Translation System for SignLanguage Learning

N Meenakshi[1], Thejas Vinodh[2], Abel Thomas[3], Shifil S[4], Jibin Joy[5]

[1-4]BCA Student, Department of Computer Science, Yuvakshetra Institute of Management Studies, Palakkad, Kerala, India

[5]Assistant Professor, Department of Computer Science, Yuvakshetra Institute of Management Studies, Palakkad, Kerala, India

ARTICLEINFO

ABSTRACT

Sign language display software converts text/speech to animated sign language to support the special needs population, aiming to enhance communication comfort, health, and productivity. Advancements in technology, particularly computer systems, enable the development of innovative solutions to address the unique needs of individuals with special requirements, potentially enhancing their mental well-being. Using Python and NLP, a process has been devised to detect text and live speech, converting it into animated sign language in real-time. Blender is utilized for animation and video processing, while datasets and NLP are employed to train and convert text to animation. This project aims to cater to a diverse range of users across different countries where various sign languages are prevalent. By bridging the gap between linguistic and cultural differences, such software not only facilitates communication but also serves as an educational tool. Overall, it offers a cost-effective and widely applicable solution to promote inclusivity and accessibility.

Index Terms : Natural Language Processing (NLP), Sign Language Learning

I. INTRODUCTION

The importance of studying sign language translation lies in its ability to bridge the communication gap between the deaf and hearing communities. By creating systems that can transform text or speech into sign language, we can enhance communication and promote inclusivity for those who primarily use sign language. Understanding and exploring sign language translation can foster equal opportunities and mutual understanding among individuals with varying communication abilities.

Sign language display software converts text/speech into animated sign language to cater to the needs of the special needs population. Its objective is to enhance communication comfort, improve health, and boost productivity. With the advancement of technology and increased use of computer systems, there are better ways to address the needs of individuals with special requirements, potentially benefiting their overall well-being. This project aims to enhance communication skills, leading to improved mental health. Using Python and NLP, efforts have been made to design a process that can detect text and live speech, converting them into animated sign language in real-time.

II.   NEED FOR STUDY

The study of sign language translation is important because it helps bridge the communication gap between the hearing and the deaf communities. By developing systems that can convert text or voice into sign language, we can enable better communication and inclusion for individuals who use sign language as their primary means of communication. It can also facilitate accessibility in various domains such as education, healthcare, and everyday interactions. Understanding and studying sign language translation can have a positive impact on fostering equal opportunities and understanding among people of different communication abilities.

The system then computes various hand parameters of the person 's gesture. Upon identifying and recognizing these parameters, the system compares these parameters with gesture for human communication. Based on this static gesture the system concludes the person 's communication state. Therefore, we have created a platform which can bridge the gap of this isolation and misunderstandings, using the concepts of Machine Learning. Sign-L is a sign language translator, which can translate actions to text and voice to actions through animation. Not just translations, but it also provides tutorials to learn sign language and increase the much-needed awareness among others as well. This includes the various types of sign languages like deaf sign language, Auxiliary sign language, and signed mode of sign language. These act as a tool to bridge the daily interaction for accessing the information. Sign languages are used by the deaf and hard-of-hearing population but recently they are also used by people on the autism spectrum for improving their communication. Gesture recognition is an important topic due to the fact that segmenting a foreground object from a cluttered background is a challenging problem.

III.   LITERATURE SURVEY

A literature review justifies what has been published on a specific topic by researchers and accredited scholars. It comprises the current knowledge, which includes substantive findings and methodological and theoretical contributions to a particular case. Literature reviews use secondary sources, and it does not report original or new experimental work. A literature review lets us gain and demonstrate skills in information-seeking and critical appraisal.

A Sign Language is one of the ways to communicate with deaf people. In this work sets, included features and variation in the language with locality have been the major barriers which has led to little research being done in ISL. One should learn sign language to interact with them. Learning usually takesplace in peer groups. There are very few study materials available for sign learning. Because of this, the process of learning sign language learning is a very difficult task. The initial stage of isign learning is Finger spelled signi learning and moreover, are used when no corresponding sign exists or signer is not aware of it. Most of the existing tools for sign language learning use external sensors which are costly. Our project aims at extending a step forward in this field by collecting a dataset and then use various feature extraction techniques to extract useful information which is then input into various supervised learning techniques. Currently, we have reported four fold cross validated results for the different approaches, and the difference from the previous work done can be attributed to the fact that in our fourfold i cross validation, the validation set Correspond to images of aiperson different from the persons in the training set.

The sign language is used widely by people who are deaf-dumb these are used as a medium for communication. A sign language is nothing but composed of various gestures formed by different shapes of hand, its movements, orientations as well as the facial expressions. There are around 466 million people worldwide with hearing loss and 34 million of these are children. `Deaf' people have very little or no hearing ability .They use sign language for communication. People use different sign languages in different parts of the world. Compared to spoken languages they are very less in number[1][2]. India has its own sign language by the name Indian Sign Language (ISL). In developing countries there are only very few schools for deaf students. Unemployment rate among adults with hearing loss are very high in developing countries [3]. Data from Ethnologue[4] states that among deaf population in India, which is about 1% of total population, literacy rate and number of children attending school is very less. It goes on to state that official recognition of sign languages, increasing the availability of interpreters and providing transcription in sign languages greatly improve accessibility. Signs in sign languages are the equivalent of words in spoken languages Signed languages appear to favour.

IV. SYSTEM REQUIREMENTS

Python

Python is the world's fastest-growing and most popular programming language among software engineers, mathematicians, scientists, data analysts, networking engineers, and accountants. It's a very beginner-friendly programming language. Python has been used for various tasks such as visualization, analysis of data, AI, automation and ML. Instead of boring, repetitive tasks such as copying files and folders around, renaming them, and uploading to a server, the python scripts can be used to easily automate all that and thus save time. Python can also be used to develop mobile, web, and desktop applications as well as software testing or even hacking. Thus, it is a multi-purpose language. So, it enables complex issues to be solved more quickly and with fewer lines of code. Complex tasks like memory management can be completed because it is a high-level language. Python can be used to createand run python programmes on Windows, Mac OS X, and Linux. It involves various libraries, tools and frameworks. Its python's simplicity & elegance has made it grow way than the other programming languages.

OpenCV

OpenCV is a versatile open-source computer vision library that facilitates tasks such as image analysis, video analysis, image processing, and manipulation. This library enables users to load images, apply various transformations to images, perform facial detection and recognition, implement object detection, track objects, and analyze motion in both images and videos. OpenCV, known for its ease of use, is a Python package that can be easily installed using the pip command. While it is primarily used with Python, OpenCV is also available in other programming languages.

When working with OpenCV, images are loaded by specifying the path to the image file. Images in formats like JPEG and PNG can be loaded into OpenCV. By default, OpenCV loads images in the blue, green, and red color pattern. Users have the flexibility to load images in grayscale or in their original color format. Additionally, images can be loaded with or without considering transparency.

To display an image in OpenCV, the command "show" is used, which creates a window with a label for the displayed image. The "waitKey" command is utilized to pause execution and wait for keyboard input. Finally, the window displaying the image is closed using the "destroyAllWindows" command.

NumPY

A Python package called NumPy. Its acronym is "Numerical Python." It is a library made up of routines for handling arrays and multidimensional array objects. Numeric, the ancestor of NumPy, was developed by Jim Hugunin. Another package, Numeric array, was also developed, having some additional functionalities. In 2005, Travis Oliphant created the NumPy package by incorporating the features of the Numeric array into the Numeric package. There are many contributors to this open-source project.

The N-dimensional array type known as the array is the most significant object defined in NumPy. The collection of identically categorized things is described. A zero-based index can be used to access itemsin the collection. A ndarray's items all take up the same amount of space as a memory block. Every item in the array is a data-type object (called dtype). A Python object of one of the arrays scalar types represents each item that is retrieved from an array object (via slicing).

V. METHODOLOGY

The system translates input into Indian Sign Language using specific methodologies. This project is divided into two main sections focusing on direct and indirect translations. Motion Recognition and Speech Recognition are key concepts utilized in the Voice Detection Panel and Voice Translation Panel respectively. Communication plays a crucial role in our lives, influencing our actions and words. Analyzing human behavior involves studying communication, including hand gestures known as affect data, which can be in the form of signs, images, etc. Utilizing this communicational data for gesture recognition falls under the interdisciplinary field of Affective Computing. This paper provides an overview of past research in gesture recognition, exploring various sign models and computational approaches.

MOTION RECOGNITION

This module involves tracking and analyzing the movements of the user's hands or body to interpret sign language gestures accurately. It utilizes computer vision techniques, such as image processing and machine learning, to recognize and understand the different hand shapes, movements, and facial expressions that are integral to sign language communication.

Step 1: Images are captured for multiple ISL conventions using OpenCV.

Step 2: In this step, operations are focused on different parameters of the given picture. Here, the captured image is cropped, filtered and adjusted according to the brightness and contrast. To acquire this efficiently, image enhancement, image cropping and image segmentation methods are used.

Step 3: It consists of the sampling and labelling of the image. The following steps are considered to obtain high quality datasets for image training: The image is converted from RGB format to a binary format. After conversion, cropping of the image is done to obtain the key parts of the image. Further, image enhancement takes place by focusing on a selected area to improve the quality and the information of original data. Then the collected images are labelled using the python's Labeling package, which is a graphical image annotation tool.

Step 4: Data is sent to get trained using ssd_mobnet which is a unified framework for object detection. It predicts the boundary boxes and their classes from feature maps in one single pass.

Step 5: Finally, the model makes real time detections by recognizing multiple ISL gestures

SPEECH RECOGNITION:

This module focuses on converting spoken language into written text. It involves using algorithms and techniques to analyze audio input and accurately transcribe it into text form. Speech recognition technology has advanced significantly in recent years

and plays a crucial role in various applications like voice assistants, transcription services, and now, sign language translation.

Step 1: The end user inserts data in the form of voice, which is then converted into text by using the speech-recognition module NLTK. NLTK is one of the modules of the NLP algorithm, in which voice to text conversions are done with the use of a trained voice database.

Step 2: The speech recognizer first converts voice into text, which then split into words using word tokenizer. Then the translation module applies different rules that convert the tagged word/words into signs by means of grouping concepts.

Step 3: Lastly, the converted sign language is illustrated through a series of hand movements by an animated avatar (created through blender software) using our own database that have been incorporated within the system.

NATURAL LANGUAGE PROCESSING:

NLP is a field of artificial intelligence that focuses on the interaction between computers and human language. In your project, NLP can be used to analyze and understand the text input or voice commands, enabling the system to interpret and generate appropriate sign language translations. NLP techniques like sentiment analysis, part-of-speech tagging, and named entity recognition can enhance the accuracy and fluency of the translations.In the translation process we encounter many unnecessary words like _is', 'are', 'was',etc. , are filler words they do not help in the translation process so we remove them from the sentence.

1). Preprocessing: Once we have the text, we need to preprocess it by removing any unnecessary elements like punctuation, stopwords, or special characters. This helps clean the text and make it easierto work with.

2). Tokenization: Next, we tokenize the preprocessed text by breaking it down into individual words or tokens. This step helps in analyzing and understanding the text at a granular level.

3) . Part-of-Speech Tagging: After tokenization, we assign each word a part-of-speech tag (noun, verb, adjective, etc.). This helps in understanding the grammatical structure and context of the text

4) .Named Entity Recognition: In this step, we identify and classify named entities such as names, locations, organizations, etc. This information can be useful in mapping the spoken language to the appropriate sign language gestures or animations.

ROOT WORDS:

The words may be in plural form, adjective form or any other form .The system removes or converts the words into root words by elimination. The roots words are very effective for bridging the void that could happen when transcribing between fundamentally different languages.

1. Tokenization: The input text is broken down into individual words or tokens.

2. Lemmatization: Each token is transformed into its base or root form using lemmatization techniques. This helps in simplifying the language and reducing variations of words to their common form.

3. Stemming: In some cases, stemming algorithms are applied to further reduce words to their root form by removing prefixes or suffixes. This can help in standardizing the words and improving matching accuracy.

4. Mapping: The root words are mapped to their original positions in the input text to maintain the context and structure of the sentence.

VI. RESULT AND DISSCUSSION

The project reflects a potential solution towards Hand Sign Language Recognition and Translation to Audio and Text. It is preferred that hand signs are made on plain background and it neither too far nor too nearby speaker, so that the predicted output is

accurate. Currently project works on some the statements orwords but for the real-world purpose, we have to add more classes and more samples to get accurate output.

This project makes use of the video that are more effective ways of communicating as they convey the verbal and non-verbal ques used in them. Our proposed System translates the input into Indian Sign Language using methodologies. Natural Language Processing: In the translation process we encounter many unnecessary words like _is',‘are',‘was',etc. , are filler words they do not help in the translation process so we remove them from the sentence. Root Words: The words may be in plural form adjective form or any other form .The system removes or converts the words into root words by elimination. The roots words are very effective for bridging the void that could happen when transcribing between fundamentally different languages.

VII. CONCLUSION

Application is deeply rooted in the deaf community and their lifestyle. However, the majority are not familiar with this nonverbal form of communication which results in a linguistic rift. To avoid such circumstances, the idea of Sign-L was introduced. Mobile phones in the future are expected to be more closely embedded in our day-to-day lives than ever before. They still are more convenient to be used for most of the applications. It is obvious that platforms like Sign-L will be more productive and convenient when embedded in smart phones, making real time translations handier and on the go. Thus, making the transition into a mobile app would be our prioritized forthcoming work. Sign language is very extensively used and vital in conveying information with regard to various social settings. Lack of communication canbe a hindrance be it in terms of education, health, or traveling. It removes the communication-barrier between a normal hearing person and DHH Here, this model is aimed as more of a general approach, which will help them not become left out mainly in terms of education, the lack of the resources for ISL is one of the reasons that the usage of ASL is being more and more widespread.

VIII. REFERENCES

[1]. T. Starner, J. Weaver, A. Pentland. Real-Time American Sign Language Recognition from Video Using Hidden Markov Models, M.I.T. Media Laboratory Perceptual Computing Section Technical Report No. 375, 1996.

[2]. H. Hienz, K. Grobel, Automatic Estimation of Body Regions from Video Images, in I. Wachsmuth and M. Fröhlich (Eds.) Gesture and Sign Language in Human Computer Interaction (Berlin: Springer-Verlag,1998), pp. 135-145.

[3]. S. He. (2019). Research of a Sign Language Translation System Based on Deep Learning, pp. 392- 396. 10.1109/AIAM48774.2019.00083.

[4]. Herath, H.C.M. & W.A.L.V. Kumari, &Senevirathne, W.A.P.B &Dissanayake, Maheshi. (2013). IMAGE BASED SIGN LANGUAGE RECOGNITION SYSTEM FOR SINHALA SIGN LANGUAGE.

[5]. M. Geetha and U. C. Manjusha, ―A Vision Based Recognition of Indian Sign

[6]. Language Alphabets and Numerals Using B-Spline Approximation‖, International Journal on Computer Science and Engineering (IJCSE), vol. 4, no. 3, pp. 406-415. 2012.

[7]. Pigou L., Dieleman S., Kindermans PJ., Schrauwen B. (2015) Sign Language Recognition Using Convolutional Neural Networks. In: Agapito L., Bronstein M., Rother C. (eds) Computer Vision - ECCV 2014 Workshops. ECCV 2014. Lecture Notes in Computer Science, vol. 8925. Springer, Cham.

[8]. Escalera S., Baró X., Gonzàlez J., Bautista M.A., Madadi, M., Reyes M., PonceLópez V, Escalante H.J., Shotton J., Guyon, I. (2014). ChaLearn Looking at People Challenge

[9]. 2014: Dataset and Results. Workshop at the European Conference on Computer Vision (pp. 459473). Springer, Cham.

[10]. Huang J., Zhou W., & Li H. (2015). Sign Language Recognition using 3D convolutional neural networks. IEEE International Conference on Multimedia and Expo (ICME) (pp. 16). Turin: IEEE.

[11]. Edon Mustafa. Sign Language Interpretation using Kinect, MSc in Software Engineering and Telecommunications, The University of Sheffield. 2014.

[12]. https://www.kaggle.com/ - Sign Language MNIST Dataset.(Accessed on 25th July, 2022)

[13]. R. Rumana, ReddygariSandhya Rani, and R. Prema, ―A Review Paper on Sign Language Recognition for The Deaf and Dumb‖. (2021).