

ABSTRACT

According to 2011 , there are 4.73 lakh deaf and 4.76 lakh mute people in Maharashtra. In Daily life , they face many issue to communicate as they use sign language to convey their message. But Common human can't understand sign language as it is hard to learn sign language to everyone .To bridge the gap between the communication of deaf and mute people with any common person For this problem, we have proposed model to identify Indian Sign Language into text .Hence there is a need of a system which recognizes the different signs, gestures and conveys the information to the normal people. It bridges the gap between physically challenged people and normal people .

INTRODUCTION

The goal of this project was to build a neural network able to classify which letter of the Indian Sign Language (ISL) alphabet is being signed, given an image of a signing hand. This project is a first step towards building a possible sign language translator, which can take communications in sign language and translate them into written and oral language. Such a translator would greatly lower the barrier for many deaf and mute individuals to be able to better communicate with others in day to day interactions.

This goal is further motivated by the isolation that is felt within the deaf community. Loneliness and depression exists in higher rates among the deaf population, especially when they are immersed in a hearing world. Large barriers that profoundly affect life quality stem from the communication disconnect between the deaf and the hearing. Some examples are information deprivation, limitation of social connections, and difficulty integrating in society.

Most research implementations for this task have used depth maps generated by depth camera and high resolution images. The objective of this project was to see if neural networks are able to classify signed ISL letters using simple images of hands taken with a personal device such as a laptop webcam. This is in alignment with the motivation as this would make a future implementation of a real time ISL-to-oral/written language translator practical in an everyday situation.



SIGN LANGUAGE

It is a language that includes gestures made with the hands and other body parts, including facial expressions and postures of the body. It is used primarily by people who are deaf and dumb. There are many different sign languages as, British, Indian and American sign languages. British sign language (BSL) is not easily intelligible to users of American sign Language (ASL) and vice versa . A functioning signing recognition system could provide a chance for the inattentive communicate with non-signing people without the necessity for an interpreter. It might be wont to generate speech or text making the deaf more independent. Unfortunately there has not been any system with these capabilities thus far. during this project our aim is to develop a system which may classify signing accurately. Indian Sign Language (ISL) is a complete, natural language that has the same linguistic properties as spoken languages, with grammar that differs from English. ISL is expressed by movements of the hands and face. It is the primary language of many Indians who are deaf and hard of hearing, and is used by many hearing people as well.



SIGN LANGUAGE AND HAND GESTURE RECOGNITION

The process of converting the signs and gestures shown by the user into text is called sign language recognition. It bridges the communication gap between people who cannot speak and the general public. Image processing algorithms along with neural networks is used to map the gesture to appropriate text in the training data and hence raw images/videos are converted into respective text that can be read and understood. Dumb people are usually deprived of normal

communication with other people in the society. It has been observed that they find it really difficult at times to interact with normal people with their gestures, as only a very few of those are recognized by most people. Since people with hearing impairment or deaf people cannot talk like normal people so they have to depend on some sort of visual communication in most of the time. Sign Language is the primary means of communication in the deaf and dumb community. As like any other language it has also got grammar and vocabulary but uses visual modality for exchanging information. The problem arises when dumb or deaf people try to express themselves to other people with the help of these sign language grammars. This is because normal people are usually unaware of these grammars. As a result it has been seen that communication of a dumb person are only limited within his/her family or the deaf community. The importance of sign language is emphasized by the growing public approval and funds for international project. At this age of Technology the demand for a computer based system is highly demanding for the dumb community. However, researchers have been attacking the problem for quite some time now and the results are showing some promise. Interesting technologies are being developed for speech recognition but no real commercial product for sign recognition is actually there in the current market. The idea is to make computers to understand human language and develop a user friendly human computer interfaces (HCI). Making a computer understand speech, facial expressions and human gestures are some steps towards it. Gestures are the non-verbally exchanged information. A person can perform innumerable gestures at a time. Since human gestures are perceived through vision, it is a subject of great interest for computer vision researchers. The project aims to determine human gestures by creating an HCI. Coding of these gestures into machine language demands a complex programming algorithm. In our project we are focusing on Image Processing and Template matching for better output generation



PROPOSED WORK

TRAINING MODULE:

Supervised machine learning: It is one of the ways of machine learning where the model is trained by input data and expected output data. To create such model, it is necessary to go through the following phases:

1. model construction
2. model training
3. model testing
4. model evaluation

Model construction:

It depends on machine learning algorithms. In this projects case, it was neural networks. Such an algorithm looks like: 1. begin with its object: `model = Sequential()` 2. then consist of layers with their types: `model.Add(type_of_layer())` 3. after adding a sufficient number of layers the model is compiled. At this moment Keras communicates with TensorFlow for construction of the model. During model compilation it is important to write a loss function and an optimizer algorithm. It looks like: `model.comile(loss= 'name_of_loss_function', optimizer= 'name_of_opimazer_alg')` The loss function shows the accuracy of each prediction made by the model. Before model training it is important to scale data for their further use.

Model training:

After model construction it is time for model training. In this phase, the model is trained using training data and expected output for this data. It's look this way: `model.fit(training_data, expected_output)`. Progress is visible on the console when the script runs. At the end it will report the final accuracy of the model.

Model Testing:

During this phase a second set of data is loaded. This data set has never been seen by the model and therefore it's true accuracy will be verified. After the model training is complete, and it is understood that the model shows the right result, it can be saved by: `model.save("name_of_file.h5")`. Finally, the saved model can be used in the real world. The name of this phase is model evaluation. This means that the model can be used to evaluate new data.

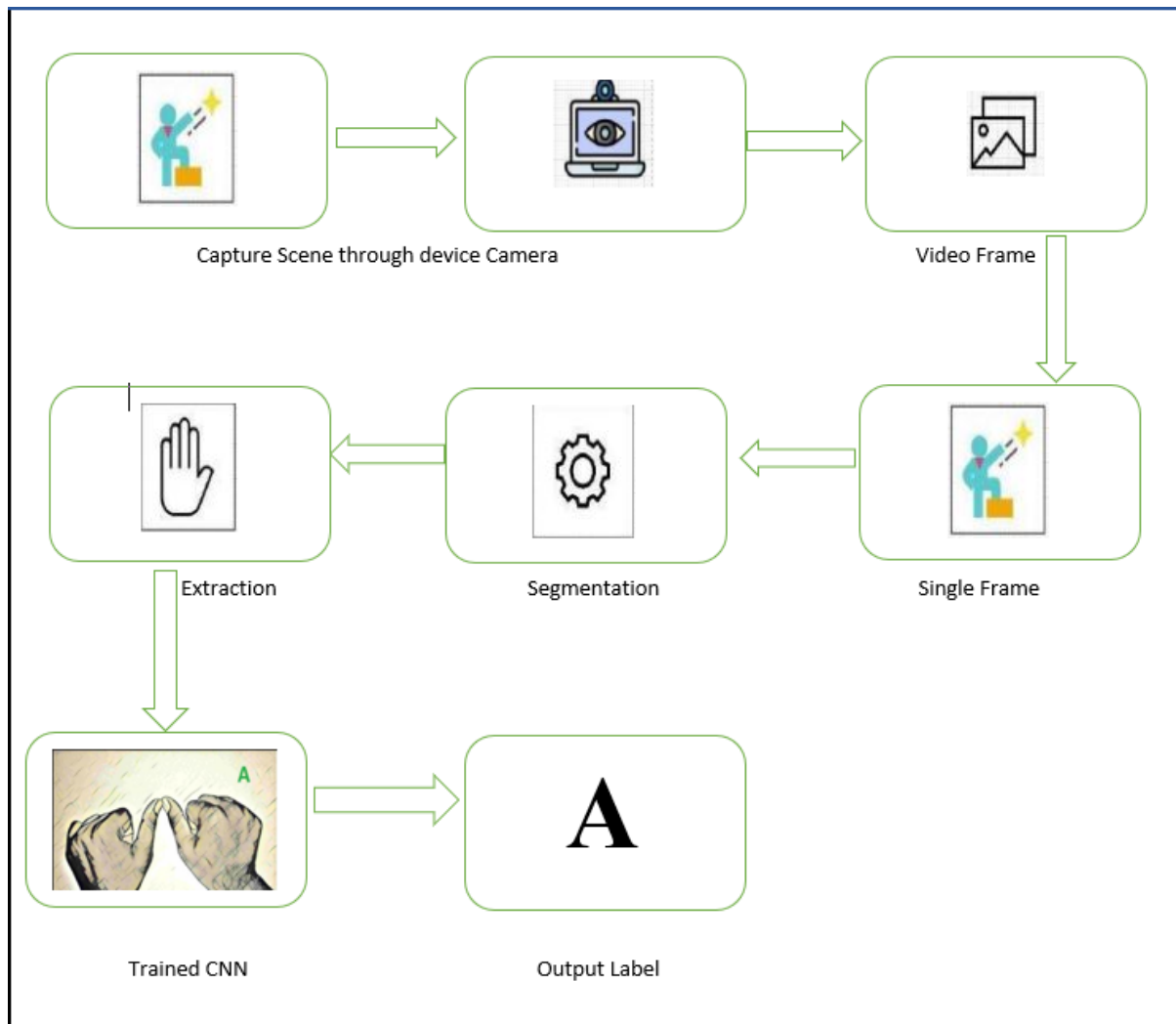


Fig. Architecture Of System

IMAGEPROCESSING:

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. Image processing basically includes the following three steps: • Importing the image via image acquisition tools. • Analysing and manipulating the image. • Output in which result can be altered image or report that is based on image analysis. There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The

three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

OpenCV:

OpenCV (Open Source Computer Vision Library) is a library of programming functions mainly aimed at real-time computer vision.[1] Originally developed by Intel, it was later supported by Willow Garage then Itseez (which was later acquired by Intel[2]). The library is cross-platform and free for use under the open-source BSD license. OpenCV's application areas include:

- 2D and 3D feature toolkits
- Ego motion estimation
- Facial recognition system
- Gesture recognition
- Human–computer interaction (HCI)
- Mobile robotics
- Motion understanding
- Object identification

Convolution neural network:

Convolutional neural networks (CNN) is a special architecture of artificial neural networks, proposed by Yann LeCun in 1988. CNN uses some features of the visual cortex. One of the most popular uses of this architecture is image classification. For example Facebook uses CNN for automatic tagging algorithms, Amazon — for generating product recommendations and Google — for search through among users' photos. Instead of the image, the computer sees an array of pixels. For example, if image size is 300 x 300. In this case, the size of the array will be 300x300x3. Where 300 is width, next 300 is height and 3 is RGB channel values. The computer is assigned a value from 0 to 255 to each of these numbers. This value describes the intensity of the pixel at each point. To solve this problem the computer looks for the characteristics of the baselevel. In human understanding such characteristics are for example the trunk or large ears. For the computer, these characteristics are boundaries or curvatures. And then through the groups of convolutional layers the computer constructs more abstract concepts. In more detail: the image is passed through a series of convolutional, nonlinear, pooling layers and fully connected layers, and then generates the output.

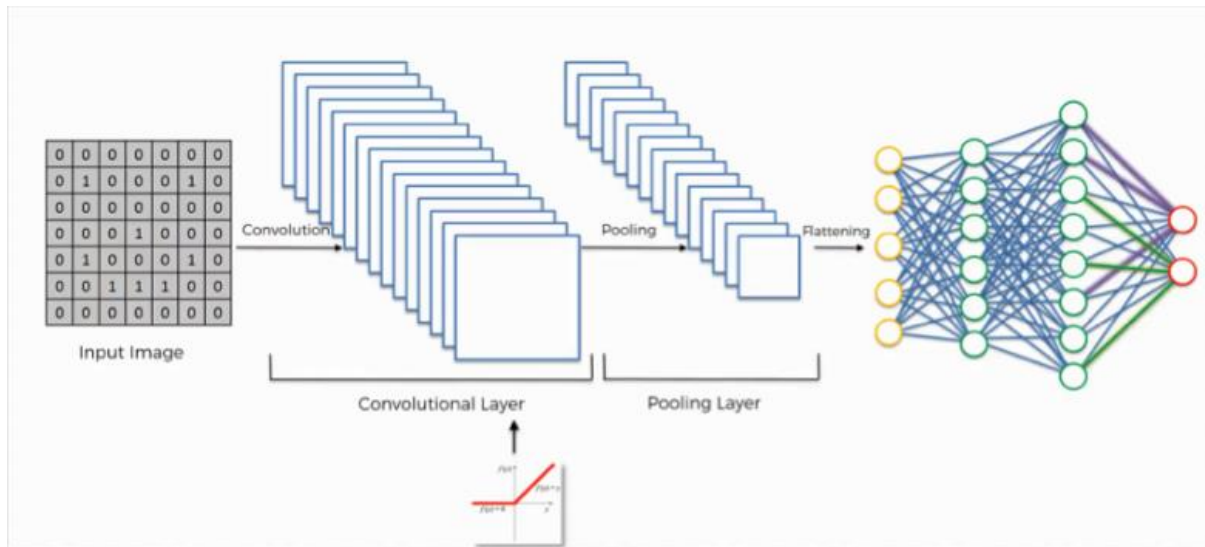


Fig.Layers involved in CNN

Streamlit :

Streamlit is a python framework that creates a web interface as the user requires. Streamlit, an open-source app framework that allows us to deploy ML models easily. You write an app as you write your python script. Streamlit has a unique data flow that if we update anything on the page it will rerun the whole program from top to bottom. Streamlit allows us to create apps for our machine-learning project with simple Python scripts. Hot reloading is also supported, so our app can be updated live while we edit and save our file. Streamlit API allows us to create an app in a few lines of code (as we'll see below). Declaring a variable is the same thing as adding a widget. We don't need to create a backend, handle HTTP requests or define different routes. It's easy to set up and maintain.

Phase 1:

Our proposed system is sign language recognition using convolutional neural networks, which recognizes various hand gestures by capturing video and converting it into frames. Then the hand pixels are segmented and the image is obtained and sent for comparison to the trained model. Thus our system is more strong in getting exact text labels of letters with a simple user-friendly interface with streamlit.

Here there are various image acquisition devices like cameras. First step is Image Acquisition then image pre-processing i.e. converting image

into black mode. The Third step is extracting hand features and next Recognizing the hand gestures.

At last we add sign language Dataset and finally there is recognition of sign into text.

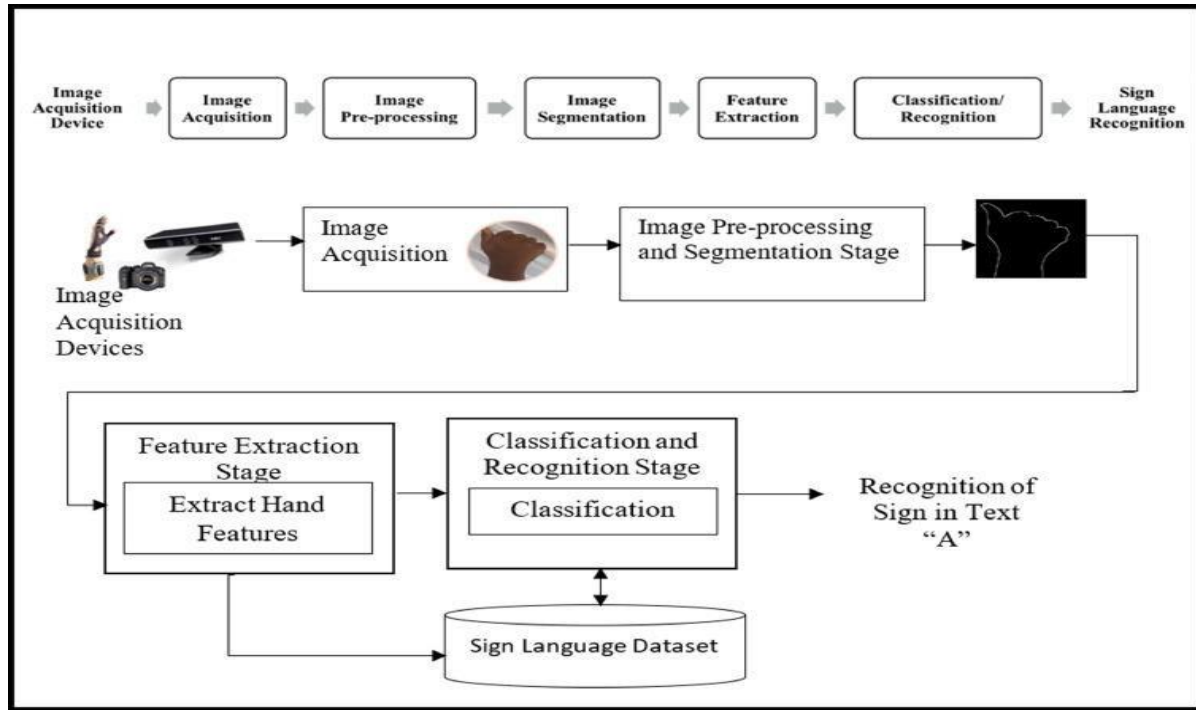


Fig. Architecture Of Sign to Text

Software Requirements:

Operating System: Windows, Mac, Linux.

SDK: CNN, OpenCV, Keras, Numpy.

Hardware Requirements : Camera (Good Quality 3 MP), **Ram:** Minimum 8GB or higher, **GPU:** 4GB dedicated, **Processor:** Intel Pentium 4 or higher, **HDD:** 10GB or higher, **Monitor:** 15" or 17" colour monitor, **Mouse:** Scroll or Optical Mouse or Touch Pad, **Keyboard:** Standard 110 keys keyboard.

Phase 2:

Our proposed system is sign Language recognition using convolution neural networks, which recognizes various hand gestures by capturing video and converting it into frames. Then the hand pixels are segmented and the image is

obtained and sent for comparison to trained model. Thus our system is more strong in getting exact text labels of letters.

In Phase 2 we are going to convert Text to speech by using NLP (pyttsx3) . In the above image Camera captures the hand gestures , track and identify body parts i.e. postures and gestures then it is again classified into summary of information i.e. words and sentences then we convert that sentences into speech with the help of NLP (pyttsx3).

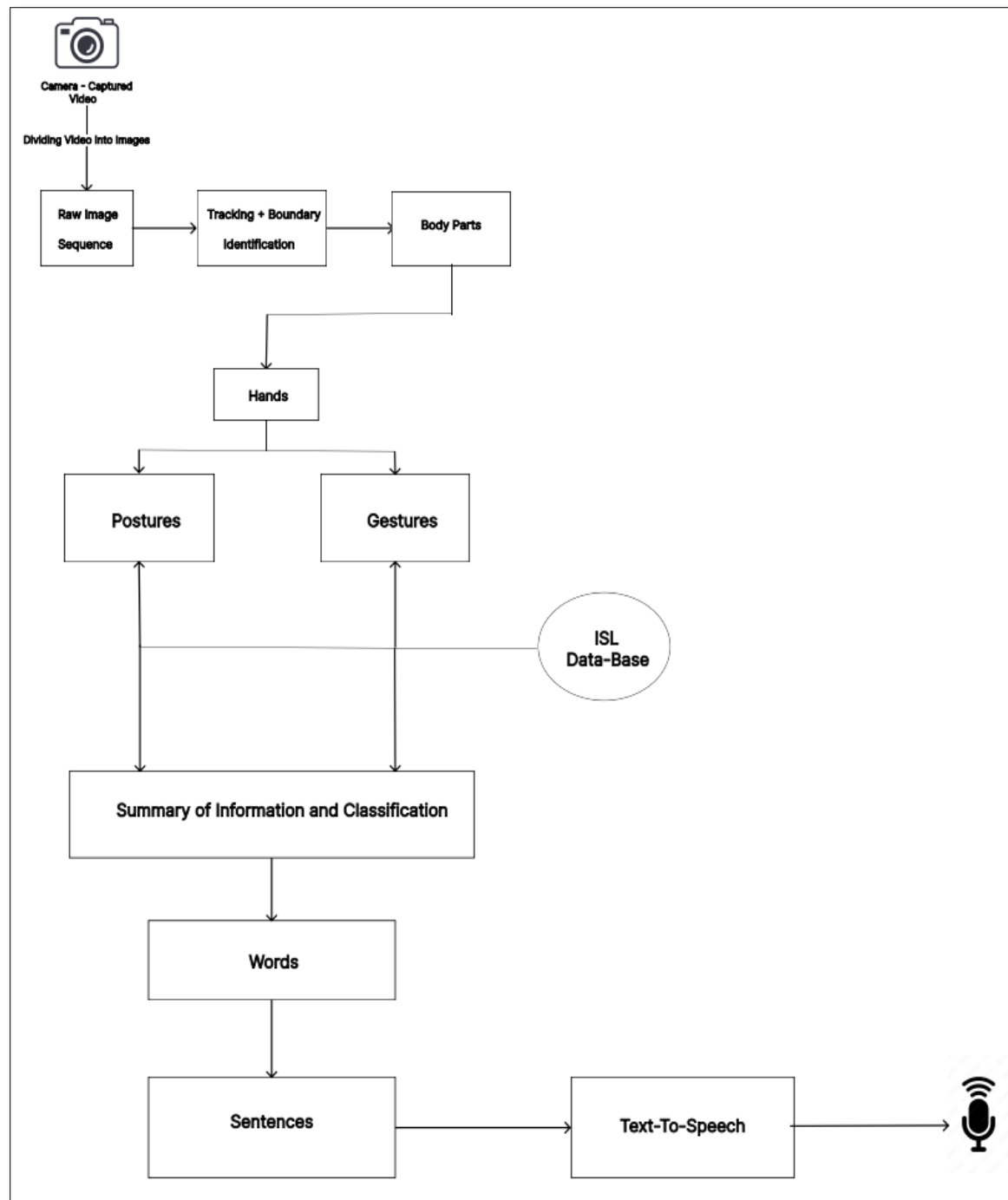


Fig . Architecture Of Text to Speech

Software Requirements: NLP((pyttsx3) , Google Translate (API)

Hardware Requirements : Camera (Good Quality 3 MP) , Micro-phone .

LITERATURE SURVEY

[1] “[Indian Sign Language Recognition System](#)” .

Normal humans can easily interact and communicate with one another, but the person with hearing and speaking disabilities face problems in communicating with other hearing people without a translator. The Sign Language is a barrier of communication for deaf and dumb people. People with hearing and speaking disability are highly dependent on non-verbal form of communication that involves hand gesture. This is the reason that the implementation of a system that recognize the sign language would have a significant benefit impact on dumb - deaf people. In this paper, a method is proposed for the automatic recognition of the finger spelling in the Indian sign language. Here, the sign in the form of gestures is given as an input to the system. Further various steps are performed on the input sign image. Firstly segmentation phase is performed based on the skin colour so as to detect the shape of the sign. The detected region is then transformed into binary image. Later, the Euclidean distance transformation is applied on the obtained binary image. Row and column projection is applied on the distance transformed image. For feature extraction central moments along with HUs moments are used. For classification, neural network and SVM are used.2022 .

[2] “[Integrative Review on Vision-Based Dynamic Indian Sign Language Recognition Systems](#)” .

Human-computer interaction is capable of solving the complex problems and challenges faced by human beings, among many of the complex jobs Sign Language Recognition is one of them. Therefore, automatically detecting the sign language is a broad area of research many works have been done in this area, and still, the work is going on. A variety of sign languages can be found throughout the globe sometimes the sign languages can be diversified by the country or region, the sign language(SL) which is available in India is known as the Indian Sign Language(ISL). Indian sign language requires the involvement of both hands, face, and upper body part movement which makes it difficult from the other single-handed sign languages. If we compare the Static gesture identification with the dynamic gesture identification, it's obvious that the former is easier. In real-life scenarios, a system should have the ability to identify the continuous and dynamic gestures, so that it can become an interface between the hearing impaired people and the normal people. Therefore, an Integrative review has been presented here which strongly summarizes the works on Indian Sign Language Recognition(ISLR) systems capable of identifying the dynamic and

continuous Vision-based gestures without using any gloves or sensor-enabled wearables.2021.

[3] [“Indian Sign Language Recognition”](#)

The paper focuses on designing and developing a user interface to help out the dumb community in making a better use of their gestures. It mainly deals with making services of the hand gestures to be easily accessible and understandable to by the people using sign languages. This system makes use of data collected from standards of Indian Sign Languages (ISL). The system is built using machine learning tools, TensorFlow library. The result of this project is to translate the gestures into the texts and return it to the web interface. The sole reason of this project is to help the individual with speech and hearing impairment2021 .

[4] [“Indian Sign Language Recognition”](#)

Sign language is a language that is used by dumb and deaf people in order to communicate with society. The problem is that common people find difficulty in understanding this language, so we have come up with a sign language recognition model which can solve this issue. Sign language recognition is the most important in research areas when it comes to Human computer Interaction (HCI).We have developed our model using TensorFlow , it is a framework used for creating deep learning models. We used Jupyter notebook to build our model. .Jupyter notebook is a web based application for authoring documents that combine live code with narrative text ,equations and visualizations.2021

[5] [“Indian Sign Language Recognition Using Random Forest Classifier”](#)

Communication is the foundation of all human relationships, both personal and professional. It is one of the basic requirements for survival in a society. Verbal communication is impossible without a well-defined language that is understood by both parties. Around 26% of the disabled population in India use sign language for communication. As a result, there is a pressing need to bridge the communication gap between the general public and the speech impaired. The proposed idea is to develop a pair of sensor gloves which detects Indian Sign Language (ISL) gestures and converts them into audible speech. The gloves are mounted with various sensors and modules such as the Arduino Nano microcontrollers, flex sensors, touch sensors, Inertial Measurement Units (IMU), RF and Bluetooth modules. With these sensors, the state of both hands can be quantified in a series of numerical data to capture their motion. The sensor values are also sent to a Machine Learning classification algorithm which improves the accuracy of gesture recognition. The audible speech output is obtained by creating an app on a smart phone that can convert text to speech.2021 .

[6] [“Detection and Recognition of Hand Gestures for Indian Sign Language Recognition System”](#)

People with disabilities (hearing and listening impaired) have a vast social circle all over the world. For deaf and mute people, the sign language paves a way for the better communication which is the method that everyone understands and leads to effective communication among our diverse population. This study provides a comparative analysis for this complex task problems which are out of reach for a simple machine. As a result, there is an urgent need for the solution for such a problem, so the solution is integrating this problem with Machine Learning algorithms like Support Vector Machine, Convolutional Neural Network, K- Nearest neighbors. The results produced from Convolutional Neural Network are more accurate than those which is achieved by other several classifiers.2021 .

[7] [“Indian Sign Language Recognition on PYNQ Board”](#)

Sign language is the only way to communicate for speech-impaired people. But this sign language is not known to normal people so this is a barrier in communication. This is the problem faced by people with speech impairments or disorder. In this paper, we have presented a system which captures hand gestures with a Kinect camera and classifies the hand gesture into its correct symbol.

Methods: We used the Kinect camera, not the ordinary web camera, because the ordinary camera does not capture its 3d orientation or depth of an image; however, Kinect camera can capture 3d image and this will make the classification more accurate.

Results: Kinect camera produces a different image for hand gestures for ‘2’ and ‘V’ and similarly for ‘1’ and ‘I’; however, a simple web camera cannot distinguish between these two. We used hand gestures for Indian sign language and our dataset contained 46339, RGB images and 46339 depth images. 80% of the total images were used for training and the remaining 20% for testing. In total, 36 hand gestures were considered to capture alphabets and alphabets ranged from A-Z and 10 for numeric.

Conclusion: Along with real-time implementation, we have also shown the comparison of the performance of various machine learning models in which we found that CNN working on depth- images has more accuracy than other models. All these resulted were obtained on the PYNQ Z2 board.

2020 .

[8] [“Indian Sign Language Recognition using SVM Classifier”](#)

Sign language is the medium of communication for the hearing impaired people. It uses gestures instead of sound to convey meaning. It combines hand-shapes, orientation and movement of the hands, arms or body, facial expressions and lip-patterns for conveying messages. Different types of project are done against deaf, mute, hard hearing people. A system with computer human interface is proposed for sign language recognition. But there is country wide variation available in that project. The main idea of this project is design a system which is useful for communication of that people with outside world in any public places, so that no need to interpreter in public places. In that project we need the isolated images in the form of database with Indian sign language of numeric sign. A regular camera is useful for acquiring this numeric sign. Principal Component Analysis (PCA) is used for pre-processing, in which the removal of redundant and unwanted data is done.2020.

[9] [“Indian Sign Language Recognition System using Openpose”](#)

Human beings communicate through language, be it verbal or be it a sign language that makes use of body motion. Hearing and Speech impaired people, having no way to communicate verbally, make use of Sign Language. They perform gestures using a sign language in order to convey their message and effectively communicate with each other. Since, not everyone knows about Indian Sign Language (ISL), it becomes difficult for normal people to fluently communicate with Hearing and Speech impaired community. This paper proposes ISL gesture recognition system in order to decrease this communication gap. The dataset consists of videos of ISL gestures, which are performed by different Subjects. The proposed system uses OpenPose library, which helps in creating the skeleton of human body and thus it provides key points of the whole human body frame by frame. The use of this library removes the dependency on lighting conditions and background. It helps in focusing on just the gesture movements. After extracting the key points, Long Short Term Memory (LSTM) is used for classification of gestures. LSTM model classifies which ISL gesture the particular video belongs to.2019

[10] [“Indian Sign Language Recognition System in Marathi Language Text”](#)

Sign language is a natural language that is used to communicate with deaf and mute people. It is a significant way of communication between normal and deaf and dumb people, which does not require an interpreter. The main objective of this project is to develop a system that helps hearing and speech impaired people to convey their messages to ordinary people. There are different sign languages in the world. But the main focus of system is on Indian Sign Language (ISL) which is on the way of standardization. This system will concentrate on hand gestures only. Hand gesture is very important part of the body for exchanging ideas, messages, thoughts among deaf and dumb people. The proposed system will recognize the Indian hand sign language of words and sentences and translate

the signs into Marathi text with images which have been extracted from the input videos. The process is divided into three parts i.e. pre-processing, feature extraction, classification. It will initially identify the gestures from Indian Sign language. Finally, the system processes the gesture to recognize character with the help of classification. 2019 .

REFERENCES

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- [2] [\(PDF\) Indian Sign Language Recognition System \(researchgate.net\)](#)
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- [7] [A UGC Approved and Indexed with ICI, DOI, Research Gate, Google Scholar, DPI Digital Library, Scopus \(under review\), Thomson Reuters \(under review\) \) | Engineering UGC approved journal | computer science UGC approved journal | computer science and engineering UGC approved journal \(ijcseonline.org\)](#)

