Sign Language Recognition

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Abstract - The biggest challenge with sign language is not being universal because it varies from country to country. Sign language is a way of communication adopted by hearing and speech impaired people by using hand gestures. It is a challenge for other people to communicate with them and vice versa. To make communication easier, there is a need for a bridge connecting the gap between physically challenged people and others. This project focuses on identifying the characters and numbers of Indian Sign Language using Convolutional Neural Network (CNN), Keras, Tensor Flow libraries. India doesn't have standard sign language but adopts ASL (American Sign Language), which is single-handed whereas ISL uses two hands for communicating. These reasons boosted us to develop software recognizing hand gestures using ISL.

***Key Words*: Datasets, sign language, Communication, Deaf, Dumb, Indian sign language**

1. INTRODUCTION

As stipulated by Nelson Mandela, Talk to a man in a language he understands, that goes to his head. Talk to him in his own language, that goes to his heart, language is undoubtedly essential to human interaction and has existed since human civilization began. It is the medium people use to communicate and express themselves to the real world. Sign language is the primary means of communication in the deaf and dumb community. Only a minimal number of people are aware of Sign language and so there is a need for a system that recognizes alphanumeric gestures. Through various researches, efforts are made to build system for the problem predominantly for ASL gesture detection and a minuscule amount of focus has been given to ISL gestures.

2. LITERATURE REVIEW

L. G. Zhang, Y. Chen, G. Fang, X. Chen, and W. Gao, "A vision-based sign language recognition system using tied-mixture density HMM" , in ICMI '04: Proceedings of the 6th international conference on Multimodal interfaces, 2004, pp 198–204, doi:10.11451027933.1027967

In this paper, a system was developed that will serve as a learning tool for starters in sign language that involves hand detection. This system is based on a skin-color modeling technique, i.e., explicit skin-color space thresholding. The skin-color range is predetermined that will extract pixels (hand) from non-pixels (background). The images were fed into the model called the Convolutional Neural Network (CNN) for the classification of images. Keras was used for the training of images. Provided with proper lighting conditions and uniform background, the system acquired an average testing accuracy of 93.67%, of which 90.04% was attributed to ASL alphabet recognition, 93.44% for number recognition and 97.52% for static word recognition, thus surpassing that of other related studies. The approach is used for fast computation and is done in real-time. The hidden Markov model (HMM) works on continuous SLR because HMM enables the segmentation of data stream into its continuous signs implicitly, thus bypassing the hard problem of segmentation entirely.

3. PROBLEM DEFINITION

One of the important thing in social survival is communication. Communicating with the person with hearing disability is a challenging one. Deaf and dumb people use combination of hand movements, hand shapes in order to convey particular information. Normal people face difficulty in understanding their language. Sign language is a message behind the hand. So, there is a need for a system that recognizes the different signs, gestures and conveys the information to normal people. It bridges the gap between physically challenged people and normal people.

4. PROPOSED SYSTEM

To solve the problem of communication between a normal person and who was lacking to speak the word or hearing the person's voice, we build our proposed system in simple ways. We create the sign detector which will detect the numbers from 1 to 10 and alphabets A to Z. To identify the hand gestures of the person we divided our proposed system into 3 phases.

5. SYSTEM REQUIREMENTS

5.1.Software Requirements

- Jupyter Notebook
- Windows or ubuntu operating system

5.2.Hardware Requirements

- Laptop with webcam Ram 8GB

- Core i5/i7/19 processor

5.3. Programming Language

- Python

5.4. Packages

- OpenCV
- Keras
- Tensorflow
- Numpy

6. METHODOLOGY

6.1Dataset Creation

In this phase, we'll be having a live feed from the web cam, and we will be creating ROI which is the part of the frame where we want to detect the hand for the gestures using OpenCV. Every frame that detects a hand in the Region of Interest created will be saved in a directory that contains two folders train and test.

6.2Training Of CNN

In this phase we will be creating a CNN model from the created Dataset. Initially we will be loading the dataset using ImageDataGenerator of keras. Then we fit the model and save the model for predicting the gesture. An image in the dataset is verified using the size and the shape function. CNN will be able to work with every image very quickly. Next, we need to reshape our dataset input to the shape that we expect when we train the model. To build our model we use a sequential model because it allows you to build a model layer by layer. Then we fit the model and save the model for predicting the gesture.

6.3Predicting the Dataset

In this, initially we are detecting the ROI as we did in creating the dataset. This is done for identifying any foreground object. Now we find the max contour and if contour is detected that means a hand is detected so the threshold of the ROI is treated as a test image. We load the previously saved model and feed the threshold image of the ROI consisting of the hand as an input to the model for prediction.

7. FLOWCHART

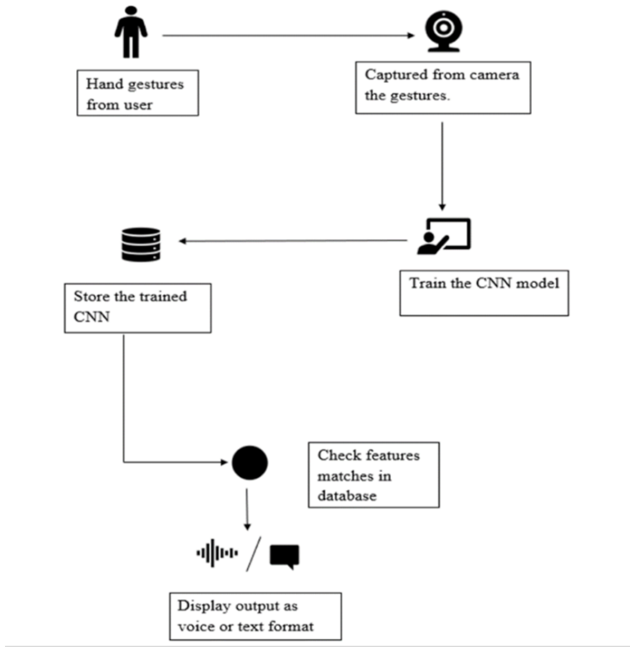

Fig 1: Flow chart

8. Output Screenshots

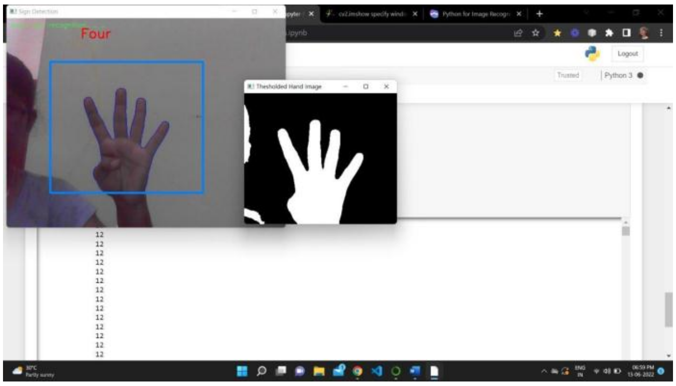

Fig 2: Numeric - four

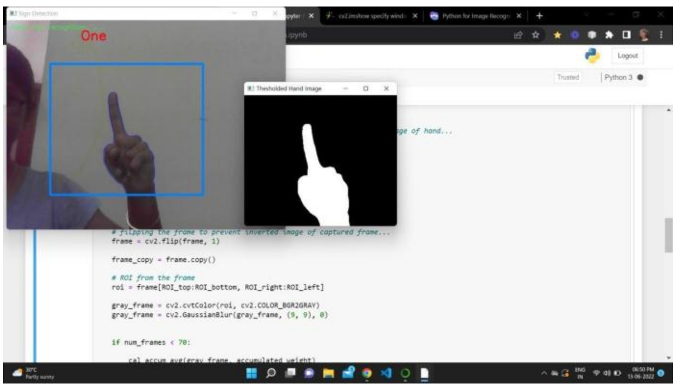

Fig 3: Numeric - one

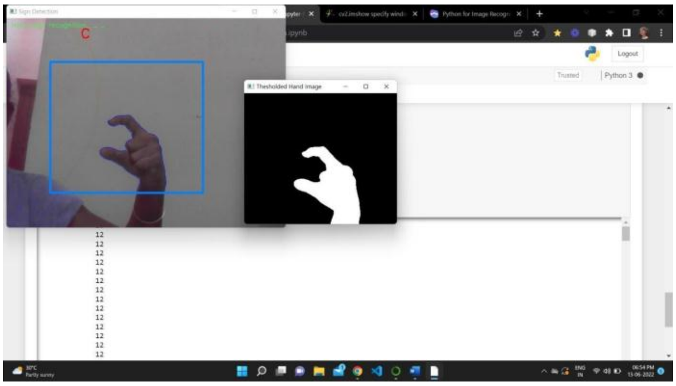

Fig 4: Alphabet - C

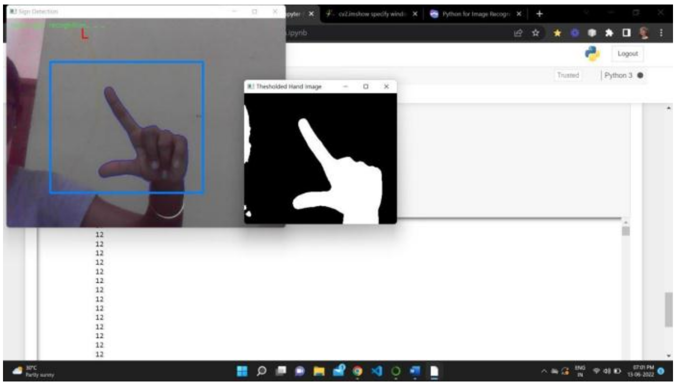

Fig 5: Alphabet - L

9. Performance Analysis

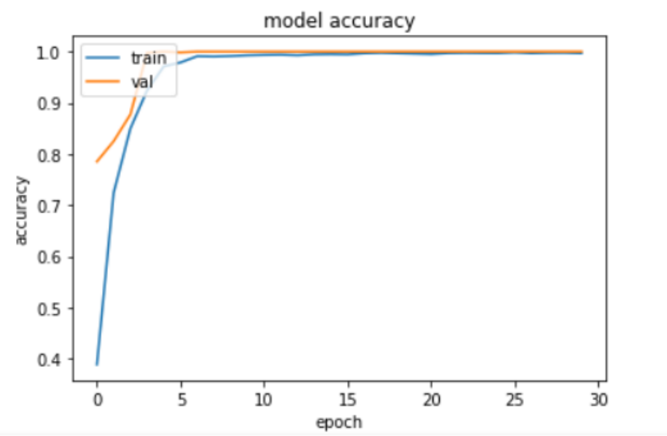

Fig 6:Model Accuracy

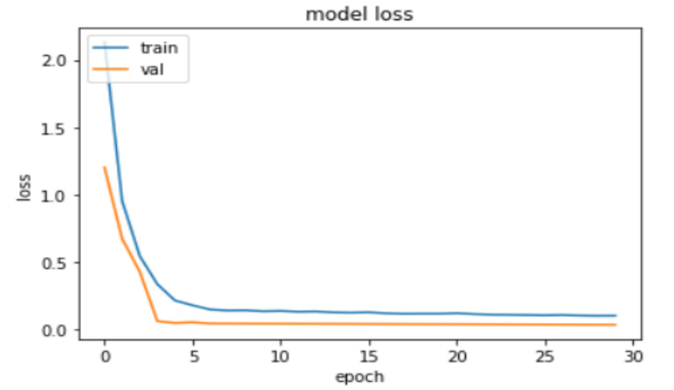

Fig 7: Model Loss

10. CONCLUSIONS

Sign Language Recognition is one of the crucial and diverse area of research for Computer Vision. ISL Sign detection implemented in this project is only the subset of it and this can be diversified with more complex algorithms and has the prospect to open up development of new real time solutions for differently abled persons. We have pioneered and successfully detected over 20+ gestures including 5+ dual hand gestures which is a pivotal point in dual hand gestures detection system.

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