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SIGN LANGUAGE RECOGNITION USING DEEP LEARNING

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ABSTRACT

This paper proposes an approach to solve the problem of decoding the sign language which goes by when a person is talking in sign language in coverage of the web camera used in our system, then a corresponding meaning associated to the gesture is displayed on the computer screen along the percentage efficiency of that gesture. We previously were focused on working sign language but all the available approaches were outdated and therefore by making use of new and recent technologies we developed gesture detection system which can also serve as sign language translator and also there is a speech conversion feature added in this project. This system makes use of the following dependencies which are OpenCV, TensorFlow API, and Keras. The main purpose of our system is to reduce the loss and increase the efficiency of hand gestures in day-to-day life. The existing system and the modified system are both present in this project.

Keywords: Opencv, Tensorflow, Keras, Python, Machine Learning.

I. INTRODUCTION

Over 5% of the global population is suffering from hearing-loss, and out of these only a handful of group's needs are being fulfilled. Each and every individual stands an equal chance to be heard and communicated with, just like every other common interaction, be it from buying groceries or to convey their emotions to their close ones. Sign Languages are visual representation of thoughts through hand gestures, Facial expressions, and body movements. Sign Languages also have several variants, such as American Sign Language(ASL), Argentinian Sign Language(LSA), British Sign Language(BSL)and Indian Sign Language(ISL).

II. METHODOLOGY

We utilized a method called Transfer Learning along with Data Augmentation to create a deep learning model for the ASL dataset .To train the model for better real-world scenarios, we have augmented the data using brightness shift (ranging in 20% darker lighting conditions) and zoom shift (zooming out up to 120%).The model is efficient, since we used a compact **CNN-based architecture**, it's also computationally efficient and thus making it easier to deploy the model to embedded systems (Raspberry Pi, Google Coral, etc.). This system can therefore be used in real-time applications which aims at bridging the the gap in the process of communication between the deaf and dumb people with rest of the world.

Gaussian filter is used as a pre-processing technique to make the image smooth and eliminate all the irrelevant noise .Intensity is analyzed and Non-Maximum suppression is implemented to remove false edges .For a better pre-processed image data, double thresholding is implemented to consider only the strong edges in the images .All the weak edges are finally removed and only the strong edges are considered for the further phases.

III. MODELING AND ANALYSIS

After the model is trained, it is then loaded in the application. OpenCV is used to capture frames from a video feed. The application provides an area (inside the green rectangle) where the signs are to be presented to be detected or recognized. The signs are then captured in frames, the frame is processed for the model and then fed to the model. Based on the sign made, the model predicts the sign captured. If the model predicts a sign with a confidence greater than 20%, the prediction is presented to the user (LOW confidence sign predictions are predictions above 20% to 50% confidence which are presented with a Maybe [sign] - [confidence] output and HIGH confidence sign predictions are above 50% confidence and presented with a [sign] - [confidence].

Output where [sign] is the model predicted sign and [confidence] is the model's confidence for that prediction). Else, the model displays nothing as output

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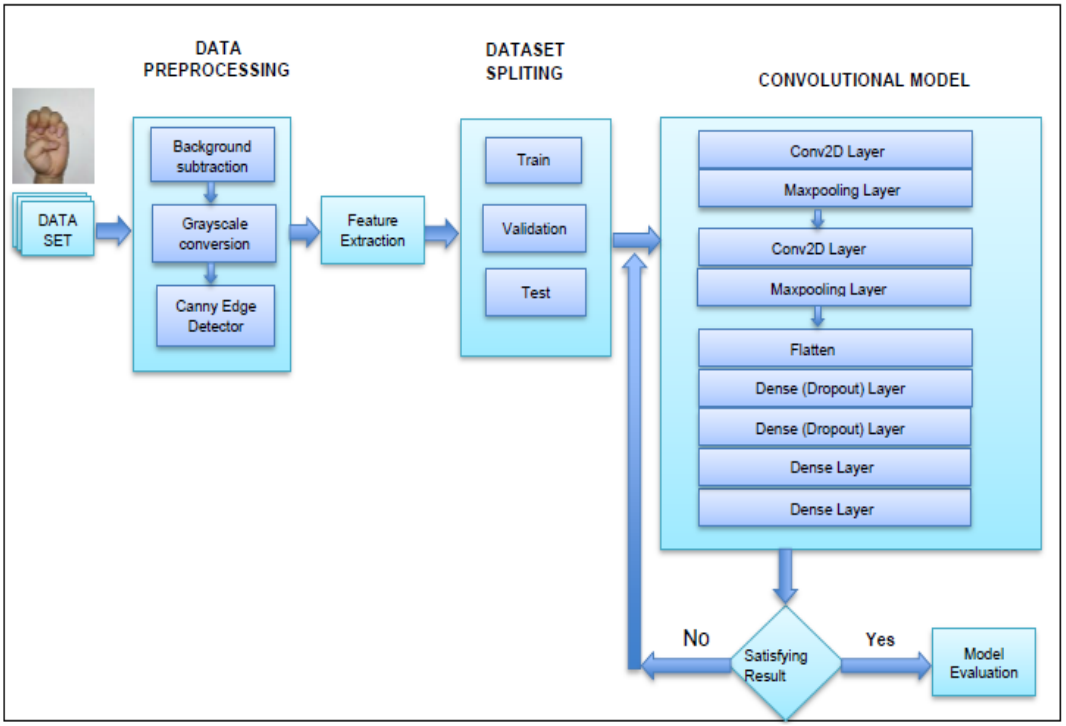

Figure 1: The figure above shows a detailed pipeline of the model architecture. It can be interpreted that a Convolutional architecture has been proposed.

IV. RESULTS AND DISCUSSION

Our model gave 99.8% accuracy for Sign Language Detection after training.

- The model has been trained on a python based environment on Jupyter platform.
- The model is iterated for a total epoch of 20.
- The model has attained an accuracy of 99.88 % accuracy on the Validation set.
- The prescribed model has been evaluated on Test set where it has attained an accuracy of 99.85% with loss of 0.60 %.

Table 1. Alphabet accuracy chart

	precision	recall	f1-score	support
0	1.00	1.00	1.00	117
A	1.00	1.00	1.00	115
B	1.00	1.00	1.00	135
C	1.00	1.00	1.00	124
D	0.98	1.00	0.99	118
E	1.00	1.00	1.00	120
F	1.00	0.99	1.00	142
G	1.00	1.00	1.00	126
H	1.00	1.00	1.00	140
I	1.00	1.00	1.00	115
J	1.00	1.00	1.00	141
K	1.00	1.00	1.00	123
L	1.00	1.00	1.00	132
M	1.00	1.00	1.00	130
N	1.00	1.00	1.00	124
O	1.00	1.00	1.00	120
P	1.00	1.00	1.00	118
Q	1.00	1.00	1.00	121
R	1.00	1.00	1.00	133
S	1.00	1.00	1.00	112
T	1.00	0.99	1.00	151
U	1.00	1.00	1.00	123
V	1.00	1.00	1.00	137
W	1.00	1.00	1.00	127
X	1.00	1.00	1.00	120
Y	1.00	1.00	1.00	125
Z	1.00	1.00	1.00	134
accuracy			1.00	3423
macro avg	1.00	1.00	1.00	3423
weighted avg	1.00	1.00	1.00	3423

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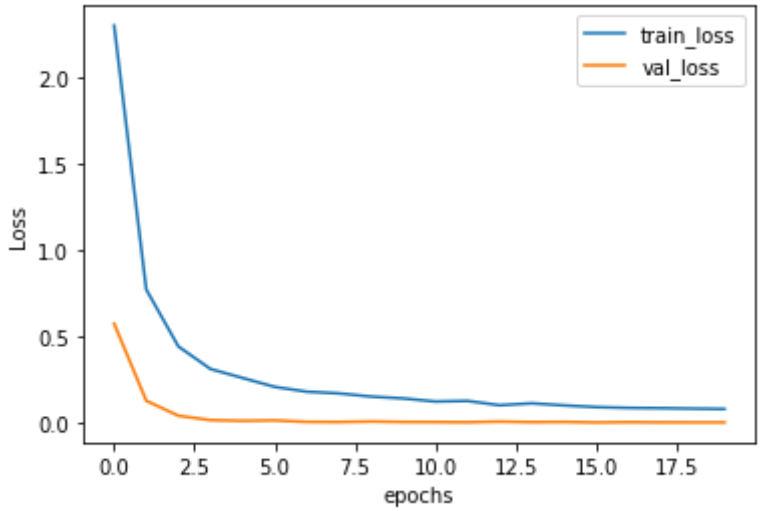

Figure 2: Accuracy/loss training curve plot

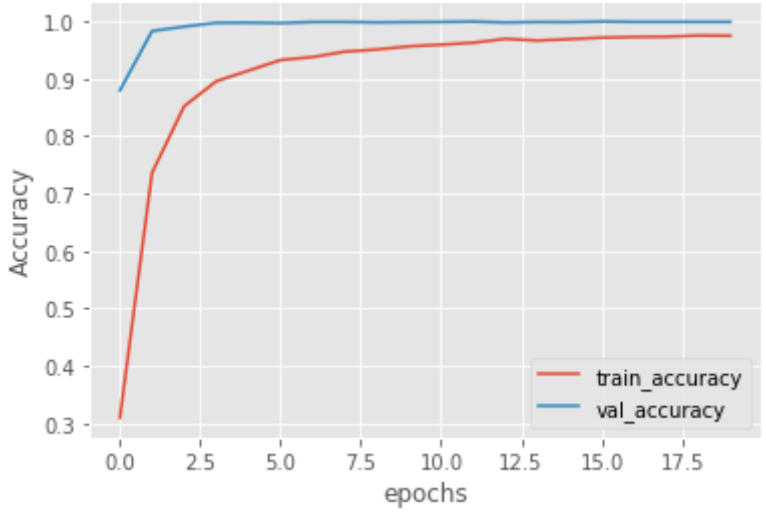

Figure 3: Accuracy plot of the model throughout it's training journey.

V. CONCLUSION

In this project, we proposed an idea for feasible communication between hearing impaired and normal person with the help of deep learning and machine learning approach. The model was successfully able to provide good accuracy when provided with the test data indicating that the model can be used to gain knowledge to the machine There is ever the sounding challenge to develop a sign language system in data the collection remains invariant of the unconstraint environment. This project can be extended to the real time data.

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