**Gesture Recognition Case Study Write Up**

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Testing the optimum value for batch size: Initially, we experimented with various batch sizes. A batch size of 128 caused an error, so our testing was conducted exclusively with batch sizes of 32 and 64.

For image resolution, we tested the models with an 80\*80 resolution and also tried a 120\*120 resolution. However, we did not observe a significant improvement in accuracy with the higher resolution image, so we opted to use an 80\*80 image for the final model.

The initial model encountered generator and memory errors. Subsequently, we built upon that model, and the notebook now features our third model as the first one successfully executed using Conv3D.

We are using the SGD optimizer, as we have found it effective with Conv2D models. We anticipate it will perform well with this Conv3D model too.

**Different Models Tested:**

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| **Experiment Number** | **Model** | **Result** | **Decision + Explanation** |
| **1 & 2** | **Conv3D** | **Model 1 threw out of memory error for batch size 128. So, we decided to stick with batch size 32 and 64.**  **Model 2 Throws Generator error** | We will use a batch size of 32, and for a couple of models, we will also experiment with a batch size of 64. The image resolution will be set at 80\*80, and we will additionally test 120\*120 for a couple of models to assess its impact on accuracy. |
| **3-> First model in notebook, Built on top of 1 & 2** | **Conv3D** | **No of Params =** 1,733,509  **Epochs = 20**  **Training Accuracy = 0.85**  **Validation Accuracy = 0.80** | The validation accuracy was deemed satisfactory, but it exhibited significant fluctuations across different epochs. To investigate, we will test whether consistent results can be achieved by changing the batch size to 64. Additionally, we will extend the number of epochs to observe if this stabilizes the validation accuracy. |
| **4 -> Model 2** | **Conv3D** | **No of Params =** 1,733,509  **Epochs = 30**  **Training Accuracy = 0.93**  **Validation Accuracy = 0.83** | We observed an improvement in the validation accuracy, which remained stable with the increased number of epochs. Now, we aim to experiment and explore the possibility of achieving better results by enhancing the image resolution. In our previous attempts, we utilized an 80\*80 image resolution and considered only 13 images from the set. For the upcoming experiments, we will adopt a 120\*120 image resolution and include 20 images from each set of video frames |
| **5 -> Model 3** | **Conv3D** | **No of Params =** 7,467,909  **Epochs = 20**  **Training Accuracy = 0.92**  **Validation Accuracy = 0.64** | In this model, we observe overfitting, as the validation accuracy has dropped significantly. Our next step is to experiment and determine whether increasing the number of epochs can help improve the validation accuracy, as observed in the first two models. Alternatively, we may need to consider data augmentation to generate more training data as a strategy to mitigate overfitting. |
| **6 -> Model 4** | **Conv3D** | **No of Params =** 7,467,909  **Epochs = 40**  **Training Accuracy = 0.95**  **Validation Accuracy = 0.80** | In this case, we observe an increase in validation accuracy compared to the previous model. However, it fails to surpass the threshold of 0.80, despite the training accuracy reaching 0.95. This indicates that an increase in the number of epochs does not significantly improve the overfitting model.  Our next step involves implementing the CNN + LSTM model and comparing its results with the second model, which achieved the highest validation accuracy. |
| **7 -> Model 5** | **CNN+LSTM** | **No of Params =** 6,714,117  **Epochs = 20**  **Training Accuracy = 0.74**  **Validation Accuracy = 0.60** | While this model exhibits lower overall training and validation accuracy, there is a consistent upward trend in both metrics. Increasing the number of epochs may be beneficial in further enhancing accuracy in this case |
| **8 -> Model 6 -> Final Model** | **CNN+LSTM** | **No of Params =** 6,714,117  **Epochs = 40**  **Training Accuracy = 0.96**  **Validation Accuracy = 0.83** | With further training, this model achieved commendable accuracy in both training and validation sets |