ISSN No:-2456-2165

Indian Sign Language Recognition System

Saurabh Kumbhar, Abhishek Landge, Akash Kulkarni, Devesh Solanki, Vidya Kurtadikar
School of CET
Dr. Vishwanath Karad MIT World Peace University
Pune, India

Abstract: Sign language is a visual language that uses hand gesture, change of hand shape and track information to express meaning, and is the main communication tool for people with hearing and language impairment. Recently, there has been an increase in research in the field of deep learning and creation of deep learning libraries like tensorflow, keras etc. have made it easy to make use of convolutional neural networks. It has made it easy to create different layers like convolutional layers, pooling layers, fully connected layers etc.

Based on the recent developments and technology we are proposing a system for sign language recognition of alphabets and numbers based on CNN. We have used CNN because it increases the accuracy of the system by recognizing hidden patterns and correlation in raw data.

Keywords:- *Convolution Neural Network (CNN), tensorflow, Keras, Indian Sign Language(ISL), American Sign Language(ASL).*

I. INTRODUCTION

Sign Language is hard to understand for the normal person. According to WHO around 466 million people in world are dumb or deaf i.e., approximately 5% of total's world population. [1] Sign Language is a language like any other globally recognized language. It is a non-verbal means of communication used by the deaf and mute to communicate amongst each other and with others. It allows people to express themselves and understand each other without speaking. There are many different sign languages, for example Indian Sign Language, American Sign Language, Chinese Sign Language etc. In the current scenario American Sign Language is the most used language among all. We are proposing a simple system to convert the Indian Sign Language to text by identifying the sign using CNN.

II. RELATED WORKS

1. Developed a system using ARM Cortex A8 processor for recognizing the American Sign Language (ASL) symbols. Jarvis algorithm was used to cluster the images of numbers and the alphabets. This is achieved by segregating groups of images with similar features and forming a circular cluster around particular groups starting from the leftmost point in counterclockwise direction.
2. Proposed an architecture to recognize Indian Sign Language using Fuzzy c means (FCM) algorithm. FCM classified basic words and sentences by assigning membership to each data point corresponding to each cluster center. More the data near to the cluster center more is its membership towards the particular cluster center.
3. Used Faster R-CNN network to locate hand in a video, 3D CNN to extract the essential features, and long and short time memory (LSTM) network to construct the sign language images of sequences. The framework improved the recognition accuracy by learning the context of sign language.
4. Designed an ISL (Indian Sign Language) hand gesture motion translation tool for helping the deaf-mute community to convey their ideas by converting images of hand gestures into text format. A self-recorded ISL image dataset was created for training the model by converting larger lengthened video gestures to a series of video frames. Inception V3 CNN model was used to extract the features, LSTM (Long Short-Term Memory), an architecture of RNN (Recurrent neural network), classified the gestures, and are translated into text.
5. Applied deep belief net (DBN) to recognize Chinese Sign Language (CSL). In this study, eight subjects were involved in an experiment of performing CSL on a target word set consisting of 150 CSL sub words. Also, the signals from surface electromyography, accelerometer, and gyroscope were collected and used for CSL recognition. 95.1% accuracy was observed.

III. METHODOLOGY

Today the technology is evolved and has potential to help the dumb and deaf people. We propose a model that can recognize sign language using the Convolutional network as in Fig 1. The user can recognize sign language using a smartphone camera and the predicted alphabets will be visible on the real time basis. In addition to that we can also make the model available for different sign languages. To develop this model we used tensorflow library and keras library. For this we created the dataset using the Video and extracted images or frames using OpenCV library.

A. Preprocessing

We have augmented images using keras preprocessing library. We have used width and height shift of 0.2, shear range of 0.2, brightness range varying from 0.2 to 1.0, zoom range of 0.2 and set horizontal shift to true for left hand on training data.

B. Model Creating and Training

We created the model Fig 1, using tensorflow library. We used RMSprops as the loss function having a learning rate of 0.0001 as it gave us better accuracy among all. We trained model for 30 epochs

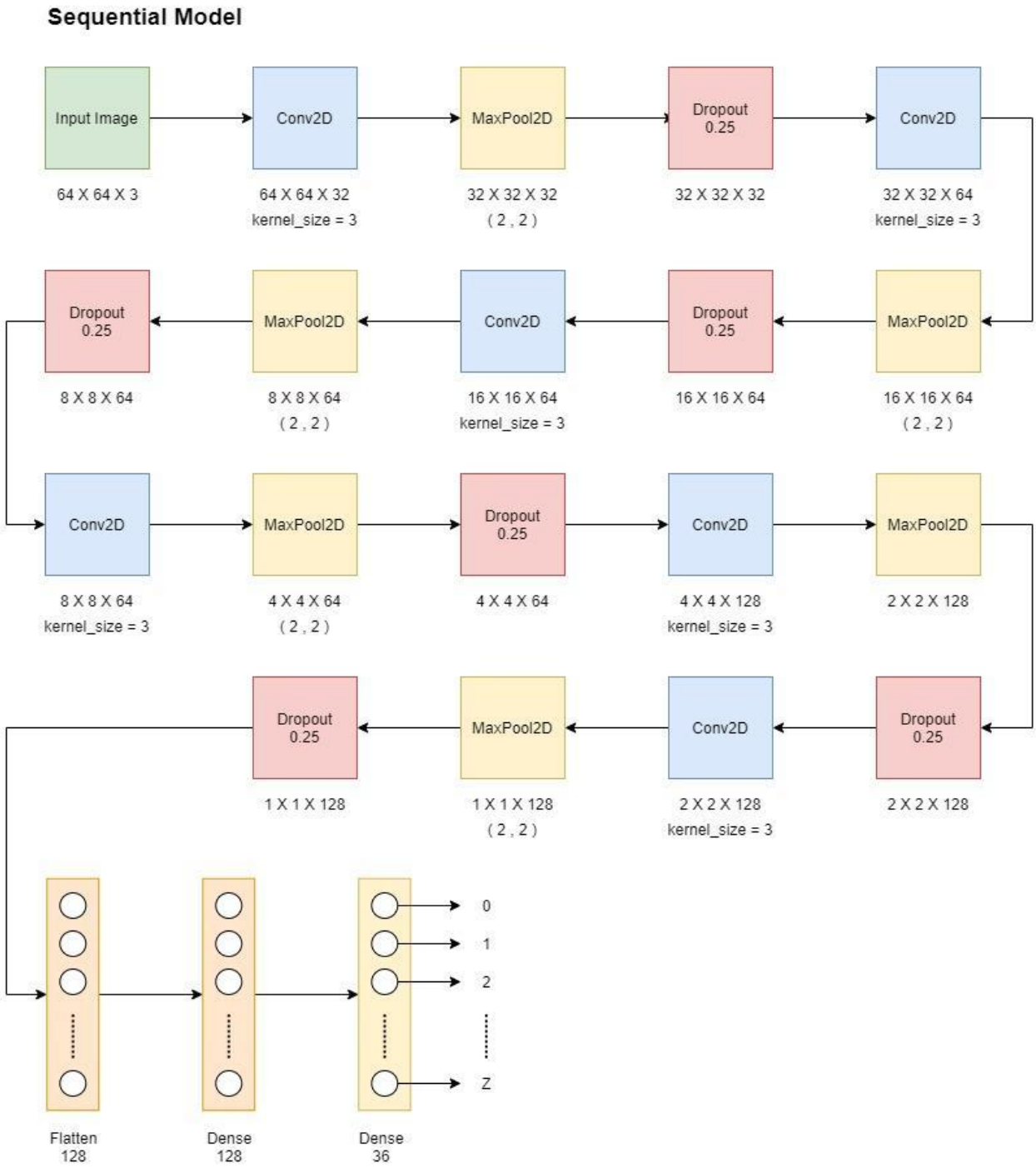

Fig. 1 CNN Model Diagram

C. Dataset

The Indian sign language dataset available on [7] (42,000 images) was used as a part of the whole dataset to train the proposed model. But this dataset lacked the variations in hand gestures. Hence, we learned sign language [8], created videos of hand gestures. Then converting video to frames using OpenCV library we developed dataset Fig 2. It consists of around 1,60,000 images in total belonging to 36 classes (0 to 9 and A to Z).

ISSN No:-2456-2165

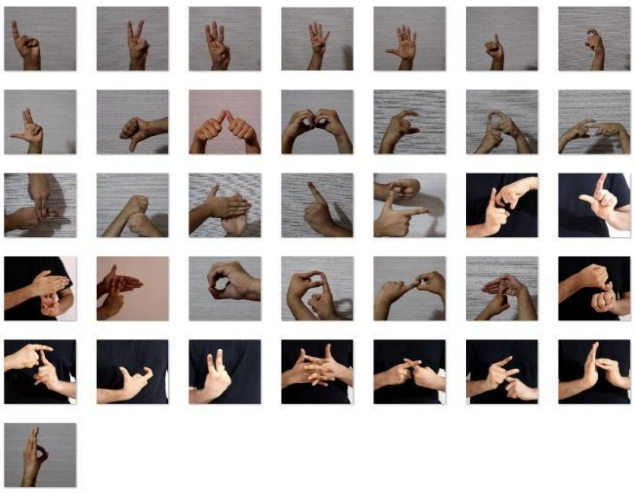

Fig 2. Dataset used for training

IV. RESULTS

This CNN based sign language recognition system, for recognizing the numbers and alphabets of ISL has produced test accuracy of 92.56 % and validation accuracy of 98.34 %.

The Fig 3 depicts that the proposed model is neither overfitted nor underfitted.

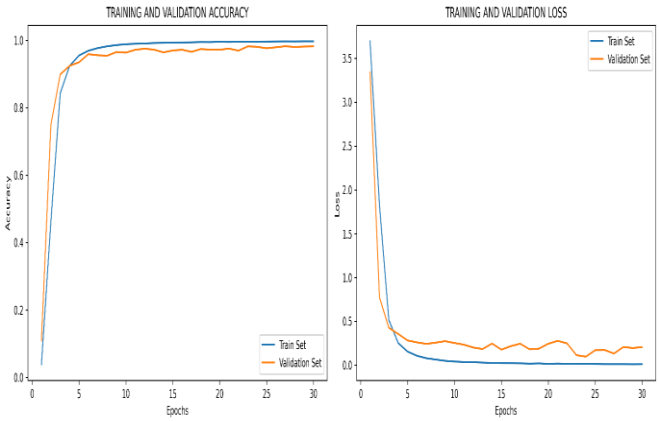

Fig 3. Training, Validation Accuracy and Loss graph after each epoch.

V. CONCLUSION

This system helps many dumb and deaf people. Though this CNN model is efficient, it needs more computations for building and loading model. The proposed model takes input image and recognizes the sign language. We proposed the model with an accuracy of 98.34%.

In future work we can work on recognizing sentences and words in real time to ease the communication between the deaf or dumb and the normal person.

ACKNOWLEDGEMENT

Sincere thanks to Prof Vidya Kurtadikar for helping out in solving difficulties in the project. A special thanks to those computer gigs who developed beautiful libraries which saves a lot of time. We are also thankful to the stackoverflow community for helping out with the use of libraries.

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