Indian Sign Language Recognition

Summer Project

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5th SEM, CSE

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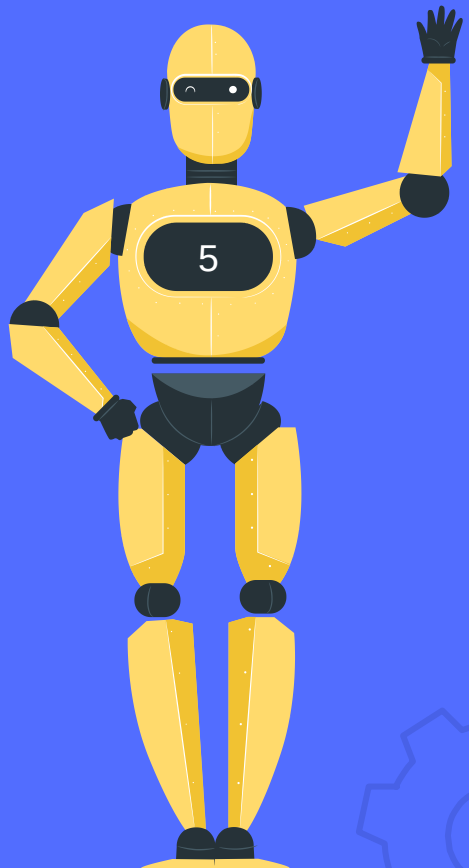
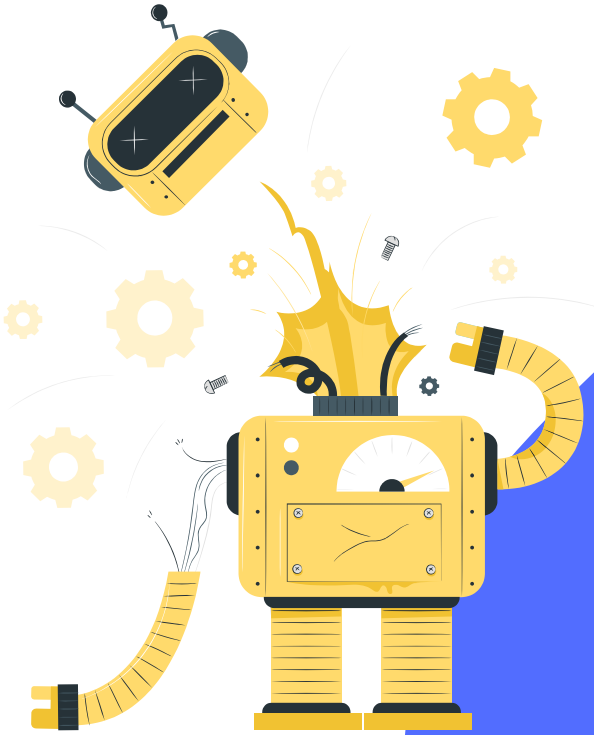
ABSTRACT

Communication is a basic prerequisite for an individual to express feelings, thoughts, and ideas, yet the vast majority of individuals find it difficult to interact with the hearing and speech challenged community. Hearing and speech disabled people can engage with the rest of society through sign language. The Indian government has passed the Rights of Persons with Disabilities (RPWD) Act, 2016, which acknowledges Indian Sign Language (ISL) and requires the use of sign language interpreters in all government-aided organizations and public sector proceedings.





PROBLEM

Unfortunately, a large percentage of the Indian population is not familiar with the semantics of the gestures associated with ISL.

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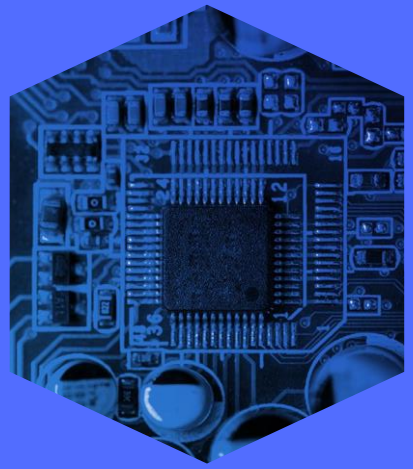
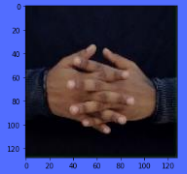
PROBLEM vs SOLUTION

What could be the solution for this ?





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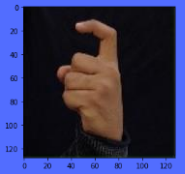

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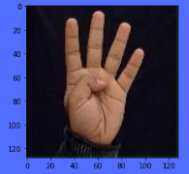

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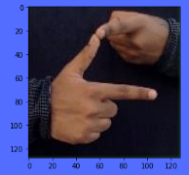
To bridge this communication gap, this project develops a model that uses Convolutional Neural Networks to detect and classify Indian Sign Language.

The model seeks to categories 36 ISL gestures representing 0-9 digits and A-Z alphabets by converting them to their text equivalents using OpenCV and Keras implementation of CNNs. The developed and used dataset consists of 350 photos for each gesture, which were input into the CNN model for training and testing. The model was successfully implemented & achieved 99.03% accuracy for the test images.



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Neural Network

CNNs

Keras

AWESOME WORDS!

Training

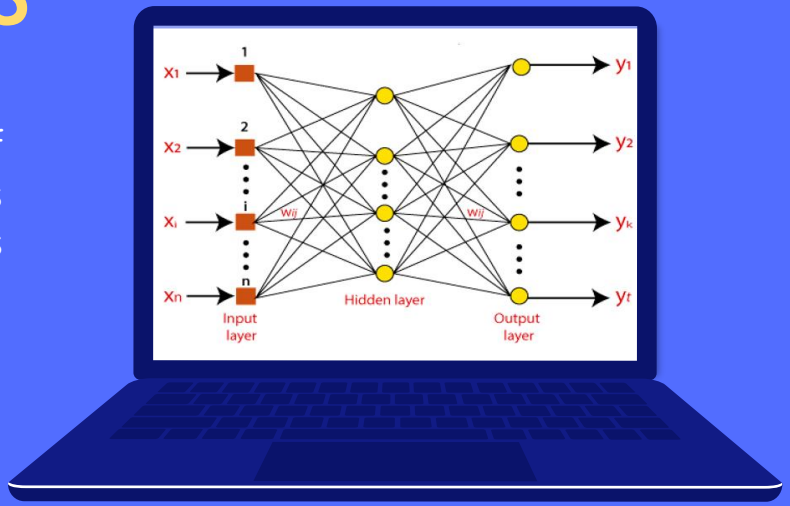
Model

99.03% Accuracy

What do they mean ?

02 NEURAL NETWORKS

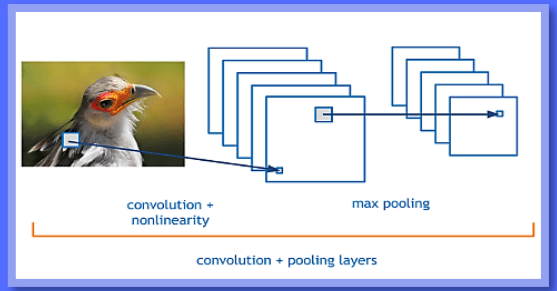
Neural networks are a class of machine learning algorithms used to model complex patterns in datasets using multiple hidden layers and non-linear activation functions.

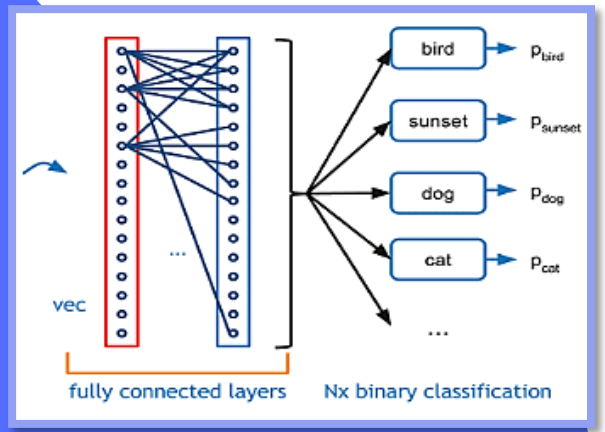


Neural networks are artificial systems that were inspired by biological neural networks. These systems learn to perform tasks by being exposed to various datasets and examples without any task-specific rules.

03 CONVOLUTIONAL NEURAL NETWORKS

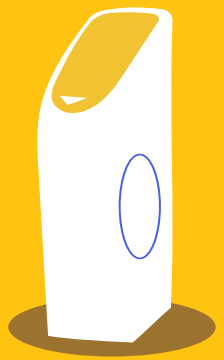
A convolutional neural network (CNN) is a type of artificial neural network used in image recognition and processing that is specifically designed to process pixel data. A neural networks a system of hardware and/or software patterned after the operation of neurons in the human brain.

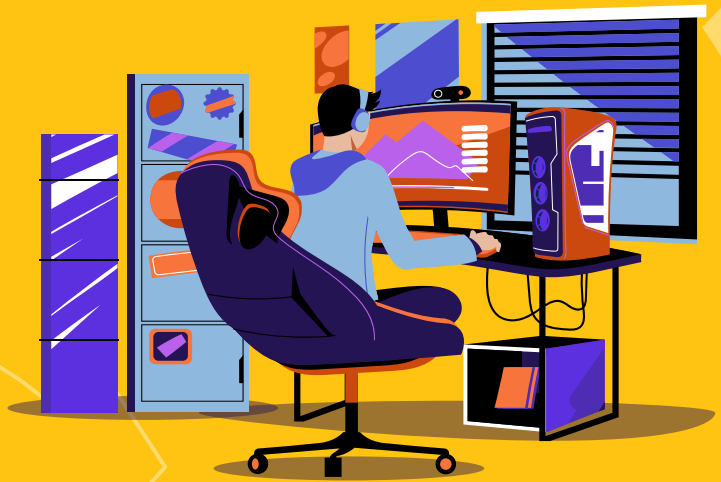




NOW, BACK TO THE MODEL !

Pre – Processing, Training, Testing and Results





04 PRE - PROCESSING

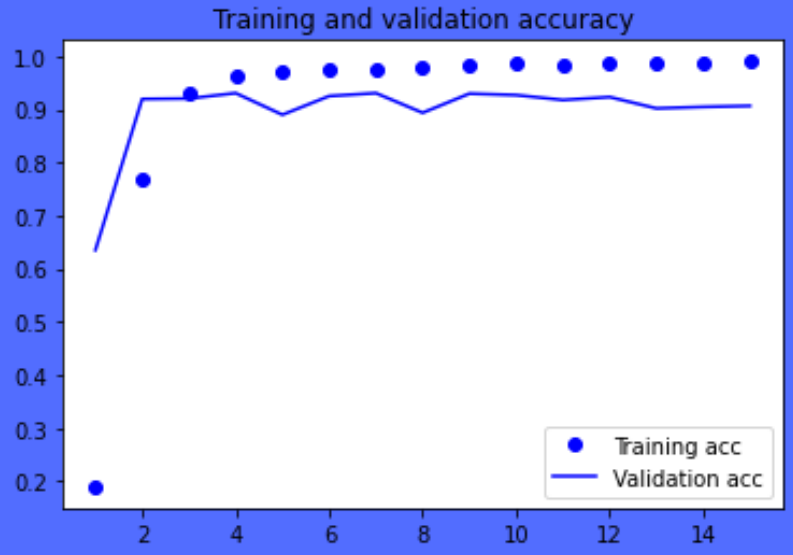
Before designing and training a Convolutional Neural Network (CNN), the dataset was loaded and the images were resized to 128 x 128 pixels.

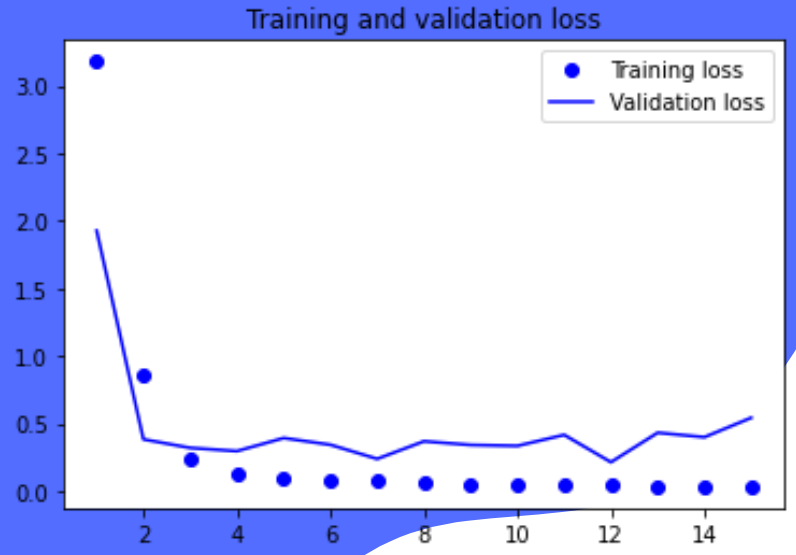
Then the data was split into 2 sets; the Training data which was 80% of the whole dataset and the Test data which was the remaining 20%. Once the dataset was pre-processed, it was ready to be fed into the CNN model along with their class labels.

The model comprised the following layers:
- Convolutional Layers
- Max Pooling Layers
- Dropout Layer
- Fully Connected Layers (Dense Layers)

05 TRAINING

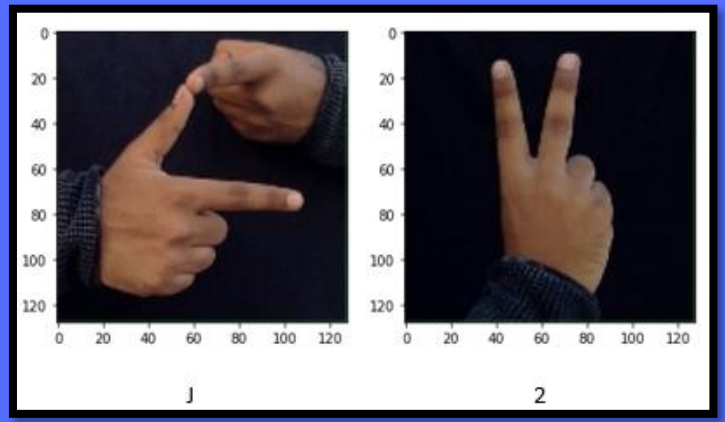
After the model was successfully compiled, we fit the model on the training dataset for 15 epochs using the two training callbacks discussed above and with a 10% validation data split. The model was saved after training was over.

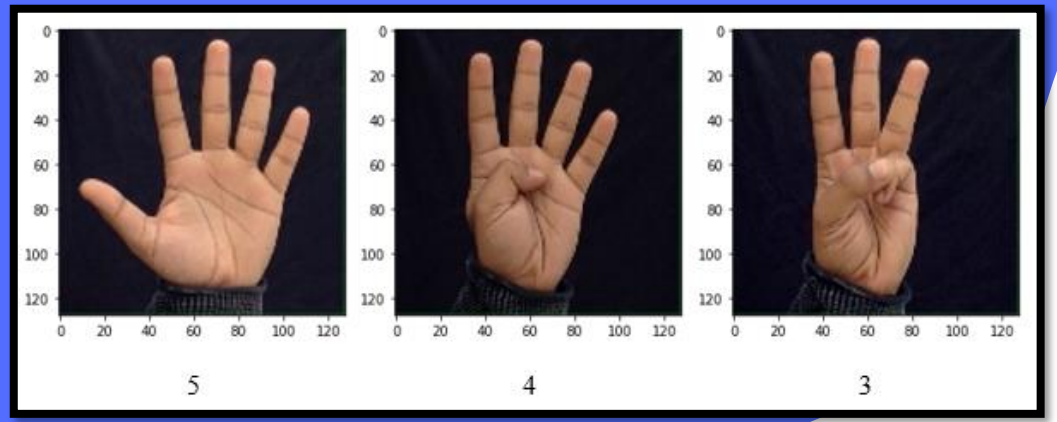


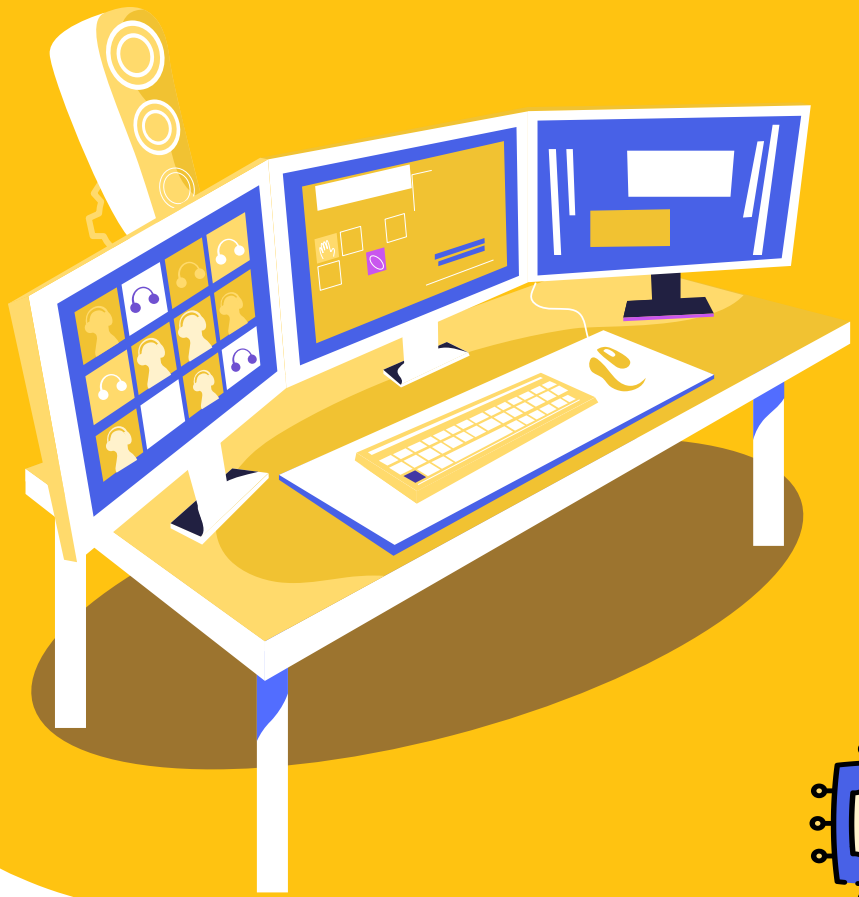


06 TESTING

The model was trained and tested on 350 images of each ISL alphabet and numeral sign. A collection of 10800 randomly selected images out of the total 12600 images were fed into the model for training. Some testing outputs are:







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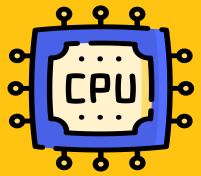
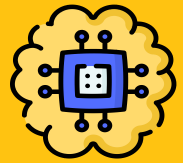
WHAT ARE THE RESULTS ?



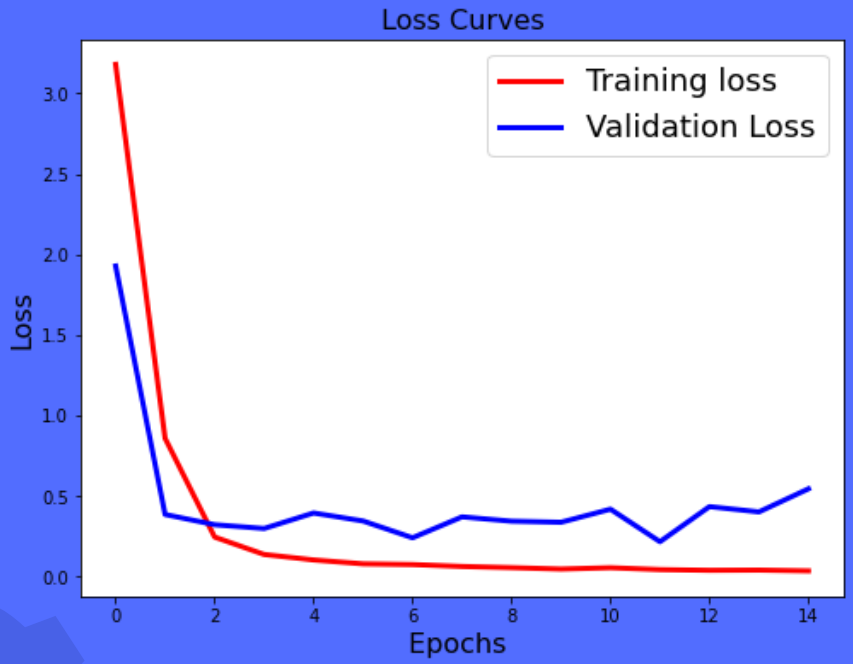


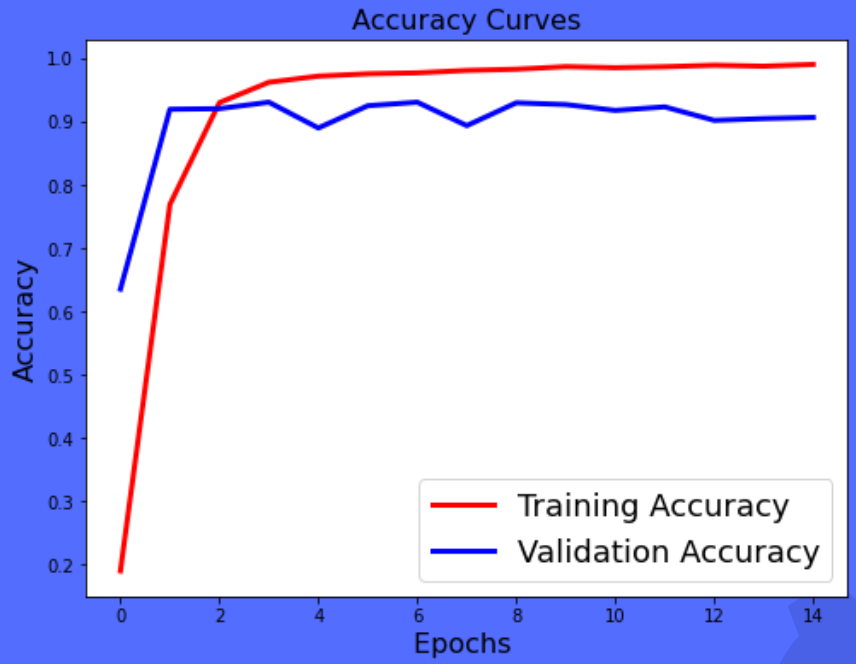
RESULTS

The model achieved 90.65% validation accuracy. Post training, the model was tested on 1800 test images, and an accuracy of 99.03% and a loss value of 0.032 was obtained, with the model correctly classifying 1782 test images out of the total test dataset of 1800 images.

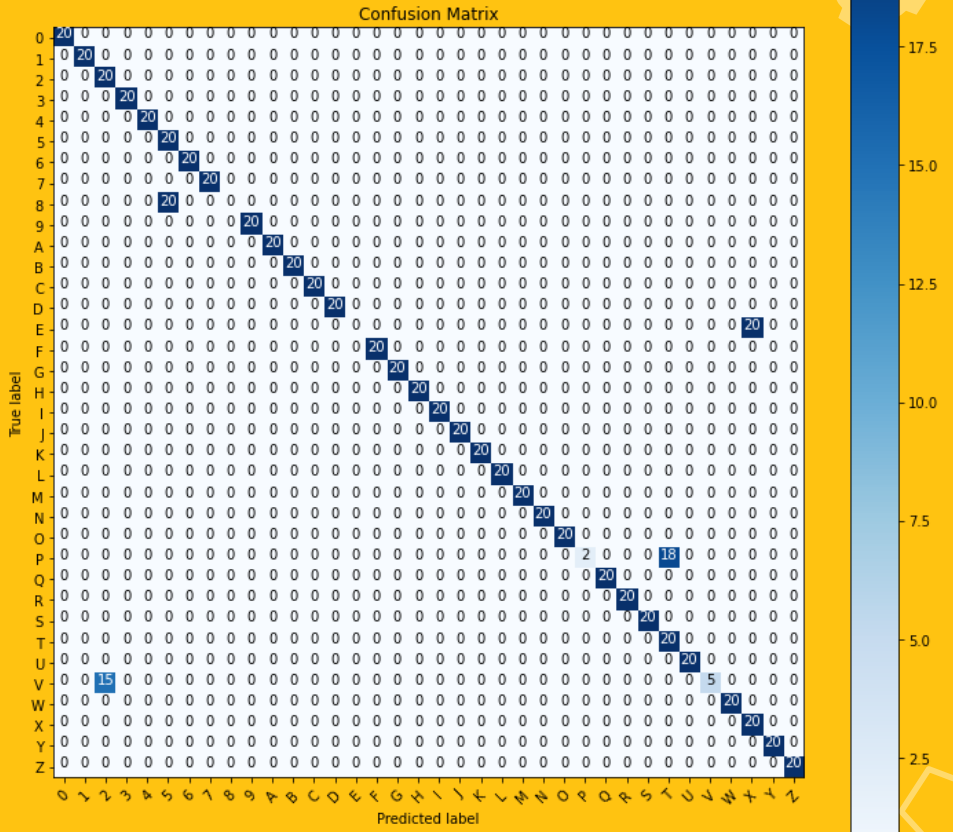
TRAINING ACCURACY 99.03%	**VALIDATION ACCURACY** 90.65%
LOSS VALUE 0.032	**CORRECTLY CLASSIFIED** 1782 / 1800 IMAGES

CURVES


Loss Curves
Training loss
Validation Loss
Loss
Epochs
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
2
4
6
8
10
12
14


Accuracy Curves
Training Accuracy
Validation Accuracy
Accuracy
Epochs
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
0
2
4
6
8
10
12
14

CONFUSION MATRIX



Thus, the proposed CNN model was successfully implemented and achieved 90.65% validation accuracy on the training images. On testing the model on test data, an accuracy score of 99.03% was obtained. Such a sign language recognition system can prove to be very helpful for the deaf and dumb population of the country in communicating with others.

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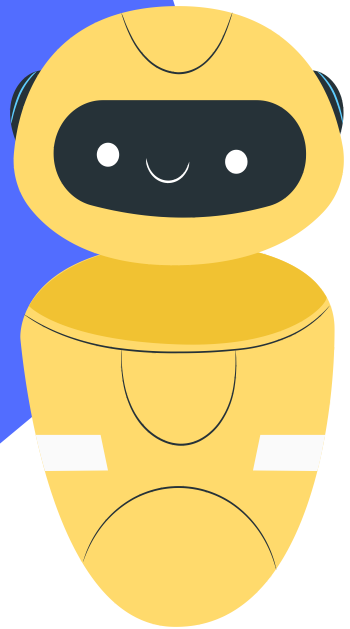

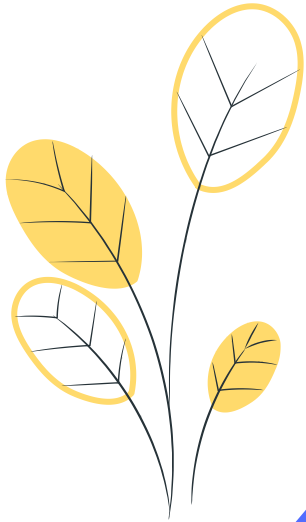

Thank You