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Hand Gesture Recognition using Deep Learning

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ABSTRACT: Hand Gestures are a form of nonverbal communication in which visible bodily actions are used to communicate important messages, either in place of speech or together and in parallel with spoken words. Gestures include movement of the hands, face, or other parts of the body. Physical non-verbal communication such as purely expressive displays, proxemics, or displays of joint attention differ from gestures, which communicate specific messages. Gestures are culture-specific and may convey very different meanings in different social or cultural settings. This project is to train a Machine Learning algorithm capable of classifying images of different hand gestures, such as a fist, palm, showing the thumb, and others A comparison of the proposed and current algorithms reveals that the accuracy of hand gesture types classification based on Convolutional Neural Networks(CNN) is higher than other algorithms. It is predicted that the success of the obtained results will increase if the CNN method is supported by adding extra feature extraction methods and classifying successful fruits types on image.

KEYWORDS: Convolutional Neural Networks, Deep Learning, Gesture recognition.

I. INTRODUCTION

A Gesture is defined as the physical movement of the hands, fingers, arms, and other parts of the human body through which the human can convey meaning and information for interaction with each other. There are two different approaches for human-computer interactions, the data gloves approach and the vision-based approach. The vision-based approach was investigated in the following experiments including, the detection and classification of hand gestures. A Hand gesture is one of the logical ways to generate a convenient and high adaptability interface between devices and users. The best communicative technique and the common concept used in a gesture recognition system is hand gestures. Hand gestures can be detected by one of these following techniques: posture is a static hand shape ratio without hand movements, or a gesture is dynamic hand motion with or without hand movements. Using any type of camera will detect any type of hand gesture; keeping in mind that different cameras will yield different resolution qualities. Sign language is one of the common examples of a hand gesture system. It is defined as a linguistic system based on hand motions besides other motions. For instance, most hearing, impaired people around the world use universal sign language. Sign language contains three fundamental parts: word-level sign vocabulary, non-manual features, and fingerspelling.

One of the best methods to communicate with hearing-impaired people is sign language. Recently, sign language may be achieved by some types of robotics using some appropriate sensors used on a patient's body. Another example is stroke rehabilitation. People who have experienced stroke can have paraplegia which prevents them from moving their lower limbs. Stroke rehabilitation can play a significant role to solve this type of issue. Additionally, some people who have a stroke cannot communicate adequately with other people. Hand Gesture Recognition using Deep Learning will enable us to learn different types of hand gestures by training the system.

II. RELATED WORK

The paper Hand Gesture Recognition for Sign Language Using 3DCNN by Muneer Al-Hammadi et al [1] said about Automatic hand gesture recognition has gained increasing importance for two principal reasons: the growth of the deaf and hearing-impaired population, and the development of vision-based applications and touchless control on ubiquitous devices. the next paper by Zhengjie Wang et al [2] was Hand Gesture recognition based on Active Ultrasonic Sensing of Smartphone survey drawn attention in the field of human-computer interaction mode.
The base paper of our proposed paper is Electromyography-based Hand Gesture Recognition System for Upper Limb Amputees by Sidharth Pancholi and Amit M Joshi which presents admirable results for low power applications in rehabilitation and myoelectric prosthetics. With this system, grasping motion can decode easily in 75ms completion time after training model generation.

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III. METHODOLOGY

The proposed system of our paper is focused on introducing Deep Learning technology in finding the hand gestures efficiently. The deep learning method is used in the study is Le Net and Alex Net Convolutional Neural Networks by adding extra feature extracting methods and classifying hand gestures.

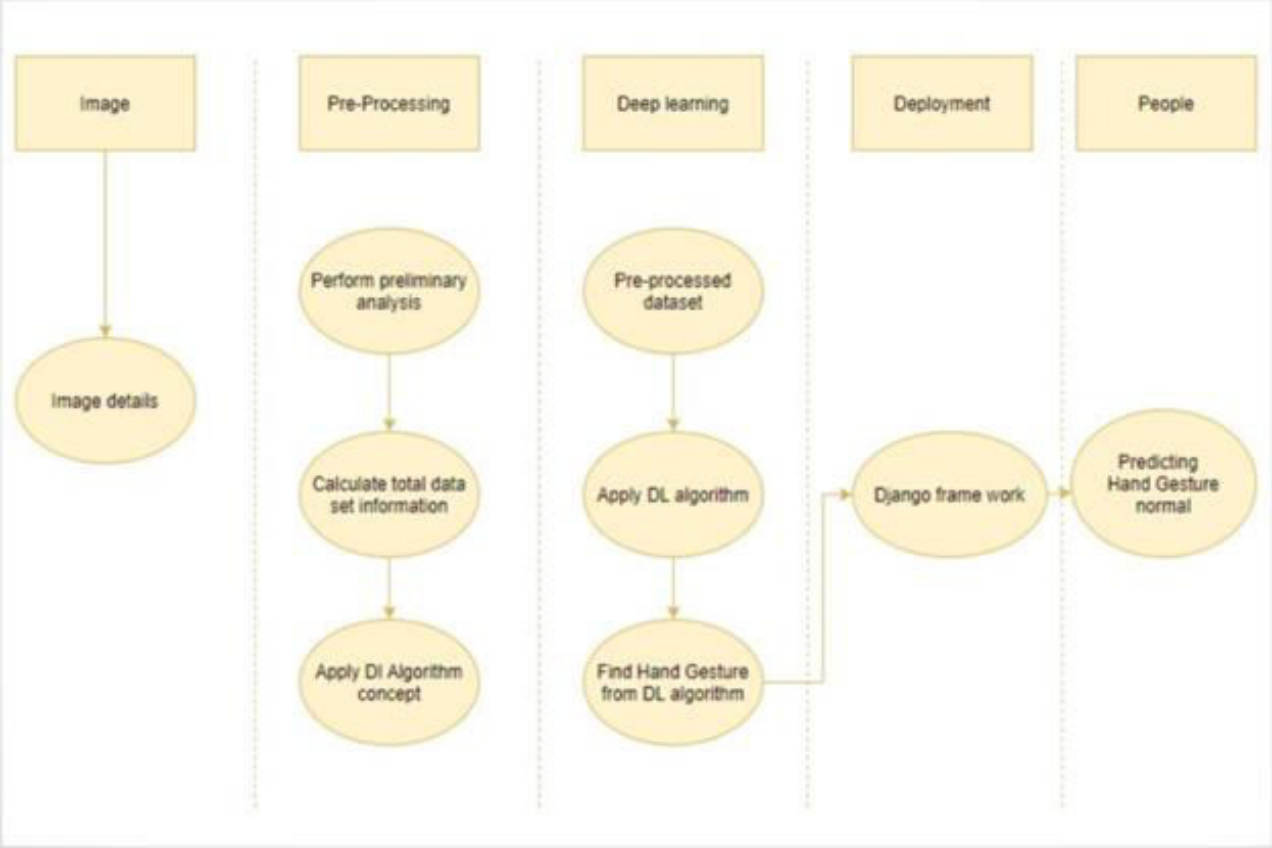
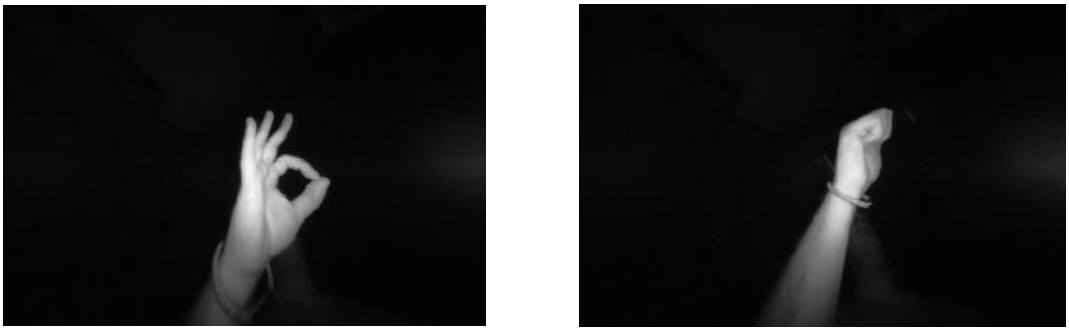


Fig.1.Design Architecture

Importing the image datasets:

We have to import our data set using Keraspreprocessing image data generator function also we create size, rescale, range, zoom range, horizontal flip. Then we import our image dataset from the folder through the data generator function. Here we set to train, test, and validation also we set target size, batch size, and class-mode from this function we have to train by manual CNN network. After importing the dataset, we have to declare the path of that dataset to the variable.



(a) (b)

Fig.2.Input Image Datasets (a) gesture indicating ‘ok’ (b) fist moved

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Training the Model:
To train our dataset using a classifier and fit generator function also make training steps per epoch's then total number of epochs, validation data, and validation steps using this data we can train our dataset. In our project, we have used 3 convolutional neural networks and the best out of them is taken and deployed in a Django framework for python.

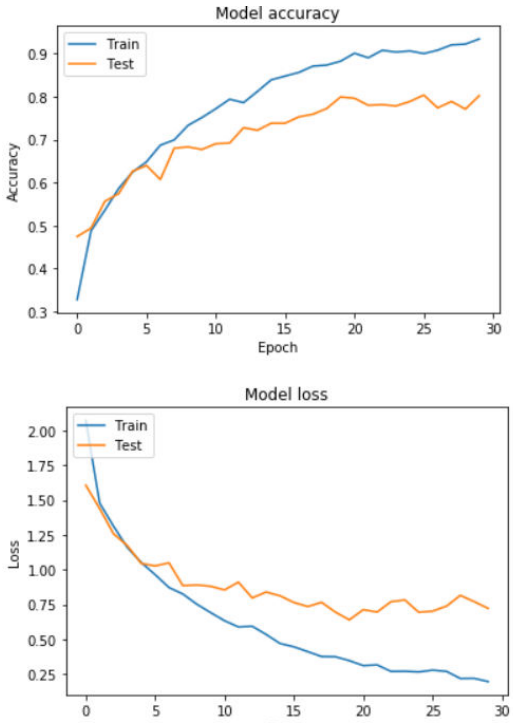
IV. EXPERIMENTAL RESULTS

The three networks used are Le Neural Network, Alex Neural Network, and Manual neural network(developed with basic layers). The figures below show the experimental results of the three neural networks.

For Alex Neural Network with epochs size as 30 and batch size as 32, we get the final result of 77%
Epoch 30/30 87/87 [==============================] - 58s 663ms/step - loss: 0.6390 - accuracy: 0.7744 - val_loss: 0.7449 - val_accuracy: 0.7351

Now taking the LeNet with the same epochs=30 and batch size =32, we get an accuracy of 92% Epoch 30/30 87/87 [==============================] - 62s 716ms/step - loss: 0.2293 - accuracy: 0.9224 - val_loss: 0.8255 - val_accuracy: 0.7604

Hence with the obtained results, we save the model in .h5 format for the purpose of deployment in Django Framework



(a)

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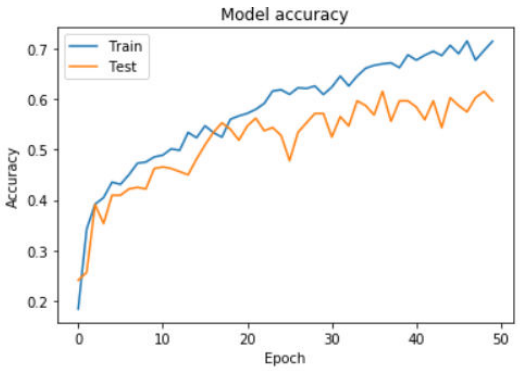
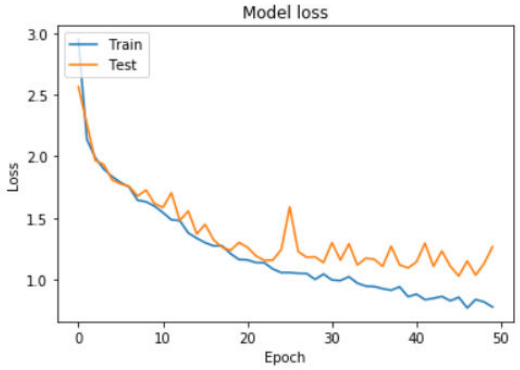
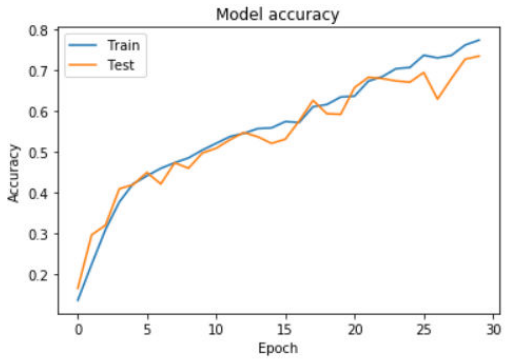
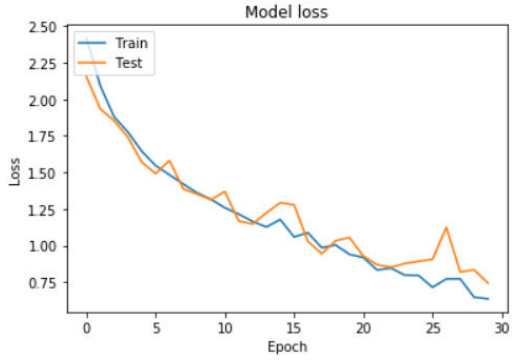




(b)

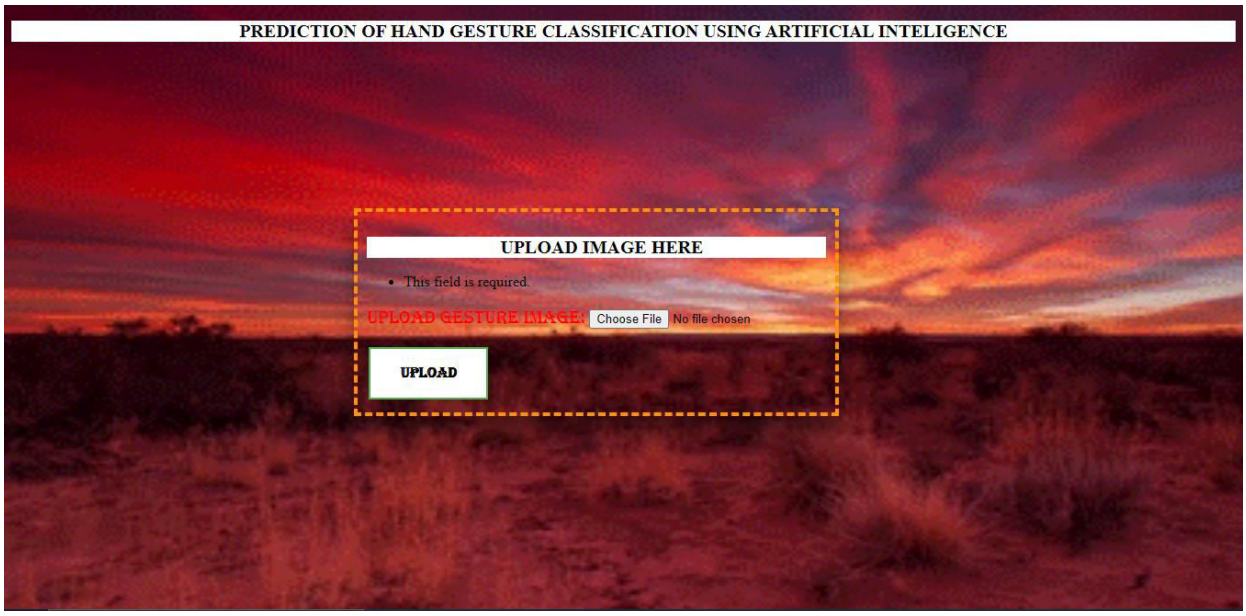




(c)

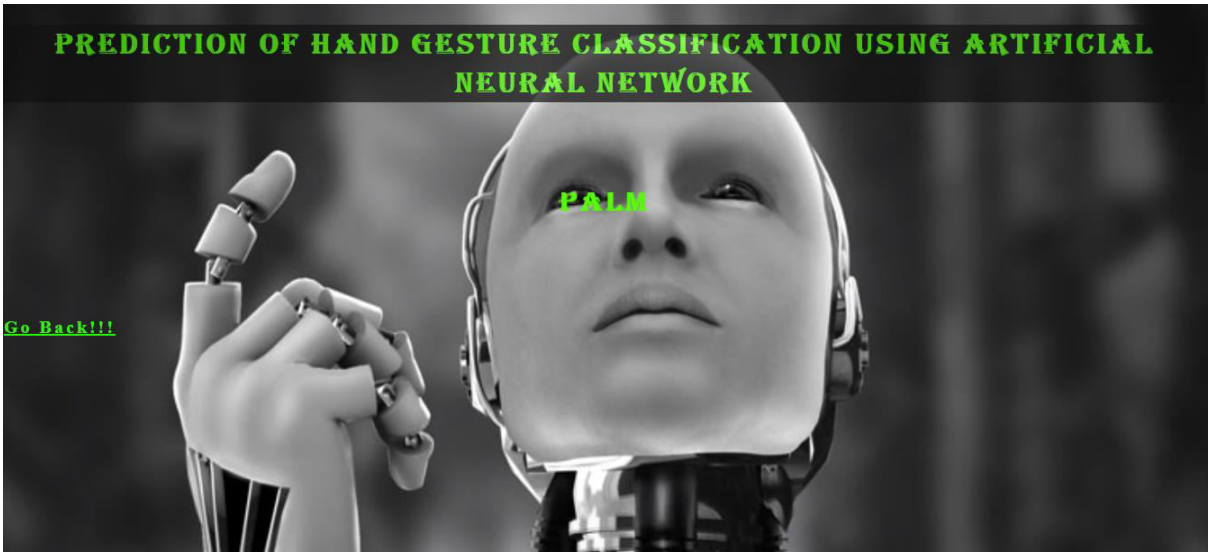
Fig.3.Experimental results of (a) Manual Neural Network (b) Le Neural Network (c) Alex Neural Network.

Output result:



(a)

(b)



(c)

Fig.4 Output from Django Framework (a) web page display (b) after upload of the data (c) prediction of hand gesture classification

The coding for the deployment includes both HTML and CSS. After the coding part, the local servers are run where the files are loaded and the HTML link is displayed. On clicking the link, the web framework is opened in an internet browser.

V. CONCLUSION

Our project focused on how images from the given datasets (trained datasets) in the field and past data set used to predict the pattern of different hand gestures using the CNN model. This brings some of the following different gestures prediction. We have applied different type of CNN compared the accuracy and LeNet makes the better classification and the .h5 file is taken from there and deployed in Django Framework for a better user interface.

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