**Gesture Recognition – Writeup**

In this project, 2 models are being built namely Conv3D, LSTM and experimented with different batch sizes and number of epochs. Before getting into the generator code and building the actual models, random seed is set so that the results of the model do not show drastic variation. The folder names are then fed into the training and validation doc. Then comes the generator function which is the heart of the structure. Here the images are processed before building any model to resize and normalize the images. This is required as the images would mostly be of different dimensions and for the any model to fit, its important to get all the images into a common dimension. This would help in boosting the accuracy.

**Conv3D Model:**

In this model the 4 filters and 3 dense layers are used with the final dense layer being the softmax. The dropout is included to get a better accuracy to avoid overfitting. 2 experiments conducted with Conv3D model for input size of (30,120,120,3)(Input size(frames,num\_rows,num\_columns, channel)). One with batch size 10 and epoch 10. This is a test model to get started a glimpse of the way the accuracy shows up. Below is the result of this model:

Epoch 6/10

21/21 [==============================] - 40s 2s/step - loss: 1.1080 - categorical\_accuracy: 0.5098 - val\_loss: 1.0002 - val\_categorical\_accuracy: 0.6875

Epoch 00006: saving model to model\_init\_2020-05-2410\_46\_33.444757/model-00006-1.10796-0.50980-1.00023-0.68750.h5

Second training is with batch size of 512 and epoch 30 and below is the result for this combination:

Epoch 20/30

2/2 [==============================] - 4s 2s/step - loss: 0.7981 - categorical\_accuracy: 0.7647 - val\_loss: 0.3020 - val\_categorical\_accuracy: 1.0000

Epoch 00020: saving model to model\_init\_2020-05-2410\_46\_33.444757/model-00020-0.79814-0.76471-0.30201-1.00000.h5

**CNN-RNN(LSTM) Model:**

In this model as well the experiment is carried out with filters and dense layers with the final dense layer being the softmax. The first training done with batch size 10 and epoch 10 and below is the result:

Epoch 9/10

2/2 [==============================] - 4s 2s/step - loss: 1.5718 - categorical\_accuracy: 0.2941 - val\_loss: 1.3906 - val\_categorical\_accuracy: 0.7500

Epoch 00009: saving model to model\_init\_2020-05-2410\_46\_33.444757/model-00009-1.57176-0.29412-1.39061-0.75000.h5

The second training is with batch size 256 and epoch 15 and below is the result:

Epoch 13/15

3/3 [==============================] - 6s 2s/step - loss: 1.4796 - categorical\_accuracy: 0.2353 - val\_loss: 1.2202 - val\_categorical\_accuracy: 1.0000

Epoch 00013: saving model to model\_init\_2020-05-2410\_46\_33.444757/model-00013-1.47962-0.23529-1.22018-1.00000.h5

**Conclusion:**

With above experiments across 2 models, the conclusion drawn as the analysis is that Conv3D model seems to perform better in comparison with the LSTM model for below reasons.

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| **Experiment Number** | **Model** | **Result** | **Decision + Explanation** |
| **1** | **Conv3D :**  **Batch size 10**  **Epoch 10** | **loss: 1.1080**  **categorical\_accuracy: 0.5098**  **val\_loss: 1.0002**  **val\_categorical\_accuracy: 0.6875** | **The test and the validation accuracy is 50.98% and 68.75%. This can be further improved to get better accuracy score by iterating further with the batch size and number of epochs.** |
| **2** | **Conv3D**  **Batch size 512**  **Epoch 30** | **loss: 0.7981**  **categorical\_accuracy: 0.7647**  **val\_loss: 0.3020**  **val\_categorical\_accuracy: 1.0000** | **Increased the batch size and the number of epochs. This gives a better test accuracy score and the validation accuracy is 100%.** |
| **3** | **LSTM**  **Batch size 10**  **Epoch 10** | **loss: 1.5718**  **categorical\_accuracy: 0.2941**  **val\_loss: 1.3906**  **val\_categorical\_accuracy: 0.7500** | **Tried with the LSTM model to check on better accuracy score. Test accuracy is as low as 29.4% while the validation accuracy boosts to 75%. A sign of overfitting.** |
| **4** | **LSTM**  **Batch size 256**  **Epoch 15** | **loss: 1.4796**  **categorical\_accuracy: 0.2353**  **val\_loss: 1.2202**  **val\_categorical\_accuracy: 1.0000** | **combination of batch size and epoch still shows this model literally is overfitting. The test accuracy is 23.5% but the validation accuracy has shot up to 100% clear demonstration of overfitting.** |
| **Final Model** | **Conv3D with batch size 512 and Epoch 30** | **Val Loss: 0.3**  **Val Accuracy : 100%** | **With low validation loss and very good validation accuracy, this model seems to have performed good. Though the validation accuracy is at 100% not really a case of overfitting as the loss also seems to have low value and test accuracy is also good.** |