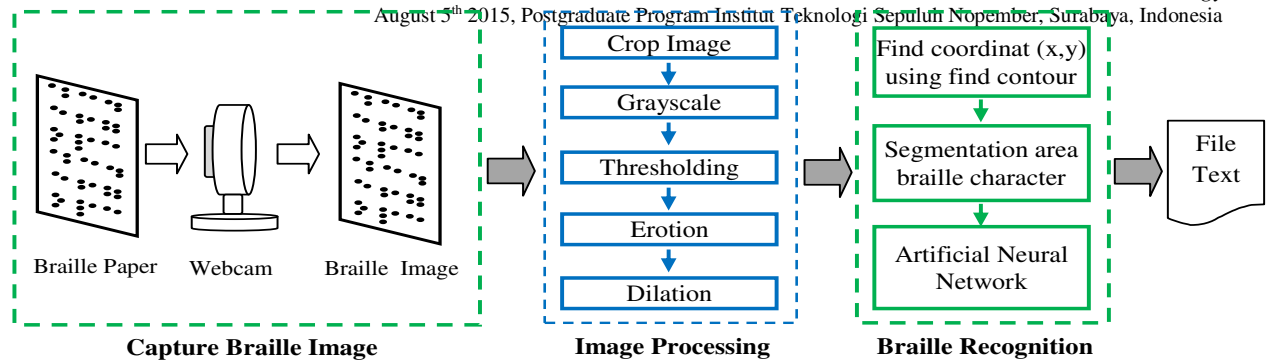


Figure 2. System block diagram of braille letters recognition using artificial neural network method.

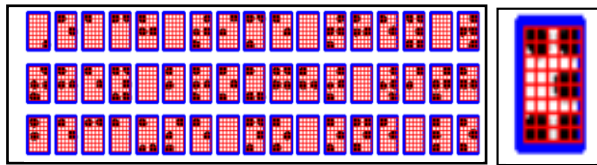


Figure 3. Segmentation small each braille character.

From 40 area small segmentation will be read value of pixels. Where in this area is value between 0 (black) or 255 (white), each small area segmentation will be get 1 data input. So, result in this process will be 40 get data. This data will be as data input for artificial neural network process.

#### E. Artificial Neural Network

Artificial Neural Network (ANN) is a mathematical model in the form of a collection of units connected in parallel which resembles a neural network in the human brain. So can be used then ANN must be learning first. Learning process by providing the data input of the data patterns is included with the desired target output value.

In this research made five kinds of data patterns at each of the braille characters. In the output layer 6 neuron used, because will purpose can be make combination binary 6 bit. Structure topology ANN can be shown in fig.4.

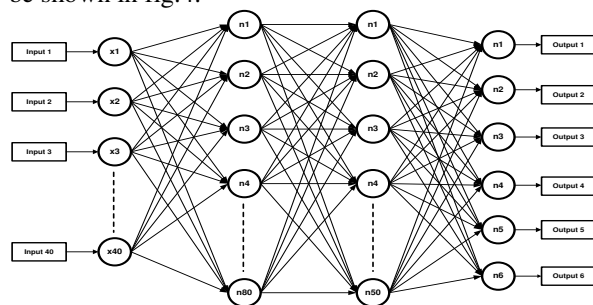


Figure 4. Structure topology of ANN in used.

#### RESULTS

To determine the level of accuracy of the system in recognizing braille character, it is tested by performing the introduction of braille on 10 different images data. The test is done with a variety of degree of picture tilting. The degree ranging from -1.5 degrees to 1.5 degrees.

TABLE 1. THE DATA OF EXPERIMENT BRAILLE RECOGNITION

Degree	All Data				
	Actual	Read	Mising	Error	Accuracy
0°	1229	1226	3	0,25 %	99,75 %
0,25°	1229	1225	4	0,33 %	99,67 %
0,5°	1229	1225	4	0,33 %	99,67 %
0,75°	1229	1214	15	1,23 %	98,77 %
1°	1229	1221	8	0,66 %	99,34 %
1,25°	1229	731	498	40,53 %	59,47 %
1,5	1229	24	1205	98,05 %	1,95 %

#### CONCLUSIONS

In this research, the braille recognition system using artificial neural network method is realized. From the experimental results, accuracy level of 99% can be achieved by this system on the tilted the image of -1 degrees to 1 degrees. The level of accuracy began to decrease when the image is tilted more than 1 degree, and the system is unable to recognize the image at all when the image is tilted at 1.5 degrees. According to this, the image should be straighten first to get a better result.

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