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Sign Language Detector Using Cloud

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ABSTRACT

Sign language recognition System is one of the systems that have major use for the peoples who are deaf\dumb. With the development of this system, we can provide such kind of peoples, a medium to communicate with peoples and their family member. As we all know deaf\dumb peoples are very far from the mainstream, such kind of person don't have proper job and proper livelihood. They spent their whole life in learning sign languages, that are not understandable for a normal people. Here sign languages detection system plays a major role by providing a platform between deaf\dumb peoples and normal people, so that they can communicate with each other. Sign language detection systems can be setup at schools, hospitals, hotels, malls etc. which will make it very simple for such peoples to communicate. Hand gestures is easiest way of nonverbal communication which plays vital role in daily life. The propped paper provides a user-friendly way of communication with the help of CNN algorithm.

KEYWORDS: *Sign language detector, cloud, OpenCV, CNN, Recognition*

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1. INTRODUCTION

Sign Language Detection System is one the important kind of system in today's world, as we all are growing and developing our skills on daily basis with advanced technologies. The peoples who are deaf\dumb are unable to express their feeling, as they are using old sign language techniques to communicate with normal peoples who don't even understand the sign language.

In the new era of technology there must be some focus on developing Sign languages detection systems that can be used by deaf\dumb peoples to express their thought. This sign language detector will work as a mediator between deaf\dumb peoples and normal peoples to translate sign languages to alphabets. In this research paper we are working on developing such kind of system, we are developing this system with the help of Python, TensorFlow, Keras, OpenCV which is available free of cost. In this paper we are using 26 English alphabets and every alphabet represents a specific sign.

To develop such kind of systems we need to setup the environment by selecting the developing IDE (PyCharm), installing different modules and supporting files.

After the development of sign language detector system, we can deploy it on cloud-based platforms such as Amazon web services so that is will always available online with zero downtime and without data loss and it will freely available and easy to access with the help of browsers. We can use S3 Bucket for storing dataset and EC2 for deploying our system over cloud.

2. Literature Review

Literature review of our proposed system shows that there has been many research done on the sign language detection in videos and images using several methods and algorithms.

The paper by M. Geetha and U. C. Manjusha[7], make use of 50 specimens of every alphabets and digits in a vision based recognition of Indian Sign Language characters and numerals using B-Spine approximations. The region of interest of the sign gesture is analysed and the boundary is removed. The boundary obtained is further transformed to a B-spline curve by using the Maximum Curvature Points (MCPs) as the Control points. The B-spline curve undergoes a series of smoothening process so features

can be extracted. Support vector machine is used to classify the images and the accuracy is 90.00%.

Paper done by Rekha, J[5]. which made use of YCbCr skin model to detect and fragment the skin region of the hand gestures. Using Principal Curvature based Region Detector, the image features are extracted and classified with Multi class SVM, DTW and non-linear KNN. A dataset of 23 Indian Sign Language static alphabet signs were used for training and 25 videos for testing. The experimental result obtained were 94.4%for static and 86.4% for dynamic.

Siming He[4] proposed a system having a dataset of 40 common words and 10,000 sign language images. To locate the hand regions in the video frame, Faster R-CNN with an embedded RPN module is used. It improves performance in terms of accuracy. Detection and template classification can be done at a higher speed as compared to single stage target detection algorithm such as YOLO. The detection accuracy of Faster R-CNN in the paper increases from 89.0% to 91.7% as compared to Fast-RCNN. A 3D CNN is used for feature extraction and a sign-language recognition framework consisting of long and short-time memory (LSTM) coding and decoding network are built for the language image sequences. On the problem of RGB sign language image or video recognition in practical problems, the paper merges the hand locating network, 3D CNN feature extraction network and LSTM encoding and decoding to construct the algorithm for extraction. This paper has achieved a recognition of 99% in common vocabulary dataset.

3. Dataset

Datasets are collection of data that can be used to perform gesture recognition. Every alphabet that is assigned with specific gesture has a multiple set images. Like Alphabet A has set of 1750 gestures and similarly other alphabets also have 1750 gesture per alphabets. So total numbers of dataset are 1750*26 which is a huge dataset. The accuracy of sign detection will be more if the datasets size is huge.

Mentioned below are the dataset used

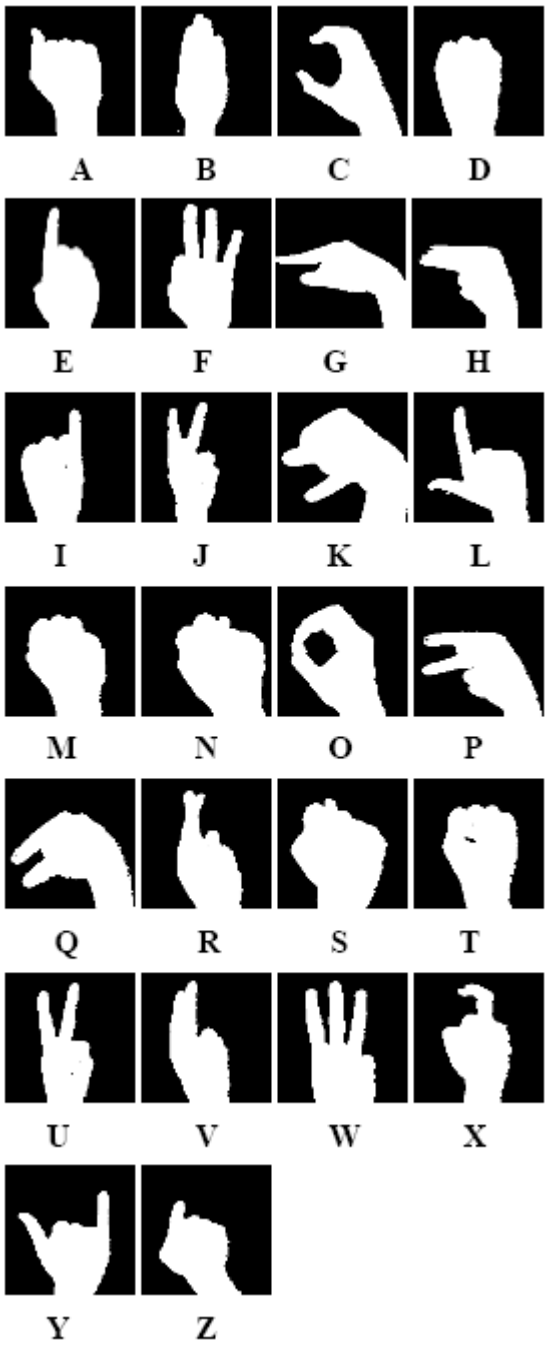

Fig 1 Dataset

4. Architecture Diagram

The diagram mentioned below is for the proposed system. At first step skin colour and tone is recognized and segmentation is performed on that image. This process broken down the digital image into subgroups called image segments and converts the colour image into black and white image.

Pattern recognition is the use of machine learning algorithms to identify patterns and their representation. With the help of this labeled training data is used to train pattern recognition systems. A label is attached to a specific input value that is used to produce a pattern-based output. In the absence of labeled data, other computer algorithms may be employed to find unknown patterns.

Pattern recognition is achieved by utilizing the concept of learning. Learning enables the pattern recognition system to be trained and to become adaptable to provide more accurate results. A section of the dataset is used for training the system while the rest is used for testing it.

The following image shows how data is used for training and testing.

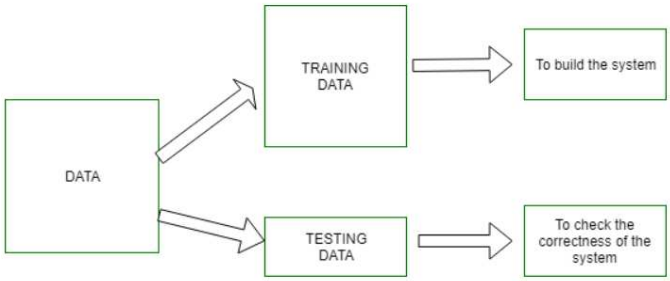

Fig. 2 Training and testing

Gesture Pose Identification identifies the hand sign and gets the respective alphabet that is assigned to the particular sign.

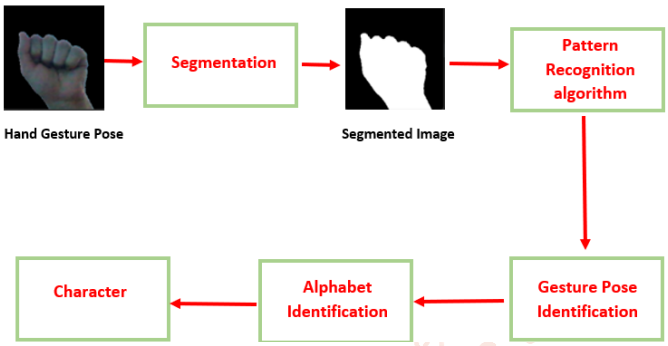

Fig. 3 Architecture Diagram of Proposed System

5. Algorithms

A. Region of interest extraction

Regions of interest (ROI) means the meaningful and important regions of images. It is region or rectangular box that appears while recognizing sign where we put our hand symbol inside that box, the image that comes under that box is ROI.

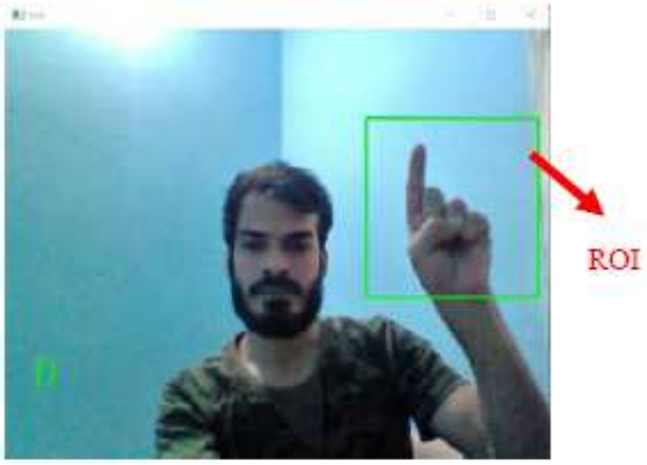

Fig 4 Region of Interest (ROI)

B. Convolutional Neural Network (CNN)

Convolutional Neural Network is a type of artificial neural network used in image recognition and processing that is specifically designed to process pixel data.

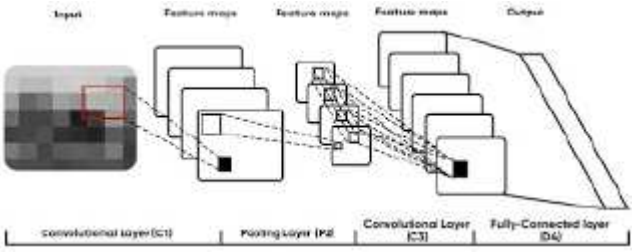

Fig. 5 CNN

C. Convolutional Layer

A convolutional layer is the main building block of a CNN. It contains a set of filters (or kernels), parameters of which are to be learned throughout the training. The size of the filters is usually smaller than the actual image. Each filter convolves with the image and creates an activation map.

D. Relu Layer

The rectified linear activation function or ReLU for short is a piecewise linear function that will output the input directly if it is positive, otherwise, it will output zero.

E. Pooling Layer

Pooling layers are used to reduce the dimensions of the feature maps. Thus, it reduces the number of parameters to learn and the amount of computation performed in the network. The pooling layer summarises the features present in a region of the feature map generated by a convolution layer.

F. Fully-connected Layer

Fully Connected Layer is simply, feed forward neural networks. Fully Connected Layers form the last few layers in the network. The input to the fully connected layer is the output from the final Pooling or Convolutional Layer, which is flattened and then fed into the fully connected layer

6. Result

We are successfully able to develop sign language detector using cloud, only part left is deployment of project on cloud platform and storing dataset on S3 bucket. Due to lack of resources unable to deploy sign language detector on cloud platform.

We are able to create dataset with good clarity after adjusting the histogram and recognition of alphabets are working as expected, overall goal has been achieved.

Fig. 6 Image and Converted Image

Sample proof of sign language detector is mentioned below while recognizing alphabet A.

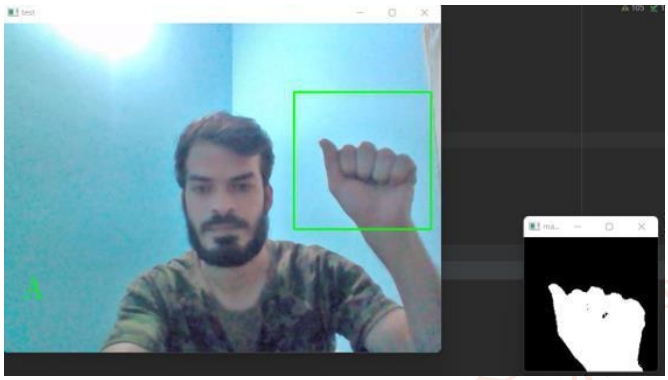

Fig. 7 Result

7. Future Scope

The sign language detector using cloud future scope will be to deploy it on cloud-based platform at first priority. There are some important changes that is required which can be developed later, like writing of words and sentences by showing gestures will make the system easier to use and provides an advanced sign language detection system.

My future goal is to modify to project to make it more user friendly and increase the dataset size to get more accurate results.

Also, there is need to add numbers in our gesture datasets.

8. Conclusion

Sign language detector using cloud is a difficult problem if we review all the set of gestures that a system of this type use to translate. The best way to solve such kind of problem is to divide problem in simpler forms, and here we used simpler form by developing project with different smaller modules.

The system is able to perform in a good manner, the only issue we face is that while setting up histogram for recognizing gestures we need a wall in background which is not a disturbing background and adequate light is required, more than enough light will cause difficulty.

It is observed that for some alphabets recognition time takes is less and for some other it takes more time, as we can notice that some of the alphabets have similar gestures.

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