Link to .h5 file:

<https://drive.google.com/file/d/1qnm8y0346Ax6ZVaTVjdkNpaJRvpMvFPD/view?usp=sharing>

The different architectures and hyper parameters that were chosen are shown in the table below.

**Model 1**

The experiments were started with basic starter code.

**Preprocessing:**

The images were cropped based on the two different sizes of images available. Normalization of images were done by dividing each image value by 255. The images were re sized to 84 x 84. The number of batches were chosen to be 64 and epochs were 30.

**Architecture:**

3 Convolution layers with 64 , 128 and 256 filters with a size of (3,3,3) stride of (1,1,1) and padding “same” with dropout = 0.25 before dense layers were chosen. Two Dense layers of 512 followed by 256 neurons were chosen. For optimizer “Adam” was chosen. Activation function of ‘elu’ was chosen

The metric chosen was loss='categorical\_crossentropy', metrics=['categorical\_accuracy']

. This model gave results that were highly overfitting since the train results and validation results had a huge difference.

The reduction earning rate had the following parameters:

ReduceLROnPlateau(monitor='val\_loss', factor=0.5, patience=2, verbose=1, mode='min', min\_delta=0.0001, cooldown=0, min\_lr=0.00001)

**Model 2**

To deal with the overfitting model from above **dropouts** were increased to 0.5 before dense layers and dropouts of 0.2 were added before convolution layers. The optimiser was changed to SGD with learning\_rate=0.001, decay=1e-6, momentum=0.7, nesterov=True. The **normalization** of images was changes to scale between **percentiles** of 5 and 95. The train accuracy increased and so did the cross validation accuracy. The accuracy values of train and validation are still showing signs of overfitting.

**Model 3**

Further to reduce overfitting the **epoch size** was increased to 50 and the **batch size** was reduced to 32 (since 64 gave memory error). Keeping all other model parameters same as above model2. The results did not change much the model was still overfitting.

**Model 4**

The **optimiser** was changed to RMS. The results did not change much the model was still overfitting. Keeping all other model parameters same as above model2. The results did not change much the model was still overfitting.

**Model 5**

The optimiser was changed to back to SGD. The **L2 regularization** was introduced in all the convolution layers. The results did not change much the model was still overfitting. Keeping all other model parameters same as above model2. The results did not change much the model was still overfitting.

**Model 6**

The **dropouts** were reduced to 0.2 and 0.25 before the dense layers and the last convolution layer. The dense layers were changed to 512 neurons each. The results for validation increased to 87% . Keeping all other model parameters same as model2. The results were best among all the models.

**Model 7**

This model was basic CNN+RNN with transfer learning from VGG16 the model was not pursued further.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Experiment Number** | **Model** | **Result** | **Train**  **Accuracy** | **Val Accuracy** | **Epoch** | **Batch Size** | **Optimizer** | **Regularization** | **Decision + Explanation** |
| **1** | **Conv3D** | **Overfitting model** | **83.5** | **68.5** | **30** | **64** | **Adam** | **Dropouts before dense layers 0.2** | **Initial model basic cropping was done. Scaling by dividing 255, sgd optimiser, epoch = 30, batch size 64** |
| **2** | **Conv3D** | **Overfitting model** | **98.5** | **77.3** | **30** | **64** | **SGD** | **Dropouts before dense layers 0.5 and 0.2 before Convolution Layers** | **Scaling changed to scale between percentile values of .5 and .95 epoch = 30, batch size 64 and dropout layers added before dense layers** |
| **3** | **Conv3D** | **Overfitting model,** | **98** | **76** | **50** | **32** | **SGD** | **Dropouts before dense layers 0.5 and 0.2 before Convolution Layers** | **batch size 64 throws memory error hence downsized epoch = 50, batch size 32 and dropout layers added before dense layers** |
| **4** | **Conv 3D** | **Overfits** | **95.3** | **73** | **50** | **32** | **RMS** | **Dropouts before dense layers 0.5 and 0.2 before** | **Introduced L2 regularization to handle overfitting did not help** |
| **5** | **Conv 3D** | **Overfits** | **99.8** | **77.3** | **50** | **32** | **SGD** | **Convolution Layers with L2 regularization** | **Changed to SGD with above config did not help** |
| **6** | **Conv3D** | **Best model of all the experiments** | **98** | **87** | **50** | **32** |  | **Reducing dropout to 0.2 keeping the regularization** | **Increase in validation accuracy** |
| **7** | **CNN+RNN with Transfer Learning** |  | **88.3** | **72.5** | **50** | **32** |  |  | **VGG16 with CNN and RNN** |