```
Epoch 1/100
99/99 [==============================] - 29s 142ms/step - loss: 1.5619 - sparse_categorical_accuracy: 0.5010
- val_loss: 6.7442 - val_sparse_categorical_accuracy: 0.1000
Epoch 2/100
99/99 [==============================] - 11s 114ms/step - loss: 1.1055 - sparse_categorical_accuracy: 0.6208
- val_loss: 3.4965 - val_sparse_categorical_accuracy: 0.0992
Epoch 3/100
99/99 [==============================] - 11s 107ms/step - loss: 0.9633 - sparse_categorical_accuracy: 0.6675
- val_loss: 3.5726 - val_sparse_categorical_accuracy: 0.1602
Epoch 4/100
99/99 [==============================] - 11s 112ms/step - loss: 0.8361 - sparse_categorical_accuracy: 0.7100
- val_loss: 1.7748 - val_sparse_categorical_accuracy: 0.4414
Epoch 5/100
99/99 [==============================] - 11s 108ms/step - loss: 0.7207 - sparse_categorical_accuracy: 0.7536
- val_loss: 1.9694 - val_sparse_categorical_accuracy: 0.4148
Epoch 6/100
99/99 [==============================] - 11s 112ms/step - loss: 0.6119 - sparse_categorical_accuracy: 0.7913
- val_loss: 1.3196 - val_sparse_categorical_accuracy: 0.5906
Epoch 7/100
99/99 [==============================] - 11s 110ms/step - loss: 0.4905 - sparse_categorical_accuracy: 0.8347
- val_loss: 2.6281 - val_sparse_categorical_accuracy: 0.4148
Epoch 8/100
99/99 [==============================] - 11s 116ms/step - loss: 0.3672 - sparse_categorical_accuracy: 0.8743
- val_loss: 1.2164 - val_sparse_categorical_accuracy: 0.6375
Epoch 9/100
99/99 [==============================] - 11s 109ms/step - loss: 0.2787 - sparse_categorical_accuracy: 0.9022
- val_loss: 2.9165 - val_sparse_categorical_accuracy: 0.4250
Epoch 10/100
99/99 [==============================] - 11s 110ms/step - loss: 0.2011 - sparse_categorical_accuracy: 0.9319
- val_loss: 1.7195 - val_sparse_categorical_accuracy: 0.5844
Epoch 11/100
99/99 [==============================] - 11s 110ms/step - loss: 0.1511 - sparse_categorical_accuracy: 0.9491
- val_loss: 2.1046 - val_sparse_categorical_accuracy: 0.5625
Epoch 12/100
99/99 [==============================] - 11s 110ms/step - loss: 0.1195 - sparse_categorical_accuracy: 0.9598
- val_loss: 2.3378 - val_sparse_categorical_accuracy: 0.5680
Epoch 13/100
99/99 [==============================] - 11s 110ms/step - loss: 0.1088 - sparse_categorical_accuracy: 0.9618
- val_loss: 2.0301 - val_sparse_categorical_accuracy: 0.6125
Epoch 14/100
99/99 [==============================] - 11s 108ms/step - loss: 0.0957 - sparse_categorical_accuracy: 0.9666
- val_loss: 2.1424 - val_sparse_categorical_accuracy: 0.6133
Epoch 15/100
```

```
99/99 [==============================] - 11s 111ms/step - loss: 0.0638 - sparse_categorical_accuracy: 0.9785
- val_loss: 1.7880 - val_sparse_categorical_accuracy: 0.6625
Epoch 16/100
99/99 [==============================] - 11s 108ms/step - loss: 0.0460 - sparse_categorical_accuracy: 0.9841
- val_loss: 2.6219 - val_sparse_categorical_accuracy: 0.6055
Epoch 17/100
99/99 [==============================] - 11s 113ms/step - loss: 0.0713 - sparse_categorical_accuracy: 0.9764
- val_loss: 4.8680 - val_sparse_categorical_accuracy: 0.4297
Epoch 18/100
99/99 [==============================] - 11s 109ms/step - loss: 0.0629 - sparse_categorical_accuracy: 0.9787
- val_loss: 2.7368 - val_sparse_categorical_accuracy: 0.5063
Epoch 19/100
99/99 [==============================] - 11s 109ms/step - loss: 0.0627 - sparse_categorical_accuracy: 0.9772
- val_loss: 2.8881 - val_sparse_categorical_accuracy: 0.5594
Epoch 20/100
99/99 [==============================] - 11s 112ms/step - loss: 0.0451 - sparse_categorical_accuracy: 0.9832
- val_loss: 2.2466 - val_sparse_categorical_accuracy: 0.6461
Epoch 21/100
99/99 [==============================] - 11s 112ms/step - loss: 0.0474 - sparse_categorical_accuracy: 0.9836
- val_loss: 2.2194 - val_sparse_categorical_accuracy: 0.6203
Epoch 22/100
99/99 [==============================] - 11s 112ms/step - loss: 0.0220 - sparse_categorical_accuracy: 0.9928
- val_loss: 1.8752 - val_sparse_categorical_accuracy: 0.6852
Epoch 23/100
99/99 [==============================] - 11s 112ms/step - loss: 0.0359 - sparse_categorical_accuracy: 0.9882
- val_loss: 2.1677 - val_sparse_categorical_accuracy: 0.6016
Epoch 24/100
99/99 [==============================] - 11s 110ms/step - loss: 0.0513 - sparse_categorical_accuracy: 0.9820
- val_loss: 2.2757 - val_sparse_categorical_accuracy: 0.6531
Epoch 25/100
99/99 [==============================] - 11s 110ms/step - loss: 0.0468 - sparse_categorical_accuracy: 0.9841
- val_loss: 2.0504 - val_sparse_categorical_accuracy: 0.6281
Epoch 26/100
99/99 [==============================] - 11s 110ms/step - loss: 0.0371 - sparse_categorical_accuracy: 0.9879
- val_loss: 1.8747 - val_sparse_categorical_accuracy: 0.6586
Epoch 27/100
99/99 [==============================] - 11s 111ms/step - loss: 0.0240 - sparse_categorical_accuracy: 0.9925
- val_loss: 1.8835 - val_sparse_categorical_accuracy: 0.6758
Epoch 28/100
99/99 [==============================] - 11s 110ms/step - loss: 0.0243 - sparse_categorical_accuracy: 0.9915
- val_loss: 2.9892 - val_sparse_categorical_accuracy: 0.5938
Epoch 29/100
99/99 [==============================] - 11s 110ms/step - loss: 0.0497 - sparse_categorical_accuracy: 0.9832
- val_loss: 2.9491 - val_sparse_categorical_accuracy: 0.5500
```

Epoch 30/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0443 - sparse_categorical_accuracy: 0.9848 - val_loss: 2.8894 - val_sparse_categorical_accuracy: 0.6125

Epoch 31/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0209 - sparse_categorical_accuracy: 0.9932 - val_loss: 2.6156 - val_sparse_categorical_accuracy: 0.6000

Epoch 32/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0125 - sparse_categorical_accuracy: 0.9961 - val_loss: 2.1044 - val_sparse_categorical_accuracy: 0.6500

Epoch 33/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0270 - sparse_categorical_accuracy: 0.9914 - val_loss: 2.4819 - val_sparse_categorical_accuracy: 0.6320

Epoch 34/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0371 - sparse_categorical_accuracy: 0.9871 - val_loss: 2.6621 - val_sparse_categorical_accuracy: 0.5898

Epoch 35/100

99/99 [==============================] - 11s 110ms/step - loss: 0.0476 - sparse_categorical_accuracy: 0.9839 - val_loss: 2.6271 - val_sparse_categorical_accuracy: 0.6195

Epoch 36/100

99/99 [==============================] - 11s 112ms/step - loss: 0.0329 - sparse_categorical_accuracy: 0.9885 - val_loss: 2.1772 - val_sparse_categorical_accuracy: 0.6406

Epoch 37/100

99/99 [==============================] - 11s 110ms/step - loss: 0.0200 - sparse_categorical_accuracy: 0.9924 - val_loss: 2.3802 - val_sparse_categorical_accuracy: 0.6367

Epoch 38/100

99/99 [==============================] - 11s 110ms/step - loss: 0.0203 - sparse_categorical_accuracy: 0.9937 - val_loss: 2.3007 - val_sparse_categorical_accuracy: 0.6352

Epoch 39/100

99/99 [==============================] - 11s 110ms/step - loss: 0.0448 - sparse_categorical_accuracy: 0.9862 - val_loss: 2.6816 - val_sparse_categorical_accuracy: 0.6172

Epoch 40/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0276 - sparse_categorical_accuracy: 0.9910 - val_loss: 2.0862 - val_sparse_categorical_accuracy: 0.6289

Epoch 41/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0319 - sparse_categorical_accuracy: 0.9889 - val_loss: 4.1102 - val_sparse_categorical_accuracy: 0.4781

Epoch 42/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0334 - sparse_categorical_accuracy: 0.9898 - val_loss: 2.7346 - val_sparse_categorical_accuracy: 0.6258

Epoch 43/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0164 - sparse_categorical_accuracy: 0.9944 - val_loss: 2.3141 - val_sparse_categorical_accuracy: 0.6703

Epoch 44/100

```
99/99 [==============================] - 11s 111ms/step - loss: 0.0068 - sparse_categorical_accuracy: 0.9976
- val_loss: 2.2378 - val_sparse_categorical_accuracy: 0.6578
Epoch 45/100
99/99 [==============================] - 11s 112ms/step - loss: 0.0226 - sparse_categorical_accuracy: 0.9929
- val_loss: 2.4519 - val_sparse_categorical_accuracy: 0.6234
Epoch 46/100
99/99 [==============================] - 11s 113ms/step - loss: 0.0240 - sparse_categorical_accuracy: 0.9917
- val_loss: 2.7227 - val_sparse_categorical_accuracy: 0.5758
Epoch 47/100
99/99 [==============================] - 11s 111ms/step - loss: 0.0278 - sparse_categorical_accuracy: 0.9902
- val_loss: 2.7404 - val_sparse_categorical_accuracy: 0.5867
Epoch 48/100
99/99 [==============================] - 11s 110ms/step - loss: 0.0229 - sparse_categorical_accuracy: 0.9920
- val_loss: 2.3305 - val_sparse_categorical_accuracy: 0.6547
Epoch 49/100
99/99 [==============================] - 11s 111ms/step - loss: 0.0145 - sparse_categorical_accuracy: 0.9959
- val_loss: 2.2089 - val_sparse_categorical_accuracy: 0.6727
Epoch 50/100
99/99 [==============================] - 11s 113ms/step - loss: 0.0114 - sparse_categorical_accuracy: 0.9963
- val_loss: 2.3405 - val_sparse_categorical_accuracy: 0.6664
Epoch 51/100
99/99 [==============================] - 11s 110ms/step - loss: 0.0194 - sparse_categorical_accuracy: 0.9934
- val_loss: 2.8569 - val_sparse_categorical_accuracy: 0.6242
Epoch 52/100
99/99 [==============================] - 11s 114ms/step - loss: 0.0405 - sparse_categorical_accuracy: 0.9864
- val_loss: 3.6207 - val_sparse_categorical_accuracy: 0.5773
Epoch 53/100
99/99 [==============================] - 11s 111ms/step - loss: 0.0304 - sparse_categorical_accuracy: 0.9902
- val_loss: 2.6361 - val_sparse_categorical_accuracy: 0.5938
Epoch 54/100
99/99 [==============================] - 11s 115ms/step - loss: 0.0205 - sparse_categorical_accuracy: 0.9928
- val_loss: 2.1671 - val_sparse_categorical_accuracy: 0.6781
Epoch 55/100
99/99 [==============================] - 11s 114ms/step - loss: 0.0234 - sparse_categorical_accuracy: 0.9929
- val_loss: 3.2395 - val_sparse_categorical_accuracy: 0.5680
Epoch 56/100
99/99 [==============================] - 11s 110ms/step - loss: 0.0292 - sparse_categorical_accuracy: 0.9913
- val_loss: 1.9802 - val_sparse_categorical_accuracy: 0.6734
Epoch 57/100
99/99 [==============================] - 11s 111ms/step - loss: 0.0156 - sparse_categorical_accuracy: 0.9951
- val_loss: 2.0897 - val_sparse_categorical_accuracy: 0.6703
Epoch 58/100
99/99 [==============================] - 11s 111ms/step - loss: 0.0180 - sparse_categorical_accuracy: 0.9936
- val_loss: 2.2699 - val_sparse_categorical_accuracy: 0.6695
```

Epoch 59/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0226 - sparse_categorical_accuracy: 0.9920 - val_loss: 2.9472 - val_sparse_categorical_accuracy: 0.5938

Epoch 60/100

99/99 [==============================] - 11s 114ms/step - loss: 0.0205 - sparse_categorical_accuracy: 0.9924 - val_loss: 1.9527 - val_sparse_categorical_accuracy: 0.6914

Epoch 61/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0106 - sparse_categorical_accuracy: 0.9964 - val_loss: 2.3733 - val_sparse_categorical_accuracy: 0.6375

Epoch 62/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0103 - sparse_categorical_accuracy: 0.9963 - val_loss: 3.2713 - val_sparse_categorical_accuracy: 0.6250

Epoch 63/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0273 - sparse_categorical_accuracy: 0.9910 - val_loss: 3.2059 - val_sparse_categorical_accuracy: 0.5844

Epoch 64/100

99/99 [==============================] - 11s 112ms/step - loss: 0.0160 - sparse_categorical_accuracy: 0.9945 - val_loss: 4.0450 - val_sparse_categorical_accuracy: 0.5508

Epoch 65/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0322 - sparse_categorical_accuracy: 0.9894 - val_loss: 5.3525 - val_sparse_categorical_accuracy: 0.4742

Epoch 66/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0282 - sparse_categorical_accuracy: 0.9901 - val_loss: 2.4226 - val_sparse_categorical_accuracy: 0.6617

Epoch 67/100

99/99 [==============================] - 11s 113ms/step - loss: 0.0139 - sparse_categorical_accuracy: 0.9956 - val_loss: 2.4570 - val_sparse_categorical_accuracy: 0.6266

Epoch 68/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0040 - sparse_categorical_accuracy: 0.9987 - val_loss: 1.7378 - val_sparse_categorical_accuracy: 0.7102

Epoch 69/100

99/99 [==============================] - 11s 114ms/step - loss: 0.0028 - sparse_categorical_accuracy: 0.9990 - val_loss: 1.9060 - val_sparse_categorical_accuracy: 0.7141

Epoch 70/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0012 - sparse_categorical_accuracy: 0.9998 - val_loss: 2.7022 - val_sparse_categorical_accuracy: 0.6445

Epoch 71/100

99/99 [==============================] - 11s 114ms/step - loss: 9.6010e-04 - sparse_categorical_accuracy: 0.9998 - val_loss: 2.1004 - val_sparse_categorical_accuracy: 0.6969

Epoch 72/100

99/99 [==============================] - 11s 111ms/step - loss: 3.7192e-04 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.9014 - val_sparse_categorical_accuracy: 0.7352

Epoch 73/100

99/99 [==============================] - 11s 112ms/step - loss: 1.9511e-04 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.8582 - val_sparse_categorical_accuracy: 0.7289
Epoch 74/100
99/99 [==============================] - 11s 114ms/step - loss: 8.6527e-05 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.9069 - val_sparse_categorical_accuracy: 0.7352
Epoch 75/100
99/99 [==============================] - 11s 111ms/step - loss: 3.9457e-05 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.8976 - val_sparse_categorical_accuracy: 0.7375
Epoch 76/100
99/99 [==============================] - 11s 114ms/step - loss: 3.0670e-05 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.8929 - val_sparse_categorical_accuracy: 0.7406
Epoch 77/100
99/99 [==============================] - 11s 114ms/step - loss: 2.6125e-05 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.9047 - val_sparse_categorical_accuracy: 0.7391
Epoch 78/100
99/99 [==============================] - 11s 111ms/step - loss: 2.3609e-05 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.8961 - val_sparse_categorical_accuracy: 0.7391
Epoch 79/100
99/99 [==============================] - 11s 111ms/step - loss: 2.9173e-05 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.9081 - val_sparse_categorical_accuracy: 0.7367
Epoch 80/100
99/99 [==============================] - 11s 114ms/step - loss: 0.0038 - sparse_categorical_accuracy: 0.9990 - val_loss: 3.8251 - val_sparse_categorical_accuracy: 0.5672
Epoch 81/100
99/99 [==============================] - 11s 111ms/step - loss: 0.1357 - sparse_categorical_accuracy: 0.9587 - val_loss: 3.0937 - val_sparse_categorical_accuracy: 0.5891
Epoch 82/100
99/99 [==============================] - 11s 115ms/step - loss: 0.0549 - sparse_categorical_accuracy: 0.9818 - val_loss: 2.1266 - val_sparse_categorical_accuracy: 0.6453
Epoch 83/100
99/99 [==============================] - 11s 114ms/step - loss: 0.0157 - sparse_categorical_accuracy: 0.9952 - val_loss: 2.9214 - val_sparse_categorical_accuracy: 0.5695
Epoch 84/100
99/99 [==============================] - 11s 111ms/step - loss: 0.0079 - sparse_categorical_accuracy: 0.9973 - val_loss: 2.0891 - val_sparse_categorical_accuracy: 0.6664
Epoch 85/100
99/99 [==============================] - 11s 114ms/step - loss: 0.0117 - sparse_categorical_accuracy: 0.9960 - val_loss: 2.4596 - val_sparse_categorical_accuracy: 0.6391
Epoch 86/100
99/99 [==============================] - 11s 111ms/step - loss: 0.0094 - sparse_categorical_accuracy: 0.9972 - val_loss: 2.2491 - val_sparse_categorical_accuracy: 0.6602
Epoch 87/100
99/99 [==============================] - 11s 113ms/step - loss: 0.0211 - sparse_categorical_accuracy: 0.9931 - val_loss: 2.8594 - val_sparse_categorical_accuracy: 0.5945

Epoch 88/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0179 - sparse_categorical_accuracy: 0.9941 - val_loss: 2.7730 - val_sparse_categorical_accuracy: 0.6156

Epoch 89/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0066 - sparse_categorical_accuracy: 0.9980 - val_loss: 2.4352 - val_sparse_categorical_accuracy: 0.6508

Epoch 90/100

99/99 [==============================] - 11s 114ms/step - loss: 0.0280 - sparse_categorical_accuracy: 0.9909 - val_loss: 2.7435 - val_sparse_categorical_accuracy: 0.6039

Epoch 91/100

99/99 [==============================] - 11s 115ms/step - loss: 0.0201 - sparse_categorical_accuracy: 0.9930 - val_loss: 2.2221 - val_sparse_categorical_accuracy: 0.6422

Epoch 92/100

99/99 [==============================] - 11s 114ms/step - loss: 0.0143 - sparse_categorical_accuracy: 0.9956 - val_loss: 2.0664 - val_sparse_categorical_accuracy: 0.6898

Epoch 93/100

99/99 [==============================] - 11s 114ms/step - loss: 0.0148 - sparse_categorical_accuracy: 0.9956 - val_loss: 2.0796 - val_sparse_categorical_accuracy: 0.6930

Epoch 94/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0036 - sparse_categorical_accuracy: 0.9990 - val_loss: 1.8456 - val_sparse_categorical_accuracy: 0.7117

Epoch 95/100

99/99 [==============================] - 11s 114ms/step - loss: 0.0040 - sparse_categorical_accuracy: 0.9987 - val_loss: 2.0501 - val_sparse_categorical_accuracy: 0.6820

Epoch 96/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0067 - sparse_categorical_accuracy: 0.9978 - val_loss: 2.4159 - val_sparse_categorical_accuracy: 0.6609

Epoch 97/100

99/99 [==============================] - 11s 114ms/step - loss: 0.0038 - sparse_categorical_accuracy: 0.9988 - val_loss: 2.1334 - val_sparse_categorical_accuracy: 0.6820

Epoch 98/100

99/99 [==============================] - 11s 114ms/step - loss: 0.0025 - sparse_categorical_accuracy: 0.9994 - val_loss: 2.2072 - val_sparse_categorical_accuracy: 0.6812

Epoch 99/100

99/99 [==============================] - 11s 111ms/step - loss: 0.0062 - sparse_categorical_accuracy: 0.9981 - val_loss: 2.3308 - val_sparse_categorical_accuracy: 0.6742

Epoch 100/100

99/99 [==============================] - 11s 114ms/step - loss: 0.0105 - sparse_categorical_accuracy: 0.9968 - val_loss: 3.0382 - val_sparse_categorical_accuracy: 0.6000

Model: "shallow__res_2"

Layer (type)	Output Shape	Param #
conv2d_28 (Conv2D)	multiple	9472

```
batch_normalization_28 (Bat    multiple                        256
chNormalization)

activation_22 (Activation)     multiple                        0

max_pooling2d_2 (MaxPooling    multiple                        0
2D)

sequential_2 (Sequential)      (None, 4, 4, 512)               15534336

global_average_pooling2d_2     multiple                        0
(GlobalAveragePooling2D)

dense_2 (Dense)                multiple                        5130

=================================================================
Total params: 15,549,194
Trainable params: 15,538,314
Non-trainable params: 10,880
```