```
Epoch 1/100
99/99 [==============================] - 29s 133ms/step - loss: 1.4569 - sparse_categorical_accuracy: 0.5128
- val_loss: 3.6043 - val_sparse_categorical_accuracy: 0.1688
Epoch 2/100
99/99 [==============================] - 10s 100ms/step - loss: 1.1179 - sparse_categorical_accuracy: 0.6201
- val_loss: 2.7884 - val_sparse_categorical_accuracy: 0.2156
Epoch 3/100
99/99 [==============================] - 10s 97ms/step - loss: 0.9824 - sparse_categorical_accuracy: 0.6627
- val_loss: 2.6966 - val_sparse_categorical_accuracy: 0.2188
Epoch 4/100
99/99 [==============================] - 10s 98ms/step - loss: 0.8720 - sparse_categorical_accuracy: 0.6993
- val_loss: 2.4252 - val_sparse_categorical_accuracy: 0.3008
Epoch 5/100
99/99 [==============================] - 10s 98ms/step - loss: 0.7569 - sparse_categorical_accuracy: 0.7382
- val_loss: 1.7503 - val_sparse_categorical_accuracy: 0.4695
Epoch 6/100
99/99 [==============================] - 9s 94ms/step - loss: 0.6544 - sparse_categorical_accuracy: 0.7749
- val_loss: 1.7590 - val_sparse_categorical_accuracy: 0.4469
Epoch 7/100
99/99 [==============================] - 10s 98ms/step - loss: 0.5428 - sparse_categorical_accuracy: 0.8153
- val_loss: 2.0913 - val_sparse_categorical_accuracy: 0.4359
Epoch 8/100
99/99 [==============================] - 10s 97ms/step - loss: 0.4401 - sparse_categorical_accuracy: 0.8480
- val_loss: 2.6675 - val_sparse_categorical_accuracy: 0.4031
Epoch 9/100
99/99 [==============================] - 9s 95ms/step - loss: 0.3198 - sparse_categorical_accuracy: 0.8899
- val_loss: 2.0174 - val_sparse_categorical_accuracy: 0.4734
Epoch 10/100
99/99 [==============================] - 9s 95ms/step - loss: 0.2401 - sparse_categorical_accuracy: 0.9190
- val_loss: 1.9050 - val_sparse_categorical_accuracy: 0.5242
Epoch 11/100
99/99 [==============================] - 9s 95ms/step - loss: 0.1618 - sparse_categorical_accuracy: 0.9443
- val_loss: 1.9722 - val_sparse_categorical_accuracy: 0.5813
Epoch 12/100
99/99 [==============================] - 9s 96ms/step - loss: 0.1386 - sparse_categorical_accuracy: 0.9522
- val_loss: 2.1300 - val_sparse_categorical_accuracy: 0.5852
Epoch 13/100
99/99 [==============================] - 9s 96ms/step - loss: 0.1101 - sparse_categorical_accuracy: 0.9618
- val_loss: 2.0817 - val_sparse_categorical_accuracy: 0.6391
Epoch 14/100
99/99 [==============================] - 10s 100ms/step - loss: 0.0850 - sparse_categorical_accuracy: 0.9695
- val_loss: 2.0036 - val_sparse_categorical_accuracy: 0.5945
Epoch 15/100
```

99/99 [==============================] - 10s 96ms/step - loss: 0.0754 - sparse_categorical_accuracy: 0.9737 - val_loss: 2.3929 - val_sparse_categorical_accuracy: 0.5719

Epoch 16/100

99/99 [==============================] - 10s 97ms/step - loss: 0.0715 - sparse_categorical_accuracy: 0.9766 - val_loss: 2.4458 - val_sparse_categorical_accuracy: 0.5680

Epoch 17/100

99/99 [==============================] - 10s 101ms/step - loss: 0.0561 - sparse_categorical_accuracy: 0.9807 - val_loss: 1.7497 - val_sparse_categorical_accuracy: 0.6758

Epoch 18/100

99/99 [==============================] - 10s 101ms/step - loss: 0.0666 - sparse_categorical_accuracy: 0.9782 - val_loss: 2.0317 - val_sparse_categorical_accuracy: 0.6227

Epoch 19/100

99/99 [==============================] - 10s 98ms/step - loss: 0.0395 - sparse_categorical_accuracy: 0.9877 - val_loss: 1.8181 - val_sparse_categorical_accuracy: 0.6539

Epoch 20/100

99/99 [==============================] - 10s 97ms/step - loss: 0.0410 - sparse_categorical_accuracy: 0.9860 - val_loss: 3.6534 - val_sparse_categorical_accuracy: 0.4703

Epoch 21/100

99/99 [==============================] - 10s 98ms/step - loss: 0.0657 - sparse_categorical_accuracy: 0.9783 - val_loss: 3.4103 - val_sparse_categorical_accuracy: 0.4383

Epoch 22/100

99/99 [==============================] - 10s 102ms/step - loss: 0.0413 - sparse_categorical_accuracy: 0.9868 - val_loss: 1.7070 - val_sparse_categorical_accuracy: 0.6594

Epoch 23/100

99/99 [==============================] - 10s 98ms/step - loss: 0.0296 - sparse_categorical_accuracy: 0.9897 - val_loss: 2.6150 - val_sparse_categorical_accuracy: 0.5875

Epoch 24/100

99/99 [==============================] - 10s 98ms/step - loss: 0.0315 - sparse_categorical_accuracy: 0.9892 - val_loss: 2.4700 - val_sparse_categorical_accuracy: 0.6242

Epoch 25/100

99/99 [==============================] - 10s 98ms/step - loss: 0.0499 - sparse_categorical_accuracy: 0.9843 - val_loss: 1.9280 - val_sparse_categorical_accuracy: 0.6602

Epoch 26/100

99/99 [==============================] - 10s 98ms/step - loss: 0.0317 - sparse_categorical_accuracy: 0.9892 - val_loss: 1.8834 - val_sparse_categorical_accuracy: 0.6867

Epoch 27/100

99/99 [==============================] - 10s 98ms/step - loss: 0.0346 - sparse_categorical_accuracy: 0.9879 - val_loss: 2.6169 - val_sparse_categorical_accuracy: 0.5867

Epoch 28/100

99/99 [==============================] - 10s 98ms/step - loss: 0.0418 - sparse_categorical_accuracy: 0.9866 - val_loss: 3.0903 - val_sparse_categorical_accuracy: 0.5602

Epoch 29/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0389 - sparse_categorical_accuracy: 0.9875 - val_loss: 2.6799 - val_sparse_categorical_accuracy: 0.5523

Epoch 30/100

99/99 [==============================] - 10s 101ms/step - loss: 0.0205 - sparse_categorical_accuracy: 0.9929 - val_loss: 1.8444 - val_sparse_categorical_accuracy: 0.6852

Epoch 31/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0247 - sparse_categorical_accuracy: 0.9920 - val_loss: 2.1105 - val_sparse_categorical_accuracy: 0.6664

Epoch 32/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0280 - sparse_categorical_accuracy: 0.9913 - val_loss: 2.1239 - val_sparse_categorical_accuracy: 0.6391

Epoch 33/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0300 - sparse_categorical_accuracy: 0.9899 - val_loss: 3.3815 - val_sparse_categorical_accuracy: 0.5250

Epoch 34/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0343 - sparse_categorical_accuracy: 0.9882 - val_loss: 3.6752 - val_sparse_categorical_accuracy: 0.5727

Epoch 35/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0433 - sparse_categorical_accuracy: 0.9852 - val_loss: 2.1523 - val_sparse_categorical_accuracy: 0.6195

Epoch 36/100

99/99 [==============================] - 10s 98ms/step - loss: 0.0197 - sparse_categorical_accuracy: 0.9933 - val_loss: 2.3563 - val_sparse_categorical_accuracy: 0.6344

Epoch 37/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0331 - sparse_categorical_accuracy: 0.9902 - val_loss: 6.0563 - val_sparse_categorical_accuracy: 0.3898

Epoch 38/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0309 - sparse_categorical_accuracy: 0.9910 - val_loss: 2.1634 - val_sparse_categorical_accuracy: 0.6406

Epoch 39/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0173 - sparse_categorical_accuracy: 0.9943 - val_loss: 2.2977 - val_sparse_categorical_accuracy: 0.6367

Epoch 40/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0118 - sparse_categorical_accuracy: 0.9965 - val_loss: 2.2518 - val_sparse_categorical_accuracy: 0.6570

Epoch 41/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0061 - sparse_categorical_accuracy: 0.9981 - val_loss: 2.5439 - val_sparse_categorical_accuracy: 0.6086

Epoch 42/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0022 - sparse_categorical_accuracy: 0.9995 - val_loss: 1.8235 - val_sparse_categorical_accuracy: 0.7172

Epoch 43/100

99/99 [==============================] - 10s 104ms/step - loss: 0.0191 - sparse_categorical_accuracy: 0.9940 - val_loss: 1.9416 - val_sparse_categorical_accuracy: 0.6648

Epoch 44/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0323 - sparse_categorical_accuracy: 0.9890 - val_loss: 2.7616 - val_sparse_categorical_accuracy: 0.5719

Epoch 45/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0460 - sparse_categorical_accuracy: 0.9850 - val_loss: 2.5456 - val_sparse_categorical_accuracy: 0.6297

Epoch 46/100

99/99 [==============================] - 10s 102ms/step - loss: 0.0338 - sparse_categorical_accuracy: 0.9877 - val_loss: 3.7664 - val_sparse_categorical_accuracy: 0.5250

Epoch 47/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0273 - sparse_categorical_accuracy: 0.9910 - val_loss: 3.9031 - val_sparse_categorical_accuracy: 0.5180

Epoch 48/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0145 - sparse_categorical_accuracy: 0.9951 - val_loss: 1.9702 - val_sparse_categorical_accuracy: 0.6953

Epoch 49/100

99/99 [==============================] - 10s 102ms/step - loss: 0.0171 - sparse_categorical_accuracy: 0.9946 - val_loss: 2.7907 - val_sparse_categorical_accuracy: 0.5820

Epoch 50/100

99/99 [==============================] - 10s 104ms/step - loss: 0.0347 - sparse_categorical_accuracy: 0.9874 - val_loss: 3.5265 - val_sparse_categorical_accuracy: 0.5578

Epoch 51/100

99/99 [==============================] - 10s 101ms/step - loss: 0.0167 - sparse_categorical_accuracy: 0.9943 - val_loss: 3.2634 - val_sparse_categorical_accuracy: 0.5852

Epoch 52/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0121 - sparse_categorical_accuracy: 0.9958 - val_loss: 3.5779 - val_sparse_categorical_accuracy: 0.5578

Epoch 53/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0207 - sparse_categorical_accuracy: 0.9930 - val_loss: 3.3810 - val_sparse_categorical_accuracy: 0.5586

Epoch 54/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0186 - sparse_categorical_accuracy: 0.9936 - val_loss: 2.6750 - val_sparse_categorical_accuracy: 0.6070

Epoch 55/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0270 - sparse_categorical_accuracy: 0.9914 - val_loss: 3.4492 - val_sparse_categorical_accuracy: 0.5148

Epoch 56/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0193 - sparse_categorical_accuracy: 0.9938 - val_loss: 2.4096 - val_sparse_categorical_accuracy: 0.6438

Epoch 57/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0136 - sparse_categorical_accuracy: 0.9950 - val_loss: 3.8139 - val_sparse_categorical_accuracy: 0.5234

Epoch 58/100

99/99 [==============================] - 10s 102ms/step - loss: 0.0129 - sparse_categorical_accuracy: 0.9963 - val_loss: 3.6068 - val_sparse_categorical_accuracy: 0.5461

Epoch 59/100

99/99 [==============================] – 10s 99ms/step – loss: 0.0095 – sparse_categorical_accuracy: 0.9970 – val_loss: 2.5713 – val_sparse_categorical_accuracy: 0.6289

Epoch 60/100

99/99 [==============================] – 10s 104ms/step – loss: 0.0343 – sparse_categorical_accuracy: 0.9889 – val_loss: 3.5117 – val_sparse_categorical_accuracy: 0.5609

Epoch 61/100

99/99 [==============================] – 10s 99ms/step – loss: 0.0372 – sparse_categorical_accuracy: 0.9884 – val_loss: 3.2234 – val_sparse_categorical_accuracy: 0.5141

Epoch 62/100

99/99 [==============================] – 10s 99ms/step – loss: 0.0278 – sparse_categorical_accuracy: 0.9904 – val_loss: 11.2062 – val_sparse_categorical_accuracy: 0.2977

Epoch 63/100

99/99 [==============================] – 10s 99ms/step – loss: 0.0266 – sparse_categorical_accuracy: 0.9914 – val_loss: 1.9855 – val_sparse_categorical_accuracy: 0.6609

Epoch 64/100

99/99 [==============================] – 10s 99ms/step – loss: 0.0060 – sparse_categorical_accuracy: 0.9979 – val_loss: 1.9185 – val_sparse_categorical_accuracy: 0.6766

Epoch 65/100

99/99 [==============================] – 10s 99ms/step – loss: 0.0032 – sparse_categorical_accuracy: 0.9993 – val_loss: 2.1076 – val_sparse_categorical_accuracy: 0.6711

Epoch 66/100

99/99 [==============================] – 10s 99ms/step – loss: 5.8776e-04 – sparse_categorical_accuracy: 0.9998 – val_loss: 2.0193 – val_sparse_categorical_accuracy: 0.6922

Epoch 67/100

99/99 [==============================] – 10s 99ms/step – loss: 7.6516e-04 – sparse_categorical_accuracy: 0.9997 – val_loss: 2.2908 – val_sparse_categorical_accuracy: 0.6742

Epoch 68/100

99/99 [==============================] – 10s 99ms/step – loss: 0.0011 – sparse_categorical_accuracy: 0.9995 – val_loss: 2.2124 – val_sparse_categorical_accuracy: 0.6898

Epoch 69/100

99/99 [==============================] – 10s 99ms/step – loss: 0.0199 – sparse_categorical_accuracy: 0.9937 – val_loss: 4.2694 – val_sparse_categorical_accuracy: 0.4906

Epoch 70/100

99/99 [==============================] – 10s 103ms/step – loss: 0.0317 – sparse_categorical_accuracy: 0.9901 – val_loss: 2.8713 – val_sparse_categorical_accuracy: 0.5875

Epoch 71/100

99/99 [==============================] – 10s 100ms/step – loss: 0.0329 – sparse_categorical_accuracy: 0.9891 – val_loss: 4.9663 – val_sparse_categorical_accuracy: 0.4398

Epoch 72/100

99/99 [==============================] – 10s 99ms/step – loss: 0.0227 – sparse_categorical_accuracy: 0.9918 – val_loss: 2.1137 – val_sparse_categorical_accuracy: 0.6578

Epoch 73/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0177 - sparse_categorical_accuracy: 0.9945 - val_loss: 1.9616 - val_sparse_categorical_accuracy: 0.6828

Epoch 74/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0099 - sparse_categorical_accuracy: 0.9971 - val_loss: 1.9673 - val_sparse_categorical_accuracy: 0.7000

Epoch 75/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0124 - sparse_categorical_accuracy: 0.9960 - val_loss: 2.1830 - val_sparse_categorical_accuracy: 0.6695

Epoch 76/100

99/99 [==============================] - 10s 102ms/step - loss: 0.0068 - sparse_categorical_accuracy: 0.9979 - val_loss: 2.5645 - val_sparse_categorical_accuracy: 0.6313

Epoch 77/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0066 - sparse_categorical_accuracy: 0.9976 - val_loss: 2.4224 - val_sparse_categorical_accuracy: 0.6461

Epoch 78/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0125 - sparse_categorical_accuracy: 0.9950 - val_loss: 3.2758 - val_sparse_categorical_accuracy: 0.5203

Epoch 79/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0338 - sparse_categorical_accuracy: 0.9889 - val_loss: 2.8848 - val_sparse_categorical_accuracy: 0.5961

Epoch 80/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0236 - sparse_categorical_accuracy: 0.9917 - val_loss: 2.3009 - val_sparse_categorical_accuracy: 0.6234

Epoch 81/100

99/99 [==============================] - 10s 101ms/step - loss: 0.0312 - sparse_categorical_accuracy: 0.9905 - val_loss: 2.2968 - val_sparse_categorical_accuracy: 0.6555

Epoch 82/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0131 - sparse_categorical_accuracy: 0.9956 - val_loss: 2.1167 - val_sparse_categorical_accuracy: 0.6852

Epoch 83/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0037 - sparse_categorical_accuracy: 0.9989 - val_loss: 2.2122 - val_sparse_categorical_accuracy: 0.6836

Epoch 84/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0020 - sparse_categorical_accuracy: 0.9994 - val_loss: 1.9402 - val_sparse_categorical_accuracy: 0.7188

Epoch 85/100

99/99 [==============================] - 10s 101ms/step - loss: 3.5290e-04 - sparse_categorical_accuracy: 0.9999 - val_loss: 1.9113 - val_sparse_categorical_accuracy: 0.7320

Epoch 86/100

99/99 [==============================] - 10s 100ms/step - loss: 1.2907e-04 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.9404 - val_sparse_categorical_accuracy: 0.7320

Epoch 87/100

99/99 [==============================] - 10s 103ms/step - loss: 7.2462e-05 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.9338 - val_sparse_categorical_accuracy: 0.7383

Epoch 88/100

99/99 [==============================] - 10s 99ms/step - loss: 6.2882e-05 - sparse_categorical_accuracy: 1.0000 - val_loss: 1.9536 - val_sparse_categorical_accuracy: 0.7352

Epoch 89/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0034 - sparse_categorical_accuracy: 0.9988 - val_loss: 2.3732 - val_sparse_categorical_accuracy: 0.6781

Epoch 90/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0329 - sparse_categorical_accuracy: 0.9898 - val_loss: 4.0137 - val_sparse_categorical_accuracy: 0.5102

Epoch 91/100

99/99 [==============================] - 10s 101ms/step - loss: 0.0384 - sparse_categorical_accuracy: 0.9868 - val_loss: 2.1168 - val_sparse_categorical_accuracy: 0.6781

Epoch 92/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0178 - sparse_categorical_accuracy: 0.9949 - val_loss: 2.5576 - val_sparse_categorical_accuracy: 0.5734

Epoch 93/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0211 - sparse_categorical_accuracy: 0.9935 - val_loss: 2.2595 - val_sparse_categorical_accuracy: 0.6539

Epoch 94/100

99/99 [==============================] - 10s 103ms/step - loss: 0.0139 - sparse_categorical_accuracy: 0.9958 - val_loss: 2.2469 - val_sparse_categorical_accuracy: 0.6734

Epoch 95/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0076 - sparse_categorical_accuracy: 0.9976 - val_loss: 1.9926 - val_sparse_categorical_accuracy: 0.6687

Epoch 96/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0237 - sparse_categorical_accuracy: 0.9936 - val_loss: 2.7474 - val_sparse_categorical_accuracy: 0.5805

Epoch 97/100

99/99 [==============================] - 10s 99ms/step - loss: 0.0386 - sparse_categorical_accuracy: 0.9878 - val_loss: 2.3981 - val_sparse_categorical_accuracy: 0.6148

Epoch 98/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0095 - sparse_categorical_accuracy: 0.9970 - val_loss: 2.0563 - val_sparse_categorical_accuracy: 0.6664

Epoch 99/100

99/99 [==============================] - 10s 100ms/step - loss: 0.0011 - sparse_categorical_accuracy: 0.9998 - val_loss: 1.8428 - val_sparse_categorical_accuracy: 0.7086

Epoch 100/100

99/99 [==============================] - 10s 100ms/step - loss: 9.2390e-04 - sparse_categorical_accuracy: 0.9997 - val_loss: 1.9160 - val_sparse_categorical_accuracy: 0.7125

Model: "shallow_res_1"

Layer (type)	Output Shape	Param #
conv2d_12 (Conv2D)	multiple	9472

```
batch_normalization_12 (Bat    multiple                256
chNormalization)

activation_9 (Activation)      multiple                0

max_pooling2d_1 (MaxPooling     multiple                0
2D)

sequential_1 (Sequential)      (None, 4, 4, 512)        10810624

global_average_pooling2d_1      multiple                0
(GlobalAveragePooling2D)

dense_1 (Dense)                multiple                5130
```

```
=================================================================
Total params: 10,825,482
Trainable params: 10,816,650
Non-trainable params: 8,832
```


Training and Validation Accuracy Training and Valiidation Loss