



₹ 200/-

ISBN 978-81-946650-0-7



9 788819 466500 7



ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

ಹೊನ್ನ ಹಣತೆಯ ಬೆಳ್ಳಿ ಬೆಳಕು



ಸಂ. ಪ್ರೊ. ಎಂ. ಶಂಕರ

ಹೇಮಗಂಗೋತ್ರಿ

ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಸ್ನಾತಕೋತ್ತರ ಕೇಂದ್ರ
ಹಾಸನ

14. Sign Language Recognition

- Dr Mahadeva Prasad M.

Abstract: The sign language is the communication medium for the speaking and hearing deficit people. These people use the sign language to exchange their thoughts, feelings, and information with the persons having the speaking and hearing deficiency. The persons without these deficiencies have to learn the meaning of the sign language gestures made by the deficit persons to understand the message conveyed by them. Due to the advances in the artificial intelligence and machine learning research and development activities, people are designing the systems that can interpret the sign language gestures. These human computer interaction systems are capable of converting the sign language gestures into respective text or voice data. Because of this, the burden on the common man to learn the sign language has been reduced. A sign language recognition system consists of a training module and a testing module. The images that contain the hand gestures representing various hand gestures of a sign language are used to train the system to generate the trained database. In the test phase, an image that has the hand gesture of a sign language which is of unknown sign language

symbol is tested against the trained database to know the sign language gesture symbol in the test image. In this paper, an overview of the sign language, the design flow, and the methods used to design the sign language recognition system are presented.

Index Terms- Sign Language; Sign Language Recognition System; Human Computer Interaction;

1. INTRODUCTION

Communication is the way by which exchange of messages, feelings, thoughts, etc., takes place. In addition to human beings, other living beings also communicate among themselves to indicate the location of food, entry of other animals to their territory, occurrence of danger situations, etc. The round and waggle dances of honey bee are one of the best examples which reflects that even animals and insects do communicate among themselves for the exchange of information. Animals like elephants and bats do communication in the ultrasonic band of electro magnetic spectrum. For human beings, effective communication is one of the important life skills for the success. The methods through which human beings communicate in their society can be broadly classified into two categories. They are; verbal communication and non-verbal communication. In verbal communication, voice is used as the medium for the communication. In the non-verbal methods, information to be communicated is represented by writings, visual representation of information through sketches, painting, various body languages, gestures, facial expressions, etc., are used as the means of communication to exchange information.

In the case of verbal communication, a well-defined spoken language is chosen to do communication. For the effective verbal communication, proper spoken language should be selected such that both the speaker and the listener have the knowledge over the selected language. While carrying out the communication through the well-defined spoken language, people add various non-verbal signs to convey the intended information to others. However, people with the speaking and hearing impairments depend mainly on the use of non-verbal methods for communication.

Among the non-verbal communication methods, people with speaking and hearing impairment use gestures to convey information. In a gesture based non-verbal communication, movement of the human body parts are done to convey the message. More commonly, the head and the hand movements are used to represent the message. Because of the limitations with the number of head movements that can be made to convey different messages, variety of hand movements is preferred in gesture based non-verbal communication. As that of the spoken language, certain rules and standard symbolic representation to indicate different messages have been formulated in gesture based communication. While using hand as the body part in the gesture based communication, different shapes, orientation, movement, etc., of hands are made to represent different messages. The different poses of the hands have been standardized to represent different symbols or signs of conventional languages. These standardized symbols or

signs are called the sign language (SL) of the respective conventional language. For example, to represent twenty-six English alphabets and ten decimal numerals, the shapes, orientation and movements of hand has been defined. This standardized representation is known as the American Sign Language (ASL). The various hand shapes defined to represent twenty-six English alphabets are shown in Fig. 1 [1].

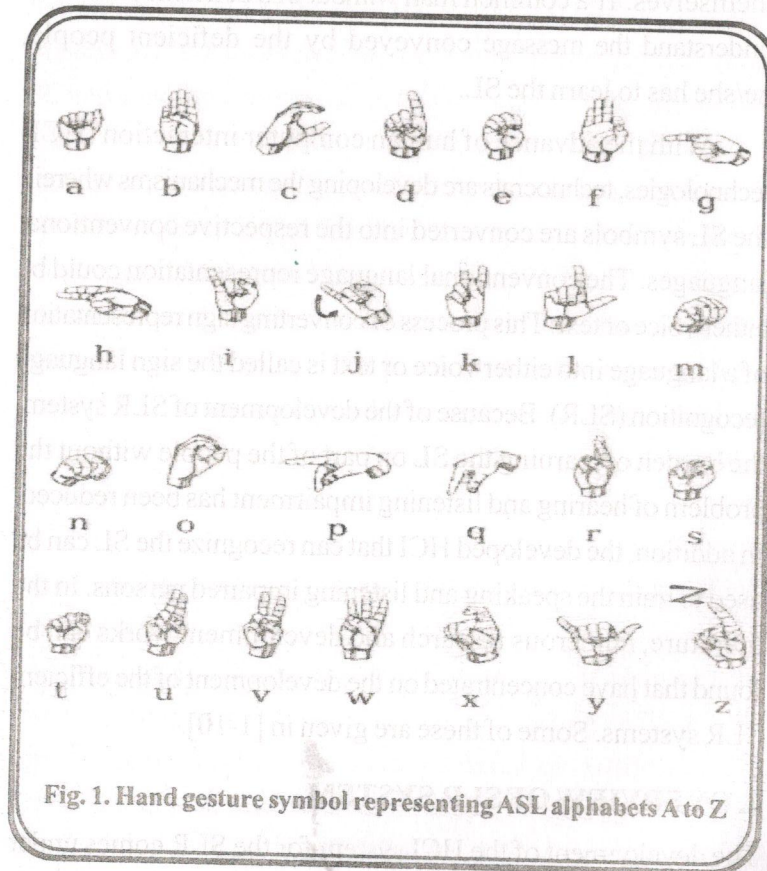


Fig. 1. Hand gesture symbol representing ASL alphabets A to Z

In order to make the communication possible between two speaking and listening impaired persons, proper training of sign language is necessary. While training these people for a particular SL, the various hand gesture shapes and movements that have to be used to represent corresponding alphanumeric symbols and messages of a conventional language are taught. With the proper training on a particular SL, people with hearing and speaking deficiency problem can do communication among themselves. If a common man without this deficiency wants to understand the message conveyed by the deficient people, he/she has to learn the SL.

With the advance of human computer interaction (HCI) technologies, technocrats are developing the mechanisms wherein the SL symbols are converted into the respective conventional languages. The conventional language representation could be either voice or text. This process of converting sign representation of a language into either voice or text is called the sign language recognition (SLR). Because of the development of SLR system, the burden of learning the SL on part of the people without the problem of hearing and listening impairment has been reduced. In addition, the developed HCI that can recognize the SL can be used to train the speaking and listening impaired persons. In the literature, numerous research and development works can be found that have concentrated on the development of the efficient SLR systems. Some of these are given in [1-10].

2. OVERVIEW OF SLR SYSTEM

The development of the HCI system for the SLR comes under the domain of pattern recognition and machine learning. In the

SLR system, the designed machine interprets different symbols of the SL. The developed system takes the various signs or gestures of hand as input and gives out the corresponding symbols of the language either in the form of text or voice. The HCI system that is designed to recognize the SL has two modules. One is the training module and the other is the testing module. Explanation on various components of these two modules is given in the next sections.

2.1 TRAINING MODULE OF SLR SYSTEM

In order to make the system to carry out the process of converting SL gestures into corresponding text or voice format, the machine has to be trained with different combination of SL gestures. The flow diagram showing the process of training the SL recognition system is shown in Fig. 2. In the training module, the sensor is either a still camera or a video which is used to capture images or video of hand that indicates different SL symbols of a language. Depending on the image and video type, there will be several preprocessing steps. If the video is captured, it is converted into images so that each image has a hand symbol that represent particular SL. The other steps in the preprocessing are; hand gesture extraction by removing the background scene, segmentation, noise removal, etc. After the preprocessing, different features are extracted to represent the SL symbol image in an abstract manner. From the extracted features, the sign language recognition system (SLRS) is trained. Depending on the specific applications, the training modules based on artificial neural networks, hidden Markov models, support vector machines, etc., can be used to train the SLRS. All these steps results in the trained database of various symbols of a SL.

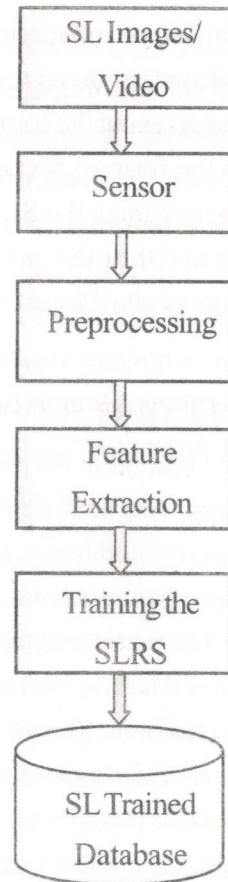


Fig.2. Training flow diagram of hand gesture recognition system

2.2 TESTING MODULE OF SLR SYSTEM

During the test phase, after subjecting the test SL symbol to various preprocessing and feature extraction process, its pattern is compared against all the SL symbols that are present in the SL trained database. Based on this comparison, the class of the SL symbol to which the test pattern belongs is find out. The flow diagram showing the process of testing the SL symbol is shown in Fig. 3.

3. DATA COLLECTION

The sign language data contains the gestures corresponding to alphabets, numbers, special symbols of a language and also common gestures which are used on regular basis for communication. Therefore, depending on the proposed SLR system, the corresponding SL data has to be collected. For designing the SLRS, either the SL data available in the public domain can be used or the developer can create the required SL database through data collection. A sample of hand gesture images corresponding to the decimal numbers 0 to 1 is shown in Fig. 4 [10].

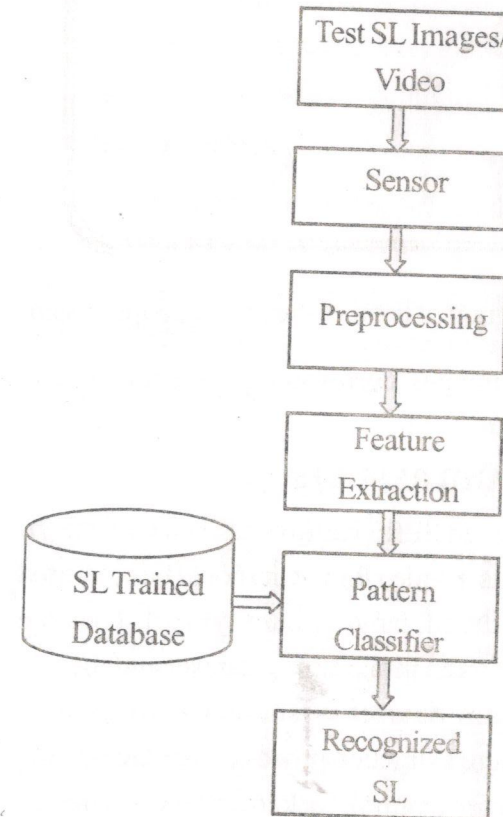




Fig.3. Testing flow diagram of hand gesture recognition system

Fig.4. Hang gesture images correspondin to Indo-Arabic numeral - to 9

4. EXPERIMENTS AND RESULTS

To begin with the proposed SLRS has to be trained with the SL gesture data. If the data is in video format, it should be converted into images that have the SL hand gesture symbol. Then the collected data is partitioned into training dataset and the test dataset. Then the train dataset is subjected to various preprocessing and feature extraction process. The stages in the preprocessing include noise removal, background scene removal,

and then extraction of the SL hand gesture that represent the SL. From the preprocessed SL images, feature extraction is carried out. Then the SLRS is trained with the extracted features to create the trained SL database. In the testing-phase of the SLR system, the image that has the SL image whose identity/label is unknown in compared with all the images in the trained SL database to know the symbol/label of the SL in the test image. This process is called the pattern classification. The simulation experiments for training and testing the SLR system can be carried out with the software tools like MATLAB, Python, Scilab, Open CV, etc. As part of the experimental results the recomition accurey recognition speed, confusion among sign language patterns etc can be mentioned.

5. CONCLUSIONS

In this paper, an overview of the SL and the HCI system that can recognize SL hand gestures is discussed. Explanation on the different stages in the design of training module and the testing module of a typical SLR system are presented.

REFERENCES

1. Mahadeva Prasad M., Gradient feature based static sign language recognition, Int. JI. of Computer Sciences and Enginnering, Vol. 6, Issue 12, pp.532-535. Dec. 2018.
2. Cheoljong Yang, David K. Hanb, HanseokKo, Continuous hand gesture recognition based on trajectory shape information, Pattern Recognition Letters, Vol. 99, pp. 39-47, 2017.
3. Nurettin, A hand gesture recognition technique for human-computer interaction, JI. of Visual Communication and Image Representation , Vol. 28, pp. 97-104, 2015

4. Fabio Dominio, Mauro Donadeo, Pietro Zanuttigh, Combining multiple depth-based descriptors for hand gesture Recognition, Jl. of Pattern Recognition Letters, Vol. 50, pp. 101-111, 2014.
5. Xavier Suau , Marcel Alcoverro, et. al., Real-time fingertip localization conditioned on hand gesture classification, Jl. of Image and Vision Computing, Vol. 26, pp. 1027-1037, 2008
6. Ram Pratap Sharma and Gyanendra K. Verma, Human computer interaction using hand gesture, In Procedia Computer Science, Vol. 54, pp. 721-727, 2015
7. Hamid A. Jalab, Static hand gesture recognition for human computer interaction, Jl. of Information Technology, Vo. 11 (9), pp. 1265-1271, 2012.
8. Qi Wang, Xilin Chen, Liang-Guo Zhang, Chunli Wang, Wen Gao, Viewpoint in variant sign language recognition, Computer Vision and Image Understanding, Vol. 1081, pp. 87-97, 2007
9. Asha Thalange, Dr. S. K. Dixit, COHST and wavelet features based static ASL numbers recognition, In: 2nd Int. Conf. on Intelligent Computing, Communication and Convergence, Vol. 92, pp. 455-460, 2016.
10. Dipali Rojasara, Nehal Chitaliya, Real-time visual recognition of Indian sign language using wavelet transform and principle component analysis, International Journal of Soft Computing and Engineering, Vol. 4, Issue 3, July 2014.
11. SubhaRajama P. and G. Balakrishnan, Recognition of Tamil sign language alphabet using image processing to aid deaf-dumb people, In Procedia Engineering, Vol. 30, pp. 861- 868, 2012.
12. Mahadeva Prasad M., Signer independent numeral sign language gesture recognition, Int. Jr of research in advent Technology, Vol. 7, No.3, PP. 977-980, March 2019.

Author's Mobile No: 94484 11435

e-mail: prasada9@gmail.com



ಅನುಬಂಧ ೧: ೨೦೨೦ರ ಫೆಬ್ರವರಿ ೨೭ರಂದು ನಡೆದ ಹೇಮಗಂಗೋತ್ರಿ ಬೆಳ್ಳಿಹಬ್ಬದ ಉದ್ಘಾಟನೆ ಸಮಾರಂಭದ ಛಾಯಾಚಿತ್ರಗಳು



ಹಾಸನ ಬೆಳ್ಳಾ ಉಸ್ತುವಾರಿ ಸಚಿವರಾದ ಶ್ರೀ ಜಿ.ಸಿ. ಮಾಧುಸ್ವಾಮಿಯವರು ಜ್ಯೋತಿ ಬೆಳಗಸುವ ಮೂಲಕ ಸಮಾರಂಭವನ್ನು ಉದ್ಘಾಟಿಸುತ್ತಿರುವುದು. ಮೈಸೂರು ವಿಶ್ವವಿದ್ಯಾಲಯದ ಕುಲಪತಿಗಳಾದ ಪೆ.ಪ್ರ. ಜಿ. ಹೇಮಂತಕುಮಾರ್ ವಿಶ್ರಾಂತ ಕುಲಪತಿಗಳಾದ ಪೆ.ಪ್ರ. ಎಂ. ಮಾದಯ್ಯ ಮತ್ತು ಇತರರು ಇದ್ದಾರೆ.