

## PERANCANGAN DAN IMPLEMENTASI PENERJEMAH BAHASA ISYARAT DARI VIDEO MENJADI TEKS MENGGUNAKAN EKSTRAKSI CIRI HISTOGRAM DAN ART-2

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### Abstrak

Nowadays, communication has become a very important thing and cannot be separated from human life. The interaction among humans has become borderless caused by technology development. But, it doesn't happen to the Deaf. Language constraint is the real border for them to communicate with society normally and freely. The SIBI dictionary which is used in Indonesia now cannot be accessed by everyone; it's also expensive and thick. Different interpretation might also happen because the explanation and description about Sign Language gestures is not so clear.

This research implemented a Sign Language translator system based on video processing, image processing, and neural network ART-2. The recognizing parameter used in this research was hand shape, because almost all words in SIBI dictionary are based on hand shape which shows certain letter. The hand shape was taken from the last moving frame. Then, it would be processed and the features were taken using Histogram feature extraction. Neural network ART-2 was used as the recognizer of each hand shape. Over all, there were some processes done in this research, they are : frame difference to show movement, capturing to get the hand shape, counting the pixel 1 appearance as the feature extraction, and the last was recognizing using ART-2.

Output of this research was a system that was able to visualize SIBI dictionary and to recognize each hand shape in the end of movement. The testing result showed that this system was able to recognize Sign Language hand shape with highest accuracy was as much as 100% with total testing videos that were used was 90.

**Kata Kunci :** Sign Language, hand shape, histogram, ART-2

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### Abstract

Nowadays, communication has become a very important thing and cannot be separated from human life. The interaction among humans has become borderless caused by technology development. But, it doesn't happen to the Deaf. Language constraint is the real border for them to communicate with society normally and freely. The SIBI dictionary which is used in Indonesia now cannot be accessed by everyone; it's also expensive and thick. Different interpretation might also happen because the explanation and description about Sign Language gestures is not so clear.

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## CHAPTER I

### INTRODUCTION

#### 1.1 Background

Sign Language is the language that commonly used by the Deaf to express their own intention. It uses hand gesture as the method of non-verbal communication for human beings. It combines hand shape, orientation and hands movement, arms, body, and facial expression. Sign Language is a unique language that can be different among countries worldwide. In Indonesia, the Sign Language system being used now is SIBI (Sistem Isyarat Bahasa Indonesia). SIBI refers to ASL (American Sign Language) [9].

There are few Hearing people who have much knowledge about Sign Language, and so communication between Sign Language users and Hearing people poses many problems. For this reason, the Deaf people tend to be insular and somewhat separate from the rest of society. When it is necessary to communicate with Hearing people (for example when shopping), signers often have to resort to pantomimic gestures or written notes to communicate their needs, and many are uncomfortable [10]. The condition will be worse in the future because the number of Deaf people increases every day.

On the other hand, the most common learning media for Sign Language that is available now is dictionary. The weaknesses of this dictionary are: it's very thick, heavy, expensive, and it can't be accessed by everyone. But, along with the development of technology, there are more Sign Language translator software. For now, there are two ways to collect gesture data for recognition. Device based measurement which measures hand gestures with equipment such as data gloves which can archive the accurate position of hand gestures as its position is directly measured. Second is vision-based technique, which can cover both face and hands signer in which signer does not need to wear data gloves device. All processing tasks are solved by using computer vision techniques which are more flexible and useful than prior approach [11].

This research focused on vision-based technique. The model of Sign Language used glove with certain color in the edge. The Sign Language gestures were recorded in video format. After getting frames from the Sign Language video, the frames were pre-processed. Then, the segmentation was done to get the image of hand only. That image was normalized and extracted to get the features. Afterwards, ART-2 was used as gesture recognizer and translator which changes Sign Language gesture into Indonesian text.

## 1.2 Goals and Benefits of Research

The goals of this research are :

- a. To implement a Sign Language translator system that is able to visualize the SIBI dictionary and recognize hand gesture using ART-2
- b. To analyze the system's accuracy rate when histogram feature extraction and ART-2 are used.

Meanwhile, the benefits that were expected from this system are:

- a. To help Hearing people understand more about Sign Language used daily by the Deaf
- b. To help the communication between Hearing and Deaf people

## 1.3 Statements of Problem

This research should consider about :

- a. How to detect the edge of the glove used by a person in order to determine hand shape
- b. How to extract the features of each hand shape
- c. How to recognize Sign Language based on hand shape using ART-2

## 1.4 Scope of Research

To be more specific and focus, this research will concentrate in :

- a. The words recognized were 45 words which were included in SIBI (Sistem Isyarat Bahasa Indonesia) dictionary
- b. The gestures chosen for this research had same shape from the beginning until the end. The change was only the position of the hand
- c. The model of Sign Language was the same one individual
- d. The model of Sign Language used glove with blue color in the edge for right hand detection
- e. The recognition of Sign Language was focused on the shape of right hand when it stops moving.
- f. The input for software is a video file that contains Sign Language word done by one model
- g. One video file only contains one Sign Language word
- h. The type of video file is .avi
- i. The video dimension was 320x240 pixels

- j. Mouth expression (oral statement) is not included in this research
- k. The face-up position of hand was not included in this research
- l. The recording media was still
- m. Matlab R2007a was used for programming
- n. Non real-time

## 1.5 Methods of Research

### a. Problem Identification

In this step, some problem boundaries need to be determined. Let's say, the methods, frame rate, number of Sign Language sentences, type of words, etc.

### b. Literature Study

As for the importance of matters, literature study is done to deepen the knowledge needed to make this research, for example: image processing, video processing, Sign Language, Matlab, and neural network. This literature study is done through reading books, journals, articles, and browsing the Internet.

### c. System Analysis

The analysis is done based on problem boundaries and data's availability to decide the system requirement.

### d. Design

The design is done based on the result of system analysis that has been done and the methods that have been decided before.

### e. Implementation

In this step, a software application is built. That application is able to recognize Sign Language sentence video based on the vision on one person using neural network.

### f. Test

After the application is successfully built, then the system is tested and evaluated. This step is done in order to assure the truth of the application's results, evaluate the methods' success rate that used in Sign Language identification and analyze any factors that decrease the system's success rate.

### g. Reporting

This last step covers the documenting of the whole steps and making conclusion of the system that has been made. The conclusion will be made based on the facts that happened and also the condition before and after the

system has been made. There will be also suggestions about the system for betterment in the future.

## 1.6 Writing Scheme

The writing scheme of this research consist of :

CHAPTER I : INTRODUCTION

This chapter contains backgrounds of research, goals and benefits of research, statements of problem, scope of research, research methods, and writing scheme

CHAPTER II: THEORETICAL FRAMEWORK

It contains explanation of theories about Sign Language, video, frame difference method, HSV color space, binary image, feature extraction, and ART-2 neural network

CHAPTER III: SYSTEM DESIGN AND SIMULATION

This chapter contains explanation about the process of system design from the beginning until the end. It describes each step done in this research.

CHAPTER IV: SIMULATION RESULT ANALYSIS

It contains the analysis of the system that has been made.

CHAPTER V: CONCLUSION

This part contains the conclusions of the analysis and suggestions for future research

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## CHAPTER V

### CONCLUSION

#### 5.1 CONCLUSION

There are some things which can be concluded from this research :

1. HSV Color Space was better than RGB Color Space for this research
2. Both one quadrant and four quadrant histogram gave the same results with highest accuracy was 100%. In other words, histogram feature extraction is already suitable for this hand shape-based Sign Language translator system
3. Rho in slow learning resulted highest accuracy at 67.78%. While in fast learning, the highest accuracy was 100%
4. The highest accuracy reached when iteration changed was 100%
5. The highest accuracy reached when alpha changed was 100%
6. Rho, iteration, and alpha were not directly proportional to accuracy. The increasing of one parameter would not always make the accuracy increase also.
7. One quadrant histogram needed shorter time in processing the feature extraction than four quadrant histogram
8. In fast learning, the network was able to learn patterns faster than in slow learning. But in both condition, the network was still able to reach stability.

#### 5.2 FUTURE RESEARCH

Future research can develop and continue this research by adding several things into the research :

1. There are more vocabularies that can be added by :
  - a. Adding and combining the parameters for feature extraction
  - b. Using more than one handy cams
  - c. Using different glove for right and left hand in order to detect both hands
2. For hand shape recognition, different type of feature extraction outside Histogram can be used, like wavelet
3. Use different recognizer which suits video processing. For example, another neural network outside ART-2.
4. Make an online system by using webcam

5. Combine with text-to-speech, so the output is voice, the natural language that commonly used in communication (verbal).
6. Make a real time application
7. Try to make text-to-Sign Language or voice-to-Sign Language
8. Other programming language can be used, like C Language



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