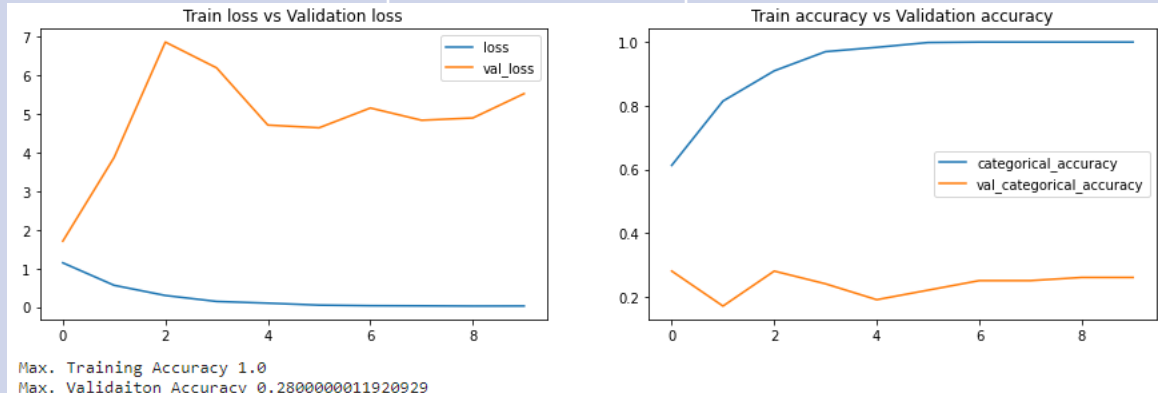# Gesture Recognition – Deep learning
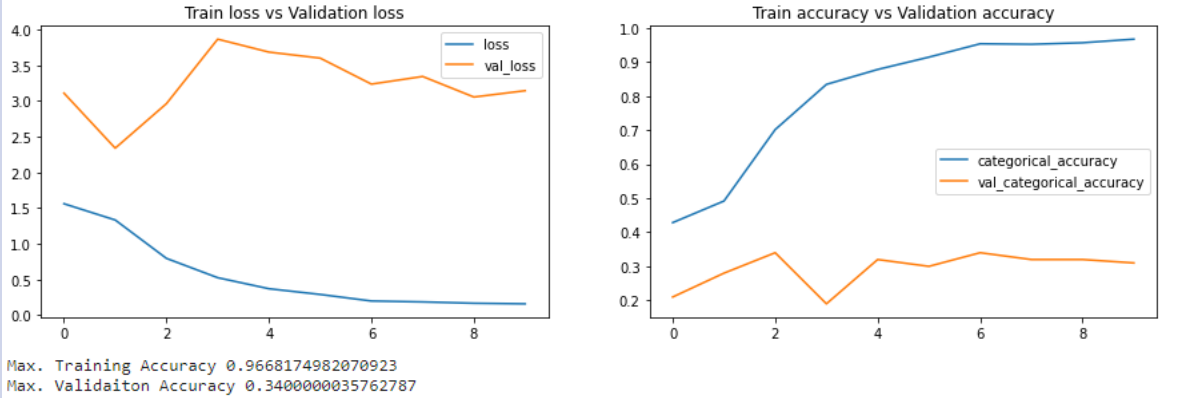
Gesture Recognition Experiment Details -
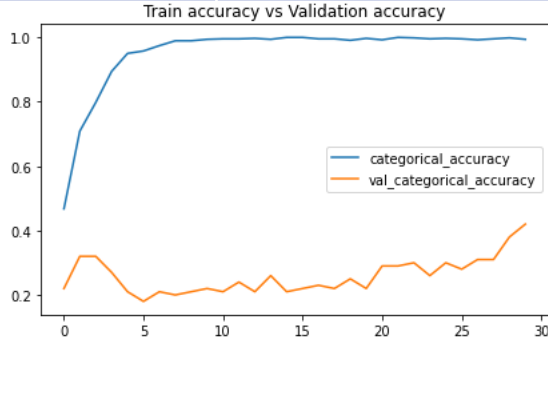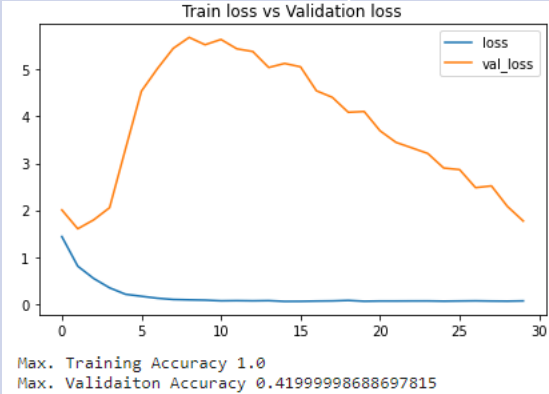
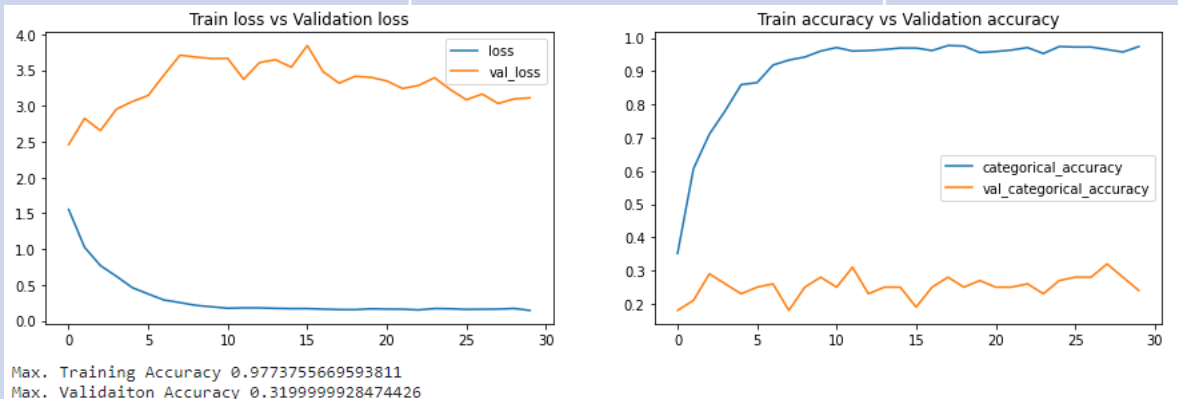| Experiment Number	Model	Result	Decision + Explanation
1	Conv3D	After 10 Epochs – Train Accuracy : 1 Val Accuracy : 0.28 • Model is overfitting 	Parameters - Batch Size : 32 No of Frames : 30 First Conv3D Filter Size : 3,3,3 No of Epochs : 10 Observation – Very high Train Accuracy but very low Validation Accuracy Huge difference in Train & Validation Accuracy High Number of Trainable Parameters were recorded. Decision - Hence we decided to reduce overfitting by adding Dropouts and an extra Dense Layer.

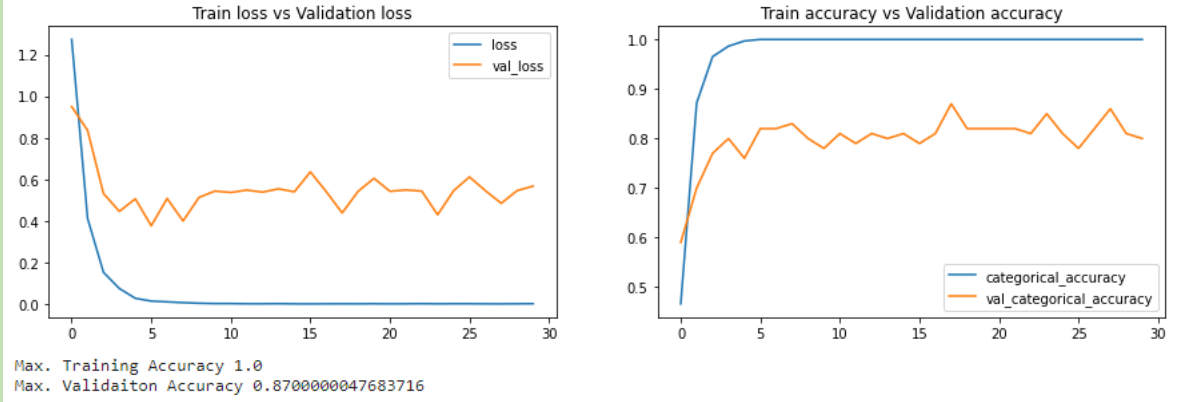| Experiment Number	Model	Result	Decision + Explanation
2	Conv3D	After 10 Epochs - Train Accuracy : 0.96 Val Accuracy : 0.31 • Still model is overfitting Max. Training Accuracy 0.9668174982070923 Max. Validaiton Accuracy 0.3400000035762787	Parameters - Batch Size : Same as Model1 i.e. 32 No of Frames : Same as model1 i.e. 30 First Conv3D Filter Size : Same as model1 i.e. 3,3,3 No of Epochs : Same as model1 i.e. 10 Observation – After adding Dropouts & an extra Dense Layer there is again very High Train Accuracy and very low Validation Accuracies. Number of Trainable Parameter increased due to added Dense Layer. Decision – Reduce overfitting by decreasing Trainable Parameters.

| Experiment Number	Model	Result	Decision + Explanation
3	Conv3D	After 30 Epochs - Train Accuracy : 1 Val Accuracy : 0.42 • Improvement in Validation Accuracy is observed • Significant decrease in difference of loss between Train & Validation sets is observed • Model is still overfitting Max. Training Accuracy 1.0 Max. Validaiton Accuracy 0.41999998688697815	Parameters – Batch Size : Increase to 64 No of Frames : Reduced to 20 First Conv3D Filters Size : Increased to 5,5,5 No of Epochs : Increased to 30 Observation – With increase in filter size, batch size and reducing no of frames, resulted in lesser Number of Trainable Parameter than first 2 models. Decision – As no much improvement observed using Conv3D. Hence we decided to use combination of Conv2D + RNN Architecture.

Experiment Number	Model	Result	Decision + Explanation
4	Conv2D	After 30 Epochs - Train Accuracy : 0.97 Val Accuracy : 0.24 • Huge difference between Train & Validation Accuracy is observed. • Model is overfitting. Max. Training Accuracy 0.9773755669593811 Max. Validaiton Accuracy 0.3199999928474426	Parameters - Batch Size : Same as Model3 i.e. 64 No of Frames : Same as Model3 i.e. 20 No of Epochs : Same as Model3 i.e. 30 Observation – Change of Architecture resulted in reduced Number of Trainable Parameters. Still very High Training Accuracy and very low Validation Accuracy. Decision – Addition of more Convolution Layers may reduce overfitting hence we decided to use known architecture through Transfer Learning.

Experiment Number	Model	Result	Decision + Explanation
5	Transfer Learning (Mobile Net) + GRU	After 30 Epochs - Train Accuracy : 1 Val Accuracy : 0.8 - Huge reduction in the gap of loss and accuracy between Train & Validation Sets. - Model is generalising well compared with previous models. Max. Training Accuracy 1.0 Max. Validaiton Accuracy 0.8700000047683716	Parameters Batch Size : Same as Model4 i.e. 64 No of Frames : Same as Model4 i.e. 20 No of Epochs : Same as Model4 i.e. 30 Observation – **Better Validation Accuracy Reduced Number of Trainable Parameters by half number** Decision – As we have seen improvement by using layers of MobileNet, we further decided to experiment combination of layers of MobileNet and LSTM.

Experiment Number	Model	Result	Decision + Explanation
6	Transfer Learning (Mobile Net) + LSTM	After 30 Epochs – Train Accuracy: 1.0 Validation Accuracy: 0.87 • Gap in loss between Train & Validation sets is lower. Max. Training Accuracy 1.0 Max. Validaiton Accuracy 0.8700000047683716	Parameters Batch Size : Same as Model4 i.e. 64 No of Frames : Same as Model4 i.e. 20 No of Epochs : Same as Model4 i.e. 30 Observation – Slight increase in Number of Trainable Parameter Compared to Model5. This model's performance is similar to Model5. Further experimentation with combination of known architecture and RNN may result in better performance.
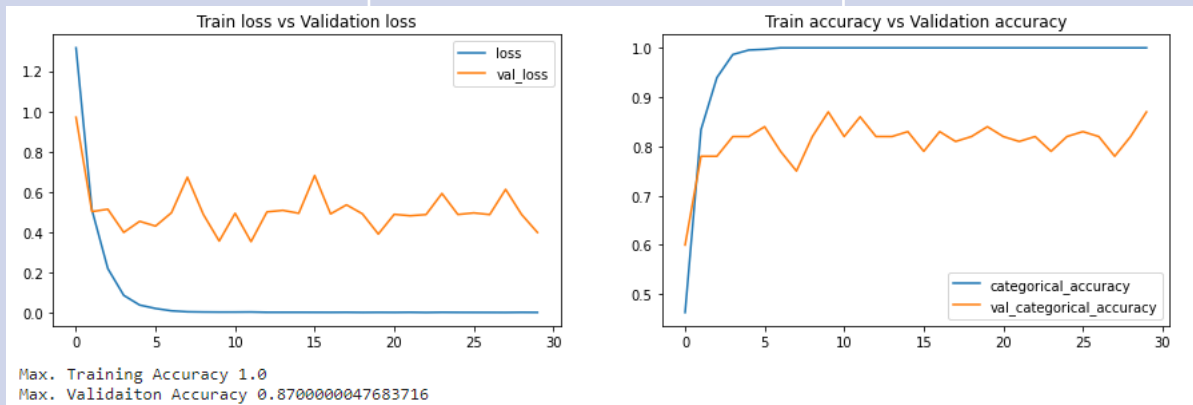
Conclusion

- Experiment #5 & Experiment #6 are giving best results compared to rest of the experiments.

- However, Experiment #5: **Transfer Learning (MobileNet) + GRU** having lesser Number of Trainable Parameters (3, 412, 997) with respect to Experiment #6: **Transfer Learning (MobileNet) + LSTM (4, 526, 597)**

- Hence we are choosing Model5 build through **Experiment #5 as the Best model**.