Gesture Recognition

Problem Statement:

A home electronics company which manufactures state of the art **smart televisions**. You want to develop a cool feature in the smart-TV that can **recognize five different gestures** performed by the user which will help users control the TV without using a remote.

Each gesture corresponds to a specific command:

- Thumbs up: Increase the volume

- Thumbs down: Decrease the volume

- Left swipe: 'Jump' backwards 10 seconds

- Right swipe: 'Jump' forward 10 seconds

- Stop: Pause the movie

Training Data set:

The training data consists of a few hundred videos categorized into one of the five classes. Each video (typically 2-3 seconds long) is divided into a **sequence of 30 frames(images)**. These videos have been recorded by various people performing one of the five gestures in front of a webcam similar to what the smart TV will use.

Generator Used:

1. generator () : A custom generator for Conv 3D Model
2. generatorLSTM (): A Generator for LSTM Model
3. generatorMobileNet() : A Generator for Pre-Trained Mobile Net

We have Used multiple options of Model such as Conv3D , CNN+RNN , CNN+RNN with Pre-Trained Model. Each of them provide us different results, there results and specifications are given below which we have tried to build it.

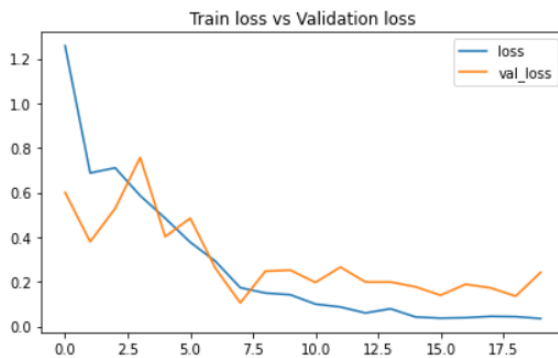| Exp. #	Model	Hyperparameters	Result	Decision + Explanation
1	Conv3D	No of frames = 16 No. epochs = 10 Batch Size = 20	Max. Training Accuracy 0.855614960193634 Max. Validation Accuracy 0.375 Total Params: 4,050,085	The Model is learning but while validating we are seeing the gaps trying to reduce the gap
2	Conv3D	No of frames = 20 No. epochs = 20 Batch Size = 64	Max. Training Accuracy 0.9572192430496216 Max. Validation Accuracy 0.625 Total Params: 1,301,045	There is slight in improvement in training accuracy and the validation is as is so still try to reduce the gap
3	Conv3D	No of frames = 20 No. epochs = 20 Batch Size = 64 Different set of Filters applied	Max. Training Accuracy 0.6417112350463867 Max. Validation Accuracy 0.625 Total Params: 226,341	We applied different set of params with different filters and normalization. With Reduced parameters There is dip in training accuracy and the validation is as is so still try to reduce the gap
4	CNN+LSTM	No of frames = 20 No. epochs = 20 Batch Size = 20	Max. Training Accuracy 0.8250377178192139 Max. Validation Accuracy 0.7300000190734863 Total Params: 1,657,445	We choose CNN + RNN with LSTM Model and run the model with different params and we got reasonably good accuracy and validation accuracy but it can be improved further.
5	CNN+LSTM with GRU	No of frames = 20 No. epochs = 20 Batch Size = 20	Max. Training Accuracy 0.889894425868988 Max. Validation Accuracy 0.7200000286102295 Total Params: 2573541	After updating our model to LSTM to GRU we get the best accuracy so far of 94% and validation accuracy of 72% .But still we can do better so , we can try some pre-trained model next.
6	Mobilenet Transfer Learning	No of frames = 20 No. epochs = 20 Batch Size = 20	Max. Training Accuracy 1.00 Max.ValidationAccuracy 0.8100000023841858 Total Params: 3840453	With Mobile Net Pre-trained model using transfer learning we get 100% accuracy and 81% Validation Accuracy of Maximum, But there is some level of overfitting going on here which can address in the next model
7	Transfer Learning with GRU	No of frames = 20 No. epochs = 20 Batch Size = 5	Max. Training Accuracy 0.9924585223197937 Max. Validation Accuracy 0.9599999785423279 Total params: 3840453	**Transfer Learning with GRU** **This is the best model so far we can get.** **The validation accuracy is good with 0.99 % and validation accuracy of 0.95% with no-overfitting, we can choose this as final model.**

Final Model Details:

We have selected Transfer Learning with GRU as our Final Model which has gicen as solid accuracy of 99% and validation accuracy of 95% , even though they total no of parameters it has trained is littler higher , which bound to happen since we are using all they pre-trained weights to provide as best result.

Model Name: Transfer Learning with GRU

model file : model-00020-0.03456-0.99246-0.24174-0.93000.h5

Accuracy: 99%

Validation Accuracy: 95%


```
Max. Training Accuracy 0.9924585223197937
Max. Validaiton Accuracy 0.9599999785423279
```