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**Problem Statement:**

Imagine you are working as a data scientist at a home electronics company, which manufactures state of the art smart televisions. You want to develop a cool feature in the smart-TV that can recognise five different gestures performed by the user, which will help users control the TV without using a remote.

The gestures are continuously monitored by the webcam mounted on the TV. Each gesture corresponds to a specific command:

* Thumbs up: Increase the volume
* Thumbs down: Decrease the volume
* Left swipe: 'Jump' backwards 10 seconds
* Right swipe: 'Jump' forward 10 seconds
* Stop: Pause the movie

The data contains a 'train' and a 'val' folder with two CSV files for the two folders. These folders are in turn divided into subfolders where each subfolder represents a video of a particular gesture. Each subfolder, i.e. a video, contains 30 frames (or images). All images in a particular video subfolder have the same dimensions but different videos may have different dimensions. Specifically, videos have two types of dimensions - either 360x360 or 120x160.

Each row of the CSV file represents one video and contains three main pieces of information - the name of the subfolder containing the 30 images of the video, the name of the gesture and the numeric label (between 0-4) of the video.

**List of Models along with the explanation:**

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| **Experiment Number** | **Model** | **Result** | **Explanation** |
| **1** | Conv2D layers + GRU Layer+ Adam optimiser + No dropout | * Training Accuracy: 0.97 * Validation Accuracy: 0.57 | * The accuracy on the training dataset in very high while the accuracy on the validation dataset is too low. * This is an indication of overfitting on the training dataset. |
| **2** | Conv2D layers + GRU Layer+ Adam optimiser + dropout | * Training Accuracy: 0.88 * Validation Accuracy: 0.61 | * Dropout value of 0.25 was added after every alter convolution unit and GRU unit. * The overfitting has slightly reduced compared to the previous model but still the accuracy of validation dataset is quite low. |
| **3** | Conv2D layers + GRU Layer+ Adam optimiser + dropout+ L2 regularization | * Training Accuracy: 0.83 * Validation Accuracy: 0.65 | * The accuracy on the validation dataset is improved after addition of L2 regularization |
| **4** | Conv2D layers + GRU Layer+ SDG optimiser + dropout + L2 regularization | * Training Accuracy: 0.78 * Validation Accuracy: 0.64 | * Used SDG Optimizer instead of Adam optimizer. * The accuracy on the training dataset and validation dataset reduced further. |
| **5** | Conv3D layers + Dropout + Batch Normalization + L2 Regularization | * Training Accuracy: 0.55 * Validation Accuracy: 0.43 | * The accuracy on the training and the validation dataset is very less after using Conv3D layers instead of Conv2D layers |
| **6** | Transfer Learning + Resnet50 + dropout + GRU Layer | * Training Accuracy: 0.59 * Validation Accuracy: 0.43 | * There is a slight improvement when Pre-trained model (Resnet50) was used in placed of Conv3D layers. |
| **7** | Transfer Learning + VGGNET + dropout + GRU Layer | * Training Accuracy: 0.44 * Validation Accuracy: 0.44 | * The accuracy worsened even further while using VGGNET model * The accuracy of the training and validation dataset obtained is the very poor. |
| **8** | Transfer Learning + mobilenet + dropout + GRU Layer | * Training Accuracy: 0.94 * Validation Accuracy: 0.78 | * There is a significant increase in accuracy in both training and the validation. * While try to increase the epoch number as the training obtained was quite slow |
| **9** | Transfer Learning + mobilenet + dropout + GRU Layer + Increased epoch | * Training Accuracy: 0.95 * Validation Accuracy: 0.78 | * This is no much improvement in the model accuracy by increasing the epoch size from 10 to 15 * Will next try to increase the batch size |
| **10** | Transfer Learning + mobilenet + dropout + GRU Layer + Increased epoch + Increased Batch Size | * Training Accuracy: 0.97 * Validation Accuracy: 0.95 | * By increasing the batch size from 15 to 20, the accuracy has increased drastically. * Will further try increasing the batch size to see if there is more improvement in the model accuracy |
| **11** | Transfer Learning + mobilenet + dropout + GRU Layer + Increased Batch Size (More) | * Training Accuracy: 0.96 * Validation Accuracy: 0.95 | * Increasing the batch size even further(i.e. 25) did not have much an impact on the model accuracy |

**Conclusion:**

The best model was obtained for **Model 10** wherein transfer-learning technique using mobilenet was applied along with alternate dropouts and GRU layer and having epoch of 15 and batch size of 20