

Model Development Phase Template

Date	15 June 2025
Team ID	SWTID1750006853
Project Title	ASL- Alphabet Image Recognition
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):

Paste the screenshot of the model training code

Model Validation and Evaluation Report (5 marks):

Model	Summary	Training and Validation Performance Metrics																																																																														
	<p>Model: "functional"</p> <table border="1"> <thead> <tr> <th>Layer (type)</th><th>Output Shape</th><th>Param #</th></tr> </thead> <tbody> <tr> <td>input_layer (InputLayer)</td><td>(None, 224, 224, 3)</td><td>0</td></tr> <tr> <td>conv2d (Conv2D)</td><td>(None, 224, 224, 32)</td><td>896</td></tr> <tr> <td>max_pooling2d (MaxPooling2D)</td><td>(None, 112, 112, 32)</td><td>0</td></tr> <tr> <td>conv2d_1 (Conv2D)</td><td>(None, 112, 112, 64)</td><td>18,496</td></tr> <tr> <td>max_pooling2d_1 (MaxPooling2D)</td><td>(None, 56, 56, 64)</td><td>0</td></tr> <tr> <td>conv2d_2 (Conv2D)</td><td>(None, 56, 56, 128)</td><td>73,856</td></tr> <tr> <td>max_pooling2d_2 (MaxPooling2D)</td><td>(None, 28, 28, 128)</td><td>0</td></tr> <tr> <td>flatten (Flatten)</td><td>(None, 100192)</td><td>0</td></tr> <tr> <td>dense (Dense)</td><td>(None, 256)</td><td>25,990,368</td></tr> <tr> <td>dropout (Dropout)</td><td>(None, 256)</td><td>0</td></tr> <tr> <td>dense_1 (Dense)</td><td>(None, 25)</td><td>7,455</td></tr> </tbody> </table> <p>Total params: 25,791,669 (98.39 MB)</p> <p>Trainable params: 25,791,669 (98.39 MB)</p> <p>Non-trainable params: 0 (0.00 B)</p>	Layer (type)	Output Shape	Param #	input_layer (InputLayer)	(None, 224, 224, 3)	0	conv2d (Conv2D)	(None, 224, 224, 32)	896	max_pooling2d (MaxPooling2D)	(None, 112, 112, 32)	0	conv2d_1 (Conv2D)	(None, 112, 112, 64)	18,496	max_pooling2d_1 (MaxPooling2D)	(None, 56, 56, 64)	0	conv2d_2 (Conv2D)	(None, 56, 56, 128)	73,856	max_pooling2d_2 (MaxPooling2D)	(None, 28, 28, 128)	0	flatten (Flatten)	(None, 100192)	0	dense (Dense)	(None, 256)	25,990,368	dropout (Dropout)	(None, 256)	0	dense_1 (Dense)	(None, 25)	7,455	<pre> Epoch 1/20 512/60000 - 40:48 38ms/step - accuracy: 0.3054 - loss: 2.1568 Epoch 2: val_accuracy improved from 0.0 to 0.00130, saving model to ai1_custom_cm_best_weights.h5 WARNING:absl>You are saving your model as an H5 file via model.save() or keras.saving.save_model(model). This file format is considered legacy. 60000/60000 - 01s 957us/step - accuracy: 0.5974 - loss: 1.3608 - val_accuracy: 0.9419 - val_loss: 0.2238 Epoch 3/20 512/60000 - 40:18 46ms/step - accuracy: 0.8031 - loss: 0.3106 Epoch 4: val_accuracy improved from 0.00130 to 0.00827, saving model to ai1_custom_cm_best_weights.h5 WARNING:absl>You are saving your model as an H5 file via model.save() or keras.saving.save_model(model). This file format is considered legacy. 60000/60000 - 7s 188ms/step - accuracy: 0.9138 - loss: 0.2465 - val_accuracy: 0.9893 - val_loss: 0.0607 Epoch 5/20 512/60000 - 40:51 47ms/step - accuracy: 0.9495 - loss: 0.1667 Epoch 6: val_accuracy improved from 0.00827 to 0.09042, saving model to ai1_custom_cm_best_weights.h5 WARNING:absl>You are saving your model as an H5 file via model.save() or keras.saving.save_model(model). This file format is considered legacy. 60000/60000 - 54s 888us/step - accuracy: 0.9535 - loss: 0.1363 - val_accuracy: 0.9968 - val_loss: 0.0284 Epoch 6/20 512/60000 - 40:53 47ms/step - accuracy: 0.9644 - loss: 0.1072 Epoch 7: val_accuracy did not improve from 0.09042 60000/60000 - 02s 874us/step - accuracy: 0.9675 - loss: 0.0974 - val_accuracy: 0.9939 - val_loss: 0.0357 Epoch 8/20 512/60000 - 40:56 47ms/step - accuracy: 0.9733 - loss: 0.0777 Epoch 9: val_accuracy did not improve from 0.09042 60000/60000 - 53s 877us/step - accuracy: 0.9758 - loss: 0.0714 - val_accuracy: 0.9940 - val_loss: 0.0188 Epoch 9/20 512/60000 - 47:34 48ms/step - accuracy: 0.9796 - loss: 0.0625 Epoch 10: val_accuracy improved from 0.09042 to 0.09776, saving model to ai1_custom_cm_best_weights.h5 WARNING:absl>You are saving your model as an H5 file via model.save() or keras.saving.save_model(model). This file format is considered legacy. 60000/60000 - 01s 873us/step - accuracy: 0.9799 - loss: 0.0516 - val_accuracy: 0.9978 - val_loss: 0.0086 Epoch 11/20 512/60000 - 46:13 46ms/step - accuracy: 0.9858 - loss: 0.0543 Epoch 12: val_accuracy improved from 0.09776 to 0.09877, saving model to ai1_custom_cm_best_weights.h5 WARNING:absl>You are saving your model as an H5 file via model.save() or keras.saving.save_model(model). This file format is considered legacy. 60000/60000 - 01s 873us/step - accuracy: 0.9823 - loss: 0.0466 - val_accuracy: 0.9988 - val_loss: 0.0046 Epoch 13/20 512/60000 - 45:09 45ms/step - accuracy: 0.9834 - loss: 0.0514 Epoch 14: val_accuracy did not improve from 0.09877 60000/60000 - 02s 873us/step - accuracy: 0.9844 - loss: 0.0449 - val_accuracy: 0.9982 - val_loss: 0.0066 Epoch 15/20 512/60000 - 46:35 46ms/step - accuracy: 0.9866 - loss: 0.0400 Epoch 16: val_accuracy did not improve from 0.09877 60000/60000 - 02s 873us/step - accuracy: 0.9875 - loss: 0.0377 - val_accuracy: 0.9972 - val_loss: 0.0066 Epoch 16/20 512/60000 - 45:09 45ms/step - accuracy: 0.9881 - loss: 0.0406 Epoch 17: val_accuracy improved from 0.09877 to 0.09893, saving model to ai1_custom_cm_best_weights.h5 WARNING:absl>You are saving your model as an H5 file via model.save() or keras.saving.save_model(model). This file format is considered legacy. 60000/60000 - 53s 811us/step - accuracy: 0.9888 - loss: 0.0331 - val_accuracy: 0.9989 - val_loss: 0.0013 </pre>																																										
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Model 1	<p>56889256/56889256 — 4s 0us/step</p> <p>Model: "functional"</p> <table border="1"> <thead> <tr> <th>Layer (type)</th><th>Output Shape</th><th>Param #</th></tr> </thead> <tbody> <tr> <td>input_layer (InputLayer)</td><td>(None, 64, 64, 3)</td><td>0</td></tr> <tr> <td>block1_conv1 (Conv2D)</td><td>(None, 64, 64, 64)</td><td>1,792</td></tr> <tr> <td>block1_conv2 (Conv2D)</td><td>(None, 64, 64, 64)</td><td>36,928</td></tr> <tr> <td>block1_pool (MaxPooling2D)</td><td>(None, 32, 32, 64)</td><td>0</td></tr> <tr> <td>block2_conv1 (Conv2D)</td><td>(None, 32, 32, 128)</td><td>73,856</td></tr> <tr> <td>block2_conv2 (Conv2D)</td><td>(None, 32, 32, 128)</td><td>147,584</td></tr> <tr> <td>block2_pool (MaxPooling2D)</td><td>(None, 16, 16, 128)</td><td>0</td></tr> <tr> <td>block3_conv1 (Conv2D)</td><td>(None, 16, 16, 256)</td><td>295,168</td></tr> <tr> <td>block3_conv2 (Conv2D)</td><td>(None, 16, 16, 256)</td><td>590,800</td></tr> <tr> <td>block3_conv3 (Conv2D)</td><td>(None, 16, 16, 256)</td><td>590,800</td></tr> <tr> <td>block3_pool (MaxPooling2D)</td><td>(None, 8, 8, 256)</td><td>0</td></tr> <tr> <td>block4_conv1 (Conv2D)</td><td>(None, 8, 8, 512)</td><td>1,198,160</td></tr> <tr> <td>block4_conv2 (Conv2D)</td><td>(None, 8, 8, 512)</td><td>2,350,800</td></tr> <tr> <td>block4_conv3 (Conv2D)</td><td>(None, 8, 8, 512)</td><td>2,350,800</td></tr> <tr> <td>block4_pool (MaxPooling2D)</td><td>(None, 4, 4, 512)</td><td>0</td></tr> <tr> <td>block5_conv1 (Conv2D)</td><td>(None, 4, 4, 512)</td><td>2,350,800</td></tr> <tr> <td>block5_conv2 (Conv2D)</td><td>(None, 4, 4, 512)</td><td>2,350,800</td></tr> <tr> <td>block5_conv3 (Conv2D)</td><td>(None, 4, 4, 512)</td><td>2,350,800</td></tr> <tr> <td>block5_pool (MaxPooling2D)</td><td>(None, 2, 2, 512)</td><td>0</td></tr> <tr> <td>flatten (Flatten)</td><td>(None, 2048)</td><td>0</td></tr> <tr> <td>dense (Dense)</td><td>(None, 256)</td><td>524,544</td></tr> <tr> <td>dropout (Dropout)</td><td>(None, 256)</td><td>0</td></tr> <tr> <td>dense_1 (Dense)</td><td>(None, 512)</td><td>131,584</td></tr> <tr> <td>dropout_1 (Dropout)</td><td>(None, 512)</td><td>0</td></tr> <tr> <td>dense_2 (Dense)</td><td>(None, 25)</td><td>18,877</td></tr> </tbody> </table> <p>Total params: 15,385,833 (58.69 MB)</p> <p>Trainable params: 671,681 (2.56 MB)</p>	Layer (type)	Output Shape	Param #	input_layer (InputLayer)	(None, 64, 64, 3)	0	block1_conv1 (Conv2D)	(None, 64, 64, 64)	1,792	block1_conv2 (Conv2D)	(None, 64, 64, 64)	36,928	block1_pool (MaxPooling2D)	(None, 32, 32, 64)	0	block2_conv1 (Conv2D)	(None, 32, 32, 128)	73,856	block2_conv2 (Conv2D)	(None, 32, 32, 128)	147,584	block2_pool (MaxPooling2D)	(None, 16, 16, 128)	0	block3_conv1 (Conv2D)	(None, 16, 16, 256)	295,168	block3_conv2 (Conv2D)	(None, 16, 16, 256)	590,800	block3_conv3 (Conv2D)	(None, 16, 16, 256)	590,800	block3_pool (MaxPooling2D)	(None, 8, 8, 256)	0	block4_conv1 (Conv2D)	(None, 8, 8, 512)	1,198,160	block4_conv2 (Conv2D)	(None, 8, 8, 512)	2,350,800	block4_conv3 (Conv2D)	(None, 8, 8, 512)	2,350,800	block4_pool (MaxPooling2D)	(None, 4, 4, 512)	0	block5_conv1 (Conv2D)	(None, 4, 4, 512)	2,350,800	block5_conv2 (Conv2D)	(None, 4, 4, 512)	2,350,800	block5_conv3 (Conv2D)	(None, 4, 4, 512)	2,350,800	block5_pool (MaxPooling2D)	(None, 2, 2, 512)	0	flatten (Flatten)	(None, 2048)	0	dense (Dense)	(None, 256)	524,544	dropout (Dropout)	(None, 256)	0	dense_1 (Dense)	(None, 512)	131,584	dropout_1 (Dropout)	(None, 512)	0	dense_2 (Dense)	(None, 25)	18,877	<pre> Epoch 1/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 2/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 3/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 4/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 5/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 6/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 7/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 8/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 9/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 10/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 11/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 12/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 13/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 14/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 15/100 1024/100000 - 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0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 30/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 31/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 32/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 33/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 34/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 35/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 36/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 37/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 38/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 39/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 40/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 41/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 42/100 1024/100000 - 0s 0us/step - accuracy: 0.0000 - loss: 1.6449 Epoch 43/100 1024/100000 - 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