1. The detailed procedure followed in choosing the final model.

* We experimented with *SGD()* and *Adam()* optimizers but went forward with *Adam()* as it lead to improvement in model’s accuracy by rectifying high variance in the model’s parameters
* Experimented with different model configurations and hyper-parameters and various iterations and combinations of batch sizes, image dimensions, filter sizes, padding and stride length were experimented with.
* Batch size was directly impacting the GPU memory. A large batch size gave us *error ,* thus after reducing the batch size and also image size till we got an optimal value of the batch size which our GPU could support.
* Also, , choosing larger batch size makes model compute faster else we can choose lower batch size if we want our model to be of more accuracy
* Transfer learning boosted the overall accuracy of the model.
* After doing all the experiments, we finalized **Model 9– Transfer Learning + GRU** which performed well. Since it has the best training accuracy and Validation accuracy

| **Experiment Number** | **Model** | **Result** | **Decision + Explanation** |
| --- | --- | --- | --- |
|  | Conv3D | Throws Generator error | * Scipy.misc is deprecated * For imread skimage is used * For resizing Open CV is used * -if images are not resized ram is crashing |
| 1 | Model1  Base Model:conv3d  Batch Size: 32  Number of Epochs:20  Number of Frames:15 | Training Accuracy: 77%  Validation Accuracy: 0% | * Overfitting on the data * Took sample data of 200 from training and 50 from validation * poor performance on the validation data set |
| 2 | Model2  Base Model:conv3d  Batch Size: 32  Number of Epochs:20  Number of Frames:15 | Training Accuracy: 96%  Validation Accuracy: 50% | * overfitting on training data * added one more dense layer when compared to model 1 * tested the model on the sample data training 200 samples and validation 50 |
| 3 | Model3:Tested model2 with more number of samples to check its accuracy | Training Accuracy: 97%  Validation Accuracy: 37% | * The training accuracy was same but validation accuracy reduced |
| 4 | Model4:Reducing the number of neurons in the hidden layers  Batch size:32  Epochs:20  Frames:15 | Training Accuracy: 91%  Validation Accuracy: 50% | * overfitting on the training data * validation accuracy is 50% for the sample data set of 200 training,50 validation and 20 epochs |
| 5 | Model5  Conv\_ gru  Batch size:32  Epochs:20  Frames:15 | Training Accuracy: 30%  Validation Accuracy: 25% | * Model performed poor on both training and validation data set |
| 6 | Model6  Conv\_ Lstm  Batch size:32  Epochs:20  Frames:18 | Training Accuracy: 26%  Validation Accuracy: 18% | * poor performance |
| 7 | Model7  Mobinet transfer learning with gru  Batch size:32  Epochs:20  Frames:18 | Training Accuracy: 42%  Validation Accuracy: 31% | under fitting for some epochs the validation accuracy is higher than the training accuracy |
| 8 | Model8  VGGnet  Batchsize:20  Epochs:20  Frames:30 | Training Accuracy:86%  Validation Accuracy:66% | After changing batch size and number of frames with 420 training and 100 validation samples ,the accuracy of the model has increased |
| 9 | Model9  which is same as model7 with different parameters  Mobilenet Transfer with gru  Batchsize:20  Epochs:20  Frames:30 | Training Accuracy:95%  Validation Accuracy:94% | This is the best model with parameters of 4,036,549  which has less parameters and best accuracy when compare to the other models and can be used as our final model for prediction |
| 10 | model 10 which is same as model 6 but with different parameters  conv\_lstm  Batchsize:20  Epochs:20  Frames:30 | Training Accuracy:40%  Validation Accuracy:56% | Underfitting and  poor performance |

**Conclusion:**When the batch size is 32 and number of frames per video is 15 images the most of the models where not performed well even changing the other hyperparameters like adding or removing layers and changing the learning rate has not given desired results.Most of the conv3d network models above are overfitting and has poor performance on the validation data set .Transfer learning models and conv\_lstm,conv\_gru has poor training and validation accuracy but after changing the batch size and including all the frames made the networks to improve their accuracy .Out of all the models the mobilenet transfer learning with gru has given the best accuracy and also has less trainable parameters ,so can be chosen has our final model for the prediction