A survey on Indian Sign Language

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Abstract:

Sign language is widely used by hearing-impaired people all over the world. As we've observed recent advancements in the technological field belonging to Artificial Intelligence, Machine Learning and Deep Learning, the cutting edge deep learning techniques have been immense in developing various algorithms for helping the people who need help. With the new deep learning techniques, there has been enormous attention given by the researchers for sign language conversion. In this paper, we are reviewing some of the recent work in the domain.

Keywords — **Machine Learning, Deep Learning, CNN, Open CV**

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I. INTRODUCTION

Speech impaired people around the world communicate using sign language. It is important for the person with whom they are communicating to know sign language. There are Human Interpreters available at the cost of money and privacy. Someone who comes from an average background cannot afford an interpreter, and having an interpreter can sometimes lead to an embarrassing moment and at the cost of revealing sensitive information to them.

While sign language is an important mode of communication for speech impaired people, normal people tend to ignore the importance of sign language. The hearing impaired are more in trouble due to their hearing inability; they are sometimes unable to understand and as a consequence, they withdraw themselves from society and isolate

themselves. When speech impaired people have to visit a clinic, they need to make sure that they have a doctor who is proficient in sign language so that they can convey the symptoms and the required treatment can be done. If the Doctor has no idea about the sign language then the issue may escalate since he wasn't able to understand what the issue was and hence the doctor might not be able to prescribe a proper medicine or treatment to them.

One of the similar problems can be faced in the educational institutions where the speech-impaired person might have not been able to understand a particular topic and if he is unable to convey his doubts then the concept might remain unclear to him. Speech-impaired people face a lot of issues in their daily life, like asking directions, or maybe if they need to enquire something, if they don't have an interpreter around them.

II. LITERATURE REVIEW

For a smooth interaction between people and speech impaired people, a language mode is created called Sign Language, although not everyone is familiar with it since it is different from normal text. So they depend on vision-based communication for communication. To close this gap the Computer Vision Approach seems to be more effective and it minimizes the cost of interpreters up to some extent.

In the paper ***"Sign Language Recognition to Aid Physically Challenged using OpenCV and CNN"*** by Dr V.Subedha and her students[1]. They used images of sign language which acted as their dataset. The images were alphabets A-Z and each alphabet had 150 signs of 28x28 pixels. They used TensorFlow. Their model consisted of a couple of Conv2D and Maxpooling Layers, which was followed by some completely connected dense layers. The final layer was used to provide output for the 26 letters of alphabets. The dropout layer was used after the second layer for regularization and softmax function in the final layer for prediction.

In the paper ***"Sign Language Recognition"*** by Keerthana P and her colleagues[2]. They used a webcam to capture the image, which continuously captured the frames and provided the raw data. The collected images were RGB which had to be processed before the images were rendered. OTSU algorithm was used and a greyscale was transformed to a binary image using the algorithm. The point of interest was the hands, so the image segmentation was done in two ways. The first being, Local

or pixel-based method which included edge detection. The second being, mixing the regions, splitting regions and the threshold process. The approach used was computer vision, which maps a segmented image and extracts a feature. Objects or signs with similar characteristics can be used to categorize, such a combination is called pattern recognition. A classification takes N features as inputs and gives one output: a classification or judgment. The decision rule which is a space or subset determines the relationship between input and output. Classifier ability of a classifier to classify objects based on the rule.

In the paper ***"Chinese fingerspelling recognition"*** by Yalan Gao and his colleagues[3]. They used a dataset of 720 coloured images of 30 isolated Chinese Sign Language. Normalization was done where the hand gesture was extracted and the background was set to zero. The gray value was later reduced from 256 to 8 using Principal Component Analysis. The training and testing were split into a 7:3 ratio and classification was done using ***"Fuzzy Support Vector Machine"***.

In the paper ***"Indian Sign Language Recognition using CNN"*** by Keerthi Reddy and her colleagues[4]. The dataset used was self-made by them by capturing the images using the webcam. Each gesture had 1,000 images and 25 such gestures were captured which means in total 25,000 images were captured. The gestures recorded were done in plain background. Then the image smoothening process was done where the noises were reduced by using the Gaussian Blur method. Image segmentation was performed to extract features from a particular gesture. The system uses CNN which consists of 3 layers. Each input was passed through various convolution and pooling layers. There were a total of 7 convolutional layers, 7 pooling layers followed by 2 fully connected layers. Max pooling was used for the pooling layers.

In the paper ***"Communication Application for Gifted People"*** by Prof. Pratiksha Shevatekar and her students[5]. The data was collected by capturing a video of 24 different alphabets by 20 people. The frames are extracted from the video and the frame is converted to HSV Colour space. Then it's smoothened to finally the binary image so that it avoids consideration of skin-coloured objects other than the hand. Then the results are achieved using skin filtering. Then the Canny Edge detection algorithm is used to detect the edges. The optimal weight was computed and classified by using

Brute Force Search Method Algorithm, Genetic Algorithm and Fisher's Linear Discriminant Analysis. The suggested algorithms were GMM and Adaptive Skin Colour Segmentation and Fuzzy Set II for Author thresholding and detections.

In the paper ***"American Sign Language Identification Using Hand Trackpoint Analysis"*** by the authors Yugam Bajaj and Puru Malhotra[6]. The data was collected using the webcam where 4 volunteers participated and made a gesture of 24 American Alphabets, the background was kept plain. The captured images were later passed to Mediapipe Hand Tracking where the coordinates of the hand point were extracted using the Cuboidal Bounding Box and Cubical Bounding Box. Three algorithms were used to achieve the goals which were: k-Nearest Neighbour Classifier, Random Forest Classifier and Neural Network.

In the paper ***"Sign Language Interpreter using Image Processing and Machine Learning "*** by Omar Vedak and his colleagues [7]. The dataset was created by recording a video of the sign language of 26 English Alphabets which was volunteered by 2 different individuals. The video was then broken down into frames and 250 images for each sign were obtained. They were then split into 4800 images for training and 1200 images for testing. Before feature extraction, the images were processed in such a way that only the useful information was considered and the noise eliminated. The images were converted into 100 * 100-pixel size and then into a binary image. The edge detection was performed using the Canny Edge Detector. The feature extraction was done using the Histogram of Oriented Gradients(HOG). The SVM algorithm was used to classify the signs.

In the paper ***"Sign Language Recognition using Sensor Gloves"*** by Yasir Niaz Khan and Syed Atif Mehdi [8], the author uses the sensor gloves to predict the Sign Language made by the user. It uses the gesture of the hand to predict the Sign Language and give its output. It uses the Artificial Neural Network approach to calculate the sensor values. The Network has 7 input nodes, a hidden layer with 54 nodes and 26 output nodes, where each denotes one Alphabet.

In the paper ***"Sign Language Recognition using Kinetic"*** by Simon Lang and his colleagues [9], the author uses Microsoft Kinect which is capable of tracking a body movement and then it uses the Hidden Makarov Models (HMM) for the recognition part. The signs were recognized based on handshape, palm orientation, location and movement. When a particular sign is

made the probability of the sign is calculated by the HMM and the prediction is done. To implement the HMM more precisely they have used the Dragonfly framework. The observations are recorded and the data such as the position of the hand, speed and others are stored in a vector, every time the user actions drop the speed threshold the action is stored and a new vector is assigned for the new action.

In the paper ***"Using Deep Convolutional Networks for Gesture Recognition"*** by Vivek Bheda and N. Dianna Radpour[10], the CNN architecture is trained on 22 handshapes which correspond to 26 letters of the Alphabet and 10 digits hand signs. The recognition was based on the American Sign Language and focused more on the individual letter. They used the approach of Mini Batch Stochastic Gradient Descent since this was supervised learning. The images were being padded to 200*200. The architecture had 3 groups of 2 convolutional layers followed by a max-pool layer and a dropout layer and then followed by two groups of fully connected layers and a dropout layer and at last, were connected to one layer of output.

In the paper ***"American Sign Language Recognition Using Leap Motion Sensor"*** by Ching-Hua Chuan and his colleagues[11]. The author uses Leap Motion Controller which is a compact and affordable sensor for hand and finger movements in 3D space. The sensor reports data such as position and spread of palm and fingers based on the sensor's coordinate. The data was collected with the help of 2 faculty members and 1 speech-impaired person. The signer was asked to hold for 5 seconds with the sign for the device to record the sign language. The algorithms used were k-Nearest Neighbour and Support Vector Machine for it to recognise the sign language.

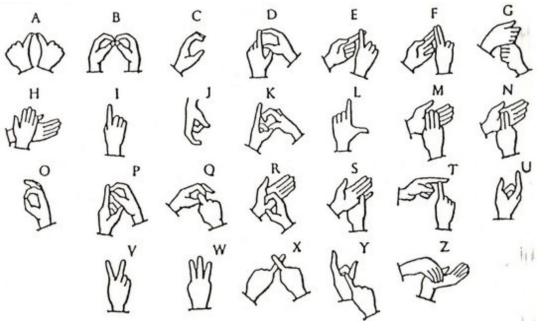

Fig.1. Indian Sign Language

In the paper ***"Bangla Language Modeling Algorithm for Automatic Recognition of Bangla Sign Language"*** by Muhammad Aminur Rahman and his colleagues [12], the author uses the novel method for Bengali Hand Gesture Recognition. The system captures his hand gestures based on Hue and Saturation, it detects the Openhand and

close hand to even simplify the process. The image detects the edges and then uses the KNN Algorithm which classifies the Gesture and gives the output as to which Alphabet it matches.These are the codes to specify to speak secretly and they will know what is the purpose to move a direction to full file the problem of ours. And also who can't speak with their mouth and they will speak with us like a secret coding as ***Indian Sign Language.***

And also there is another language there that is mainly for the agents only useful because that agents will be in other countries and they will tell us like a video with the code as an eye blinking code. It is like a eye blinking code and that will tell a our country will be occupied by like this they will tell like this and our agents also will tell with the eye blinking code with us to be secure and then it will be more useful for us and the agents also be safe for our secret operation of the other countries and also it will be more useful for us. And this is not an Indian Sign Language this is for only the agents and only the operation checkers. This is the main operation for our country developing in a few years as a development. Those are called Eye Blinking Operations And I will tell you a letter coding in the eye blinking code. Those are with the letters. Those are the Eye Blinking with the others to prove and then they can tell the country of the evidence and also it can be useful for many more of our careers and also it can be useful for the coding language skills. It will be more useful for our daily usage.

* -> Closed Eye

\- ->Eye Blinked

A → * -

B → - * * *

C → - * - *

D → - * *

E → *

F → * * - *

G → - - *

H → * * * *

I → * *

J → * - - -

K → - * -

L → * - * *

M → - -

N → - *

O → - - -

P → * - - *

Q → - - * -

R → * - - *

S → * * *

T → -

U → * * -

V → * * * -

W → * - -

X → - * * -

Y → - * - -

Z → - - * *

These are the coding Language as an Eye Coding Language and this is the main coding language and we can't understand this coding and for this there is a classes also we want to know this coding language means then we need to attend these classes and then we can understand this coding languages and then we can give a response to the deaf persons also and also the signs with our hands and we can prepare the coding skills with them.

III. ACCURACY RATES AND EXISTING TECHNOLOGIES

Dr V Subedha, Sandhya M, Shree Lakshmi, Swathi A, April 2021[1], proposed a CNN method for Sign Language Recognition and it was able to classify the Sign Languages.

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Yugam Bajaj, Puru Malhotra, 2020[6], proposed 3 methods which were k-Nearest Neighbour Classifier, Random Forest Classifier and Neural Method. The accuracy achieved was 93% for each of them.

Omkar Vedak, Prasad Zavre, Abhijeet Todkar, Manoj Patil, April 2019[7], the proposed method contained two stages: first, Hand Segmentation and second, Hand sign recognition. The overall accuracy achieved by the system was 88%.

Yasir Niaz Khan, Syed Atif Mehdi, December 2002[8], the proposed method included sensor with Neural Network implementation. The overall accuracy achieved was 88%.

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IV. CONCLUSION

A comparison of different “Sign Language Recognition” methods are analyzed and inspected. From the study it

is seen that most of the study revolves around the American Sign Language and there is limited research being done in the Indian Sign Language domain. The existing work focuses more on Alphabets and Numerics rather than on real world words. The existing proposed methods use Machine Learning and a lot of pre-processing has to be done before passing the data to the models. Some of the methods use devices which are hard to set up for a normal person for the usage. Finally in future, the research work can be carried out by using Deep Learning Techniques such as Transfer Learning like the Single Shot Detection Mobilenet v2 or by using Mediapipe with it. And also we can give the Army also as a coding language for knowing the designs of the other countries and we can design our own products from it.

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