In [1]:

```
import tensorflow as tf
from tensorflow.keras.applications import EfficientNetB0
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Dropout, BatchNormalization
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.losses import CategoricalCrossentropy
from tensorflow.keras.callbacks import EarlyStopping, ReduceLROnPlateau

# Directories where your data is stored
train_dir = r'C:\Users\Abhishek\Downloads\cotton_plant_new (1)\cotton_plant_new\trai
validation_dir =r'C:\Users\Abhishek\Downloads\cotton_plant_new (1)\cotton_plant_new\
test_dir = r'C:\Users\Abhishek\Downloads\cotton_plant_new (1)\cotton_plant_new\test'

# Define constants
IMG_SIZE = 224
BATCH_SIZE = 8  # Reduced batch size
NUM_CLASSES = 6 # Number of classes in your dataset
EPOCHS = 100

# Generate batches of tensor image data with real-time data augmentation
datagen = ImageDataGenerator(
    rescale=1./255,
    horizontal_flip=True,
    vertical_flip=True)

train_generator = datagen.flow_from_directory(
    train_dir,
    target_size=(IMG_SIZE, IMG_SIZE),
    batch_size=BATCH_SIZE,
    class_mode='categorical')

validation_generator = datagen.flow_from_directory(
    validation_dir,
    target_size=(IMG_SIZE, IMG_SIZE),
    batch_size=BATCH_SIZE,
    class_mode='categorical')

test_generator = datagen.flow_from_directory(
    test_dir,
    target_size=(IMG_SIZE, IMG_SIZE),
    batch_size=BATCH_SIZE,
    class_mode='categorical')

# Load base model
base_model = EfficientNetB0(weights='imagenet', include_top=False, input_shape=(IMG_

# Add a new top layer
x = base_model.output
x = tf.keras.layers.GlobalAveragePooling2D()(x)
x = Dense(512, activation='relu')(x)  # Reduced the number of neurons
x = Dropout(0.2)(x)  # Add dropout layer to reduce overfitting
x = BatchNormalization()(x)
predictions = Dense(NUM_CLASSES, activation='softmax')(x)

# This is the model we will train
model = tf.keras.models.Model(inputs=base_model.input, outputs=predictions)

# Freeze the base model
for layer in base_model.layers:
    layer.trainable = False
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# Compile the model
model.compile(optimizer=Adam(lr=0.001), loss=CategoricalCrossentropy(), metrics=['ac

# Define callbacks
early_stopping = EarlyStopping(monitor='val_loss', patience=10, restore_best_weights
reduce_lr = ReduceLROnPlateau(monitor='val_loss', factor=0.2, patience=5, min_lr=0.0

# Train the model
history = model.fit(
    train_generator,
    epochs=EPOCHS,
    validation_data=validation_generator,
    callbacks=[early_stopping, reduce_lr])

# Unfreeze the layers of the base model and fine-tune the entire model
for layer in base_model.layers:
    layer.trainable = True

# Recompile the model
model.compile(optimizer=Adam(lr=0.00001), loss=CategoricalCrossentropy(), metrics=['

# Continue training the model
history_fine_tuning = model.fit(
    train_generator,
    epochs=EPOCHS,
    validation_data=validation_generator,
    callbacks=[early_stopping, reduce_lr])

# Evaluate the model on the test data after fine-tuning
# Evaluate the model on the test data after fine-tuning
score = model.evaluate(test_generator)
print(f'Test loss: {score[0]} / Test accuracy: {score[1]}')
```

```
Found 2400 images belonging to 6 classes.
Found 599 images belonging to 6 classes.
Found 237 images belonging to 6 classes.
WARNING:absl:`lr` is deprecated, please use `learning_rate` instead, or use the lega
cy optimizer, e.g.,tf.keras.optimizers.legacy.Adam.
Epoch 1/100
300/300 [==============================] - 221s 708ms/step - loss: 1.9758 - accurac
y: 0.1779 - val_loss: 1.8303 - val_accuracy: 0.1786 - lr: 0.0010
Epoch 2/100
300/300 [==============================] - 203s 675ms/step - loss: 1.9042 - accurac
y: 0.1725 - val_loss: 1.8313 - val_accuracy: 0.2654 - lr: 0.0010
Epoch 3/100
300/300 [==============================] - 206s 684ms/step - loss: 1.8461 - accurac
y: 0.1771 - val_loss: 1.7853 - val_accuracy: 0.1736 - lr: 0.0010
Epoch 4/100
300/300 [==============================] - 209s 695ms/step - loss: 1.8268 - accurac
y: 0.1917 - val_loss: 1.9546 - val_accuracy: 0.1703 - lr: 0.0010
Epoch 5/100
300/300 [==============================] - 209s 694ms/step - loss: 1.8052 - accurac
y: 0.1937 - val_loss: 1.7811 - val_accuracy: 0.2304 - lr: 0.0010
Epoch 6/100
300/300 [==============================] - 209s 698ms/step - loss: 1.8065 - accurac
y: 0.1883 - val_loss: 1.7842 - val_accuracy: 0.1870 - lr: 0.0010
Epoch 7/100
300/300 [==============================] - 209s 697ms/step - loss: 1.7993 - accurac
y: 0.1875 - val_loss: 1.7882 - val_accuracy: 0.1669 - lr: 0.0010
Epoch 8/100
300/300 [==============================] - 240s 801ms/step - loss: 1.8032 - accurac
y: 0.1746 - val_loss: 1.7899 - val_accuracy: 0.1686 - lr: 0.0010
Epoch 9/100
300/300 [==============================] - 272s 906ms/step - loss: 1.7989 - accurac
y: 0.1667 - val_loss: 1.7887 - val_accuracy: 0.1653 - lr: 0.0010
Epoch 10/100
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300/300 [==============================] - 268s 894ms/step - loss: 1.7942 - accurac
y: 0.1779 - val_loss: 1.7882 - val_accuracy: 0.1770 - lr: 0.0010
Epoch 11/100
300/300 [==============================] - 271s 905ms/step - loss: 1.7963 - accurac
y: 0.1879 - val_loss: 1.7848 - val_accuracy: 0.1703 - lr: 2.0000e-04
Epoch 12/100
300/300 [==============================] - 271s 905ms/step - loss: 1.7928 - accurac
y: 0.1821 - val_loss: 1.7847 - val_accuracy: 0.1669 - lr: 2.0000e-04
Epoch 13/100
300/300 [==============================] - 272s 907ms/step - loss: 1.7858 - accurac
y: 0.2008 - val_loss: 1.7861 - val_accuracy: 0.2003 - lr: 2.0000e-04
Epoch 14/100
300/300 [==============================] - 275s 918ms/step - loss: 1.7916 - accurac
y: 0.1725 - val_loss: 1.7856 - val_accuracy: 0.1820 - lr: 2.0000e-04
Epoch 15/100
300/300 [==============================] - 273s 910ms/step - loss: 1.7802 - accurac
y: 0.2075 - val_loss: 1.7810 - val_accuracy: 0.1669 - lr: 2.0000e-04
Epoch 16/100
300/300 [==============================] - 273s 910ms/step - loss: 1.7811 - accurac
y: 0.2008 - val_loss: 1.7757 - val_accuracy: 0.1836 - lr: 2.0000e-04
Epoch 17/100
300/300 [==============================] - 186s 618ms/step - loss: 1.7835 - accurac
y: 0.1925 - val_loss: 1.7772 - val_accuracy: 0.2421 - lr: 2.0000e-04
Epoch 18/100
300/300 [==============================] - 179s 595ms/step - loss: 1.7880 - accurac
y: 0.1921 - val_loss: 1.7844 - val_accuracy: 0.1820 - lr: 2.0000e-04
Epoch 19/100
300/300 [==============================] - 179s 597ms/step - loss: 1.7849 - accurac
y: 0.1954 - val_loss: 1.7843 - val_accuracy: 0.1886 - lr: 2.0000e-04
Epoch 20/100
300/300 [==============================] - 179s 596ms/step - loss: 1.7766 - accurac
y: 0.1950 - val_loss: 1.7761 - val_accuracy: 0.2571 - lr: 2.0000e-04
Epoch 21/100
300/300 [==============================] - 178s 593ms/step - loss: 1.7831 - accurac
y: 0.1967 - val_loss: 1.7741 - val_accuracy: 0.2204 - lr: 2.0000e-04
Epoch 22/100
300/300 [==============================] - 178s 593ms/step - loss: 1.7809 - accurac
y: 0.1992 - val_loss: 1.7828 - val_accuracy: 0.1669 - lr: 2.0000e-04
Epoch 23/100
300/300 [==============================] - 180s 601ms/step - loss: 1.7815 - accurac
y: 0.2025 - val_loss: 1.7794 - val_accuracy: 0.1736 - lr: 2.0000e-04
Epoch 24/100
300/300 [==============================] - 179s 599ms/step - loss: 1.7796 - accurac
y: 0.2029 - val_loss: 1.7760 - val_accuracy: 0.2154 - lr: 2.0000e-04
Epoch 25/100
300/300 [==============================] - 177s 591ms/step - loss: 1.7813 - accurac
y: 0.1900 - val_loss: 1.7897 - val_accuracy: 0.1669 - lr: 2.0000e-04
Epoch 26/100
300/300 [==============================] - 181s 603ms/step - loss: 1.7922 - accurac
y: 0.1708 - val_loss: 1.7818 - val_accuracy: 0.2204 - lr: 2.0000e-04
Epoch 27/100
300/300 [==============================] - 178s 594ms/step - loss: 1.7780 - accurac
y: 0.2200 - val_loss: 1.7820 - val_accuracy: 0.2554 - lr: 4.0000e-05
Epoch 28/100
300/300 [==============================] - 180s 600ms/step - loss: 1.7773 - accurac
y: 0.2117 - val_loss: 1.7804 - val_accuracy: 0.2104 - lr: 4.0000e-05
Epoch 29/100
300/300 [==============================] - 179s 595ms/step - loss: 1.7773 - accurac
y: 0.2167 - val_loss: 1.7796 - val_accuracy: 0.2220 - lr: 4.0000e-05
Epoch 30/100
300/300 [==============================] - 177s 591ms/step - loss: 1.7775 - accurac
y: 0.2058 - val_loss: 1.7734 - val_accuracy: 0.2922 - lr: 4.0000e-05
Epoch 31/100
300/300 [==============================] - 179s 595ms/step - loss: 1.7712 - accurac
y: 0.2050 - val_loss: 1.7729 - val_accuracy: 0.2154 - lr: 4.0000e-05
Epoch 32/100
300/300 [==============================] - 177s 591ms/step - loss: 1.7699 - accurac
y: 0.2050 - val_loss: 1.7733 - val_accuracy: 0.1953 - lr: 4.0000e-05
Epoch 33/100
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300/300 [==============================] - 180s 599ms/step - loss: 1.7672 - accurac
y: 0.2192 - val_loss: 1.7747 - val_accuracy: 0.1903 - lr: 4.0000e-05
Epoch 34/100
300/300 [==============================] - 179s 596ms/step - loss: 1.7709 - accurac
y: 0.2108 - val_loss: 1.7706 - val_accuracy: 0.2304 - lr: 4.0000e-05
Epoch 35/100
300/300 [==============================] - 179s 596ms/step - loss: 1.7653 - accurac
y: 0.2250 - val_loss: 1.7690 - val_accuracy: 0.2170 - lr: 4.0000e-05
Epoch 36/100
300/300 [==============================] - 177s 590ms/step - loss: 1.7659 - accurac
y: 0.2262 - val_loss: 1.7656 - val_accuracy: 0.2220 - lr: 4.0000e-05
Epoch 37/100
300/300 [==============================] - 178s 591ms/step - loss: 1.7641 - accurac
y: 0.2150 - val_loss: 1.7693 - val_accuracy: 0.2137 - lr: 4.0000e-05
Epoch 38/100
300/300 [==============================] - 178s 594ms/step - loss: 1.7638 - accurac
y: 0.2396 - val_loss: 1.7699 - val_accuracy: 0.2070 - lr: 4.0000e-05
Epoch 39/100
300/300 [==============================] - 179s 596ms/step - loss: 1.7644 - accurac
y: 0.2142 - val_loss: 1.7708 - val_accuracy: 0.2020 - lr: 4.0000e-05
Epoch 40/100
300/300 [==============================] - 179s 594ms/step - loss: 1.7641 - accurac
y: 0.2204 - val_loss: 1.7668 - val_accuracy: 0.2170 - lr: 4.0000e-05
Epoch 41/100
300/300 [==============================] - 178s 595ms/step - loss: 1.7619 - accurac
y: 0.2221 - val_loss: 1.7672 - val_accuracy: 0.2187 - lr: 4.0000e-05
Epoch 42/100
300/300 [==============================] - 179s 595ms/step - loss: 1.7603 - accurac
y: 0.2271 - val_loss: 1.7701 - val_accuracy: 0.1753 - lr: 1.0000e-05
Epoch 43/100
300/300 [==============================] - 179s 596ms/step - loss: 1.7618 - accurac
y: 0.2179 - val_loss: 1.7658 - val_accuracy: 0.2170 - lr: 1.0000e-05
Epoch 44/100
300/300 [==============================] - 178s 593ms/step - loss: 1.7600 - accurac
y: 0.2158 - val_loss: 1.7667 - val_accuracy: 0.1937 - lr: 1.0000e-05
Epoch 45/100
300/300 [==============================] - 173s 578ms/step - loss: 1.7538 - accurac
y: 0.2442 - val_loss: 1.7656 - val_accuracy: 0.2003 - lr: 1.0000e-05
Epoch 46/100
300/300 [==============================] - 173s 579ms/step - loss: 1.7645 - accurac
y: 0.2167 - val_loss: 1.7671 - val_accuracy: 0.1987 - lr: 1.0000e-05
WARNING:absl:`lr` is deprecated, please use `learning_rate` instead, or use the lega
cy optimizer, e.g.,tf.keras.optimizers.legacy.Adam.
Epoch 1/100
300/300 [==============================] - 561s 2s/step - loss: 0.6806 - accuracy:
0.7713 - val_loss: 3.1886 - val_accuracy: 0.1669 - lr: 0.0010
Epoch 2/100
300/300 [==============================] - 519s 2s/step - loss: 0.3832 - accuracy:
0.8675 - val_loss: 3.0712 - val_accuracy: 0.1669 - lr: 0.0010
Epoch 3/100
300/300 [==============================] - 531s 2s/step - loss: 0.2985 - accuracy:
0.9042 - val_loss: 5.0390 - val_accuracy: 0.1920 - lr: 0.0010
Epoch 4/100
300/300 [==============================] - 520s 2s/step - loss: 0.2444 - accuracy:
0.9183 - val_loss: 25.4544 - val_accuracy: 0.1770 - lr: 0.0010
Epoch 5/100
300/300 [==============================] - 518s 2s/step - loss: 0.2822 - accuracy:
0.9112 - val_loss: 6.1993 - val_accuracy: 0.1803 - lr: 0.0010
Epoch 6/100
300/300 [==============================] - 520s 2s/step - loss: 0.2336 - accuracy:
0.9258 - val_loss: 2.9479 - val_accuracy: 0.1653 - lr: 0.0010
Epoch 7/100
300/300 [==============================] - 522s 2s/step - loss: 0.1758 - accuracy:
0.9413 - val_loss: 3.8571 - val_accuracy: 0.1820 - lr: 0.0010
Epoch 8/100
300/300 [==============================] - 522s 2s/step - loss: 0.1748 - accuracy:
0.9450 - val_loss: 7.0559 - val_accuracy: 0.1669 - lr: 0.0010
Epoch 9/100
300/300 [==============================] - 517s 2s/step - loss: 0.1954 - accuracy:
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0.9358 - val_loss: 6.7899 - val_accuracy: 0.1669 - lr: 0.0010
Epoch 10/100
300/300 [==============================] - 518s 2s/step - loss: 0.1457 - accuracy:
0.9529 - val_loss: 14.3089 - val_accuracy: 0.1669 - lr: 0.0010
Epoch 11/100
300/300 [==============================] - 517s 2s/step - loss: 0.1496 - accuracy:
0.9517 - val_loss: 6.7682 - val_accuracy: 0.1619 - lr: 0.0010
Epoch 12/100
300/300 [==============================] - 515s 2s/step - loss: 0.0881 - accuracy:
0.9688 - val_loss: 1.0620 - val_accuracy: 0.7229 - lr: 2.0000e-04
Epoch 13/100
300/300 [==============================] - 507s 2s/step - loss: 0.0439 - accuracy:
0.9879 - val_loss: 0.3089 - val_accuracy: 0.9249 - lr: 2.0000e-04
Epoch 14/100
300/300 [==============================] - 519s 2s/step - loss: 0.0467 - accuracy:
0.9862 - val_loss: 1.1661 - val_accuracy: 0.6928 - lr: 2.0000e-04
Epoch 15/100
300/300 [==============================] - 517s 2s/step - loss: 0.0291 - accuracy:
0.9908 - val_loss: 1.5583 - val_accuracy: 0.6995 - lr: 2.0000e-04
Epoch 16/100
300/300 [==============================] - 515s 2s/step - loss: 0.0415 - accuracy:
0.9850 - val_loss: 2.4371 - val_accuracy: 0.4290 - lr: 2.0000e-04
Epoch 17/100
300/300 [==============================] - 523s 2s/step - loss: 0.0285 - accuracy:
0.9925 - val_loss: 0.7543 - val_accuracy: 0.8164 - lr: 2.0000e-04
Epoch 18/100
300/300 [==============================] - 510s 2s/step - loss: 0.0243 - accuracy:
0.9925 - val_loss: 2.9952 - val_accuracy: 0.4641 - lr: 2.0000e-04
Epoch 19/100
300/300 [==============================] - 517s 2s/step - loss: 0.0214 - accuracy:
0.9937 - val_loss: 0.0030 - val_accuracy: 1.0000 - lr: 4.0000e-05
Epoch 20/100
300/300 [==============================] - 519s 2s/step - loss: 0.0194 - accuracy:
0.9958 - val_loss: 0.0038 - val_accuracy: 1.0000 - lr: 4.0000e-05
Epoch 21/100
300/300 [==============================] - 520s 2s/step - loss: 0.0173 - accuracy:
0.9954 - val_loss: 0.0023 - val_accuracy: 1.0000 - lr: 4.0000e-05
Epoch 22/100
300/300 [==============================] - 519s 2s/step - loss: 0.0145 - accuracy:
0.9962 - val_loss: 0.0141 - val_accuracy: 0.9967 - lr: 4.0000e-05
Epoch 23/100
300/300 [==============================] - 528s 2s/step - loss: 0.0120 - accuracy:
0.9971 - val_loss: 0.0710 - val_accuracy: 0.9733 - lr: 4.0000e-05
Epoch 24/100
300/300 [==============================] - 652s 2s/step - loss: 0.0130 - accuracy:
0.9962 - val_loss: 0.0025 - val_accuracy: 1.0000 - lr: 4.0000e-05
Epoch 25/100
300/300 [==============================] - 639s 2s/step - loss: 0.0087 - accuracy:
0.9983 - val_loss: 0.0101 - val_accuracy: 0.9983 - lr: 4.0000e-05
Epoch 26/100
300/300 [==============================] - 649s 2s/step - loss: 0.0075 - accuracy:
0.9987 - val_loss: 0.2796 - val_accuracy: 0.9316 - lr: 4.0000e-05
Epoch 27/100
300/300 [==============================] - 650s 2s/step - loss: 0.0110 - accuracy:
0.9979 - val_loss: 0.0032 - val_accuracy: 0.9983 - lr: 1.0000e-05
Epoch 28/100
300/300 [==============================] - 650s 2s/step - loss: 0.0104 - accuracy:
0.9967 - val_loss: 0.0012 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 29/100
300/300 [==============================] - 549s 2s/step - loss: 0.0100 - accuracy:
0.9979 - val_loss: 9.7479e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 30/100
300/300 [==============================] - 416s 1s/step - loss: 0.0088 - accuracy:
0.9975 - val_loss: 0.0014 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 31/100
300/300 [==============================] - 415s 1s/step - loss: 0.0134 - accuracy:
0.9962 - val_loss: 5.7980e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 32/100
300/300 [==============================] - 416s 1s/step - loss: 0.0158 - accuracy:
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0.9975 - val_loss: 0.0071 - val_accuracy: 0.9983 - lr: 1.0000e-05
Epoch 33/100
300/300 [==============================] - 416s 1s/step - loss: 0.0105 - accuracy:
0.9975 - val_loss: 0.0018 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 34/100
300/300 [==============================] - 417s 1s/step - loss: 0.0087 - accuracy:
0.9992 - val_loss: 0.0015 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 35/100
300/300 [==============================] - 415s 1s/step - loss: 0.0078 - accuracy:
0.9975 - val_loss: 9.0518e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 36/100
300/300 [==============================] - 417s 1s/step - loss: 0.0059 - accuracy:
0.9996 - val_loss: 7.0204e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 37/100
300/300 [==============================] - 415s 1s/step - loss: 0.0098 - accuracy:
0.9975 - val_loss: 4.5426e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 38/100
300/300 [==============================] - 418s 1s/step - loss: 0.0071 - accuracy:
0.9992 - val_loss: 6.0702e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 39/100
300/300 [==============================] - 422s 1s/step - loss: 0.0101 - accuracy:
0.9979 - val_loss: 0.0013 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 40/100
300/300 [==============================] - 416s 1s/step - loss: 0.0084 - accuracy:
0.9979 - val_loss: 6.5971e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 41/100
300/300 [==============================] - 414s 1s/step - loss: 0.0106 - accuracy:
0.9967 - val_loss: 7.2131e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 42/100
300/300 [==============================] - 418s 1s/step - loss: 0.0099 - accuracy:
0.9971 - val_loss: 5.0673e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 43/100
300/300 [==============================] - 418s 1s/step - loss: 0.0065 - accuracy:
0.9987 - val_loss: 4.7697e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 44/100
300/300 [==============================] - 418s 1s/step - loss: 0.0096 - accuracy:
0.9975 - val_loss: 8.8538e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 45/100
300/300 [==============================] - 421s 1s/step - loss: 0.0075 - accuracy:
0.9987 - val_loss: 8.6841e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 46/100
300/300 [==============================] - 416s 1s/step - loss: 0.0083 - accuracy:
0.9975 - val_loss: 6.4586e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 47/100
300/300 [==============================] - 416s 1s/step - loss: 0.0080 - accuracy:
0.9979 - val_loss: 4.1072e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 48/100
300/300 [==============================] - 416s 1s/step - loss: 0.0079 - accuracy:
0.9979 - val_loss: 4.7236e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 49/100
300/300 [==============================] - 415s 1s/step - loss: 0.0082 - accuracy:
0.9975 - val_loss: 4.6998e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 50/100
300/300 [==============================] - 415s 1s/step - loss: 0.0067 - accuracy:
0.9987 - val_loss: 5.2836e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 51/100
300/300 [==============================] - 419s 1s/step - loss: 0.0108 - accuracy:
0.9979 - val_loss: 4.8905e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 52/100
300/300 [==============================] - 417s 1s/step - loss: 0.0053 - accuracy:
0.9992 - val_loss: 0.0011 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 53/100
300/300 [==============================] - 416s 1s/step - loss: 0.0044 - accuracy:
0.9996 - val_loss: 5.7278e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 54/100
300/300 [==============================] - 413s 1s/step - loss: 0.0078 - accuracy:
0.9979 - val_loss: 6.8032e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 55/100
300/300 [==============================] - 428s 1s/step - loss: 0.0064 - accuracy:
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0.9987 - val_loss: 8.0859e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 56/100
300/300 [==============================] - 415s 1s/step - loss: 0.0047 - accuracy:
0.9992 - val_loss: 3.1052e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 57/100
300/300 [==============================] - 414s 1s/step - loss: 0.0131 - accuracy:
0.9954 - val_loss: 0.0020 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 58/100
300/300 [==============================] - 414s 1s/step - loss: 0.0076 - accuracy:
0.9983 - val_loss: 4.2991e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 59/100
300/300 [==============================] - 415s 1s/step - loss: 0.0053 - accuracy:
0.9987 - val_loss: 3.7668e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 60/100
300/300 [==============================] - 418s 1s/step - loss: 0.0093 - accuracy:
0.9979 - val_loss: 5.6501e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 61/100
300/300 [==============================] - 415s 1s/step - loss: 0.0059 - accuracy:
0.9996 - val_loss: 7.6682e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 62/100
300/300 [==============================] - 416s 1s/step - loss: 0.0097 - accuracy:
0.9975 - val_loss: 4.1299e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 63/100
300/300 [==============================] - 416s 1s/step - loss: 0.0059 - accuracy:
0.9996 - val_loss: 4.4858e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 64/100
300/300 [==============================] - 420s 1s/step - loss: 0.0045 - accuracy:
0.9996 - val_loss: 7.0026e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 65/100
300/300 [==============================] - 422s 1s/step - loss: 0.0069 - accuracy:
0.9987 - val_loss: 0.0010 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 66/100
300/300 [==============================] - 417s 1s/step - loss: 0.0048 - accuracy:
0.9992 - val_loss: 2.4333e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 67/100
300/300 [==============================] - 415s 1s/step - loss: 0.0072 - accuracy:
0.9979 - val_loss: 3.4570e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 68/100
300/300 [==============================] - 419s 1s/step - loss: 0.0042 - accuracy:
0.9992 - val_loss: 2.2983e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 69/100
300/300 [==============================] - 419s 1s/step - loss: 0.0036 - accuracy:
0.9996 - val_loss: 2.6770e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 70/100
300/300 [==============================] - 417s 1s/step - loss: 0.0057 - accuracy:
0.9983 - val_loss: 2.8992e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 71/100
300/300 [==============================] - 417s 1s/step - loss: 0.0095 - accuracy:
0.9979 - val_loss: 2.4301e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 72/100
300/300 [==============================] - 419s 1s/step - loss: 0.0062 - accuracy:
0.9987 - val_loss: 2.6647e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 73/100
300/300 [==============================] - 435s 1s/step - loss: 0.0030 - accuracy:
0.9996 - val_loss: 2.5045e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 74/100
300/300 [==============================] - 426s 1s/step - loss: 0.0067 - accuracy:
0.9983 - val_loss: 1.8708e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 75/100
300/300 [==============================] - 419s 1s/step - loss: 0.0036 - accuracy:
0.9996 - val_loss: 2.2721e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 76/100
300/300 [==============================] - 420s 1s/step - loss: 0.0049 - accuracy:
0.9992 - val_loss: 2.6728e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 77/100
300/300 [==============================] - 421s 1s/step - loss: 0.0049 - accuracy:
0.9983 - val_loss: 0.0024 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 78/100
300/300 [==============================] - 420s 1s/step - loss: 0.0039 - accuracy:
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0.9992 - val_loss: 2.7184e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 79/100
300/300 [==============================] - 420s 1s/step - loss: 0.0046 - accuracy:
0.9987 - val_loss: 2.4079e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 80/100
300/300 [==============================] - 417s 1s/step - loss: 0.0037 - accuracy:
0.9992 - val_loss: 1.7322e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 81/100
300/300 [==============================] - 424s 1s/step - loss: 0.0044 - accuracy:
0.9996 - val_loss: 3.8968e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 82/100
300/300 [==============================] - 422s 1s/step - loss: 0.0037 - accuracy:
0.9992 - val_loss: 3.1726e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 83/100
300/300 [==============================] - 420s 1s/step - loss: 0.0047 - accuracy:
0.9987 - val_loss: 3.8338e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 84/100
300/300 [==============================] - 418s 1s/step - loss: 0.0075 - accuracy:
0.9983 - val_loss: 2.1682e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 85/100
300/300 [==============================] - 443s 1s/step - loss: 0.0115 - accuracy:
0.9983 - val_loss: 2.1871e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 86/100
300/300 [==============================] - 423s 1s/step - loss: 0.0070 - accuracy:
0.9979 - val_loss: 2.7122e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 87/100
300/300 [==============================] - 418s 1s/step - loss: 0.0041 - accuracy:
0.9996 - val_loss: 2.4211e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 88/100
300/300 [==============================] - 419s 1s/step - loss: 0.0043 - accuracy:
0.9992 - val_loss: 2.0730e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 89/100
300/300 [==============================] - 419s 1s/step - loss: 0.0030 - accuracy:
0.9992 - val_loss: 1.8479e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
Epoch 90/100
300/300 [==============================] - 421s 1s/step - loss: 0.0056 - accuracy:
0.9979 - val_loss: 2.1296e-04 - val_accuracy: 1.0000 - lr: 1.0000e-05
30/30 [==============================] - 11s 379ms/step - loss: 0.0029 - accuracy:
1.0000
Test loss: 0.002871558303013444 / Test accuracy: 1.0
```

In [ ]: