```
Downloading data from https://www.cs.toronto.edu/~kriz/cifar-10-python.tar.gz
170498071/170498071 ──────────────────── 2s 0us/step
/usr/local/lib/python3.11/dist-packages/keras/src/layers/convolutional/base_conv.py:1
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Epoch 1/100
625/625 ──────────────────── 241s 376ms/step - accuracy: 0.3337 - loss: 2.1266 - val_
Epoch 2/100
625/625 ──────────────────── 226s 361ms/step - accuracy: 0.5726 - loss: 1.2007 - val_
Epoch 3/100
625/625 ──────────────────── 249s 341ms/step - accuracy: 0.6502 - loss: 0.9905 - val_
Epoch 4/100
625/625 ──────────────────── 272s 358ms/step - accuracy: 0.6959 - loss: 0.8593 - val_
Epoch 5/100
625/625 ──────────────────── 214s 343ms/step - accuracy: 0.7321 - loss: 0.7706 - val_
Epoch 6/100
625/625 ──────────────────── 223s 357ms/step - accuracy: 0.7543 - loss: 0.7121 - val_
Epoch 7/100
625/625 ──────────────────── 253s 342ms/step - accuracy: 0.7737 - loss: 0.6531 - val_
Epoch 8/100
625/625 ──────────────────── 224s 359ms/step - accuracy: 0.7828 - loss: 0.6187 - val_
Epoch 9/100
625/625 ──────────────────── 252s 343ms/step - accuracy: 0.8055 - loss: 0.5655 - val_
Epoch 10/100
625/625 ──────────────────── 270s 356ms/step - accuracy: 0.8165 - loss: 0.5363 - val_
Epoch 11/100
625/625 ──────────────────── 252s 341ms/step - accuracy: 0.8250 - loss: 0.5080 - val_
Epoch 12/100
625/625 ──────────────────── 271s 355ms/step - accuracy: 0.8302 - loss: 0.4871 - val_
Epoch 13/100
625/625 ──────────────────── 223s 356ms/step - accuracy: 0.8456 - loss: 0.4521 - val_
Epoch 14/100
625/625 ──────────────────── 253s 343ms/step - accuracy: 0.8486 - loss: 0.4350 - val_
Epoch 15/100
625/625 ──────────────────── 271s 358ms/step - accuracy: 0.8575 - loss: 0.4146 - val_
Epoch 16/100
625/625 ──────────────────── 215s 344ms/step - accuracy: 0.8615 - loss: 0.4062 - val
```

```
625/625                            ????  94ms/step - accuracy: 0.0015 - loss: 0.4002 - val_
Epoch 17/100
625/625 ———————————————— 260s 340ms/step - accuracy: 0.8682 - loss: 0.3800 - val_
Epoch 18/100
625/625 ———————————————— 273s 358ms/step - accuracy: 0.8731 - loss: 0.3623 - val_
Epoch 19/100
625/625 ———————————————— 252s 342ms/step - accuracy: 0.8777 - loss: 0.3520 - val_
Epoch 20/100
625/625 ———————————————— 263s 344ms/step - accuracy: 0.8815 - loss: 0.3406 - val_
Epoch 21/100
625/625 ———————————————— 269s 356ms/step - accuracy: 0.8851 - loss: 0.3326 - val_
Epoch 22/100
625/625 ———————————————— 222s 355ms/step - accuracy: 0.8889 - loss: 0.3214 - val_
Epoch 23/100
625/625 ———————————————— 261s 354ms/step - accuracy: 0.8896 - loss: 0.3111 - val_
Epoch 24/100
625/625 ———————————————— 220s 353ms/step - accuracy: 0.8943 - loss: 0.2963 - val_
Epoch 25/100
625/625 ———————————————— 263s 354ms/step - accuracy: 0.8970 - loss: 0.3017 - val_
Epoch 26/100
625/625 ———————————————— 261s 353ms/step - accuracy: 0.9029 - loss: 0.2785 - val_
Epoch 27/100
625/625 ———————————————— 262s 353ms/step - accuracy: 0.9142 - loss: 0.2433 - val_
Epoch 28/100
625/625 ———————————————— 261s 353ms/step - accuracy: 0.9244 - loss: 0.2156 - val_
Epoch 29/100
625/625 ———————————————— 263s 354ms/step - accuracy: 0.9297 - loss: 0.2004 - val_
Epoch 30/100
625/625 ———————————————— 222s 355ms/step - accuracy: 0.9317 - loss: 0.1986 - val_
Epoch 31/100
625/625 ———————————————— 252s 339ms/step - accuracy: 0.9352 - loss: 0.1894 - val_
Epoch 32/100
625/625 ———————————————— 220s 352ms/step - accuracy: 0.9371 - loss: 0.1828 - val_
Epoch 33/100
625/625 ———————————————— 254s 340ms/step - accuracy: 0.9354 - loss: 0.1807 - val_
Epoch 34/100
625/625 ———————————————— 222s 356ms/step - accuracy: 0.9427 - loss: 0.1683 - val_
Epoch 35/100
625/625 ———————————————— 261s 354ms/step - accuracy: 0.9434 - loss: 0.1614 - val_
Epoch 36/100
625/625 ———————————————— 262s 354ms/step - accuracy: 0.9435 - loss: 0.1615 - val_
Epoch 37/100
625/625 ———————————————— 262s 353ms/step - accuracy: 0.9429 - loss: 0.1691 - val_
Epoch 38/100
625/625 ———————————————— 261s 352ms/step - accuracy: 0.9435 - loss: 0.1604 - val_
313/313 ———————————————— 13s 42ms/step - accuracy: 0.8622 - loss: 0.4486
Test Loss: 0.4562, Test Accuracy: 0.8598
313/313 ———————————————— 13s 42ms/step
```

	precision	recall	f1-score	support
0	0.88	0.85	0.87	1000
1	0.94	0.94	0.94	1000
2	0.83	0.76	0.79	1000
3	0.75	0.72	0.73	1000
4	0.85	0.86	0.85	1000

5	0.76	0.82	0.79	1000
6	0.87	0.91	0.89	1000
7	0.92	0.88	0.90	1000
8	0.90	0.94	0.92	1000
9	0.91	0.92	0.91	1000
accuracy			0.86	10000
macro avg	0.86	0.86	0.86	10000
weighted avg	0.86	0.86	0.86	10000

Accuracy Curves — Loss Curves
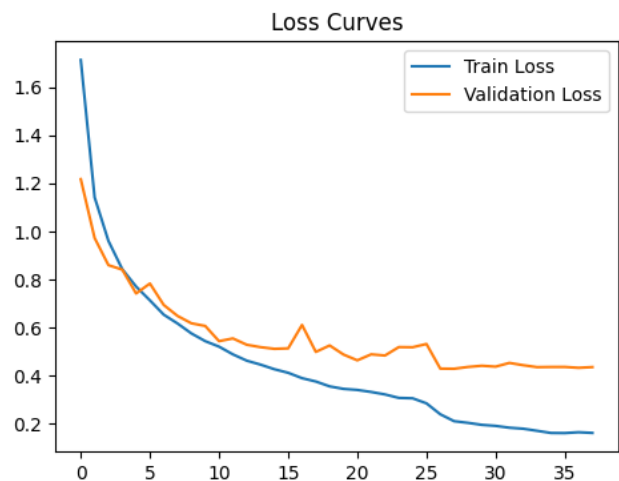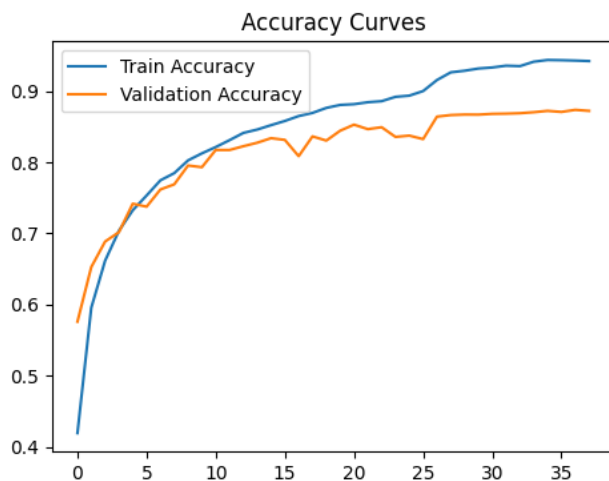
```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/vg
58889256/58889256 ———————————————— 0s 0us/step
Epoch 1/50
625/625 ———————————————— 395s 628ms/step - accuracy: 0.2333 - loss: 2.4805 - val_
Epoch 2/50
625/625 ———————————————— 433s 615ms/step - accuracy: 0.4268 - loss: 1.7177 - val_
Epoch 3/50
625/625 ———————————————— 390s 625ms/step - accuracy: 0.4662 - loss: 1.5711 - val_
Epoch 4/50
625/625 ———————————————— 390s 624ms/step - accuracy: 0.4927 - loss: 1.4864 - val_
Epoch 5/50
625/625 ———————————————— 389s 623ms/step - accuracy: 0.5077 - loss: 1.4281 - val_
Epoch 6/50
625/625 ———————————————— 390s 625ms/step - accuracy: 0.5196 - loss: 1.3846 - val_
Epoch 7/50
625/625 ———————————————— 444s 628ms/step - accuracy: 0.5380 - loss: 1.3366 - val_
Epoch 8/50
625/625 ———————————————— 441s 626ms/step - accuracy: 0.5443 - loss: 1.3145 - val_
Epoch 9/50
625/625 ———————————————— 440s 624ms/step - accuracy: 0.5527 - loss: 1.2998 - val_
Epoch 10/50
625/625 ———————————————— 391s 626ms/step - accuracy: 0.5608 - loss: 1.2751 - val_
Epoch 11/50
625/625 ———————————————— 384s 615ms/step - accuracy: 0.5635 - loss: 1.2663 - val_
Epoch 12/50
625/625 ———————————————— 448s 624ms/step - accuracy: 0.5717 - loss: 1.2374 - val_
Epoch 13/50
625/625 ———————————————— 436s 615ms/step - accuracy: 0.5757 - loss: 1.2182 - val_
Epoch 14/50
625/625 ———————————————— 443s 616ms/step - accuracy: 0.5814 - loss: 1.2013 - val_
```

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Epoch 15/50
625/625 ──────────────────── 385s 616ms/step - accuracy: 0.5831 - loss: 1.2029 - val_
Epoch 16/50
625/625 ──────────────────── 447s 624ms/step - accuracy: 0.5816 - loss: 1.2029 - val_
Epoch 17/50
625/625 ──────────────────── 443s 625ms/step - accuracy: 0.5924 - loss: 1.1778 - val_
Epoch 18/50
625/625 ──────────────────── 442s 626ms/step - accuracy: 0.5901 - loss: 1.1863 - val_
Epoch 19/50
625/625 ──────────────────── 389s 623ms/step - accuracy: 0.5913 - loss: 1.1770 - val_
Epoch 20/50
625/625 ──────────────────── 390s 624ms/step - accuracy: 0.5953 - loss: 1.1707 - val_
Epoch 21/50
625/625 ──────────────────── 443s 627ms/step - accuracy: 0.6003 - loss: 1.1517 - val_
Epoch 22/50
625/625 ──────────────────── 441s 625ms/step - accuracy: 0.6022 - loss: 1.1455 - val_
Epoch 23/50
625/625 ──────────────────── 391s 626ms/step - accuracy: 0.6046 - loss: 1.1390 - val_
Epoch 24/50
625/625 ──────────────────── 385s 616ms/step - accuracy: 0.6097 - loss: 1.1303 - val_
Epoch 25/50
625/625 ──────────────────── 389s 623ms/step - accuracy: 0.6150 - loss: 1.1254 - val_
Epoch 26/50
625/625 ──────────────────── 444s 627ms/step - accuracy: 0.6131 - loss: 1.1198 - val_
Epoch 27/50
625/625 ──────────────────── 441s 625ms/step - accuracy: 0.6123 - loss: 1.1046 - val_
Epoch 28/50
625/625 ──────────────────── 385s 616ms/step - accuracy: 0.6167 - loss: 1.1063 - val_
Epoch 29/50
625/625 ──────────────────── 447s 624ms/step - accuracy: 0.6138 - loss: 1.1141 - val_
Epoch 30/50
625/625 ──────────────────── 442s 625ms/step - accuracy: 0.6201 - loss: 1.1057 - val_
Epoch 31/50
625/625 ──────────────────── 442s 625ms/step - accuracy: 0.6169 - loss: 1.0998 - val_
Epoch 32/50
625/625 ──────────────────── 393s 630ms/step - accuracy: 0.6228 - loss: 1.0968 - val_
Epoch 33/50
625/625 ──────────────────── 392s 627ms/step - accuracy: 0.6224 - loss: 1.0913 - val_
Epoch 34/50
625/625 ──────────────────── 443s 628ms/step - accuracy: 0.6230 - loss: 1.0759 - val_
Epoch 35/50
625/625 ──────────────────── 441s 627ms/step - accuracy: 0.6326 - loss: 1.0623 - val_
Epoch 36/50
625/625 ──────────────────── 443s 628ms/step - accuracy: 0.6320 - loss: 1.0691 - val_
Epoch 37/50
625/625 ──────────────────── 443s 630ms/step - accuracy: 0.6259 - loss: 1.0654 - val_
Epoch 38/50
625/625 ──────────────────── 443s 631ms/step - accuracy: 0.6259 - loss: 1.0749 - val_
Epoch 39/50
625/625 ──────────────────── 440s 628ms/step - accuracy: 0.6329 - loss: 1.0605 - val_
Epoch 40/50
625/625 ──────────────────── 441s 626ms/step - accuracy: 0.6316 - loss: 1.0641 - val_
Epoch 41/50
625/625 ──────────────────── 444s 630ms/step - accuracy: 0.6319 - loss: 1.0562 - val_
```

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Epoch 42/50
625/625 ──────────────────── 441s 629ms/step - accuracy: 0.6355 - loss: 1.0495 - val_
Epoch 43/50
625/625 ──────────────────── 447s 636ms/step - accuracy: 0.6329 - loss: 1.0455 - val_
Epoch 44/50
625/625 ──────────────────── 392s 627ms/step - accuracy: 0.6421 - loss: 1.0321 - val_
Epoch 45/50
625/625 ──────────────────── 395s 631ms/step - accuracy: 0.6384 - loss: 1.0445 - val_
Epoch 46/50
625/625 ──────────────────── 444s 635ms/step - accuracy: 0.6437 - loss: 1.0261 - val_
Epoch 47/50
625/625 ──────────────────── 395s 633ms/step - accuracy: 0.6422 - loss: 1.0251 - val_
Epoch 48/50
625/625 ──────────────────── 435s 621ms/step - accuracy: 0.6438 - loss: 1.0263 - val_
Epoch 49/50
625/625 ──────────────────── 395s 632ms/step - accuracy: 0.6441 - loss: 1.0293 - val_
Epoch 50/50
625/625 ──────────────────── 442s 632ms/step - accuracy: 0.6484 - loss: 1.0156 - val_
313/313 ──────────────────── 82s 261ms/step - accuracy: 0.6089 - loss: 1.1258
Transfer Learning Test Loss: 1.1292, Transfer Learning Test Accuracy: 0.6098
313/313 ──────────────────── 81s 257ms/step
              precision    recall  f1-score   support

           0       0.71      0.67      0.69      1000
           1       0.63      0.73      0.68      1000
           2       0.54      0.48      0.51      1000
           3       0.46      0.45      0.45      1000
           4       0.56      0.53      0.54      1000
           5       0.54      0.53      0.54      1000
           6       0.64      0.66      0.65      1000
           7       0.65      0.68      0.66      1000
           8       0.71      0.74      0.73      1000
           9       0.63      0.64      0.63      1000

    accuracy                           0.61     10000
   macro avg       0.61      0.61      0.61     10000
weighted avg       0.61      0.61      0.61     10000
```