IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Sign Language Recognition using Python

[1]Amey Waghchoure, [2]Tejas Sawalkar, [3]Harshad Chavan, [4]Balaji Mundhe

[1,2,3,4]Student, Department of Mechanical Engineering, Jayawantrao Sawant College of Engineering, Savitribai Phule Pune University, Pune, India.

Under the guidance of Prof. Vijaya Avati, Assistant Professor, Jayawantrao Sawant College of Engineering, Savitribai Phule Pune University, Pune, India.

Department of Mechanical Engineering,

Jayawantrao Sawant College of Engineering, Savitribai Phule Pune University, Pune, India

Abstract: Sign language has been a solid medium for dumb and deaf people to interact with others. Speech-impaired people and people with impaired hearing make use of different meaningful hand-gestures and facial expressions to convey their message. However, many people lack the knowledge and understanding of such hand gestures, which then leads to difficulty in communicating or exchanging information with one another. Thus, there is a communication gap between them and normal people. The sign language recognition system acts as a supportive interface between their community and other people out there. This paper presents a way to convert human sign language or hand gestures to a meaningful text. This is achieved with the help of the Python programming language.

Index Terms **– Sign Language, Dumb-deaf people, Hand gestures, Recognition system, Python.**

I. INTRODUCTION

Gesture is defined as the movement of individual body parts mostly of arms, hands, facial expressions or a collaboration between them to accentuate something i.e., an idea, belief, thought, emotion, etc. These non-verbal or non-vocal way of communication plays a major role for dumb and deaf people to express themselves, convey a message, or for exchanging information. Sign language is a visual-manual form of communication using facial expressions, hand movements and gestures, body language, etc. instead of verbal communication. Sign Language varies from nation to nation; hence it is not universal in nature. Different sign languages are supported by different countries, or people residing there.

There are more than three hundred varieties of sign languages used around the globe. Sign language can have many diverse regional accents that cause subtle variances in how people use and comprehend signs, even in nations where the same language is spoken. Some of the sign languages around the world are: Indian Sign Language (ISL) or Indo-Pakistani Sign Language, American Sign Language (ASL), French Sign Language (FSL), Arabic Sign Language, Chinese Sign Language (CSL), Japanese Sign Language (JSL). To interpret these sign languages or gestures, we developed a sign language recognition system which acts as connecting line between two dots i.e., dump/deaf people and others. This system converts the visually detected hand gestures into meaningful texts.

II. PROBLEM STATEMENT

Humans are social beings; therefore, communication plays a vital part in their life. People with speech or hearing-disability have to rely on non-verbal way of communication. This way of communication is fluent in their community. However, problem arises when this way of communication becomes unfit for expressing themselves to normal people. In order to overcome these issues, this sign language recognition system is utilized to convert a non-verbal communication such as hand gestures into text form.

III. OBJECTIVES

- To provide a simple, reliable sign language recognition system.
- To develop a model for hand gesture recognition.
- To optimize the model by a strong dataset and make it cost effective.
- To bridge the communication gap between speech/hearing-impaired people and others.
- To create awareness regarding the importance of sign language.

IV. LITERATURE REVIEW

A. Victoria et al. [1] describes a way to transform hand gestures (ASL- American Sign Language) into meaningful text. It also converts it into speech using unsupervised learning approach. The system performs feature detection and image segmentation to break the barrier between deaf and dump people and others.

P. Kartik et al. [2] proposed a model using deep learning techniques for sign language recognition. This system is based on Convolution Neural Network (ConvNet) for feature detection and image segmentation. The model had a dataset of nearly 87000 images. The model was trained and tested by splitting the dataset in the ratio of 9:1. The model achieved a training accuracy of 98%.

P. Umang et al. [3] developed a system that captures hand signs, with the help of Probabilistic Neural Network (PNN) and K-Nearest Neighbor (KNN) classification methods and process the captured images through MATLAB. The output of this system is in the form of text/speech in any of the two languages, Hindi or English.

S. Krunal [4], built a system comprising of glove, flex sensor, microcontroller, LCD, etc. It detects the Indian sign language's alphabets formed by the action of the person wearing that glove with the help of the sensor attached to it. After interpreting those signs, it displays the text on LCD.

K. Manisha et al. [5], reviewed various practical methods by means of which its possible to develop an embedded device (sign language translator) to aid communication between normal people and hearing/speech impaired ones. They stated that Artificial Neural Network (ANN) and Vision-based methods are quite useful for acquiring and identifying hand signs.

W. Feng et al. [6], proposed a system that overcomes the drawbacks of general glove-based techniques which are just capable of identifying certain hand signs and output seems to be limited to few words, numbers, letters, etc. The suggested glove-based model is based on VR-interface and Deep learning approach. It translates the hand signs to corresponding text/audio with an accuracy of 86.67%. A two layered triboelectric sensor is attached on the glove, one for detecting each finger movement.

V. Christian et al. [7], proposed a framework for recognizing American Sign Language (ASL) i.e., Hidden Markov Model (HMM). There are two channels being utilized, one for each hand. The same word used in voice recognition is split into basic phonemes.

G. Bhumika et al. [8], presented a model which recognize single/double-handed Indian Sign Language (ISL) alphabets images. After categorizing them based on single/double handed, SIFT (Scale Invariant and Feature Transform) and HOG (Histogram of Oriented Gradients) are extracted for training-testing purpose. Then, by obtaining a correlation between them, it is given to K-Nearest Neighbor (KNN) for providing the final accurate classification of the image.

M. Nobuhiko et al. [9], described a video-based sign language recognition system. It consists of static images of hand signs fed to it and is based Convolution Neural Network (CNN) to achieve the desired outcome. The model's accuracy is 96.9%.

V. Nikhilan et al. [10], suggested an integrated hardware and software system for detecting hand gestures. This detection or recognition is possible by motion sensing device 'Kinect'. Kinect is a series of motion sensing devices developed by Microsoft. However, the output of this system is limited to text only.

X. Yaofeng et al. [11], proposed a system for recognition of Chinese Sign Language (CSL). With the help of leap-motion sensor, various text/speech recognition APIs and K-Nearest Neighbor (KNN) approach they provided a way to interpret static hand gestures with better accuracy.

V. PROPOSED SYSTEM

5.1 System Architecture and Flow:

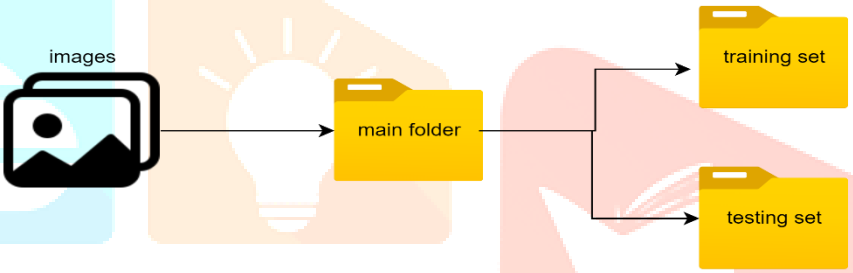
Fig. 1 System Overview

The proposed Sign Language Recognition System involves:

1. **Input Data:**
   For this model to work efficiently, we had captured various images of hand gestures.

2. **Dataset Formation:**
   Collected images are then stored in a folder as a complete dataset, initially.

3. **Splitting the Dataset:**
   The data in the folder is then split in the ratio of 70:30 as the training and testing dataset.



4. **Output Data:**
   After running the program, the camera detects the hand gestures made by the user. It compares it with the images fed in the dataset and displays the outcome of the system in the form of text.

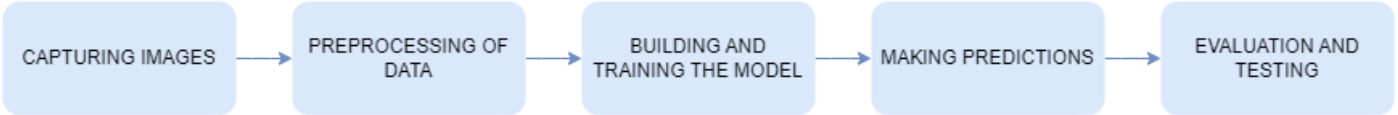


Fig. 2 Flowchart of Sign Language Recognition System

5.2 Programming language used:

Python:
It is general purpose, high level, interpreted language which is quite helpful in machine learning for creating ML-based models. It comes with variety of libraries and useful functions.

5.3 Necessary Dependencies used:

1. **OpenCV:** It is a great tool for gesture detection, processing images and dealing with computer vision-based problems.
2. **TensorFlow:** It's an open-source and free software library used for artificial intelligence and machine learning tasks, problems or implementing deep learning applications due to its fast numerical computing.
3. **Matplotlib:** It is an open-source data visualization library. It consists of a sub-package 'pyplot'.
4. **NumPy:** It is an open-source array processing package used to work with arrays.
5. **OS module:** A folder can be removed or created, its contents can be fetched, the current directory can be changed and other operations are possible with the help of OS module.
6. **MediaPipe:** It is cross-platform library or pipeline framework which is utilized to build/provide machine learning solutions for computer vision applications.

Long Short-Term Memory Network:
Recurrent Neural Network (RNN) include LSTM which are capable of learning long-term connections between data time steps. LSTMs are frequently used to learn, process and classify data.

VI. PROPOSED OUTCOME

The system will detect real-time hand signs/gestures and compare it with images stored in the dataset. Thus, providing a textual output in words/sentences by displaying it on the screen.

VII. CONCLUSION AND FUTURE SCOPE

Sign Language is a way of communication between speech/hearing impaired community and normal people. However, due to lack of awareness and understanding of different hand signs, it becomes difficult for the hearing/speech impaired community to convey their message, share an idea with normal people. Therefore, in this study, we used a simple system for recognizing hand gestures and providing a text output using Python programming language.
Further enhancement in the system is possible by adding speech output, or by converting a speech into a meaningful text. The system can be made to work in association with a virtual assistant like Google Assistant, Amazon Alexa, Apple Siri, etc.

VIII. REFERENCES

[1] A. Victoria, Dr. Adejoke Olamiti, "Conversion of sign language to text and speech using machine learning techniques", Journal of Research and Review in Science, vol. 5, pp. 58-65, 2018.
[2] P. V. Kartik, K. B. Sumanth, V. N. V. Ram, P. Prakash, "Sign language to text conversion using deep learning", Inventive Communication and Computational Technologies, pp. 219-227, 2020.
[3] P. Umang, A. Aarti, "Moment based sign language recognition for Indian languages", IEEE Xplore, 2018.
[4] S. Krunal, "Indian sign language using flex sensor glove", IJETT, vol 4, 2013.
[5] K. Manisha, N. Mahender, R. Amit, "A review paper on sign language recognition system for deaf and dump people using image processing", IJERT, vol. 5, 2016.
[6] W. Feng, Z. Zixuan, H. Tianyiyi, L. Chengkuo, "AI enabled sign language recognition and VR space bidirectional communication using triboelectric smart glove", Nature Communications, 2021.
[7] V. Christian, M. Dimitris, "Hand shapes and movements: Multiple channel American Sign Language (ASL) Recognition", Springer-Verlag Berlin Heidelberg, pp. 247-258, 2004.
[8] Bhumika Gupta, Pushkar Shukla, Ankush Mittal, "K-Nearest correlated neighbor classification for Indian Sign Language gesture recognition using feature fusion", International Conference on Computer Communication and Informatics (ICCCI), IEEE, 2016.
[9] M. Nobuhiko, Y. Shoya, C. Youngha, "Japanese sign language recognition based on a video accompanied by the finger images", Nicograph International (Nicoint), IEEE, 2021.
[10] V. Nikhilan, S. Harsh, J. Abhishek, "Indo-Pak sign language translator using Kinect", New Trends in Computational Vision and Bio-inspired Computing, pp. 725-732, 2020.
[11] X. Yaofeng, G. Shang, S. Huali, Q. Wei, "A Chinese sign language recognition system using leap motion", International Conference on Virtual Reality and Visualization (ICVRV), IEEE, 2017.
[12] J. Sarvesh, S. Hrishikesh, J. Aayush, D. Priya, S. Pankaj, "A Multi-Modular approach for gesture recognition and text formulation in American Sign Language", International Journal of Computer Applications Technology and Research, vol. 9, 2020.

[13] M. Saad, M. Talha, M. Yasir, A. Asghar, "Alphabetical gesture recognition of American Sign Language using E-Voice Smart Glove", IEEE 23rd International Multitopic Conference (INMIC), 2020.
[14] P. Francesco, C. Dario, C. Maria, "Improvements in a wearable device for sign language translation", Advances in Human Factors in Wearable Technologies and Game Design, pp. 70-81, 2020.
[15] W. Zhibo, Z. Tengda, M. Jinxin, "Hear sign language: A real-time end-to-end sign language recognition system", IEEE Transactions on Mobile Computing, vol. 21, 2022.
[16] S. Rajani, "Sign language conversion to speech with the application of KNN algorithm", Sixth International Conference on I-SMAC, 2022.
[17] L. Tengfei, Y. Yongmeng, D. Wenquing, "Sign language recognition based on Computer Vision", IEEE International Conference on Artificial Intelligence and Computer Applications (ICAICA), 2022.