mobilenetv2

November 24, 2024

[ ]:
```
import os
import numpy as np
import cv2
import mediapipe as mp
import matplotlib.pyplot as plt
import torch
import torch.nn as nn
import torch.optim as optim
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import accuracy_score, classification_report
import seaborn as sns
import pandas as pd
```

[2]:
```
x = np.load('pose_landmarks_dataset.npy')
y = np.load('pose_landmarks_labels.npy')
```

[3]:
```
x_train, x_val, y_train, y_val = train_test_split(x, y, test_size=0.2,␣
↪random_state=42)
```

[4]:
```
label_encoder = LabelEncoder()
y_train_encoded = label_encoder.fit_transform(y_train)
y_val_encoded = label_encoder.transform(y_val)
```

[6]:
```
from keras.applications import MobileNetV2
from keras.models import Sequential
from keras.layers import Dense, GlobalAveragePooling2D, TimeDistributed, LSTM,␣
↪Dropout
from keras.optimizers import Adam
```

[8]:
```
# Assuming you already have x_train and x_val processed
num_classes = len(np.unique(y_train_encoded))

# Define the input shape based on your landmarks data
input_shape = (x_train.shape[1], x_train.shape[2])  # (timesteps, features)
```

[9]:
```
# Load the pre-trained MobileNetV2 model without the top classification layers
base_model = MobileNetV2(weights='imagenet', include_top=False,␣
 ↪input_shape=(224, 224, 3))
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applicatio
ns/mobilenet_v2/mobilenet_v2_weights_tf_dim_ordering_tf_kernels_1.0_224_no_top.h
5
9406464/9406464            0s
0us/step
```

[10]:
```
from keras.layers import Input
inputs = Input(shape=input_shape)
x = LSTM(128, return_sequences=True)(inputs)
x = Dropout(0.4)(x)
x = LSTM(64)(x)
x = Dropout(0.4)(x)
x = Dense(64, activation='relu')(x)
x = Dropout(0.4)(x)
outputs = Dense(num_classes, activation='softmax')(x)
```

[11]:
```
# Create the model
from keras.models import Model
model = Model(inputs=inputs, outputs=outputs)

# Compile the model
optimizer = Adam(learning_rate=0.001)
model.compile(optimizer=optimizer, loss='sparse_categorical_crossentropy',␣
 ↪metrics=['accuracy'])
```

[ ]:
```
# Train the model
history = model.fit(x_train, y_train_encoded,
                    validation_data=(x_val, y_val_encoded),
                    epochs=600, batch_size=32)
train_accuracy = history.history['accuracy']
val_accuracy = history.history['val_accuracy']
epochs = range(1, len(train_accuracy) + 1)

plt.figure(figsize=(10, 5))
plt.plot(epochs, train_accuracy, label='Training Accuracy', color='blue')
plt.plot(epochs, val_accuracy, label='Validation Accuracy', color='orange')

plt.title('Training and Validation Accuracy over Epochs')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```

[ ]:
```
# Save the model
model.save('/kaggle/working/tf_pretrained_model.h5')
```

[13]:
```
from tensorflow.keras.models import load_model
from sklearn.metrics import accuracy_score

model = load_model('/kaggle/working/tf_pretrained_model.h5')

predictions = model.predict(x_val)
predicted_classes = predictions.argmax(axis=1)

accuracy = accuracy_score(y_val_encoded, predicted_classes)
print(f'TensorFlow Model Validation Accuracy: {accuracy:.4f}')
```

```
38/38             1s 29ms/step
TensorFlow Model Validation Accuracy: 0.8724
```

[15]:
```
# Compile the model
optimizer = Adam(learning_rate=0.001)
model.compile(optimizer=optimizer, loss='sparse_categorical_crossentropy',␣
 ↪metrics=['accuracy'])
```

[16]:
```
# Train the model
history = model.fit(x_train, y_train_encoded,
                    validation_data=(x_val, y_val_encoded),
                    epochs=600, batch_size=32)
train_accuracy = history.history['accuracy']
val_accuracy = history.history['val_accuracy']
epochs = range(1, len(train_accuracy) + 1)

plt.figure(figsize=(10, 5))
plt.plot(epochs, train_accuracy, label='Training Accuracy', color='blue')
plt.plot(epochs, val_accuracy, label='Validation Accuracy', color='orange')

plt.title('Training and Validation Accuracy over Epochs')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()3

plt.show()
```

```
Epoch 1/600
150/150             12s 58ms/step -
accuracy: 0.9111 - loss: 0.2443 - val_accuracy: 0.8399 - val_loss: 0.4853
Epoch 2/600
150/150             9s 52ms/step -
accuracy: 0.8932 - loss: 0.2676 - val_accuracy: 0.8707 - val_loss: 0.3732
Epoch 3/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9138 - loss: 0.2271 - val_accuracy: 0.8574 - val_loss: 0.4520
Epoch 4/600
150/150            8s 52ms/step -
accuracy: 0.9193 - loss: 0.2140 - val_accuracy: 0.8557 - val_loss: 0.4467
Epoch 5/600
150/150            8s 54ms/step -
accuracy: 0.9018 - loss: 0.2598 - val_accuracy: 0.8782 - val_loss: 0.3897
Epoch 6/600
150/150            8s 52ms/step -
accuracy: 0.9069 - loss: 0.2472 - val_accuracy: 0.8532 - val_loss: 0.3844
Epoch 7/600
150/150            8s 53ms/step -
accuracy: 0.9171 - loss: 0.2047 - val_accuracy: 0.8157 - val_loss: 0.6184
Epoch 8/600
150/150            8s 52ms/step -
accuracy: 0.8768 - loss: 0.3215 - val_accuracy: 0.8674 - val_loss: 0.4346
Epoch 9/600
150/150            8s 55ms/step -
accuracy: 0.9110 - loss: 0.2152 - val_accuracy: 0.8632 - val_loss: 0.4382
Epoch 10/600
150/150            8s 52ms/step -
accuracy: 0.9159 - loss: 0.2337 - val_accuracy: 0.8607 - val_loss: 0.4427
Epoch 11/600
150/150            8s 52ms/step -
accuracy: 0.9181 - loss: 0.2164 - val_accuracy: 0.8724 - val_loss: 0.4265
Epoch 12/600
150/150            8s 53ms/step -
accuracy: 0.9193 - loss: 0.2233 - val_accuracy: 0.8649 - val_loss: 0.4632
Epoch 13/600
150/150            8s 56ms/step -
accuracy: 0.9213 - loss: 0.2243 - val_accuracy: 0.8507 - val_loss: 0.4518
Epoch 14/600
150/150            8s 52ms/step -
accuracy: 0.8985 - loss: 0.2528 - val_accuracy: 0.8490 - val_loss: 0.4569
Epoch 15/600
150/150            8s 51ms/step -
accuracy: 0.8985 - loss: 0.2693 - val_accuracy: 0.8716 - val_loss: 0.3632
Epoch 16/600
150/150            8s 52ms/step -
accuracy: 0.9126 - loss: 0.2322 - val_accuracy: 0.8265 - val_loss: 0.5934
Epoch 17/600
150/150            8s 54ms/step -
accuracy: 0.9050 - loss: 0.2380 - val_accuracy: 0.8515 - val_loss: 0.4340
Epoch 18/600
150/150            10s 52ms/step -
accuracy: 0.9270 - loss: 0.2062 - val_accuracy: 0.8499 - val_loss: 0.4293
Epoch 19/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9264 - loss: 0.2030 - val_accuracy: 0.8774 - val_loss: 0.3474
Epoch 20/600
150/150            8s 52ms/step -
accuracy: 0.9288 - loss: 0.1895 - val_accuracy: 0.8599 - val_loss: 0.4426
Epoch 21/600
150/150            8s 55ms/step -
accuracy: 0.9208 - loss: 0.2150 - val_accuracy: 0.8716 - val_loss: 0.4371
Epoch 22/600
150/150            8s 52ms/step -
accuracy: 0.9126 - loss: 0.2328 - val_accuracy: 0.8782 - val_loss: 0.3880
Epoch 23/600
150/150            8s 52ms/step -
accuracy: 0.9122 - loss: 0.2319 - val_accuracy: 0.8549 - val_loss: 0.4500
Epoch 24/600
150/150            8s 52ms/step -
accuracy: 0.8999 - loss: 0.2737 - val_accuracy: 0.8699 - val_loss: 0.3831
Epoch 25/600
150/150            11s 54ms/step -
accuracy: 0.9204 - loss: 0.2149 - val_accuracy: 0.8616 - val_loss: 0.4090
Epoch 26/600
150/150            8s 53ms/step -
accuracy: 0.8994 - loss: 0.2883 - val_accuracy: 0.7998 - val_loss: 0.6282
Epoch 27/600
150/150            8s 52ms/step -
accuracy: 0.8959 - loss: 0.3013 - val_accuracy: 0.8791 - val_loss: 0.3740
Epoch 28/600
150/150            8s 52ms/step -
accuracy: 0.9177 - loss: 0.2165 - val_accuracy: 0.8649 - val_loss: 0.4154
Epoch 29/600
150/150            8s 55ms/step -
accuracy: 0.9184 - loss: 0.2141 - val_accuracy: 0.8549 - val_loss: 0.4719
Epoch 30/600
150/150            8s 54ms/step -
accuracy: 0.9227 - loss: 0.2103 - val_accuracy: 0.8599 - val_loss: 0.4501
Epoch 31/600
150/150            8s 53ms/step -
accuracy: 0.9219 - loss: 0.2235 - val_accuracy: 0.8349 - val_loss: 0.5190
Epoch 32/600
150/150            8s 52ms/step -
accuracy: 0.9109 - loss: 0.2321 - val_accuracy: 0.8757 - val_loss: 0.4117
Epoch 33/600
150/150            11s 54ms/step -
accuracy: 0.9237 - loss: 0.2241 - val_accuracy: 0.8657 - val_loss: 0.4617
Epoch 34/600
150/150            8s 51ms/step -
accuracy: 0.9097 - loss: 0.2388 - val_accuracy: 0.8641 - val_loss: 0.4241
Epoch 35/600
```

```
150/150            8s 53ms/step -
accuracy: 0.9204 - loss: 0.2241 - val_accuracy: 0.8432 - val_loss: 0.5704
Epoch 36/600
150/150            8s 52ms/step -
accuracy: 0.9144 - loss: 0.2476 - val_accuracy: 0.8557 - val_loss: 0.4742
Epoch 37/600
150/150            9s 57ms/step -
accuracy: 0.9117 - loss: 0.2426 - val_accuracy: 0.8732 - val_loss: 0.4116
Epoch 38/600
150/150            8s 53ms/step -
accuracy: 0.9237 - loss: 0.1978 - val_accuracy: 0.8732 - val_loss: 0.4532
Epoch 39/600
150/150            8s 52ms/step -
accuracy: 0.9249 - loss: 0.2247 - val_accuracy: 0.8724 - val_loss: 0.3947
Epoch 40/600
150/150            10s 52ms/step -
accuracy: 0.9235 - loss: 0.2150 - val_accuracy: 0.8424 - val_loss: 0.5749
Epoch 41/600
150/150            8s 55ms/step -
accuracy: 0.9082 - loss: 0.2520 - val_accuracy: 0.8574 - val_loss: 0.4340
Epoch 42/600
150/150            8s 52ms/step -
accuracy: 0.9216 - loss: 0.1999 - val_accuracy: 0.8465 - val_loss: 0.5959
Epoch 43/600
150/150            8s 53ms/step -
accuracy: 0.9029 - loss: 0.2456 - val_accuracy: 0.8732 - val_loss: 0.4465
Epoch 44/600
150/150            8s 52ms/step -
accuracy: 0.9170 - loss: 0.2548 - val_accuracy: 0.8732 - val_loss: 0.3972
Epoch 45/600
150/150            8s 54ms/step -
accuracy: 0.9295 - loss: 0.1926 - val_accuracy: 0.8732 - val_loss: 0.4295
Epoch 46/600
150/150            8s 53ms/step -
accuracy: 0.9257 - loss: 0.1914 - val_accuracy: 0.8565 - val_loss: 0.4846
Epoch 47/600
150/150            8s 52ms/step -
accuracy: 0.9287 - loss: 0.1906 - val_accuracy: 0.8949 - val_loss: 0.3839
Epoch 48/600
150/150            8s 53ms/step -
accuracy: 0.9235 - loss: 0.2235 - val_accuracy: 0.8490 - val_loss: 0.4970
Epoch 49/600
150/150            8s 55ms/step -
accuracy: 0.9286 - loss: 0.1982 - val_accuracy: 0.8732 - val_loss: 0.4797
Epoch 50/600
150/150            8s 52ms/step -
accuracy: 0.9089 - loss: 0.2378 - val_accuracy: 0.8440 - val_loss: 0.4942
Epoch 51/600
```

```
150/150            8s 53ms/step -
accuracy: 0.9109 - loss: 0.2376 - val_accuracy: 0.8432 - val_loss: 0.5009
Epoch 52/600
150/150            8s 53ms/step -
accuracy: 0.9025 - loss: 0.2822 - val_accuracy: 0.8474 - val_loss: 0.4561
Epoch 53/600
150/150            8s 55ms/step -
accuracy: 0.9187 - loss: 0.2050 - val_accuracy: 0.8574 - val_loss: 0.4494
Epoch 54/600
150/150            8s 52ms/step -
accuracy: 0.9242 - loss: 0.2156 - val_accuracy: 0.8549 - val_loss: 0.4868
Epoch 55/600
150/150            8s 52ms/step -
accuracy: 0.9243 - loss: 0.2104 - val_accuracy: 0.8757 - val_loss: 0.4020
Epoch 56/600
150/150            8s 53ms/step -
accuracy: 0.9295 - loss: 0.1769 - val_accuracy: 0.8590 - val_loss: 0.5258
Epoch 57/600
150/150            8s 55ms/step -
accuracy: 0.9145 - loss: 0.2378 - val_accuracy: 0.8741 - val_loss: 0.4062
Epoch 58/600
150/150            10s 52ms/step -
accuracy: 0.9414 - loss: 0.1734 - val_accuracy: 0.8707 - val_loss: 0.4009
Epoch 59/600
150/150            8s 53ms/step -
accuracy: 0.9290 - loss: 0.1938 - val_accuracy: 0.8824 - val_loss: 0.4279
Epoch 60/600
150/150            8s 52ms/step -
accuracy: 0.9225 - loss: 0.2179 - val_accuracy: 0.8474 - val_loss: 0.4677
Epoch 61/600
150/150            8s 54ms/step -
accuracy: 0.9050 - loss: 0.2529 - val_accuracy: 0.8641 - val_loss: 0.4601
Epoch 62/600
150/150            8s 52ms/step -
accuracy: 0.9355 - loss: 0.1832 - val_accuracy: 0.8574 - val_loss: 0.4285
Epoch 63/600
150/150            8s 53ms/step -
accuracy: 0.9227 - loss: 0.2092 - val_accuracy: 0.8649 - val_loss: 0.4379
Epoch 64/600
150/150            8s 52ms/step -
accuracy: 0.9331 - loss: 0.1712 - val_accuracy: 0.8499 - val_loss: 0.4909
Epoch 65/600
150/150            8s 54ms/step -
accuracy: 0.9123 - loss: 0.2408 - val_accuracy: 0.8607 - val_loss: 0.4325
Epoch 66/600
150/150            8s 52ms/step -
accuracy: 0.9213 - loss: 0.2135 - val_accuracy: 0.8691 - val_loss: 0.3847
Epoch 67/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9263 - loss: 0.2114 - val_accuracy: 0.8432 - val_loss: 0.5055
Epoch 68/600
150/150            8s 53ms/step -
accuracy: 0.9255 - loss: 0.2083 - val_accuracy: 0.8882 - val_loss: 0.3745
Epoch 69/600
150/150            8s 56ms/step -
accuracy: 0.9249 - loss: 0.1948 - val_accuracy: 0.8899 - val_loss: 0.4033
Epoch 70/600
150/150            8s 52ms/step -
accuracy: 0.9384 - loss: 0.1669 - val_accuracy: 0.8682 - val_loss: 0.4679
Epoch 71/600
150/150            8s 52ms/step -
accuracy: 0.9112 - loss: 0.2616 - val_accuracy: 0.8641 - val_loss: 0.4548
Epoch 72/600
150/150            8s 53ms/step -
accuracy: 0.9118 - loss: 0.2574 - val_accuracy: 0.8549 - val_loss: 0.4896
Epoch 73/600
150/150            8s 55ms/step -
accuracy: 0.9251 - loss: 0.2027 - val_accuracy: 0.8649 - val_loss: 0.4509
Epoch 74/600
150/150            8s 53ms/step -
accuracy: 0.9179 - loss: 0.2266 - val_accuracy: 0.8515 - val_loss: 0.4522
Epoch 75/600
150/150            8s 52ms/step -
accuracy: 0.8959 - loss: 0.2640 - val_accuracy: 0.8641 - val_loss: 0.4355
Epoch 76/600
150/150            8s 52ms/step -
accuracy: 0.9365 - loss: 0.1710 - val_accuracy: 0.8641 - val_loss: 0.4612
Epoch 77/600
150/150            8s 55ms/step -
accuracy: 0.9343 - loss: 0.1773 - val_accuracy: 0.8607 - val_loss: 0.4548
Epoch 78/600
150/150            8s 53ms/step -
accuracy: 0.9058 - loss: 0.2972 - val_accuracy: 0.8841 - val_loss: 0.3688
Epoch 79/600
150/150            8s 53ms/step -
accuracy: 0.9505 - loss: 0.1456 - val_accuracy: 0.8415 - val_loss: 0.5631
Epoch 80/600
150/150            8s 52ms/step -
accuracy: 0.9023 - loss: 0.2663 - val_accuracy: 0.8907 - val_loss: 0.3711
Epoch 81/600
150/150            11s 55ms/step -
accuracy: 0.9398 - loss: 0.1544 - val_accuracy: 0.8607 - val_loss: 0.4994
Epoch 82/600
150/150            8s 55ms/step -
accuracy: 0.8928 - loss: 0.2934 - val_accuracy: 0.8832 - val_loss: 0.3823
Epoch 83/600
```

```
150/150            8s 56ms/step -
accuracy: 0.9325 - loss: 0.1842 - val_accuracy: 0.8382 - val_loss: 0.5252
Epoch 84/600
150/150            8s 52ms/step -
accuracy: 0.9119 - loss: 0.2710 - val_accuracy: 0.8582 - val_loss: 0.4426
Epoch 85/600
150/150            8s 55ms/step -
accuracy: 0.9325 - loss: 0.2013 - val_accuracy: 0.8957 - val_loss: 0.3718
Epoch 86/600
150/150            8s 54ms/step -
accuracy: 0.9433 - loss: 0.1485 - val_accuracy: 0.8607 - val_loss: 0.4540
Epoch 87/600
150/150            8s 53ms/step -
accuracy: 0.9153 - loss: 0.2104 - val_accuracy: 0.8857 - val_loss: 0.3837
Epoch 88/600
150/150            8s 53ms/step -
accuracy: 0.9318 - loss: 0.1888 - val_accuracy: 0.8766 - val_loss: 0.4534
Epoch 89/600
150/150            8s 55ms/step -
accuracy: 0.9259 - loss: 0.1963 - val_accuracy: 0.8732 - val_loss: 0.4318
Epoch 90/600
150/150            8s 53ms/step -
accuracy: 0.9222 - loss: 0.2111 - val_accuracy: 0.8632 - val_loss: 0.4448
Epoch 91/600
150/150            10s 52ms/step -
accuracy: 0.9307 - loss: 0.1989 - val_accuracy: 0.8557 - val_loss: 0.4663
Epoch 92/600
150/150            8s 53ms/step -
accuracy: 0.9281 - loss: 0.2034 - val_accuracy: 0.8582 - val_loss: 0.4380
Epoch 93/600
150/150            8s 54ms/step -
accuracy: 0.9410 - loss: 0.1889 - val_accuracy: 0.8507 - val_loss: 0.5219
Epoch 94/600
150/150            10s 51ms/step -
accuracy: 0.9239 - loss: 0.1954 - val_accuracy: 0.8782 - val_loss: 0.4189
Epoch 95/600
150/150            8s 51ms/step -
accuracy: 0.9398 - loss: 0.1659 - val_accuracy: 0.8807 - val_loss: 0.4497
Epoch 96/600
150/150            8s 52ms/step -
accuracy: 0.9482 - loss: 0.1566 - val_accuracy: 0.8649 - val_loss: 0.4432
Epoch 97/600
150/150            10s 53ms/step -
accuracy: 0.9322 - loss: 0.1866 - val_accuracy: 0.8666 - val_loss: 0.4526
Epoch 98/600
150/150            8s 52ms/step -
accuracy: 0.9454 - loss: 0.1484 - val_accuracy: 0.8457 - val_loss: 0.6724
Epoch 99/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9231 - loss: 0.2525 - val_accuracy: 0.8699 - val_loss: 0.4804
Epoch 100/600
150/150            8s 53ms/step -
accuracy: 0.9382 - loss: 0.1838 - val_accuracy: 0.8474 - val_loss: 0.5068
Epoch 101/600
150/150            8s 53ms/step -
accuracy: 0.9058 - loss: 0.2591 - val_accuracy: 0.8607 - val_loss: 0.4906
Epoch 102/600
150/150            8s 52ms/step -
accuracy: 0.9340 - loss: 0.1747 - val_accuracy: 0.8907 - val_loss: 0.3749
Epoch 103/600
150/150            8s 52ms/step -
accuracy: 0.9283 - loss: 0.2214 - val_accuracy: 0.8691 - val_loss: 0.4766
Epoch 104/600
150/150            8s 52ms/step -
accuracy: 0.9359 - loss: 0.1792 - val_accuracy: 0.8666 - val_loss: 0.4396
Epoch 105/600
150/150            8s 53ms/step -
accuracy: 0.9250 - loss: 0.2033 - val_accuracy: 0.8590 - val_loss: 0.4140
Epoch 106/600
150/150            8s 52ms/step -
accuracy: 0.9463 - loss: 0.1582 - val_accuracy: 0.8507 - val_loss: 0.5275
Epoch 107/600
150/150            8s 52ms/step -
accuracy: 0.9177 - loss: 0.2214 - val_accuracy: 0.8857 - val_loss: 0.4203
Epoch 108/600
150/150            8s 53ms/step -
accuracy: 0.9146 - loss: 0.2670 - val_accuracy: 0.8966 - val_loss: 0.3782
Epoch 109/600
150/150            8s 55ms/step -
accuracy: 0.7888 - loss: 0.9106 - val_accuracy: 0.8474 - val_loss: 0.4206
Epoch 110/600
150/150            8s 53ms/step -
accuracy: 0.9076 - loss: 0.2644 - val_accuracy: 0.8924 - val_loss: 0.3596
Epoch 111/600
150/150            8s 53ms/step -
accuracy: 0.9289 - loss: 0.1934 - val_accuracy: 0.8641 - val_loss: 0.4356
Epoch 112/600
150/150            10s 54ms/step -
accuracy: 0.9187 - loss: 0.2174 - val_accuracy: 0.8782 - val_loss: 0.4149
Epoch 113/600
150/150            10s 52ms/step -
accuracy: 0.9342 - loss: 0.1733 - val_accuracy: 0.8557 - val_loss: 0.4951
Epoch 114/600
150/150            8s 52ms/step -
accuracy: 0.9416 - loss: 0.1599 - val_accuracy: 0.8874 - val_loss: 0.4054
Epoch 115/600
```

```
150/150            8s 53ms/step -
accuracy: 0.9420 - loss: 0.1683 - val_accuracy: 0.8891 - val_loss: 0.3914
Epoch 116/600
150/150            8s 55ms/step -
accuracy: 0.9474 - loss: 0.1469 - val_accuracy: 0.8941 - val_loss: 0.3767
Epoch 117/600
150/150            8s 52ms/step -
accuracy: 0.9026 - loss: 0.2675 - val_accuracy: 0.8849 - val_loss: 0.3881
Epoch 118/600
150/150            8s 52ms/step -
accuracy: 0.9411 - loss: 0.1620 - val_accuracy: 0.8524 - val_loss: 0.5824
Epoch 119/600
150/150            8s 52ms/step -
accuracy: 0.9190 - loss: 0.1994 - val_accuracy: 0.8916 - val_loss: 0.3679
Epoch 120/600
150/150            8s 54ms/step -
accuracy: 0.9282 - loss: 0.1927 - val_accuracy: 0.8632 - val_loss: 0.4491
Epoch 121/600
150/150            10s 52ms/step -
accuracy: 0.9259 - loss: 0.2163 - val_accuracy: 0.8632 - val_loss: 0.4547
Epoch 122/600
150/150            8s 52ms/step -
accuracy: 0.9312 - loss: 0.1830 - val_accuracy: 0.8766 - val_loss: 0.4305
Epoch 123/600
150/150            8s 52ms/step -
accuracy: 0.9465 - loss: 0.1495 - val_accuracy: 0.8641 - val_loss: 0.4209
Epoch 124/600
150/150            8s 54ms/step -
accuracy: 0.9352 - loss: 0.1784 - val_accuracy: 0.8741 - val_loss: 0.4557
Epoch 125/600
150/150            8s 53ms/step -
accuracy: 0.9330 - loss: 0.1972 - val_accuracy: 0.8307 - val_loss: 0.5436
Epoch 126/600
150/150            8s 52ms/step -
accuracy: 0.8943 - loss: 0.2832 - val_accuracy: 0.8774 - val_loss: 0.4234
Epoch 127/600
150/150            8s 52ms/step -
accuracy: 0.9445 - loss: 0.1413 - val_accuracy: 0.8791 - val_loss: 0.4668
Epoch 128/600
150/150            8s 54ms/step -
accuracy: 0.9333 - loss: 0.2047 - val_accuracy: 0.8741 - val_loss: 0.4505
Epoch 129/600
150/150            10s 52ms/step -
accuracy: 0.9433 - loss: 0.1653 - val_accuracy: 0.8741 - val_loss: 0.4595
Epoch 130/600
150/150            8s 52ms/step -
accuracy: 0.9414 - loss: 0.1644 - val_accuracy: 0.8899 - val_loss: 0.3685
Epoch 131/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9605 - loss: 0.1218 - val_accuracy: 0.8365 - val_loss: 0.6324
Epoch 132/600
150/150            8s 55ms/step -
accuracy: 0.9101 - loss: 0.2546 - val_accuracy: 0.8907 - val_loss: 0.3907
Epoch 133/600
150/150            8s 52ms/step -
accuracy: 0.9318 - loss: 0.1888 - val_accuracy: 0.8941 - val_loss: 0.3541
Epoch 134/600
150/150            8s 52ms/step -
accuracy: 0.9431 - loss: 0.1627 - val_accuracy: 0.8857 - val_loss: 0.3977
Epoch 135/600
150/150            8s 53ms/step -
accuracy: 0.9500 - loss: 0.1393 - val_accuracy: 0.8932 - val_loss: 0.3898
Epoch 136/600
150/150            8s 55ms/step -
accuracy: 0.9344 - loss: 0.2012 - val_accuracy: 0.8641 - val_loss: 0.4249
Epoch 137/600
150/150            8s 53ms/step -
accuracy: 0.9483 - loss: 0.1492 - val_accuracy: 0.8682 - val_loss: 0.4679
Epoch 138/600
150/150            8s 53ms/step -
accuracy: 0.9303 - loss: 0.1862 - val_accuracy: 0.8891 - val_loss: 0.3916
Epoch 139/600
150/150            8s 52ms/step -
accuracy: 0.9167 - loss: 0.2459 - val_accuracy: 0.8924 - val_loss: 0.4036
Epoch 140/600
150/150            8s 55ms/step -
accuracy: 0.9308 - loss: 0.2148 - val_accuracy: 0.8657 - val_loss: 0.4198
Epoch 141/600
150/150            8s 53ms/step -
accuracy: 0.9450 - loss: 0.1623 - val_accuracy: 0.8791 - val_loss: 0.4488
Epoch 142/600
150/150            8s 52ms/step -
accuracy: 0.9370 - loss: 0.1761 - val_accuracy: 0.8649 - val_loss: 0.4603
Epoch 143/600
150/150            8s 53ms/step -
accuracy: 0.9254 - loss: 0.2120 - val_accuracy: 0.8832 - val_loss: 0.3777
Epoch 144/600
150/150            8s 53ms/step -
accuracy: 0.9449 - loss: 0.1631 - val_accuracy: 0.8857 - val_loss: 0.4257
Epoch 145/600
150/150            10s 52ms/step -
accuracy: 0.9406 - loss: 0.1589 - val_accuracy: 0.8724 - val_loss: 0.3901
Epoch 146/600
150/150            8s 52ms/step -
accuracy: 0.9543 - loss: 0.1229 - val_accuracy: 0.8324 - val_loss: 0.5784
Epoch 147/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9238 - loss: 0.2227 - val_accuracy: 0.8966 - val_loss: 0.3615
Epoch 148/600
150/150            8s 54ms/step -
accuracy: 0.9363 - loss: 0.1724 - val_accuracy: 0.8616 - val_loss: 0.4649
Epoch 149/600
150/150            8s 52ms/step -
accuracy: 0.9239 - loss: 0.2149 - val_accuracy: 0.8757 - val_loss: 0.4710
Epoch 150/600
150/150            8s 52ms/step -
accuracy: 0.9402 - loss: 0.1814 - val_accuracy: 0.8682 - val_loss: 0.4623
Epoch 151/600
150/150            8s 52ms/step -
accuracy: 0.9394 - loss: 0.1677 - val_accuracy: 0.8732 - val_loss: 0.4323
Epoch 152/600
150/150            8s 54ms/step -
accuracy: 0.9446 - loss: 0.1658 - val_accuracy: 0.8941 - val_loss: 0.3746
Epoch 153/600
150/150            8s 52ms/step -
accuracy: 0.9458 - loss: 0.1528 - val_accuracy: 0.8882 - val_loss: 0.4449
Epoch 154/600
150/150            10s 51ms/step -
accuracy: 0.9509 - loss: 0.1548 - val_accuracy: 0.8857 - val_loss: 0.4301
Epoch 155/600
150/150            8s 52ms/step -
accuracy: 0.9475 - loss: 0.1537 - val_accuracy: 0.8482 - val_loss: 0.5348
Epoch 156/600
150/150            8s 55ms/step -
accuracy: 0.9208 - loss: 0.2219 - val_accuracy: 0.8832 - val_loss: 0.3805
Epoch 157/600
150/150            8s 51ms/step -
accuracy: 0.9485 - loss: 0.1603 - val_accuracy: 0.8774 - val_loss: 0.3976
Epoch 158/600
150/150            8s 52ms/step -
accuracy: 0.9397 - loss: 0.1597 - val_accuracy: 0.8766 - val_loss: 0.4480
Epoch 159/600
150/150            8s 52ms/step -
accuracy: 0.9503 - loss: 0.1509 - val_accuracy: 0.8949 - val_loss: 0.4141
Epoch 160/600
150/150            8s 54ms/step -
accuracy: 0.9379 - loss: 0.1737 - val_accuracy: 0.8741 - val_loss: 0.4327
Epoch 161/600
150/150            8s 52ms/step -
accuracy: 0.9390 - loss: 0.1680 - val_accuracy: 0.8724 - val_loss: 0.5358
Epoch 162/600
150/150            8s 52ms/step -
accuracy: 0.9199 - loss: 0.2384 - val_accuracy: 0.8799 - val_loss: 0.4429
Epoch 163/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9365 - loss: 0.1866 - val_accuracy: 0.8707 - val_loss: 0.4359
Epoch 164/600
150/150            8s 52ms/step -
accuracy: 0.9473 - loss: 0.1441 - val_accuracy: 0.8399 - val_loss: 0.6290
Epoch 165/600
150/150            10s 51ms/step -
accuracy: 0.9147 - loss: 0.2451 - val_accuracy: 0.8015 - val_loss: 0.7417
Epoch 166/600
150/150            8s 51ms/step -
accuracy: 0.9140 - loss: 0.2593 - val_accuracy: 0.8932 - val_loss: 0.3708
Epoch 167/600
150/150            8s 51ms/step -
accuracy: 0.9536 - loss: 0.1320 - val_accuracy: 0.8791 - val_loss: 0.4514
Epoch 168/600
150/150            8s 53ms/step -
accuracy: 0.9535 - loss: 0.1291 - val_accuracy: 0.8849 - val_loss: 0.3994
Epoch 169/600
150/150            8s 52ms/step -
accuracy: 0.9564 - loss: 0.1201 - val_accuracy: 0.8782 - val_loss: 0.4216
Epoch 170/600
150/150            8s 52ms/step -
accuracy: 0.9240 - loss: 0.2225 - val_accuracy: 0.8766 - val_loss: 0.4445
Epoch 171/600
150/150            8s 52ms/step -
accuracy: 0.9514 - loss: 0.1321 - val_accuracy: 0.8849 - val_loss: 0.4438
Epoch 172/600
150/150            8s 53ms/step -
accuracy: 0.9544 - loss: 0.1220 - val_accuracy: 0.8832 - val_loss: 0.4754
Epoch 173/600
150/150            10s 52ms/step -
accuracy: 0.9442 - loss: 0.1732 - val_accuracy: 0.8699 - val_loss: 0.4658
Epoch 174/600
150/150            8s 51ms/step -
accuracy: 0.9456 - loss: 0.1494 - val_accuracy: 0.8791 - val_loss: 0.4264
Epoch 175/600
150/150            8s 52ms/step -
accuracy: 0.9299 - loss: 0.1957 - val_accuracy: 0.8649 - val_loss: 0.4714
Epoch 176/600
150/150            8s 55ms/step -
accuracy: 0.9426 - loss: 0.1606 - val_accuracy: 0.8691 - val_loss: 0.4678
Epoch 177/600
150/150            8s 52ms/step -
accuracy: 0.9431 - loss: 0.1729 - val_accuracy: 0.8891 - val_loss: 0.4279
Epoch 178/600
150/150            8s 52ms/step -
accuracy: 0.9523 - loss: 0.1565 - val_accuracy: 0.9008 - val_loss: 0.3379
Epoch 179/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9423 - loss: 0.1712 - val_accuracy: 0.8932 - val_loss: 0.3609
Epoch 180/600
150/150            8s 53ms/step -
accuracy: 0.9524 - loss: 0.1295 - val_accuracy: 0.8515 - val_loss: 0.5387
Epoch 181/600
150/150            10s 52ms/step -
accuracy: 0.9462 - loss: 0.1516 - val_accuracy: 0.8641 - val_loss: 0.4964
Epoch 182/600
150/150            8s 52ms/step -
accuracy: 0.9353 - loss: 0.1854 - val_accuracy: 0.8891 - val_loss: 0.4187
Epoch 183/600
150/150            8s 52ms/step -
accuracy: 0.9495 - loss: 0.1420 - val_accuracy: 0.8932 - val_loss: 0.4093
Epoch 184/600
150/150            8s 54ms/step -
accuracy: 0.9536 - loss: 0.1312 - val_accuracy: 0.8632 - val_loss: 0.4598
Epoch 185/600
150/150            8s 52ms/step -
accuracy: 0.9158 - loss: 0.2478 - val_accuracy: 0.7523 - val_loss: 0.9527
Epoch 186/600
150/150            8s 52ms/step -
accuracy: 0.8159 - loss: 0.5449 - val_accuracy: 0.8624 - val_loss: 0.3940
Epoch 187/600
150/150            8s 52ms/step -
accuracy: 0.9305 - loss: 0.1859 - val_accuracy: 0.8666 - val_loss: 0.4757
Epoch 188/600
150/150            8s 54ms/step -
accuracy: 0.9331 - loss: 0.2012 - val_accuracy: 0.8749 - val_loss: 0.4230
Epoch 189/600
150/150            8s 52ms/step -
accuracy: 0.9575 - loss: 0.1220 - val_accuracy: 0.8657 - val_loss: 0.4577
Epoch 190/600
150/150            8s 52ms/step -
accuracy: 0.9337 - loss: 0.1864 - val_accuracy: 0.8841 - val_loss: 0.3955
Epoch 191/600
150/150            8s 51ms/step -
accuracy: 0.9472 - loss: 0.1561 - val_accuracy: 0.8907 - val_loss: 0.4413
Epoch 192/600
150/150            8s 52ms/step -
accuracy: 0.9382 - loss: 0.1726 - val_accuracy: 0.8891 - val_loss: 0.3749
Epoch 193/600
150/150            8s 53ms/step -
accuracy: 0.9564 - loss: 0.1294 - val_accuracy: 0.8766 - val_loss: 0.4462
Epoch 194/600
150/150            8s 51ms/step -
accuracy: 0.9547 - loss: 0.1305 - val_accuracy: 0.8874 - val_loss: 0.4298
Epoch 195/600
```

```
150/150            8s 51ms/step -
accuracy: 0.9402 - loss: 0.1674 - val_accuracy: 0.8716 - val_loss: 0.4717
Epoch 196/600
150/150            8s 52ms/step -
accuracy: 0.9440 - loss: 0.1498 - val_accuracy: 0.8732 - val_loss: 0.4421
Epoch 197/600
150/150            8s 54ms/step -
accuracy: 0.9544 - loss: 0.1260 - val_accuracy: 0.8540 - val_loss: 0.5797
Epoch 198/600
150/150            8s 52ms/step -
accuracy: 0.8904 - loss: 0.3540 - val_accuracy: 0.8849 - val_loss: 0.4146
Epoch 199/600
150/150            10s 53ms/step -
accuracy: 0.9493 - loss: 0.1462 - val_accuracy: 0.9008 - val_loss: 0.3732
Epoch 200/600
150/150            8s 53ms/step -
accuracy: 0.9567 - loss: 0.1281 - val_accuracy: 0.9066 - val_loss: 0.3428
Epoch 201/600
150/150            10s 52ms/step -
accuracy: 0.9515 - loss: 0.1387 - val_accuracy: 0.8874 - val_loss: 0.4342
Epoch 202/600
150/150            10s 51ms/step -
accuracy: 0.9299 - loss: 0.1917 - val_accuracy: 0.8716 - val_loss: 0.4516
Epoch 203/600
150/150            8s 51ms/step -
accuracy: 0.9374 - loss: 0.1807 - val_accuracy: 0.8841 - val_loss: 0.3767
Epoch 204/600
150/150            11s 53ms/step -
accuracy: 0.9499 - loss: 0.1334 - val_accuracy: 0.8882 - val_loss: 0.3897
Epoch 205/600
150/150            8s 51ms/step -
accuracy: 0.9516 - loss: 0.1228 - val_accuracy: 0.8807 - val_loss: 0.4169
Epoch 206/600
150/150            8s 52ms/step -
accuracy: 0.9267 - loss: 0.2108 - val_accuracy: 0.8707 - val_loss: 0.4052
Epoch 207/600
150/150            8s 52ms/step -
accuracy: 0.9629 - loss: 0.1126 - val_accuracy: 0.9024 - val_loss: 0.3873
Epoch 208/600
150/150            8s 54ms/step -
accuracy: 0.9470 - loss: 0.1460 - val_accuracy: 0.8824 - val_loss: 0.4902
Epoch 209/600
150/150            8s 51ms/step -
accuracy: 0.9325 - loss: 0.2091 - val_accuracy: 0.8732 - val_loss: 0.4509
Epoch 210/600
150/150            8s 51ms/step -
accuracy: 0.9506 - loss: 0.1383 - val_accuracy: 0.8265 - val_loss: 0.6485
Epoch 211/600
```

```
150/150            8s 51ms/step -
accuracy: 0.9233 - loss: 0.2413 - val_accuracy: 0.8774 - val_loss: 0.4041
Epoch 212/600
150/150            8s 54ms/step -
accuracy: 0.9146 - loss: 0.2621 - val_accuracy: 0.8891 - val_loss: 0.3674
Epoch 213/600
150/150            8s 51ms/step -
accuracy: 0.9557 - loss: 0.1220 - val_accuracy: 0.8816 - val_loss: 0.4149
Epoch 214/600
150/150            8s 51ms/step -
accuracy: 0.9541 - loss: 0.1295 - val_accuracy: 0.8632 - val_loss: 0.5229
Epoch 215/600
150/150            8s 52ms/step -
accuracy: 0.9372 - loss: 0.1749 - val_accuracy: 0.8891 - val_loss: 0.3872
Epoch 216/600
150/150            8s 54ms/step -
accuracy: 0.9498 - loss: 0.1505 - val_accuracy: 0.8791 - val_loss: 0.4372
Epoch 217/600
150/150            8s 52ms/step -
accuracy: 0.9434 - loss: 0.1556 - val_accuracy: 0.8590 - val_loss: 0.5184
Epoch 218/600
150/150            8s 52ms/step -
accuracy: 0.9485 - loss: 0.1597 - val_accuracy: 0.8816 - val_loss: 0.4280
Epoch 219/600
150/150            8s 53ms/step -
accuracy: 0.9471 - loss: 0.1626 - val_accuracy: 0.8799 - val_loss: 0.3690
Epoch 220/600
150/150            8s 54ms/step -
accuracy: 0.9571 - loss: 0.1211 - val_accuracy: 0.8891 - val_loss: 0.3909
Epoch 221/600
150/150            8s 52ms/step -
accuracy: 0.9491 - loss: 0.1463 - val_accuracy: 0.8590 - val_loss: 0.5121
Epoch 222/600
150/150            8s 52ms/step -
accuracy: 0.9204 - loss: 0.2635 - val_accuracy: 0.9066 - val_loss: 0.3123
Epoch 223/600
150/150            8s 52ms/step -
accuracy: 0.9629 - loss: 0.1155 - val_accuracy: 0.8957 - val_loss: 0.3885
Epoch 224/600
150/150            8s 52ms/step -
accuracy: 0.9621 - loss: 0.1063 - val_accuracy: 0.8974 - val_loss: 0.4061
Epoch 225/600
150/150            8s 52ms/step -
accuracy: 0.9533 - loss: 0.1468 - val_accuracy: 0.8957 - val_loss: 0.3802
Epoch 226/600
150/150            8s 52ms/step -
accuracy: 0.9474 - loss: 0.1560 - val_accuracy: 0.8482 - val_loss: 0.5818
Epoch 227/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9274 - loss: 0.2014 - val_accuracy: 0.9024 - val_loss: 0.3778
Epoch 228/600
150/150            8s 52ms/step -
accuracy: 0.9397 - loss: 0.1736 - val_accuracy: 0.8732 - val_loss: 0.4064
Epoch 229/600
150/150            8s 54ms/step -
accuracy: 0.9295 - loss: 0.2061 - val_accuracy: 0.8882 - val_loss: 0.4068
Epoch 230/600
150/150            8s 52ms/step -
accuracy: 0.9541 - loss: 0.1371 - val_accuracy: 0.8574 - val_loss: 0.5436
Epoch 231/600
150/150            8s 52ms/step -
accuracy: 0.9384 - loss: 0.1798 - val_accuracy: 0.9024 - val_loss: 0.3747
Epoch 232/600
150/150            8s 51ms/step -
accuracy: 0.9624 - loss: 0.1260 - val_accuracy: 0.8457 - val_loss: 0.6374
Epoch 233/600
150/150            8s 54ms/step -
accuracy: 0.9308 - loss: 0.2296 - val_accuracy: 0.9008 - val_loss: 0.3730
Epoch 234/600
150/150            8s 52ms/step -
accuracy: 0.9480 - loss: 0.1559 - val_accuracy: 0.8949 - val_loss: 0.3912
Epoch 235/600
150/150            8s 51ms/step -
accuracy: 0.9471 - loss: 0.1688 - val_accuracy: 0.8924 - val_loss: 0.3875
Epoch 236/600
150/150            8s 52ms/step -
accuracy: 0.9532 - loss: 0.1242 - val_accuracy: 0.8907 - val_loss: 0.3840
Epoch 237/600
150/150            8s 54ms/step -
accuracy: 0.9504 - loss: 0.1326 - val_accuracy: 0.8799 - val_loss: 0.4098
Epoch 250/600
150/150            10s 52ms/step -
accuracy: 0.9446 - loss: 0.2369 - val_accuracy: 0.7131 - val_loss: 0.7335
Epoch 251/600
150/150            8s 51ms/step -
accuracy: 0.8363 - loss: 0.4621 - val_accuracy: 0.8807 - val_loss: 0.3427
Epoch 252/600
150/150            8s 51ms/step -
accuracy: 0.9562 - loss: 0.1522 - val_accuracy: 0.8899 - val_loss: 0.3541
Epoch 253/600
150/150            8s 55ms/step -
accuracy: 0.9657 - loss: 0.1091 - val_accuracy: 0.8991 - val_loss: 0.3555
Epoch 254/600
150/150            8s 52ms/step -
accuracy: 0.9563 - loss: 0.1343 - val_accuracy: 0.8907 - val_loss: 0.4237
Epoch 255/600
```

```
150/150            8s 51ms/step -
accuracy: 0.9518 - loss: 0.1364 - val_accuracy: 0.8982 - val_loss: 0.3912
Epoch 256/600
150/150            8s 51ms/step -
accuracy: 0.9518 - loss: 0.1377 - val_accuracy: 0.8991 - val_loss: 0.3715
Epoch 257/600
150/150            8s 53ms/step -
accuracy: 0.9510 - loss: 0.1607 - val_accuracy: 0.8791 - val_loss: 0.4249
Epoch 258/600
150/150            8s 52ms/step -
accuracy: 0.9532 - loss: 0.1395 - val_accuracy: 0.8807 - val_loss: 0.4154
Epoch 259/600
150/150            8s 52ms/step -
accuracy: 0.9547 - loss: 0.1374 - val_accuracy: 0.8924 - val_loss: 0.3472
Epoch 260/600
150/150            8s 51ms/step -
accuracy: 0.9521 - loss: 0.1235 - val_accuracy: 0.9066 - val_loss: 0.3696
Epoch 261/600
150/150            8s 52ms/step -
accuracy: 0.9676 - loss: 0.0989 - val_accuracy: 0.9024 - val_loss: 0.3524
Epoch 262/600
150/150            8s 53ms/step -
accuracy: 0.9626 - loss: 0.1252 - val_accuracy: 0.8841 - val_loss: 0.4296
Epoch 263/600
150/150            8s 52ms/step -
accuracy: 0.9516 - loss: 0.1407 - val_accuracy: 0.9066 - val_loss: 0.3370
Epoch 264/600
150/150            8s 52ms/step -
accuracy: 0.9763 - loss: 0.0843 - val_accuracy: 0.8924 - val_loss: 0.4168
Epoch 265/600
150/150            8s 51ms/step -
accuracy: 0.9584 - loss: 0.1167 - val_accuracy: 0.8916 - val_loss: 0.4305
Epoch 266/600
150/150            8s 54ms/step -
accuracy: 0.9545 - loss: 0.1391 - val_accuracy: 0.8757 - val_loss: 0.4621
Epoch 267/600
150/150            8s 51ms/step -
accuracy: 0.9488 - loss: 0.1402 - val_accuracy: 0.8599 - val_loss: 0.5105
Epoch 268/600
150/150            8s 52ms/step -
accuracy: 0.9474 - loss: 0.1627 - val_accuracy: 0.8857 - val_loss: 0.4220
Epoch 269/600
150/150            8s 51ms/step -
accuracy: 0.9544 - loss: 0.1244 - val_accuracy: 0.8782 - val_loss: 0.4794
Epoch 270/600
150/150            8s 54ms/step -
accuracy: 0.9604 - loss: 0.1103 - val_accuracy: 0.8590 - val_loss: 0.5271
Epoch 271/600
```

```
150/150            8s 51ms/step -
accuracy: 0.9244 - loss: 0.2388 - val_accuracy: 0.8390 - val_loss: 0.5482
Epoch 272/600
150/150            10s 51ms/step -
accuracy: 0.9444 - loss: 0.1647 - val_accuracy: 0.8899 - val_loss: 0.4054
Epoch 273/600
150/150            11s 53ms/step -
accuracy: 0.9466 - loss: 0.1654 - val_accuracy: 0.8932 - val_loss: 0.3821
Epoch 274/600
150/150            8s 52ms/step -
accuracy: 0.9731 - loss: 0.0863 - val_accuracy: 0.8724 - val_loss: 0.5074
Epoch 275/600
150/150            8s 51ms/step -
accuracy: 0.9060 - loss: 0.3379 - val_accuracy: 0.8932 - val_loss: 0.3751
Epoch 276/600
150/150            8s 51ms/step -
accuracy: 0.9509 - loss: 0.1492 - val_accuracy: 0.8974 - val_loss: 0.3611
Epoch 277/600
150/150            8s 52ms/step -
accuracy: 0.9534 - loss: 0.1412 - val_accuracy: 0.9008 - val_loss: 0.3872
Epoch 278/600
150/150            10s 51ms/step -
accuracy: 0.9616 - loss: 0.1084 - val_accuracy: 0.8774 - val_loss: 0.4627
Epoch 279/600
150/150            8s 52ms/step -
accuracy: 0.9556 - loss: 0.1286 - val_accuracy: 0.8816 - val_loss: 0.4544
Epoch 280/600
150/150            8s 52ms/step -
accuracy: 0.9424 - loss: 0.1643 - val_accuracy: 0.8999 - val_loss: 0.3524
Epoch 281/600
150/150            8s 54ms/step -
accuracy: 0.9501 - loss: 0.1459 - val_accuracy: 0.8757 - val_loss: 0.4087
Epoch 282/600
150/150            8s 51ms/step -
accuracy: 0.9657 - loss: 0.1181 - val_accuracy: 0.8816 - val_loss: 0.4154
Epoch 283/600
150/150            8s 51ms/step -
accuracy: 0.9533 - loss: 0.1456 - val_accuracy: 0.8966 - val_loss: 0.4336
Epoch 284/600
150/150            10s 51ms/step -
accuracy: 0.9562 - loss: 0.1176 - val_accuracy: 0.8457 - val_loss: 0.6105
Epoch 285/600
150/150            8s 54ms/step -
accuracy: 0.9411 - loss: 0.1543 - val_accuracy: 0.8799 - val_loss: 0.4758
Epoch 286/600
150/150            8s 52ms/step -
accuracy: 0.9361 - loss: 0.1774 - val_accuracy: 0.8807 - val_loss: 0.4357
Epoch 287/600
```

```
150/150            8s 51ms/step -
accuracy: 0.9346 - loss: 0.1866 - val_accuracy: 0.9083 - val_loss: 0.3299
Epoch 288/600
150/150            8s 52ms/step -
accuracy: 0.9717 - loss: 0.0851 - val_accuracy: 0.8974 - val_loss: 0.3983
Epoch 289/600
150/150            11s 54ms/step -
accuracy: 0.9163 - loss: 0.3173 - val_accuracy: 0.8832 - val_loss: 0.3730
Epoch 290/600
150/150            8s 52ms/step -
accuracy: 0.9576 - loss: 0.1336 - val_accuracy: 0.8957 - val_loss: 0.3725
Epoch 291/600
150/150            8s 51ms/step -
accuracy: 0.9480 - loss: 0.1505 - val_accuracy: 0.9074 - val_loss: 0.3279
Epoch 292/600
150/150            8s 53ms/step -
accuracy: 0.9686 - loss: 0.0964 - val_accuracy: 0.9058 - val_loss: 0.3844
Epoch 293/600
150/150            8s 56ms/step -
accuracy: 0.9538 - loss: 0.1386 - val_accuracy: 0.8907 - val_loss: 0.4232
Epoch 294/600
150/150            8s 52ms/step -
accuracy: 0.9535 - loss: 0.1397 - val_accuracy: 0.8907 - val_loss: 0.4350
Epoch 295/600
150/150            8s 51ms/step -
accuracy: 0.9621 - loss: 0.1007 - val_accuracy: 0.8899 - val_loss: 0.4729
Epoch 296/600
150/150            8s 51ms/step -
accuracy: 0.9640 - loss: 0.1028 - val_accuracy: 0.8824 - val_loss: 0.4366
Epoch 297/600
150/150            8s 54ms/step -
accuracy: 0.9640 - loss: 0.1025 - val_accuracy: 0.8824 - val_loss: 0.5225
Epoch 298/600
150/150            10s 52ms/step -
accuracy: 0.9507 - loss: 0.1483 - val_accuracy: 0.8799 - val_loss: 0.4823
Epoch 299/600
150/150            8s 52ms/step -
accuracy: 0.9568 - loss: 0.1185 - val_accuracy: 0.8732 - val_loss: 0.5311
Epoch 300/600
150/150            8s 51ms/step -
accuracy: 0.9496 - loss: 0.1378 - val_accuracy: 0.8749 - val_loss: 0.4602
Epoch 301/600
150/150            8s 54ms/step -
accuracy: 0.9332 - loss: 0.2050 - val_accuracy: 0.8532 - val_loss: 0.4970
Epoch 302/600
150/150            8s 51ms/step -
accuracy: 0.9479 - loss: 0.1490 - val_accuracy: 0.9008 - val_loss: 0.3522
Epoch 303/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9581 - loss: 0.1199 - val_accuracy: 0.8582 - val_loss: 0.4613
Epoch 304/600
150/150            10s 52ms/step -
accuracy: 0.9621 - loss: 0.1085 - val_accuracy: 0.8982 - val_loss: 0.3775
Epoch 305/600
150/150            8s 54ms/step -
accuracy: 0.9553 - loss: 0.1393 - val_accuracy: 0.8457 - val_loss: 0.6260
Epoch 306/600
150/150            8s 51ms/step -
accuracy: 0.9480 - loss: 0.1546 - val_accuracy: 0.8774 - val_loss: 0.4374
Epoch 307/600
150/150            8s 52ms/step -
accuracy: 0.9580 - loss: 0.1229 - val_accuracy: 0.8999 - val_loss: 0.3658
Epoch 308/600
150/150            8s 53ms/step -
accuracy: 0.9623 - loss: 0.1114 - val_accuracy: 0.8882 - val_loss: 0.4067
Epoch 309/600
150/150            8s 55ms/step -
accuracy: 0.9687 - loss: 0.1084 - val_accuracy: 0.8991 - val_loss: 0.3816
Epoch 310/600
150/150            8s 52ms/step -
accuracy: 0.9488 - loss: 0.1539 - val_accuracy: 0.8807 - val_loss: 0.4273
Epoch 311/600
150/150            8s 52ms/step -
accuracy: 0.9578 - loss: 0.1164 - val_accuracy: 0.9058 - val_loss: 0.3687
Epoch 312/600
150/150            10s 52ms/step -
accuracy: 0.9603 - loss: 0.1239 - val_accuracy: 0.8924 - val_loss: 0.3868
Epoch 313/600
150/150            8s 55ms/step -
accuracy: 0.9650 - loss: 0.1088 - val_accuracy: 0.8674 - val_loss: 0.5241
Epoch 314/600
150/150            8s 52ms/step -
accuracy: 0.9220 - loss: 0.2478 - val_accuracy: 0.8932 - val_loss: 0.3968
Epoch 315/600
150/150            8s 51ms/step -
accuracy: 0.9569 - loss: 0.1277 - val_accuracy: 0.8916 - val_loss: 0.3962
Epoch 316/600
150/150            8s 52ms/step -
accuracy: 0.9524 - loss: 0.1451 - val_accuracy: 0.8899 - val_loss: 0.4218
Epoch 317/600
150/150            8s 54ms/step -
accuracy: 0.9683 - loss: 0.0944 - val_accuracy: 0.8732 - val_loss: 0.5011
Epoch 318/600
150/150            8s 52ms/step -
accuracy: 0.9389 - loss: 0.1855 - val_accuracy: 0.8782 - val_loss: 0.4970
Epoch 319/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9617 - loss: 0.1197 - val_accuracy: 0.8857 - val_loss: 0.4225
Epoch 320/600
150/150            8s 52ms/step -
accuracy: 0.9527 - loss: 0.1527 - val_accuracy: 0.8882 - val_loss: 0.3463
Epoch 321/600
150/150            8s 54ms/step -
accuracy: 0.9716 - loss: 0.0893 - val_accuracy: 0.8799 - val_loss: 0.4540
Epoch 322/600
150/150            8s 52ms/step -
accuracy: 0.9490 - loss: 0.1539 - val_accuracy: 0.8932 - val_loss: 0.3858
Epoch 323/600
150/150            10s 52ms/step -
accuracy: 0.9560 - loss: 0.1206 - val_accuracy: 0.8724 - val_loss: 0.4674
Epoch 324/600
150/150            8s 52ms/step -
accuracy: 0.9583 - loss: 0.1261 - val_accuracy: 0.9041 - val_loss: 0.3540
Epoch 325/600
150/150            8s 54ms/step -
accuracy: 0.9768 - loss: 0.0715 - val_accuracy: 0.8641 - val_loss: 0.5835
Epoch 326/600
150/150            8s 51ms/step -
accuracy: 0.9376 - loss: 0.2026 - val_accuracy: 0.8749 - val_loss: 0.4688
Epoch 327/600
150/150            8s 51ms/step -
accuracy: 0.9637 - loss: 0.1063 - val_accuracy: 0.8824 - val_loss: 0.4119
Epoch 328/600
150/150            8s 52ms/step -
accuracy: 0.9570 - loss: 0.1290 - val_accuracy: 0.8916 - val_loss: 0.3972
Epoch 329/600
150/150            8s 55ms/step -
accuracy: 0.9450 - loss: 0.1669 - val_accuracy: 0.8816 - val_loss: 0.4513
Epoch 330/600
150/150            8s 52ms/step -
accuracy: 0.9566 - loss: 0.1179 - val_accuracy: 0.8849 - val_loss: 0.4032
Epoch 331/600
150/150            8s 52ms/step -
accuracy: 0.9567 - loss: 0.1223 - val_accuracy: 0.8624 - val_loss: 0.5399
Epoch 332/600
150/150            8s 53ms/step -
accuracy: 0.9319 - loss: 0.2117 - val_accuracy: 0.8841 - val_loss: 0.3677
Epoch 333/600
150/150            8s 55ms/step -
accuracy: 0.9575 - loss: 0.1293 - val_accuracy: 0.9099 - val_loss: 0.3469
Epoch 334/600
150/150            8s 53ms/step -
accuracy: 0.9717 - loss: 0.0845 - val_accuracy: 0.8924 - val_loss: 0.4236
Epoch 335/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9507 - loss: 0.1390 - val_accuracy: 0.8907 - val_loss: 0.4539
Epoch 336/600
150/150            8s 52ms/step -
accuracy: 0.9634 - loss: 0.1287 - val_accuracy: 0.8857 - val_loss: 0.4610
Epoch 337/600
150/150            11s 54ms/step -
accuracy: 0.9630 - loss: 0.0930 - val_accuracy: 0.9091 - val_loss: 0.3967
Epoch 338/600
150/150            8s 51ms/step -
accuracy: 0.9593 - loss: 0.1253 - val_accuracy: 0.8799 - val_loss: 0.4241
Epoch 339/600
150/150            8s 53ms/step -
accuracy: 0.9623 - loss: 0.1169 - val_accuracy: 0.8866 - val_loss: 0.4564
Epoch 340/600
150/150            8s 52ms/step -
accuracy: 0.9428 - loss: 0.1712 - val_accuracy: 0.8841 - val_loss: 0.4066
Epoch 341/600
150/150            8s 54ms/step -
accuracy: 0.9591 - loss: 0.1000 - val_accuracy: 0.8874 - val_loss: 0.4617
Epoch 342/600
150/150            8s 53ms/step -
accuracy: 0.9640 - loss: 0.1180 - val_accuracy: 0.8991 - val_loss: 0.4025
Epoch 343/600
150/150            8s 52ms/step -
accuracy: 0.9643 - loss: 0.1142 - val_accuracy: 0.8907 - val_loss: 0.4360
Epoch 344/600
150/150            8s 52ms/step -
accuracy: 0.9623 - loss: 0.1147 - val_accuracy: 0.8449 - val_loss: 0.6167
Epoch 345/600
150/150            8s 53ms/step -
accuracy: 0.9309 - loss: 0.2282 - val_accuracy: 0.8982 - val_loss: 0.4118
Epoch 346/600
150/150            10s 51ms/step -
accuracy: 0.9456 - loss: 0.1687 - val_accuracy: 0.8924 - val_loss: 0.4084
Epoch 347/600
150/150            8s 52ms/step -
accuracy: 0.9662 - loss: 0.1006 - val_accuracy: 0.8782 - val_loss: 0.4825
Epoch 348/600
150/150            10s 52ms/step -
accuracy: 0.9603 - loss: 0.1146 - val_accuracy: 0.9008 - val_loss: 0.3694
Epoch 349/600
150/150            8s 54ms/step -
accuracy: 0.9645 - loss: 0.1205 - val_accuracy: 0.8724 - val_loss: 0.4720
Epoch 350/600
150/150            8s 51ms/step -
accuracy: 0.9610 - loss: 0.1161 - val_accuracy: 0.8832 - val_loss: 0.4543
Epoch 351/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9587 - loss: 0.1210 - val_accuracy: 0.8540 - val_loss: 0.5299
Epoch 352/600
150/150            8s 52ms/step -
accuracy: 0.9490 - loss: 0.1485 - val_accuracy: 0.8999 - val_loss: 0.3941
Epoch 353/600
150/150            8s 54ms/step -
accuracy: 0.9655 - loss: 0.1132 - val_accuracy: 0.8791 - val_loss: 0.4819
Epoch 354/600
150/150            10s 52ms/step -
accuracy: 0.9622 - loss: 0.1030 - val_accuracy: 0.8857 - val_loss: 0.4819
Epoch 355/600
150/150            8s 51ms/step -
accuracy: 0.9537 - loss: 0.1376 - val_accuracy: 0.8757 - val_loss: 0.4935
Epoch 356/600
150/150            8s 52ms/step -
accuracy: 0.9649 - loss: 0.1060 - val_accuracy: 0.8749 - val_loss: 0.5216
Epoch 357/600
150/150            8s 55ms/step -
accuracy: 0.9568 - loss: 0.1368 - val_accuracy: 0.8749 - val_loss: 0.4348
Epoch 358/600
150/150            8s 52ms/step -
accuracy: 0.9538 - loss: 0.1489 - val_accuracy: 0.8791 - val_loss: 0.4502
Epoch 359/600
150/150            8s 52ms/step -
accuracy: 0.9705 - loss: 0.0945 - val_accuracy: 0.8857 - val_loss: 0.4338
Epoch 360/600
150/150            8s 52ms/step -
accuracy: 0.9701 - loss: 0.0919 - val_accuracy: 0.8941 - val_loss: 0.4091
Epoch 361/600
150/150            8s 55ms/step -
accuracy: 0.9601 - loss: 0.1228 - val_accuracy: 0.8849 - val_loss: 0.4301
Epoch 362/600
150/150            8s 53ms/step -
accuracy: 0.9614 - loss: 0.1125 - val_accuracy: 0.8949 - val_loss: 0.4554
Epoch 363/600
150/150            8s 53ms/step -
accuracy: 0.9660 - loss: 0.1010 - val_accuracy: 0.8357 - val_loss: 0.6265
Epoch 364/600
150/150            8s 52ms/step -
accuracy: 0.9386 - loss: 0.1945 - val_accuracy: 0.8807 - val_loss: 0.3765
Epoch 365/600
150/150            8s 55ms/step -
accuracy: 0.9630 - loss: 0.1194 - val_accuracy: 0.8707 - val_loss: 0.4613
Epoch 366/600
150/150            8s 53ms/step -
accuracy: 0.9514 - loss: 0.1197 - val_accuracy: 0.9058 - val_loss: 0.3365
Epoch 367/600
```

```
150/150            8s 53ms/step -
accuracy: 0.9699 - loss: 0.0869 - val_accuracy: 0.8724 - val_loss: 0.4893
Epoch 368/600
150/150            10s 53ms/step -
accuracy: 0.9667 - loss: 0.1051 - val_accuracy: 0.8791 - val_loss: 0.4314
Epoch 369/600
150/150            8s 56ms/step -
accuracy: 0.9479 - loss: 0.1445 - val_accuracy: 0.8866 - val_loss: 0.3762
Epoch 370/600
150/150            8s 54ms/step -
accuracy: 0.9617 - loss: 0.1111 - val_accuracy: 0.8849 - val_loss: 0.4528
Epoch 371/600
150/150            8s 53ms/step -
accuracy: 0.9669 - loss: 0.0963 - val_accuracy: 0.8799 - val_loss: 0.4398
Epoch 372/600
150/150            8s 55ms/step -
accuracy: 0.9590 - loss: 0.1201 - val_accuracy: 0.8999 - val_loss: 0.3986
Epoch 373/600
150/150            9s 57ms/step -
accuracy: 0.9468 - loss: 0.1683 - val_accuracy: 0.8757 - val_loss: 0.4758
Epoch 374/600
150/150            8s 54ms/step -
accuracy: 0.9629 - loss: 0.1262 - val_accuracy: 0.9016 - val_loss: 0.4179
Epoch 375/600
150/150            8s 51ms/step -
accuracy: 0.9720 - loss: 0.0773 - val_accuracy: 0.8299 - val_loss: 0.8016
Epoch 376/600
150/150            8s 55ms/step -
accuracy: 0.9551 - loss: 0.1335 - val_accuracy: 0.8882 - val_loss: 0.4219
Epoch 377/600
150/150            9s 57ms/step -
accuracy: 0.9771 - loss: 0.0828 - val_accuracy: 0.8749 - val_loss: 0.4769
Epoch 378/600
150/150            8s 53ms/step -
accuracy: 0.9512 - loss: 0.1562 - val_accuracy: 0.9016 - val_loss: 0.3845
Epoch 379/600
150/150            10s 52ms/step -
accuracy: 0.9731 - loss: 0.0759 - val_accuracy: 0.8907 - val_loss: 0.4166
Epoch 380/600
150/150            8s 55ms/step -
accuracy: 0.9572 - loss: 0.1241 - val_accuracy: 0.8957 - val_loss: 0.4441
Epoch 381/600
150/150            8s 56ms/step -
accuracy: 0.9590 - loss: 0.1266 - val_accuracy: 0.8924 - val_loss: 0.4085
Epoch 382/600
150/150            10s 53ms/step -
accuracy: 0.9619 - loss: 0.1200 - val_accuracy: 0.8757 - val_loss: 0.5037
Epoch 383/600
```

```
150/150            8s 54ms/step -
accuracy: 0.9593 - loss: 0.1362 - val_accuracy: 0.9033 - val_loss: 0.3667
Epoch 384/600
150/150            8s 54ms/step -
accuracy: 0.9803 - loss: 0.0716 - val_accuracy: 0.8899 - val_loss: 0.4768
Epoch 385/600
150/150            10s 52ms/step -
accuracy: 0.9537 - loss: 0.1430 - val_accuracy: 0.8991 - val_loss: 0.4334
Epoch 386/600
150/150            8s 54ms/step -
accuracy: 0.9718 - loss: 0.0976 - val_accuracy: 0.8882 - val_loss: 0.4441
Epoch 387/600
150/150            8s 54ms/step -
accuracy: 0.9657 - loss: 0.1032 - val_accuracy: 0.8616 - val_loss: 0.5633
Epoch 388/600
150/150            8s 55ms/step -
accuracy: 0.9418 - loss: 0.1784 - val_accuracy: 0.9041 - val_loss: 0.4194
Epoch 389/600
150/150            8s 54ms/step -
accuracy: 0.9660 - loss: 0.1027 - val_accuracy: 0.8991 - val_loss: 0.4343
Epoch 390/600
150/150            8s 54ms/step -
accuracy: 0.9581 - loss: 0.1398 - val_accuracy: 0.8699 - val_loss: 0.4780
Epoch 391/600
150/150            8s 52ms/step -
accuracy: 0.9649 - loss: 0.1258 - val_accuracy: 0.8482 - val_loss: 0.5352
Epoch 392/600
150/150            8s 55ms/step -
accuracy: 0.9263 - loss: 0.2070 - val_accuracy: 0.8824 - val_loss: 0.4558
Epoch 393/600
150/150            8s 53ms/step -
accuracy: 0.9521 - loss: 0.1344 - val_accuracy: 0.9083 - val_loss: 0.3462
Epoch 394/600
150/150            8s 53ms/step -
accuracy: 0.9746 - loss: 0.0778 - val_accuracy: 0.8390 - val_loss: 0.6249
Epoch 395/600
150/150            8s 52ms/step -
accuracy: 0.9478 - loss: 0.1606 - val_accuracy: 0.8932 - val_loss: 0.4894
Epoch 396/600
150/150            8s 57ms/step -
accuracy: 0.9594 - loss: 0.1249 - val_accuracy: 0.8799 - val_loss: 0.4861
Epoch 397/600
150/150            8s 53ms/step -
accuracy: 0.9542 - loss: 0.1384 - val_accuracy: 0.8982 - val_loss: 0.3944
Epoch 398/600
150/150            8s 53ms/step -
accuracy: 0.9710 - loss: 0.0895 - val_accuracy: 0.8699 - val_loss: 0.5199
Epoch 399/600
```

```
150/150            8s 54ms/step -
accuracy: 0.9349 - loss: 0.2164 - val_accuracy: 0.8949 - val_loss: 0.3690
Epoch 400/600
150/150            8s 56ms/step -
accuracy: 0.9565 - loss: 0.1676 - val_accuracy: 0.8999 - val_loss: 0.3909
Epoch 401/600
150/150            8s 53ms/step -
accuracy: 0.9729 - loss: 0.0880 - val_accuracy: 0.8741 - val_loss: 0.4820
Epoch 402/600
150/150            8s 53ms/step -
accuracy: 0.9630 - loss: 0.1040 - val_accuracy: 0.8749 - val_loss: 0.4834
Epoch 403/600
150/150            8s 54ms/step -
accuracy: 0.9527 - loss: 0.1577 - val_accuracy: 0.8974 - val_loss: 0.3960
Epoch 404/600
150/150            8s 55ms/step -
accuracy: 0.9734 - loss: 0.0804 - val_accuracy: 0.8941 - val_loss: 0.4047
Epoch 405/600
150/150            8s 55ms/step -
accuracy: 0.9705 - loss: 0.1247 - val_accuracy: 0.8949 - val_loss: 0.4235
Epoch 406/600
150/150            8s 56ms/step -
accuracy: 0.9729 - loss: 0.0873 - val_accuracy: 0.8782 - val_loss: 0.4732
Epoch 407/600
150/150            8s 53ms/step -
accuracy: 0.9468 - loss: 0.1498 - val_accuracy: 0.8891 - val_loss: 0.4755
Epoch 408/600
150/150            9s 58ms/step -
accuracy: 0.9603 - loss: 0.1204 - val_accuracy: 0.8949 - val_loss: 0.4024
Epoch 409/600
150/150            8s 56ms/step -
accuracy: 0.9615 - loss: 0.1263 - val_accuracy: 0.9008 - val_loss: 0.3902
Epoch 410/600
150/150            8s 55ms/step -
accuracy: 0.9615 - loss: 0.1071 - val_accuracy: 0.9116 - val_loss: 0.3659
Epoch 411/600
150/150            8s 53ms/step -
accuracy: 0.9796 - loss: 0.0622 - val_accuracy: 0.8707 - val_loss: 0.5420
Epoch 412/600
150/150            8s 56ms/step -
accuracy: 0.9387 - loss: 0.1961 - val_accuracy: 0.8957 - val_loss: 0.3887
Epoch 413/600
150/150            8s 53ms/step -
accuracy: 0.9625 - loss: 0.1087 - val_accuracy: 0.8907 - val_loss: 0.4399
Epoch 414/600
150/150            8s 52ms/step -
accuracy: 0.9781 - loss: 0.0707 - val_accuracy: 0.8949 - val_loss: 0.4521
Epoch 415/600
```

```
150/150            8s 52ms/step -
accuracy: 0.9598 - loss: 0.1431 - val_accuracy: 0.8941 - val_loss: 0.4198
Epoch 416/600
150/150            8s 55ms/step -
accuracy: 0.9597 - loss: 0.1336 - val_accuracy: 0.8799 - val_loss: 0.4771
Epoch 417/600
150/150            8s 53ms/step -
accuracy: 0.9687 - loss: 0.0936 - val_accuracy: 0.8916 - val_loss: 0.4255
Epoch 418/600
150/150            8s 53ms/step -
accuracy: 0.9707 - loss: 0.0862 - val_accuracy: 0.8932 - val_loss: 0.4749
Epoch 419/600
150/150            8s 53ms/step -
accuracy: 0.9677 - loss: 0.1115 - val_accuracy: 0.8874 - val_loss: 0.4758
Epoch 420/600
150/150            8s 56ms/step -
accuracy: 0.9744 - loss: 0.0918 - val_accuracy: 0.9141 - val_loss: 0.3847
Epoch 421/600
150/150            8s 52ms/step -
accuracy: 0.9646 - loss: 0.1142 - val_accuracy: 0.8916 - val_loss: 0.4907
Epoch 422/600
150/150            8s 53ms/step -
accuracy: 0.9443 - loss: 0.1833 - val_accuracy: 0.8866 - val_loss: 0.4806
Epoch 423/600
150/150            8s 52ms/step -
accuracy: 0.9566 - loss: 0.1275 - val_accuracy: 0.8999 - val_loss: 0.3755
Epoch 424/600
150/150            10s 54ms/step -
accuracy: 0.9754 - loss: 0.0705 - val_accuracy: 0.9008 - val_loss: 0.4299
Epoch 425/600
150/150            8s 53ms/step -
accuracy: 0.9665 - loss: 0.1141 - val_accuracy: 0.8907 - val_loss: 0.4267
Epoch 426/600
150/150            10s 54ms/step -
accuracy: 0.9602 - loss: 0.1134 - val_accuracy: 0.8807 - val_loss: 0.4437
Epoch 427/600
150/150            8s 53ms/step -
accuracy: 0.9636 - loss: 0.1116 - val_accuracy: 0.8415 - val_loss: 0.7001
Epoch 428/600
150/150            8s 56ms/step -
accuracy: 0.9602 - loss: 0.1185 - val_accuracy: 0.9033 - val_loss: 0.4062
Epoch 429/600
150/150            8s 53ms/step -
accuracy: 0.9601 - loss: 0.1073 - val_accuracy: 0.8957 - val_loss: 0.4135
Epoch 430/600
150/150            8s 54ms/step -
accuracy: 0.9684 - loss: 0.0893 - val_accuracy: 0.9074 - val_loss: 0.4043
Epoch 431/600
```

```
150/150            8s 54ms/step -
accuracy: 0.9764 - loss: 0.0772 - val_accuracy: 0.9074 - val_loss: 0.4340
Epoch 432/600
150/150            8s 56ms/step -
accuracy: 0.9640 - loss: 0.1122 - val_accuracy: 0.8691 - val_loss: 0.4757
Epoch 433/600
150/150            8s 54ms/step -
accuracy: 0.9503 - loss: 0.1594 - val_accuracy: 0.8841 - val_loss: 0.4511
Epoch 434/600
150/150            8s 52ms/step -
accuracy: 0.9652 - loss: 0.1144 - val_accuracy: 0.8982 - val_loss: 0.4389
Epoch 435/600
150/150            8s 53ms/step -
accuracy: 0.9718 - loss: 0.0728 - val_accuracy: 0.8782 - val_loss: 0.5391
Epoch 436/600
150/150            9s 57ms/step -
accuracy: 0.9566 - loss: 0.1455 - val_accuracy: 0.8924 - val_loss: 0.4346
Epoch 437/600
150/150            8s 54ms/step -
accuracy: 0.9689 - loss: 0.1015 - val_accuracy: 0.8999 - val_loss: 0.4114
Epoch 438/600
150/150            8s 53ms/step -
accuracy: 0.9742 - loss: 0.0758 - val_accuracy: 0.9041 - val_loss: 0.4286
Epoch 439/600
150/150            8s 54ms/step -
accuracy: 0.9710 - loss: 0.0820 - val_accuracy: 0.8841 - val_loss: 0.4419
Epoch 440/600
150/150            8s 55ms/step -
accuracy: 0.9691 - loss: 0.0821 - val_accuracy: 0.9074 - val_loss: 0.3983
Epoch 441/600
150/150            8s 53ms/step -
accuracy: 0.9783 - loss: 0.0653 - val_accuracy: 0.8874 - val_loss: 0.4954
Epoch 442/600
150/150            8s 53ms/step -
accuracy: 0.9404 - loss: 0.1920 - val_accuracy: 0.8757 - val_loss: 0.4089
Epoch 443/600
150/150            8s 54ms/step -
accuracy: 0.9601 - loss: 0.1302 - val_accuracy: 0.8932 - val_loss: 0.4223
Epoch 444/600
150/150            8s 55ms/step -
accuracy: 0.9712 - loss: 0.0953 - val_accuracy: 0.9041 - val_loss: 0.4453
Epoch 445/600
150/150            8s 55ms/step -
accuracy: 0.9740 - loss: 0.0880 - val_accuracy: 0.9008 - val_loss: 0.4259
Epoch 446/600
150/150            8s 54ms/step -
accuracy: 0.9745 - loss: 0.0788 - val_accuracy: 0.8991 - val_loss: 0.4093
Epoch 447/600
```

```
150/150            8s 54ms/step -
accuracy: 0.9746 - loss: 0.0832 - val_accuracy: 0.9066 - val_loss: 0.3647
Epoch 448/600
150/150            8s 55ms/step -
accuracy: 0.9677 - loss: 0.0999 - val_accuracy: 0.8907 - val_loss: 0.5018
Epoch 449/600
150/150            8s 54ms/step -
accuracy: 0.9521 - loss: 0.1441 - val_accuracy: 0.8824 - val_loss: 0.4690
Epoch 450/600
150/150            8s 52ms/step -
accuracy: 0.9631 - loss: 0.1187 - val_accuracy: 0.8757 - val_loss: 0.5806
Epoch 451/600
150/150            8s 52ms/step -
accuracy: 0.9600 - loss: 0.1076 - val_accuracy: 0.8724 - val_loss: 0.5224
Epoch 452/600
150/150            8s 56ms/step -
accuracy: 0.9516 - loss: 0.1305 - val_accuracy: 0.8866 - val_loss: 0.4803
Epoch 453/600
150/150            8s 54ms/step -
accuracy: 0.9699 - loss: 0.0952 - val_accuracy: 0.8832 - val_loss: 0.5556
Epoch 454/600
150/150            8s 52ms/step -
accuracy: 0.9150 - loss: 0.3581 - val_accuracy: 0.8766 - val_loss: 0.3970
Epoch 455/600
150/150            8s 52ms/step -
accuracy: 0.9634 - loss: 0.1157 - val_accuracy: 0.9066 - val_loss: 0.3521
Epoch 456/600
150/150            8s 55ms/step -
accuracy: 0.9636 - loss: 0.1112 - val_accuracy: 0.9008 - val_loss: 0.4195
Epoch 457/600
150/150            8s 52ms/step -
accuracy: 0.9763 - loss: 0.0754 - val_accuracy: 0.9016 - val_loss: 0.4706
Epoch 458/600
150/150            8s 52ms/step -
accuracy: 0.9720 - loss: 0.0884 - val_accuracy: 0.8891 - val_loss: 0.4600
Epoch 459/600
150/150            10s 52ms/step -
accuracy: 0.9706 - loss: 0.0795 - val_accuracy: 0.8932 - val_loss: 0.4592
Epoch 460/600
150/150            8s 55ms/step -
accuracy: 0.9731 - loss: 0.0857 - val_accuracy: 0.8707 - val_loss: 0.6059
Epoch 461/600
150/150            8s 53ms/step -
accuracy: 0.9612 - loss: 0.1452 - val_accuracy: 0.8966 - val_loss: 0.4102
Epoch 462/600
150/150            10s 52ms/step -
accuracy: 0.9786 - loss: 0.0669 - val_accuracy: 0.9099 - val_loss: 0.3918
Epoch 463/600
```

```
150/150            8s 56ms/step -
accuracy: 0.9738 - loss: 0.0898 - val_accuracy: 0.8724 - val_loss: 0.4804
Epoch 464/600
150/150            8s 52ms/step -
accuracy: 0.9707 - loss: 0.1019 - val_accuracy: 0.9049 - val_loss: 0.3960
Epoch 465/600
150/150            8s 52ms/step -
accuracy: 0.9736 - loss: 0.0788 - val_accuracy: 0.8507 - val_loss: 0.5511
Epoch 466/600
150/150            8s 52ms/step -
accuracy: 0.9520 - loss: 0.1558 - val_accuracy: 0.9091 - val_loss: 0.3136
Epoch 467/600
150/150            8s 54ms/step -
accuracy: 0.9869 - loss: 0.0511 - val_accuracy: 0.9174 - val_loss: 0.3407
Epoch 468/600
150/150            8s 52ms/step -
accuracy: 0.9692 - loss: 0.0954 - val_accuracy: 0.8849 - val_loss: 0.4907
Epoch 481/600
150/150            8s 52ms/step -
accuracy: 0.9647 - loss: 0.1241 - val_accuracy: 0.8932 - val_loss: 0.3999
Epoch 482/600
150/150            8s 53ms/step -
accuracy: 0.9700 - loss: 0.1008 - val_accuracy: 0.9099 - val_loss: 0.4001
Epoch 483/600
150/150            8s 54ms/step -
accuracy: 0.9744 - loss: 0.0797 - val_accuracy: 0.8832 - val_loss: 0.4791
Epoch 484/600
150/150            8s 51ms/step -
accuracy: 0.9722 - loss: 0.0883 - val_accuracy: 0.9058 - val_loss: 0.4274
Epoch 485/600
150/150            10s 52ms/step -
accuracy: 0.9743 - loss: 0.0823 - val_accuracy: 0.8799 - val_loss: 0.4640
Epoch 486/600
150/150            8s 52ms/step -
accuracy: 0.9658 - loss: 0.1010 - val_accuracy: 0.8949 - val_loss: 0.4399
Epoch 487/600
150/150            8s 54ms/step -
accuracy: 0.9774 - loss: 0.0728 - val_accuracy: 0.8899 - val_loss: 0.4558
Epoch 488/600
150/150            8s 52ms/step -
accuracy: 0.9752 - loss: 0.0771 - val_accuracy: 0.9024 - val_loss: 0.4365
Epoch 489/600
150/150            8s 52ms/step -
accuracy: 0.9833 - loss: 0.0602 - val_accuracy: 0.8666 - val_loss: 0.5578
Epoch 490/600
150/150            8s 52ms/step -
accuracy: 0.9428 - loss: 0.1896 - val_accuracy: 0.9058 - val_loss: 0.3701
Epoch 491/600
```

```
150/150             8s 54ms/step -
accuracy: 0.9850 - loss: 0.0517 - val_accuracy: 0.8999 - val_loss: 0.4236
Epoch 492/600
150/150             8s 52ms/step -
accuracy: 0.9603 - loss: 0.1279 - val_accuracy: 0.8899 - val_loss: 0.4159
Epoch 493/600
150/150             8s 52ms/step -
accuracy: 0.9628 - loss: 0.1141 - val_accuracy: 0.8540 - val_loss: 0.6649
Epoch 494/600
150/150             8s 51ms/step -
accuracy: 0.9525 - loss: 0.1491 - val_accuracy: 0.9108 - val_loss: 0.4028
Epoch 495/600
150/150             8s 53ms/step -
accuracy: 0.9821 - loss: 0.0606 - val_accuracy: 0.8899 - val_loss: 0.4680
Epoch 496/600
150/150             8s 53ms/step -
accuracy: 0.9542 - loss: 0.1200 - val_accuracy: 0.9024 - val_loss: 0.4557
Epoch 497/600
150/150             8s 52ms/step -
accuracy: 0.9831 - loss: 0.0549 - val_accuracy: 0.8974 - val_loss: 0.4581
Epoch 498/600
150/150             8s 52ms/step -
accuracy: 0.9727 - loss: 0.0841 - val_accuracy: 0.8849 - val_loss: 0.5630
Epoch 499/600
150/150             8s 52ms/step -
accuracy: 0.9554 - loss: 0.1531 - val_accuracy: 0.8999 - val_loss: 0.4258
Epoch 500/600
150/150             10s 52ms/step -
accuracy: 0.9792 - loss: 0.0667 - val_accuracy: 0.8949 - val_loss: 0.4607
Epoch 501/600
150/150             8s 52ms/step -
accuracy: 0.9732 - loss: 0.0830 - val_accuracy: 0.8807 - val_loss: 0.4971
Epoch 502/600
150/150             8s 52ms/step -
accuracy: 0.9672 - loss: 0.1056 - val_accuracy: 0.9066 - val_loss: 0.4023
Epoch 503/600
150/150             8s 53ms/step -
accuracy: 0.9798 - loss: 0.0655 - val_accuracy: 0.8991 - val_loss: 0.4680
Epoch 504/600
150/150             8s 51ms/step -
accuracy: 0.9588 - loss: 0.1353 - val_accuracy: 0.8841 - val_loss: 0.4576
Epoch 505/600
150/150             10s 53ms/step -
accuracy: 0.9692 - loss: 0.0905 - val_accuracy: 0.8824 - val_loss: 0.4616
Epoch 506/600
150/150             8s 52ms/step -
accuracy: 0.9601 - loss: 0.1221 - val_accuracy: 0.9041 - val_loss: 0.4180
Epoch 507/600
```

```
150/150            8s 54ms/step -
accuracy: 0.9755 - loss: 0.0809 - val_accuracy: 0.8941 - val_loss: 0.4763
Epoch 508/600
150/150            8s 52ms/step -
accuracy: 0.9655 - loss: 0.1070 - val_accuracy: 0.8974 - val_loss: 0.4745
Epoch 509/600
150/150            8s 52ms/step -
accuracy: 0.9670 - loss: 0.1126 - val_accuracy: 0.8932 - val_loss: 0.4114
Epoch 510/600
150/150            8s 51ms/step -
accuracy: 0.9813 - loss: 0.0668 - val_accuracy: 0.9166 - val_loss: 0.3868
Epoch 511/600
150/150            8s 54ms/step -
accuracy: 0.9787 - loss: 0.0672 - val_accuracy: 0.8957 - val_loss: 0.4844
Epoch 512/600
150/150            8s 51ms/step -
accuracy: 0.9583 - loss: 0.1273 - val_accuracy: 0.9083 - val_loss: 0.3657
Epoch 513/600
150/150            8s 51ms/step -
accuracy: 0.9847 - loss: 0.0566 - val_accuracy: 0.9066 - val_loss: 0.4444
Epoch 514/600
150/150            10s 51ms/step -
accuracy: 0.9753 - loss: 0.0958 - val_accuracy: 0.8741 - val_loss: 0.4831
Epoch 515/600
150/150            8s 54ms/step -
accuracy: 0.9645 - loss: 0.1049 - val_accuracy: 0.9083 - val_loss: 0.4011
Epoch 516/600
150/150            8s 52ms/step -
accuracy: 0.9756 - loss: 0.0764 - val_accuracy: 0.9016 - val_loss: 0.4065
Epoch 517/600
150/150            8s 51ms/step -
accuracy: 0.9841 - loss: 0.0519 - val_accuracy: 0.8824 - val_loss: 0.4895
Epoch 518/600
150/150            8s 51ms/step -
accuracy: 0.9529 - loss: 0.1490 - val_accuracy: 0.9149 - val_loss: 0.3760
Epoch 519/600
150/150            8s 54ms/step -
accuracy: 0.9707 - loss: 0.0871 - val_accuracy: 0.9033 - val_loss: 0.4435
Epoch 520/600
150/150            10s 52ms/step -
accuracy: 0.9823 - loss: 0.0577 - val_accuracy: 0.9033 - val_loss: 0.4133
Epoch 521/600
150/150            8s 52ms/step -
accuracy: 0.9872 - loss: 0.0414 - val_accuracy: 0.8974 - val_loss: 0.4769
Epoch 522/600
150/150            10s 52ms/step -
accuracy: 0.9658 - loss: 0.1136 - val_accuracy: 0.8774 - val_loss: 0.4797
Epoch 523/600
```

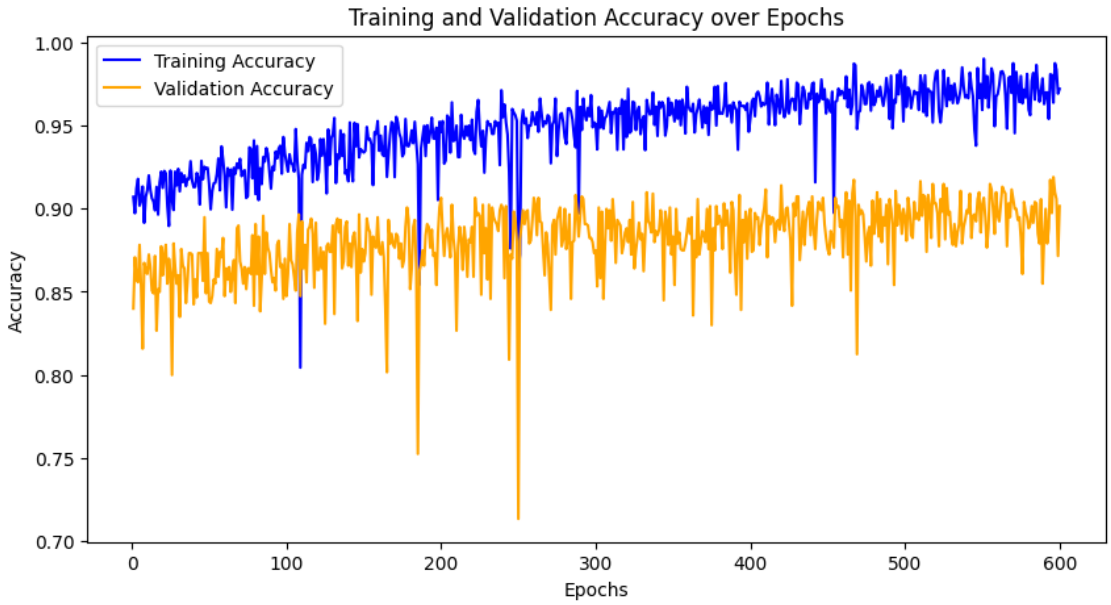
```
150/150            8s 55ms/step -
accuracy: 0.9354 - loss: 0.2363 - val_accuracy: 0.9058 - val_loss: 0.3534
Epoch 524/600
150/150            8s 52ms/step -
accuracy: 0.9606 - loss: 0.1213 - val_accuracy: 0.8982 - val_loss: 0.3544
Epoch 525/600
150/150            8s 51ms/step -
accuracy: 0.9828 - loss: 0.0521 - val_accuracy: 0.9149 - val_loss: 0.3361
Epoch 526/600
150/150            8s 52ms/step -
accuracy: 0.9796 - loss: 0.0664 - val_accuracy: 0.8816 - val_loss: 0.4926
Epoch 527/600
150/150            8s 55ms/step -
accuracy: 0.9420 - loss: 0.2352 - val_accuracy: 0.9124 - val_loss: 0.3627
Epoch 528/600
150/150            8s 52ms/step -
accuracy: 0.9814 - loss: 0.0575 - val_accuracy: 0.8966 - val_loss: 0.4234
Epoch 529/600
150/150            10s 52ms/step -
accuracy: 0.9570 - loss: 0.1552 - val_accuracy: 0.8982 - val_loss: 0.4414
Epoch 530/600
150/150            8s 52ms/step -
accuracy: 0.9792 - loss: 0.0673 - val_accuracy: 0.8832 - val_loss: 0.4861
Epoch 531/600
150/150            10s 53ms/step -
accuracy: 0.9594 - loss: 0.1187 - val_accuracy: 0.8782 - val_loss: 0.4529
Epoch 532/600
150/150            8s 52ms/step -
accuracy: 0.9720 - loss: 0.0833 - val_accuracy: 0.8907 - val_loss: 0.4584
Epoch 533/600
150/150            10s 51ms/step -
accuracy: 0.9759 - loss: 0.0820 - val_accuracy: 0.8774 - val_loss: 0.5503
Epoch 534/600
150/150            8s 55ms/step -
accuracy: 0.9604 - loss: 0.1417 - val_accuracy: 0.8857 - val_loss: 0.4674
Epoch 535/600
150/150            8s 53ms/step -
accuracy: 0.9721 - loss: 0.0948 - val_accuracy: 0.8907 - val_loss: 0.4345
Epoch 536/600
150/150            8s 54ms/step -
accuracy: 0.9627 - loss: 0.1239 - val_accuracy: 0.9108 - val_loss: 0.3705
Epoch 537/600
150/150            8s 53ms/step -
accuracy: 0.9910 - loss: 0.0326 - val_accuracy: 0.8791 - val_loss: 0.5645
Epoch 538/600
150/150            8s 56ms/step -
accuracy: 0.9758 - loss: 0.0733 - val_accuracy: 0.8891 - val_loss: 0.5238
Epoch 539/600
```

```
150/150            8s 53ms/step -
accuracy: 0.9616 - loss: 0.1272 - val_accuracy: 0.8932 - val_loss: 0.4601
Epoch 540/600
150/150            8s 53ms/step -
accuracy: 0.9745 - loss: 0.0810 - val_accuracy: 0.8991 - val_loss: 0.4348
Epoch 541/600
150/150            8s 53ms/step -
accuracy: 0.9731 - loss: 0.0886 - val_accuracy: 0.8974 - val_loss: 0.4154
Epoch 542/600
150/150            8s 54ms/step -
accuracy: 0.9798 - loss: 0.0730 - val_accuracy: 0.9091 - val_loss: 0.4226
Epoch 543/600
150/150            8s 52ms/step -
accuracy: 0.9808 - loss: 0.0688 - val_accuracy: 0.8824 - val_loss: 0.4973
Epoch 544/600
150/150            8s 52ms/step -
accuracy: 0.9623 - loss: 0.1163 - val_accuracy: 0.8957 - val_loss: 0.4009
Epoch 545/600
150/150            8s 52ms/step -
accuracy: 0.9445 - loss: 0.1759 - val_accuracy: 0.8966 - val_loss: 0.3926
Epoch 546/600
150/150            8s 53ms/step -
accuracy: 0.9176 - loss: 0.2998 - val_accuracy: 0.8924 - val_loss: 0.3863
Epoch 547/600
150/150            8s 54ms/step -
accuracy: 0.9781 - loss: 0.0653 - val_accuracy: 0.9058 - val_loss: 0.3993
Epoch 548/600
150/150            8s 51ms/step -
accuracy: 0.9764 - loss: 0.0894 - val_accuracy: 0.9099 - val_loss: 0.4164
Epoch 549/600
150/150            8s 52ms/step -
accuracy: 0.9783 - loss: 0.0736 - val_accuracy: 0.8857 - val_loss: 0.5053
Epoch 550/600
150/150            8s 53ms/step -
accuracy: 0.9474 - loss: 0.2010 - val_accuracy: 0.9024 - val_loss: 0.4010
Epoch 551/600
150/150            8s 55ms/step -
accuracy: 0.9922 - loss: 0.0337 - val_accuracy: 0.9066 - val_loss: 0.4393
Epoch 552/600
150/150            8s 52ms/step -
accuracy: 0.9686 - loss: 0.0956 - val_accuracy: 0.8949 - val_loss: 0.4199
Epoch 553/600
150/150            8s 51ms/step -
accuracy: 0.9802 - loss: 0.0580 - val_accuracy: 0.8766 - val_loss: 0.5691
Epoch 554/600
150/150            8s 51ms/step -
accuracy: 0.9624 - loss: 0.1184 - val_accuracy: 0.8882 - val_loss: 0.4243
Epoch 555/600
```

```
150/150            10s 53ms/step -
accuracy: 0.9637 - loss: 0.1186 - val_accuracy: 0.9149 - val_loss: 0.3961
Epoch 556/600
150/150            8s 52ms/step -
accuracy: 0.9828 - loss: 0.0551 - val_accuracy: 0.9116 - val_loss: 0.4462
Epoch 557/600
150/150            8s 52ms/step -
accuracy: 0.9832 - loss: 0.0550 - val_accuracy: 0.8999 - val_loss: 0.4921
Epoch 558/600
150/150            8s 52ms/step -
accuracy: 0.9641 - loss: 0.1238 - val_accuracy: 0.8849 - val_loss: 0.4383
Epoch 559/600
150/150            8s 53ms/step -
accuracy: 0.9478 - loss: 0.1701 - val_accuracy: 0.9099 - val_loss: 0.3961
Epoch 560/600
150/150            8s 52ms/step -
accuracy: 0.9804 - loss: 0.0710 - val_accuracy: 0.8957 - val_loss: 0.3921
Epoch 561/600
150/150            8s 52ms/step -
accuracy: 0.9650 - loss: 0.1211 - val_accuracy: 0.8924 - val_loss: 0.4870
Epoch 562/600
150/150            8s 52ms/step -
accuracy: 0.9823 - loss: 0.0642 - val_accuracy: 0.9024 - val_loss: 0.4506
Epoch 563/600
150/150            8s 55ms/step -
accuracy: 0.9817 - loss: 0.0609 - val_accuracy: 0.9133 - val_loss: 0.3755
Epoch 564/600
150/150            10s 51ms/step -
accuracy: 0.9786 - loss: 0.0616 - val_accuracy: 0.9108 - val_loss: 0.4463
Epoch 565/600
150/150            8s 50ms/step -
accuracy: 0.9768 - loss: 0.0775 - val_accuracy: 0.9091 - val_loss: 0.4210
Epoch 566/600
150/150            8s 51ms/step -
accuracy: 0.9693 - loss: 0.1018 - val_accuracy: 0.8774 - val_loss: 0.4218
Epoch 567/600
150/150            8s 54ms/step -
accuracy: 0.9679 - loss: 0.1085 - val_accuracy: 0.9033 - val_loss: 0.4213
Epoch 568/600
150/150            8s 52ms/step -
accuracy: 0.9843 - loss: 0.0509 - val_accuracy: 0.8949 - val_loss: 0.4581
Epoch 569/600
150/150            8s 52ms/step -
accuracy: 0.9667 - loss: 0.1055 - val_accuracy: 0.9116 - val_loss: 0.4132
Epoch 570/600
150/150            8s 52ms/step -
accuracy: 0.9881 - loss: 0.0426 - val_accuracy: 0.9058 - val_loss: 0.4540
Epoch 571/600
```

```
150/150            8s 54ms/step -
accuracy: 0.9720 - loss: 0.1056 - val_accuracy: 0.8999 - val_loss: 0.3737
Epoch 572/600
150/150            8s 51ms/step -
accuracy: 0.9823 - loss: 0.0656 - val_accuracy: 0.8999 - val_loss: 0.4765
Epoch 573/600
150/150            8s 50ms/step -
accuracy: 0.9783 - loss: 0.0640 - val_accuracy: 0.8932 - val_loss: 0.5035
Epoch 574/600
150/150            8s 50ms/step -
accuracy: 0.9571 - loss: 0.1357 - val_accuracy: 0.8949 - val_loss: 0.4931
Epoch 575/600
150/150            8s 54ms/step -
accuracy: 0.9798 - loss: 0.0712 - val_accuracy: 0.8824 - val_loss: 0.4952
Epoch 576/600
150/150            8s 51ms/step -
accuracy: 0.9666 - loss: 0.0990 - val_accuracy: 0.8607 - val_loss: 0.5072
Epoch 577/600
150/150            8s 51ms/step -
accuracy: 0.9714 - loss: 0.0874 - val_accuracy: 0.9041 - val_loss: 0.3818
Epoch 578/600
150/150            8s 51ms/step -
accuracy: 0.9737 - loss: 0.0891 - val_accuracy: 0.8982 - val_loss: 0.3662
Epoch 579/600
150/150            8s 55ms/step -
accuracy: 0.9812 - loss: 0.0624 - val_accuracy: 0.8949 - val_loss: 0.4446
Epoch 580/600
150/150            8s 52ms/step -
accuracy: 0.9744 - loss: 0.0741 - val_accuracy: 0.8882 - val_loss: 0.4267
Epoch 581/600
150/150            8s 52ms/step -
accuracy: 0.9524 - loss: 0.1618 - val_accuracy: 0.8907 - val_loss: 0.4492
Epoch 582/600
150/150            8s 51ms/step -
accuracy: 0.9683 - loss: 0.1033 - val_accuracy: 0.9016 - val_loss: 0.3879
Epoch 583/600
150/150            8s 54ms/step -
accuracy: 0.9854 - loss: 0.0487 - val_accuracy: 0.8916 - val_loss: 0.4701
Epoch 584/600
150/150            8s 51ms/step -
accuracy: 0.9653 - loss: 0.1034 - val_accuracy: 0.9041 - val_loss: 0.4320
Epoch 585/600
150/150            8s 52ms/step -
accuracy: 0.9823 - loss: 0.0578 - val_accuracy: 0.9033 - val_loss: 0.4134
Epoch 586/600
150/150            8s 52ms/step -
accuracy: 0.9831 - loss: 0.0529 - val_accuracy: 0.8849 - val_loss: 0.4820
Epoch 587/600
```

```
150/150             8s 54ms/step -
accuracy: 0.9720 - loss: 0.0923 - val_accuracy: 0.8791 - val_loss: 0.4604
Epoch 588/600
150/150             8s 52ms/step -
accuracy: 0.9604 - loss: 0.1488 - val_accuracy: 0.9058 - val_loss: 0.4010
Epoch 589/600
150/150             8s 52ms/step -
accuracy: 0.9855 - loss: 0.0528 - val_accuracy: 0.8549 - val_loss: 0.6202
Epoch 590/600
150/150             10s 52ms/step -
accuracy: 0.9556 - loss: 0.1326 - val_accuracy: 0.8832 - val_loss: 0.4565
Epoch 591/600
150/150             8s 55ms/step -
accuracy: 0.9646 - loss: 0.1006 - val_accuracy: 0.8999 - val_loss: 0.4280
Epoch 592/600
150/150             8s 52ms/step -
accuracy: 0.9776 - loss: 0.0736 - val_accuracy: 0.8791 - val_loss: 0.4998
Epoch 593/600
150/150             8s 52ms/step -
accuracy: 0.9498 - loss: 0.1513 - val_accuracy: 0.8882 - val_loss: 0.4356
Epoch 594/600
150/150             8s 51ms/step -
accuracy: 0.9709 - loss: 0.1126 - val_accuracy: 0.9174 - val_loss: 0.3395
Epoch 595/600
150/150             8s 55ms/step -
accuracy: 0.9894 - loss: 0.0466 - val_accuracy: 0.8974 - val_loss: 0.4087
Epoch 596/600
150/150             8s 53ms/step -
accuracy: 0.9617 - loss: 0.1243 - val_accuracy: 0.9191 - val_loss: 0.3579
Epoch 597/600
150/150             8s 51ms/step -
accuracy: 0.9895 - loss: 0.0435 - val_accuracy: 0.9099 - val_loss: 0.4211
Epoch 598/600
150/150             8s 51ms/step -
accuracy: 0.9892 - loss: 0.0382 - val_accuracy: 0.9058 - val_loss: 0.4667
Epoch 599/600
150/150             8s 53ms/step -
accuracy: 0.9725 - loss: 0.1033 - val_accuracy: 0.8716 - val_loss: 0.5427
Epoch 600/600
150/150             10s 51ms/step -
accuracy: 0.9635 - loss: 0.1226 - val_accuracy: 0.9016 - val_loss: 0.3924
```



[ ]:
```
# Save the model
model.save('/kaggle/working/tf_pretrained_model.h5')
loss, tf_keras_val_accuracy = model.evaluate(x_val, y_val_encoded, verbose=0)
print(f'TensorFlow/Keras Model Validation Accuracy: {tf_keras_val_accuracy:.
  ↪4f}')

y_pred = model.predict(x_val)
y_pred_classes = np.argmax(y_pred, axis=1)

print(classification_report(y_val_encoded, y_pred_classes,␣
  ↪target_names=label_encoder.classes_))
```