

Model Development Phase Template

Date	7 Feb 2025
Team ID	xxxxxx
Project Title	xxxxxx
Maximum Marks	10 Marks

Initial Model Training Code, Model Validation and Evaluation Report

The initial model training code will be showcased in the future through a screenshot. The model validation and evaluation report will include a summary and training and validation performance metrics for multiple models, presented through respective screenshots.

Initial Model Training Code (5 marks):

```
import keras
early_stopping=keras.callbacks.EarlyStopping(patience=10)

hist=model.fit(train_ds,
                epochs=100,
                verbose=1,
                validation_data=validation_ds,
                callbacks=early_stopping
              )
```

Model Validation and Evaluation Report (5 marks):

Model	Summary	Training and Validation Performance Metrics																																																															
Custom CNN	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Layer (type)</th> <th style="text-align: left;">Output Shape</th> <th style="text-align: right;">Param #</th> </tr> </thead> <tbody> <tr><td>conv2d (Conv2D)</td><td>(None, 150, 150, 32)</td><td style="text-align: right;">896</td></tr> <tr><td>batch_normalization (BatchNormalization)</td><td>(None, 150, 150, 32)</td><td style="text-align: right;">128</td></tr> <tr><td>max_pooling2d (MaxPooling2D)</td><td>(None, 75, 75, 32)</td><td style="text-align: right;">0</td></tr> <tr><td>dropout (Dropout)</td><td>(None, 75, 75, 32)</td><td style="text-align: right;">0</td></tr> <tr><td>conv2d_1 (Conv2D)</td><td>(None, 75, 75, 64)</td><td style="text-align: right;">18,496</td></tr> <tr><td>batch_normalization_1 (BatchNormalization)</td><td>(None, 75, 75, 64)</td><td style="text-align: right;">256</td></tr> <tr><td>max_pooling2d_1 (MaxPooling2D)</td><td>(None, 37, 37, 64)</td><td style="text-align: right;">0</td></tr> <tr><td>dropout_1 (Dropout)</td><td>(None, 37, 37, 64)</td><td style="text-align: right;">0</td></tr> <tr><td>conv2d_2 (Conv2D)</td><td>(None, 37, 37, 128)</td><td style="text-align: right;">73,856</td></tr> <tr><td>batch_normalization_2 (BatchNormalization)</td><td>(None, 37, 37, 128)</td><td style="text-align: right;">512</td></tr> <tr><td>max_pooling2d_2 (MaxPooling2D)</td><td>(None, 18, 18, 128)</td><td style="text-align: right;">0</td></tr> <tr><td>dropout_2 (Dropout)</td><td>(None, 18, 18, 128)</td><td style="text-align: right;">0</td></tr> <tr><td>conv2d_3 (Conv2D)</td><td>(None, 18, 18, 256)</td><td style="text-align: right;">295,168</td></tr> <tr><td>batch_normalization_3 (BatchNormalization)</td><td>(None, 18, 18, 256)</td><td style="text-align: right;">1,024</td></tr> <tr><td>max_pooling2d_3 (MaxPooling2D)</td><td>(None, 9, 9, 256)</td><td style="text-align: right;">0</td></tr> <tr><td>dropout_3 (Dropout)</td><td>(None, 9, 9, 256)</td><td style="text-align: right;">0</td></tr> <tr><td>flatten (Flatten)</td><td>(None, 20736)</td><td style="text-align: right;">0</td></tr> <tr><td>dense (Dense)</td><td>(None, 512)</td><td style="text-align: right;">10,617,344</td></tr> <tr><td>dropout_4 (Dropout)</td><td>(None, 512)</td><td style="text-align: right;">0</td></tr> <tr><td>dense_1 (Dense)</td><td>(None, 15)</td><td style="text-align: right;">7,695</td></tr> </tbody> </table>	Layer (type)	Output Shape	Param #	conv2d (Conv2D)	(None, 150, 150, 32)	896	batch_normalization (BatchNormalization)	(None, 150, 150, 32)	128	max_pooling2d (MaxPooling2D)	(None, 75, 75, 32)	0	dropout (Dropout)	(None, 75, 75, 32)	0	conv2d_1 (Conv2D)	(None, 75, 75, 64)	18,496	batch_normalization_1 (BatchNormalization)	(None, 75, 75, 64)	256	max_pooling2d_1 (MaxPooling2D)	(None, 37, 37, 64)	0	dropout_1 (Dropout)	(None, 37, 37, 64)	0	conv2d_2 (Conv2D)	(None, 37, 37, 128)	73,856	batch_normalization_2 (BatchNormalization)	(None, 37, 37, 128)	512	max_pooling2d_2 (MaxPooling2D)	(None, 18, 18, 128)	0	dropout_2 (Dropout)	(None, 18, 18, 128)	0	conv2d_3 (Conv2D)	(None, 18, 18, 256)	295,168	batch_normalization_3 (BatchNormalization)	(None, 18, 18, 256)	1,024	max_pooling2d_3 (MaxPooling2D)	(None, 9, 9, 256)	0	dropout_3 (Dropout)	(None, 9, 9, 256)	0	flatten (Flatten)	(None, 20736)	0	dense (Dense)	(None, 512)	10,617,344	dropout_4 (Dropout)	(None, 512)	0	dense_1 (Dense)	(None, 15)	7,695	<p style="text-align: center;">Training and Validation Performance Metrics</p> <pre> Epoch 19/100 469/469 ━━━━━━━━━━━━━━━━━━━━━━━━ 13s 28ms/step - accuracy: 0.9572 - loss: 0.1619 - val_accuracy: 0.9327 - va l_loss: 0.5387 Epoch 20/100 469/469 ━━━━━━━━━━━━━━━━━━━━━━━━ 14s 29ms/step - accuracy: 0.9608 - loss: 0.1507 - val_accuracy: 0.9338 - va l_loss: 0.5599 Epoch 21/100 469/469 ━━━━━━━━━━━━━━━━━━━━━━━━ 13s 28ms/step - accuracy: 0.9588 - loss: 0.1710 - val_accuracy: 0.9683 - va l_loss: 0.1612 Epoch 22/100 469/469 ━━━━━━━━━━━━━━━━━━━━━━━━ 13s 28ms/step - accuracy: 0.9710 - loss: 0.1268 - val_accuracy: 0.9657 - va l_loss: 0.1943 Epoch 23/100 469/469 ━━━━━━━━━━━━━━━━━━━━━━━━ 28s 28ms/step - accuracy: 0.9669 - loss: 0.1486 - val_accuracy: 0.9818 - va l_loss: 0.0997 Epoch 24/100 469/469 ━━━━━━━━━━━━━━━━━━━━━━━━ 14s 29ms/step - accuracy: 0.9691 - loss: 0.1338 - val_accuracy: 0.9733 - va l_loss: 0.1589 Epoch 25/100 469/469 ━━━━━━━━━━━━━━━━━━━━━━━━ 13s 27ms/step - accuracy: 0.9721 - loss: 0.1183 - val_accuracy: 0.9373 - va l_loss: 0.5844 </pre>
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