Comparative Analysis of Indian Sign Language Recognition System

Ms. R.S. Kale[1], Dr. D.N. Besekar[2]

[1]Assistant Professor, Department of Computer Science, Shri Shivaji College of Arts,Commerce and Science, Akola, India

[2]Professor, Department of Computer Science, Shri Shivaji College of Arts,Commerce and Science, Akola, India

ARTICLEINFO

ABSTRACT

Sign language is a way of communication among Hearing and Speech Impaired Persons. Normal peoples can not understand sign language and it is not feasible for deaf-dumb people to bring translator with them in every place. So, for bridging this gap many systems have been developed. Sign Language recognition systems which can convert Sign into text or Speech and vice-versa. Sign language recognition system work in five steps are: data acquisition, pre-processing, feature extraction, classification and recognition. This paper discussed the Indian sign language recognition system. In this paper, a comparative analysis of various gesture recognition techniques involving Artificial Neural Network, Convolutional Neural Networks Hidden Markov Model and PCA has been discussed with its accuracy.

This comparative study came across that much work has been done in alphabet and numeric level but work in word and sentence level is less. Sign language recognition for static signs has been done by many researchers but dynamic sign recognition systems have scope of development. A Comparative study is utilized to find out research gaps in existing systems and give inspiration to develop interpreters for Indian Sign Languages.

Keywords: sign language, ISLR, ISL, HMM, PCA, ANN, CNN, vision based, glove based.

I. INTRODUCTION

The World Health Organization's (WHO) survey states that above 6% of the world's population is suffering from hearing impairment. In March 2018, the number of people with this disability was 466 million, and it is expected to be 900 million by 2050. Also, the 2011

336

census of India states that about 2.8 million Indians are suffering from hearing and speech impairment [1].

Like any other spoken language, sign languages developed naturally through the communication of different groups of people. There are 138 to 300 different types of sign language used around the world today. Some of them are Indian Sign Language (ISL), American Sign Language (ASL), British Sign Language (BSL), Chinese Sign Language (CSL) and so on [2]

The government of India has enacted the Rights of Persons with Disabilities Act 2016 (RPwD Act 2016). This act recognizes Indian Sign Language (ISL) as an important communication medium for communicating with hearing impaired people. This also insists on the need for sign language interpreters in all Government organizations and public sector undertakings in order to abide by RPwD Act 2016 [3].

The sign language in use at a particular place depends on the culture and spoken language at that place. Indian sign language (ISL) is used by the deaf community in India. ISL is a standard and well-developed way of communication for hearing impaired people in India and speaking in English. Different symbols are involved for different alphabets for Indian Sign Language. It consists of both word level gestures and finger spelling. [4]

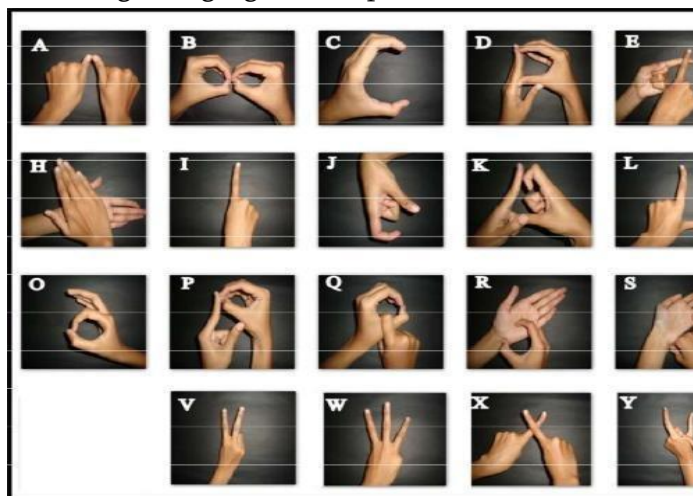Following figure shows some hand gestures of The Indian Sign Language (ISL) alphabets.

Fig 1: 26 alphabets of Indian Sign Language [5]

In gesture recognition, sign language recognition forms an important application. It consists of different approaches [2].

- Glove based approach
- Vision based approach

Glove based approach: Here the signer needs to wear a sensor or colored glove. Wearing a glove makes the task easier during the segmentation phase. The limitation in this approach is that it becomes mandatory for the signatory to tolerate sensory hardware including gloves during all operations.

Vision based approach: In this approach image is captured by webcam or camera. It works without using expensive sensors and color gloves. This paper discussed a vision based approach.

II. LITERATURE REVIEW

Bhumika Pathak, et al. (2019) [1], "Motion Direction Code—A Novel Feature for Hand Gesture Recognition", in this paper they have presented a novel approach in the context of Indian sign language recognition for finding out the motion trajectory of the hand that helps in hand gesture recognition. In this paper the proposed feature termed MDC generates a unique code for distinct signs, and thus efficiently classifies the various signs. This proposed MDC is user-independent and provides reliable results even when tested on multiple signers.

Pratibha Pandey, et al. (2015) [2], "Hand Gesture Recognition for Sign Language Recognition: A Review", in this paper author present an overview of some technique like K-Mean, Canny Edge Detector, CAMSHIFT algorithm, Euclidean Distance based classification, intrinsic mode entropy (IMEn). The author discussed different types of approaches for SLR which are vision based approach, instrumental glove based approach and color marker based approach, and

concluded that vision based hand gesture recognition has made remarkable progress and also vision based methods can be implemented practically.

Shruthi C. J, et al. (2019) [3], "Signet: A Deep Learning based Indian Sign Language Recognition System". This paper presented vision based deep learning architecture for signer independent Indian Sign Language static alphabet recognition. in this system they use Convolutional Neural Network (CNN) architecture for ISL static alphabet recognition from the binary silhouette of signer hand region. Implementation of their proposed system is done using python 3.2, and also used keras and tensorflow for implementing the CNN part. They used binary hand region silhouette of signer image. They collected data from seven different signers. Their system was successfully trained on all 24 ISL static alphabets with training accuracy of 99.93% and with testing validity accuracy of 98.64%.

Yogeshwar I. Rokade, et al. (2017) [4], "Indian Sign Language Recognition System", in this paper the author discussed two different approaches used in SLR, the Vision based approach and the Glove based approach. This paper presented a novel approach to recognize the Indian sign language using Artificial Neural Network (ANN) and Support Vector Machine (SVM). They used the Central Movement and HU Movement for feature Extraction. They used MATLAB R2012a for coding. To recognize Indian Sign Language ANN and SVM are used. ANN and SVM are used to classify the sign which gives accuracy 94.37% and 92.12% respectively. The author used a vision based approach to recognize 17 ISL alphabets. They conclude both the classifier gives higher accuracy with 13 features but ANN gives better accuracy with less number of features.

Table 1 : Comparison Table

Refere-nces	Author	Year	Method	Research Based System	Techniques	Accuracy	Sample size
[3]	Shruthi C. J, et al.	2019	Vision based	ISL	CNN	98.64%	24 ISL static alphabets
[6]	S. Kadam, et al.	2019	Vision Based	ISL	OH, PCA multi-class CNN	88.25%	ISL alphabets
[7]	Deepali G Mali	2019	[48]	ISL	SVM, PCA	95.31%	Alphabets and numerals
[9]	P. Kumar et al.	2018	Kinect Camera	ISL	HMM Classifier	83.77	10 signer, 30 signs
[10]	G. A. Rao et al.	2018	Vision Based	ISL	Mean Pooling, Max Pooling And Stochastic Pooling, CNN, ANN, MDC	CNN-98.22%	5 signers 200 signs in 5 different viewing angles

[11]	T.D. Sajanraj et al.	2018	RGB Camera	ISL	Thresholding using the HSV color space, CNN	97.26	300 images of Numeral signs
[12]	Muthu Mariappan H et al.	2018	Phone Camera	ISL	HMM and K Nearest Neighbor, Fuzzy C-Means Clustering (FCM)	75%	40 Words
[4]	Yogeshwar I. Rokade, et al.	2017	Vision based and glove based	ISL	ANN, SVM	94.37% and 92.12%	17 ISL alphabets
[5]	Sudeep D. Thepade, et al.	2017	Vision based	ISL	Discrete Cosine Transform (DCT)		260 images of 26 alphabets

III. CONCLUSION

In this study, we have attempted to perform an analytic comparison among some Indian Sign Language Recognition. Much work has been done at the alphabet and numeric level but work on word and sentence level is less. Many systems have been developed for static sign language recognition but dynamic sign recognition systems have scope of development. A system can be developed to eliminate feature occlusion, feature occlusion is a condition due to use of two hands in some ISL gestures. Recently many researchers' are working in the area of automatic sign language recognition (SLR) and translation. Use of Machine Learning is a recent trend in this area of research. It is an accurate and effective methodology. By the evolution of deep learning the strategy of feature extraction is directed to the area of computer vision.

IV. REFERENCES

[1]. Pathak, Bhumika & Jalal, Anand, Motion Direction Code—A Novel Feature for Hand Gesture Recognition," ICCI-2017, 2019.

[2]. Pratibha Pandey, Vinay Jain, "Hand Gesture Recognition for Sign Language Recognition: A Review ", International Journal of Science, Engineering and Technology Research (IJSETR) Volume 4, Issue 3, pp. 464-470, March 2015.

[3]. S. C.J. and L. A., "Signet: A Deep Learning based Indian Sign Language Recognition System," International Conference on Communication and Signal Processing (ICCSP), pp. 0596-0600, 2019.

[4]. Yogeshwar I. Rokade, Prashant M. Jadav, "Indian Sign Language Recognition System," Article in International Journal of Engineering and Technology, July 2017.

[5]. Sudeep D. Thepade, Nilima Phatak, Deepali Naglot, Aishwarya Chandrasekaran, "Novel Feature Extraction Technique for Indian Sign Language Recognition using Energy Compaction of Cosine Transform", International Journal of

Computer Applications (0975 – 8887), Volume 177 – No.2, pp. 9-11, November 2017.

[6]. S. Kadam, A. Ghodke and S. Sadhukhan, "Hand Gesture Recognition Software Based on Indian Sign Language," 1st International Conference on Innovations in Information and Communication Technology (ICIICT), pp. 1-6, 2019.

[7]. Deepali G Mali, Nitin S. Limkar. Satish H. Mali, "Indian Sign Language Recognition using SVM classifier," International Conference on Communication and Information Processing (ICCIP), 2019.

[8]. Ashish Sharma, Nikita Sharma, Yatharth Saxena, Anuraj Singh & Debanjan Sadhya, "Benchmarking deep neural network approaches for Indian Sign Language recognition." Neural Computing & Application 33, 6685–6696, 2021.

[9]. Kumar, Pradeep & Saini, Rajkumar & Roy, Partha & Dogra, Debi, "A position and rotation invariant framework for sign language recognition (SLR) using Kinect," Multimedia Tools and Applications, 2018.

[10]. G. A. Rao, K. Syamala, P. V. V. Kishore and A. S. C. S. Sastry, "Deep convolutional neural networks for sign language recognition," Conference on Signal Processing And Communication Engineering Systems (SPACES), pp. 194-197, 2018.

[11]. T. D. Sajanraj and M. Beena, "Indian Sign Language Numeral Recognition Using Region of Interest Convolutional Neural Network," Second International Conference on Inventive Communication and Computational Technologies (ICICCT), pp. 636-640, 2018.

[12]. H. Muthu Mariappan and V. Gomathi, "Real-Time Recognition of Indian Sign Language," International Conference on Computational Intelligence in Data Science (ICCIDS), pp. 1-6, 2019.