**Analysis**:

Throughout our experiments, the Conv2D + GRU architecture emerged as the most effective model for our gesture recognition task. By selecting 20 frames, increasing the epochs to 40, and balancing model complexity with regularization, we achieved a substantial improvement in validation accuracy, reaching approximately 72%.

Frame Selection & Epochs: Increasing the number of frames and epochs proved crucial in enhancing model performance, as it provided a richer temporal context and allowed the model more time to converge. Simplified Architecture with GRU: While LSTMs struggled to generalize well on data, GRUs maintained a balance, leading to better validation performance. Regularization & Dropout: Regularization techniques like Dropout effectively reduced overfitting, particularly in complex architectures. Avoiding Overly Complex Layers: Deeper architectures with multiple Conv3D layers and high frame counts tended to overfit, learning noise rather than valuable features. Simplified Conv2D layers with GRU performed best by capturing temporal dynamics without excessive complexity. Future improvements could include fine-tuning hyperparameters, experimenting with slightly lower batch sizes (if memory allows), and using techniques like learning rate scheduling to further refine convergence. Looks like, complex architectures often introduce noise, reaffirming that simpler, well-regularized models are often more robust for this type of sequential data.

| **Experiment Number** | **Model** | **Accuracy** | **Observations** |
| --- | --- | --- | --- |
| 1 | Conv 2D + LSTM | Training accuracy: 72%  Validation accuracy:54% | While the categorical accuracy is 72%,the validation accuracy is 54% indicating the overfitting of the data |
| 2 | Conv 2D + LSTM  (More hidden layers) | Training accuracy:22%  Validation accuracy:18% | While the categorical accuracy is 22%,the validation accuracy is 18% indicating the underfitting of the data |
| 3 | Conv2D + LSTM, more images, increased filters | Training accuracy:20%  Validation accuracy:25% | While the categorical accuracy is 20%,the validation accuracy is 25% indicating the low accuracy |
| 4 | Conv 2D + GRU | Training accuracy:68%  Validation accuracy 61% | While the categorical accuracy is 68%,the validation accuracy is 61% indicating good performance |
| 5 | Conv2D + GRU, more epochs, improved Generalization with SpacialDropout, an additional Conv2D layers | Training accuracy:63%  Validation accuracy 66% | While the categorical accuracy is 63%,the validation accuracy is 66% indicating good performance |
| 6 | Conv 3D | Training accuracy:75%  Validation accuracy 51% | While the categorical accuracy is 75%,the validation accuracy is 51% indicating overfittinhg |
| 7 | Conv 3D + GRU | Training accuracy:61%  Validation accuracy 35% | While the categorical accuracy is 75%,the validation accuracy is 51% indicating overfittinhg |
| 8 | Conv3D +GRU(simplified,early stopping) | Training accuracy:62%  Validation accuracy 51% | While the categorical accuracy is 62%,the validation accuracy is 51% indicating good performance but slightly overfitting |