

PERFORMANCE AND FINAL SUBMISSION PHRASE

Date	14 November 2023
Team ID	Team- 591769
Project Name	ASL - Alphabet image recognition
Maximum Marks	10 Marks

Model Performance Testing:

S.No.	Parameter	Values	Screenshot
1.	Metrics	<p>Classification Model: VGG16 model</p> <p>Confusion Matrix , Classification Report & Accuracy Scores-</p> <p>Training accuracy:- 94.98%</p> <p>Testing accuracy:- 96.26%</p>	<p>Confusion Matrix:-</p> <pre> tf.Tensor([[[578 1 0 0 2 0 0 0 0 0 0 0 0 5 1 0 0 0 0 0 7 1 1 0 0 1 0 3 0 0 0] [0 585 0 0 1 1 0 0 0 0 1 0 0 0 1 0 0 5 0 0 5 0 0 0 0 0 0 1 0] [0 1 585 0 0 0 3 0 0 0 0 0 0 3 0 1 0 1 1 0 0 0 0 0 2 0 3] [0 6 0 584 0 2 0 0 1 0 0 0 0 0 5 0 0 1 0 0 0 1 0 0 0 0 0 0] [12 6 0 0 565 1 0 0 5 0 0 0 2 0 1 0 0 0 7 0 0 1 0 0 0 0 0 0] [0 2 0 3 1 590 0 0 0 0 0 0 1 0 1 0 0 0 1 0 0 0 0 0 1 0 0 0] [3 0 0 0 0 0 572 5 2 0 0 0 0 0 5 0 0 2 0 0 2 0 0 1 1 0 1] [0 0 0 0 0 0 5 589 0 1 0 0 0 0 1 0 0 0 0 0 0 0 0 0 2 0 2] [1 6 0 1 4 0 0 0 568 0 0 0 0 0 0 0 4 1 0 1 1 0 0 2 3 0 0] [0 0 0 0 0 0 0 3 0 584 0 0 0 0 0 0 0 0 0 0 0 0 0 4 3 0 0] [0 12 0 2 0 0 0 0 2 0 544 0 0 0 0 0 0 9 0 0 27 3 0 0 0 0 1 0] [2 0 0 0 0 0 2 0 5 3 0 572 0 0 0 0 0 0 1 10 0 0 0 3 1 1 0 0] [0 0 0 1 0 0 0 0 0 0 0 578 10 2 0 0 0 1 0 0 0 0 0 0 0 0] [0 0 0 0 0 0 1 0 0 0 0 39 551 0 0 0 0 4 0 3 0 0 0 0 1 1] [0 0 0 2 0 0 0 0 0 0 0 0 0 585 2 0 1 0 0 0 0 0 0 1 0 1] [0 0 1 0 0 0 0 0 0 0 0 0 0 0 593 2 0 1 0 1 0 0 0 0 1 0 1] [0 0 0 0 0 0 0 0 0 1 4 0 1] [0 0 0 0 0 0 0 1 4 0 1] [6 0 10 0 0 4 0 0 0 0] [3 0 0 0 0 0 0 0 0 0 0 3 3 0 0 0 0 578 2 2 0 0 4 0 3 0 1 1] [0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 12 576 0 0 0 0 4 6 0 0] [0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 50 4 0 539 2 0 4 0 0 0] [0 0 0 0 0 0 0 0 2 0 12 0 1 0 0 0 10 7 1 5 548 8 6 0 0 0 0] [0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 2 2 0 1 22 563 0 2 1 0 0] [2 0 0 0 0 0 0 0 1 0 0 1 2 0 0 0 0 44 3 3 1 0 529 0 5 0 1] [0 0 0 0 0 0 0 0 0 3 0 0 0 0 0 0 0 4 1 0 0 0 590 2 0 0] [1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 9 0 0 0 0 1 3 564 0 0] [0 0 0 0 0 0 2 0 0 0 1 0 0 0 0 1 2 584 2 2] [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 599 0] </pre> <p>Classification report:-</p>

		<div>136/136 [=====] - 25s 181ms/step</div> <table><tr><th></th><th>precision</th><th>recall</th><th>f1-score</th><th>support</th></tr><tr><td>A</td><td>0.95</td><td>0.95</td><td>0.95</td><td>600</td></tr><tr><td>B</td><td>0.94</td><td>0.96</td><td>0.95</td><td>600</td></tr><tr><td>C</td><td>1.00</td><td>0.97</td><td>0.98</td><td>600</td></tr><tr><td>D</td><td>0.99</td><td>0.98</td><td>0.98</td><td>600</td></tr><tr><td>E</td><td>0.98</td><td>0.94</td><td>0.96</td><td>600</td></tr><tr><td>F</td><td>0.99</td><td>0.97</td><td>0.98</td><td>600</td></tr><tr><td>G</td><td>0.99</td><td>0.95</td><td>0.97</td><td>600</td></tr><tr><td>H</td><td>0.97</td><td>0.98</td><td>0.97</td><td>600</td></tr><tr><td>I</td><td>0.97</td><td>0.96</td><td>0.96</td><td>600</td></tr><tr><td>J</td><td>0.97</td><td>0.97</td><td>0.97</td><td>600</td></tr><tr><td>K</td><td>0.94</td><td>0.91</td><td>0.93</td><td>600</td></tr><tr><td>L</td><td>1.00</td><td>0.96</td><td>0.98</td><td>600</td></tr><tr><td>M</td><td>0.93</td><td>0.93</td><td>0.93</td><td>600</td></tr><tr><td>N</td><td>0.94</td><td>0.95</td><td>0.94</td><td>600</td></tr><tr><td>O</td><td>0.97</td><td>0.99</td><td>0.98</td><td>600</td></tr><tr><td>P</td><td>0.98</td><td>0.98</td><td>0.98</td><td>600</td></tr><tr><td>Q</td><td>0.99</td><td>0.98</td><td>0.98</td><td>600</td></tr><tr><td>R</td><td>0.84</td><td>0.93</td><td>0.88</td><td>600</td></tr><tr><td>S</td><td>0.81</td><td>0.96</td><td>0.88</td><td>600</td></tr><tr><td>T</td><td>0.98</td><td>0.95</td><td>0.96</td><td>600</td></tr><tr><td>U</td><td>0.91</td><td>0.89</td><td>0.90</td><td>600</td></tr><tr><td>V</td><td>0.91</td><td>0.91</td><td>0.91</td><td>600</td></tr><tr><td>W</td><td>0.98</td><td>0.93</td><td>0.96</td><td>600</td></tr><tr><td>X</td><td>0.96</td><td>0.87</td><td>0.91</td><td>600</td></tr><tr><td>Y</td><td>0.97</td><td>0.97</td><td>0.97</td><td>600</td></tr><tr><td>Z</td><td>0.95</td><td>0.98</td><td>0.96</td><td>600</td></tr><tr><td>del</td><td>0.98</td><td>0.97</td><td>0.98</td><td>600</td></tr><tr><td>nothing</td><td>0.98</td><td>1.00</td><td>0.99</td><td>600</td></tr><tr><td>space</td><td>0.98</td><td>0.98</td><td>0.98</td><td>600</td></tr><tr><td>accuracy</td><td></td><td></td><td>0.95</td><td>17400</td></tr><tr><td>macro avg</td><td>0.96</td><td>0.95</td><td>0.95</td><td>17400</td></tr><tr><td>weighted avg</td><td>0.96</td><td>0.95</td><td>0.95</td><td>17400</td></tr></table> <div>Accuracy Score:-</div> <div>Epoch 1/10 543/543 [=====] - ETA: 8s - loss: 2.4236 - accuracy: 0.1703 Epoch 1: val_accuracy improved from inf to 0.4174, saving model to /content/sample_data/best_model_weights.h5 543/543 [=====] - 101s 170ms/step - loss: 2.8205 - accuracy: 0.1702 - val_loss: 1.8888 - val_accuracy: 0.4175 Epoch 2/10 543/543 [=====] - ETA: 8s - loss: 1.8716 - accuracy: 0.6207 Epoch 2: val_accuracy improved from 0.4174 to 0.7842, saving model to /content/sample_data/best_model_weights.h5 543/543 [=====] - 101s 128ms/step - loss: 1.8705 - accuracy: 0.6207 - val_loss: 0.4604 - val_accuracy: 0.7894 Epoch 3/10 543/543 [=====] - ETA: 8s - loss: 0.5276 - accuracy: 0.8276 Epoch 3: val_accuracy improved from 0.7842 to 0.84824, saving model to /content/sample_data/best_model_weights.h5 543/543 [=====] - 100s 105ms/step - loss: 0.5275 - accuracy: 0.8275 - val_loss: 0.4481 - val_accuracy: 0.8482 Epoch 4/10 543/543 [=====] - ETA: 8s - loss: 0.1992 - accuracy: 0.8792 Epoch 4: val_accuracy improved from 0.84824 to 0.89718, saving model to /content/sample_data/best_model_weights.h5 543/543 [=====] - 100s 173ms/step - loss: 0.1992 - accuracy: 0.8792 - val_loss: 0.3918 - val_accuracy: 0.8972 Epoch 5/10 543/543 [=====] - ETA: 8s - loss: 0.1364 - accuracy: 0.9027 Epoch 5: val_accuracy improved from 0.89718 to 0.90805, saving model to /content/sample_data/best_model_weights.h5 543/543 [=====] - 100s 145ms/step - loss: 0.1364 - accuracy: 0.9027 - val_loss: 0.3819 - val_accuracy: 0.9085 Epoch 6/10 543/543 [=====] - ETA: 8s - loss: 0.1039 - accuracy: 0.9199 Epoch 6: val_accuracy improved from 0.90805 to 0.92127, saving model to /content/sample_data/best_model_weights.h5 543/543 [=====] - 100s 172ms/step - loss: 0.1039 - accuracy: 0.9199 - val_loss: 0.3688 - val_accuracy: 0.9273 Epoch 7/10 543/543 [=====] - ETA: 8s - loss: 0.2397 - accuracy: 0.9331 Epoch 7: val_accuracy did not improve from 0.92127 543/543 [=====] - 101s 145ms/step - loss: 0.2397 - accuracy: 0.9331 - val_loss: 0.2852 - val_accuracy: 0.9226 Epoch 8/10 543/543 [=====] - ETA: 8s - loss: 0.1162 - accuracy: 0.9397 Epoch 8: val_accuracy improved from 0.92127 to 0.94394, saving model to /content/sample_data/best_model_weights.h5 543/543 [=====] - 100s 128ms/step - loss: 0.1162 - accuracy: 0.9397 - val_loss: 0.1797 - val_accuracy: 0.9483 Epoch 9/10 543/543 [=====] - ETA: 8s - loss: 0.1093 - accuracy: 0.9445 Epoch 9: val_accuracy improved from 0.94394 to 0.9525, saving model to /content/sample_data/best_model_weights.h5 543/543 [=====] - 100s 102ms/step - loss: 0.1093 - accuracy: 0.9445 - val_loss: 0.1645 - val_accuracy: 0.9526 Epoch 10/10 543/543 [=====] - ETA: 8s - loss: 0.1818 - accuracy: 0.9498 Epoch 10: val_accuracy improved from 0.9525 to 0.9582, saving model to /content/sample_data/best_model_weights.h5 543/543 [=====] - 101s 109ms/step - loss: 0.1818 - accuracy: 0.9498 - val_loss: 0.1669 - val_accuracy: 0.9570 scores = model.evaluate(test_generator) print("%s: %2f%%" % ("Evaluate Test Accuracy", scores[1]*100)) 136/136 [=====] - 25s 182ms/step - loss: 0.1469 - accuracy: 0.9626 Evaluate Test Accuracy: 96.264368%</div>		precision	recall	f1-score	support	A	0.95	0.95	0.95	600	B	0.94	0.96	0.95	600	C	1.00	0.97	0.98	600	D	0.99	0.98	0.98	600	E	0.98	0.94	0.96	600	F	0.99	0.97	0.98	600	G	0.99	0.95	0.97	600	H	0.97	0.98	0.97	600	I	0.97	0.96	0.96	600	J	0.97	0.97	0.97	600	K	0.94	0.91	0.93	600	L	1.00	0.96	0.98	600	M	0.93	0.93	0.93	600	N	0.94	0.95	0.94	600	O	0.97	0.99	0.98	600	P	0.98	0.98	0.98	600	Q	0.99	0.98	0.98	600	R	0.84	0.93	0.88	600	S	0.81	0.96	0.88	600	T	0.98	0.95	0.96	600	U	0.91	0.89	0.90	600	V	0.91	0.91	0.91	600	W	0.98	0.93	0.96	600	X	0.96	0.87	0.91	600	Y	0.97	0.97	0.97	600	Z	0.95	0.98	0.96	600	del	0.98	0.97	0.98	600	nothing	0.98	1.00	0.99	600	space	0.98	0.98	0.98	600	accuracy			0.95	17400	macro avg	0.96	0.95	0.95	17400	weighted avg	0.96	0.95	0.95	17400
	precision	recall	f1-score	support																																																																																																																																																																			
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W	0.98	0.93	0.96	600																																																																																																																																																																			
X	0.96	0.87	0.91	600																																																																																																																																																																			
Y	0.97	0.97	0.97	600																																																																																																																																																																			
Z	0.95	0.98	0.96	600																																																																																																																																																																			
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weighted avg	0.96	0.95	0.95	17400																																																																																																																																																																			
2.	Tune the Model	<div>Hyperparameter Tuning: The model is tuned with following hyper parameters- Optimizer - Adam Learning rate - 0.0001 Loss - Categorical cross entropy Batch size - 128 EPOCHS - 10</div> <div>Validation Method: The validation of the model is done through the validation data , which is set to 20% of training data. Data augmentation and callbacks are also used to validate performance. Accuracy is the validation parameter that we have monitored</div>	<div>Hyperparameter Tuning:-</div> <div>1 # Compile the model 2 model.compile(optimizer=Adam(lr=0.0001), loss='categorical_crossentropy', metrics=['accuracy']) 3 1 # Configuration 2 class CFG: 3 # Set the batch size for training 4 batch_size = 128 5 # Set the height and width of input images 6 img_height = 32 7 img_width = 32 8 epochs = 10 Validation Method:- 22 # Split the training set into training and validation sets 23 X_train, X_val, y_train, y_val = train_test_split(24 data_train['image_path'], 25 data_train['label'], 26 test_size=0.2/0.7, # Assuming you want 20% for validation out of the training set 27 random_state=2255, 28 shuffle=True, 29 stratify=data_train['label']) 30 31 32 # Create a DataFrame for the validation set 33 data_val = pd.DataFrame(34 'image_path': X_val, 35 'label': y_val 36) 4 # Create a ModelCheckpoint callback 5 checkpoint_callback = ModelCheckpoint(6 filepath='/content/sample_data/best_model_weights.h5', 7 monitor='val_accuracy', # Monitor validation accuracy for saving the best model 8 save_best_only=True, 9 mode='max', 10 verbose=1 11)</div>																																																																																																																																																																				

CONFUSION MATRIX:-

tf.Tensor([[578	1	0	0	2	0	0	0	0	0	0	5	1	0	0	0
7	1	1	0	0	1	0	3	0	0	0]					
[	0	585	0	0	1	1	0	0	0	1	0	0	0	1	0
0	0	5	0	0	0	0	0	0	1	0]					5
[	0	1	585	0	0	0	0	3	0	0	0	0	0	3	0
1	1	0	0	0	0	0	0	2	0	3]					1
[	0	6	0	584	0	2	0	0	1	0	0	0	0	5	0
0	0	0	1	0	0	0	0	0	0	0]					1
[	12	6	0	0	565	1	0	0	5	0	0	0	2	0	0
7	0	0	1	0	0	0	0	0	0	0]					0
[	0	2	0	3	1	590	0	0	0	0	0	0	1	0	0
1	0	0	0	0	0	1	0	0	0	0]					0
[	3	0	0	0	0	0	572	5	2	6	0	0	0	0	5
2	0	0	2	0	0	1	1	0	0	1]					0
[	0	0	0	0	0	0	5	589	0	1	0	0	0	1	0
0	0	0	0	0	0	0	2	0	2	0]					0
[	1	6	0	1	4	0	0	0	568	8	0	0	0	0	0
1	0	1	1	0	0	2	3	0	0	0]					4
[	0	0	0	0	0	0	0	3	6	584	0	0	0	0	0
0	0	0	0	0	0	4	3	0	0	0]					0
[	0	12	0	2	0	0	0	2	0	544	0	0	0	0	0
0	0	0	27	3	0	0	0	0	1	0]					9
[	2	0	0	0	0	0	2	0	5	3	0	572	0	0	0
1	10	0	0	0	3	1	1	0	0	0]					0
[	0	0	0	0	1	0	0	0	0	0	0	578	18	2	0
1	0	0	0	0	0	0	0	0	0	0]					0
[	0	0	0	0	0	0	0	1	0	0	0	39	551	0	0
4	0	3	0	0	0	0	0	1	1	0]					0
[	0	0	0	2	0	0	0	0	0	0	0	0	0	585	2
7	0	0	0	0	0	0	1	1	0	1]					1
[	0	0	0	0	0	0	0	0	1	0	0	0	0	0	593
1	0	1	0	0	0	0	0	1	0	1]					2
[	0	0	1	0	0	0	0	0	0	0	0	0	0	1	592
0	0	0	0	0	0	1	4	0	1]						0
[	0	0	0	0	0	1	4	0	1	0	0	0	0	0	0
6	0	18	6	0	4	0	0	0	0	0]					560
[	3	0	0	0	0	0	0	0	0	0	0	3	3	0	0
578	2	2	0	0	4	0	3	0	1	1]					0
[	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
12	576	0	0	0	0	4	6	0	0	0]					0
[	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
4	0	539	2	0	4	0	0	0	0	0]					50
[	0	0	0	0</											

CLASSIFICATION REPORT:-

136/136 [=====] - 25s 181ms/step

	precision	recall	f1-score	support
A	0.95	0.95	0.95	600
B	0.94	0.96	0.95	600
C	1.00	0.97	0.98	600
D	0.99	0.98	0.98	600
E	0.98	0.94	0.96	600
F	0.99	0.97	0.98	600
G	0.99	0.95	0.97	600
H	0.97	0.98	0.97	600
I	0.97	0.96	0.96	600
J	0.97	0.97	0.97	600
K	0.94	0.91	0.93	600
L	1.00	0.96	0.98	600
M	0.93	0.93	0.93	600
N	0.94	0.95	0.94	600
O	0.97	0.99	0.98	600
P	0.98	0.98	0.98	600
Q	0.99	0.98	0.98	600
R	0.84	0.93	0.88	600
S	0.81	0.96	0.88	600
T	0.98	0.95	0.96	600
U	0.91	0.89	0.90	600
V	0.91	0.91	0.91	600
W	0.98	0.93	0.96	600
X	0.96	0.87	0.91	600
Y	0.97	0.97	0.97	600
Z	0.95	0.98	0.96	600
del	0.98	0.97	0.98	600
nothing	0.98	1.00	0.99	600
space	0.98	0.98	0.98	600
accuracy			0.95	17400
macro avg	0.96	0.95	0.95	17400
weighted avg	0.96	0.95	0.95	17400

ACCURACY SCORE:-

```
Epoch 1/10
543/543 [=====] - ETA: 0s - loss: 2.6236 - accuracy: 0.1762
Epoch 1: val_accuracy improved from -inf to 0.41754, saving model to /content/sample_data/best_model_weights.h5
543/543 [=====] - 163s 273ms/step - loss: 2.6236 - accuracy: 0.1762 - val_loss: 1.6868 - val_accuracy: 0.4175
Epoch 2/10
543/543 [=====] - ETA: 0s - loss: 1.0716 - accuracy: 0.6257
Epoch 2: val_accuracy improved from 0.41754 to 0.78942, saving model to /content/sample_data/best_model_weights.h5
543/543 [=====] - 130s 239ms/step - loss: 1.0716 - accuracy: 0.6257 - val_loss: 0.6494 - val_accuracy: 0.7894
Epoch 3/10
543/543 [=====] - ETA: 0s - loss: 0.5376 - accuracy: 0.8276
Epoch 3: val_accuracy improved from 0.78942 to 0.84824, saving model to /content/sample_data/best_model_weights.h5
543/543 [=====] - 144s 265ms/step - loss: 0.5376 - accuracy: 0.8276 - val_loss: 0.4681 - val_accuracy: 0.8482
Epoch 4/10
543/543 [=====] - ETA: 0s - loss: 0.3992 - accuracy: 0.8792
Epoch 4: val_accuracy improved from 0.84824 to 0.89718, saving model to /content/sample_data/best_model_weights.h5
543/543 [=====] - 129s 237ms/step - loss: 0.3992 - accuracy: 0.8792 - val_loss: 0.3558 - val_accuracy: 0.8972
Epoch 5/10
543/543 [=====] - ETA: 0s - loss: 0.3364 - accuracy: 0.9027
Epoch 5: val_accuracy improved from 0.89718 to 0.90045, saving model to /content/sample_data/best_model_weights.h5
543/543 [=====] - 132s 243ms/step - loss: 0.3364 - accuracy: 0.9027 - val_loss: 0.3819 - val_accuracy: 0.9005
Epoch 6/10
543/543 [=====] - ETA: 0s - loss: 0.2839 - accuracy: 0.9199
Epoch 6: val_accuracy improved from 0.90045 to 0.92727, saving model to /content/sample_data/best_model_weights.h5
543/543 [=====] - 148s 272ms/step - loss: 0.2839 - accuracy: 0.9199 - val_loss: 0.2608 - val_accuracy: 0.9273
Epoch 7/10
543/543 [=====] - ETA: 0s - loss: 0.2397 - accuracy: 0.9331
Epoch 7: val_accuracy did not improve from 0.92727
543/543 [=====] - 131s 241ms/step - loss: 0.2397 - accuracy: 0.9331 - val_loss: 0.2851 - val_accuracy: 0.9226
Epoch 8/10
543/543 [=====] - ETA: 0s - loss: 0.2162 - accuracy: 0.9397
Epoch 8: val_accuracy improved from 0.92727 to 0.94934, saving model to /content/sample_data/best_model_weights.h5
543/543 [=====] - 129s 238ms/step - loss: 0.2162 - accuracy: 0.9397 - val_loss: 0.1797 - val_accuracy: 0.9493
Epoch 9/10
543/543 [=====] - ETA: 0s - loss: 0.2057 - accuracy: 0.9445
Epoch 9: val_accuracy improved from 0.94934 to 0.95262, saving model to /content/sample_data/best_model_weights.h5
543/543 [=====] - 142s 262ms/step - loss: 0.2057 - accuracy: 0.9445 - val_loss: 0.1645 - val_accuracy: 0.9526
Epoch 10/10
543/543 [=====] - ETA: 0s - loss: 0.1810 - accuracy: 0.9498
Epoch 10: val_accuracy improved from 0.95262 to 0.95701, saving model to /content/sample_data/best_model_weights.h5
543/543 [=====] - 141s 259ms/step - loss: 0.1810 - accuracy: 0.9498 - val_loss: 0.1669 - val_accuracy: 0.9570
```

```
scores = model.evaluate(test_generator)
print("%s: %2f%%" % ("Evaluate Test Accuracy", scores[1]*100))
```

```
136/136 [=====] - 25s 182ms/step - loss: 0.1469 - accuracy: 0.9626
Evaluate Test Accuracy: 96.264368%
```

HYPERPARAMETER TUNING:-

```
1 # Compile the model
2 model.compile(optimizer=Adam(lr=0.0001), loss='categorical_crossentropy', metrics=['accuracy'])
3
```

```

1 # Configuration
2 class CFG:
3     # Set the batch size for training
4     batch_size = 128
5     # Set the height and width of input images
6     img_height = 32
7     img_width = 32
8     epochs = 10

```

VALIDATION METHOD:-

```

22 # Split the training set into training and validation sets
23 X_train, X_val, y_train, y_val = train_test_split(
24     data_train['image_path'],
25     data_train['label'],
26     test_size=0.2/0.7, # Assuming you want 20% for validation out of the training set
27     random_state=2253,
28     shuffle=True,
29     stratify=data_train['label']
30 )
31
32 # Create a DataFrame for the validation set
33 data_val = pd.DataFrame({
34     'image_path': X_val,
35     'label': y_val
36 })

```

```

4 # Create a ModelCheckpoint callback
5 checkpoint_callback = ModelCheckpoint(
6     filepath='/content/sample_data/best_model_weights.h5',
7     monitor='val_accuracy', # Monitor validation accuracy for saving the best model
8     save_best_only=True,
9     mode='max',
10    verbose=1
11 )

```