A Survey on Hand Gesture Recognition for Differently Abled People

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ABSTRACT: Hand Gesture is the most basic technique for conversation amongst humans. Today in the time of current day innovation, gesture recognition affects the world in a different way, from physically challenged individuals to robotic control. Human hand gestures provide a natural and effective approach to non-verbal conversation with the computer system. The deaf and mute make use of sign language to communicate which is difficult to interpret by the individuals who are not well-aware of it. There is a need to build a device that can interpret the gestures into text and speech. To tackle this problem, the system created here will use the Deep Learning Model created using Tensorflow to interpret the gestures, capture the image, and finally, use it to give the result of the gesture shown by the user.

Keywords: Hand Gesture, Tensorflow, Deep Learning, Image Processing, Computer vision, Text, Audio.

I. INTRODUCTION

In recent years, the population of deaf-dumb victims has accumulated due to birth defects and different problems. Since a deaf and mute person cannot speak with a standard person they have to be compelled to some quiet communication system. Sign language is very popular among them and they use hand gestures to express themselves. Gestures could be an image of physical behavior or emotional expression. It includes body gestures and hand gestures. It is mainly classified into two parts one is a static gesture and another is a dynamic gesture. For the previous, the posture of the body or the gesture of the hand denotes a symbol. For the latter, the gesture of the hand denotes equivalent messages. Gesture recognition determines the user intent through the popularity of the gesture or movement of the body or body elements. Within the past decades, many researchers have striven to spice up hand gesture recognition technology. Hand gesture recognition has nice value in several applications like language recognition, video games, language interpreters for the disabled, and golem management. The importance of gesture recognition has accrued at a really quick pace owing to the new generation of gesture interface technology. Sign language is especially a language for the differently-abled(deaf-mute) community that can't use spoken languages to speak with others. Though they will see, the utilization of hand signs to move becomes inconvenient to precise one's feelings without delay if a typical hand language isn't followed. A customary language features an outlined set of signs and their meanings, creating them simple to grasp. The language uses completely different gestures for communication, principally the hand. Sign languages are distinct from spoken languages. The utilization of hand gestures for interaction either with humans or with machines is relatively beyond different body gestures like head and eyes because of the actual fact that hands send additional clearer signals and also the gestures may be created ad-lib. Nowadays, deaf and dumb individuals are getting additional and additional outgoing, and in contrast to the past, don't rely upon anybody for communication. So, for such individuals, it's vital that the public around them should be ready to perceive what they require to inform them of exploitation language. For such individuals, we tend to build the hand gesture recognition system in order that although anyone doesn't grasp the meanings of the signs, they will use this program to recognize the language. Hence, the deaf and dumb individuals don't have any barrier in their communication.
The proposed system is expected to give an accuracy of 90%.

II. LITERATURE SURVEY

[1] Parshwa P. Patil, Maithili J. Phatak, Suharsh S. Kale developed a model for Hand Gesture Recognition for Deaf and Dumb using Adaptive Boosting, Motion Detection, Region of Interest,Thresholding techniques. This model produced decent classification results of 73.68% with a small feature vector size containing 8 features.

[2] Kundan Kumar Dubey, Ajitanshu Jha, Akshay Tiwari, K. Narmatha used OpenCV, Computer Vision, Deep Learning to create a Hand Gesture Movement Recognition System Using Convolution Neural Network Algorithm. Inception v3 was one of the techniques that was used to improve the accuracy of the model. The proposed system is capable of recognising hand gestures from the entire image without the use of any image region selection framework.

[3] Vaidyanath Areyur Shanthakumar Chao Peng Jeffrey Hansberger Lizhou Cao made a system for hand gesture recognition approach for real-time interactions.In this work they detect and recognize in-air hand gestures, which are natural and intuitive to perform and can be used to interact with touchless user interfaces.This is different from machine learning approach, their angular-velocity method do not require data preprocessing like data collection, annotation, or training. The overall mean accuracy is 97.3%, which takes both static and dynamic gestures into account.

[4] Guillaume Devineau, Wang Xi, Fabien Moutarde, Jie Yang made a deep Learning for Hand Gesture Recognition on Skeletal Data. In this work, they use convolutional neural networks to classify (recognize) hand gestures using skeletal data. They introduce a 3D hand gesture recognition approach supported by deep learning algorithms using Convolutional Neural Network (CNN) wherever sequences of hand-skeletal joints' positions are processed by parallel convolutions. This model achieves a 91.28% accuracy for the 14 gesture classes case and an 84.35% accuracy for the 28 gesture classes case.

[5] Munir Oudah, Ali Al-Naji, and Javaan Chahl created hand gesture recognition based on computer vision. Glove-based attached sensor. Color recognition, Motion recognition, Deep Learn recognition, Depth recognition are the techniques that were used to build this model. This paper provides insight into some gesture recognition systems under various scenarios.

[6] Xianzhi Chu, Jiang Liu made a sensor-based hand gesture recognition system for Japanese sign language. They have used sensor based gloves to recognize the gesture and convert that into text or voice.Five flex sensors, an Inertial Measurement Unit, and three Force Sensing Resistors (FSRs) are to observe the bending degree of fingers and hand movement data. This system can recognize 24 static and 2 dynamic letters with about 96.5% accuracy.

[7] Zhi-hua Chen, Jung-Tae Kim, Jianning Liang, Jing Zhang and Yu-Bo Yuan worked on creating Real-Time Hand Gesture Recognition Using Finger Segmentation. Here, They presented an efficient and effective method for hand gesture recognition. The hand region is detected through the background subtraction method. The palm and fingers are split so as to recognize the fingers. After the fingers are recognized, the hand gesture will be classified through a simple rule classifier. In this system the total classification accuracy for 1300 images was 89%.

[8] Ming Jin Cheok Zaid Omar Mohamed Hisham Jaward worked on analyzing different techniques for automated gesture recognition. They have reviewed different techniques such as Feature extraction, Gesture classification etc. This paper has achieved a high accuracy in recognising the gesture.

III. DATASET

The Sign language dataset is to be created on the standards set by the Indian sign language organization(ISL). Since there are no proper resources which provide datasets for the Indian sign language , There is a need to create new datasets for all the gestures. The datasets will be created using OpenCV. 30-40 images (or even more depending on the complexity of the gestures) will be collected for each gesture. These images are taken on different backgrounds, with the right and left hand of the user and also with different lighting conditions. There will be 80% use of the captured images for training and roughly 20% will be used for testing.
There are also pre existing datasets for Numerals and Alphabets which will be used for the training and testing of model.

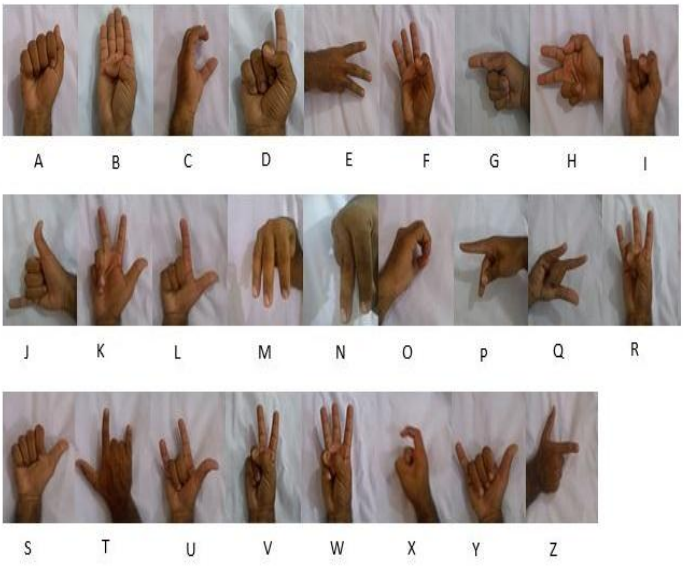

Fig1: Dataset showing gestures for English Alphabets.

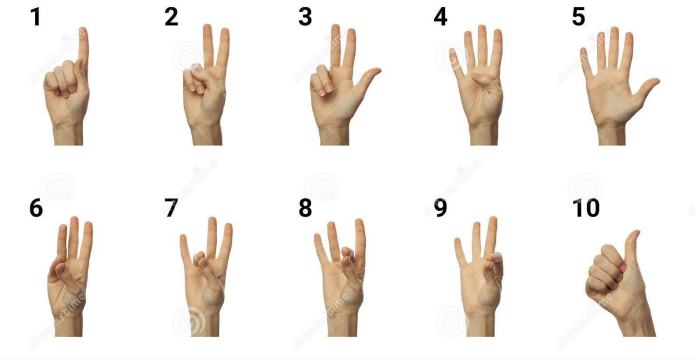

Fig2: Dataset showing gestures for Numerals.

IV. METHODOLOGY

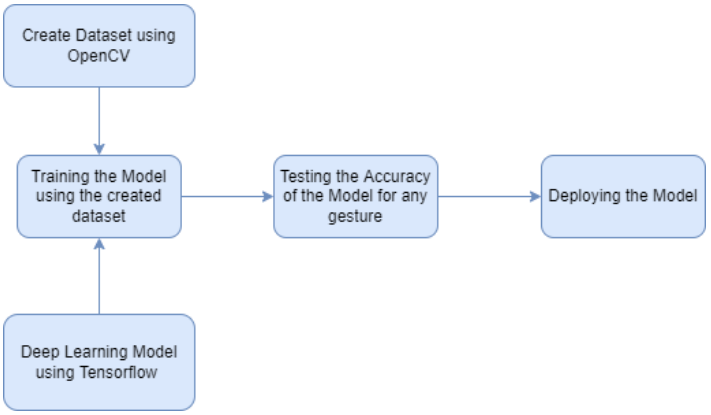

Fig3: Creation of Dataset and Model of the System

Dataset Preparation : The dataset will be created using OpenCV. 30 or more images will be captured per gesture.

Initially images of 20 gestures will be acquired, later it will be increased based on the need.

Model Creation : A Deep Learning model will be created using tensorflow library. Tensorflow Object Detection API will be used in the creation of the model. This API has come pre existing models which will be used for building the model. Then the model goes through an extensive level of training so that it can accurately detect the gestures.

Training and Testing of Model : The deep learning model will be trained using the dataset that has been created. As mentioned above, 80% will be used for model training. Since the images are complex and the model needs a large number of images for training, the division was chosen. The more images we use for training, the better accuracy the model outputs. With the 20% left, it will be used for testing the model. The testing is done to view how well the model is trained and how a model would work in a real-world scenario.

Deploying the Model : The trained model will then be deployed using a web application. This web application will depict the flow of the model created for the user to understand.

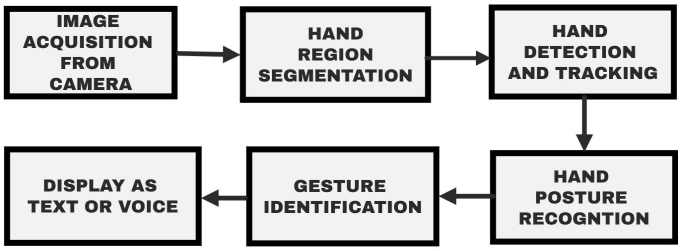

Fig4: Internal working of the gesture recognition system

During the testing of the current system, testing begins with the capture of the image using the webcam of a computer or the camera in any mobile device.

Once the image is acquired, OpenCV will segment the region in the image where the gesture is present and that will be stored in the database. This image is now fed to the model which will be developed using deep learning algorithms from tensorflow library.

This model will now recognize the gesture and will compare it with the trained data. Once the model has compared the gesture it will now identify the gesture and begin to give the output. The output from the system will be in the form of either text or voice based on the user requirement. This will be seen through a Web based or Mobile based Application.

V. TECHNOLOGIES USED

1. **OpenCV**: OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

2. **Deep Learning:** Deep learning is part of a broader family of machine learning methods based on artificial neural networks with representation learning. Learning can be supervised, semi-supervised or unsupervised.

3. **Tensorflow:** TensorFlow is a free and open-source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks.
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4. **Convolutional Neural Network(CNN):**
A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

5. **Streamlit:** Streamlit is a free, open-source, all-python framework that enables data scientists to quickly build interactive dashboards and machine learning web apps with no front-end web development experience required.

VI. CONCLUSION

The planned hand recognition system is extremely helpful because it is often used as a human-computer interface similarly as it will facilitate paralytic folks. In future devices are often simply controlled through the hand gesture movement simply. In previous ideas, the device techniques were used, however, during this system, no further device is required. It is often achieved by deep convolutional neural network algorithmic rule. Deep learning deals with serious information sets. The convolutional network is a bedded algorithmic rule that is especially divided into 2 phases. The 1st one is feature extraction with a convolutional neural network and another one is the classification part with absolutely connected layers. The coaching of neural networks is completed for a significant set of knowledge and goal is achieved.

FUTURE WORK

This current system will be programmed to recognize upto 20 gestures with high accuracy. In the future the number of gestures and the accuracy of the system will be increased slowly. For the daily use of this system, a Mobile Application will be developed so that the differently abled community can easily utilize this app in their lives and not face difficulties they are facing today. Lastly, this system was developed for the Indian Sign Language, but it can be

used for recognizing other country's sign language once they have been trained enough with the gestures accepted by the particular country's sign language organization.

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