**Cropping and Normalization**

* Image cropping strategy is done on the basis of the region of interest which is the part of an image where in the hand present so that the focus should remain on the hand keeping other objects in the image out of the focus.
* Normalization of the image is done to remove the noise from an image, its purely based on an experimental basis.

**Model 1:**

1. The Model relies on the 3D Convolution principle and the model consists of the 4 hidden layers of 8, 16, 32 and 64 3 by 3 by 3 with a max pooling of 2 by 2 by 2 and batch normalization arrangement.
2. Max pooling layers are added to downsample the feature maps by summarizing the features present in the patches.
3. Dropouts are added to prevent the overfitting of the model by passing only the relevant neuron information to the next layer of neurons and making other neuron’s weights 0.
4. After last convolution the feature maps flattened in the form of 1D array and fed into the two layers ANN with dropout 40% drop out on each layer.
5. The successive hidden layers were added to get more features at an abstract level and eventually improving the accuracy of the model.
6. Batch Normalization is added to the model for the faster convergence of the gradients which inturn will make the optimization of the loss function faster.
7. Dropout for the layers after the flattening layer changed from 0.5 to 0.4 to prevent the over regularization.

**Conclusive Analysis**: The Model doesn’t give the accuracy more than 10 or 20% with one or two hidden layers as it doesn’t give sufficient no. of features enough to classify the image. Hence, added some more layers to get more features so that image classification accuracy can be improved.

Used Batch normalization to keep the weights in range and prevents outlier effect and Drop outs for the regularization.

**Experiments with different hyperparameters**

Model without Batch Normalization.

categorical\_accuracy: 0.0029

Model without Drop out

categorical\_accuracy: 0.0059

Model with Batch Normalization and Drop out

categorical\_accuracy 0.9832