

200207u-ma4144inclass4-cnn

October 28, 2024

#

Convolutional Neural Networks

##

Inclass Project 4 - MA4144

This project contains 5 tasks/questions to be completed, some require written answers. Open a markdown cell below the respective question that require written answers and provide (type) your answers. Questions that required written answers are given in blue fonts. Almost all written questions are open ended, they do not have a correct or wrong answer. You are free to give your opinions, but please provide related answers within the context.

After finishing project run the entire notebook once and **save the notebook as a pdf** (File menu -> Save and Export Notebook As -> PDF). You are **required to upload this PDF on moodle**.

0.1 Outline of the project

The aim of the project is to practically learn and implement about CNN. This project will have two main sections.

Section 1: Build a convolutional layer and pooling layer from scratch. Then test them on a sample image.

Section 2: Use the Keras library to implement a CNN to classify images on the [CIFAR10 dataset](#).

Use the below cell to use any include any imports

```
[20]: import numpy as np
import matplotlib.pyplot as plt
import random
from keras.preprocessing.image import load_img, img_to_array
import keras
from keras import models, layers
from keras.regularizers import l1, l2
from keras.callbacks import ReduceLROnPlateau, EarlyStopping
from keras.optimizers import Adam
from sklearn.model_selection import KFold
```

```
from sklearn.metrics import confusion_matrix, ConfusionMatrixDisplay, \
classification_report
```

0.2 Section 1: Convolution and Pooling

Q1 In the following cell, implement a method called `create_padding`. The method will take in `input_image` ($n \times m$) and will return a zero-padded image called `output_image` of dimension $(n + 2d) \times (m + 2d)$ where d is the padding thickness on either side.

```
[21]: def create_padding(input_image, d):

    #TODO
    output_image = np.pad(input_image, pad_width=d, mode="constant", \
    constant_values=0)
    return output_image
```

Q2 In the following cell, implement a method called `convolution`. The method will take in `input_image` ($n \times m$), `kernel` ($k \times k$) and will return `output_image` of dimension $(n - k + 1) \times (m - k + 1)$. The `output_image` is the result of the convolution between `input_image` and `kernel`. You may assume that the stride is 1.

```
[23]: def convolution(input_image, kernel):

    #TODO
    # output_image = keras.layers.Conv2D(1,3)(input_image)
    arr = np.asarray(input_image)
    arr = arr[:, :, 0]
    n, m = arr.shape
    k = kernel.shape[0]
    output_image = np.zeros((n-k+1, m-k+1))
    for i in range(n-k+1):
        for j in range(m-k+1):
            matrix = arr[i:i+k, j:j+k]
            temp = np.einsum("i,i->", kernel.flatten(), matrix.flatten())
            output_image[i][j] = np.maximum(temp, 0)

    return output_image
```

Q3 In the following cell, implement a method called `pooling`. The method will take in `input_image` ($n \times m$), p the pooling dimension, `pooling_type` (either `max_pooling` or `avg_pooling`) and will return `output_image` of dimension $(n - p + 1) \times (m - p + 1)$. The `output_image` is the result of performing pooling on `input_image` by a window of dimension $p \times p$. You may assume that the stride is 1.

```
[24]: def pooling(input_image, p, pooling_type = "max_pooling"):

    if pooling_type == "max_pooling":
```

```

    #TODO
    # max_pooling2D = keras.layers.MaxPool2D(pool_size=(p,p), strides=(1,1))
    # output_image = max_pooling2D(input_image)
    n,m = input_image.shape
    output_image = np.zeros((n-p+1,m-p+1))
    for i in range(n-p+1):
        for j in range(m-p+1):
            matrix = input_image[i:i+p, j:j+p]
            output_image[i][j] = np.max(matrix.flatten())
        pass

    elif pooling_type == "avg_pooling":

        #TODO
        # avg_pooling2D = keras.layers.AveragePooling2D(pool_size=(p,p),
        ↪strides=(1,1))
        # output_image = avg_pooling2D(input_image)
        n,m = input_image.size
        output_image = np.zeros((n-p+1,m-p+1))
        for i in range(n-p+1):
            for j in range(m-p+1):
                matrix = input_image[i:i+p, j:j+p]
                output_image[i][j] = np.average(matrix.flatten())
            pass

    else:
        print("Error: Invalid pooling type")
        return

    return(output_image)

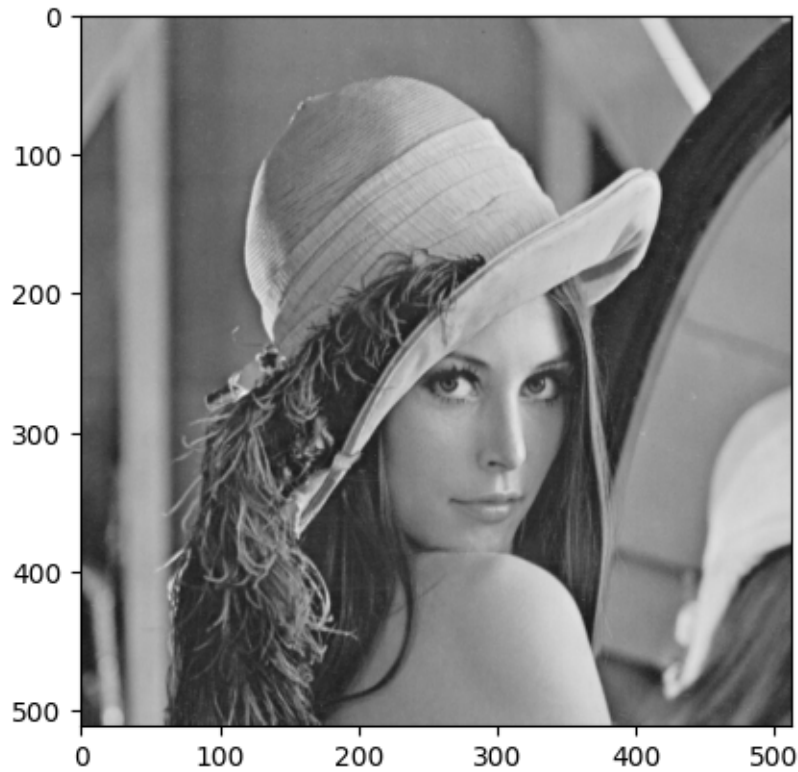
```

The ‘lena’ image is widely used for image processing experiments and has been a benchmark image until recently. We will use a 512×512 grayscale lena sample to test our convolution and pooling implementations.

```

[25]: lena = load_img('/kaggle/input/lenaimage/lena.gif')
      plt.imshow(lena)
      plt.show()

```



Q4 In the following perform convolution on lena. Make sure you use padding appropriately to maintain the image size after convolution. However, pooling should be done on an unpadded image and image size may not be preserved after pooling. Use the following kernels to perform convolution separately.

1.
$$\begin{bmatrix} +1 & 0 & -1 \\ +1 & 0 & -1 \\ +1 & 0 & -1 \end{bmatrix}$$

2.
$$\begin{bmatrix} -1 & -1 & -1 \\ 0 & 0 & 0 \\ +1 & +1 & +1 \end{bmatrix}$$

3.
$$\begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix}$$

4.
$$\begin{bmatrix} +1 & +2 & +1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$$

5. Any other kernel that you may find interesting.

Explain what the above kernels (including your choice) will do to the image.

Answer (to write answers edit this cell)

K1 = This is a vertical edge detection filter. it highlights verticle edges in an image. When there is a transition from dark to light vertically, this will highlish it.

K2 = This is a horizontal edge detection filter. it highlights horizontal edges in an image. When there is a transition from dark to light horizontally, this will highlish it.

K3 = This is another vertical edge detector, but this will show stronger verticle edges in the output image.

k4 = This is another horizontal edge detector, but this will show stronger horizontal edges in the output image.

k5 = This will highlight the changes diagonally.

```
[13]: #TODO
      #Write code to use your convolution and pooling methods.
      k1 = np.array([[1,0,-1],[1,0,-1],[1,0,-1]])
      k2 = np.array([[-1,-1,-1],[0,0,0],[1,1,1]])
      k3 = np.array([[-1,0,1],[-2,0,2],[-1,0,1]])
      k4 = np.array([[1,2,1],[0,0,0],[-1,-2,-1]])
      k5 = np.array([[2,-1,-1],[-1,2,-1],[-1,-1,2]])

      # lena_array = img_to_array(lena)
      # lena_array = np.expand_dims(lena_array, axis=0)

      def conv_pool_plot(k,i):
          conv_image = convolution(lena,k)

          plt.figure(figsize=(10,5))
          plt.subplot(1,2,1)
          plt.imshow(conv_image)
          plt.title("After convolution")

          conv_image = create_padding(conv_image, k.shape[0]-1)

          pooled_image = pooling(conv_image,3)
          plt.subplot(1,2,2)
          plt.imshow(pooled_image)
          plt.title("After pooling")

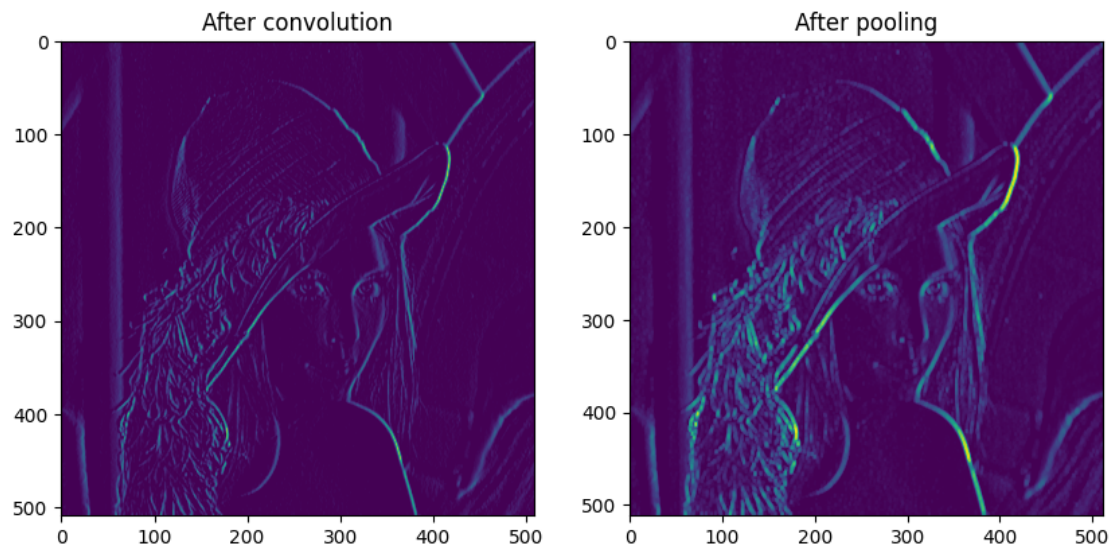
          plt.suptitle("kernel number "+str(i))
          plt.show()

          return

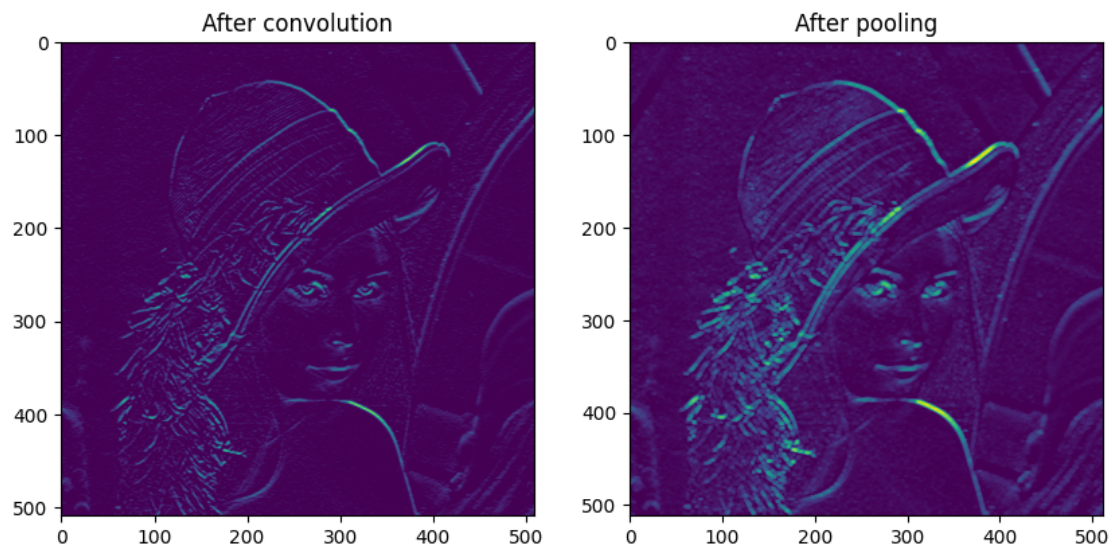
      # k1
      conv_pool_plot(k1,1)
      # k2
      conv_pool_plot(k2,2)
      # k3
      conv_pool_plot(k3,3)
```

```
# k4  
conv_pool_plot(k4,4)  
# k5  
conv_pool_plot(k5,5)
```

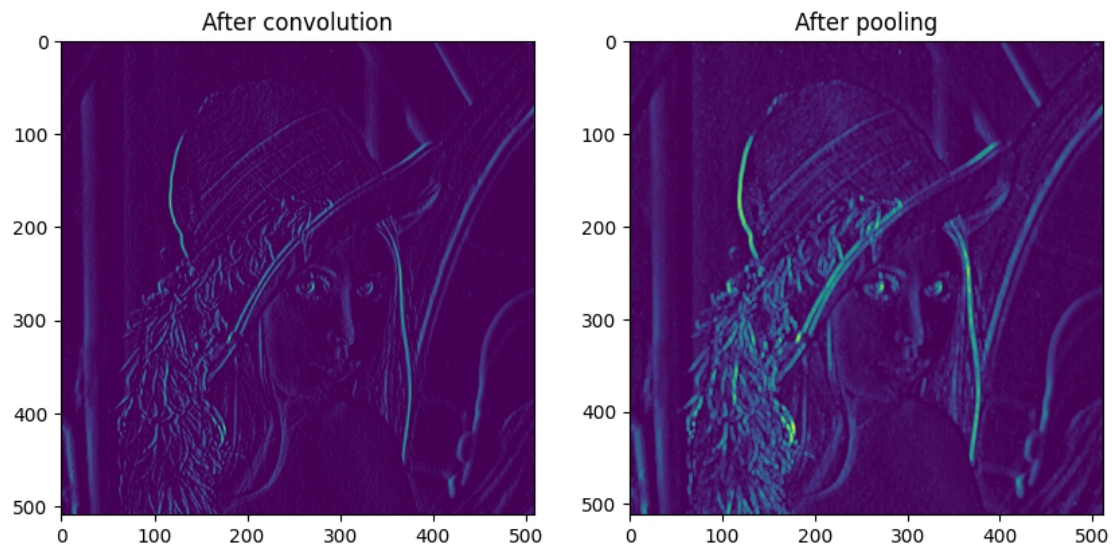
kernel number 1



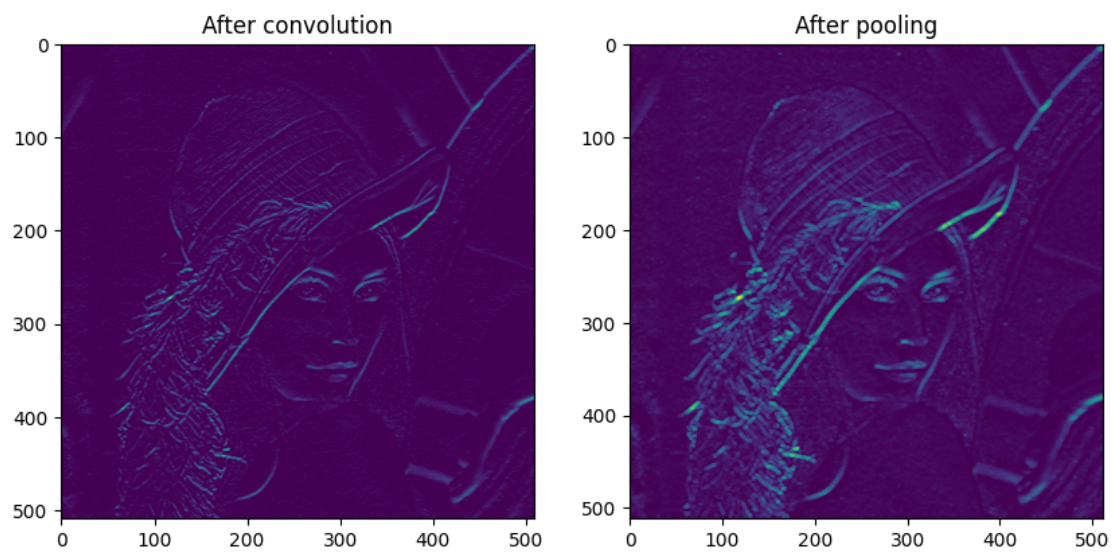
kernel number 2

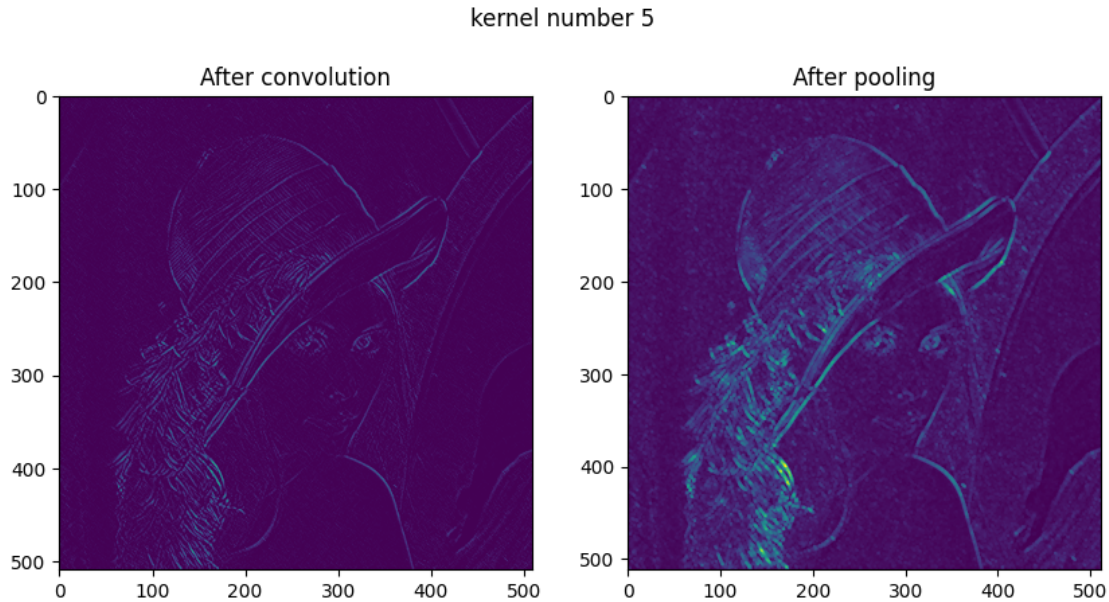


kernel number 3



kernel number 4





Show the resulting image after convolution and pooling separately on two subplots (of the same plot) for each kernel. There should be 5 plots with two sub plots in each.

Comment on the results of the above experiment. Mention whether you think the experiment was successful, and what your learnt from it.

Answer (to write answers edit this cell)

k1, k3 = Vertical edges are highlighted.
k2, k4 = Horizontal edges are highlighted.
k5 = Diagonal changes are highlighted.

The experiment is successful as we can clearly see the details of the images through the output images.

How to use kernels intentionally to obtain information about the images in image classification was observed during this experiment.

0.3 Section 2: Using Keras to implement CNN for image classification

This section, unlike the previous projects you are granted full liberty to build the structure of your project appropriately using keras. I have provided only the code to download the cifar10 dataset. After using CNN on the dataset, provide the following. (Note that cifar10 contains rgb images with 3 channels unlike the grayscale image lena we used earlier.)

1. 5-fold cross validation accuracy.
2. Testing accuracy.
3. Confusion matrix of the result.
4. Precision recall for each class.

Note: You are required test on different hyperparameters and network architectures and select decide the best performer based on the cross-validation accuracy.

```
[15]: (x_train, y_train), (x_test, y_test) = keras.datasets.cifar10.load_data()
```

```
[14]: #TODO
```

```
#Include necessary code in this cell, or cells added below as required.
```

```
def CNN(batch_size, no_epochs, l1_val, drop_out, init_lr):

    kfold = KFold(n_splits=5, shuffle=True)
    fold_no = 1
    acc_per_fold = []
    loss_per_fold = []

    all_train_accuracies = []
    all_val_accuracies = []

    for train, val in kfold.split(x_train, y_train):

        model = models.Sequential()

        model.add(layers.Conv2D(64, (3, 3), activation="relu",
↪input_shape=(32,32,3)))
        model.add(layers.BatchNormalization())
        model.add(layers.Dropout(drop_out))

        model.add(layers.Conv2D(128, (3, 3), activation="relu"))
        model.add(layers.BatchNormalization())
        model.add(layers.MaxPool2D((2,2)))
        model.add(layers.Dropout(drop_out))

        model.add(layers.Conv2D(256, (3, 3), activation="relu",
↪kernel_regularizer=l2(l1_val)))
        model.add(layers.BatchNormalization())
        model.add(layers.MaxPool2D((2,2)))
        model.add(layers.Dropout(drop_out))

        model.add(layers.Conv2D(512, (3, 3), activation="relu",
↪kernel_regularizer=l2(l1_val)))
        model.add(layers.BatchNormalization())
        model.add(layers.MaxPool2D((2,2)))
        model.add(layers.Dropout(drop_out))

        model.add(layers.Flatten())
```

```

        model.add(layers.Dense(256, activation="relu",
↪kernel_regularizer=l2(l1_val)))
        model.add(layers.BatchNormalization())
        model.add(layers.Dropout(drop_out))

        model.add(layers.Dense(128, activation="relu",
↪kernel_regularizer=l2(l1_val)))
        model.add(layers.BatchNormalization())
        model.add(layers.Dropout(drop_out))

        model.add(layers.Dense(10, activation="softmax"))

        model.compile(optimizer=Adam(learning_rate=init_lr),
                        loss=keras.losses.
↪SparseCategoricalCrossentropy(from_logits=False),
                        metrics=["accuracy"])

        lr_scheduler = ReduceLROnPlateau(monitor='val_loss', factor=0.5,
↪patience=5, min_lr=1e-6)
        early_stopping = EarlyStopping(monitor='val_loss', patience=15,
↪restore_best_weights=True)

        history = model.fit(x_train[train], y_train[train],
                            batch_size=batch_size,
                            epochs=no_epochs,
                            validation_data=(x_train[val], y_train[val]),
                            callbacks=[lr_scheduler, early_stopping])

        all_train_accuracies.append(history.history["accuracy"])
        all_val_accuracies.append(history.history["val_accuracy"])

        test_loss, test_acc = model.evaluate(x_test, y_test, verbose=0)
        print(f'Score for fold {fold_no}: test loss of {test_loss}; test
↪accuracy of {test_acc*100}%')
        acc_per_fold.append(test_acc * 100)
        loss_per_fold.append(test_loss)

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

        cm = confusion_matrix(y_test, y_pred_classes)
        disp = ConfusionMatrixDisplay(confusion_matrix=cm)
        disp.plot(cmap=plt.cm.Blues)
        plt.title(f'Confusion Matrix for Fold {fold_no}')
        plt.show()

```

```

        report = classification_report(y_test, y_pred_classes,
        ↪target_names=[f'Class {i}' for i in range(10)])
        print(f'Classification Report for Fold {fold_no}:\n{report}')

    fold_no += 1

plt.figure(figsize=(15, 8))
for i in range(len(all_train_accuracies)):
    plt.subplot(2,3,i+1)
    plt.plot(all_train_accuracies[i], label="Train Accuracy")
    plt.plot(all_val_accuracies[i], label="Validation Accuracy")
    plt.title(f"Train / Val Accuracy for Fold {i}")
    plt.xlabel("Epoch")
    plt.ylabel("Accuracy")
    plt.legend()
plt.show()

avg_test_loss = np.average(loss_per_fold)
avg_test_acc = np.average(acc_per_fold)
print(f'Average test loss = {avg_test_loss}; Average test accuracy =
↪{avg_test_acc}%')
return

```

[16]: CNN(batch_size=256, no_epochs=250, l1_val=0.005, drop_out=0.5, init_lr=0.001)

/opt/conda/lib/python3.10/site-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. When using Sequential models, prefer using an `Input(shape)` object as the first layer in the model instead.

```
super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Epoch 1/250

157/157 40s 128ms/step -
accuracy: 0.2024 - loss: 8.1069 - val_accuracy: 0.3093 - val_loss: 5.6062 -
learning_rate: 0.0010

Epoch 2/250

157/157 8s 52ms/step -
accuracy: 0.3750 - loss: 4.9492 - val_accuracy: 0.3097 - val_loss: 3.9574 -
learning_rate: 0.0010

Epoch 3/250

157/157 8s 53ms/step -
accuracy: 0.4742 - loss: 3.2297 - val_accuracy: 0.3800 - val_loss: 2.9975 -
learning_rate: 0.0010

Epoch 4/250

157/157 8s 53ms/step -
accuracy: 0.5322 - loss: 2.5180 - val_accuracy: 0.5520 - val_loss: 2.2704 -

learning_rate: 0.0010
Epoch 5/250
157/157 8s 52ms/step -
accuracy: 0.5918 - loss: 2.1658 - val_accuracy: 0.6011 - val_loss: 2.0648 -
learning_rate: 0.0010
Epoch 6/250
157/157 8s 52ms/step -
accuracy: 0.6264 - loss: 2.0251 - val_accuracy: 0.6148 - val_loss: 2.0690 -
learning_rate: 0.0010
Epoch 7/250
157/157 8s 52ms/step -
accuracy: 0.6397 - loss: 2.0206 - val_accuracy: 0.6660 - val_loss: 1.9607 -
learning_rate: 0.0010
Epoch 8/250
157/157 8s 51ms/step -
accuracy: 0.6569 - loss: 1.9971 - val_accuracy: 0.6724 - val_loss: 1.9516 -
learning_rate: 0.0010
Epoch 9/250
157/157 8s 51ms/step -
accuracy: 0.6586 - loss: 1.9983 - val_accuracy: 0.6927 - val_loss: 1.8997 -
learning_rate: 0.0010
Epoch 10/250
157/157 8s 51ms/step -
accuracy: 0.6649 - loss: 1.9872 - val_accuracy: 0.6641 - val_loss: 1.9968 -
learning_rate: 0.0010
Epoch 11/250
157/157 8s 51ms/step -
accuracy: 0.6777 - loss: 1.9866 - val_accuracy: 0.7027 - val_loss: 1.9041 -
learning_rate: 0.0010
Epoch 12/250
157/157 8s 51ms/step -
accuracy: 0.6782 - loss: 1.9929 - val_accuracy: 0.6962 - val_loss: 1.9387 -
learning_rate: 0.0010
Epoch 13/250
157/157 8s 52ms/step -
accuracy: 0.6818 - loss: 1.9831 - val_accuracy: 0.7182 - val_loss: 1.8494 -
learning_rate: 0.0010
Epoch 14/250
157/157 8s 52ms/step -
accuracy: 0.6832 - loss: 1.9863 - val_accuracy: 0.7146 - val_loss: 1.8488 -
learning_rate: 0.0010
Epoch 15/250
157/157 8s 52ms/step -
accuracy: 0.6972 - loss: 1.9365 - val_accuracy: 0.7014 - val_loss: 1.8851 -
learning_rate: 0.0010
Epoch 16/250
157/157 8s 52ms/step -
accuracy: 0.6908 - loss: 1.9602 - val_accuracy: 0.6978 - val_loss: 1.9295 -

```

learning_rate: 0.0010
Epoch 17/250
157/157          8s 52ms/step -
accuracy: 0.6979 - loss: 1.9593 - val_accuracy: 0.6905 - val_loss: 1.9440 -
learning_rate: 0.0010
Epoch 18/250
157/157          8s 51ms/step -
accuracy: 0.6952 - loss: 1.9628 - val_accuracy: 0.7119 - val_loss: 1.9151 -
learning_rate: 0.0010
Epoch 19/250
157/157          8s 51ms/step -
accuracy: 0.7007 - loss: 1.9710 - val_accuracy: 0.7358 - val_loss: 1.8761 -
learning_rate: 0.0010
Epoch 20/250
157/157          8s 51ms/step -
accuracy: 0.7246 - loss: 1.8516 - val_accuracy: 0.7572 - val_loss: 1.5682 -
learning_rate: 5.0000e-04
Epoch 21/250
157/157          8s 51ms/step -
accuracy: 0.7447 - loss: 1.6001 - val_accuracy: 0.7448 - val_loss: 1.5414 -
learning_rate: 5.0000e-04
Epoch 22/250
157/157          8s 51ms/step -
accuracy: 0.7446 - loss: 1.5430 - val_accuracy: 0.7545 - val_loss: 1.4883 -
learning_rate: 5.0000e-04
Epoch 23/250
157/157          8s 51ms/step -
accuracy: 0.7468 - loss: 1.5266 - val_accuracy: 0.7902 - val_loss: 1.4227 -
learning_rate: 5.0000e-04
Epoch 24/250
157/157          8s 51ms/step -
accuracy: 0.7513 - loss: 1.5275 - val_accuracy: 0.7748 - val_loss: 1.4402 -
learning_rate: 5.0000e-04
Epoch 25/250
157/157          8s 51ms/step -
accuracy: 0.7504 - loss: 1.5188 - val_accuracy: 0.7678 - val_loss: 1.4712 -
learning_rate: 5.0000e-04
Epoch 26/250
157/157          8s 52ms/step -
accuracy: 0.7538 - loss: 1.5023 - val_accuracy: 0.7863 - val_loss: 1.4152 -
learning_rate: 5.0000e-04
Epoch 27/250
157/157          8s 51ms/step -
accuracy: 0.7622 - loss: 1.4890 - val_accuracy: 0.7781 - val_loss: 1.4322 -
learning_rate: 5.0000e-04
Epoch 28/250
157/157          8s 51ms/step -
accuracy: 0.7576 - loss: 1.5074 - val_accuracy: 0.7755 - val_loss: 1.4525 -

```

```

learning_rate: 5.0000e-04
Epoch 29/250
157/157      8s 51ms/step -
accuracy: 0.7596 - loss: 1.4942 - val_accuracy: 0.7925 - val_loss: 1.3963 -
learning_rate: 5.0000e-04
Epoch 30/250
157/157      8s 51ms/step -
accuracy: 0.7648 - loss: 1.4665 - val_accuracy: 0.7716 - val_loss: 1.4638 -
learning_rate: 5.0000e-04
Epoch 31/250
157/157      8s 51ms/step -
accuracy: 0.7639 - loss: 1.4715 - val_accuracy: 0.7828 - val_loss: 1.4080 -
learning_rate: 5.0000e-04
Epoch 32/250
157/157      8s 51ms/step -
accuracy: 0.7652 - loss: 1.4763 - val_accuracy: 0.7930 - val_loss: 1.3919 -
learning_rate: 5.0000e-04
Epoch 33/250
157/157      8s 51ms/step -
accuracy: 0.7660 - loss: 1.4632 - val_accuracy: 0.7814 - val_loss: 1.4067 -
learning_rate: 5.0000e-04
Epoch 34/250
157/157      8s 51ms/step -
accuracy: 0.7659 - loss: 1.4837 - val_accuracy: 0.7935 - val_loss: 1.4038 -
learning_rate: 5.0000e-04
Epoch 35/250
157/157      8s 51ms/step -
accuracy: 0.7724 - loss: 1.4571 - val_accuracy: 0.7752 - val_loss: 1.4231 -
learning_rate: 5.0000e-04
Epoch 36/250
157/157      8s 51ms/step -
accuracy: 0.7707 - loss: 1.4542 - val_accuracy: 0.7847 - val_loss: 1.4054 -
learning_rate: 5.0000e-04
Epoch 37/250
157/157      8s 51ms/step -
accuracy: 0.7720 - loss: 1.4427 - val_accuracy: 0.7897 - val_loss: 1.3803 -
learning_rate: 5.0000e-04
Epoch 38/250
157/157      8s 51ms/step -
accuracy: 0.7737 - loss: 1.4398 - val_accuracy: 0.7909 - val_loss: 1.3916 -
learning_rate: 5.0000e-04
Epoch 39/250
157/157      8s 51ms/step -
accuracy: 0.7748 - loss: 1.4412 - val_accuracy: 0.7962 - val_loss: 1.3605 -
learning_rate: 5.0000e-04
Epoch 40/250
157/157      8s 51ms/step -
accuracy: 0.7761 - loss: 1.4346 - val_accuracy: 0.8084 - val_loss: 1.3337 -

```

```

learning_rate: 5.0000e-04
Epoch 41/250
157/157          8s 51ms/step -
accuracy: 0.7731 - loss: 1.4438 - val_accuracy: 0.7683 - val_loss: 1.4626 -
learning_rate: 5.0000e-04
Epoch 42/250
157/157          8s 50ms/step -
accuracy: 0.7721 - loss: 1.4446 - val_accuracy: 0.7995 - val_loss: 1.3716 -
learning_rate: 5.0000e-04
Epoch 43/250
157/157          8s 50ms/step -
accuracy: 0.7753 - loss: 1.4384 - val_accuracy: 0.7859 - val_loss: 1.3954 -
learning_rate: 5.0000e-04
Epoch 44/250
157/157          8s 50ms/step -
accuracy: 0.7787 - loss: 1.4240 - val_accuracy: 0.8065 - val_loss: 1.3402 -
learning_rate: 5.0000e-04
Epoch 45/250
157/157          8s 50ms/step -
accuracy: 0.7774 - loss: 1.4264 - val_accuracy: 0.7934 - val_loss: 1.3786 -
learning_rate: 5.0000e-04
Epoch 46/250
157/157          8s 50ms/step -
accuracy: 0.7874 - loss: 1.3811 - val_accuracy: 0.8014 - val_loss: 1.2750 -
learning_rate: 2.5000e-04
Epoch 47/250
157/157          8s 50ms/step -
accuracy: 0.8108 - loss: 1.2289 - val_accuracy: 0.8102 - val_loss: 1.1969 -
learning_rate: 2.5000e-04
Epoch 48/250
157/157          8s 50ms/step -
accuracy: 0.8062 - loss: 1.1932 - val_accuracy: 0.8226 - val_loss: 1.1344 -
learning_rate: 2.5000e-04
Epoch 49/250
157/157          8s 50ms/step -
accuracy: 0.8148 - loss: 1.1480 - val_accuracy: 0.8238 - val_loss: 1.1091 -
learning_rate: 2.5000e-04
Epoch 50/250
157/157          8s 50ms/step -
accuracy: 0.8128 - loss: 1.1380 - val_accuracy: 0.8143 - val_loss: 1.1255 -
learning_rate: 2.5000e-04
Epoch 51/250
157/157          8s 50ms/step -
accuracy: 0.8137 - loss: 1.1189 - val_accuracy: 0.8250 - val_loss: 1.0827 -
learning_rate: 2.5000e-04
Epoch 52/250
157/157          8s 50ms/step -
accuracy: 0.8160 - loss: 1.1112 - val_accuracy: 0.8361 - val_loss: 1.0553 -

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learning_rate: 2.5000e-04
Epoch 53/250
157/157      8s 50ms/step -
accuracy: 0.8183 - loss: 1.0908 - val_accuracy: 0.8319 - val_loss: 1.0651 -
learning_rate: 2.5000e-04
Epoch 54/250
157/157      8s 50ms/step -
accuracy: 0.8222 - loss: 1.0859 - val_accuracy: 0.8291 - val_loss: 1.0648 -
learning_rate: 2.5000e-04
Epoch 55/250
157/157      8s 50ms/step -
accuracy: 0.8162 - loss: 1.0979 - val_accuracy: 0.8339 - val_loss: 1.0415 -
learning_rate: 2.5000e-04
Epoch 56/250
157/157      8s 50ms/step -
accuracy: 0.8188 - loss: 1.0894 - val_accuracy: 0.8274 - val_loss: 1.0593 -
learning_rate: 2.5000e-04
Epoch 57/250
157/157      8s 50ms/step -
accuracy: 0.8220 - loss: 1.0770 - val_accuracy: 0.8380 - val_loss: 1.0382 -
learning_rate: 2.5000e-04
Epoch 58/250
157/157      8s 50ms/step -
accuracy: 0.8216 - loss: 1.0790 - val_accuracy: 0.8270 - val_loss: 1.0781 -
learning_rate: 2.5000e-04
Epoch 59/250
157/157      8s 50ms/step -
accuracy: 0.8211 - loss: 1.0775 - val_accuracy: 0.8383 - val_loss: 1.0276 -
learning_rate: 2.5000e-04
Epoch 60/250
157/157      8s 50ms/step -
accuracy: 0.8222 - loss: 1.0690 - val_accuracy: 0.8356 - val_loss: 1.0349 -
learning_rate: 2.5000e-04
Epoch 61/250
157/157      8s 50ms/step -
accuracy: 0.8222 - loss: 1.0669 - val_accuracy: 0.8383 - val_loss: 1.0390 -
learning_rate: 2.5000e-04
Epoch 62/250
157/157      8s 50ms/step -
accuracy: 0.8282 - loss: 1.0604 - val_accuracy: 0.8393 - val_loss: 1.0286 -
learning_rate: 2.5000e-04
Epoch 63/250
157/157      8s 50ms/step -
accuracy: 0.8270 - loss: 1.0582 - val_accuracy: 0.8299 - val_loss: 1.0504 -
learning_rate: 2.5000e-04
Epoch 64/250
157/157      8s 50ms/step -
accuracy: 0.8259 - loss: 1.0626 - val_accuracy: 0.8365 - val_loss: 1.0369 -

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learning_rate: 2.5000e-04
Epoch 65/250
157/157      8s 50ms/step -
accuracy: 0.8369 - loss: 1.0284 - val_accuracy: 0.8498 - val_loss: 0.9721 -
learning_rate: 1.2500e-04
Epoch 66/250
157/157      8s 50ms/step -
accuracy: 0.8476 - loss: 0.9689 - val_accuracy: 0.8471 - val_loss: 0.9517 -
learning_rate: 1.2500e-04
Epoch 67/250
157/157      8s 50ms/step -
accuracy: 0.8491 - loss: 0.9347 - val_accuracy: 0.8539 - val_loss: 0.9109 -
learning_rate: 1.2500e-04
Epoch 68/250
157/157      8s 50ms/step -
accuracy: 0.8486 - loss: 0.9175 - val_accuracy: 0.8478 - val_loss: 0.9197 -
learning_rate: 1.2500e-04
Epoch 69/250
157/157      8s 50ms/step -
accuracy: 0.8530 - loss: 0.9005 - val_accuracy: 0.8611 - val_loss: 0.8819 -
learning_rate: 1.2500e-04
Epoch 70/250
157/157      8s 50ms/step -
accuracy: 0.8575 - loss: 0.8709 - val_accuracy: 0.8539 - val_loss: 0.8857 -
learning_rate: 1.2500e-04
Epoch 71/250
157/157      8s 50ms/step -
accuracy: 0.8569 - loss: 0.8597 - val_accuracy: 0.8461 - val_loss: 0.9035 -
learning_rate: 1.2500e-04
Epoch 72/250
157/157      8s 50ms/step -
accuracy: 0.8611 - loss: 0.8434 - val_accuracy: 0.8556 - val_loss: 0.8651 -
learning_rate: 1.2500e-04
Epoch 73/250
157/157      8s 50ms/step -
accuracy: 0.8617 - loss: 0.8349 - val_accuracy: 0.8439 - val_loss: 0.8799 -
learning_rate: 1.2500e-04
Epoch 74/250
157/157      8s 50ms/step -
accuracy: 0.8600 - loss: 0.8291 - val_accuracy: 0.8584 - val_loss: 0.8435 -
learning_rate: 1.2500e-04
Epoch 75/250
157/157      8s 50ms/step -
accuracy: 0.8602 - loss: 0.8281 - val_accuracy: 0.8618 - val_loss: 0.8359 -
learning_rate: 1.2500e-04
Epoch 76/250
157/157      8s 50ms/step -
accuracy: 0.8641 - loss: 0.8129 - val_accuracy: 0.8580 - val_loss: 0.8384 -

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learning_rate: 1.2500e-04
Epoch 77/250
157/157          8s 50ms/step -
accuracy: 0.8650 - loss: 0.8072 - val_accuracy: 0.8622 - val_loss: 0.8179 -
learning_rate: 1.2500e-04
Epoch 78/250
157/157          8s 50ms/step -
accuracy: 0.8659 - loss: 0.7966 - val_accuracy: 0.8610 - val_loss: 0.8287 -
learning_rate: 1.2500e-04
Epoch 79/250
157/157          8s 50ms/step -
accuracy: 0.8631 - loss: 0.7962 - val_accuracy: 0.8634 - val_loss: 0.8194 -
learning_rate: 1.2500e-04
Epoch 80/250
157/157          8s 50ms/step -
accuracy: 0.8700 - loss: 0.7789 - val_accuracy: 0.8594 - val_loss: 0.8270 -
learning_rate: 1.2500e-04
Epoch 81/250
157/157          8s 50ms/step -
accuracy: 0.8629 - loss: 0.7906 - val_accuracy: 0.8618 - val_loss: 0.8206 -
learning_rate: 1.2500e-04
Epoch 82/250
157/157          8s 50ms/step -
accuracy: 0.8704 - loss: 0.7798 - val_accuracy: 0.8603 - val_loss: 0.8260 -
learning_rate: 1.2500e-04
Epoch 83/250
157/157          8s 50ms/step -
accuracy: 0.8712 - loss: 0.7700 - val_accuracy: 0.8641 - val_loss: 0.8035 -
learning_rate: 6.2500e-05
Epoch 84/250
157/157          8s 50ms/step -
accuracy: 0.8798 - loss: 0.7410 - val_accuracy: 0.8631 - val_loss: 0.7970 -
learning_rate: 6.2500e-05
Epoch 85/250
157/157          8s 50ms/step -
accuracy: 0.8848 - loss: 0.7187 - val_accuracy: 0.8679 - val_loss: 0.7769 -
learning_rate: 6.2500e-05
Epoch 86/250
157/157          8s 51ms/step -
accuracy: 0.8844 - loss: 0.7044 - val_accuracy: 0.8670 - val_loss: 0.7746 -
learning_rate: 6.2500e-05
Epoch 87/250
157/157          8s 51ms/step -
accuracy: 0.8875 - loss: 0.6922 - val_accuracy: 0.8692 - val_loss: 0.7599 -
learning_rate: 6.2500e-05
Epoch 88/250
157/157          8s 50ms/step -
accuracy: 0.8830 - loss: 0.6958 - val_accuracy: 0.8636 - val_loss: 0.7733 -

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learning_rate: 6.2500e-05
Epoch 89/250
157/157          8s 50ms/step -
accuracy: 0.8897 - loss: 0.6813 - val_accuracy: 0.8698 - val_loss: 0.7571 -
learning_rate: 6.2500e-05
Epoch 90/250
157/157          8s 50ms/step -
accuracy: 0.8894 - loss: 0.6688 - val_accuracy: 0.8719 - val_loss: 0.7461 -
learning_rate: 6.2500e-05
Epoch 91/250
157/157          8s 50ms/step -
accuracy: 0.8907 - loss: 0.6617 - val_accuracy: 0.8733 - val_loss: 0.7353 -
learning_rate: 6.2500e-05
Epoch 92/250
157/157          8s 51ms/step -
accuracy: 0.8916 - loss: 0.6495 - val_accuracy: 0.8702 - val_loss: 0.7339 -
learning_rate: 6.2500e-05
Epoch 93/250
157/157          8s 51ms/step -
accuracy: 0.8922 - loss: 0.6455 - val_accuracy: 0.8715 - val_loss: 0.7327 -
learning_rate: 6.2500e-05
Epoch 94/250
157/157         10s 50ms/step -
accuracy: 0.8923 - loss: 0.6386 - val_accuracy: 0.8746 - val_loss: 0.7197 -
learning_rate: 6.2500e-05
Epoch 95/250
157/157          8s 50ms/step -
accuracy: 0.8908 - loss: 0.6380 - val_accuracy: 0.8742 - val_loss: 0.7167 -
learning_rate: 6.2500e-05
Epoch 96/250
157/157          8s 50ms/step -
accuracy: 0.8963 - loss: 0.6231 - val_accuracy: 0.8714 - val_loss: 0.7243 -
learning_rate: 6.2500e-05
Epoch 97/250
157/157          8s 50ms/step -
accuracy: 0.8957 - loss: 0.6238 - val_accuracy: 0.8712 - val_loss: 0.7251 -
learning_rate: 6.2500e-05
Epoch 98/250
157/157          8s 50ms/step -
accuracy: 0.8956 - loss: 0.6211 - val_accuracy: 0.8727 - val_loss: 0.7092 -
learning_rate: 6.2500e-05
Epoch 99/250
157/157          8s 50ms/step -
accuracy: 0.8953 - loss: 0.6164 - val_accuracy: 0.8689 - val_loss: 0.7234 -
learning_rate: 6.2500e-05
Epoch 100/250
157/157          8s 50ms/step -
accuracy: 0.8975 - loss: 0.6090 - val_accuracy: 0.8736 - val_loss: 0.7039 -

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learning_rate: 6.2500e-05
Epoch 101/250
157/157          8s 50ms/step -
accuracy: 0.8963 - loss: 0.6102 - val_accuracy: 0.8752 - val_loss: 0.6979 -
learning_rate: 6.2500e-05
Epoch 102/250
157/157          8s 50ms/step -
accuracy: 0.8985 - loss: 0.5928 - val_accuracy: 0.8720 - val_loss: 0.7030 -
learning_rate: 6.2500e-05
Epoch 103/250
157/157          8s 50ms/step -
accuracy: 0.8981 - loss: 0.5950 - val_accuracy: 0.8708 - val_loss: 0.7116 -
learning_rate: 6.2500e-05
Epoch 104/250
157/157          8s 50ms/step -
accuracy: 0.8953 - loss: 0.5937 - val_accuracy: 0.8748 - val_loss: 0.7010 -
learning_rate: 6.2500e-05
Epoch 105/250
157/157          8s 50ms/step -
accuracy: 0.8974 - loss: 0.5939 - val_accuracy: 0.8765 - val_loss: 0.6958 -
learning_rate: 6.2500e-05
Epoch 106/250
157/157          8s 50ms/step -
accuracy: 0.8991 - loss: 0.5911 - val_accuracy: 0.8753 - val_loss: 0.6917 -
learning_rate: 6.2500e-05
Epoch 107/250
157/157          8s 50ms/step -
accuracy: 0.9031 - loss: 0.5736 - val_accuracy: 0.8763 - val_loss: 0.6845 -
learning_rate: 6.2500e-05
Epoch 108/250
157/157          8s 50ms/step -
accuracy: 0.9012 - loss: 0.5775 - val_accuracy: 0.8752 - val_loss: 0.6847 -
learning_rate: 6.2500e-05
Epoch 109/250
157/157          8s 50ms/step -
accuracy: 0.8956 - loss: 0.5872 - val_accuracy: 0.8749 - val_loss: 0.6877 -
learning_rate: 6.2500e-05
Epoch 110/250
157/157          8s 50ms/step -
accuracy: 0.9053 - loss: 0.5684 - val_accuracy: 0.8741 - val_loss: 0.6893 -
learning_rate: 6.2500e-05
Epoch 111/250
157/157          8s 50ms/step -
accuracy: 0.9016 - loss: 0.5725 - val_accuracy: 0.8768 - val_loss: 0.6853 -
learning_rate: 6.2500e-05
Epoch 112/250
157/157          8s 50ms/step -
accuracy: 0.8995 - loss: 0.5712 - val_accuracy: 0.8765 - val_loss: 0.6808 -

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learning_rate: 6.2500e-05
Epoch 113/250
157/157          8s 50ms/step -
accuracy: 0.9018 - loss: 0.5661 - val_accuracy: 0.8742 - val_loss: 0.6835 -
learning_rate: 6.2500e-05
Epoch 114/250
157/157          8s 50ms/step -
accuracy: 0.9037 - loss: 0.5630 - val_accuracy: 0.8748 - val_loss: 0.6765 -
learning_rate: 6.2500e-05
Epoch 115/250
157/157          8s 50ms/step -
accuracy: 0.9019 - loss: 0.5640 - val_accuracy: 0.8774 - val_loss: 0.6720 -
learning_rate: 6.2500e-05
Epoch 116/250
157/157          8s 50ms/step -
accuracy: 0.9012 - loss: 0.5653 - val_accuracy: 0.8755 - val_loss: 0.6748 -
learning_rate: 6.2500e-05
Epoch 117/250
157/157          8s 50ms/step -
accuracy: 0.9019 - loss: 0.5597 - val_accuracy: 0.8739 - val_loss: 0.6875 -
learning_rate: 6.2500e-05
Epoch 118/250
157/157          8s 50ms/step -
accuracy: 0.9041 - loss: 0.5525 - val_accuracy: 0.8757 - val_loss: 0.6707 -
learning_rate: 6.2500e-05
Epoch 119/250
157/157          8s 50ms/step -
accuracy: 0.9051 - loss: 0.5494 - val_accuracy: 0.8787 - val_loss: 0.6626 -
learning_rate: 6.2500e-05
Epoch 120/250
157/157          8s 50ms/step -
accuracy: 0.9071 - loss: 0.5470 - val_accuracy: 0.8760 - val_loss: 0.6733 -
learning_rate: 6.2500e-05
Epoch 121/250
157/157          8s 50ms/step -
accuracy: 0.9062 - loss: 0.5478 - val_accuracy: 0.8785 - val_loss: 0.6618 -
learning_rate: 6.2500e-05
Epoch 122/250
157/157          8s 50ms/step -
accuracy: 0.9047 - loss: 0.5467 - val_accuracy: 0.8733 - val_loss: 0.6784 -
learning_rate: 6.2500e-05
Epoch 123/250
157/157          8s 50ms/step -
accuracy: 0.9013 - loss: 0.5543 - val_accuracy: 0.8773 - val_loss: 0.6586 -
learning_rate: 6.2500e-05
Epoch 124/250
157/157          8s 50ms/step -
accuracy: 0.9078 - loss: 0.5377 - val_accuracy: 0.8754 - val_loss: 0.6715 -

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learning_rate: 6.2500e-05
Epoch 125/250
157/157      8s 50ms/step -
accuracy: 0.9088 - loss: 0.5354 - val_accuracy: 0.8773 - val_loss: 0.6735 -
learning_rate: 6.2500e-05
Epoch 126/250
157/157      8s 50ms/step -
accuracy: 0.9047 - loss: 0.5464 - val_accuracy: 0.8768 - val_loss: 0.6609 -
learning_rate: 6.2500e-05
Epoch 127/250
157/157      8s 50ms/step -
accuracy: 0.9063 - loss: 0.5379 - val_accuracy: 0.8812 - val_loss: 0.6567 -
learning_rate: 6.2500e-05
Epoch 128/250
157/157      8s 50ms/step -
accuracy: 0.9026 - loss: 0.5417 - val_accuracy: 0.8783 - val_loss: 0.6721 -
learning_rate: 6.2500e-05
Epoch 129/250
157/157      8s 50ms/step -
accuracy: 0.9098 - loss: 0.5285 - val_accuracy: 0.8750 - val_loss: 0.6760 -
learning_rate: 6.2500e-05
Epoch 130/250
157/157      8s 50ms/step -
accuracy: 0.9044 - loss: 0.5397 - val_accuracy: 0.8768 - val_loss: 0.6702 -
learning_rate: 6.2500e-05
Epoch 131/250
157/157      8s 50ms/step -
accuracy: 0.9052 - loss: 0.5373 - val_accuracy: 0.8751 - val_loss: 0.6665 -
learning_rate: 6.2500e-05
Epoch 132/250
157/157      8s 50ms/step -
accuracy: 0.9091 - loss: 0.5309 - val_accuracy: 0.8752 - val_loss: 0.6709 -
learning_rate: 6.2500e-05
Epoch 133/250
157/157      8s 50ms/step -
accuracy: 0.9089 - loss: 0.5273 - val_accuracy: 0.8808 - val_loss: 0.6560 -
learning_rate: 3.1250e-05
Epoch 134/250
157/157      8s 50ms/step -
accuracy: 0.9175 - loss: 0.5053 - val_accuracy: 0.8798 - val_loss: 0.6581 -
learning_rate: 3.1250e-05
Epoch 135/250
157/157      8s 50ms/step -
accuracy: 0.9117 - loss: 0.5157 - val_accuracy: 0.8800 - val_loss: 0.6548 -
learning_rate: 3.1250e-05
Epoch 136/250
157/157      8s 50ms/step -
accuracy: 0.9139 - loss: 0.5101 - val_accuracy: 0.8795 - val_loss: 0.6478 -

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learning_rate: 3.1250e-05
Epoch 137/250
157/157      8s 50ms/step -
accuracy: 0.9168 - loss: 0.4975 - val_accuracy: 0.8807 - val_loss: 0.6451 -
learning_rate: 3.1250e-05
Epoch 138/250
157/157      8s 50ms/step -
accuracy: 0.9189 - loss: 0.4918 - val_accuracy: 0.8775 - val_loss: 0.6532 -
learning_rate: 3.1250e-05
Epoch 139/250
157/157      8s 50ms/step -
accuracy: 0.9196 - loss: 0.4956 - val_accuracy: 0.8792 - val_loss: 0.6457 -
learning_rate: 3.1250e-05
Epoch 140/250
157/157      8s 50ms/step -
accuracy: 0.9192 - loss: 0.4818 - val_accuracy: 0.8861 - val_loss: 0.6297 -
learning_rate: 3.1250e-05
Epoch 141/250
157/157      8s 50ms/step -
accuracy: 0.9189 - loss: 0.4863 - val_accuracy: 0.8814 - val_loss: 0.6355 -
learning_rate: 3.1250e-05
Epoch 142/250
157/157      8s 50ms/step -
accuracy: 0.9188 - loss: 0.4806 - val_accuracy: 0.8807 - val_loss: 0.6401 -
learning_rate: 3.1250e-05
Epoch 143/250
157/157      8s 50ms/step -
accuracy: 0.9211 - loss: 0.4757 - val_accuracy: 0.8816 - val_loss: 0.6324 -
learning_rate: 3.1250e-05
Epoch 144/250
157/157      8s 50ms/step -
accuracy: 0.9225 - loss: 0.4675 - val_accuracy: 0.8826 - val_loss: 0.6323 -
learning_rate: 3.1250e-05
Epoch 145/250
157/157      8s 50ms/step -
accuracy: 0.9220 - loss: 0.4726 - val_accuracy: 0.8814 - val_loss: 0.6314 -
learning_rate: 3.1250e-05
Epoch 146/250
157/157      8s 50ms/step -
accuracy: 0.9243 - loss: 0.4610 - val_accuracy: 0.8822 - val_loss: 0.6290 -
learning_rate: 1.5625e-05
Epoch 147/250
157/157      8s 50ms/step -
accuracy: 0.9282 - loss: 0.4507 - val_accuracy: 0.8825 - val_loss: 0.6302 -
learning_rate: 1.5625e-05
Epoch 148/250
157/157      8s 50ms/step -
accuracy: 0.9259 - loss: 0.4589 - val_accuracy: 0.8848 - val_loss: 0.6234 -

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learning_rate: 1.5625e-05
Epoch 149/250
157/157      8s 50ms/step -
accuracy: 0.9278 - loss: 0.4480 - val_accuracy: 0.8846 - val_loss: 0.6230 -
learning_rate: 1.5625e-05
Epoch 150/250
157/157      8s 50ms/step -
accuracy: 0.9261 - loss: 0.4497 - val_accuracy: 0.8849 - val_loss: 0.6233 -
learning_rate: 1.5625e-05
Epoch 151/250
157/157      8s 50ms/step -
accuracy: 0.9285 - loss: 0.4462 - val_accuracy: 0.8838 - val_loss: 0.6225 -
learning_rate: 1.5625e-05
Epoch 152/250
157/157      8s 50ms/step -
accuracy: 0.9273 - loss: 0.4432 - val_accuracy: 0.8862 - val_loss: 0.6221 -
learning_rate: 1.5625e-05
Epoch 153/250
157/157      8s 50ms/step -
accuracy: 0.9301 - loss: 0.4405 - val_accuracy: 0.8833 - val_loss: 0.6229 -
learning_rate: 1.5625e-05
Epoch 154/250
157/157      8s 51ms/step -
accuracy: 0.9277 - loss: 0.4390 - val_accuracy: 0.8830 - val_loss: 0.6198 -
learning_rate: 1.5625e-05
Epoch 155/250
157/157      8s 50ms/step -
accuracy: 0.9327 - loss: 0.4332 - val_accuracy: 0.8835 - val_loss: 0.6169 -
learning_rate: 1.5625e-05
Epoch 156/250
157/157      8s 50ms/step -
accuracy: 0.9308 - loss: 0.4349 - val_accuracy: 0.8834 - val_loss: 0.6201 -
learning_rate: 1.5625e-05
Epoch 157/250
157/157      8s 50ms/step -
accuracy: 0.9307 - loss: 0.4299 - val_accuracy: 0.8858 - val_loss: 0.6178 -
learning_rate: 1.5625e-05
Epoch 158/250
157/157      8s 50ms/step -
accuracy: 0.9318 - loss: 0.4283 - val_accuracy: 0.8848 - val_loss: 0.6163 -
learning_rate: 1.5625e-05
Epoch 159/250
157/157      8s 50ms/step -
accuracy: 0.9289 - loss: 0.4316 - val_accuracy: 0.8843 - val_loss: 0.6162 -
learning_rate: 1.5625e-05
Epoch 160/250
157/157      8s 51ms/step -
accuracy: 0.9312 - loss: 0.4256 - val_accuracy: 0.8848 - val_loss: 0.6171 -

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learning_rate: 1.5625e-05
Epoch 161/250
157/157      8s 51ms/step -
accuracy: 0.9337 - loss: 0.4216 - val_accuracy: 0.8862 - val_loss: 0.6119 -
learning_rate: 1.5625e-05
Epoch 162/250
157/157      8s 51ms/step -
accuracy: 0.9317 - loss: 0.4232 - val_accuracy: 0.8859 - val_loss: 0.6115 -
learning_rate: 1.5625e-05
Epoch 163/250
157/157      8s 50ms/step -
accuracy: 0.9319 - loss: 0.4173 - val_accuracy: 0.8864 - val_loss: 0.6103 -
learning_rate: 1.5625e-05
Epoch 164/250
157/157      8s 51ms/step -
accuracy: 0.9350 - loss: 0.4167 - val_accuracy: 0.8859 - val_loss: 0.6093 -
learning_rate: 1.5625e-05
Epoch 165/250
157/157      8s 51ms/step -
accuracy: 0.9315 - loss: 0.4171 - val_accuracy: 0.8860 - val_loss: 0.6128 -
learning_rate: 1.5625e-05
Epoch 166/250
157/157      8s 51ms/step -
accuracy: 0.9369 - loss: 0.4096 - val_accuracy: 0.8859 - val_loss: 0.6113 -
learning_rate: 1.5625e-05
Epoch 167/250
157/157      8s 50ms/step -
accuracy: 0.9309 - loss: 0.4179 - val_accuracy: 0.8838 - val_loss: 0.6111 -
learning_rate: 1.5625e-05
Epoch 168/250
157/157      8s 50ms/step -
accuracy: 0.9339 - loss: 0.4134 - val_accuracy: 0.8844 - val_loss: 0.6066 -
learning_rate: 1.5625e-05
Epoch 169/250
157/157      8s 50ms/step -
accuracy: 0.9296 - loss: 0.4130 - val_accuracy: 0.8854 - val_loss: 0.6081 -
learning_rate: 1.5625e-05
Epoch 170/250
157/157      8s 50ms/step -
accuracy: 0.9367 - loss: 0.4009 - val_accuracy: 0.8851 - val_loss: 0.6099 -
learning_rate: 1.5625e-05
Epoch 171/250
157/157      8s 51ms/step -
accuracy: 0.9351 - loss: 0.4051 - val_accuracy: 0.8849 - val_loss: 0.6074 -
learning_rate: 1.5625e-05
Epoch 172/250
157/157      8s 50ms/step -
accuracy: 0.9308 - loss: 0.4091 - val_accuracy: 0.8839 - val_loss: 0.6067 -

```

```

learning_rate: 1.5625e-05
Epoch 173/250
157/157          8s 50ms/step -
accuracy: 0.9328 - loss: 0.4049 - val_accuracy: 0.8819 - val_loss: 0.6094 -
learning_rate: 1.5625e-05
Epoch 174/250
157/157          8s 50ms/step -
accuracy: 0.9380 - loss: 0.3953 - val_accuracy: 0.8838 - val_loss: 0.6035 -
learning_rate: 7.8125e-06
Epoch 175/250
157/157          8s 51ms/step -
accuracy: 0.9382 - loss: 0.3932 - val_accuracy: 0.8842 - val_loss: 0.6018 -
learning_rate: 7.8125e-06
Epoch 176/250
157/157          8s 50ms/step -
accuracy: 0.9350 - loss: 0.4000 - val_accuracy: 0.8846 - val_loss: 0.6034 -
learning_rate: 7.8125e-06
Epoch 177/250
157/157          8s 51ms/step -
accuracy: 0.9342 - loss: 0.4006 - val_accuracy: 0.8848 - val_loss: 0.6015 -
learning_rate: 7.8125e-06
Epoch 178/250
157/157          8s 51ms/step -
accuracy: 0.9376 - loss: 0.3942 - val_accuracy: 0.8850 - val_loss: 0.6021 -
learning_rate: 7.8125e-06
Epoch 179/250
157/157          8s 51ms/step -
accuracy: 0.9363 - loss: 0.3963 - val_accuracy: 0.8859 - val_loss: 0.5989 -
learning_rate: 7.8125e-06
Epoch 180/250
157/157          8s 51ms/step -
accuracy: 0.9362 - loss: 0.3931 - val_accuracy: 0.8853 - val_loss: 0.5989 -
learning_rate: 7.8125e-06
Epoch 181/250
157/157          8s 50ms/step -
accuracy: 0.9391 - loss: 0.3876 - val_accuracy: 0.8855 - val_loss: 0.5994 -
learning_rate: 7.8125e-06
Epoch 182/250
157/157          8s 51ms/step -
accuracy: 0.9369 - loss: 0.3918 - val_accuracy: 0.8861 - val_loss: 0.5996 -
learning_rate: 7.8125e-06
Epoch 183/250
157/157          8s 51ms/step -
accuracy: 0.9367 - loss: 0.3896 - val_accuracy: 0.8851 - val_loss: 0.6019 -
learning_rate: 7.8125e-06
Epoch 184/250
157/157          8s 50ms/step -
accuracy: 0.9392 - loss: 0.3829 - val_accuracy: 0.8837 - val_loss: 0.6003 -

```

learning_rate: 7.8125e-06
Epoch 185/250
157/157 8s 50ms/step -
accuracy: 0.9403 - loss: 0.3860 - val_accuracy: 0.8839 - val_loss: 0.6002 -
learning_rate: 3.9063e-06
Epoch 186/250
157/157 8s 50ms/step -
accuracy: 0.9388 - loss: 0.3827 - val_accuracy: 0.8849 - val_loss: 0.5993 -
learning_rate: 3.9063e-06
Epoch 187/250
157/157 8s 50ms/step -
accuracy: 0.9381 - loss: 0.3854 - val_accuracy: 0.8845 - val_loss: 0.5989 -
learning_rate: 3.9063e-06
Epoch 188/250
157/157 8s 50ms/step -
accuracy: 0.9390 - loss: 0.3853 - val_accuracy: 0.8844 - val_loss: 0.5992 -
learning_rate: 3.9063e-06
Epoch 189/250
157/157 8s 50ms/step -
accuracy: 0.9403 - loss: 0.3795 - val_accuracy: 0.8852 - val_loss: 0.5978 -
learning_rate: 3.9063e-06
Epoch 190/250
157/157 8s 51ms/step -
accuracy: 0.9397 - loss: 0.3807 - val_accuracy: 0.8856 - val_loss: 0.5973 -
learning_rate: 3.9063e-06
Epoch 191/250
157/157 8s 51ms/step -
accuracy: 0.9399 - loss: 0.3791 - val_accuracy: 0.8851 - val_loss: 0.5975 -
learning_rate: 3.9063e-06
Epoch 192/250
157/157 8s 50ms/step -
accuracy: 0.9377 - loss: 0.3863 - val_accuracy: 0.8846 - val_loss: 0.5996 -
learning_rate: 3.9063e-06
Epoch 193/250
157/157 8s 51ms/step -
accuracy: 0.9404 - loss: 0.3821 - val_accuracy: 0.8848 - val_loss: 0.5977 -
learning_rate: 3.9063e-06
Epoch 194/250
157/157 8s 51ms/step -
accuracy: 0.9422 - loss: 0.3748 - val_accuracy: 0.8864 - val_loss: 0.5960 -
learning_rate: 3.9063e-06
Epoch 195/250
157/157 8s 50ms/step -
accuracy: 0.9401 - loss: 0.3772 - val_accuracy: 0.8848 - val_loss: 0.5972 -
learning_rate: 3.9063e-06
Epoch 196/250
157/157 8s 50ms/step -
accuracy: 0.9421 - loss: 0.3711 - val_accuracy: 0.8850 - val_loss: 0.5954 -

learning_rate: 3.9063e-06
Epoch 197/250
157/157 8s 51ms/step -
accuracy: 0.9391 - loss: 0.3787 - val_accuracy: 0.8855 - val_loss: 0.5947 -
learning_rate: 3.9063e-06
Epoch 198/250
157/157 8s 51ms/step -
accuracy: 0.9413 - loss: 0.3734 - val_accuracy: 0.8851 - val_loss: 0.5957 -
learning_rate: 3.9063e-06
Epoch 199/250
157/157 8s 51ms/step -
accuracy: 0.9393 - loss: 0.3796 - val_accuracy: 0.8852 - val_loss: 0.5960 -
learning_rate: 3.9063e-06
Epoch 200/250
157/157 8s 51ms/step -
accuracy: 0.9394 - loss: 0.3724 - val_accuracy: 0.8855 - val_loss: 0.5946 -
learning_rate: 3.9063e-06
Epoch 201/250
157/157 8s 51ms/step -
accuracy: 0.9410 - loss: 0.3756 - val_accuracy: 0.8846 - val_loss: 0.5960 -
learning_rate: 3.9063e-06
Epoch 202/250
157/157 8s 51ms/step -
accuracy: 0.9407 - loss: 0.3748 - val_accuracy: 0.8835 - val_loss: 0.5951 -
learning_rate: 3.9063e-06
Epoch 203/250
157/157 8s 51ms/step -
accuracy: 0.9406 - loss: 0.3778 - val_accuracy: 0.8834 - val_loss: 0.5945 -
learning_rate: 3.9063e-06
Epoch 204/250
157/157 8s 51ms/step -
accuracy: 0.9430 - loss: 0.3702 - val_accuracy: 0.8841 - val_loss: 0.5945 -
learning_rate: 3.9063e-06
Epoch 205/250
157/157 8s 51ms/step -
accuracy: 0.9430 - loss: 0.3719 - val_accuracy: 0.8842 - val_loss: 0.5948 -
learning_rate: 3.9063e-06
Epoch 206/250
157/157 8s 51ms/step -
accuracy: 0.9402 - loss: 0.3765 - val_accuracy: 0.8855 - val_loss: 0.5939 -
learning_rate: 3.9063e-06
Epoch 207/250
157/157 8s 51ms/step -
accuracy: 0.9424 - loss: 0.3725 - val_accuracy: 0.8855 - val_loss: 0.5943 -
learning_rate: 3.9063e-06
Epoch 208/250
157/157 8s 51ms/step -
accuracy: 0.9440 - loss: 0.3698 - val_accuracy: 0.8854 - val_loss: 0.5926 -

```

learning_rate: 3.9063e-06
Epoch 209/250
157/157          8s 51ms/step -
accuracy: 0.9422 - loss: 0.3685 - val_accuracy: 0.8848 - val_loss: 0.5924 -
learning_rate: 3.9063e-06
Epoch 210/250
157/157          8s 51ms/step -
accuracy: 0.9421 - loss: 0.3697 - val_accuracy: 0.8854 - val_loss: 0.5917 -
learning_rate: 3.9063e-06
Epoch 211/250
157/157          8s 50ms/step -
accuracy: 0.9424 - loss: 0.3704 - val_accuracy: 0.8864 - val_loss: 0.5924 -
learning_rate: 3.9063e-06
Epoch 212/250
157/157          8s 51ms/step -
accuracy: 0.9409 - loss: 0.3734 - val_accuracy: 0.8852 - val_loss: 0.5927 -
learning_rate: 3.9063e-06
Epoch 213/250
157/157          8s 51ms/step -
accuracy: 0.9414 - loss: 0.3709 - val_accuracy: 0.8856 - val_loss: 0.5926 -
learning_rate: 3.9063e-06
Epoch 214/250
157/157          8s 50ms/step -
accuracy: 0.9433 - loss: 0.3652 - val_accuracy: 0.8864 - val_loss: 0.5911 -
learning_rate: 3.9063e-06
Epoch 215/250
157/157          8s 50ms/step -
accuracy: 0.9421 - loss: 0.3698 - val_accuracy: 0.8865 - val_loss: 0.5914 -
learning_rate: 3.9063e-06
Epoch 216/250
157/157          8s 50ms/step -
accuracy: 0.9433 - loss: 0.3640 - val_accuracy: 0.8855 - val_loss: 0.5911 -
learning_rate: 3.9063e-06
Epoch 217/250
157/157          8s 50ms/step -
accuracy: 0.9432 - loss: 0.3637 - val_accuracy: 0.8864 - val_loss: 0.5916 -
learning_rate: 3.9063e-06
Epoch 218/250
157/157          8s 50ms/step -
accuracy: 0.9415 - loss: 0.3664 - val_accuracy: 0.8861 - val_loss: 0.5905 -
learning_rate: 3.9063e-06
Epoch 219/250
157/157          8s 51ms/step -
accuracy: 0.9470 - loss: 0.3599 - val_accuracy: 0.8856 - val_loss: 0.5891 -
learning_rate: 3.9063e-06
Epoch 220/250
157/157          8s 51ms/step -
accuracy: 0.9423 - loss: 0.3704 - val_accuracy: 0.8856 - val_loss: 0.5901 -

```



```

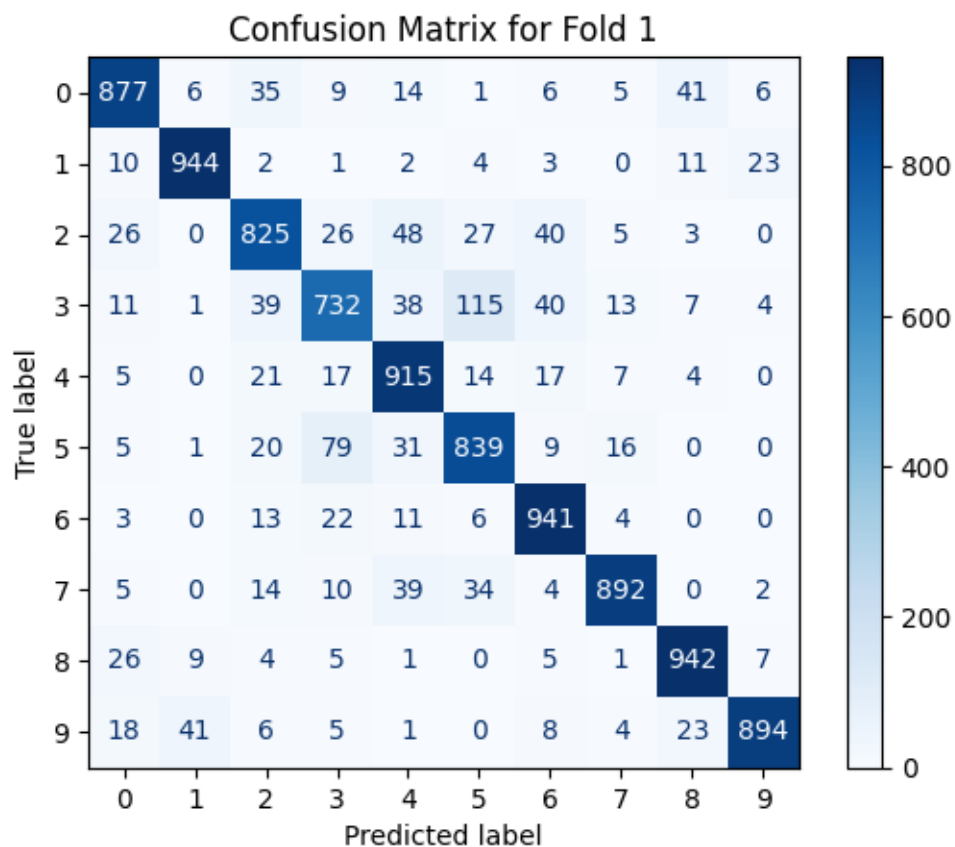
learning_rate: 3.9063e-06
Epoch 221/250
157/157          8s 51ms/step -
accuracy: 0.9431 - loss: 0.3614 - val_accuracy: 0.8864 - val_loss: 0.5882 -
learning_rate: 3.9063e-06
Epoch 222/250
157/157          8s 50ms/step -
accuracy: 0.9432 - loss: 0.3650 - val_accuracy: 0.8861 - val_loss: 0.5870 -
learning_rate: 3.9063e-06
Epoch 223/250
157/157          8s 50ms/step -
accuracy: 0.9469 - loss: 0.3513 - val_accuracy: 0.8867 - val_loss: 0.5880 -
learning_rate: 3.9063e-06
Epoch 224/250
157/157          8s 51ms/step -
accuracy: 0.9450 - loss: 0.3584 - val_accuracy: 0.8864 - val_loss: 0.5883 -
learning_rate: 3.9063e-06
Epoch 225/250
157/157          8s 51ms/step -
accuracy: 0.9409 - loss: 0.3661 - val_accuracy: 0.8870 - val_loss: 0.5853 -
learning_rate: 3.9063e-06
Epoch 226/250
157/157          8s 50ms/step -
accuracy: 0.9433 - loss: 0.3604 - val_accuracy: 0.8856 - val_loss: 0.5882 -
learning_rate: 3.9063e-06
Epoch 227/250
157/157          8s 50ms/step -
accuracy: 0.9437 - loss: 0.3576 - val_accuracy: 0.8867 - val_loss: 0.5883 -
learning_rate: 3.9063e-06
Epoch 228/250
157/157          8s 51ms/step -
accuracy: 0.9423 - loss: 0.3615 - val_accuracy: 0.8860 - val_loss: 0.5869 -
learning_rate: 3.9063e-06
Epoch 229/250
157/157          8s 50ms/step -
accuracy: 0.9444 - loss: 0.3607 - val_accuracy: 0.8864 - val_loss: 0.5870 -
learning_rate: 3.9063e-06
Epoch 230/250
157/157          8s 50ms/step -
accuracy: 0.9450 - loss: 0.3592 - val_accuracy: 0.8863 - val_loss: 0.5868 -
learning_rate: 3.9063e-06
Epoch 231/250
157/157          8s 50ms/step -
accuracy: 0.9443 - loss: 0.3585 - val_accuracy: 0.8862 - val_loss: 0.5862 -
learning_rate: 1.9531e-06
Epoch 232/250
157/157          8s 50ms/step -
accuracy: 0.9449 - loss: 0.3591 - val_accuracy: 0.8863 - val_loss: 0.5868 -

```

```

learning_rate: 1.9531e-06
Epoch 233/250
157/157          8s 50ms/step -
accuracy: 0.9433 - loss: 0.3574 - val_accuracy: 0.8867 - val_loss: 0.5867 -
learning_rate: 1.9531e-06
Epoch 234/250
157/157          8s 50ms/step -
accuracy: 0.9431 - loss: 0.3560 - val_accuracy: 0.8869 - val_loss: 0.5863 -
learning_rate: 1.9531e-06
Epoch 235/250
157/157          8s 51ms/step -
accuracy: 0.9439 - loss: 0.3579 - val_accuracy: 0.8868 - val_loss: 0.5866 -
learning_rate: 1.9531e-06
Epoch 236/250
157/157          8s 51ms/step -
accuracy: 0.9444 - loss: 0.3599 - val_accuracy: 0.8865 - val_loss: 0.5862 -
learning_rate: 1.0000e-06
Epoch 237/250
157/157          8s 51ms/step -
accuracy: 0.9459 - loss: 0.3552 - val_accuracy: 0.8872 - val_loss: 0.5871 -
learning_rate: 1.0000e-06
Epoch 238/250
157/157          8s 51ms/step -
accuracy: 0.9466 - loss: 0.3562 - val_accuracy: 0.8872 - val_loss: 0.5865 -
learning_rate: 1.0000e-06
Epoch 239/250
157/157          8s 51ms/step -
accuracy: 0.9424 - loss: 0.3595 - val_accuracy: 0.8874 - val_loss: 0.5868 -
learning_rate: 1.0000e-06
Epoch 240/250
157/157          8s 52ms/step -
accuracy: 0.9445 - loss: 0.3534 - val_accuracy: 0.8870 - val_loss: 0.5868 -
learning_rate: 1.0000e-06
Score for fold 1: test loss of 0.6027002930641174; test accuracy of
88.01000118255615%
313/313          1s 3ms/step

```



Classification Report for Fold 1:

	precision	recall	f1-score	support
Class 0	0.89	0.88	0.88	1000
Class 1	0.94	0.94	0.94	1000
Class 2	0.84	0.82	0.83	1000
Class 3	0.81	0.73	0.77	1000
Class 4	0.83	0.92	0.87	1000
Class 5	0.81	0.84	0.82	1000
Class 6	0.88	0.94	0.91	1000
Class 7	0.94	0.89	0.92	1000
Class 8	0.91	0.94	0.93	1000
Class 9	0.96	0.89	0.92	1000
accuracy			0.88	10000
macro avg	0.88	0.88	0.88	10000
weighted avg	0.88	0.88	0.88	10000

/opt/conda/lib/python3.10/site-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not

pass an ``input_shape`/`input_dim`` argument to a layer. When using Sequential models, prefer using an ``Input(shape)`` object as the first layer in the model instead.

```
super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Epoch 1/250

157/157 34s 122ms/step -

accuracy: 0.1983 - loss: 8.0839 - val_accuracy: 0.2497 - val_loss: 5.7746 -
learning_rate: 0.0010

Epoch 2/250

157/157 8s 51ms/step -

accuracy: 0.3674 - loss: 4.9646 - val_accuracy: 0.2493 - val_loss: 3.9941 -
learning_rate: 0.0010

Epoch 3/250

157/157 8s 51ms/step -

accuracy: 0.4637 - loss: 3.2755 - val_accuracy: 0.3833 - val_loss: 3.0125 -
learning_rate: 0.0010

Epoch 4/250

157/157 8s 52ms/step -

accuracy: 0.5268 - loss: 2.5158 - val_accuracy: 0.5607 - val_loss: 2.2336 -
learning_rate: 0.0010

Epoch 5/250

157/157 8s 52ms/step -

accuracy: 0.5818 - loss: 2.1691 - val_accuracy: 0.5905 - val_loss: 2.1159 -
learning_rate: 0.0010

Epoch 6/250

157/157 8s 51ms/step -

accuracy: 0.6209 - loss: 2.0660 - val_accuracy: 0.6148 - val_loss: 2.0754 -
learning_rate: 0.0010

Epoch 7/250

157/157 8s 51ms/step -

accuracy: 0.6418 - loss: 2.0038 - val_accuracy: 0.6097 - val_loss: 2.1117 -
learning_rate: 0.0010

Epoch 8/250

157/157 8s 50ms/step -

accuracy: 0.6487 - loss: 2.0031 - val_accuracy: 0.6642 - val_loss: 1.9209 -
learning_rate: 0.0010

Epoch 9/250

157/157 8s 50ms/step -

accuracy: 0.6647 - loss: 1.9738 - val_accuracy: 0.6785 - val_loss: 1.9339 -
learning_rate: 0.0010

Epoch 10/250

157/157 8s 50ms/step -

accuracy: 0.6684 - loss: 1.9900 - val_accuracy: 0.6724 - val_loss: 1.9509 -
learning_rate: 0.0010

Epoch 11/250

157/157 8s 50ms/step -

accuracy: 0.6835 - loss: 1.9547 - val_accuracy: 0.6801 - val_loss: 1.9320 -

```

learning_rate: 0.0010
Epoch 12/250
157/157          8s 52ms/step -
accuracy: 0.6809 - loss: 1.9677 - val_accuracy: 0.6933 - val_loss: 1.9120 -
learning_rate: 0.0010
Epoch 13/250
157/157          8s 50ms/step -
accuracy: 0.6899 - loss: 1.9703 - val_accuracy: 0.6977 - val_loss: 1.9351 -
learning_rate: 0.0010
Epoch 14/250
157/157          8s 51ms/step -
accuracy: 0.6896 - loss: 1.9739 - val_accuracy: 0.6652 - val_loss: 2.0513 -
learning_rate: 0.0010
Epoch 15/250
157/157          8s 51ms/step -
accuracy: 0.6910 - loss: 1.9772 - val_accuracy: 0.7037 - val_loss: 1.9288 -
learning_rate: 0.0010
Epoch 16/250
157/157          8s 51ms/step -
accuracy: 0.6953 - loss: 1.9828 - val_accuracy: 0.6958 - val_loss: 1.9527 -
learning_rate: 0.0010
Epoch 17/250
157/157         10s 51ms/step -
accuracy: 0.7020 - loss: 1.9501 - val_accuracy: 0.7248 - val_loss: 1.8620 -
learning_rate: 0.0010
Epoch 18/250
157/157          8s 50ms/step -
accuracy: 0.6992 - loss: 1.9621 - val_accuracy: 0.7077 - val_loss: 1.8982 -
learning_rate: 0.0010
Epoch 19/250
157/157          8s 50ms/step -
accuracy: 0.7026 - loss: 1.9281 - val_accuracy: 0.6955 - val_loss: 1.9335 -
learning_rate: 0.0010
Epoch 20/250
157/157          8s 50ms/step -
accuracy: 0.7053 - loss: 1.9226 - val_accuracy: 0.7144 - val_loss: 1.8820 -
learning_rate: 0.0010
Epoch 21/250
157/157          8s 50ms/step -
accuracy: 0.7044 - loss: 1.9398 - val_accuracy: 0.6950 - val_loss: 1.9381 -
learning_rate: 0.0010
Epoch 22/250
157/157          8s 50ms/step -
accuracy: 0.7055 - loss: 1.9572 - val_accuracy: 0.6701 - val_loss: 2.0228 -
learning_rate: 0.0010
Epoch 23/250
157/157          8s 50ms/step -
accuracy: 0.7256 - loss: 1.8063 - val_accuracy: 0.7543 - val_loss: 1.5364 -

```

learning_rate: 5.0000e-04
Epoch 24/250
157/157 8s 50ms/step -
accuracy: 0.7487 - loss: 1.5454 - val_accuracy: 0.7494 - val_loss: 1.4880 -
learning_rate: 5.0000e-04
Epoch 25/250
157/157 8s 50ms/step -
accuracy: 0.7479 - loss: 1.5283 - val_accuracy: 0.7503 - val_loss: 1.4909 -
learning_rate: 5.0000e-04
Epoch 26/250
157/157 8s 50ms/step -
accuracy: 0.7502 - loss: 1.5143 - val_accuracy: 0.7469 - val_loss: 1.5184 -
learning_rate: 5.0000e-04
Epoch 27/250
157/157 8s 50ms/step -
accuracy: 0.7514 - loss: 1.5054 - val_accuracy: 0.7611 - val_loss: 1.4678 -
learning_rate: 5.0000e-04
Epoch 28/250
157/157 8s 50ms/step -
accuracy: 0.7533 - loss: 1.4981 - val_accuracy: 0.7618 - val_loss: 1.4759 -
learning_rate: 5.0000e-04
Epoch 29/250
157/157 8s 50ms/step -
accuracy: 0.7588 - loss: 1.4871 - val_accuracy: 0.7772 - val_loss: 1.4062 -
learning_rate: 5.0000e-04
Epoch 30/250
157/157 8s 50ms/step -
accuracy: 0.7593 - loss: 1.4771 - val_accuracy: 0.7589 - val_loss: 1.4580 -
learning_rate: 5.0000e-04
Epoch 31/250
157/157 8s 50ms/step -
accuracy: 0.7614 - loss: 1.4772 - val_accuracy: 0.7826 - val_loss: 1.4078 -
learning_rate: 5.0000e-04
Epoch 32/250
157/157 8s 50ms/step -
accuracy: 0.7656 - loss: 1.4735 - val_accuracy: 0.7703 - val_loss: 1.4266 -
learning_rate: 5.0000e-04
Epoch 33/250
157/157 8s 50ms/step -
accuracy: 0.7605 - loss: 1.4815 - val_accuracy: 0.7666 - val_loss: 1.4722 -
learning_rate: 5.0000e-04
Epoch 34/250
157/157 8s 50ms/step -
accuracy: 0.7660 - loss: 1.4730 - val_accuracy: 0.7773 - val_loss: 1.4256 -
learning_rate: 5.0000e-04
Epoch 35/250
157/157 8s 50ms/step -
accuracy: 0.7829 - loss: 1.4000 - val_accuracy: 0.7791 - val_loss: 1.3329 -

```

learning_rate: 2.5000e-04
Epoch 36/250
157/157          8s 50ms/step -
accuracy: 0.7964 - loss: 1.2671 - val_accuracy: 0.8070 - val_loss: 1.1909 -
learning_rate: 2.5000e-04
Epoch 37/250
157/157          8s 50ms/step -
accuracy: 0.7974 - loss: 1.2212 - val_accuracy: 0.7889 - val_loss: 1.2115 -
learning_rate: 2.5000e-04
Epoch 38/250
157/157          8s 50ms/step -
accuracy: 0.8041 - loss: 1.1771 - val_accuracy: 0.8079 - val_loss: 1.1377 -
learning_rate: 2.5000e-04
Epoch 39/250
157/157          8s 50ms/step -
accuracy: 0.8054 - loss: 1.1601 - val_accuracy: 0.8049 - val_loss: 1.1456 -
learning_rate: 2.5000e-04
Epoch 40/250
157/157          8s 50ms/step -
accuracy: 0.8009 - loss: 1.1590 - val_accuracy: 0.8144 - val_loss: 1.1068 -
learning_rate: 2.5000e-04
Epoch 41/250
157/157          8s 50ms/step -
accuracy: 0.8103 - loss: 1.1213 - val_accuracy: 0.7958 - val_loss: 1.1689 -
learning_rate: 2.5000e-04
Epoch 42/250
157/157          8s 50ms/step -
accuracy: 0.8059 - loss: 1.1305 - val_accuracy: 0.8204 - val_loss: 1.0761 -
learning_rate: 2.5000e-04
Epoch 43/250
157/157          8s 50ms/step -
accuracy: 0.8150 - loss: 1.1057 - val_accuracy: 0.8157 - val_loss: 1.1033 -
learning_rate: 2.5000e-04
Epoch 44/250
157/157          8s 50ms/step -
accuracy: 0.8103 - loss: 1.1170 - val_accuracy: 0.8166 - val_loss: 1.0845 -
learning_rate: 2.5000e-04
Epoch 45/250
157/157          8s 50ms/step -
accuracy: 0.8138 - loss: 1.1063 - val_accuracy: 0.8265 - val_loss: 1.0575 -
learning_rate: 2.5000e-04
Epoch 46/250
157/157          8s 50ms/step -
accuracy: 0.8093 - loss: 1.1120 - val_accuracy: 0.8098 - val_loss: 1.1184 -
learning_rate: 2.5000e-04
Epoch 47/250
157/157          8s 50ms/step -
accuracy: 0.8171 - loss: 1.0906 - val_accuracy: 0.8107 - val_loss: 1.1143 -

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learning_rate: 2.5000e-04
Epoch 48/250
157/157      8s 50ms/step -
accuracy: 0.8155 - loss: 1.0935 - val_accuracy: 0.8141 - val_loss: 1.0987 -
learning_rate: 2.5000e-04
Epoch 49/250
157/157      8s 50ms/step -
accuracy: 0.8184 - loss: 1.0841 - val_accuracy: 0.8246 - val_loss: 1.0511 -
learning_rate: 2.5000e-04
Epoch 50/250
157/157      8s 50ms/step -
accuracy: 0.8190 - loss: 1.0817 - val_accuracy: 0.8086 - val_loss: 1.1073 -
learning_rate: 2.5000e-04
Epoch 51/250
157/157      8s 50ms/step -
accuracy: 0.8226 - loss: 1.0796 - val_accuracy: 0.8241 - val_loss: 1.0666 -
learning_rate: 2.5000e-04
Epoch 52/250
157/157      8s 50ms/step -
accuracy: 0.8228 - loss: 1.0747 - val_accuracy: 0.8135 - val_loss: 1.0961 -
learning_rate: 2.5000e-04
Epoch 53/250
157/157      8s 50ms/step -
accuracy: 0.8205 - loss: 1.0747 - val_accuracy: 0.8167 - val_loss: 1.0908 -
learning_rate: 2.5000e-04
Epoch 54/250
157/157      8s 50ms/step -
accuracy: 0.8235 - loss: 1.0674 - val_accuracy: 0.8174 - val_loss: 1.0881 -
learning_rate: 2.5000e-04
Epoch 55/250
157/157      8s 50ms/step -
accuracy: 0.8293 - loss: 1.0463 - val_accuracy: 0.8243 - val_loss: 1.0296 -
learning_rate: 1.2500e-04
Epoch 56/250
157/157      8s 50ms/step -
accuracy: 0.8403 - loss: 0.9776 - val_accuracy: 0.8375 - val_loss: 0.9718 -
learning_rate: 1.2500e-04
Epoch 57/250
157/157      8s 50ms/step -
accuracy: 0.8451 - loss: 0.9493 - val_accuracy: 0.8331 - val_loss: 0.9745 -
learning_rate: 1.2500e-04
Epoch 58/250
157/157      8s 50ms/step -
accuracy: 0.8489 - loss: 0.9172 - val_accuracy: 0.8452 - val_loss: 0.9280 -
learning_rate: 1.2500e-04
Epoch 59/250
157/157      8s 50ms/step -
accuracy: 0.8486 - loss: 0.9021 - val_accuracy: 0.8427 - val_loss: 0.9272 -

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learning_rate: 1.2500e-04
Epoch 60/250
157/157 8s 50ms/step -
accuracy: 0.8539 - loss: 0.8757 - val_accuracy: 0.8485 - val_loss: 0.9049 -
learning_rate: 1.2500e-04
Epoch 61/250
157/157 8s 50ms/step -
accuracy: 0.8514 - loss: 0.8772 - val_accuracy: 0.8424 - val_loss: 0.9113 -
learning_rate: 1.2500e-04
Epoch 62/250
157/157 8s 50ms/step -
accuracy: 0.8554 - loss: 0.8608 - val_accuracy: 0.8497 - val_loss: 0.8755 -
learning_rate: 1.2500e-04
Epoch 63/250
157/157 8s 50ms/step -
accuracy: 0.8535 - loss: 0.8534 - val_accuracy: 0.8445 - val_loss: 0.8863 -
learning_rate: 1.2500e-04
Epoch 64/250
157/157 8s 50ms/step -
accuracy: 0.8583 - loss: 0.8326 - val_accuracy: 0.8396 - val_loss: 0.8948 -
learning_rate: 1.2500e-04
Epoch 65/250
157/157 8s 50ms/step -
accuracy: 0.8535 - loss: 0.8371 - val_accuracy: 0.8498 - val_loss: 0.8652 -
learning_rate: 1.2500e-04
Epoch 66/250
157/157 8s 50ms/step -
accuracy: 0.8612 - loss: 0.8194 - val_accuracy: 0.8508 - val_loss: 0.8571 -
learning_rate: 1.2500e-04
Epoch 67/250
157/157 8s 50ms/step -
accuracy: 0.8602 - loss: 0.8176 - val_accuracy: 0.8522 - val_loss: 0.8410 -
learning_rate: 1.2500e-04
Epoch 68/250
157/157 8s 50ms/step -
accuracy: 0.8612 - loss: 0.8176 - val_accuracy: 0.8520 - val_loss: 0.8517 -
learning_rate: 1.2500e-04
Epoch 69/250
157/157 8s 50ms/step -
accuracy: 0.8586 - loss: 0.8234 - val_accuracy: 0.8524 - val_loss: 0.8474 -
learning_rate: 1.2500e-04
Epoch 70/250
157/157 8s 50ms/step -
accuracy: 0.8587 - loss: 0.8104 - val_accuracy: 0.8473 - val_loss: 0.8589 -
learning_rate: 1.2500e-04
Epoch 71/250
157/157 8s 50ms/step -
accuracy: 0.8664 - loss: 0.7944 - val_accuracy: 0.8530 - val_loss: 0.8493 -

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learning_rate: 1.2500e-04
Epoch 72/250
157/157          8s 51ms/step -
accuracy: 0.8626 - loss: 0.7945 - val_accuracy: 0.8518 - val_loss: 0.8406 -
learning_rate: 1.2500e-04
Epoch 73/250
157/157          8s 51ms/step -
accuracy: 0.8656 - loss: 0.7899 - val_accuracy: 0.8578 - val_loss: 0.8250 -
learning_rate: 1.2500e-04
Epoch 74/250
157/157          8s 51ms/step -
accuracy: 0.8649 - loss: 0.7911 - val_accuracy: 0.8529 - val_loss: 0.8433 -
learning_rate: 1.2500e-04
Epoch 75/250
157/157          8s 51ms/step -
accuracy: 0.8635 - loss: 0.7867 - val_accuracy: 0.8439 - val_loss: 0.8652 -
learning_rate: 1.2500e-04
Epoch 76/250
157/157          8s 51ms/step -
accuracy: 0.8679 - loss: 0.7794 - val_accuracy: 0.8471 - val_loss: 0.8395 -
learning_rate: 1.2500e-04
Epoch 77/250
157/157          8s 50ms/step -
accuracy: 0.8638 - loss: 0.7850 - val_accuracy: 0.8563 - val_loss: 0.8145 -
learning_rate: 1.2500e-04
Epoch 78/250
157/157          8s 50ms/step -
accuracy: 0.8670 - loss: 0.7774 - val_accuracy: 0.8573 - val_loss: 0.8299 -
learning_rate: 1.2500e-04
Epoch 79/250
157/157          8s 50ms/step -
accuracy: 0.8673 - loss: 0.7675 - val_accuracy: 0.8553 - val_loss: 0.8327 -
learning_rate: 1.2500e-04
Epoch 80/250
157/157          8s 50ms/step -
accuracy: 0.8651 - loss: 0.7792 - val_accuracy: 0.8511 - val_loss: 0.8464 -
learning_rate: 1.2500e-04
Epoch 81/250
157/157          8s 50ms/step -
accuracy: 0.8683 - loss: 0.7721 - val_accuracy: 0.8555 - val_loss: 0.8223 -
learning_rate: 1.2500e-04
Epoch 82/250
157/157          8s 50ms/step -
accuracy: 0.8693 - loss: 0.7645 - val_accuracy: 0.8577 - val_loss: 0.8213 -
learning_rate: 1.2500e-04
Epoch 83/250
157/157          8s 50ms/step -
accuracy: 0.8754 - loss: 0.7454 - val_accuracy: 0.8493 - val_loss: 0.8436 -

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learning_rate: 6.2500e-05
Epoch 84/250
157/157          8s 50ms/step -
accuracy: 0.8799 - loss: 0.7272 - val_accuracy: 0.8631 - val_loss: 0.7954 -
learning_rate: 6.2500e-05
Epoch 85/250
157/157          8s 50ms/step -
accuracy: 0.8818 - loss: 0.7193 - val_accuracy: 0.8548 - val_loss: 0.8123 -
learning_rate: 6.2500e-05
Epoch 86/250
157/157          8s 50ms/step -
accuracy: 0.8816 - loss: 0.6988 - val_accuracy: 0.8624 - val_loss: 0.7803 -
learning_rate: 6.2500e-05
Epoch 87/250
157/157          8s 50ms/step -
accuracy: 0.8880 - loss: 0.6840 - val_accuracy: 0.8510 - val_loss: 0.8067 -
learning_rate: 6.2500e-05
Epoch 88/250
157/157          8s 50ms/step -
accuracy: 0.8861 - loss: 0.6768 - val_accuracy: 0.8575 - val_loss: 0.7809 -
learning_rate: 6.2500e-05
Epoch 89/250
157/157          8s 50ms/step -
accuracy: 0.8869 - loss: 0.6777 - val_accuracy: 0.8641 - val_loss: 0.7605 -
learning_rate: 6.2500e-05
Epoch 90/250
157/157          8s 50ms/step -
accuracy: 0.8930 - loss: 0.6572 - val_accuracy: 0.8630 - val_loss: 0.7580 -
learning_rate: 6.2500e-05
Epoch 91/250
157/157          8s 50ms/step -
accuracy: 0.8924 - loss: 0.6504 - val_accuracy: 0.8552 - val_loss: 0.7794 -
learning_rate: 6.2500e-05
Epoch 92/250
157/157          8s 50ms/step -
accuracy: 0.8933 - loss: 0.6490 - val_accuracy: 0.8577 - val_loss: 0.7721 -
learning_rate: 6.2500e-05
Epoch 93/250
157/157          8s 50ms/step -
accuracy: 0.8934 - loss: 0.6411 - val_accuracy: 0.8661 - val_loss: 0.7403 -
learning_rate: 6.2500e-05
Epoch 94/250
157/157          8s 50ms/step -
accuracy: 0.8946 - loss: 0.6315 - val_accuracy: 0.8676 - val_loss: 0.7343 -
learning_rate: 6.2500e-05
Epoch 95/250
157/157          8s 50ms/step -
accuracy: 0.8941 - loss: 0.6301 - val_accuracy: 0.8651 - val_loss: 0.7319 -

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learning_rate: 6.2500e-05
Epoch 96/250
157/157          8s 50ms/step -
accuracy: 0.8960 - loss: 0.6193 - val_accuracy: 0.8645 - val_loss: 0.7427 -
learning_rate: 6.2500e-05
Epoch 97/250
157/157          8s 50ms/step -
accuracy: 0.8941 - loss: 0.6243 - val_accuracy: 0.8608 - val_loss: 0.7427 -
learning_rate: 6.2500e-05
Epoch 98/250
157/157          8s 50ms/step -
accuracy: 0.8946 - loss: 0.6202 - val_accuracy: 0.8675 - val_loss: 0.7274 -
learning_rate: 6.2500e-05
Epoch 99/250
157/157          8s 50ms/step -
accuracy: 0.9006 - loss: 0.6009 - val_accuracy: 0.8680 - val_loss: 0.7222 -
learning_rate: 6.2500e-05
Epoch 100/250
157/157          8s 50ms/step -
accuracy: 0.8984 - loss: 0.6060 - val_accuracy: 0.8666 - val_loss: 0.7233 -
learning_rate: 6.2500e-05
Epoch 101/250
157/157          8s 50ms/step -
accuracy: 0.8957 - loss: 0.6035 - val_accuracy: 0.8633 - val_loss: 0.7422 -
learning_rate: 6.2500e-05
Epoch 102/250
157/157          8s 50ms/step -
accuracy: 0.9008 - loss: 0.5896 - val_accuracy: 0.8629 - val_loss: 0.7318 -
learning_rate: 6.2500e-05
Epoch 103/250
157/157          8s 50ms/step -
accuracy: 0.9022 - loss: 0.5861 - val_accuracy: 0.8602 - val_loss: 0.7355 -
learning_rate: 6.2500e-05
Epoch 104/250
157/157          8s 50ms/step -
accuracy: 0.8991 - loss: 0.5904 - val_accuracy: 0.8637 - val_loss: 0.7281 -
learning_rate: 6.2500e-05
Epoch 105/250
157/157          8s 50ms/step -
accuracy: 0.9036 - loss: 0.5808 - val_accuracy: 0.8702 - val_loss: 0.7023 -
learning_rate: 3.1250e-05
Epoch 106/250
157/157          8s 51ms/step -
accuracy: 0.9065 - loss: 0.5669 - val_accuracy: 0.8677 - val_loss: 0.7105 -
learning_rate: 3.1250e-05
Epoch 107/250
157/157          8s 51ms/step -
accuracy: 0.9047 - loss: 0.5684 - val_accuracy: 0.8696 - val_loss: 0.7054 -

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learning_rate: 3.1250e-05
Epoch 108/250
157/157          8s 51ms/step -
accuracy: 0.9079 - loss: 0.5552 - val_accuracy: 0.8672 - val_loss: 0.7109 -
learning_rate: 3.1250e-05
Epoch 109/250
157/157          8s 50ms/step -
accuracy: 0.9096 - loss: 0.5482 - val_accuracy: 0.8728 - val_loss: 0.6875 -
learning_rate: 3.1250e-05
Epoch 110/250
157/157          8s 50ms/step -
accuracy: 0.9095 - loss: 0.5465 - val_accuracy: 0.8727 - val_loss: 0.6934 -
learning_rate: 3.1250e-05
Epoch 111/250
157/157          8s 50ms/step -
accuracy: 0.9080 - loss: 0.5463 - val_accuracy: 0.8697 - val_loss: 0.6951 -
learning_rate: 3.1250e-05
Epoch 112/250
157/157          8s 50ms/step -
accuracy: 0.9068 - loss: 0.5421 - val_accuracy: 0.8686 - val_loss: 0.6988 -
learning_rate: 3.1250e-05
Epoch 113/250
157/157          8s 50ms/step -
accuracy: 0.9167 - loss: 0.5252 - val_accuracy: 0.8706 - val_loss: 0.6948 -
learning_rate: 3.1250e-05
Epoch 114/250
157/157          8s 50ms/step -
accuracy: 0.9145 - loss: 0.5247 - val_accuracy: 0.8759 - val_loss: 0.6801 -
learning_rate: 3.1250e-05
Epoch 115/250
157/157          8s 51ms/step -
accuracy: 0.9148 - loss: 0.5197 - val_accuracy: 0.8713 - val_loss: 0.6910 -
learning_rate: 3.1250e-05
Epoch 116/250
157/157          8s 51ms/step -
accuracy: 0.9114 - loss: 0.5222 - val_accuracy: 0.8717 - val_loss: 0.6800 -
learning_rate: 3.1250e-05
Epoch 117/250
157/157          8s 51ms/step -
accuracy: 0.9141 - loss: 0.5143 - val_accuracy: 0.8703 - val_loss: 0.6822 -
learning_rate: 3.1250e-05
Epoch 118/250
157/157          8s 50ms/step -
accuracy: 0.9153 - loss: 0.5121 - val_accuracy: 0.8715 - val_loss: 0.6763 -
learning_rate: 3.1250e-05
Epoch 119/250
157/157          8s 51ms/step -
accuracy: 0.9179 - loss: 0.5066 - val_accuracy: 0.8696 - val_loss: 0.6849 -

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learning_rate: 3.1250e-05
Epoch 120/250
157/157          8s 51ms/step -
accuracy: 0.9149 - loss: 0.5071 - val_accuracy: 0.8699 - val_loss: 0.6785 -
learning_rate: 3.1250e-05
Epoch 121/250
157/157          8s 50ms/step -
accuracy: 0.9185 - loss: 0.4980 - val_accuracy: 0.8724 - val_loss: 0.6676 -
learning_rate: 3.1250e-05
Epoch 122/250
157/157          8s 50ms/step -
accuracy: 0.9165 - loss: 0.4991 - val_accuracy: 0.8741 - val_loss: 0.6681 -
learning_rate: 3.1250e-05
Epoch 123/250
157/157          8s 51ms/step -
accuracy: 0.9142 - loss: 0.5084 - val_accuracy: 0.8694 - val_loss: 0.6927 -
learning_rate: 3.1250e-05
Epoch 124/250
157/157          8s 50ms/step -
accuracy: 0.9196 - loss: 0.4871 - val_accuracy: 0.8708 - val_loss: 0.6716 -
learning_rate: 3.1250e-05
Epoch 125/250
157/157          8s 50ms/step -
accuracy: 0.9197 - loss: 0.4895 - val_accuracy: 0.8710 - val_loss: 0.6723 -
learning_rate: 3.1250e-05
Epoch 126/250
157/157          8s 50ms/step -
accuracy: 0.9210 - loss: 0.4866 - val_accuracy: 0.8745 - val_loss: 0.6650 -
learning_rate: 3.1250e-05
Epoch 127/250
157/157          8s 51ms/step -
accuracy: 0.9213 - loss: 0.4841 - val_accuracy: 0.8730 - val_loss: 0.6677 -
learning_rate: 3.1250e-05
Epoch 128/250
157/157          8s 51ms/step -
accuracy: 0.9162 - loss: 0.4896 - val_accuracy: 0.8756 - val_loss: 0.6560 -
learning_rate: 3.1250e-05
Epoch 129/250
157/157          8s 51ms/step -
accuracy: 0.9203 - loss: 0.4803 - val_accuracy: 0.8690 - val_loss: 0.6783 -
learning_rate: 3.1250e-05
Epoch 130/250
157/157          8s 50ms/step -
accuracy: 0.9195 - loss: 0.4737 - val_accuracy: 0.8750 - val_loss: 0.6634 -
learning_rate: 3.1250e-05
Epoch 131/250
157/157          8s 51ms/step -
accuracy: 0.9202 - loss: 0.4762 - val_accuracy: 0.8749 - val_loss: 0.6567 -

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learning_rate: 3.1250e-05
Epoch 132/250
157/157          8s 50ms/step -
accuracy: 0.9232 - loss: 0.4640 - val_accuracy: 0.8749 - val_loss: 0.6553 -
learning_rate: 3.1250e-05
Epoch 133/250
157/157          8s 50ms/step -
accuracy: 0.9205 - loss: 0.4700 - val_accuracy: 0.8745 - val_loss: 0.6513 -
learning_rate: 3.1250e-05
Epoch 134/250
157/157          8s 51ms/step -
accuracy: 0.9213 - loss: 0.4718 - val_accuracy: 0.8733 - val_loss: 0.6580 -
learning_rate: 3.1250e-05
Epoch 135/250
157/157          8s 51ms/step -
accuracy: 0.9216 - loss: 0.4641 - val_accuracy: 0.8717 - val_loss: 0.6629 -
learning_rate: 3.1250e-05
Epoch 136/250
157/157          8s 50ms/step -
accuracy: 0.9244 - loss: 0.4524 - val_accuracy: 0.8729 - val_loss: 0.6519 -
learning_rate: 3.1250e-05
Epoch 137/250
157/157          8s 50ms/step -
accuracy: 0.9225 - loss: 0.4613 - val_accuracy: 0.8744 - val_loss: 0.6519 -
learning_rate: 3.1250e-05
Epoch 138/250
157/157          8s 50ms/step -
accuracy: 0.9253 - loss: 0.4561 - val_accuracy: 0.8729 - val_loss: 0.6539 -
learning_rate: 3.1250e-05
Epoch 139/250
157/157          8s 50ms/step -
accuracy: 0.9222 - loss: 0.4565 - val_accuracy: 0.8739 - val_loss: 0.6491 -
learning_rate: 1.5625e-05
Epoch 140/250
157/157          8s 51ms/step -
accuracy: 0.9282 - loss: 0.4433 - val_accuracy: 0.8730 - val_loss: 0.6534 -
learning_rate: 1.5625e-05
Epoch 141/250
157/157          8s 51ms/step -
accuracy: 0.9264 - loss: 0.4476 - val_accuracy: 0.8748 - val_loss: 0.6463 -
learning_rate: 1.5625e-05
Epoch 142/250
157/157          8s 51ms/step -
accuracy: 0.9294 - loss: 0.4413 - val_accuracy: 0.8763 - val_loss: 0.6437 -
learning_rate: 1.5625e-05
Epoch 143/250
157/157          8s 51ms/step -
accuracy: 0.9289 - loss: 0.4350 - val_accuracy: 0.8752 - val_loss: 0.6449 -

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learning_rate: 1.5625e-05
Epoch 144/250
157/157          8s 51ms/step -
accuracy: 0.9292 - loss: 0.4352 - val_accuracy: 0.8739 - val_loss: 0.6436 -
learning_rate: 1.5625e-05
Epoch 145/250
157/157          8s 51ms/step -
accuracy: 0.9290 - loss: 0.4332 - val_accuracy: 0.8741 - val_loss: 0.6429 -
learning_rate: 1.5625e-05
Epoch 146/250
157/157          8s 51ms/step -
accuracy: 0.9281 - loss: 0.4299 - val_accuracy: 0.8758 - val_loss: 0.6362 -
learning_rate: 1.5625e-05
Epoch 147/250
157/157          8s 51ms/step -
accuracy: 0.9305 - loss: 0.4255 - val_accuracy: 0.8734 - val_loss: 0.6424 -
learning_rate: 1.5625e-05
Epoch 148/250
157/157          8s 51ms/step -
accuracy: 0.9277 - loss: 0.4307 - val_accuracy: 0.8769 - val_loss: 0.6360 -
learning_rate: 1.5625e-05
Epoch 149/250
157/157          8s 50ms/step -
accuracy: 0.9291 - loss: 0.4305 - val_accuracy: 0.8751 - val_loss: 0.6378 -
learning_rate: 1.5625e-05
Epoch 150/250
157/157          8s 50ms/step -
accuracy: 0.9309 - loss: 0.4218 - val_accuracy: 0.8745 - val_loss: 0.6372 -
learning_rate: 1.5625e-05
Epoch 151/250
157/157          8s 51ms/step -
accuracy: 0.9292 - loss: 0.4232 - val_accuracy: 0.8762 - val_loss: 0.6348 -
learning_rate: 1.5625e-05
Epoch 152/250
157/157          8s 51ms/step -
accuracy: 0.9303 - loss: 0.4202 - val_accuracy: 0.8758 - val_loss: 0.6344 -
learning_rate: 1.5625e-05
Epoch 153/250
157/157          8s 51ms/step -
accuracy: 0.9316 - loss: 0.4152 - val_accuracy: 0.8762 - val_loss: 0.6356 -
learning_rate: 1.5625e-05
Epoch 154/250
157/157          8s 50ms/step -
accuracy: 0.9276 - loss: 0.4250 - val_accuracy: 0.8736 - val_loss: 0.6388 -
learning_rate: 1.5625e-05
Epoch 155/250
157/157          8s 50ms/step -
accuracy: 0.9332 - loss: 0.4156 - val_accuracy: 0.8742 - val_loss: 0.6364 -

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learning_rate: 1.5625e-05
Epoch 156/250
157/157          10s 51ms/step -
accuracy: 0.9338 - loss: 0.4088 - val_accuracy: 0.8754 - val_loss: 0.6352 -
learning_rate: 1.5625e-05
Epoch 157/250
157/157          8s 50ms/step -
accuracy: 0.9310 - loss: 0.4148 - val_accuracy: 0.8751 - val_loss: 0.6395 -
learning_rate: 1.5625e-05
Epoch 158/250
157/157          8s 50ms/step -
accuracy: 0.9331 - loss: 0.4077 - val_accuracy: 0.8771 - val_loss: 0.6269 -
learning_rate: 7.8125e-06
Epoch 159/250
157/157          8s 50ms/step -
accuracy: 0.9295 - loss: 0.4134 - val_accuracy: 0.8770 - val_loss: 0.6280 -
learning_rate: 7.8125e-06
Epoch 160/250
157/157          8s 50ms/step -
accuracy: 0.9320 - loss: 0.4104 - val_accuracy: 0.8759 - val_loss: 0.6314 -
learning_rate: 7.8125e-06
Epoch 161/250
157/157          8s 50ms/step -
accuracy: 0.9336 - loss: 0.4070 - val_accuracy: 0.8764 - val_loss: 0.6300 -
learning_rate: 7.8125e-06
Epoch 162/250
157/157          8s 50ms/step -
accuracy: 0.9356 - loss: 0.4019 - val_accuracy: 0.8765 - val_loss: 0.6269 -
learning_rate: 7.8125e-06
Epoch 163/250
157/157          8s 50ms/step -
accuracy: 0.9325 - loss: 0.4077 - val_accuracy: 0.8771 - val_loss: 0.6241 -
learning_rate: 7.8125e-06
Epoch 164/250
157/157          8s 50ms/step -
accuracy: 0.9353 - loss: 0.3996 - val_accuracy: 0.8756 - val_loss: 0.6282 -
learning_rate: 7.8125e-06
Epoch 165/250
157/157          8s 50ms/step -
accuracy: 0.9362 - loss: 0.3986 - val_accuracy: 0.8762 - val_loss: 0.6285 -
learning_rate: 7.8125e-06
Epoch 166/250
157/157          8s 51ms/step -
accuracy: 0.9337 - loss: 0.4045 - val_accuracy: 0.8765 - val_loss: 0.6247 -
learning_rate: 7.8125e-06
Epoch 167/250
157/157          8s 51ms/step -
accuracy: 0.9351 - loss: 0.3993 - val_accuracy: 0.8766 - val_loss: 0.6286 -

```

```

learning_rate: 7.8125e-06
Epoch 168/250
157/157      8s 50ms/step -
accuracy: 0.9345 - loss: 0.3962 - val_accuracy: 0.8785 - val_loss: 0.6226 -
learning_rate: 7.8125e-06
Epoch 169/250
157/157      8s 50ms/step -
accuracy: 0.9356 - loss: 0.3972 - val_accuracy: 0.8780 - val_loss: 0.6218 -
learning_rate: 7.8125e-06
Epoch 170/250
157/157      8s 50ms/step -
accuracy: 0.9356 - loss: 0.4006 - val_accuracy: 0.8771 - val_loss: 0.6237 -
learning_rate: 7.8125e-06
Epoch 171/250
157/157      8s 50ms/step -
accuracy: 0.9364 - loss: 0.3955 - val_accuracy: 0.8786 - val_loss: 0.6193 -
learning_rate: 7.8125e-06
Epoch 172/250
157/157      8s 50ms/step -
accuracy: 0.9370 - loss: 0.3892 - val_accuracy: 0.8786 - val_loss: 0.6205 -
learning_rate: 7.8125e-06
Epoch 173/250
157/157      8s 50ms/step -
accuracy: 0.9374 - loss: 0.3873 - val_accuracy: 0.8768 - val_loss: 0.6289 -
learning_rate: 7.8125e-06
Epoch 174/250
157/157      8s 50ms/step -
accuracy: 0.9374 - loss: 0.3886 - val_accuracy: 0.8774 - val_loss: 0.6214 -
learning_rate: 7.8125e-06
Epoch 175/250
157/157      8s 50ms/step -
accuracy: 0.9366 - loss: 0.3881 - val_accuracy: 0.8776 - val_loss: 0.6206 -
learning_rate: 7.8125e-06
Epoch 176/250
157/157      8s 50ms/step -
accuracy: 0.9421 - loss: 0.3803 - val_accuracy: 0.8762 - val_loss: 0.6223 -
learning_rate: 7.8125e-06
Epoch 177/250
157/157      8s 50ms/step -
accuracy: 0.9344 - loss: 0.3885 - val_accuracy: 0.8763 - val_loss: 0.6205 -
learning_rate: 3.9063e-06
Epoch 178/250
157/157      8s 50ms/step -
accuracy: 0.9390 - loss: 0.3878 - val_accuracy: 0.8763 - val_loss: 0.6232 -
learning_rate: 3.9063e-06
Epoch 179/250
157/157      8s 50ms/step -
accuracy: 0.9392 - loss: 0.3837 - val_accuracy: 0.8775 - val_loss: 0.6198 -

```

```

learning_rate: 3.9063e-06
Epoch 180/250
157/157          8s 50ms/step -
accuracy: 0.9384 - loss: 0.3825 - val_accuracy: 0.8778 - val_loss: 0.6202 -
learning_rate: 3.9063e-06
Epoch 181/250
157/157          8s 50ms/step -
accuracy: 0.9371 - loss: 0.3816 - val_accuracy: 0.8775 - val_loss: 0.6210 -
learning_rate: 3.9063e-06
Epoch 182/250
157/157          8s 50ms/step -
accuracy: 0.9404 - loss: 0.3758 - val_accuracy: 0.8786 - val_loss: 0.6182 -
learning_rate: 1.9531e-06
Epoch 183/250
157/157          8s 50ms/step -
accuracy: 0.9390 - loss: 0.3777 - val_accuracy: 0.8780 - val_loss: 0.6184 -
learning_rate: 1.9531e-06
Epoch 184/250
157/157          8s 50ms/step -
accuracy: 0.9391 - loss: 0.3867 - val_accuracy: 0.8785 - val_loss: 0.6191 -
learning_rate: 1.9531e-06
Epoch 185/250
157/157          8s 50ms/step -
accuracy: 0.9373 - loss: 0.3819 - val_accuracy: 0.8784 - val_loss: 0.6195 -
learning_rate: 1.9531e-06
Epoch 186/250
157/157          8s 50ms/step -
accuracy: 0.9397 - loss: 0.3786 - val_accuracy: 0.8774 - val_loss: 0.6201 -
learning_rate: 1.9531e-06
Epoch 187/250
157/157          8s 50ms/step -
accuracy: 0.9400 - loss: 0.3799 - val_accuracy: 0.8770 - val_loss: 0.6204 -
learning_rate: 1.9531e-06
Epoch 188/250
157/157          8s 50ms/step -
accuracy: 0.9415 - loss: 0.3737 - val_accuracy: 0.8772 - val_loss: 0.6194 -
learning_rate: 1.0000e-06
Epoch 189/250
157/157          8s 50ms/step -
accuracy: 0.9377 - loss: 0.3838 - val_accuracy: 0.8774 - val_loss: 0.6197 -
learning_rate: 1.0000e-06
Epoch 190/250
157/157          8s 50ms/step -
accuracy: 0.9376 - loss: 0.3842 - val_accuracy: 0.8775 - val_loss: 0.6196 -
learning_rate: 1.0000e-06
Epoch 191/250
157/157          8s 50ms/step -
accuracy: 0.9393 - loss: 0.3818 - val_accuracy: 0.8773 - val_loss: 0.6185 -

```

```

learning_rate: 1.0000e-06
Epoch 192/250
157/157      8s 50ms/step -
accuracy: 0.9413 - loss: 0.3763 - val_accuracy: 0.8776 - val_loss: 0.6176 -
learning_rate: 1.0000e-06
Epoch 193/250
157/157      8s 50ms/step -
accuracy: 0.9378 - loss: 0.3778 - val_accuracy: 0.8773 - val_loss: 0.6187 -
learning_rate: 1.0000e-06
Epoch 194/250
157/157      8s 50ms/step -
accuracy: 0.9392 - loss: 0.3792 - val_accuracy: 0.8777 - val_loss: 0.6180 -
learning_rate: 1.0000e-06
Epoch 195/250
157/157      8s 51ms/step -
accuracy: 0.9386 - loss: 0.3808 - val_accuracy: 0.8779 - val_loss: 0.6174 -
learning_rate: 1.0000e-06
Epoch 196/250
157/157      8s 50ms/step -
accuracy: 0.9394 - loss: 0.3789 - val_accuracy: 0.8775 - val_loss: 0.6180 -
learning_rate: 1.0000e-06
Epoch 197/250
157/157      8s 50ms/step -
accuracy: 0.9380 - loss: 0.3821 - val_accuracy: 0.8766 - val_loss: 0.6187 -
learning_rate: 1.0000e-06
Epoch 198/250
157/157      8s 50ms/step -
accuracy: 0.9384 - loss: 0.3780 - val_accuracy: 0.8773 - val_loss: 0.6175 -
learning_rate: 1.0000e-06
Epoch 199/250
157/157      8s 50ms/step -
accuracy: 0.9390 - loss: 0.3758 - val_accuracy: 0.8776 - val_loss: 0.6175 -
learning_rate: 1.0000e-06
Epoch 200/250
157/157      8s 50ms/step -
accuracy: 0.9381 - loss: 0.3822 - val_accuracy: 0.8776 - val_loss: 0.6178 -
learning_rate: 1.0000e-06
Epoch 201/250
157/157      8s 50ms/step -
accuracy: 0.9407 - loss: 0.3741 - val_accuracy: 0.8780 - val_loss: 0.6180 -
learning_rate: 1.0000e-06
Epoch 202/250
157/157      8s 50ms/step -
accuracy: 0.9386 - loss: 0.3800 - val_accuracy: 0.8779 - val_loss: 0.6173 -
learning_rate: 1.0000e-06
Epoch 203/250
157/157      8s 51ms/step -
accuracy: 0.9394 - loss: 0.3765 - val_accuracy: 0.8774 - val_loss: 0.6174 -

```

```

learning_rate: 1.0000e-06
Epoch 204/250
157/157      8s 50ms/step -
accuracy: 0.9388 - loss: 0.3758 - val_accuracy: 0.8779 - val_loss: 0.6174 -
learning_rate: 1.0000e-06
Epoch 205/250
157/157      8s 50ms/step -
accuracy: 0.9386 - loss: 0.3777 - val_accuracy: 0.8774 - val_loss: 0.6178 -
learning_rate: 1.0000e-06
Epoch 206/250
157/157      8s 50ms/step -
accuracy: 0.9385 - loss: 0.3788 - val_accuracy: 0.8770 - val_loss: 0.6166 -
learning_rate: 1.0000e-06
Epoch 207/250
157/157      8s 50ms/step -
accuracy: 0.9384 - loss: 0.3792 - val_accuracy: 0.8775 - val_loss: 0.6156 -
learning_rate: 1.0000e-06
Epoch 208/250
157/157      8s 50ms/step -
accuracy: 0.9393 - loss: 0.3770 - val_accuracy: 0.8769 - val_loss: 0.6179 -
learning_rate: 1.0000e-06
Epoch 209/250
157/157      8s 50ms/step -
accuracy: 0.9394 - loss: 0.3753 - val_accuracy: 0.8772 - val_loss: 0.6182 -
learning_rate: 1.0000e-06
Epoch 210/250
157/157      8s 50ms/step -
accuracy: 0.9417 - loss: 0.3723 - val_accuracy: 0.8774 - val_loss: 0.6173 -
learning_rate: 1.0000e-06
Epoch 211/250
157/157      8s 51ms/step -
accuracy: 0.9389 - loss: 0.3735 - val_accuracy: 0.8777 - val_loss: 0.6166 -
learning_rate: 1.0000e-06
Epoch 212/250
157/157      8s 50ms/step -
accuracy: 0.9416 - loss: 0.3727 - val_accuracy: 0.8778 - val_loss: 0.6178 -
learning_rate: 1.0000e-06
Epoch 213/250
157/157      8s 51ms/step -
accuracy: 0.9411 - loss: 0.3766 - val_accuracy: 0.8778 - val_loss: 0.6173 -
learning_rate: 1.0000e-06
Epoch 214/250
157/157      8s 51ms/step -
accuracy: 0.9393 - loss: 0.3753 - val_accuracy: 0.8777 - val_loss: 0.6176 -
learning_rate: 1.0000e-06
Epoch 215/250
157/157      8s 51ms/step -
accuracy: 0.9400 - loss: 0.3740 - val_accuracy: 0.8778 - val_loss: 0.6176 -

```

```

learning_rate: 1.0000e-06
Epoch 216/250
157/157          8s 51ms/step -
accuracy: 0.9413 - loss: 0.3736 - val_accuracy: 0.8778 - val_loss: 0.6179 -
learning_rate: 1.0000e-06
Epoch 217/250
157/157          8s 51ms/step -
accuracy: 0.9362 - loss: 0.3830 - val_accuracy: 0.8774 - val_loss: 0.6183 -
learning_rate: 1.0000e-06
Epoch 218/250
157/157          8s 51ms/step -
accuracy: 0.9397 - loss: 0.3731 - val_accuracy: 0.8779 - val_loss: 0.6169 -
learning_rate: 1.0000e-06
Epoch 219/250
157/157          8s 50ms/step -
accuracy: 0.9425 - loss: 0.3682 - val_accuracy: 0.8780 - val_loss: 0.6155 -
learning_rate: 1.0000e-06
Epoch 220/250
157/157          8s 50ms/step -
accuracy: 0.9389 - loss: 0.3739 - val_accuracy: 0.8776 - val_loss: 0.6157 -
learning_rate: 1.0000e-06
Epoch 221/250
157/157          8s 50ms/step -
accuracy: 0.9387 - loss: 0.3752 - val_accuracy: 0.8782 - val_loss: 0.6145 -
learning_rate: 1.0000e-06
Epoch 222/250
157/157          8s 50ms/step -
accuracy: 0.9404 - loss: 0.3734 - val_accuracy: 0.8781 - val_loss: 0.6159 -
learning_rate: 1.0000e-06
Epoch 223/250
157/157          8s 50ms/step -
accuracy: 0.9415 - loss: 0.3719 - val_accuracy: 0.8773 - val_loss: 0.6167 -
learning_rate: 1.0000e-06
Epoch 224/250
157/157          8s 50ms/step -
accuracy: 0.9412 - loss: 0.3764 - val_accuracy: 0.8772 - val_loss: 0.6167 -
learning_rate: 1.0000e-06
Epoch 225/250
157/157          8s 50ms/step -
accuracy: 0.9394 - loss: 0.3784 - val_accuracy: 0.8782 - val_loss: 0.6157 -
learning_rate: 1.0000e-06
Epoch 226/250
157/157          8s 50ms/step -
accuracy: 0.9422 - loss: 0.3696 - val_accuracy: 0.8789 - val_loss: 0.6146 -
learning_rate: 1.0000e-06
Epoch 227/250
157/157          8s 50ms/step -
accuracy: 0.9425 - loss: 0.3693 - val_accuracy: 0.8787 - val_loss: 0.6146 -

```

```

learning_rate: 1.0000e-06
Epoch 228/250
157/157      8s 50ms/step -
accuracy: 0.9416 - loss: 0.3696 - val_accuracy: 0.8788 - val_loss: 0.6141 -
learning_rate: 1.0000e-06
Epoch 229/250
157/157      8s 50ms/step -
accuracy: 0.9380 - loss: 0.3776 - val_accuracy: 0.8783 - val_loss: 0.6137 -
learning_rate: 1.0000e-06
Epoch 230/250
157/157      8s 50ms/step -
accuracy: 0.9393 - loss: 0.3732 - val_accuracy: 0.8775 - val_loss: 0.6141 -
learning_rate: 1.0000e-06
Epoch 231/250
157/157      8s 50ms/step -
accuracy: 0.9414 - loss: 0.3679 - val_accuracy: 0.8774 - val_loss: 0.6137 -
learning_rate: 1.0000e-06
Epoch 232/250
157/157      8s 50ms/step -
accuracy: 0.9408 - loss: 0.3736 - val_accuracy: 0.8782 - val_loss: 0.6138 -
learning_rate: 1.0000e-06
Epoch 233/250
157/157      8s 50ms/step -
accuracy: 0.9412 - loss: 0.3694 - val_accuracy: 0.8780 - val_loss: 0.6140 -
learning_rate: 1.0000e-06
Epoch 234/250
157/157      8s 50ms/step -
accuracy: 0.9401 - loss: 0.3734 - val_accuracy: 0.8780 - val_loss: 0.6129 -
learning_rate: 1.0000e-06
Epoch 235/250
157/157      8s 50ms/step -
accuracy: 0.9393 - loss: 0.3709 - val_accuracy: 0.8782 - val_loss: 0.6128 -
learning_rate: 1.0000e-06
Epoch 236/250
157/157      8s 50ms/step -
accuracy: 0.9365 - loss: 0.3789 - val_accuracy: 0.8776 - val_loss: 0.6137 -
learning_rate: 1.0000e-06
Epoch 237/250
157/157      8s 50ms/step -
accuracy: 0.9410 - loss: 0.3680 - val_accuracy: 0.8777 - val_loss: 0.6141 -
learning_rate: 1.0000e-06
Epoch 238/250
157/157      8s 50ms/step -
accuracy: 0.9397 - loss: 0.3740 - val_accuracy: 0.8783 - val_loss: 0.6138 -
learning_rate: 1.0000e-06
Epoch 239/250
157/157      8s 50ms/step -
accuracy: 0.9434 - loss: 0.3638 - val_accuracy: 0.8783 - val_loss: 0.6140 -

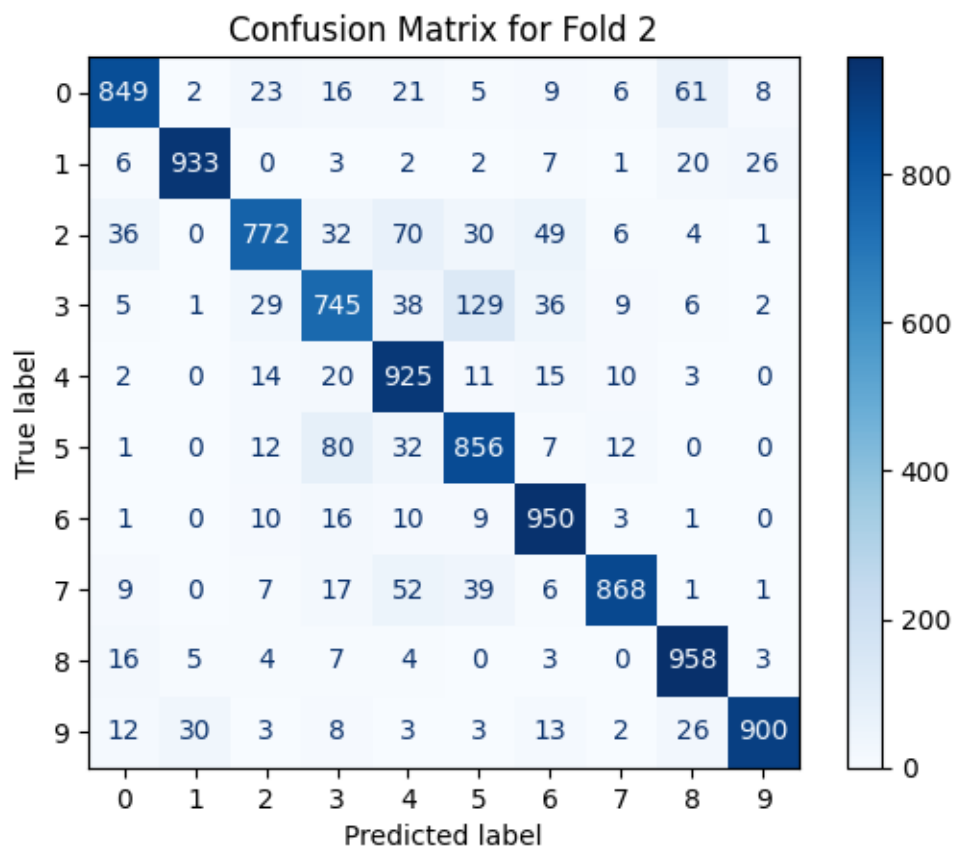
```



```

learning_rate: 1.0000e-06
Epoch 240/250
157/157          8s 50ms/step -
accuracy: 0.9406 - loss: 0.3739 - val_accuracy: 0.8780 - val_loss: 0.6134 -
learning_rate: 1.0000e-06
Epoch 241/250
157/157          8s 50ms/step -
accuracy: 0.9421 - loss: 0.3678 - val_accuracy: 0.8786 - val_loss: 0.6135 -
learning_rate: 1.0000e-06
Epoch 242/250
157/157          8s 50ms/step -
accuracy: 0.9409 - loss: 0.3700 - val_accuracy: 0.8783 - val_loss: 0.6142 -
learning_rate: 1.0000e-06
Epoch 243/250
157/157          8s 51ms/step -
accuracy: 0.9450 - loss: 0.3597 - val_accuracy: 0.8775 - val_loss: 0.6147 -
learning_rate: 1.0000e-06
Epoch 244/250
157/157          8s 50ms/step -
accuracy: 0.9395 - loss: 0.3750 - val_accuracy: 0.8783 - val_loss: 0.6133 -
learning_rate: 1.0000e-06
Epoch 245/250
157/157          8s 50ms/step -
accuracy: 0.9414 - loss: 0.3699 - val_accuracy: 0.8784 - val_loss: 0.6140 -
learning_rate: 1.0000e-06
Epoch 246/250
157/157          8s 50ms/step -
accuracy: 0.9422 - loss: 0.3676 - val_accuracy: 0.8781 - val_loss: 0.6132 -
learning_rate: 1.0000e-06
Epoch 247/250
157/157          8s 50ms/step -
accuracy: 0.9427 - loss: 0.3658 - val_accuracy: 0.8784 - val_loss: 0.6138 -
learning_rate: 1.0000e-06
Epoch 248/250
157/157          8s 50ms/step -
accuracy: 0.9401 - loss: 0.3735 - val_accuracy: 0.8777 - val_loss: 0.6153 -
learning_rate: 1.0000e-06
Epoch 249/250
157/157          8s 50ms/step -
accuracy: 0.9412 - loss: 0.3674 - val_accuracy: 0.8786 - val_loss: 0.6148 -
learning_rate: 1.0000e-06
Epoch 250/250
157/157          8s 50ms/step -
accuracy: 0.9403 - loss: 0.3669 - val_accuracy: 0.8783 - val_loss: 0.6135 -
learning_rate: 1.0000e-06
Score for fold 2: test loss of 0.6244381070137024; test accuracy of
87.55999803543091%
313/313          1s 4ms/step

```



Classification Report for Fold 2:

	precision	recall	f1-score	support
Class 0	0.91	0.85	0.88	1000
Class 1	0.96	0.93	0.95	1000
Class 2	0.88	0.77	0.82	1000
Class 3	0.79	0.74	0.77	1000
Class 4	0.80	0.93	0.86	1000
Class 5	0.79	0.86	0.82	1000
Class 6	0.87	0.95	0.91	1000
Class 7	0.95	0.87	0.91	1000
Class 8	0.89	0.96	0.92	1000
Class 9	0.96	0.90	0.93	1000
accuracy			0.88	10000
macro avg	0.88	0.88	0.88	10000
weighted avg	0.88	0.88	0.88	10000

/opt/conda/lib/python3.10/site-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not

pass an ``input_shape`/`input_dim`` argument to a layer. When using Sequential models, prefer using an ``Input(shape)`` object as the first layer in the model instead.

```
super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Epoch 1/250

157/157 32s 118ms/step -

accuracy: 0.2030 - loss: 8.0466 - val_accuracy: 0.2274 - val_loss: 5.7277 -
learning_rate: 0.0010

Epoch 2/250

157/157 8s 51ms/step -

accuracy: 0.3580 - loss: 4.8972 - val_accuracy: 0.3143 - val_loss: 3.8092 -
learning_rate: 0.0010

Epoch 3/250

157/157 8s 51ms/step -

accuracy: 0.4604 - loss: 3.2199 - val_accuracy: 0.4465 - val_loss: 2.7956 -
learning_rate: 0.0010

Epoch 4/250

157/157 8s 51ms/step -

accuracy: 0.5417 - loss: 2.4603 - val_accuracy: 0.4283 - val_loss: 2.6559 -
learning_rate: 0.0010

Epoch 5/250

157/157 8s 51ms/step -

accuracy: 0.5884 - loss: 2.1642 - val_accuracy: 0.6205 - val_loss: 2.0088 -
learning_rate: 0.0010

Epoch 6/250

157/157 8s 51ms/step -

accuracy: 0.6198 - loss: 2.0580 - val_accuracy: 0.5629 - val_loss: 2.2512 -
learning_rate: 0.0010

Epoch 7/250

157/157 8s 51ms/step -

accuracy: 0.6459 - loss: 1.9988 - val_accuracy: 0.6871 - val_loss: 1.8685 -
learning_rate: 0.0010

Epoch 8/250

157/157 8s 50ms/step -

accuracy: 0.6534 - loss: 2.0011 - val_accuracy: 0.6669 - val_loss: 1.9664 -
learning_rate: 0.0010

Epoch 9/250

157/157 8s 50ms/step -

accuracy: 0.6666 - loss: 1.9917 - val_accuracy: 0.7005 - val_loss: 1.8866 -
learning_rate: 0.0010

Epoch 10/250

157/157 8s 50ms/step -

accuracy: 0.6744 - loss: 1.9798 - val_accuracy: 0.6862 - val_loss: 1.9037 -
learning_rate: 0.0010

Epoch 11/250

157/157 8s 50ms/step -

accuracy: 0.6752 - loss: 1.9762 - val_accuracy: 0.7039 - val_loss: 1.8883 -

```

learning_rate: 0.0010
Epoch 12/250
157/157          8s 50ms/step -
accuracy: 0.6903 - loss: 1.9577 - val_accuracy: 0.7106 - val_loss: 1.8908 -
learning_rate: 0.0010
Epoch 13/250
157/157          8s 51ms/step -
accuracy: 0.7098 - loss: 1.8430 - val_accuracy: 0.7306 - val_loss: 1.6090 -
learning_rate: 5.0000e-04
Epoch 14/250
157/157          8s 51ms/step -
accuracy: 0.7271 - loss: 1.6196 - val_accuracy: 0.7453 - val_loss: 1.5106 -
learning_rate: 5.0000e-04
Epoch 15/250
157/157          8s 51ms/step -
accuracy: 0.7322 - loss: 1.5632 - val_accuracy: 0.7543 - val_loss: 1.4827 -
learning_rate: 5.0000e-04
Epoch 16/250
157/157          8s 50ms/step -
accuracy: 0.7327 - loss: 1.5572 - val_accuracy: 0.7380 - val_loss: 1.5253 -
learning_rate: 5.0000e-04
Epoch 17/250
157/157          8s 51ms/step -
accuracy: 0.7403 - loss: 1.5401 - val_accuracy: 0.7575 - val_loss: 1.4789 -
learning_rate: 5.0000e-04
Epoch 18/250
157/157          8s 51ms/step -
accuracy: 0.7410 - loss: 1.5532 - val_accuracy: 0.7684 - val_loss: 1.4595 -
learning_rate: 5.0000e-04
Epoch 19/250
157/157          8s 50ms/step -
accuracy: 0.7500 - loss: 1.5270 - val_accuracy: 0.7677 - val_loss: 1.4638 -
learning_rate: 5.0000e-04
Epoch 20/250
157/157          8s 50ms/step -
accuracy: 0.7470 - loss: 1.5277 - val_accuracy: 0.7422 - val_loss: 1.5363 -
learning_rate: 5.0000e-04
Epoch 21/250
157/157          8s 50ms/step -
accuracy: 0.7461 - loss: 1.5325 - val_accuracy: 0.7609 - val_loss: 1.4948 -
learning_rate: 5.0000e-04
Epoch 22/250
157/157          8s 50ms/step -
accuracy: 0.7481 - loss: 1.5414 - val_accuracy: 0.7541 - val_loss: 1.4988 -
learning_rate: 5.0000e-04
Epoch 23/250
157/157          8s 50ms/step -
accuracy: 0.7543 - loss: 1.5154 - val_accuracy: 0.7781 - val_loss: 1.4303 -

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learning_rate: 5.0000e-04
Epoch 24/250
157/157          8s 50ms/step -
accuracy: 0.7551 - loss: 1.5015 - val_accuracy: 0.7584 - val_loss: 1.4840 -
learning_rate: 5.0000e-04
Epoch 25/250
157/157          8s 51ms/step -
accuracy: 0.7587 - loss: 1.4926 - val_accuracy: 0.7661 - val_loss: 1.4693 -
learning_rate: 5.0000e-04
Epoch 26/250
157/157          8s 50ms/step -
accuracy: 0.7584 - loss: 1.4804 - val_accuracy: 0.7687 - val_loss: 1.4505 -
learning_rate: 5.0000e-04
Epoch 27/250
157/157          8s 50ms/step -
accuracy: 0.7627 - loss: 1.4836 - val_accuracy: 0.7770 - val_loss: 1.4468 -
learning_rate: 5.0000e-04
Epoch 28/250
157/157          8s 50ms/step -
accuracy: 0.7591 - loss: 1.4994 - val_accuracy: 0.7678 - val_loss: 1.4740 -
learning_rate: 5.0000e-04
Epoch 29/250
157/157          8s 50ms/step -
accuracy: 0.7749 - loss: 1.4201 - val_accuracy: 0.7780 - val_loss: 1.3519 -
learning_rate: 2.5000e-04
Epoch 30/250
157/157          8s 50ms/step -
accuracy: 0.7942 - loss: 1.2940 - val_accuracy: 0.8071 - val_loss: 1.2005 -
learning_rate: 2.5000e-04
Epoch 31/250
157/157          8s 50ms/step -
accuracy: 0.7974 - loss: 1.2252 - val_accuracy: 0.8086 - val_loss: 1.1472 -
learning_rate: 2.5000e-04
Epoch 32/250
157/157          8s 50ms/step -
accuracy: 0.8018 - loss: 1.1817 - val_accuracy: 0.8002 - val_loss: 1.1701 -
learning_rate: 2.5000e-04
Epoch 33/250
157/157          8s 50ms/step -
accuracy: 0.8003 - loss: 1.1766 - val_accuracy: 0.8168 - val_loss: 1.1361 -
learning_rate: 2.5000e-04
Epoch 34/250
157/157          8s 50ms/step -
accuracy: 0.7991 - loss: 1.1753 - val_accuracy: 0.8125 - val_loss: 1.1228 -
learning_rate: 2.5000e-04
Epoch 35/250
157/157          8s 50ms/step -
accuracy: 0.8032 - loss: 1.1561 - val_accuracy: 0.8074 - val_loss: 1.1385 -

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learning_rate: 2.5000e-04
Epoch 36/250
157/157      8s 50ms/step -
accuracy: 0.8060 - loss: 1.1411 - val_accuracy: 0.8094 - val_loss: 1.1234 -
learning_rate: 2.5000e-04
Epoch 37/250
157/157      8s 50ms/step -
accuracy: 0.8065 - loss: 1.1374 - val_accuracy: 0.8175 - val_loss: 1.0878 -
learning_rate: 2.5000e-04
Epoch 38/250
157/157      8s 50ms/step -
accuracy: 0.8117 - loss: 1.1221 - val_accuracy: 0.8219 - val_loss: 1.0801 -
learning_rate: 2.5000e-04
Epoch 39/250
157/157      8s 50ms/step -
accuracy: 0.8107 - loss: 1.1210 - val_accuracy: 0.8010 - val_loss: 1.1361 -
learning_rate: 2.5000e-04
Epoch 40/250
157/157      8s 50ms/step -
accuracy: 0.8123 - loss: 1.1192 - val_accuracy: 0.8271 - val_loss: 1.0630 -
learning_rate: 2.5000e-04
Epoch 41/250
157/157      8s 50ms/step -
accuracy: 0.8100 - loss: 1.1145 - val_accuracy: 0.8219 - val_loss: 1.0799 -
learning_rate: 2.5000e-04
Epoch 42/250
157/157      8s 50ms/step -
accuracy: 0.8088 - loss: 1.1205 - val_accuracy: 0.8225 - val_loss: 1.0971 -
learning_rate: 2.5000e-04
Epoch 43/250
157/157      8s 50ms/step -
accuracy: 0.8154 - loss: 1.0989 - val_accuracy: 0.8135 - val_loss: 1.1047 -
learning_rate: 2.5000e-04
Epoch 44/250
157/157      8s 50ms/step -
accuracy: 0.8154 - loss: 1.0993 - val_accuracy: 0.8255 - val_loss: 1.0814 -
learning_rate: 2.5000e-04
Epoch 45/250
157/157      8s 50ms/step -
accuracy: 0.8155 - loss: 1.1062 - val_accuracy: 0.8205 - val_loss: 1.0978 -
learning_rate: 2.5000e-04
Epoch 46/250
157/157      8s 50ms/step -
accuracy: 0.8298 - loss: 1.0613 - val_accuracy: 0.8280 - val_loss: 1.0478 -
learning_rate: 1.2500e-04
Epoch 47/250
157/157      8s 50ms/step -
accuracy: 0.8371 - loss: 1.0115 - val_accuracy: 0.8365 - val_loss: 0.9977 -

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learning_rate: 1.2500e-04
Epoch 48/250
157/157          8s 51ms/step -
accuracy: 0.8437 - loss: 0.9705 - val_accuracy: 0.8399 - val_loss: 0.9716 -
learning_rate: 1.2500e-04
Epoch 49/250
157/157          8s 50ms/step -
accuracy: 0.8457 - loss: 0.9475 - val_accuracy: 0.8275 - val_loss: 1.0009 -
learning_rate: 1.2500e-04
Epoch 50/250
157/157          8s 50ms/step -
accuracy: 0.8488 - loss: 0.9151 - val_accuracy: 0.8297 - val_loss: 0.9640 -
learning_rate: 1.2500e-04
Epoch 51/250
157/157          8s 50ms/step -
accuracy: 0.8466 - loss: 0.9116 - val_accuracy: 0.8308 - val_loss: 0.9676 -
learning_rate: 1.2500e-04
Epoch 52/250
157/157          8s 50ms/step -
accuracy: 0.8488 - loss: 0.8947 - val_accuracy: 0.8366 - val_loss: 0.9262 -
learning_rate: 1.2500e-04
Epoch 53/250
157/157          8s 50ms/step -
accuracy: 0.8543 - loss: 0.8708 - val_accuracy: 0.8528 - val_loss: 0.8825 -
learning_rate: 1.2500e-04
Epoch 54/250
157/157          8s 50ms/step -
accuracy: 0.8545 - loss: 0.8581 - val_accuracy: 0.8485 - val_loss: 0.8869 -
learning_rate: 1.2500e-04
Epoch 55/250
157/157          8s 50ms/step -
accuracy: 0.8539 - loss: 0.8560 - val_accuracy: 0.8398 - val_loss: 0.8998 -
learning_rate: 1.2500e-04
Epoch 56/250
157/157          8s 50ms/step -
accuracy: 0.8547 - loss: 0.8437 - val_accuracy: 0.8446 - val_loss: 0.8842 -
learning_rate: 1.2500e-04
Epoch 57/250
157/157          8s 50ms/step -
accuracy: 0.8526 - loss: 0.8437 - val_accuracy: 0.8479 - val_loss: 0.8722 -
learning_rate: 1.2500e-04
Epoch 58/250
157/157          8s 50ms/step -
accuracy: 0.8577 - loss: 0.8319 - val_accuracy: 0.8492 - val_loss: 0.8760 -
learning_rate: 1.2500e-04
Epoch 59/250
157/157          8s 50ms/step -
accuracy: 0.8596 - loss: 0.8279 - val_accuracy: 0.8536 - val_loss: 0.8477 -

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learning_rate: 1.2500e-04
Epoch 60/250
157/157          8s 50ms/step -
accuracy: 0.8576 - loss: 0.8241 - val_accuracy: 0.8492 - val_loss: 0.8567 -
learning_rate: 1.2500e-04
Epoch 61/250
157/157          8s 50ms/step -
accuracy: 0.8561 - loss: 0.8205 - val_accuracy: 0.8407 - val_loss: 0.8810 -
learning_rate: 1.2500e-04
Epoch 62/250
157/157          8s 50ms/step -
accuracy: 0.8593 - loss: 0.8164 - val_accuracy: 0.8494 - val_loss: 0.8585 -
learning_rate: 1.2500e-04
Epoch 63/250
157/157          8s 50ms/step -
accuracy: 0.8595 - loss: 0.8035 - val_accuracy: 0.8477 - val_loss: 0.8593 -
learning_rate: 1.2500e-04
Epoch 64/250
157/157          8s 50ms/step -
accuracy: 0.8613 - loss: 0.8099 - val_accuracy: 0.8431 - val_loss: 0.8825 -
learning_rate: 1.2500e-04
Epoch 65/250
157/157          8s 51ms/step -
accuracy: 0.8649 - loss: 0.7932 - val_accuracy: 0.8557 - val_loss: 0.8348 -
learning_rate: 6.2500e-05
Epoch 66/250
157/157          8s 50ms/step -
accuracy: 0.8717 - loss: 0.7636 - val_accuracy: 0.8565 - val_loss: 0.8239 -
learning_rate: 6.2500e-05
Epoch 67/250
157/157          8s 50ms/step -
accuracy: 0.8698 - loss: 0.7586 - val_accuracy: 0.8595 - val_loss: 0.8067 -
learning_rate: 6.2500e-05
Epoch 68/250
157/157          8s 50ms/step -
accuracy: 0.8753 - loss: 0.7386 - val_accuracy: 0.8623 - val_loss: 0.7899 -
learning_rate: 6.2500e-05
Epoch 69/250
157/157          8s 50ms/step -
accuracy: 0.8738 - loss: 0.7351 - val_accuracy: 0.8608 - val_loss: 0.7928 -
learning_rate: 6.2500e-05
Epoch 70/250
157/157          8s 50ms/step -
accuracy: 0.8820 - loss: 0.7055 - val_accuracy: 0.8593 - val_loss: 0.7919 -
learning_rate: 6.2500e-05
Epoch 71/250
157/157          8s 50ms/step -
accuracy: 0.8833 - loss: 0.6999 - val_accuracy: 0.8570 - val_loss: 0.7873 -

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learning_rate: 6.2500e-05
 Epoch 72/250
 157/157 8s 50ms/step -
 accuracy: 0.8801 - loss: 0.6930 - val_accuracy: 0.8579 - val_loss: 0.7763 -
 learning_rate: 6.2500e-05
 Epoch 73/250
 157/157 8s 50ms/step -
 accuracy: 0.8825 - loss: 0.6813 - val_accuracy: 0.8620 - val_loss: 0.7660 -
 learning_rate: 6.2500e-05
 Epoch 74/250
 157/157 8s 50ms/step -
 accuracy: 0.8879 - loss: 0.6683 - val_accuracy: 0.8608 - val_loss: 0.7713 -
 learning_rate: 6.2500e-05
 Epoch 75/250
 157/157 8s 50ms/step -
 accuracy: 0.8877 - loss: 0.6592 - val_accuracy: 0.8626 - val_loss: 0.7588 -
 learning_rate: 6.2500e-05
 Epoch 76/250
 157/157 8s 50ms/step -
 accuracy: 0.8896 - loss: 0.6577 - val_accuracy: 0.8636 - val_loss: 0.7549 -
 learning_rate: 6.2500e-05
 Epoch 77/250
 157/157 8s 50ms/step -
 accuracy: 0.8883 - loss: 0.6610 - val_accuracy: 0.8629 - val_loss: 0.7514 -
 learning_rate: 6.2500e-05
 Epoch 78/250
 157/157 8s 51ms/step -
 accuracy: 0.8897 - loss: 0.6462 - val_accuracy: 0.8611 - val_loss: 0.7476 -
 learning_rate: 6.2500e-05
 Epoch 79/250
 157/157 8s 50ms/step -
 accuracy: 0.8875 - loss: 0.6456 - val_accuracy: 0.8614 - val_loss: 0.7578 -
 learning_rate: 6.2500e-05
 Epoch 80/250
 157/157 8s 50ms/step -
 accuracy: 0.8864 - loss: 0.6464 - val_accuracy: 0.8609 - val_loss: 0.7458 -
 learning_rate: 6.2500e-05
 Epoch 81/250
 157/157 8s 50ms/step -
 accuracy: 0.8857 - loss: 0.6398 - val_accuracy: 0.8631 - val_loss: 0.7424 -
 learning_rate: 6.2500e-05
 Epoch 82/250
 157/157 8s 50ms/step -
 accuracy: 0.8933 - loss: 0.6247 - val_accuracy: 0.8602 - val_loss: 0.7501 -
 learning_rate: 6.2500e-05
 Epoch 83/250
 157/157 8s 50ms/step -
 accuracy: 0.8949 - loss: 0.6079 - val_accuracy: 0.8619 - val_loss: 0.7540 -

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learning_rate: 6.2500e-05
Epoch 84/250
157/157      8s 50ms/step -
accuracy: 0.8924 - loss: 0.6227 - val_accuracy: 0.8616 - val_loss: 0.7457 -
learning_rate: 6.2500e-05
Epoch 85/250
157/157      8s 50ms/step -
accuracy: 0.8930 - loss: 0.6142 - val_accuracy: 0.8659 - val_loss: 0.7301 -
learning_rate: 6.2500e-05
Epoch 86/250
157/157      8s 50ms/step -
accuracy: 0.8940 - loss: 0.6091 - val_accuracy: 0.8667 - val_loss: 0.7214 -
learning_rate: 6.2500e-05
Epoch 87/250
157/157      8s 50ms/step -
accuracy: 0.8939 - loss: 0.6087 - val_accuracy: 0.8705 - val_loss: 0.7164 -
learning_rate: 6.2500e-05
Epoch 88/250
157/157      8s 50ms/step -
accuracy: 0.8948 - loss: 0.6062 - val_accuracy: 0.8629 - val_loss: 0.7468 -
learning_rate: 6.2500e-05
Epoch 89/250
157/157      8s 50ms/step -
accuracy: 0.8952 - loss: 0.5998 - val_accuracy: 0.8603 - val_loss: 0.7360 -
learning_rate: 6.2500e-05
Epoch 90/250
157/157      8s 50ms/step -
accuracy: 0.9015 - loss: 0.5885 - val_accuracy: 0.8615 - val_loss: 0.7308 -
learning_rate: 6.2500e-05
Epoch 91/250
157/157      8s 50ms/step -
accuracy: 0.8974 - loss: 0.5898 - val_accuracy: 0.8609 - val_loss: 0.7409 -
learning_rate: 6.2500e-05
Epoch 92/250
157/157      8s 50ms/step -
accuracy: 0.9008 - loss: 0.5863 - val_accuracy: 0.8630 - val_loss: 0.7213 -
learning_rate: 6.2500e-05
Epoch 93/250
157/157      8s 51ms/step -
accuracy: 0.9011 - loss: 0.5773 - val_accuracy: 0.8634 - val_loss: 0.7211 -
learning_rate: 3.1250e-05
Epoch 94/250
157/157      8s 50ms/step -
accuracy: 0.9036 - loss: 0.5699 - val_accuracy: 0.8669 - val_loss: 0.7050 -
learning_rate: 3.1250e-05
Epoch 95/250
157/157      8s 50ms/step -
accuracy: 0.9051 - loss: 0.5653 - val_accuracy: 0.8680 - val_loss: 0.7049 -

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learning_rate: 3.1250e-05
Epoch 96/250
157/157      8s 50ms/step -
accuracy: 0.9037 - loss: 0.5580 - val_accuracy: 0.8666 - val_loss: 0.7080 -
learning_rate: 3.1250e-05
Epoch 97/250
157/157      8s 50ms/step -
accuracy: 0.9080 - loss: 0.5486 - val_accuracy: 0.8653 - val_loss: 0.7078 -
learning_rate: 3.1250e-05
Epoch 98/250
157/157      8s 50ms/step -
accuracy: 0.9103 - loss: 0.5439 - val_accuracy: 0.8664 - val_loss: 0.7045 -
learning_rate: 3.1250e-05
Epoch 99/250
157/157      8s 50ms/step -
accuracy: 0.9093 - loss: 0.5433 - val_accuracy: 0.8687 - val_loss: 0.7018 -
learning_rate: 3.1250e-05
Epoch 100/250
157/157      8s 50ms/step -
accuracy: 0.9091 - loss: 0.5372 - val_accuracy: 0.8671 - val_loss: 0.7042 -
learning_rate: 3.1250e-05
Epoch 101/250
157/157      8s 51ms/step -
accuracy: 0.9109 - loss: 0.5261 - val_accuracy: 0.8691 - val_loss: 0.6991 -
learning_rate: 3.1250e-05
Epoch 102/250
157/157      8s 50ms/step -
accuracy: 0.9103 - loss: 0.5279 - val_accuracy: 0.8690 - val_loss: 0.6969 -
learning_rate: 3.1250e-05
Epoch 103/250
157/157      8s 50ms/step -
accuracy: 0.9081 - loss: 0.5344 - val_accuracy: 0.8695 - val_loss: 0.6932 -
learning_rate: 3.1250e-05
Epoch 104/250
157/157      8s 50ms/step -
accuracy: 0.9145 - loss: 0.5137 - val_accuracy: 0.8661 - val_loss: 0.7004 -
learning_rate: 3.1250e-05
Epoch 105/250
157/157      8s 50ms/step -
accuracy: 0.9118 - loss: 0.5212 - val_accuracy: 0.8678 - val_loss: 0.6956 -
learning_rate: 3.1250e-05
Epoch 106/250
157/157      8s 50ms/step -
accuracy: 0.9123 - loss: 0.5182 - val_accuracy: 0.8682 - val_loss: 0.6886 -
learning_rate: 3.1250e-05
Epoch 107/250
157/157      8s 50ms/step -
accuracy: 0.9132 - loss: 0.5072 - val_accuracy: 0.8683 - val_loss: 0.6888 -

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learning_rate: 3.1250e-05
Epoch 108/250
157/157          8s 50ms/step -
accuracy: 0.9152 - loss: 0.5055 - val_accuracy: 0.8723 - val_loss: 0.6744 -
learning_rate: 3.1250e-05
Epoch 109/250
157/157          8s 50ms/step -
accuracy: 0.9175 - loss: 0.4980 - val_accuracy: 0.8744 - val_loss: 0.6714 -
learning_rate: 3.1250e-05
Epoch 110/250
157/157          8s 50ms/step -
accuracy: 0.9137 - loss: 0.5025 - val_accuracy: 0.8693 - val_loss: 0.6843 -
learning_rate: 3.1250e-05
Epoch 111/250
157/157          8s 50ms/step -
accuracy: 0.9158 - loss: 0.4961 - val_accuracy: 0.8698 - val_loss: 0.6760 -
learning_rate: 3.1250e-05
Epoch 112/250
157/157          8s 50ms/step -
accuracy: 0.9171 - loss: 0.4976 - val_accuracy: 0.8702 - val_loss: 0.6794 -
learning_rate: 3.1250e-05
Epoch 113/250
157/157          8s 50ms/step -
accuracy: 0.9146 - loss: 0.4999 - val_accuracy: 0.8707 - val_loss: 0.6685 -
learning_rate: 3.1250e-05
Epoch 114/250
157/157          8s 50ms/step -
accuracy: 0.9196 - loss: 0.4825 - val_accuracy: 0.8666 - val_loss: 0.6889 -
learning_rate: 3.1250e-05
Epoch 115/250
157/157          8s 50ms/step -
accuracy: 0.9175 - loss: 0.4853 - val_accuracy: 0.8686 - val_loss: 0.6799 -
learning_rate: 3.1250e-05
Epoch 116/250
157/157          8s 50ms/step -
accuracy: 0.9178 - loss: 0.4823 - val_accuracy: 0.8679 - val_loss: 0.6824 -
learning_rate: 3.1250e-05
Epoch 117/250
157/157          10s 50ms/step -
accuracy: 0.9175 - loss: 0.4873 - val_accuracy: 0.8689 - val_loss: 0.6750 -
learning_rate: 3.1250e-05
Epoch 118/250
157/157          8s 50ms/step -
accuracy: 0.9188 - loss: 0.4783 - val_accuracy: 0.8696 - val_loss: 0.6685 -
learning_rate: 3.1250e-05
Epoch 119/250
157/157          8s 50ms/step -
accuracy: 0.9205 - loss: 0.4728 - val_accuracy: 0.8711 - val_loss: 0.6607 -

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learning_rate: 1.5625e-05
Epoch 120/250
157/157          8s 50ms/step -
accuracy: 0.9220 - loss: 0.4708 - val_accuracy: 0.8692 - val_loss: 0.6696 -
learning_rate: 1.5625e-05
Epoch 121/250
157/157          8s 50ms/step -
accuracy: 0.9246 - loss: 0.4604 - val_accuracy: 0.8705 - val_loss: 0.6595 -
learning_rate: 1.5625e-05
Epoch 122/250
157/157          8s 50ms/step -
accuracy: 0.9232 - loss: 0.4606 - val_accuracy: 0.8716 - val_loss: 0.6618 -
learning_rate: 1.5625e-05
Epoch 123/250
157/157          8s 50ms/step -
accuracy: 0.9222 - loss: 0.4558 - val_accuracy: 0.8754 - val_loss: 0.6512 -
learning_rate: 1.5625e-05
Epoch 124/250
157/157          8s 50ms/step -
accuracy: 0.9209 - loss: 0.4626 - val_accuracy: 0.8746 - val_loss: 0.6512 -
learning_rate: 1.5625e-05
Epoch 125/250
157/157          8s 50ms/step -
accuracy: 0.9274 - loss: 0.4492 - val_accuracy: 0.8731 - val_loss: 0.6506 -
learning_rate: 1.5625e-05
Epoch 126/250
157/157          8s 50ms/step -
accuracy: 0.9257 - loss: 0.4488 - val_accuracy: 0.8745 - val_loss: 0.6475 -
learning_rate: 1.5625e-05
Epoch 127/250
157/157          8s 50ms/step -
accuracy: 0.9264 - loss: 0.4461 - val_accuracy: 0.8723 - val_loss: 0.6546 -
learning_rate: 1.5625e-05
Epoch 128/250
157/157          8s 50ms/step -
accuracy: 0.9236 - loss: 0.4509 - val_accuracy: 0.8712 - val_loss: 0.6542 -
learning_rate: 1.5625e-05
Epoch 129/250
157/157          8s 50ms/step -
accuracy: 0.9256 - loss: 0.4488 - val_accuracy: 0.8724 - val_loss: 0.6514 -
learning_rate: 1.5625e-05
Epoch 130/250
157/157          8s 50ms/step -
accuracy: 0.9249 - loss: 0.4491 - val_accuracy: 0.8740 - val_loss: 0.6491 -
learning_rate: 1.5625e-05
Epoch 131/250
157/157          8s 50ms/step -
accuracy: 0.9271 - loss: 0.4395 - val_accuracy: 0.8753 - val_loss: 0.6487 -

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learning_rate: 1.5625e-05
Epoch 132/250
157/157          8s 50ms/step -
accuracy: 0.9266 - loss: 0.4371 - val_accuracy: 0.8755 - val_loss: 0.6438 -
learning_rate: 7.8125e-06
Epoch 133/250
157/157          8s 50ms/step -
accuracy: 0.9298 - loss: 0.4324 - val_accuracy: 0.8763 - val_loss: 0.6428 -
learning_rate: 7.8125e-06
Epoch 134/250
157/157          8s 50ms/step -
accuracy: 0.9294 - loss: 0.4332 - val_accuracy: 0.8759 - val_loss: 0.6418 -
learning_rate: 7.8125e-06
Epoch 135/250
157/157          8s 50ms/step -
accuracy: 0.9252 - loss: 0.4397 - val_accuracy: 0.8752 - val_loss: 0.6421 -
learning_rate: 7.8125e-06
Epoch 136/250
157/157          8s 50ms/step -
accuracy: 0.9318 - loss: 0.4301 - val_accuracy: 0.8749 - val_loss: 0.6457 -
learning_rate: 7.8125e-06
Epoch 137/250
157/157          8s 50ms/step -
accuracy: 0.9325 - loss: 0.4234 - val_accuracy: 0.8746 - val_loss: 0.6454 -
learning_rate: 7.8125e-06
Epoch 138/250
157/157          8s 50ms/step -
accuracy: 0.9301 - loss: 0.4281 - val_accuracy: 0.8750 - val_loss: 0.6470 -
learning_rate: 7.8125e-06
Epoch 139/250
157/157          8s 50ms/step -
accuracy: 0.9295 - loss: 0.4278 - val_accuracy: 0.8754 - val_loss: 0.6399 -
learning_rate: 7.8125e-06
Epoch 140/250
157/157          8s 51ms/step -
accuracy: 0.9303 - loss: 0.4279 - val_accuracy: 0.8743 - val_loss: 0.6419 -
learning_rate: 7.8125e-06
Epoch 141/250
157/157          8s 50ms/step -
accuracy: 0.9259 - loss: 0.4308 - val_accuracy: 0.8727 - val_loss: 0.6439 -
learning_rate: 7.8125e-06
Epoch 142/250
157/157          8s 50ms/step -
accuracy: 0.9296 - loss: 0.4272 - val_accuracy: 0.8742 - val_loss: 0.6391 -
learning_rate: 7.8125e-06
Epoch 143/250
157/157          8s 50ms/step -
accuracy: 0.9337 - loss: 0.4162 - val_accuracy: 0.8742 - val_loss: 0.6407 -

```

```

learning_rate: 7.8125e-06
Epoch 144/250
157/157          8s 50ms/step -
accuracy: 0.9340 - loss: 0.4141 - val_accuracy: 0.8742 - val_loss: 0.6417 -
learning_rate: 7.8125e-06
Epoch 145/250
157/157          8s 50ms/step -
accuracy: 0.9318 - loss: 0.4201 - val_accuracy: 0.8750 - val_loss: 0.6407 -
learning_rate: 7.8125e-06
Epoch 146/250
157/157          8s 50ms/step -
accuracy: 0.9325 - loss: 0.4161 - val_accuracy: 0.8755 - val_loss: 0.6349 -
learning_rate: 7.8125e-06
Epoch 147/250
157/157          8s 50ms/step -
accuracy: 0.9306 - loss: 0.4224 - val_accuracy: 0.8740 - val_loss: 0.6438 -
learning_rate: 7.8125e-06
Epoch 148/250
157/157          8s 50ms/step -
accuracy: 0.9320 - loss: 0.4153 - val_accuracy: 0.8760 - val_loss: 0.6363 -
learning_rate: 7.8125e-06
Epoch 149/250
157/157          8s 50ms/step -
accuracy: 0.9326 - loss: 0.4118 - val_accuracy: 0.8759 - val_loss: 0.6365 -
learning_rate: 7.8125e-06
Epoch 150/250
157/157          8s 50ms/step -
accuracy: 0.9354 - loss: 0.4097 - val_accuracy: 0.8777 - val_loss: 0.6386 -
learning_rate: 7.8125e-06
Epoch 151/250
157/157          8s 50ms/step -
accuracy: 0.9305 - loss: 0.4194 - val_accuracy: 0.8770 - val_loss: 0.6375 -
learning_rate: 7.8125e-06
Epoch 152/250
157/157          8s 50ms/step -
accuracy: 0.9340 - loss: 0.4088 - val_accuracy: 0.8754 - val_loss: 0.6365 -
learning_rate: 3.9063e-06
Epoch 153/250
157/157          8s 50ms/step -
accuracy: 0.9323 - loss: 0.4121 - val_accuracy: 0.8757 - val_loss: 0.6363 -
learning_rate: 3.9063e-06
Epoch 154/250
157/157          8s 50ms/step -
accuracy: 0.9372 - loss: 0.3989 - val_accuracy: 0.8770 - val_loss: 0.6345 -
learning_rate: 3.9063e-06
Epoch 155/250
157/157          8s 50ms/step -
accuracy: 0.9354 - loss: 0.3996 - val_accuracy: 0.8760 - val_loss: 0.6342 -

```

```

learning_rate: 3.9063e-06
Epoch 156/250
157/157      8s 50ms/step -
accuracy: 0.9344 - loss: 0.4092 - val_accuracy: 0.8767 - val_loss: 0.6332 -
learning_rate: 3.9063e-06
Epoch 157/250
157/157      8s 50ms/step -
accuracy: 0.9334 - loss: 0.4054 - val_accuracy: 0.8768 - val_loss: 0.6336 -
learning_rate: 3.9063e-06
Epoch 158/250
157/157      8s 50ms/step -
accuracy: 0.9347 - loss: 0.4067 - val_accuracy: 0.8766 - val_loss: 0.6346 -
learning_rate: 3.9063e-06
Epoch 159/250
157/157      8s 50ms/step -
accuracy: 0.9357 - loss: 0.4020 - val_accuracy: 0.8769 - val_loss: 0.6335 -
learning_rate: 3.9063e-06
Epoch 160/250
157/157      8s 50ms/step -
accuracy: 0.9322 - loss: 0.4072 - val_accuracy: 0.8763 - val_loss: 0.6333 -
learning_rate: 3.9063e-06
Epoch 161/250
157/157      8s 50ms/step -
accuracy: 0.9367 - loss: 0.3995 - val_accuracy: 0.8776 - val_loss: 0.6331 -
learning_rate: 3.9063e-06
Epoch 162/250
157/157      8s 50ms/step -
accuracy: 0.9330 - loss: 0.4071 - val_accuracy: 0.8769 - val_loss: 0.6329 -
learning_rate: 3.9063e-06
Epoch 163/250
157/157      8s 50ms/step -
accuracy: 0.9333 - loss: 0.4031 - val_accuracy: 0.8766 - val_loss: 0.6323 -
learning_rate: 3.9063e-06
Epoch 164/250
157/157      8s 50ms/step -
accuracy: 0.9328 - loss: 0.4029 - val_accuracy: 0.8765 - val_loss: 0.6321 -
learning_rate: 3.9063e-06
Epoch 165/250
157/157      8s 50ms/step -
accuracy: 0.9353 - loss: 0.4027 - val_accuracy: 0.8762 - val_loss: 0.6315 -
learning_rate: 3.9063e-06
Epoch 166/250
157/157      8s 50ms/step -
accuracy: 0.9326 - loss: 0.4047 - val_accuracy: 0.8766 - val_loss: 0.6329 -
learning_rate: 3.9063e-06
Epoch 167/250
157/157      8s 50ms/step -
accuracy: 0.9327 - loss: 0.4040 - val_accuracy: 0.8773 - val_loss: 0.6302 -

```



```

learning_rate: 3.9063e-06
Epoch 168/250
157/157      8s 50ms/step -
accuracy: 0.9337 - loss: 0.4047 - val_accuracy: 0.8779 - val_loss: 0.6306 -
learning_rate: 3.9063e-06
Epoch 169/250
157/157      8s 50ms/step -
accuracy: 0.9313 - loss: 0.4039 - val_accuracy: 0.8788 - val_loss: 0.6286 -
learning_rate: 3.9063e-06
Epoch 170/250
157/157      8s 50ms/step -
accuracy: 0.9393 - loss: 0.3913 - val_accuracy: 0.8761 - val_loss: 0.6324 -
learning_rate: 3.9063e-06
Epoch 171/250
157/157      8s 50ms/step -
accuracy: 0.9374 - loss: 0.3921 - val_accuracy: 0.8775 - val_loss: 0.6305 -
learning_rate: 3.9063e-06
Epoch 172/250
157/157      8s 50ms/step -
accuracy: 0.9380 - loss: 0.3921 - val_accuracy: 0.8775 - val_loss: 0.6303 -
learning_rate: 3.9063e-06
Epoch 173/250
157/157      8s 50ms/step -
accuracy: 0.9336 - loss: 0.4018 - val_accuracy: 0.8775 - val_loss: 0.6290 -
learning_rate: 3.9063e-06
Epoch 174/250
157/157      8s 50ms/step -
accuracy: 0.9350 - loss: 0.3981 - val_accuracy: 0.8783 - val_loss: 0.6290 -
learning_rate: 3.9063e-06
Epoch 175/250
157/157      8s 50ms/step -
accuracy: 0.9356 - loss: 0.4012 - val_accuracy: 0.8774 - val_loss: 0.6283 -
learning_rate: 1.9531e-06
Epoch 176/250
157/157      8s 51ms/step -
accuracy: 0.9366 - loss: 0.3953 - val_accuracy: 0.8780 - val_loss: 0.6275 -
learning_rate: 1.9531e-06
Epoch 177/250
157/157      8s 50ms/step -
accuracy: 0.9365 - loss: 0.3990 - val_accuracy: 0.8782 - val_loss: 0.6279 -
learning_rate: 1.9531e-06
Epoch 178/250
157/157     10s 50ms/step -
accuracy: 0.9350 - loss: 0.3994 - val_accuracy: 0.8772 - val_loss: 0.6278 -
learning_rate: 1.9531e-06
Epoch 179/250
157/157      8s 50ms/step -
accuracy: 0.9327 - loss: 0.3993 - val_accuracy: 0.8770 - val_loss: 0.6305 -

```

```

learning_rate: 1.9531e-06
Epoch 180/250
157/157          8s 50ms/step -
accuracy: 0.9348 - loss: 0.3953 - val_accuracy: 0.8773 - val_loss: 0.6300 -
learning_rate: 1.9531e-06
Epoch 181/250
157/157          8s 50ms/step -
accuracy: 0.9396 - loss: 0.3883 - val_accuracy: 0.8773 - val_loss: 0.6289 -
learning_rate: 1.9531e-06
Epoch 182/250
157/157          8s 50ms/step -
accuracy: 0.9330 - loss: 0.3996 - val_accuracy: 0.8772 - val_loss: 0.6280 -
learning_rate: 1.0000e-06
Epoch 183/250
157/157          8s 50ms/step -
accuracy: 0.9352 - loss: 0.3975 - val_accuracy: 0.8768 - val_loss: 0.6286 -
learning_rate: 1.0000e-06
Epoch 184/250
157/157          8s 50ms/step -
accuracy: 0.9373 - loss: 0.3905 - val_accuracy: 0.8773 - val_loss: 0.6278 -
learning_rate: 1.0000e-06
Epoch 185/250
157/157          8s 50ms/step -
accuracy: 0.9390 - loss: 0.3872 - val_accuracy: 0.8777 - val_loss: 0.6279 -
learning_rate: 1.0000e-06
Epoch 186/250
157/157          8s 50ms/step -
accuracy: 0.9367 - loss: 0.3912 - val_accuracy: 0.8776 - val_loss: 0.6276 -
learning_rate: 1.0000e-06
Epoch 187/250
157/157          8s 50ms/step -
accuracy: 0.9372 - loss: 0.3926 - val_accuracy: 0.8773 - val_loss: 0.6289 -
learning_rate: 1.0000e-06
Epoch 188/250
157/157          8s 50ms/step -
accuracy: 0.9362 - loss: 0.3994 - val_accuracy: 0.8776 - val_loss: 0.6268 -
learning_rate: 1.0000e-06
Epoch 189/250
157/157          8s 50ms/step -
accuracy: 0.9352 - loss: 0.3951 - val_accuracy: 0.8778 - val_loss: 0.6273 -
learning_rate: 1.0000e-06
Epoch 190/250
157/157          8s 50ms/step -
accuracy: 0.9373 - loss: 0.3951 - val_accuracy: 0.8770 - val_loss: 0.6274 -
learning_rate: 1.0000e-06
Epoch 191/250
157/157          8s 50ms/step -
accuracy: 0.9354 - loss: 0.3953 - val_accuracy: 0.8770 - val_loss: 0.6285 -

```

```

learning_rate: 1.0000e-06
Epoch 192/250
157/157          8s 50ms/step -
accuracy: 0.9340 - loss: 0.3984 - val_accuracy: 0.8772 - val_loss: 0.6279 -
learning_rate: 1.0000e-06
Epoch 193/250
157/157          8s 50ms/step -
accuracy: 0.9374 - loss: 0.3936 - val_accuracy: 0.8778 - val_loss: 0.6274 -
learning_rate: 1.0000e-06
Epoch 194/250
157/157          8s 50ms/step -
accuracy: 0.9374 - loss: 0.3896 - val_accuracy: 0.8776 - val_loss: 0.6274 -
learning_rate: 1.0000e-06
Epoch 195/250
157/157          8s 50ms/step -
accuracy: 0.9357 - loss: 0.3940 - val_accuracy: 0.8774 - val_loss: 0.6270 -
learning_rate: 1.0000e-06
Epoch 196/250
157/157          8s 50ms/step -
accuracy: 0.9370 - loss: 0.3877 - val_accuracy: 0.8775 - val_loss: 0.6282 -
learning_rate: 1.0000e-06
Epoch 197/250
157/157          8s 50ms/step -
accuracy: 0.9341 - loss: 0.3945 - val_accuracy: 0.8778 - val_loss: 0.6281 -
learning_rate: 1.0000e-06
Epoch 198/250
157/157          8s 50ms/step -
accuracy: 0.9376 - loss: 0.3881 - val_accuracy: 0.8773 - val_loss: 0.6275 -
learning_rate: 1.0000e-06
Epoch 199/250
157/157          8s 50ms/step -
accuracy: 0.9399 - loss: 0.3830 - val_accuracy: 0.8774 - val_loss: 0.6279 -
learning_rate: 1.0000e-06
Epoch 200/250
157/157          8s 50ms/step -
accuracy: 0.9351 - loss: 0.3950 - val_accuracy: 0.8782 - val_loss: 0.6279 -
learning_rate: 1.0000e-06
Epoch 201/250
157/157          8s 50ms/step -
accuracy: 0.9363 - loss: 0.3932 - val_accuracy: 0.8774 - val_loss: 0.6280 -
learning_rate: 1.0000e-06
Epoch 202/250
157/157          8s 50ms/step -
accuracy: 0.9365 - loss: 0.3894 - val_accuracy: 0.8780 - val_loss: 0.6279 -
learning_rate: 1.0000e-06
Epoch 203/250
157/157          8s 50ms/step -
accuracy: 0.9363 - loss: 0.3942 - val_accuracy: 0.8772 - val_loss: 0.6280 -

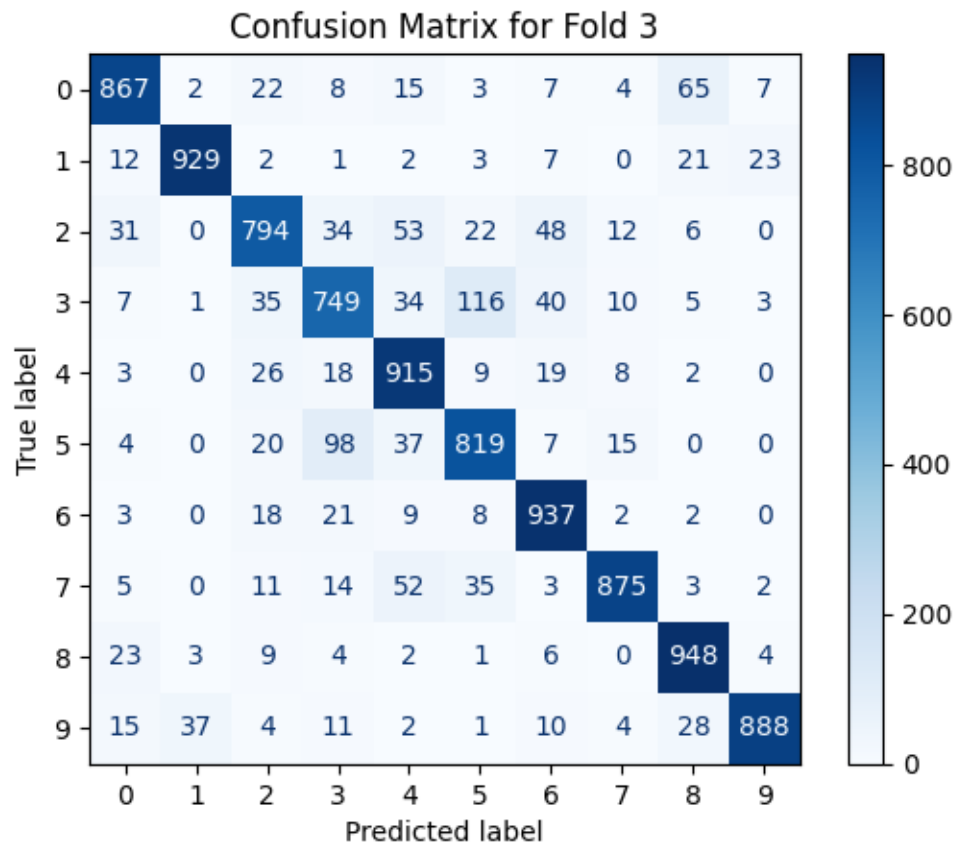
```

learning_rate: 1.0000e-06

Score for fold 3: test loss of 0.639955997467041; test accuracy of 87.20999956130981%

313/313

1s 3ms/step



Classification Report for Fold 3:

	precision	recall	f1-score	support
Class 0	0.89	0.87	0.88	1000
Class 1	0.96	0.93	0.94	1000
Class 2	0.84	0.79	0.82	1000
Class 3	0.78	0.75	0.77	1000
Class 4	0.82	0.92	0.86	1000
Class 5	0.81	0.82	0.81	1000
Class 6	0.86	0.94	0.90	1000
Class 7	0.94	0.88	0.91	1000
Class 8	0.88	0.95	0.91	1000
Class 9	0.96	0.89	0.92	1000
accuracy			0.87	10000

macro avg	0.87	0.87	0.87	10000
weighted avg	0.87	0.87	0.87	10000

```
/opt/conda/lib/python3.10/site-
packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not
pass an `input_shape`/`input_dim` argument to a layer. When using Sequential
models, prefer using an `Input(shape)` object as the first layer in the model
instead.
```

```
super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Epoch 1/250

```
157/157          32s 120ms/step -
accuracy: 0.1919 - loss: 8.0696 - val_accuracy: 0.2569 - val_loss: 5.6347 -
learning_rate: 0.0010
```

Epoch 2/250

```
157/157          8s 51ms/step -
accuracy: 0.3642 - loss: 4.8930 - val_accuracy: 0.2143 - val_loss: 4.2320 -
learning_rate: 0.0010
```

Epoch 3/250

```
157/157          8s 51ms/step -
accuracy: 0.4646 - loss: 3.2023 - val_accuracy: 0.3402 - val_loss: 3.0739 -
learning_rate: 0.0010
```

Epoch 4/250

```
157/157          8s 51ms/step -
accuracy: 0.5353 - loss: 2.4487 - val_accuracy: 0.4731 - val_loss: 2.4292 -
learning_rate: 0.0010
```

Epoch 5/250

```
157/157          8s 51ms/step -
accuracy: 0.5794 - loss: 2.2208 - val_accuracy: 0.6346 - val_loss: 2.0392 -
learning_rate: 0.0010
```

Epoch 6/250

```
157/157          8s 51ms/step -
accuracy: 0.6175 - loss: 2.0673 - val_accuracy: 0.6518 - val_loss: 1.9777 -
learning_rate: 0.0010
```

Epoch 7/250

```
157/157          8s 51ms/step -
accuracy: 0.6315 - loss: 2.0670 - val_accuracy: 0.6026 - val_loss: 2.0810 -
learning_rate: 0.0010
```

Epoch 8/250

```
157/157          8s 50ms/step -
accuracy: 0.6514 - loss: 2.0207 - val_accuracy: 0.6716 - val_loss: 1.9256 -
learning_rate: 0.0010
```

Epoch 9/250

```
157/157          8s 51ms/step -
accuracy: 0.6600 - loss: 2.0107 - val_accuracy: 0.6703 - val_loss: 1.9484 -
learning_rate: 0.0010
```

Epoch 10/250

```
157/157          8s 50ms/step -
```

```

accuracy: 0.6690 - loss: 1.9895 - val_accuracy: 0.6253 - val_loss: 2.1191 -
learning_rate: 0.0010
Epoch 11/250
157/157          8s 50ms/step -
accuracy: 0.6755 - loss: 1.9972 - val_accuracy: 0.6784 - val_loss: 1.9336 -
learning_rate: 0.0010
Epoch 12/250
157/157          8s 50ms/step -
accuracy: 0.6771 - loss: 1.9671 - val_accuracy: 0.6898 - val_loss: 1.9060 -
learning_rate: 0.0010
Epoch 13/250
157/157          8s 50ms/step -
accuracy: 0.6830 - loss: 1.9871 - val_accuracy: 0.6986 - val_loss: 1.9194 -
learning_rate: 0.0010
Epoch 14/250
157/157          8s 51ms/step -
accuracy: 0.6875 - loss: 1.9786 - val_accuracy: 0.7192 - val_loss: 1.8458 -
learning_rate: 0.0010
Epoch 15/250
157/157          8s 51ms/step -
accuracy: 0.6900 - loss: 1.9384 - val_accuracy: 0.6824 - val_loss: 1.9579 -
learning_rate: 0.0010
Epoch 16/250
157/157          8s 51ms/step -
accuracy: 0.6843 - loss: 1.9781 - val_accuracy: 0.6805 - val_loss: 1.9635 -
learning_rate: 0.0010
Epoch 17/250
157/157          8s 51ms/step -
accuracy: 0.6944 - loss: 1.9824 - val_accuracy: 0.7265 - val_loss: 1.8606 -
learning_rate: 0.0010
Epoch 18/250
157/157          8s 50ms/step -
accuracy: 0.6876 - loss: 1.9920 - val_accuracy: 0.6689 - val_loss: 2.0022 -
learning_rate: 0.0010
Epoch 19/250
157/157          8s 50ms/step -
accuracy: 0.6964 - loss: 1.9545 - val_accuracy: 0.6949 - val_loss: 1.9472 -
learning_rate: 0.0010
Epoch 20/250
157/157          8s 50ms/step -
accuracy: 0.7241 - loss: 1.8143 - val_accuracy: 0.7124 - val_loss: 1.6487 -
learning_rate: 5.0000e-04
Epoch 21/250
157/157          8s 50ms/step -
accuracy: 0.7385 - loss: 1.5809 - val_accuracy: 0.7466 - val_loss: 1.4944 -
learning_rate: 5.0000e-04
Epoch 22/250
157/157          8s 50ms/step -

```

accuracy: 0.7433 - loss: 1.5297 - val_accuracy: 0.7603 - val_loss: 1.4710 -
 learning_rate: 5.0000e-04
 Epoch 23/250
 157/157 8s 50ms/step -
 accuracy: 0.7426 - loss: 1.5430 - val_accuracy: 0.7679 - val_loss: 1.4375 -
 learning_rate: 5.0000e-04
 Epoch 24/250
 157/157 8s 50ms/step -
 accuracy: 0.7454 - loss: 1.5236 - val_accuracy: 0.7786 - val_loss: 1.4092 -
 learning_rate: 5.0000e-04
 Epoch 25/250
 157/157 8s 50ms/step -
 accuracy: 0.7530 - loss: 1.5100 - val_accuracy: 0.7774 - val_loss: 1.4183 -
 learning_rate: 5.0000e-04
 Epoch 26/250
 157/157 8s 50ms/step -
 accuracy: 0.7499 - loss: 1.5148 - val_accuracy: 0.7712 - val_loss: 1.4337 -
 learning_rate: 5.0000e-04
 Epoch 27/250
 157/157 8s 50ms/step -
 accuracy: 0.7545 - loss: 1.5027 - val_accuracy: 0.7812 - val_loss: 1.3856 -
 learning_rate: 5.0000e-04
 Epoch 28/250
 157/157 8s 50ms/step -
 accuracy: 0.7518 - loss: 1.4979 - val_accuracy: 0.7604 - val_loss: 1.4631 -
 learning_rate: 5.0000e-04
 Epoch 29/250
 157/157 8s 50ms/step -
 accuracy: 0.7598 - loss: 1.4869 - val_accuracy: 0.7726 - val_loss: 1.4300 -
 learning_rate: 5.0000e-04
 Epoch 30/250
 157/157 8s 50ms/step -
 accuracy: 0.7585 - loss: 1.4964 - val_accuracy: 0.7762 - val_loss: 1.4295 -
 learning_rate: 5.0000e-04
 Epoch 31/250
 157/157 8s 50ms/step -
 accuracy: 0.7603 - loss: 1.4938 - val_accuracy: 0.7811 - val_loss: 1.3974 -
 learning_rate: 5.0000e-04
 Epoch 32/250
 157/157 8s 50ms/step -
 accuracy: 0.7630 - loss: 1.4645 - val_accuracy: 0.7932 - val_loss: 1.3653 -
 learning_rate: 5.0000e-04
 Epoch 33/250
 157/157 8s 50ms/step -
 accuracy: 0.7643 - loss: 1.4728 - val_accuracy: 0.7763 - val_loss: 1.4106 -
 learning_rate: 5.0000e-04
 Epoch 34/250
 157/157 8s 50ms/step -

```

accuracy: 0.7625 - loss: 1.4680 - val_accuracy: 0.7612 - val_loss: 1.4706 -
learning_rate: 5.0000e-04
Epoch 35/250
157/157      8s 50ms/step -
accuracy: 0.7676 - loss: 1.4621 - val_accuracy: 0.7896 - val_loss: 1.3738 -
learning_rate: 5.0000e-04
Epoch 36/250
157/157      8s 50ms/step -
accuracy: 0.7682 - loss: 1.4471 - val_accuracy: 0.7636 - val_loss: 1.4316 -
learning_rate: 5.0000e-04
Epoch 37/250
157/157      8s 50ms/step -
accuracy: 0.7703 - loss: 1.4513 - val_accuracy: 0.7635 - val_loss: 1.4508 -
learning_rate: 5.0000e-04
Epoch 38/250
157/157      8s 50ms/step -
accuracy: 0.7793 - loss: 1.4005 - val_accuracy: 0.8128 - val_loss: 1.2164 -
learning_rate: 2.5000e-04
Epoch 39/250
157/157      8s 50ms/step -
accuracy: 0.7972 - loss: 1.2614 - val_accuracy: 0.8044 - val_loss: 1.1850 -
learning_rate: 2.5000e-04
Epoch 40/250
157/157      8s 50ms/step -
accuracy: 0.8009 - loss: 1.2041 - val_accuracy: 0.7898 - val_loss: 1.1915 -
learning_rate: 2.5000e-04
Epoch 41/250
157/157      8s 50ms/step -
accuracy: 0.7974 - loss: 1.1823 - val_accuracy: 0.8094 - val_loss: 1.1210 -
learning_rate: 2.5000e-04
Epoch 42/250
157/157      8s 50ms/step -
accuracy: 0.8026 - loss: 1.1534 - val_accuracy: 0.8152 - val_loss: 1.1010 -
learning_rate: 2.5000e-04
Epoch 43/250
157/157      8s 50ms/step -
accuracy: 0.8046 - loss: 1.1470 - val_accuracy: 0.8159 - val_loss: 1.0937 -
learning_rate: 2.5000e-04
Epoch 44/250
157/157      8s 50ms/step -
accuracy: 0.8109 - loss: 1.1288 - val_accuracy: 0.8122 - val_loss: 1.0931 -
learning_rate: 2.5000e-04
Epoch 45/250
157/157      8s 51ms/step -
accuracy: 0.8069 - loss: 1.1295 - val_accuracy: 0.7796 - val_loss: 1.2208 -
learning_rate: 2.5000e-04
Epoch 46/250
157/157      8s 50ms/step -

```


accuracy: 0.8094 - loss: 1.1158 - val_accuracy: 0.8220 - val_loss: 1.0746 -
 learning_rate: 2.5000e-04
 Epoch 47/250
 157/157 8s 50ms/step -
 accuracy: 0.8064 - loss: 1.1259 - val_accuracy: 0.8223 - val_loss: 1.0653 -
 learning_rate: 2.5000e-04
 Epoch 48/250
 157/157 8s 50ms/step -
 accuracy: 0.8110 - loss: 1.1147 - val_accuracy: 0.8091 - val_loss: 1.0955 -
 learning_rate: 2.5000e-04
 Epoch 49/250
 157/157 8s 50ms/step -
 accuracy: 0.8149 - loss: 1.0971 - val_accuracy: 0.8254 - val_loss: 1.0459 -
 learning_rate: 2.5000e-04
 Epoch 50/250
 157/157 8s 50ms/step -
 accuracy: 0.8184 - loss: 1.0910 - val_accuracy: 0.8278 - val_loss: 1.0420 -
 learning_rate: 2.5000e-04
 Epoch 51/250
 157/157 8s 50ms/step -
 accuracy: 0.8132 - loss: 1.0981 - val_accuracy: 0.8078 - val_loss: 1.1034 -
 learning_rate: 2.5000e-04
 Epoch 52/250
 157/157 8s 50ms/step -
 accuracy: 0.8174 - loss: 1.0897 - val_accuracy: 0.8193 - val_loss: 1.0743 -
 learning_rate: 2.5000e-04
 Epoch 53/250
 157/157 8s 50ms/step -
 accuracy: 0.8207 - loss: 1.0719 - val_accuracy: 0.8252 - val_loss: 1.0529 -
 learning_rate: 2.5000e-04
 Epoch 54/250
 157/157 8s 50ms/step -
 accuracy: 0.8206 - loss: 1.0846 - val_accuracy: 0.8308 - val_loss: 1.0387 -
 learning_rate: 2.5000e-04
 Epoch 55/250
 157/157 8s 50ms/step -
 accuracy: 0.8214 - loss: 1.0798 - val_accuracy: 0.8147 - val_loss: 1.0863 -
 learning_rate: 2.5000e-04
 Epoch 56/250
 157/157 8s 50ms/step -
 accuracy: 0.8182 - loss: 1.0829 - val_accuracy: 0.8354 - val_loss: 1.0219 -
 learning_rate: 2.5000e-04
 Epoch 57/250
 157/157 8s 50ms/step -
 accuracy: 0.8199 - loss: 1.0794 - val_accuracy: 0.8160 - val_loss: 1.0711 -
 learning_rate: 2.5000e-04
 Epoch 58/250
 157/157 8s 50ms/step -

accuracy: 0.8242 - loss: 1.0806 - val_accuracy: 0.8233 - val_loss: 1.0704 -
 learning_rate: 2.5000e-04
 Epoch 59/250
 157/157 8s 50ms/step -
 accuracy: 0.8218 - loss: 1.0785 - val_accuracy: 0.8208 - val_loss: 1.0708 -
 learning_rate: 2.5000e-04
 Epoch 60/250
 157/157 8s 50ms/step -
 accuracy: 0.8245 - loss: 1.0769 - val_accuracy: 0.8074 - val_loss: 1.1082 -
 learning_rate: 2.5000e-04
 Epoch 61/250
 157/157 8s 50ms/step -
 accuracy: 0.8274 - loss: 1.0581 - val_accuracy: 0.8281 - val_loss: 1.0399 -
 learning_rate: 2.5000e-04
 Epoch 62/250
 157/157 8s 50ms/step -
 accuracy: 0.8267 - loss: 1.0448 - val_accuracy: 0.8404 - val_loss: 0.9825 -
 learning_rate: 1.2500e-04
 Epoch 63/250
 157/157 8s 50ms/step -
 accuracy: 0.8401 - loss: 0.9841 - val_accuracy: 0.8360 - val_loss: 0.9767 -
 learning_rate: 1.2500e-04
 Epoch 64/250
 157/157 8s 50ms/step -
 accuracy: 0.8460 - loss: 0.9467 - val_accuracy: 0.8478 - val_loss: 0.9233 -
 learning_rate: 1.2500e-04
 Epoch 65/250
 157/157 8s 50ms/step -
 accuracy: 0.8496 - loss: 0.9183 - val_accuracy: 0.8456 - val_loss: 0.9131 -
 learning_rate: 1.2500e-04
 Epoch 66/250
 157/157 8s 50ms/step -
 accuracy: 0.8513 - loss: 0.8987 - val_accuracy: 0.8408 - val_loss: 0.9200 -
 learning_rate: 1.2500e-04
 Epoch 67/250
 157/157 8s 50ms/step -
 accuracy: 0.8538 - loss: 0.8766 - val_accuracy: 0.8431 - val_loss: 0.9008 -
 learning_rate: 1.2500e-04
 Epoch 68/250
 157/157 8s 50ms/step -
 accuracy: 0.8527 - loss: 0.8749 - val_accuracy: 0.8487 - val_loss: 0.8762 -
 learning_rate: 1.2500e-04
 Epoch 69/250
 157/157 8s 50ms/step -
 accuracy: 0.8564 - loss: 0.8593 - val_accuracy: 0.8463 - val_loss: 0.8772 -
 learning_rate: 1.2500e-04
 Epoch 70/250
 157/157 8s 50ms/step -

accuracy: 0.8584 - loss: 0.8477 - val_accuracy: 0.8486 - val_loss: 0.8517 -
 learning_rate: 1.2500e-04
 Epoch 71/250
 157/157 8s 50ms/step -
 accuracy: 0.8555 - loss: 0.8446 - val_accuracy: 0.8436 - val_loss: 0.8768 -
 learning_rate: 1.2500e-04
 Epoch 72/250
 157/157 8s 50ms/step -
 accuracy: 0.8624 - loss: 0.8285 - val_accuracy: 0.8523 - val_loss: 0.8434 -
 learning_rate: 1.2500e-04
 Epoch 73/250
 157/157 8s 50ms/step -
 accuracy: 0.8574 - loss: 0.8311 - val_accuracy: 0.8454 - val_loss: 0.8654 -
 learning_rate: 1.2500e-04
 Epoch 74/250
 157/157 8s 50ms/step -
 accuracy: 0.8566 - loss: 0.8295 - val_accuracy: 0.8522 - val_loss: 0.8443 -
 learning_rate: 1.2500e-04
 Epoch 75/250
 157/157 8s 50ms/step -
 accuracy: 0.8614 - loss: 0.8077 - val_accuracy: 0.8530 - val_loss: 0.8274 -
 learning_rate: 1.2500e-04
 Epoch 76/250
 157/157 8s 50ms/step -
 accuracy: 0.8624 - loss: 0.8034 - val_accuracy: 0.8530 - val_loss: 0.8319 -
 learning_rate: 1.2500e-04
 Epoch 77/250
 157/157 8s 50ms/step -
 accuracy: 0.8599 - loss: 0.8077 - val_accuracy: 0.8493 - val_loss: 0.8392 -
 learning_rate: 1.2500e-04
 Epoch 78/250
 157/157 8s 50ms/step -
 accuracy: 0.8609 - loss: 0.8055 - val_accuracy: 0.8453 - val_loss: 0.8477 -
 learning_rate: 1.2500e-04
 Epoch 79/250
 157/157 8s 50ms/step -
 accuracy: 0.8641 - loss: 0.7924 - val_accuracy: 0.8525 - val_loss: 0.8217 -
 learning_rate: 1.2500e-04
 Epoch 80/250
 157/157 8s 50ms/step -
 accuracy: 0.8585 - loss: 0.8045 - val_accuracy: 0.8499 - val_loss: 0.8326 -
 learning_rate: 1.2500e-04
 Epoch 81/250
 157/157 8s 50ms/step -
 accuracy: 0.8662 - loss: 0.7848 - val_accuracy: 0.8579 - val_loss: 0.8027 -
 learning_rate: 1.2500e-04
 Epoch 82/250
 157/157 8s 50ms/step -

accuracy: 0.8640 - loss: 0.7843 - val_accuracy: 0.8519 - val_loss: 0.8213 -
 learning_rate: 1.2500e-04
 Epoch 83/250
 157/157 8s 50ms/step -
 accuracy: 0.8670 - loss: 0.7841 - val_accuracy: 0.8542 - val_loss: 0.8195 -
 learning_rate: 1.2500e-04
 Epoch 84/250
 157/157 8s 50ms/step -
 accuracy: 0.8645 - loss: 0.7866 - val_accuracy: 0.8543 - val_loss: 0.8222 -
 learning_rate: 1.2500e-04
 Epoch 85/250
 157/157 8s 51ms/step -
 accuracy: 0.8662 - loss: 0.7809 - val_accuracy: 0.8556 - val_loss: 0.8018 -
 learning_rate: 1.2500e-04
 Epoch 86/250
 157/157 8s 50ms/step -
 accuracy: 0.8680 - loss: 0.7739 - val_accuracy: 0.8544 - val_loss: 0.8147 -
 learning_rate: 1.2500e-04
 Epoch 87/250
 157/157 8s 51ms/step -
 accuracy: 0.8664 - loss: 0.7732 - val_accuracy: 0.8566 - val_loss: 0.8045 -
 learning_rate: 1.2500e-04
 Epoch 88/250
 157/157 8s 51ms/step -
 accuracy: 0.8674 - loss: 0.7710 - val_accuracy: 0.8569 - val_loss: 0.8124 -
 learning_rate: 1.2500e-04
 Epoch 89/250
 157/157 8s 50ms/step -
 accuracy: 0.8689 - loss: 0.7670 - val_accuracy: 0.8537 - val_loss: 0.8144 -
 learning_rate: 1.2500e-04
 Epoch 90/250
 157/157 8s 50ms/step -
 accuracy: 0.8678 - loss: 0.7673 - val_accuracy: 0.8587 - val_loss: 0.7973 -
 learning_rate: 1.2500e-04
 Epoch 91/250
 157/157 8s 50ms/step -
 accuracy: 0.8694 - loss: 0.7640 - val_accuracy: 0.8433 - val_loss: 0.8507 -
 learning_rate: 1.2500e-04
 Epoch 92/250
 157/157 8s 50ms/step -
 accuracy: 0.8718 - loss: 0.7620 - val_accuracy: 0.8575 - val_loss: 0.8000 -
 learning_rate: 1.2500e-04
 Epoch 93/250
 157/157 8s 50ms/step -
 accuracy: 0.8656 - loss: 0.7729 - val_accuracy: 0.8554 - val_loss: 0.8099 -
 learning_rate: 1.2500e-04
 Epoch 94/250
 157/157 8s 50ms/step -

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accuracy: 0.8678 - loss: 0.7734 - val_accuracy: 0.8541 - val_loss: 0.8094 -
learning_rate: 1.2500e-04
Epoch 95/250
157/157          8s 50ms/step -
accuracy: 0.8719 - loss: 0.7579 - val_accuracy: 0.8602 - val_loss: 0.7972 -
learning_rate: 1.2500e-04
Epoch 96/250
157/157          8s 50ms/step -
accuracy: 0.8741 - loss: 0.7535 - val_accuracy: 0.8577 - val_loss: 0.7982 -
learning_rate: 6.2500e-05
Epoch 97/250
157/157          8s 50ms/step -
accuracy: 0.8791 - loss: 0.7303 - val_accuracy: 0.8619 - val_loss: 0.7712 -
learning_rate: 6.2500e-05
Epoch 98/250
157/157          8s 50ms/step -
accuracy: 0.8867 - loss: 0.7039 - val_accuracy: 0.8654 - val_loss: 0.7681 -
learning_rate: 6.2500e-05
Epoch 99/250
157/157          8s 50ms/step -
accuracy: 0.8876 - loss: 0.6918 - val_accuracy: 0.8610 - val_loss: 0.7717 -
learning_rate: 6.2500e-05
Epoch 100/250
157/157          8s 50ms/step -
accuracy: 0.8870 - loss: 0.6818 - val_accuracy: 0.8655 - val_loss: 0.7545 -
learning_rate: 6.2500e-05
Epoch 101/250
157/157          8s 50ms/step -
accuracy: 0.8867 - loss: 0.6790 - val_accuracy: 0.8690 - val_loss: 0.7331 -
learning_rate: 6.2500e-05
Epoch 102/250
157/157          8s 50ms/step -
accuracy: 0.8934 - loss: 0.6602 - val_accuracy: 0.8673 - val_loss: 0.7354 -
learning_rate: 6.2500e-05
Epoch 103/250
157/157          8s 50ms/step -
accuracy: 0.8918 - loss: 0.6600 - val_accuracy: 0.8613 - val_loss: 0.7541 -
learning_rate: 6.2500e-05
Epoch 104/250
157/157          8s 50ms/step -
accuracy: 0.8957 - loss: 0.6400 - val_accuracy: 0.8655 - val_loss: 0.7370 -
learning_rate: 6.2500e-05
Epoch 105/250
157/157          8s 50ms/step -
accuracy: 0.8935 - loss: 0.6437 - val_accuracy: 0.8670 - val_loss: 0.7315 -
learning_rate: 6.2500e-05
Epoch 106/250
157/157          8s 50ms/step -

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accuracy: 0.8947 - loss: 0.6370 - val_accuracy: 0.8653 - val_loss: 0.7338 -
 learning_rate: 6.2500e-05
 Epoch 107/250
 157/157 8s 50ms/step -
 accuracy: 0.8980 - loss: 0.6246 - val_accuracy: 0.8616 - val_loss: 0.7413 -
 learning_rate: 6.2500e-05
 Epoch 108/250
 157/157 8s 50ms/step -
 accuracy: 0.8974 - loss: 0.6214 - val_accuracy: 0.8652 - val_loss: 0.7310 -
 learning_rate: 6.2500e-05
 Epoch 109/250
 157/157 8s 50ms/step -
 accuracy: 0.8964 - loss: 0.6241 - val_accuracy: 0.8644 - val_loss: 0.7218 -
 learning_rate: 6.2500e-05
 Epoch 110/250
 157/157 8s 50ms/step -
 accuracy: 0.8977 - loss: 0.6100 - val_accuracy: 0.8720 - val_loss: 0.7029 -
 learning_rate: 6.2500e-05
 Epoch 111/250
 157/157 8s 50ms/step -
 accuracy: 0.8980 - loss: 0.6097 - val_accuracy: 0.8657 - val_loss: 0.7188 -
 learning_rate: 6.2500e-05
 Epoch 112/250
 157/157 8s 50ms/step -
 accuracy: 0.9018 - loss: 0.6016 - val_accuracy: 0.8686 - val_loss: 0.7147 -
 learning_rate: 6.2500e-05
 Epoch 113/250
 157/157 8s 50ms/step -
 accuracy: 0.8994 - loss: 0.5984 - val_accuracy: 0.8665 - val_loss: 0.7154 -
 learning_rate: 6.2500e-05
 Epoch 114/250
 157/157 8s 50ms/step -
 accuracy: 0.9007 - loss: 0.5934 - val_accuracy: 0.8677 - val_loss: 0.7113 -
 learning_rate: 6.2500e-05
 Epoch 115/250
 157/157 8s 50ms/step -
 accuracy: 0.9009 - loss: 0.5908 - val_accuracy: 0.8726 - val_loss: 0.6965 -
 learning_rate: 6.2500e-05
 Epoch 116/250
 157/157 8s 50ms/step -
 accuracy: 0.9027 - loss: 0.5862 - val_accuracy: 0.8656 - val_loss: 0.7130 -
 learning_rate: 6.2500e-05
 Epoch 117/250
 157/157 8s 50ms/step -
 accuracy: 0.9001 - loss: 0.5829 - val_accuracy: 0.8689 - val_loss: 0.7000 -
 learning_rate: 6.2500e-05
 Epoch 118/250
 157/157 8s 50ms/step -

accuracy: 0.9012 - loss: 0.5829 - val_accuracy: 0.8688 - val_loss: 0.7093 -
 learning_rate: 6.2500e-05
 Epoch 119/250
 157/157 8s 50ms/step -
 accuracy: 0.9029 - loss: 0.5822 - val_accuracy: 0.8667 - val_loss: 0.7119 -
 learning_rate: 6.2500e-05
 Epoch 120/250
 157/157 8s 50ms/step -
 accuracy: 0.9014 - loss: 0.5835 - val_accuracy: 0.8655 - val_loss: 0.6988 -
 learning_rate: 6.2500e-05
 Epoch 121/250
 157/157 8s 50ms/step -
 accuracy: 0.9024 - loss: 0.5720 - val_accuracy: 0.8706 - val_loss: 0.6822 -
 learning_rate: 3.1250e-05
 Epoch 122/250
 157/157 8s 50ms/step -
 accuracy: 0.9075 - loss: 0.5576 - val_accuracy: 0.8711 - val_loss: 0.6807 -
 learning_rate: 3.1250e-05
 Epoch 123/250
 157/157 8s 50ms/step -
 accuracy: 0.9085 - loss: 0.5506 - val_accuracy: 0.8704 - val_loss: 0.6762 -
 learning_rate: 3.1250e-05
 Epoch 124/250
 157/157 8s 50ms/step -
 accuracy: 0.9077 - loss: 0.5542 - val_accuracy: 0.8729 - val_loss: 0.6709 -
 learning_rate: 3.1250e-05
 Epoch 125/250
 157/157 8s 50ms/step -
 accuracy: 0.9108 - loss: 0.5374 - val_accuracy: 0.8710 - val_loss: 0.6742 -
 learning_rate: 3.1250e-05
 Epoch 126/250
 157/157 8s 50ms/step -
 accuracy: 0.9126 - loss: 0.5341 - val_accuracy: 0.8719 - val_loss: 0.6684 -
 learning_rate: 3.1250e-05
 Epoch 127/250
 157/157 8s 51ms/step -
 accuracy: 0.9145 - loss: 0.5287 - val_accuracy: 0.8746 - val_loss: 0.6634 -
 learning_rate: 3.1250e-05
 Epoch 128/250
 157/157 8s 50ms/step -
 accuracy: 0.9159 - loss: 0.5217 - val_accuracy: 0.8732 - val_loss: 0.6691 -
 learning_rate: 3.1250e-05
 Epoch 129/250
 157/157 8s 50ms/step -
 accuracy: 0.9138 - loss: 0.5205 - val_accuracy: 0.8713 - val_loss: 0.6737 -
 learning_rate: 3.1250e-05
 Epoch 130/250
 157/157 8s 50ms/step -

accuracy: 0.9153 - loss: 0.5214 - val_accuracy: 0.8696 - val_loss: 0.6811 -
 learning_rate: 3.1250e-05
 Epoch 131/250
 157/157 8s 50ms/step -
 accuracy: 0.9167 - loss: 0.5130 - val_accuracy: 0.8715 - val_loss: 0.6657 -
 learning_rate: 3.1250e-05
 Epoch 132/250
 157/157 8s 50ms/step -
 accuracy: 0.9147 - loss: 0.5148 - val_accuracy: 0.8747 - val_loss: 0.6614 -
 learning_rate: 3.1250e-05
 Epoch 133/250
 157/157 8s 50ms/step -
 accuracy: 0.9171 - loss: 0.5149 - val_accuracy: 0.8740 - val_loss: 0.6538 -
 learning_rate: 3.1250e-05
 Epoch 134/250
 157/157 8s 50ms/step -
 accuracy: 0.9174 - loss: 0.5033 - val_accuracy: 0.8726 - val_loss: 0.6609 -
 learning_rate: 3.1250e-05
 Epoch 135/250
 157/157 8s 50ms/step -
 accuracy: 0.9183 - loss: 0.4979 - val_accuracy: 0.8768 - val_loss: 0.6436 -
 learning_rate: 3.1250e-05
 Epoch 136/250
 157/157 8s 50ms/step -
 accuracy: 0.9166 - loss: 0.5014 - val_accuracy: 0.8709 - val_loss: 0.6610 -
 learning_rate: 3.1250e-05
 Epoch 137/250
 157/157 8s 50ms/step -
 accuracy: 0.9207 - loss: 0.4860 - val_accuracy: 0.8729 - val_loss: 0.6540 -
 learning_rate: 3.1250e-05
 Epoch 138/250
 157/157 8s 50ms/step -
 accuracy: 0.9171 - loss: 0.4962 - val_accuracy: 0.8725 - val_loss: 0.6561 -
 learning_rate: 3.1250e-05
 Epoch 139/250
 157/157 8s 50ms/step -
 accuracy: 0.9163 - loss: 0.4919 - val_accuracy: 0.8726 - val_loss: 0.6538 -
 learning_rate: 3.1250e-05
 Epoch 140/250
 157/157 8s 50ms/step -
 accuracy: 0.9188 - loss: 0.4892 - val_accuracy: 0.8732 - val_loss: 0.6451 -
 learning_rate: 3.1250e-05
 Epoch 141/250
 157/157 8s 50ms/step -
 accuracy: 0.9220 - loss: 0.4759 - val_accuracy: 0.8755 - val_loss: 0.6449 -
 learning_rate: 1.5625e-05
 Epoch 142/250
 157/157 8s 50ms/step -

accuracy: 0.9214 - loss: 0.4784 - val_accuracy: 0.8736 - val_loss: 0.6446 -
 learning_rate: 1.5625e-05
 Epoch 143/250
 157/157 8s 50ms/step -
 accuracy: 0.9205 - loss: 0.4766 - val_accuracy: 0.8766 - val_loss: 0.6402 -
 learning_rate: 1.5625e-05
 Epoch 144/250
 157/157 8s 50ms/step -
 accuracy: 0.9241 - loss: 0.4674 - val_accuracy: 0.8741 - val_loss: 0.6417 -
 learning_rate: 1.5625e-05
 Epoch 145/250
 157/157 8s 50ms/step -
 accuracy: 0.9265 - loss: 0.4627 - val_accuracy: 0.8746 - val_loss: 0.6379 -
 learning_rate: 1.5625e-05
 Epoch 146/250
 157/157 8s 50ms/step -
 accuracy: 0.9284 - loss: 0.4545 - val_accuracy: 0.8744 - val_loss: 0.6395 -
 learning_rate: 1.5625e-05
 Epoch 147/250
 157/157 8s 50ms/step -
 accuracy: 0.9255 - loss: 0.4590 - val_accuracy: 0.8759 - val_loss: 0.6337 -
 learning_rate: 1.5625e-05
 Epoch 148/250
 157/157 8s 50ms/step -
 accuracy: 0.9223 - loss: 0.4633 - val_accuracy: 0.8732 - val_loss: 0.6422 -
 learning_rate: 1.5625e-05
 Epoch 149/250
 157/157 8s 50ms/step -
 accuracy: 0.9262 - loss: 0.4560 - val_accuracy: 0.8769 - val_loss: 0.6305 -
 learning_rate: 1.5625e-05
 Epoch 150/250
 157/157 8s 50ms/step -
 accuracy: 0.9266 - loss: 0.4559 - val_accuracy: 0.8749 - val_loss: 0.6366 -
 learning_rate: 1.5625e-05
 Epoch 151/250
 157/157 8s 50ms/step -
 accuracy: 0.9295 - loss: 0.4450 - val_accuracy: 0.8758 - val_loss: 0.6333 -
 learning_rate: 1.5625e-05
 Epoch 152/250
 157/157 8s 50ms/step -
 accuracy: 0.9287 - loss: 0.4433 - val_accuracy: 0.8766 - val_loss: 0.6296 -
 learning_rate: 1.5625e-05
 Epoch 153/250
 157/157 8s 50ms/step -
 accuracy: 0.9290 - loss: 0.4440 - val_accuracy: 0.8760 - val_loss: 0.6299 -
 learning_rate: 1.5625e-05
 Epoch 154/250
 157/157 8s 50ms/step -

accuracy: 0.9266 - loss: 0.4522 - val_accuracy: 0.8767 - val_loss: 0.6294 -
 learning_rate: 1.5625e-05
 Epoch 155/250
 157/157 8s 50ms/step -
 accuracy: 0.9274 - loss: 0.4431 - val_accuracy: 0.8748 - val_loss: 0.6274 -
 learning_rate: 1.5625e-05
 Epoch 156/250
 157/157 8s 50ms/step -
 accuracy: 0.9308 - loss: 0.4341 - val_accuracy: 0.8747 - val_loss: 0.6305 -
 learning_rate: 1.5625e-05
 Epoch 157/250
 157/157 8s 50ms/step -
 accuracy: 0.9304 - loss: 0.4348 - val_accuracy: 0.8747 - val_loss: 0.6323 -
 learning_rate: 1.5625e-05
 Epoch 158/250
 157/157 8s 50ms/step -
 accuracy: 0.9284 - loss: 0.4378 - val_accuracy: 0.8774 - val_loss: 0.6263 -
 learning_rate: 1.5625e-05
 Epoch 159/250
 157/157 8s 50ms/step -
 accuracy: 0.9298 - loss: 0.4362 - val_accuracy: 0.8761 - val_loss: 0.6202 -
 learning_rate: 1.5625e-05
 Epoch 160/250
 157/157 8s 50ms/step -
 accuracy: 0.9289 - loss: 0.4335 - val_accuracy: 0.8750 - val_loss: 0.6272 -
 learning_rate: 1.5625e-05
 Epoch 161/250
 157/157 10s 50ms/step -
 accuracy: 0.9319 - loss: 0.4280 - val_accuracy: 0.8756 - val_loss: 0.6219 -
 learning_rate: 1.5625e-05
 Epoch 162/250
 157/157 8s 50ms/step -
 accuracy: 0.9308 - loss: 0.4274 - val_accuracy: 0.8749 - val_loss: 0.6264 -
 learning_rate: 1.5625e-05
 Epoch 163/250
 157/157 8s 50ms/step -
 accuracy: 0.9308 - loss: 0.4281 - val_accuracy: 0.8760 - val_loss: 0.6252 -
 learning_rate: 1.5625e-05
 Epoch 164/250
 157/157 8s 50ms/step -
 accuracy: 0.9333 - loss: 0.4213 - val_accuracy: 0.8752 - val_loss: 0.6215 -
 learning_rate: 1.5625e-05
 Epoch 165/250
 157/157 8s 50ms/step -
 accuracy: 0.9320 - loss: 0.4227 - val_accuracy: 0.8772 - val_loss: 0.6196 -
 learning_rate: 7.8125e-06
 Epoch 166/250
 157/157 8s 50ms/step -

accuracy: 0.9300 - loss: 0.4257 - val_accuracy: 0.8779 - val_loss: 0.6154 -
 learning_rate: 7.8125e-06
 Epoch 167/250
 157/157 8s 50ms/step -
 accuracy: 0.9324 - loss: 0.4207 - val_accuracy: 0.8778 - val_loss: 0.6150 -
 learning_rate: 7.8125e-06
 Epoch 168/250
 157/157 8s 50ms/step -
 accuracy: 0.9339 - loss: 0.4153 - val_accuracy: 0.8778 - val_loss: 0.6151 -
 learning_rate: 7.8125e-06
 Epoch 169/250
 157/157 8s 50ms/step -
 accuracy: 0.9316 - loss: 0.4190 - val_accuracy: 0.8782 - val_loss: 0.6157 -
 learning_rate: 7.8125e-06
 Epoch 170/250
 157/157 8s 50ms/step -
 accuracy: 0.9354 - loss: 0.4108 - val_accuracy: 0.8783 - val_loss: 0.6138 -
 learning_rate: 7.8125e-06
 Epoch 171/250
 157/157 8s 50ms/step -
 accuracy: 0.9365 - loss: 0.4091 - val_accuracy: 0.8769 - val_loss: 0.6153 -
 learning_rate: 7.8125e-06
 Epoch 172/250
 157/157 8s 50ms/step -
 accuracy: 0.9343 - loss: 0.4136 - val_accuracy: 0.8798 - val_loss: 0.6117 -
 learning_rate: 7.8125e-06
 Epoch 173/250
 157/157 8s 50ms/step -
 accuracy: 0.9349 - loss: 0.4092 - val_accuracy: 0.8777 - val_loss: 0.6138 -
 learning_rate: 7.8125e-06
 Epoch 174/250
 157/157 8s 50ms/step -
 accuracy: 0.9340 - loss: 0.4101 - val_accuracy: 0.8766 - val_loss: 0.6206 -
 learning_rate: 7.8125e-06
 Epoch 175/250
 157/157 8s 50ms/step -
 accuracy: 0.9349 - loss: 0.4082 - val_accuracy: 0.8788 - val_loss: 0.6145 -
 learning_rate: 7.8125e-06
 Epoch 176/250
 157/157 8s 50ms/step -
 accuracy: 0.9352 - loss: 0.4065 - val_accuracy: 0.8780 - val_loss: 0.6140 -
 learning_rate: 7.8125e-06
 Epoch 177/250
 157/157 8s 50ms/step -
 accuracy: 0.9358 - loss: 0.4041 - val_accuracy: 0.8774 - val_loss: 0.6160 -
 learning_rate: 7.8125e-06
 Epoch 178/250
 157/157 8s 50ms/step -

```

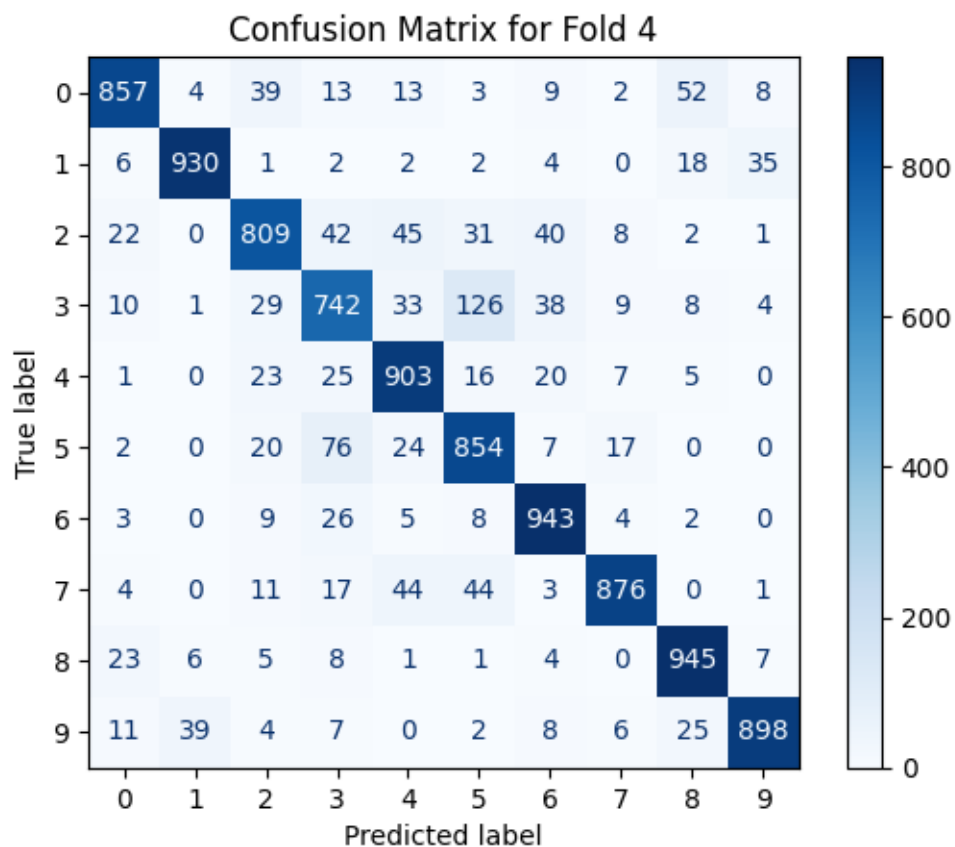
accuracy: 0.9365 - loss: 0.4006 - val_accuracy: 0.8786 - val_loss: 0.6116 -
learning_rate: 3.9063e-06
Epoch 179/250
157/157      8s 50ms/step -
accuracy: 0.9348 - loss: 0.4062 - val_accuracy: 0.8785 - val_loss: 0.6126 -
learning_rate: 3.9063e-06
Epoch 180/250
157/157      8s 50ms/step -
accuracy: 0.9359 - loss: 0.4069 - val_accuracy: 0.8791 - val_loss: 0.6087 -
learning_rate: 3.9063e-06
Epoch 181/250
157/157      8s 50ms/step -
accuracy: 0.9362 - loss: 0.4027 - val_accuracy: 0.8768 - val_loss: 0.6131 -
learning_rate: 3.9063e-06
Epoch 182/250
157/157      8s 50ms/step -
accuracy: 0.9340 - loss: 0.4042 - val_accuracy: 0.8768 - val_loss: 0.6118 -
learning_rate: 3.9063e-06
Epoch 183/250
157/157      8s 50ms/step -
accuracy: 0.9365 - loss: 0.4007 - val_accuracy: 0.8776 - val_loss: 0.6093 -
learning_rate: 3.9063e-06
Epoch 184/250
157/157      8s 50ms/step -
accuracy: 0.9375 - loss: 0.3954 - val_accuracy: 0.8783 - val_loss: 0.6089 -
learning_rate: 3.9063e-06
Epoch 185/250
157/157      8s 50ms/step -
accuracy: 0.9355 - loss: 0.3992 - val_accuracy: 0.8783 - val_loss: 0.6118 -
learning_rate: 3.9063e-06
Epoch 186/250
157/157      8s 50ms/step -
accuracy: 0.9395 - loss: 0.3925 - val_accuracy: 0.8784 - val_loss: 0.6097 -
learning_rate: 1.9531e-06
Epoch 187/250
157/157      8s 50ms/step -
accuracy: 0.9380 - loss: 0.3966 - val_accuracy: 0.8778 - val_loss: 0.6103 -
learning_rate: 1.9531e-06
Epoch 188/250
157/157      8s 50ms/step -
accuracy: 0.9361 - loss: 0.4001 - val_accuracy: 0.8791 - val_loss: 0.6096 -
learning_rate: 1.9531e-06
Epoch 189/250
157/157      8s 50ms/step -
accuracy: 0.9356 - loss: 0.4006 - val_accuracy: 0.8776 - val_loss: 0.6118 -
learning_rate: 1.9531e-06
Epoch 190/250
157/157      8s 50ms/step -

```

```

accuracy: 0.9358 - loss: 0.4022 - val_accuracy: 0.8780 - val_loss: 0.6117 -
learning_rate: 1.9531e-06
Epoch 191/250
157/157          8s 50ms/step -
accuracy: 0.9374 - loss: 0.3988 - val_accuracy: 0.8784 - val_loss: 0.6101 -
learning_rate: 1.0000e-06
Epoch 192/250
157/157          8s 50ms/step -
accuracy: 0.9378 - loss: 0.3929 - val_accuracy: 0.8782 - val_loss: 0.6108 -
learning_rate: 1.0000e-06
Epoch 193/250
157/157          8s 50ms/step -
accuracy: 0.9360 - loss: 0.4001 - val_accuracy: 0.8779 - val_loss: 0.6096 -
learning_rate: 1.0000e-06
Epoch 194/250
157/157          8s 50ms/step -
accuracy: 0.9391 - loss: 0.3903 - val_accuracy: 0.8782 - val_loss: 0.6107 -
learning_rate: 1.0000e-06
Epoch 195/250
157/157          8s 50ms/step -
accuracy: 0.9383 - loss: 0.3954 - val_accuracy: 0.8777 - val_loss: 0.6115 -
learning_rate: 1.0000e-06
Score for fold 4: test loss of 0.6310154795646667; test accuracy of
87.56999969482422%
313/313          1s 3ms/step

```



Classification Report for Fold 4:

	precision	recall	f1-score	support
Class 0	0.91	0.86	0.88	1000
Class 1	0.95	0.93	0.94	1000
Class 2	0.85	0.81	0.83	1000
Class 3	0.77	0.74	0.76	1000
Class 4	0.84	0.90	0.87	1000
Class 5	0.79	0.85	0.82	1000
Class 6	0.88	0.94	0.91	1000
Class 7	0.94	0.88	0.91	1000
Class 8	0.89	0.94	0.92	1000
Class 9	0.94	0.90	0.92	1000
accuracy			0.88	10000
macro avg	0.88	0.88	0.88	10000
weighted avg	0.88	0.88	0.88	10000

/opt/conda/lib/python3.10/site-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not

pass an ``input_shape`/`input_dim`` argument to a layer. When using Sequential models, prefer using an ``Input(shape)`` object as the first layer in the model instead.

```
super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Epoch 1/250

157/157 32s 120ms/step -

accuracy: 0.2082 - loss: 7.9969 - val_accuracy: 0.1686 - val_loss: 6.4001 -
learning_rate: 0.0010

Epoch 2/250

157/157 8s 51ms/step -

accuracy: 0.3724 - loss: 4.8786 - val_accuracy: 0.2185 - val_loss: 4.2185 -
learning_rate: 0.0010

Epoch 3/250

157/157 8s 51ms/step -

accuracy: 0.4770 - loss: 3.2046 - val_accuracy: 0.3687 - val_loss: 3.0346 -
learning_rate: 0.0010

Epoch 4/250

157/157 8s 52ms/step -

accuracy: 0.5363 - loss: 2.4992 - val_accuracy: 0.4905 - val_loss: 2.4483 -
learning_rate: 0.0010

Epoch 5/250

157/157 8s 52ms/step -

accuracy: 0.5853 - loss: 2.2147 - val_accuracy: 0.5681 - val_loss: 2.2207 -
learning_rate: 0.0010

Epoch 6/250

157/157 8s 51ms/step -

accuracy: 0.6187 - loss: 2.0955 - val_accuracy: 0.6051 - val_loss: 2.0792 -
learning_rate: 0.0010

Epoch 7/250

157/157 8s 51ms/step -

accuracy: 0.6433 - loss: 1.9992 - val_accuracy: 0.5570 - val_loss: 2.2496 -
learning_rate: 0.0010

Epoch 8/250

157/157 8s 50ms/step -

accuracy: 0.6578 - loss: 1.9934 - val_accuracy: 0.6279 - val_loss: 2.0888 -
learning_rate: 0.0010

Epoch 9/250

157/157 8s 50ms/step -

accuracy: 0.6710 - loss: 1.9778 - val_accuracy: 0.6494 - val_loss: 1.9984 -
learning_rate: 0.0010

Epoch 10/250

157/157 8s 50ms/step -

accuracy: 0.6728 - loss: 1.9924 - val_accuracy: 0.7033 - val_loss: 1.8897 -
learning_rate: 0.0010

Epoch 11/250

157/157 8s 50ms/step -

accuracy: 0.6790 - loss: 1.9828 - val_accuracy: 0.7301 - val_loss: 1.8087 -

```

learning_rate: 0.0010
Epoch 12/250
157/157          8s 50ms/step -
accuracy: 0.6858 - loss: 1.9643 - val_accuracy: 0.6956 - val_loss: 1.9267 -
learning_rate: 0.0010
Epoch 13/250
157/157          8s 51ms/step -
accuracy: 0.6866 - loss: 1.9654 - val_accuracy: 0.6911 - val_loss: 1.9443 -
learning_rate: 0.0010
Epoch 14/250
157/157          8s 51ms/step -
accuracy: 0.6895 - loss: 1.9603 - val_accuracy: 0.6719 - val_loss: 2.0303 -
learning_rate: 0.0010
Epoch 15/250
157/157          8s 50ms/step -
accuracy: 0.6954 - loss: 1.9870 - val_accuracy: 0.7026 - val_loss: 1.9444 -
learning_rate: 0.0010
Epoch 16/250
157/157          8s 50ms/step -
accuracy: 0.6906 - loss: 1.9908 - val_accuracy: 0.7274 - val_loss: 1.8331 -
learning_rate: 0.0010
Epoch 17/250
157/157          8s 51ms/step -
accuracy: 0.7214 - loss: 1.8107 - val_accuracy: 0.7512 - val_loss: 1.5640 -
learning_rate: 5.0000e-04
Epoch 18/250
157/157          8s 50ms/step -
accuracy: 0.7384 - loss: 1.5863 - val_accuracy: 0.7542 - val_loss: 1.5175 -
learning_rate: 5.0000e-04
Epoch 19/250
157/157          8s 50ms/step -
accuracy: 0.7408 - loss: 1.5505 - val_accuracy: 0.7678 - val_loss: 1.4656 -
learning_rate: 5.0000e-04
Epoch 20/250
157/157          8s 50ms/step -
accuracy: 0.7439 - loss: 1.5527 - val_accuracy: 0.7599 - val_loss: 1.4982 -
learning_rate: 5.0000e-04
Epoch 21/250
157/157          8s 50ms/step -
accuracy: 0.7456 - loss: 1.5419 - val_accuracy: 0.7619 - val_loss: 1.4905 -
learning_rate: 5.0000e-04
Epoch 22/250
157/157          8s 50ms/step -
accuracy: 0.7502 - loss: 1.5402 - val_accuracy: 0.7622 - val_loss: 1.4932 -
learning_rate: 5.0000e-04
Epoch 23/250
157/157          8s 50ms/step -
accuracy: 0.7547 - loss: 1.5215 - val_accuracy: 0.7751 - val_loss: 1.4472 -

```



```

learning_rate: 5.0000e-04
Epoch 24/250
157/157          8s 50ms/step -
accuracy: 0.7554 - loss: 1.5242 - val_accuracy: 0.7806 - val_loss: 1.4322 -
learning_rate: 5.0000e-04
Epoch 25/250
157/157          8s 50ms/step -
accuracy: 0.7561 - loss: 1.5162 - val_accuracy: 0.7814 - val_loss: 1.4275 -
learning_rate: 5.0000e-04
Epoch 26/250
157/157          8s 50ms/step -
accuracy: 0.7599 - loss: 1.5032 - val_accuracy: 0.7817 - val_loss: 1.4275 -
learning_rate: 5.0000e-04
Epoch 27/250
157/157          8s 50ms/step -
accuracy: 0.7585 - loss: 1.5067 - val_accuracy: 0.7842 - val_loss: 1.4093 -
learning_rate: 5.0000e-04
Epoch 28/250
157/157          8s 50ms/step -
accuracy: 0.7591 - loss: 1.4983 - val_accuracy: 0.7832 - val_loss: 1.4031 -
learning_rate: 5.0000e-04
Epoch 29/250
157/157          8s 50ms/step -
accuracy: 0.7621 - loss: 1.4761 - val_accuracy: 0.7880 - val_loss: 1.4103 -
learning_rate: 5.0000e-04
Epoch 30/250
157/157          8s 50ms/step -
accuracy: 0.7588 - loss: 1.4988 - val_accuracy: 0.7515 - val_loss: 1.5325 -
learning_rate: 5.0000e-04
Epoch 31/250
157/157          8s 50ms/step -
accuracy: 0.7601 - loss: 1.4895 - val_accuracy: 0.7929 - val_loss: 1.3899 -
learning_rate: 5.0000e-04
Epoch 32/250
157/157          8s 50ms/step -
accuracy: 0.7653 - loss: 1.4767 - val_accuracy: 0.7982 - val_loss: 1.3765 -
learning_rate: 5.0000e-04
Epoch 33/250
157/157          8s 50ms/step -
accuracy: 0.7663 - loss: 1.4676 - val_accuracy: 0.7888 - val_loss: 1.3947 -
learning_rate: 5.0000e-04
Epoch 34/250
157/157          8s 50ms/step -
accuracy: 0.7616 - loss: 1.4790 - val_accuracy: 0.7801 - val_loss: 1.4378 -
learning_rate: 5.0000e-04
Epoch 35/250
157/157          8s 50ms/step -
accuracy: 0.7759 - loss: 1.4459 - val_accuracy: 0.7747 - val_loss: 1.4436 -

```

```

learning_rate: 5.0000e-04
Epoch 36/250
157/157          8s 50ms/step -
accuracy: 0.7680 - loss: 1.4661 - val_accuracy: 0.7919 - val_loss: 1.3959 -
learning_rate: 5.0000e-04
Epoch 37/250
157/157          8s 51ms/step -
accuracy: 0.7702 - loss: 1.4580 - val_accuracy: 0.7772 - val_loss: 1.4379 -
learning_rate: 5.0000e-04
Epoch 38/250
157/157          8s 51ms/step -
accuracy: 0.7874 - loss: 1.3868 - val_accuracy: 0.8133 - val_loss: 1.2557 -
learning_rate: 2.5000e-04
Epoch 39/250
157/157          8s 50ms/step -
accuracy: 0.8010 - loss: 1.2675 - val_accuracy: 0.8127 - val_loss: 1.1873 -
learning_rate: 2.5000e-04
Epoch 40/250
157/157          8s 50ms/step -
accuracy: 0.8062 - loss: 1.2058 - val_accuracy: 0.8037 - val_loss: 1.1819 -
learning_rate: 2.5000e-04
Epoch 41/250
157/157          8s 50ms/step -
accuracy: 0.8071 - loss: 1.1803 - val_accuracy: 0.8300 - val_loss: 1.1042 -
learning_rate: 2.5000e-04
Epoch 42/250
157/157          8s 50ms/step -
accuracy: 0.8050 - loss: 1.1642 - val_accuracy: 0.8216 - val_loss: 1.1196 -
learning_rate: 2.5000e-04
Epoch 43/250
157/157          8s 50ms/step -
accuracy: 0.8030 - loss: 1.1615 - val_accuracy: 0.8268 - val_loss: 1.0920 -
learning_rate: 2.5000e-04
Epoch 44/250
157/157          8s 50ms/step -
accuracy: 0.8085 - loss: 1.1358 - val_accuracy: 0.8206 - val_loss: 1.1133 -
learning_rate: 2.5000e-04
Epoch 45/250
157/157          8s 50ms/step -
accuracy: 0.8094 - loss: 1.1379 - val_accuracy: 0.8221 - val_loss: 1.0979 -
learning_rate: 2.5000e-04
Epoch 46/250
157/157          8s 50ms/step -
accuracy: 0.8162 - loss: 1.1070 - val_accuracy: 0.8261 - val_loss: 1.0802 -
learning_rate: 2.5000e-04
Epoch 47/250
157/157          8s 50ms/step -
accuracy: 0.8153 - loss: 1.1074 - val_accuracy: 0.8227 - val_loss: 1.0928 -

```

```

learning_rate: 2.5000e-04
Epoch 48/250
157/157          8s 50ms/step -
accuracy: 0.8142 - loss: 1.1013 - val_accuracy: 0.8270 - val_loss: 1.0787 -
learning_rate: 2.5000e-04
Epoch 49/250
157/157          8s 50ms/step -
accuracy: 0.8140 - loss: 1.1118 - val_accuracy: 0.8383 - val_loss: 1.0445 -
learning_rate: 2.5000e-04
Epoch 50/250
157/157          8s 50ms/step -
accuracy: 0.8195 - loss: 1.0996 - val_accuracy: 0.8304 - val_loss: 1.0645 -
learning_rate: 2.5000e-04
Epoch 51/250
157/157          8s 50ms/step -
accuracy: 0.8183 - loss: 1.0934 - val_accuracy: 0.8348 - val_loss: 1.0583 -
learning_rate: 2.5000e-04
Epoch 52/250
157/157          8s 50ms/step -
accuracy: 0.8163 - loss: 1.0952 - val_accuracy: 0.8402 - val_loss: 1.0278 -
learning_rate: 2.5000e-04
Epoch 53/250
157/157          8s 50ms/step -
accuracy: 0.8191 - loss: 1.0940 - val_accuracy: 0.8321 - val_loss: 1.0584 -
learning_rate: 2.5000e-04
Epoch 54/250
157/157          8s 50ms/step -
accuracy: 0.8189 - loss: 1.0803 - val_accuracy: 0.8373 - val_loss: 1.0392 -
learning_rate: 2.5000e-04
Epoch 55/250
157/157          8s 50ms/step -
accuracy: 0.8242 - loss: 1.0786 - val_accuracy: 0.8164 - val_loss: 1.1136 -
learning_rate: 2.5000e-04
Epoch 56/250
157/157          8s 50ms/step -
accuracy: 0.8195 - loss: 1.0808 - val_accuracy: 0.8231 - val_loss: 1.0738 -
learning_rate: 2.5000e-04
Epoch 57/250
157/157          8s 50ms/step -
accuracy: 0.8210 - loss: 1.0750 - val_accuracy: 0.8254 - val_loss: 1.0773 -
learning_rate: 2.5000e-04
Epoch 58/250
157/157          8s 50ms/step -
accuracy: 0.8309 - loss: 1.0410 - val_accuracy: 0.8512 - val_loss: 0.9752 -
learning_rate: 1.2500e-04
Epoch 59/250
157/157          8s 50ms/step -
accuracy: 0.8446 - loss: 0.9851 - val_accuracy: 0.8458 - val_loss: 0.9618 -

```

```

learning_rate: 1.2500e-04
Epoch 60/250
157/157      8s 50ms/step -
accuracy: 0.8449 - loss: 0.9585 - val_accuracy: 0.8486 - val_loss: 0.9414 -
learning_rate: 1.2500e-04
Epoch 61/250
157/157      8s 50ms/step -
accuracy: 0.8484 - loss: 0.9239 - val_accuracy: 0.8498 - val_loss: 0.9238 -
learning_rate: 1.2500e-04
Epoch 62/250
157/157      8s 50ms/step -
accuracy: 0.8544 - loss: 0.9033 - val_accuracy: 0.8451 - val_loss: 0.9275 -
learning_rate: 1.2500e-04
Epoch 63/250
157/157      8s 50ms/step -
accuracy: 0.8546 - loss: 0.8820 - val_accuracy: 0.8523 - val_loss: 0.8937 -
learning_rate: 1.2500e-04
Epoch 64/250
157/157      8s 50ms/step -
accuracy: 0.8509 - loss: 0.8793 - val_accuracy: 0.8496 - val_loss: 0.8897 -
learning_rate: 1.2500e-04
Epoch 65/250
157/157      8s 50ms/step -
accuracy: 0.8559 - loss: 0.8624 - val_accuracy: 0.8563 - val_loss: 0.8678 -
learning_rate: 1.2500e-04
Epoch 66/250
157/157      8s 50ms/step -
accuracy: 0.8547 - loss: 0.8547 - val_accuracy: 0.8544 - val_loss: 0.8745 -
learning_rate: 1.2500e-04
Epoch 67/250
157/157      8s 50ms/step -
accuracy: 0.8570 - loss: 0.8421 - val_accuracy: 0.8457 - val_loss: 0.8974 -
learning_rate: 1.2500e-04
Epoch 68/250
157/157      8s 50ms/step -
accuracy: 0.8598 - loss: 0.8361 - val_accuracy: 0.8608 - val_loss: 0.8444 -
learning_rate: 1.2500e-04
Epoch 69/250
157/157      8s 50ms/step -
accuracy: 0.8582 - loss: 0.8259 - val_accuracy: 0.8557 - val_loss: 0.8662 -
learning_rate: 1.2500e-04
Epoch 70/250
157/157      8s 50ms/step -
accuracy: 0.8647 - loss: 0.8161 - val_accuracy: 0.8591 - val_loss: 0.8419 -
learning_rate: 1.2500e-04
Epoch 71/250
157/157      8s 50ms/step -
accuracy: 0.8648 - loss: 0.8106 - val_accuracy: 0.8601 - val_loss: 0.8304 -

```

```

learning_rate: 1.2500e-04
Epoch 72/250
157/157          8s 50ms/step -
accuracy: 0.8610 - loss: 0.8182 - val_accuracy: 0.8581 - val_loss: 0.8399 -
learning_rate: 1.2500e-04
Epoch 73/250
157/157          8s 50ms/step -
accuracy: 0.8615 - loss: 0.8132 - val_accuracy: 0.8567 - val_loss: 0.8424 -
learning_rate: 1.2500e-04
Epoch 74/250
157/157          8s 50ms/step -
accuracy: 0.8626 - loss: 0.8031 - val_accuracy: 0.8595 - val_loss: 0.8304 -
learning_rate: 1.2500e-04
Epoch 75/250
157/157          8s 50ms/step -
accuracy: 0.8659 - loss: 0.7948 - val_accuracy: 0.8585 - val_loss: 0.8319 -
learning_rate: 1.2500e-04
Epoch 76/250
157/157          8s 50ms/step -
accuracy: 0.8630 - loss: 0.7888 - val_accuracy: 0.8630 - val_loss: 0.8208 -
learning_rate: 1.2500e-04
Epoch 77/250
157/157          8s 50ms/step -
accuracy: 0.8655 - loss: 0.7870 - val_accuracy: 0.8619 - val_loss: 0.8185 -
learning_rate: 1.2500e-04
Epoch 78/250
157/157          8s 50ms/step -
accuracy: 0.8642 - loss: 0.7891 - val_accuracy: 0.8548 - val_loss: 0.8326 -
learning_rate: 1.2500e-04
Epoch 79/250
157/157          8s 50ms/step -
accuracy: 0.8621 - loss: 0.7988 - val_accuracy: 0.8621 - val_loss: 0.8107 -
learning_rate: 1.2500e-04
Epoch 80/250
157/157          8s 50ms/step -
accuracy: 0.8682 - loss: 0.7781 - val_accuracy: 0.8593 - val_loss: 0.8223 -
learning_rate: 1.2500e-04
Epoch 81/250
157/157          8s 51ms/step -
accuracy: 0.8699 - loss: 0.7758 - val_accuracy: 0.8628 - val_loss: 0.8186 -
learning_rate: 1.2500e-04
Epoch 82/250
157/157          8s 50ms/step -
accuracy: 0.8698 - loss: 0.7732 - val_accuracy: 0.8589 - val_loss: 0.8218 -
learning_rate: 1.2500e-04
Epoch 83/250
157/157          8s 50ms/step -
accuracy: 0.8686 - loss: 0.7743 - val_accuracy: 0.8649 - val_loss: 0.8071 -

```

```

learning_rate: 1.2500e-04
Epoch 84/250
157/157      8s 50ms/step -
accuracy: 0.8723 - loss: 0.7629 - val_accuracy: 0.8596 - val_loss: 0.8204 -
learning_rate: 1.2500e-04
Epoch 85/250
157/157      8s 50ms/step -
accuracy: 0.8699 - loss: 0.7679 - val_accuracy: 0.8612 - val_loss: 0.8166 -
learning_rate: 1.2500e-04
Epoch 86/250
157/157      8s 50ms/step -
accuracy: 0.8699 - loss: 0.7724 - val_accuracy: 0.8587 - val_loss: 0.8216 -
learning_rate: 1.2500e-04
Epoch 87/250
157/157      8s 50ms/step -
accuracy: 0.8704 - loss: 0.7697 - val_accuracy: 0.8600 - val_loss: 0.8125 -
learning_rate: 1.2500e-04
Epoch 88/250
157/157      8s 50ms/step -
accuracy: 0.8746 - loss: 0.7549 - val_accuracy: 0.8648 - val_loss: 0.8030 -
learning_rate: 1.2500e-04
Epoch 89/250
157/157      8s 50ms/step -
accuracy: 0.8688 - loss: 0.7687 - val_accuracy: 0.8603 - val_loss: 0.8108 -
learning_rate: 1.2500e-04
Epoch 90/250
157/157      8s 50ms/step -
accuracy: 0.8710 - loss: 0.7581 - val_accuracy: 0.8606 - val_loss: 0.8234 -
learning_rate: 1.2500e-04
Epoch 91/250
157/157      8s 50ms/step -
accuracy: 0.8733 - loss: 0.7456 - val_accuracy: 0.8650 - val_loss: 0.8150 -
learning_rate: 1.2500e-04
Epoch 92/250
157/157      8s 50ms/step -
accuracy: 0.8742 - loss: 0.7504 - val_accuracy: 0.8641 - val_loss: 0.8160 -
learning_rate: 1.2500e-04
Epoch 93/250
157/157      8s 50ms/step -
accuracy: 0.8757 - loss: 0.7501 - val_accuracy: 0.8615 - val_loss: 0.8123 -
learning_rate: 1.2500e-04
Epoch 94/250
157/157      8s 50ms/step -
accuracy: 0.8787 - loss: 0.7408 - val_accuracy: 0.8678 - val_loss: 0.7965 -
learning_rate: 6.2500e-05
Epoch 95/250
157/157      8s 50ms/step -
accuracy: 0.8847 - loss: 0.7180 - val_accuracy: 0.8662 - val_loss: 0.7908 -

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learning_rate: 6.2500e-05
Epoch 96/250
157/157      8s 50ms/step -
accuracy: 0.8889 - loss: 0.6971 - val_accuracy: 0.8698 - val_loss: 0.7708 -
learning_rate: 6.2500e-05
Epoch 97/250
157/157      8s 50ms/step -
accuracy: 0.8895 - loss: 0.6874 - val_accuracy: 0.8704 - val_loss: 0.7628 -
learning_rate: 6.2500e-05
Epoch 98/250
157/157      8s 50ms/step -
accuracy: 0.8920 - loss: 0.6778 - val_accuracy: 0.8697 - val_loss: 0.7676 -
learning_rate: 6.2500e-05
Epoch 99/250
157/157      8s 50ms/step -
accuracy: 0.8936 - loss: 0.6658 - val_accuracy: 0.8721 - val_loss: 0.7549 -
learning_rate: 6.2500e-05
Epoch 100/250
157/157      8s 50ms/step -
accuracy: 0.8915 - loss: 0.6595 - val_accuracy: 0.8695 - val_loss: 0.7549 -
learning_rate: 6.2500e-05
Epoch 101/250
157/157      8s 50ms/step -
accuracy: 0.8939 - loss: 0.6507 - val_accuracy: 0.8688 - val_loss: 0.7604 -
learning_rate: 6.2500e-05
Epoch 102/250
157/157      8s 50ms/step -
accuracy: 0.8929 - loss: 0.6524 - val_accuracy: 0.8711 - val_loss: 0.7443 -
learning_rate: 6.2500e-05
Epoch 103/250
157/157      8s 50ms/step -
accuracy: 0.8952 - loss: 0.6417 - val_accuracy: 0.8715 - val_loss: 0.7471 -
learning_rate: 6.2500e-05
Epoch 104/250
157/157      8s 50ms/step -
accuracy: 0.8989 - loss: 0.6314 - val_accuracy: 0.8702 - val_loss: 0.7400 -
learning_rate: 6.2500e-05
Epoch 105/250
157/157      8s 50ms/step -
accuracy: 0.8974 - loss: 0.6276 - val_accuracy: 0.8737 - val_loss: 0.7248 -
learning_rate: 6.2500e-05
Epoch 106/250
157/157      8s 50ms/step -
accuracy: 0.8974 - loss: 0.6248 - val_accuracy: 0.8735 - val_loss: 0.7222 -
learning_rate: 6.2500e-05
Epoch 107/250
157/157      8s 50ms/step -
accuracy: 0.8968 - loss: 0.6218 - val_accuracy: 0.8721 - val_loss: 0.7264 -

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learning_rate: 6.2500e-05
Epoch 108/250
157/157          8s 50ms/step -
accuracy: 0.8962 - loss: 0.6179 - val_accuracy: 0.8725 - val_loss: 0.7299 -
learning_rate: 6.2500e-05
Epoch 109/250
157/157          8s 50ms/step -
accuracy: 0.8984 - loss: 0.6107 - val_accuracy: 0.8747 - val_loss: 0.7083 -
learning_rate: 6.2500e-05
Epoch 110/250
157/157          8s 50ms/step -
accuracy: 0.9007 - loss: 0.6032 - val_accuracy: 0.8719 - val_loss: 0.7239 -
learning_rate: 6.2500e-05
Epoch 111/250
157/157          8s 50ms/step -
accuracy: 0.9030 - loss: 0.5967 - val_accuracy: 0.8736 - val_loss: 0.7119 -
learning_rate: 6.2500e-05
Epoch 112/250
157/157          8s 50ms/step -
accuracy: 0.9004 - loss: 0.5977 - val_accuracy: 0.8790 - val_loss: 0.6981 -
learning_rate: 6.2500e-05
Epoch 113/250
157/157          8s 50ms/step -
accuracy: 0.9014 - loss: 0.5942 - val_accuracy: 0.8715 - val_loss: 0.7108 -
learning_rate: 6.2500e-05
Epoch 114/250
157/157          8s 50ms/step -
accuracy: 0.9032 - loss: 0.5880 - val_accuracy: 0.8727 - val_loss: 0.7118 -
learning_rate: 6.2500e-05
Epoch 115/250
157/157          8s 50ms/step -
accuracy: 0.9018 - loss: 0.5845 - val_accuracy: 0.8704 - val_loss: 0.7129 -
learning_rate: 6.2500e-05
Epoch 116/250
157/157          8s 50ms/step -
accuracy: 0.9010 - loss: 0.5833 - val_accuracy: 0.8756 - val_loss: 0.6991 -
learning_rate: 6.2500e-05
Epoch 117/250
157/157          8s 50ms/step -
accuracy: 0.9060 - loss: 0.5718 - val_accuracy: 0.8717 - val_loss: 0.7109 -
learning_rate: 6.2500e-05
Epoch 118/250
157/157          8s 50ms/step -
accuracy: 0.9062 - loss: 0.5689 - val_accuracy: 0.8759 - val_loss: 0.6901 -
learning_rate: 3.1250e-05
Epoch 119/250
157/157          8s 50ms/step -
accuracy: 0.9065 - loss: 0.5637 - val_accuracy: 0.8741 - val_loss: 0.6955 -

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learning_rate: 3.1250e-05
Epoch 120/250
157/157          8s 50ms/step -
accuracy: 0.9082 - loss: 0.5573 - val_accuracy: 0.8755 - val_loss: 0.6884 -
learning_rate: 3.1250e-05
Epoch 121/250
157/157          8s 50ms/step -
accuracy: 0.9124 - loss: 0.5447 - val_accuracy: 0.8750 - val_loss: 0.6850 -
learning_rate: 3.1250e-05
Epoch 122/250
157/157          8s 50ms/step -
accuracy: 0.9117 - loss: 0.5432 - val_accuracy: 0.8760 - val_loss: 0.6822 -
learning_rate: 3.1250e-05
Epoch 123/250
157/157          8s 50ms/step -
accuracy: 0.9163 - loss: 0.5319 - val_accuracy: 0.8765 - val_loss: 0.6806 -
learning_rate: 3.1250e-05
Epoch 124/250
157/157          8s 50ms/step -
accuracy: 0.9123 - loss: 0.5340 - val_accuracy: 0.8757 - val_loss: 0.6767 -
learning_rate: 3.1250e-05
Epoch 125/250
157/157          8s 50ms/step -
accuracy: 0.9144 - loss: 0.5250 - val_accuracy: 0.8729 - val_loss: 0.6826 -
learning_rate: 3.1250e-05
Epoch 126/250
157/157          8s 50ms/step -
accuracy: 0.9157 - loss: 0.5224 - val_accuracy: 0.8757 - val_loss: 0.6759 -
learning_rate: 3.1250e-05
Epoch 127/250
157/157          8s 50ms/step -
accuracy: 0.9166 - loss: 0.5128 - val_accuracy: 0.8771 - val_loss: 0.6707 -
learning_rate: 3.1250e-05
Epoch 128/250
157/157          8s 50ms/step -
accuracy: 0.9184 - loss: 0.5116 - val_accuracy: 0.8768 - val_loss: 0.6623 -
learning_rate: 3.1250e-05
Epoch 129/250
157/157          8s 50ms/step -
accuracy: 0.9148 - loss: 0.5085 - val_accuracy: 0.8787 - val_loss: 0.6686 -
learning_rate: 3.1250e-05
Epoch 130/250
157/157          8s 50ms/step -
accuracy: 0.9169 - loss: 0.5091 - val_accuracy: 0.8748 - val_loss: 0.6668 -
learning_rate: 3.1250e-05
Epoch 131/250
157/157          8s 50ms/step -
accuracy: 0.9184 - loss: 0.5013 - val_accuracy: 0.8764 - val_loss: 0.6648 -

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learning_rate: 3.1250e-05
Epoch 132/250
157/157          8s 50ms/step -
accuracy: 0.9218 - loss: 0.4902 - val_accuracy: 0.8775 - val_loss: 0.6639 -
learning_rate: 3.1250e-05
Epoch 133/250
157/157          8s 50ms/step -
accuracy: 0.9188 - loss: 0.4983 - val_accuracy: 0.8763 - val_loss: 0.6586 -
learning_rate: 3.1250e-05
Epoch 134/250
157/157          8s 50ms/step -
accuracy: 0.9186 - loss: 0.4936 - val_accuracy: 0.8805 - val_loss: 0.6477 -
learning_rate: 3.1250e-05
Epoch 135/250
157/157          8s 50ms/step -
accuracy: 0.9183 - loss: 0.4953 - val_accuracy: 0.8801 - val_loss: 0.6523 -
learning_rate: 3.1250e-05
Epoch 136/250
157/157          8s 50ms/step -
accuracy: 0.9201 - loss: 0.4859 - val_accuracy: 0.8792 - val_loss: 0.6521 -
learning_rate: 3.1250e-05
Epoch 137/250
157/157          8s 50ms/step -
accuracy: 0.9226 - loss: 0.4769 - val_accuracy: 0.8772 - val_loss: 0.6556 -
learning_rate: 3.1250e-05
Epoch 138/250
157/157          8s 50ms/step -
accuracy: 0.9214 - loss: 0.4809 - val_accuracy: 0.8783 - val_loss: 0.6522 -
learning_rate: 3.1250e-05
Epoch 139/250
157/157          8s 50ms/step -
accuracy: 0.9224 - loss: 0.4807 - val_accuracy: 0.8753 - val_loss: 0.6572 -
learning_rate: 3.1250e-05
Epoch 140/250
157/157          8s 50ms/step -
accuracy: 0.9220 - loss: 0.4778 - val_accuracy: 0.8773 - val_loss: 0.6470 -
learning_rate: 1.5625e-05
Epoch 141/250
157/157          8s 50ms/step -
accuracy: 0.9240 - loss: 0.4701 - val_accuracy: 0.8784 - val_loss: 0.6473 -
learning_rate: 1.5625e-05
Epoch 142/250
157/157          8s 50ms/step -
accuracy: 0.9238 - loss: 0.4683 - val_accuracy: 0.8786 - val_loss: 0.6475 -
learning_rate: 1.5625e-05
Epoch 143/250
157/157          8s 50ms/step -
accuracy: 0.9254 - loss: 0.4665 - val_accuracy: 0.8792 - val_loss: 0.6452 -

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learning_rate: 1.5625e-05
Epoch 144/250
157/157          8s 50ms/step -
accuracy: 0.9298 - loss: 0.4511 - val_accuracy: 0.8806 - val_loss: 0.6441 -
learning_rate: 1.5625e-05
Epoch 145/250
157/157          8s 50ms/step -
accuracy: 0.9255 - loss: 0.4597 - val_accuracy: 0.8789 - val_loss: 0.6433 -
learning_rate: 1.5625e-05
Epoch 146/250
157/157          8s 50ms/step -
accuracy: 0.9282 - loss: 0.4502 - val_accuracy: 0.8810 - val_loss: 0.6371 -
learning_rate: 1.5625e-05
Epoch 147/250
157/157          8s 50ms/step -
accuracy: 0.9319 - loss: 0.4396 - val_accuracy: 0.8812 - val_loss: 0.6376 -
learning_rate: 1.5625e-05
Epoch 148/250
157/157          8s 50ms/step -
accuracy: 0.9281 - loss: 0.4475 - val_accuracy: 0.8778 - val_loss: 0.6456 -
learning_rate: 1.5625e-05
Epoch 149/250
157/157          8s 50ms/step -
accuracy: 0.9274 - loss: 0.4492 - val_accuracy: 0.8797 - val_loss: 0.6403 -
learning_rate: 1.5625e-05
Epoch 150/250
157/157          8s 50ms/step -
accuracy: 0.9279 - loss: 0.4472 - val_accuracy: 0.8790 - val_loss: 0.6378 -
learning_rate: 1.5625e-05
Epoch 151/250
157/157          8s 50ms/step -
accuracy: 0.9281 - loss: 0.4434 - val_accuracy: 0.8785 - val_loss: 0.6380 -
learning_rate: 1.5625e-05
Epoch 152/250
157/157          8s 50ms/step -
accuracy: 0.9320 - loss: 0.4351 - val_accuracy: 0.8806 - val_loss: 0.6300 -
learning_rate: 7.8125e-06
Epoch 153/250
157/157          8s 50ms/step -
accuracy: 0.9317 - loss: 0.4369 - val_accuracy: 0.8794 - val_loss: 0.6326 -
learning_rate: 7.8125e-06
Epoch 154/250
157/157          8s 50ms/step -
accuracy: 0.9279 - loss: 0.4436 - val_accuracy: 0.8794 - val_loss: 0.6337 -
learning_rate: 7.8125e-06
Epoch 155/250
157/157          8s 50ms/step -
accuracy: 0.9322 - loss: 0.4325 - val_accuracy: 0.8788 - val_loss: 0.6354 -

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learning_rate: 7.8125e-06
Epoch 156/250
157/157      8s 50ms/step -
accuracy: 0.9319 - loss: 0.4313 - val_accuracy: 0.8796 - val_loss: 0.6328 -
learning_rate: 7.8125e-06
Epoch 157/250
157/157      8s 50ms/step -
accuracy: 0.9304 - loss: 0.4341 - val_accuracy: 0.8783 - val_loss: 0.6344 -
learning_rate: 7.8125e-06
Epoch 158/250
157/157      8s 50ms/step -
accuracy: 0.9320 - loss: 0.4272 - val_accuracy: 0.8794 - val_loss: 0.6297 -
learning_rate: 3.9063e-06
Epoch 159/250
157/157      8s 50ms/step -
accuracy: 0.9329 - loss: 0.4289 - val_accuracy: 0.8798 - val_loss: 0.6324 -
learning_rate: 3.9063e-06
Epoch 160/250
157/157      8s 50ms/step -
accuracy: 0.9325 - loss: 0.4310 - val_accuracy: 0.8806 - val_loss: 0.6307 -
learning_rate: 3.9063e-06
Epoch 161/250
157/157      8s 50ms/step -
accuracy: 0.9368 - loss: 0.4172 - val_accuracy: 0.8807 - val_loss: 0.6295 -
learning_rate: 3.9063e-06
Epoch 162/250
157/157      8s 50ms/step -
accuracy: 0.9340 - loss: 0.4201 - val_accuracy: 0.8804 - val_loss: 0.6305 -
learning_rate: 3.9063e-06
Epoch 163/250
157/157      8s 50ms/step -
accuracy: 0.9348 - loss: 0.4180 - val_accuracy: 0.8806 - val_loss: 0.6304 -
learning_rate: 3.9063e-06
Epoch 164/250
157/157      8s 50ms/step -
accuracy: 0.9355 - loss: 0.4210 - val_accuracy: 0.8811 - val_loss: 0.6264 -
learning_rate: 3.9063e-06
Epoch 165/250
157/157      8s 50ms/step -
accuracy: 0.9307 - loss: 0.4277 - val_accuracy: 0.8804 - val_loss: 0.6272 -
learning_rate: 3.9063e-06
Epoch 166/250
157/157      8s 50ms/step -
accuracy: 0.9354 - loss: 0.4171 - val_accuracy: 0.8810 - val_loss: 0.6286 -
learning_rate: 3.9063e-06
Epoch 167/250
157/157      8s 50ms/step -
accuracy: 0.9331 - loss: 0.4283 - val_accuracy: 0.8805 - val_loss: 0.6285 -

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learning_rate: 3.9063e-06
Epoch 168/250
157/157      8s 50ms/step -
accuracy: 0.9332 - loss: 0.4220 - val_accuracy: 0.8809 - val_loss: 0.6280 -
learning_rate: 3.9063e-06
Epoch 169/250
157/157      8s 50ms/step -
accuracy: 0.9340 - loss: 0.4194 - val_accuracy: 0.8811 - val_loss: 0.6262 -
learning_rate: 3.9063e-06
Epoch 170/250
157/157      8s 50ms/step -
accuracy: 0.9324 - loss: 0.4228 - val_accuracy: 0.8811 - val_loss: 0.6247 -
learning_rate: 3.9063e-06
Epoch 171/250
157/157      8s 50ms/step -
accuracy: 0.9362 - loss: 0.4137 - val_accuracy: 0.8811 - val_loss: 0.6247 -
learning_rate: 3.9063e-06
Epoch 172/250
157/157      8s 50ms/step -
accuracy: 0.9342 - loss: 0.4130 - val_accuracy: 0.8794 - val_loss: 0.6275 -
learning_rate: 3.9063e-06
Epoch 173/250
157/157      8s 50ms/step -
accuracy: 0.9325 - loss: 0.4227 - val_accuracy: 0.8806 - val_loss: 0.6256 -
learning_rate: 3.9063e-06
Epoch 174/250
157/157      8s 50ms/step -
accuracy: 0.9344 - loss: 0.4167 - val_accuracy: 0.8802 - val_loss: 0.6254 -
learning_rate: 3.9063e-06
Epoch 175/250
157/157      8s 50ms/step -
accuracy: 0.9352 - loss: 0.4121 - val_accuracy: 0.8797 - val_loss: 0.6251 -
learning_rate: 3.9063e-06
Epoch 176/250
157/157      8s 50ms/step -
accuracy: 0.9350 - loss: 0.4168 - val_accuracy: 0.8807 - val_loss: 0.6251 -
learning_rate: 1.9531e-06
Epoch 177/250
157/157      8s 50ms/step -
accuracy: 0.9338 - loss: 0.4148 - val_accuracy: 0.8804 - val_loss: 0.6243 -
learning_rate: 1.9531e-06
Epoch 178/250
157/157      8s 50ms/step -
accuracy: 0.9339 - loss: 0.4159 - val_accuracy: 0.8805 - val_loss: 0.6239 -
learning_rate: 1.9531e-06
Epoch 179/250
157/157      8s 50ms/step -
accuracy: 0.9364 - loss: 0.4106 - val_accuracy: 0.8807 - val_loss: 0.6252 -

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learning_rate: 1.9531e-06
Epoch 180/250
157/157      8s 50ms/step -
accuracy: 0.9378 - loss: 0.4112 - val_accuracy: 0.8809 - val_loss: 0.6250 -
learning_rate: 1.9531e-06
Epoch 181/250
157/157      8s 50ms/step -
accuracy: 0.9357 - loss: 0.4102 - val_accuracy: 0.8805 - val_loss: 0.6241 -
learning_rate: 1.9531e-06
Epoch 182/250
157/157      8s 50ms/step -
accuracy: 0.9373 - loss: 0.4055 - val_accuracy: 0.8809 - val_loss: 0.6240 -
learning_rate: 1.9531e-06
Epoch 183/250
157/157      8s 50ms/step -
accuracy: 0.9385 - loss: 0.4070 - val_accuracy: 0.8806 - val_loss: 0.6254 -
learning_rate: 1.9531e-06
Epoch 184/250
157/157      8s 50ms/step -
accuracy: 0.9370 - loss: 0.4082 - val_accuracy: 0.8809 - val_loss: 0.6236 -
learning_rate: 1.0000e-06
Epoch 185/250
157/157      8s 50ms/step -
accuracy: 0.9342 - loss: 0.4152 - val_accuracy: 0.8809 - val_loss: 0.6230 -
learning_rate: 1.0000e-06
Epoch 186/250
157/157      8s 50ms/step -
accuracy: 0.9361 - loss: 0.4093 - val_accuracy: 0.8804 - val_loss: 0.6238 -
learning_rate: 1.0000e-06
Epoch 187/250
157/157      8s 50ms/step -
accuracy: 0.9373 - loss: 0.4088 - val_accuracy: 0.8802 - val_loss: 0.6237 -
learning_rate: 1.0000e-06
Epoch 188/250
157/157      8s 50ms/step -
accuracy: 0.9352 - loss: 0.4094 - val_accuracy: 0.8803 - val_loss: 0.6227 -
learning_rate: 1.0000e-06
Epoch 189/250
157/157      8s 50ms/step -
accuracy: 0.9346 - loss: 0.4115 - val_accuracy: 0.8810 - val_loss: 0.6227 -
learning_rate: 1.0000e-06
Epoch 190/250
157/157      8s 50ms/step -
accuracy: 0.9346 - loss: 0.4091 - val_accuracy: 0.8810 - val_loss: 0.6231 -
learning_rate: 1.0000e-06
Epoch 191/250
157/157      8s 50ms/step -
accuracy: 0.9341 - loss: 0.4125 - val_accuracy: 0.8814 - val_loss: 0.6225 -

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learning_rate: 1.0000e-06
Epoch 192/250
157/157      8s 50ms/step -
accuracy: 0.9350 - loss: 0.4134 - val_accuracy: 0.8812 - val_loss: 0.6229 -
learning_rate: 1.0000e-06
Epoch 193/250
157/157      8s 50ms/step -
accuracy: 0.9372 - loss: 0.4068 - val_accuracy: 0.8811 - val_loss: 0.6227 -
learning_rate: 1.0000e-06
Epoch 194/250
157/157      8s 50ms/step -
accuracy: 0.9357 - loss: 0.4078 - val_accuracy: 0.8815 - val_loss: 0.6226 -
learning_rate: 1.0000e-06
Epoch 195/250
157/157      8s 50ms/step -
accuracy: 0.9378 - loss: 0.4043 - val_accuracy: 0.8810 - val_loss: 0.6222 -
learning_rate: 1.0000e-06
Epoch 196/250
157/157      8s 50ms/step -
accuracy: 0.9387 - loss: 0.4025 - val_accuracy: 0.8812 - val_loss: 0.6218 -
learning_rate: 1.0000e-06
Epoch 197/250
157/157      8s 50ms/step -
accuracy: 0.9399 - loss: 0.4005 - val_accuracy: 0.8810 - val_loss: 0.6214 -
learning_rate: 1.0000e-06
Epoch 198/250
157/157      8s 50ms/step -
accuracy: 0.9366 - loss: 0.4069 - val_accuracy: 0.8812 - val_loss: 0.6223 -
learning_rate: 1.0000e-06
Epoch 199/250
157/157      8s 50ms/step -
accuracy: 0.9362 - loss: 0.4084 - val_accuracy: 0.8811 - val_loss: 0.6221 -
learning_rate: 1.0000e-06
Epoch 200/250
157/157      8s 50ms/step -
accuracy: 0.9375 - loss: 0.4027 - val_accuracy: 0.8809 - val_loss: 0.6225 -
learning_rate: 1.0000e-06
Epoch 201/250
157/157      8s 50ms/step -
accuracy: 0.9351 - loss: 0.4096 - val_accuracy: 0.8812 - val_loss: 0.6221 -
learning_rate: 1.0000e-06
Epoch 202/250
157/157      8s 50ms/step -
accuracy: 0.9343 - loss: 0.4127 - val_accuracy: 0.8806 - val_loss: 0.6222 -
learning_rate: 1.0000e-06
Epoch 203/250
157/157      8s 50ms/step -
accuracy: 0.9392 - loss: 0.4010 - val_accuracy: 0.8814 - val_loss: 0.6214 -

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learning_rate: 1.0000e-06
Epoch 204/250
157/157          8s 50ms/step -
accuracy: 0.9362 - loss: 0.4039 - val_accuracy: 0.8816 - val_loss: 0.6211 -
learning_rate: 1.0000e-06
Epoch 205/250
157/157          8s 50ms/step -
accuracy: 0.9342 - loss: 0.4071 - val_accuracy: 0.8813 - val_loss: 0.6210 -
learning_rate: 1.0000e-06
Epoch 206/250
157/157          8s 50ms/step -
accuracy: 0.9362 - loss: 0.4096 - val_accuracy: 0.8814 - val_loss: 0.6214 -
learning_rate: 1.0000e-06
Epoch 207/250
157/157          8s 50ms/step -
accuracy: 0.9364 - loss: 0.4071 - val_accuracy: 0.8810 - val_loss: 0.6211 -
learning_rate: 1.0000e-06
Epoch 208/250
157/157          8s 50ms/step -
accuracy: 0.9354 - loss: 0.4104 - val_accuracy: 0.8812 - val_loss: 0.6213 -
learning_rate: 1.0000e-06
Epoch 209/250
157/157          8s 50ms/step -
accuracy: 0.9379 - loss: 0.4042 - val_accuracy: 0.8815 - val_loss: 0.6213 -
learning_rate: 1.0000e-06
Epoch 210/250
157/157          8s 50ms/step -
accuracy: 0.9397 - loss: 0.3955 - val_accuracy: 0.8810 - val_loss: 0.6218 -
learning_rate: 1.0000e-06
Epoch 211/250
157/157          8s 50ms/step -
accuracy: 0.9384 - loss: 0.4027 - val_accuracy: 0.8811 - val_loss: 0.6210 -
learning_rate: 1.0000e-06
Epoch 212/250
157/157          8s 50ms/step -
accuracy: 0.9338 - loss: 0.4104 - val_accuracy: 0.8806 - val_loss: 0.6212 -
learning_rate: 1.0000e-06
Epoch 213/250
157/157          8s 50ms/step -
accuracy: 0.9401 - loss: 0.4008 - val_accuracy: 0.8816 - val_loss: 0.6203 -
learning_rate: 1.0000e-06
Epoch 214/250
157/157          8s 50ms/step -
accuracy: 0.9356 - loss: 0.4043 - val_accuracy: 0.8809 - val_loss: 0.6217 -
learning_rate: 1.0000e-06
Epoch 215/250
157/157          8s 50ms/step -
accuracy: 0.9383 - loss: 0.4063 - val_accuracy: 0.8808 - val_loss: 0.6211 -

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learning_rate: 1.0000e-06
Epoch 216/250
157/157      8s 50ms/step -
accuracy: 0.9359 - loss: 0.4075 - val_accuracy: 0.8813 - val_loss: 0.6208 -
learning_rate: 1.0000e-06
Epoch 217/250
157/157      8s 50ms/step -
accuracy: 0.9372 - loss: 0.4031 - val_accuracy: 0.8813 - val_loss: 0.6210 -
learning_rate: 1.0000e-06
Epoch 218/250
157/157      8s 50ms/step -
accuracy: 0.9377 - loss: 0.4033 - val_accuracy: 0.8811 - val_loss: 0.6210 -
learning_rate: 1.0000e-06
Epoch 219/250
157/157      8s 50ms/step -
accuracy: 0.9387 - loss: 0.4052 - val_accuracy: 0.8812 - val_loss: 0.6192 -
learning_rate: 1.0000e-06
Epoch 220/250
157/157      8s 50ms/step -
accuracy: 0.9379 - loss: 0.4025 - val_accuracy: 0.8818 - val_loss: 0.6192 -
learning_rate: 1.0000e-06
Epoch 221/250
157/157      8s 50ms/step -
accuracy: 0.9399 - loss: 0.3999 - val_accuracy: 0.8813 - val_loss: 0.6201 -
learning_rate: 1.0000e-06
Epoch 222/250
157/157      8s 50ms/step -
accuracy: 0.9359 - loss: 0.4081 - val_accuracy: 0.8813 - val_loss: 0.6198 -
learning_rate: 1.0000e-06
Epoch 223/250
157/157      8s 50ms/step -
accuracy: 0.9420 - loss: 0.3955 - val_accuracy: 0.8812 - val_loss: 0.6216 -
learning_rate: 1.0000e-06
Epoch 224/250
157/157      8s 50ms/step -
accuracy: 0.9378 - loss: 0.4020 - val_accuracy: 0.8809 - val_loss: 0.6201 -
learning_rate: 1.0000e-06
Epoch 225/250
157/157      8s 50ms/step -
accuracy: 0.9368 - loss: 0.4101 - val_accuracy: 0.8812 - val_loss: 0.6204 -
learning_rate: 1.0000e-06
Epoch 226/250
157/157      8s 50ms/step -
accuracy: 0.9351 - loss: 0.4077 - val_accuracy: 0.8811 - val_loss: 0.6193 -
learning_rate: 1.0000e-06
Epoch 227/250
157/157      8s 51ms/step -
accuracy: 0.9378 - loss: 0.3977 - val_accuracy: 0.8809 - val_loss: 0.6195 -

```

```

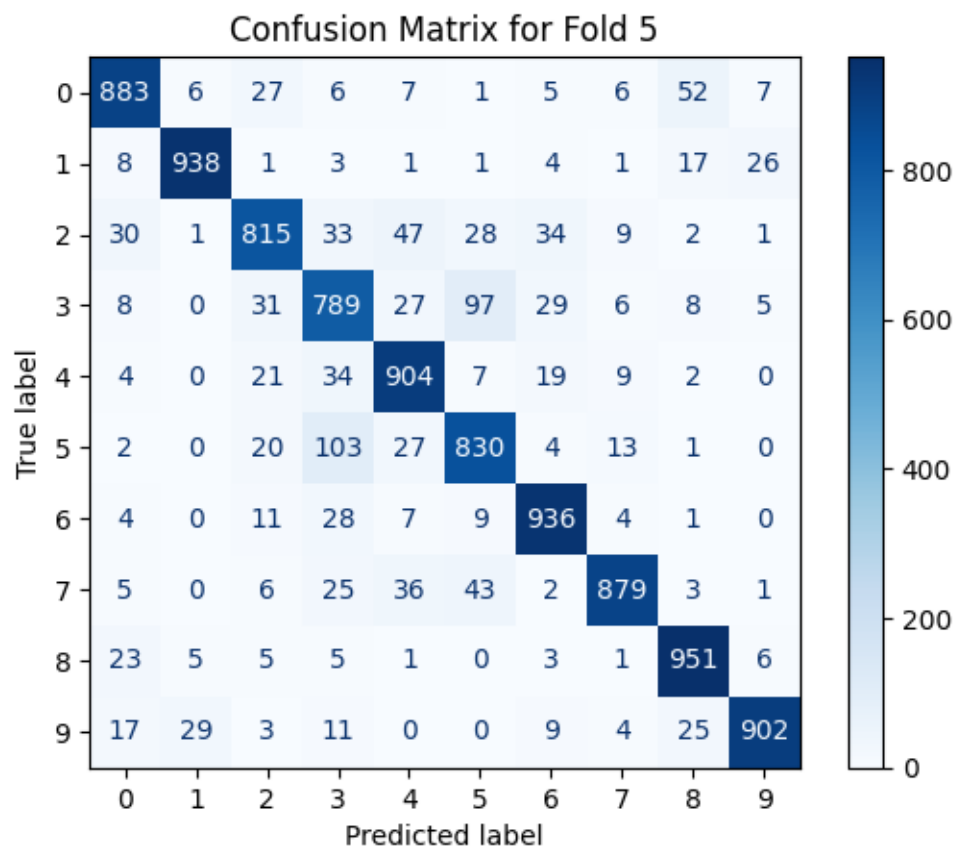
learning_rate: 1.0000e-06
Epoch 228/250
157/157      8s 50ms/step -
accuracy: 0.9384 - loss: 0.3981 - val_accuracy: 0.8811 - val_loss: 0.6194 -
learning_rate: 1.0000e-06
Epoch 229/250
157/157      8s 50ms/step -
accuracy: 0.9369 - loss: 0.4027 - val_accuracy: 0.8816 - val_loss: 0.6197 -
learning_rate: 1.0000e-06
Epoch 230/250
157/157      8s 50ms/step -
accuracy: 0.9363 - loss: 0.4028 - val_accuracy: 0.8812 - val_loss: 0.6198 -
learning_rate: 1.0000e-06
Epoch 231/250
157/157      8s 50ms/step -
accuracy: 0.9406 - loss: 0.3982 - val_accuracy: 0.8818 - val_loss: 0.6194 -
learning_rate: 1.0000e-06
Epoch 232/250
157/157      8s 50ms/step -
accuracy: 0.9361 - loss: 0.4052 - val_accuracy: 0.8825 - val_loss: 0.6201 -
learning_rate: 1.0000e-06
Epoch 233/250
157/157      8s 50ms/step -
accuracy: 0.9365 - loss: 0.4056 - val_accuracy: 0.8823 - val_loss: 0.6207 -
learning_rate: 1.0000e-06
Epoch 234/250
157/157      8s 50ms/step -
accuracy: 0.9382 - loss: 0.3999 - val_accuracy: 0.8820 - val_loss: 0.6190 -
learning_rate: 1.0000e-06
Epoch 235/250
157/157      8s 50ms/step -
accuracy: 0.9378 - loss: 0.4058 - val_accuracy: 0.8814 - val_loss: 0.6196 -
learning_rate: 1.0000e-06
Epoch 236/250
157/157      8s 50ms/step -
accuracy: 0.9385 - loss: 0.4020 - val_accuracy: 0.8821 - val_loss: 0.6197 -
learning_rate: 1.0000e-06
Epoch 237/250
157/157      8s 50ms/step -
accuracy: 0.9377 - loss: 0.4036 - val_accuracy: 0.8814 - val_loss: 0.6193 -
learning_rate: 1.0000e-06
Epoch 238/250
157/157      8s 50ms/step -
accuracy: 0.9389 - loss: 0.3986 - val_accuracy: 0.8815 - val_loss: 0.6202 -
learning_rate: 1.0000e-06
Epoch 239/250
157/157      8s 50ms/step -
accuracy: 0.9382 - loss: 0.4005 - val_accuracy: 0.8815 - val_loss: 0.6195 -

```

```

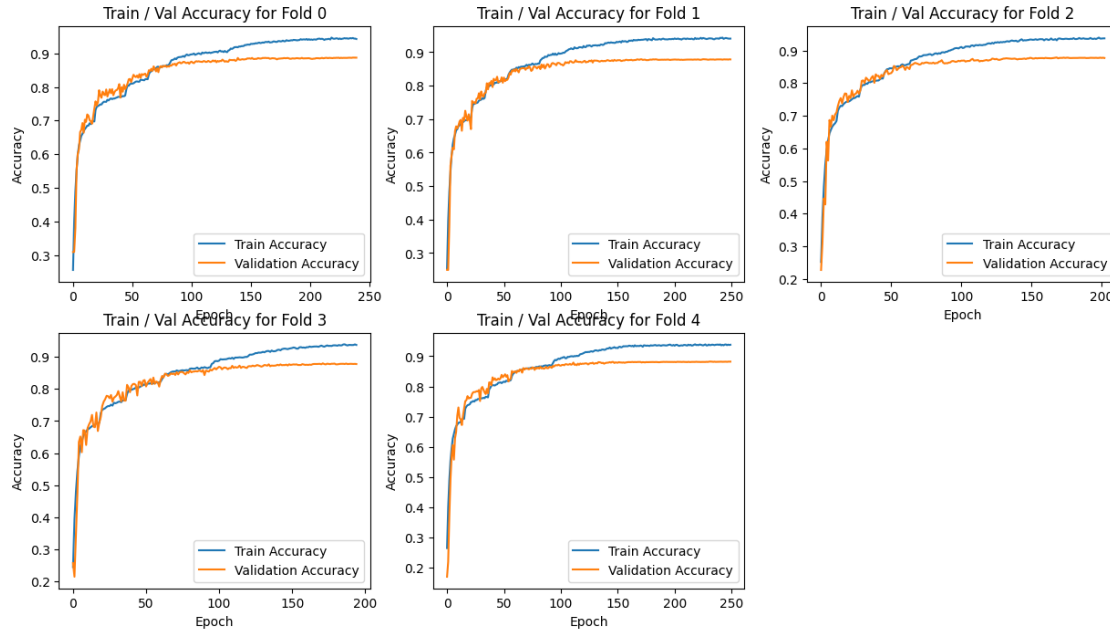
learning_rate: 1.0000e-06
Epoch 240/250
157/157          8s 50ms/step -
accuracy: 0.9348 - loss: 0.4087 - val_accuracy: 0.8818 - val_loss: 0.6193 -
learning_rate: 1.0000e-06
Epoch 241/250
157/157          8s 51ms/step -
accuracy: 0.9397 - loss: 0.3982 - val_accuracy: 0.8820 - val_loss: 0.6187 -
learning_rate: 1.0000e-06
Epoch 242/250
157/157          8s 50ms/step -
accuracy: 0.9371 - loss: 0.3999 - val_accuracy: 0.8820 - val_loss: 0.6192 -
learning_rate: 1.0000e-06
Epoch 243/250
157/157          8s 50ms/step -
accuracy: 0.9380 - loss: 0.4006 - val_accuracy: 0.8816 - val_loss: 0.6201 -
learning_rate: 1.0000e-06
Epoch 244/250
157/157          8s 50ms/step -
accuracy: 0.9351 - loss: 0.4034 - val_accuracy: 0.8818 - val_loss: 0.6189 -
learning_rate: 1.0000e-06
Epoch 245/250
157/157         10s 50ms/step -
accuracy: 0.9376 - loss: 0.4016 - val_accuracy: 0.8817 - val_loss: 0.6187 -
learning_rate: 1.0000e-06
Epoch 246/250
157/157          8s 50ms/step -
accuracy: 0.9381 - loss: 0.4045 - val_accuracy: 0.8820 - val_loss: 0.6184 -
learning_rate: 1.0000e-06
Epoch 247/250
157/157          8s 50ms/step -
accuracy: 0.9357 - loss: 0.4053 - val_accuracy: 0.8815 - val_loss: 0.6187 -
learning_rate: 1.0000e-06
Epoch 248/250
157/157          8s 50ms/step -
accuracy: 0.9392 - loss: 0.3965 - val_accuracy: 0.8821 - val_loss: 0.6181 -
learning_rate: 1.0000e-06
Epoch 249/250
157/157          8s 50ms/step -
accuracy: 0.9371 - loss: 0.4009 - val_accuracy: 0.8822 - val_loss: 0.6177 -
learning_rate: 1.0000e-06
Epoch 250/250
157/157          8s 50ms/step -
accuracy: 0.9391 - loss: 0.4006 - val_accuracy: 0.8822 - val_loss: 0.6179 -
learning_rate: 1.0000e-06
Score for fold 5: test loss of 0.6177775263786316; test accuracy of
88.27000260353088%
313/313          1s 3ms/step

```



Classification Report for Fold 5:

	precision	recall	f1-score	support
Class 0	0.90	0.88	0.89	1000
Class 1	0.96	0.94	0.95	1000
Class 2	0.87	0.81	0.84	1000
Class 3	0.76	0.79	0.77	1000
Class 4	0.86	0.90	0.88	1000
Class 5	0.82	0.83	0.82	1000
Class 6	0.90	0.94	0.92	1000
Class 7	0.94	0.88	0.91	1000
Class 8	0.90	0.95	0.92	1000
Class 9	0.95	0.90	0.93	1000
accuracy			0.88	10000
macro avg	0.88	0.88	0.88	10000
weighted avg	0.88	0.88	0.88	10000



Average test loss = 0.6231774806976318; Average test accuracy = 87.7240002155304%

[19]: CNN(batch_size=256, no_epochs=250, l1_val=0.01, drop_out=0.5, init_lr=0.001)

Epoch 1/250

157/157 35s 130ms/step -

accuracy: 0.1993 - loss: 12.6551 - val_accuracy: 0.1846 - val_loss: 7.0259 -

learning_rate: 0.0010

Epoch 2/250

157/157 8s 51ms/step -

accuracy: 0.3898 - loss: 5.5128 - val_accuracy: 0.1803 - val_loss: 4.1671 -

learning_rate: 0.0010

Epoch 3/250

157/157 8s 52ms/step -

accuracy: 0.4930 - loss: 3.0798 - val_accuracy: 0.4522 - val_loss: 2.7300 -

learning_rate: 0.0010

Epoch 4/250

157/157 8s 52ms/step -

accuracy: 0.5523 - loss: 2.4687 - val_accuracy: 0.5257 - val_loss: 2.4628 -

learning_rate: 0.0010

Epoch 5/250

157/157 8s 53ms/step -

accuracy: 0.5878 - loss: 2.3367 - val_accuracy: 0.5801 - val_loss: 2.2935 -

learning_rate: 0.0010

Epoch 6/250

157/157 8s 52ms/step -

```

accuracy: 0.6098 - loss: 2.3012 - val_accuracy: 0.5378 - val_loss: 2.4786 -
learning_rate: 0.0010
Epoch 7/250
157/157          8s 52ms/step -
accuracy: 0.6258 - loss: 2.2852 - val_accuracy: 0.5847 - val_loss: 2.4840 -
learning_rate: 0.0010
Epoch 8/250
157/157          8s 51ms/step -
accuracy: 0.6378 - loss: 2.2952 - val_accuracy: 0.6643 - val_loss: 2.2094 -
learning_rate: 0.0010
Epoch 9/250
157/157          8s 51ms/step -
accuracy: 0.6343 - loss: 2.3199 - val_accuracy: 0.6534 - val_loss: 2.1872 -
learning_rate: 0.0010
Epoch 10/250
157/157          8s 50ms/step -
accuracy: 0.6488 - loss: 2.2325 - val_accuracy: 0.6892 - val_loss: 2.1435 -
learning_rate: 0.0010
Epoch 11/250
157/157          8s 50ms/step -
accuracy: 0.6533 - loss: 2.2693 - val_accuracy: 0.6726 - val_loss: 2.1887 -
learning_rate: 0.0010
Epoch 12/250
157/157          8s 51ms/step -
accuracy: 0.6616 - loss: 2.2726 - val_accuracy: 0.6769 - val_loss: 2.1764 -
learning_rate: 0.0010
Epoch 13/250
157/157          8s 52ms/step -
accuracy: 0.6624 - loss: 2.2593 - val_accuracy: 0.6426 - val_loss: 2.3136 -
learning_rate: 0.0010
Epoch 14/250
157/157          8s 51ms/step -
accuracy: 0.6637 - loss: 2.2651 - val_accuracy: 0.6976 - val_loss: 2.1202 -
learning_rate: 0.0010
Epoch 15/250
157/157          8s 51ms/step -
accuracy: 0.6658 - loss: 2.2340 - val_accuracy: 0.6843 - val_loss: 2.2000 -
learning_rate: 0.0010
Epoch 16/250
157/157          8s 51ms/step -
accuracy: 0.6704 - loss: 2.2619 - val_accuracy: 0.7076 - val_loss: 2.1411 -
learning_rate: 0.0010
Epoch 17/250
157/157          8s 51ms/step -
accuracy: 0.6658 - loss: 2.2368 - val_accuracy: 0.6756 - val_loss: 2.1551 -
learning_rate: 0.0010
Epoch 18/250
157/157          8s 50ms/step -

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accuracy: 0.6717 - loss: 2.2277 - val_accuracy: 0.7078 - val_loss: 2.1302 -
learning_rate: 0.0010
Epoch 19/250
157/157          8s 51ms/step -
accuracy: 0.6730 - loss: 2.2489 - val_accuracy: 0.6897 - val_loss: 2.1180 -
learning_rate: 0.0010
Epoch 20/250
157/157          8s 51ms/step -
accuracy: 0.6785 - loss: 2.1929 - val_accuracy: 0.6785 - val_loss: 2.1562 -
learning_rate: 0.0010
Epoch 21/250
157/157          8s 51ms/step -
accuracy: 0.6740 - loss: 2.1882 - val_accuracy: 0.6578 - val_loss: 2.2137 -
learning_rate: 0.0010
Epoch 22/250
157/157          8s 50ms/step -
accuracy: 0.6784 - loss: 2.1896 - val_accuracy: 0.6879 - val_loss: 2.1164 -
learning_rate: 0.0010
Epoch 23/250
157/157          8s 50ms/step -
accuracy: 0.6746 - loss: 2.1872 - val_accuracy: 0.7183 - val_loss: 2.0520 -
learning_rate: 0.0010
Epoch 24/250
157/157          8s 50ms/step -
accuracy: 0.6821 - loss: 2.1752 - val_accuracy: 0.7145 - val_loss: 2.0595 -
learning_rate: 0.0010
Epoch 25/250
157/157          8s 51ms/step -
accuracy: 0.6827 - loss: 2.1721 - val_accuracy: 0.6815 - val_loss: 2.1081 -
learning_rate: 0.0010
Epoch 26/250
157/157          10s 51ms/step -
accuracy: 0.6802 - loss: 2.1933 - val_accuracy: 0.6245 - val_loss: 2.2992 -
learning_rate: 0.0010
Epoch 27/250
157/157          8s 50ms/step -
accuracy: 0.6850 - loss: 2.1803 - val_accuracy: 0.7023 - val_loss: 2.0677 -
learning_rate: 0.0010
Epoch 28/250
157/157          8s 50ms/step -
accuracy: 0.6801 - loss: 2.1588 - val_accuracy: 0.7027 - val_loss: 2.0689 -
learning_rate: 0.0010
Epoch 29/250
157/157          8s 51ms/step -
accuracy: 0.7067 - loss: 1.9664 - val_accuracy: 0.7483 - val_loss: 1.6494 -
learning_rate: 5.0000e-04
Epoch 30/250
157/157          8s 52ms/step -

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accuracy: 0.7235 - loss: 1.6999 - val_accuracy: 0.7386 - val_loss: 1.6318 -
 learning_rate: 5.0000e-04
 Epoch 31/250
 157/157 8s 51ms/step -
 accuracy: 0.7293 - loss: 1.6893 - val_accuracy: 0.7476 - val_loss: 1.6036 -
 learning_rate: 5.0000e-04
 Epoch 32/250
 157/157 8s 51ms/step -
 accuracy: 0.7277 - loss: 1.6818 - val_accuracy: 0.7449 - val_loss: 1.6170 -
 learning_rate: 5.0000e-04
 Epoch 33/250
 157/157 8s 50ms/step -
 accuracy: 0.7311 - loss: 1.6787 - val_accuracy: 0.7279 - val_loss: 1.6792 -
 learning_rate: 5.0000e-04
 Epoch 34/250
 157/157 8s 51ms/step -
 accuracy: 0.7306 - loss: 1.6857 - val_accuracy: 0.7671 - val_loss: 1.5536 -
 learning_rate: 5.0000e-04
 Epoch 35/250
 157/157 8s 50ms/step -
 accuracy: 0.7392 - loss: 1.6599 - val_accuracy: 0.7457 - val_loss: 1.6268 -
 learning_rate: 5.0000e-04
 Epoch 36/250
 157/157 8s 51ms/step -
 accuracy: 0.7367 - loss: 1.6772 - val_accuracy: 0.7506 - val_loss: 1.6101 -
 learning_rate: 5.0000e-04
 Epoch 37/250
 157/157 8s 50ms/step -
 accuracy: 0.7390 - loss: 1.6752 - val_accuracy: 0.7497 - val_loss: 1.5867 -
 learning_rate: 5.0000e-04
 Epoch 38/250
 157/157 8s 51ms/step -
 accuracy: 0.7407 - loss: 1.6644 - val_accuracy: 0.7437 - val_loss: 1.6335 -
 learning_rate: 5.0000e-04
 Epoch 39/250
 157/157 8s 51ms/step -
 accuracy: 0.7461 - loss: 1.6439 - val_accuracy: 0.7649 - val_loss: 1.5366 -
 learning_rate: 5.0000e-04
 Epoch 40/250
 157/157 8s 50ms/step -
 accuracy: 0.7422 - loss: 1.6307 - val_accuracy: 0.7295 - val_loss: 1.6455 -
 learning_rate: 5.0000e-04
 Epoch 41/250
 157/157 8s 51ms/step -
 accuracy: 0.7431 - loss: 1.6349 - val_accuracy: 0.7232 - val_loss: 1.6764 -
 learning_rate: 5.0000e-04
 Epoch 42/250
 157/157 8s 51ms/step -

accuracy: 0.7456 - loss: 1.6321 - val_accuracy: 0.7496 - val_loss: 1.5830 -
learning_rate: 5.0000e-04
Epoch 43/250
157/157 8s 51ms/step -
accuracy: 0.7485 - loss: 1.6066 - val_accuracy: 0.7423 - val_loss: 1.6094 -
learning_rate: 5.0000e-04
Epoch 44/250
157/157 8s 51ms/step -
accuracy: 0.7479 - loss: 1.6238 - val_accuracy: 0.7672 - val_loss: 1.5388 -
learning_rate: 5.0000e-04
Epoch 45/250
157/157 8s 51ms/step -
accuracy: 0.7646 - loss: 1.5172 - val_accuracy: 0.7707 - val_loss: 1.3811 -
learning_rate: 2.5000e-04
Epoch 46/250
157/157 8s 51ms/step -
accuracy: 0.7786 - loss: 1.3504 - val_accuracy: 0.7955 - val_loss: 1.2458 -
learning_rate: 2.5000e-04
Epoch 47/250
157/157 8s 51ms/step -
accuracy: 0.7830 - loss: 1.2971 - val_accuracy: 0.7816 - val_loss: 1.2800 -
learning_rate: 2.5000e-04
Epoch 48/250
157/157 8s 51ms/step -
accuracy: 0.7781 - loss: 1.3004 - val_accuracy: 0.7928 - val_loss: 1.2425 -
learning_rate: 2.5000e-04
Epoch 49/250
157/157 8s 50ms/step -
accuracy: 0.7829 - loss: 1.2785 - val_accuracy: 0.8042 - val_loss: 1.1972 -
learning_rate: 2.5000e-04
Epoch 50/250
157/157 8s 50ms/step -
accuracy: 0.7847 - loss: 1.2642 - val_accuracy: 0.7999 - val_loss: 1.2166 -
learning_rate: 2.5000e-04
Epoch 51/250
157/157 8s 51ms/step -
accuracy: 0.7856 - loss: 1.2613 - val_accuracy: 0.8111 - val_loss: 1.1779 -
learning_rate: 2.5000e-04
Epoch 52/250
157/157 8s 51ms/step -
accuracy: 0.7948 - loss: 1.2362 - val_accuracy: 0.7868 - val_loss: 1.2377 -
learning_rate: 2.5000e-04
Epoch 53/250
157/157 8s 50ms/step -
accuracy: 0.7902 - loss: 1.2508 - val_accuracy: 0.8170 - val_loss: 1.1592 -
learning_rate: 2.5000e-04
Epoch 54/250
157/157 8s 50ms/step -

accuracy: 0.7927 - loss: 1.2357 - val_accuracy: 0.8028 - val_loss: 1.2122 -
 learning_rate: 2.5000e-04
 Epoch 55/250
 157/157 8s 51ms/step -
 accuracy: 0.7904 - loss: 1.2409 - val_accuracy: 0.8195 - val_loss: 1.1554 -
 learning_rate: 2.5000e-04
 Epoch 56/250
 157/157 8s 50ms/step -
 accuracy: 0.7933 - loss: 1.2275 - val_accuracy: 0.8141 - val_loss: 1.1498 -
 learning_rate: 2.5000e-04
 Epoch 57/250
 157/157 8s 51ms/step -
 accuracy: 0.7916 - loss: 1.2304 - val_accuracy: 0.7932 - val_loss: 1.2356 -
 learning_rate: 2.5000e-04
 Epoch 58/250
 157/157 8s 51ms/step -
 accuracy: 0.8000 - loss: 1.2101 - val_accuracy: 0.8157 - val_loss: 1.1734 -
 learning_rate: 2.5000e-04
 Epoch 59/250
 157/157 8s 50ms/step -
 accuracy: 0.7992 - loss: 1.2165 - val_accuracy: 0.7944 - val_loss: 1.2229 -
 learning_rate: 2.5000e-04
 Epoch 60/250
 157/157 8s 51ms/step -
 accuracy: 0.7973 - loss: 1.2258 - val_accuracy: 0.8124 - val_loss: 1.1792 -
 learning_rate: 2.5000e-04
 Epoch 61/250
 157/157 8s 50ms/step -
 accuracy: 0.7971 - loss: 1.2229 - val_accuracy: 0.8092 - val_loss: 1.1711 -
 learning_rate: 2.5000e-04
 Epoch 62/250
 157/157 8s 51ms/step -
 accuracy: 0.8088 - loss: 1.1766 - val_accuracy: 0.8296 - val_loss: 1.0717 -
 learning_rate: 1.2500e-04
 Epoch 63/250
 157/157 8s 51ms/step -
 accuracy: 0.8242 - loss: 1.0865 - val_accuracy: 0.8339 - val_loss: 1.0234 -
 learning_rate: 1.2500e-04
 Epoch 64/250
 157/157 8s 51ms/step -
 accuracy: 0.8286 - loss: 1.0430 - val_accuracy: 0.8283 - val_loss: 1.0170 -
 learning_rate: 1.2500e-04
 Epoch 65/250
 157/157 8s 51ms/step -
 accuracy: 0.8285 - loss: 1.0062 - val_accuracy: 0.8286 - val_loss: 1.0023 -
 learning_rate: 1.2500e-04
 Epoch 66/250
 157/157 8s 50ms/step -

accuracy: 0.8281 - loss: 0.9907 - val_accuracy: 0.8318 - val_loss: 0.9754 -
 learning_rate: 1.2500e-04
 Epoch 67/250
 157/157 8s 50ms/step -
 accuracy: 0.8292 - loss: 0.9785 - val_accuracy: 0.8340 - val_loss: 0.9634 -
 learning_rate: 1.2500e-04
 Epoch 68/250
 157/157 10s 50ms/step -
 accuracy: 0.8303 - loss: 0.9688 - val_accuracy: 0.8387 - val_loss: 0.9434 -
 learning_rate: 1.2500e-04
 Epoch 69/250
 157/157 8s 51ms/step -
 accuracy: 0.8363 - loss: 0.9475 - val_accuracy: 0.8332 - val_loss: 0.9412 -
 learning_rate: 1.2500e-04
 Epoch 70/250
 157/157 8s 51ms/step -
 accuracy: 0.8339 - loss: 0.9470 - val_accuracy: 0.8434 - val_loss: 0.9199 -
 learning_rate: 1.2500e-04
 Epoch 71/250
 157/157 8s 51ms/step -
 accuracy: 0.8397 - loss: 0.9286 - val_accuracy: 0.8433 - val_loss: 0.9170 -
 learning_rate: 1.2500e-04
 Epoch 72/250
 157/157 8s 51ms/step -
 accuracy: 0.8402 - loss: 0.9234 - val_accuracy: 0.8403 - val_loss: 0.9179 -
 learning_rate: 1.2500e-04
 Epoch 73/250
 157/157 8s 50ms/step -
 accuracy: 0.8403 - loss: 0.9243 - val_accuracy: 0.8395 - val_loss: 0.9224 -
 learning_rate: 1.2500e-04
 Epoch 74/250
 157/157 8s 51ms/step -
 accuracy: 0.8418 - loss: 0.9169 - val_accuracy: 0.8369 - val_loss: 0.9273 -
 learning_rate: 1.2500e-04
 Epoch 75/250
 157/157 8s 50ms/step -
 accuracy: 0.8412 - loss: 0.9126 - val_accuracy: 0.8479 - val_loss: 0.8866 -
 learning_rate: 1.2500e-04
 Epoch 76/250
 157/157 8s 50ms/step -
 accuracy: 0.8430 - loss: 0.9051 - val_accuracy: 0.8386 - val_loss: 0.9045 -
 learning_rate: 1.2500e-04
 Epoch 77/250
 157/157 8s 50ms/step -
 accuracy: 0.8415 - loss: 0.9033 - val_accuracy: 0.8380 - val_loss: 0.9131 -
 learning_rate: 1.2500e-04
 Epoch 78/250
 157/157 8s 50ms/step -

accuracy: 0.8439 - loss: 0.9016 - val_accuracy: 0.8463 - val_loss: 0.8902 -
 learning_rate: 1.2500e-04
 Epoch 79/250
 157/157 8s 50ms/step -
 accuracy: 0.8442 - loss: 0.8964 - val_accuracy: 0.8467 - val_loss: 0.8967 -
 learning_rate: 1.2500e-04
 Epoch 80/250
 157/157 8s 50ms/step -
 accuracy: 0.8455 - loss: 0.8981 - val_accuracy: 0.8394 - val_loss: 0.9243 -
 learning_rate: 1.2500e-04
 Epoch 81/250
 157/157 8s 50ms/step -
 accuracy: 0.8515 - loss: 0.8724 - val_accuracy: 0.8568 - val_loss: 0.8513 -
 learning_rate: 6.2500e-05
 Epoch 82/250
 157/157 8s 50ms/step -
 accuracy: 0.8581 - loss: 0.8379 - val_accuracy: 0.8537 - val_loss: 0.8534 -
 learning_rate: 6.2500e-05
 Epoch 83/250
 157/157 8s 51ms/step -
 accuracy: 0.8622 - loss: 0.8174 - val_accuracy: 0.8577 - val_loss: 0.8224 -
 learning_rate: 6.2500e-05
 Epoch 84/250
 157/157 8s 50ms/step -
 accuracy: 0.8653 - loss: 0.7926 - val_accuracy: 0.8587 - val_loss: 0.8162 -
 learning_rate: 6.2500e-05
 Epoch 85/250
 157/157 8s 50ms/step -
 accuracy: 0.8643 - loss: 0.7846 - val_accuracy: 0.8591 - val_loss: 0.8019 -
 learning_rate: 6.2500e-05
 Epoch 86/250
 157/157 8s 50ms/step -
 accuracy: 0.8709 - loss: 0.7668 - val_accuracy: 0.8600 - val_loss: 0.7914 -
 learning_rate: 6.2500e-05
 Epoch 87/250
 157/157 8s 50ms/step -
 accuracy: 0.8717 - loss: 0.7523 - val_accuracy: 0.8579 - val_loss: 0.7980 -
 learning_rate: 6.2500e-05
 Epoch 88/250
 157/157 8s 50ms/step -
 accuracy: 0.8689 - loss: 0.7506 - val_accuracy: 0.8625 - val_loss: 0.7760 -
 learning_rate: 6.2500e-05
 Epoch 89/250
 157/157 8s 51ms/step -
 accuracy: 0.8741 - loss: 0.7299 - val_accuracy: 0.8616 - val_loss: 0.7685 -
 learning_rate: 6.2500e-05
 Epoch 90/250
 157/157 8s 50ms/step -

accuracy: 0.8710 - loss: 0.7276 - val_accuracy: 0.8591 - val_loss: 0.7746 -
 learning_rate: 6.2500e-05
 Epoch 91/250
 157/157 8s 50ms/step -
 accuracy: 0.8716 - loss: 0.7252 - val_accuracy: 0.8566 - val_loss: 0.7746 -
 learning_rate: 6.2500e-05
 Epoch 92/250
 157/157 8s 50ms/step -
 accuracy: 0.8743 - loss: 0.7238 - val_accuracy: 0.8638 - val_loss: 0.7501 -
 learning_rate: 6.2500e-05
 Epoch 93/250
 157/157 8s 51ms/step -
 accuracy: 0.8805 - loss: 0.6986 - val_accuracy: 0.8613 - val_loss: 0.7538 -
 learning_rate: 6.2500e-05
 Epoch 94/250
 157/157 8s 50ms/step -
 accuracy: 0.8788 - loss: 0.6915 - val_accuracy: 0.8645 - val_loss: 0.7405 -
 learning_rate: 6.2500e-05
 Epoch 95/250
 157/157 8s 50ms/step -
 accuracy: 0.8765 - loss: 0.6904 - val_accuracy: 0.8628 - val_loss: 0.7461 -
 learning_rate: 6.2500e-05
 Epoch 96/250
 157/157 8s 50ms/step -
 accuracy: 0.8748 - loss: 0.6938 - val_accuracy: 0.8663 - val_loss: 0.7308 -
 learning_rate: 6.2500e-05
 Epoch 97/250
 157/157 8s 50ms/step -
 accuracy: 0.8786 - loss: 0.6822 - val_accuracy: 0.8594 - val_loss: 0.7580 -
 learning_rate: 6.2500e-05
 Epoch 98/250
 157/157 8s 50ms/step -
 accuracy: 0.8790 - loss: 0.6786 - val_accuracy: 0.8561 - val_loss: 0.7542 -
 learning_rate: 6.2500e-05
 Epoch 99/250
 157/157 8s 51ms/step -
 accuracy: 0.8787 - loss: 0.6748 - val_accuracy: 0.8642 - val_loss: 0.7321 -
 learning_rate: 6.2500e-05
 Epoch 100/250
 157/157 8s 50ms/step -
 accuracy: 0.8789 - loss: 0.6768 - val_accuracy: 0.8589 - val_loss: 0.7458 -
 learning_rate: 6.2500e-05
 Epoch 101/250
 157/157 8s 50ms/step -
 accuracy: 0.8821 - loss: 0.6662 - val_accuracy: 0.8647 - val_loss: 0.7177 -
 learning_rate: 6.2500e-05
 Epoch 102/250
 157/157 8s 50ms/step -

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accuracy: 0.8812 - loss: 0.6633 - val_accuracy: 0.8583 - val_loss: 0.7500 -
learning_rate: 6.2500e-05
Epoch 103/250
157/157          8s 50ms/step -
accuracy: 0.8796 - loss: 0.6645 - val_accuracy: 0.8608 - val_loss: 0.7385 -
learning_rate: 6.2500e-05
Epoch 104/250
157/157          8s 50ms/step -
accuracy: 0.8789 - loss: 0.6687 - val_accuracy: 0.8601 - val_loss: 0.7351 -
learning_rate: 6.2500e-05
Epoch 105/250
157/157          8s 50ms/step -
accuracy: 0.8806 - loss: 0.6661 - val_accuracy: 0.8665 - val_loss: 0.7134 -
learning_rate: 6.2500e-05
Epoch 106/250
157/157          8s 50ms/step -
accuracy: 0.8808 - loss: 0.6566 - val_accuracy: 0.8603 - val_loss: 0.7382 -
learning_rate: 6.2500e-05
Epoch 107/250
157/157          8s 51ms/step -
accuracy: 0.8830 - loss: 0.6513 - val_accuracy: 0.8575 - val_loss: 0.7544 -
learning_rate: 6.2500e-05
Epoch 108/250
157/157          8s 50ms/step -
accuracy: 0.8832 - loss: 0.6532 - val_accuracy: 0.8662 - val_loss: 0.7120 -
learning_rate: 6.2500e-05
Epoch 109/250
157/157          8s 50ms/step -
accuracy: 0.8856 - loss: 0.6419 - val_accuracy: 0.8577 - val_loss: 0.7483 -
learning_rate: 6.2500e-05
Epoch 110/250
157/157          8s 50ms/step -
accuracy: 0.8839 - loss: 0.6483 - val_accuracy: 0.8653 - val_loss: 0.7197 -
learning_rate: 6.2500e-05
Epoch 111/250
157/157          8s 51ms/step -
accuracy: 0.8887 - loss: 0.6394 - val_accuracy: 0.8640 - val_loss: 0.7288 -
learning_rate: 6.2500e-05
Epoch 112/250
157/157          8s 50ms/step -
accuracy: 0.8834 - loss: 0.6422 - val_accuracy: 0.8618 - val_loss: 0.7269 -
learning_rate: 6.2500e-05
Epoch 113/250
157/157          8s 51ms/step -
accuracy: 0.8836 - loss: 0.6408 - val_accuracy: 0.8649 - val_loss: 0.7206 -
learning_rate: 6.2500e-05
Epoch 114/250
157/157          8s 50ms/step -

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accuracy: 0.8874 - loss: 0.6309 - val_accuracy: 0.8696 - val_loss: 0.6974 -
 learning_rate: 3.1250e-05
 Epoch 115/250
 157/157 8s 50ms/step -
 accuracy: 0.8910 - loss: 0.6183 - val_accuracy: 0.8733 - val_loss: 0.6922 -
 learning_rate: 3.1250e-05
 Epoch 116/250
 157/157 8s 50ms/step -
 accuracy: 0.8956 - loss: 0.6002 - val_accuracy: 0.8726 - val_loss: 0.6920 -
 learning_rate: 3.1250e-05
 Epoch 117/250
 157/157 8s 51ms/step -
 accuracy: 0.8997 - loss: 0.5874 - val_accuracy: 0.8740 - val_loss: 0.6784 -
 learning_rate: 3.1250e-05
 Epoch 118/250
 157/157 8s 51ms/step -
 accuracy: 0.8977 - loss: 0.5967 - val_accuracy: 0.8718 - val_loss: 0.6889 -
 learning_rate: 3.1250e-05
 Epoch 119/250
 157/157 8s 51ms/step -
 accuracy: 0.8971 - loss: 0.5857 - val_accuracy: 0.8748 - val_loss: 0.6702 -
 learning_rate: 3.1250e-05
 Epoch 120/250
 157/157 8s 50ms/step -
 accuracy: 0.9020 - loss: 0.5706 - val_accuracy: 0.8718 - val_loss: 0.6817 -
 learning_rate: 3.1250e-05
 Epoch 121/250
 157/157 8s 50ms/step -
 accuracy: 0.9047 - loss: 0.5660 - val_accuracy: 0.8747 - val_loss: 0.6723 -
 learning_rate: 3.1250e-05
 Epoch 122/250
 157/157 8s 51ms/step -
 accuracy: 0.9001 - loss: 0.5664 - val_accuracy: 0.8744 - val_loss: 0.6756 -
 learning_rate: 3.1250e-05
 Epoch 123/250
 157/157 8s 51ms/step -
 accuracy: 0.9042 - loss: 0.5557 - val_accuracy: 0.8756 - val_loss: 0.6622 -
 learning_rate: 3.1250e-05
 Epoch 124/250
 157/157 8s 50ms/step -
 accuracy: 0.9043 - loss: 0.5541 - val_accuracy: 0.8769 - val_loss: 0.6568 -
 learning_rate: 3.1250e-05
 Epoch 125/250
 157/157 8s 50ms/step -
 accuracy: 0.9064 - loss: 0.5470 - val_accuracy: 0.8722 - val_loss: 0.6710 -
 learning_rate: 3.1250e-05
 Epoch 126/250
 157/157 8s 50ms/step -

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accuracy: 0.9079 - loss: 0.5391 - val_accuracy: 0.8735 - val_loss: 0.6627 -
learning_rate: 3.1250e-05
Epoch 127/250
157/157          8s 50ms/step -
accuracy: 0.9108 - loss: 0.5354 - val_accuracy: 0.8745 - val_loss: 0.6600 -
learning_rate: 3.1250e-05
Epoch 128/250
157/157          8s 50ms/step -
accuracy: 0.9089 - loss: 0.5325 - val_accuracy: 0.8785 - val_loss: 0.6512 -
learning_rate: 3.1250e-05
Epoch 129/250
157/157          8s 50ms/step -
accuracy: 0.9103 - loss: 0.5314 - val_accuracy: 0.8742 - val_loss: 0.6599 -
learning_rate: 3.1250e-05
Epoch 130/250
157/157          8s 50ms/step -
accuracy: 0.9060 - loss: 0.5328 - val_accuracy: 0.8735 - val_loss: 0.6575 -
learning_rate: 3.1250e-05
Epoch 131/250
157/157          8s 50ms/step -
accuracy: 0.9109 - loss: 0.5226 - val_accuracy: 0.8745 - val_loss: 0.6512 -
learning_rate: 3.1250e-05
Epoch 132/250
157/157          8s 50ms/step -
accuracy: 0.9103 - loss: 0.5211 - val_accuracy: 0.8768 - val_loss: 0.6458 -
learning_rate: 3.1250e-05
Epoch 133/250
157/157          8s 50ms/step -
accuracy: 0.9076 - loss: 0.5284 - val_accuracy: 0.8742 - val_loss: 0.6503 -
learning_rate: 3.1250e-05
Epoch 134/250
157/157          8s 51ms/step -
accuracy: 0.9093 - loss: 0.5175 - val_accuracy: 0.8737 - val_loss: 0.6510 -
learning_rate: 3.1250e-05
Epoch 135/250
157/157          8s 51ms/step -
accuracy: 0.9136 - loss: 0.5093 - val_accuracy: 0.8764 - val_loss: 0.6398 -
learning_rate: 3.1250e-05
Epoch 136/250
157/157          8s 51ms/step -
accuracy: 0.9103 - loss: 0.5167 - val_accuracy: 0.8741 - val_loss: 0.6465 -
learning_rate: 3.1250e-05
Epoch 137/250
157/157          8s 51ms/step -
accuracy: 0.9097 - loss: 0.5059 - val_accuracy: 0.8743 - val_loss: 0.6425 -
learning_rate: 3.1250e-05
Epoch 138/250
157/157          8s 50ms/step -

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accuracy: 0.9091 - loss: 0.5100 - val_accuracy: 0.8758 - val_loss: 0.6382 -
learning_rate: 3.1250e-05
Epoch 139/250
157/157 8s 50ms/step -
accuracy: 0.9151 - loss: 0.4941 - val_accuracy: 0.8800 - val_loss: 0.6313 -
learning_rate: 3.1250e-05
Epoch 140/250
157/157 8s 50ms/step -
accuracy: 0.9118 - loss: 0.4996 - val_accuracy: 0.8763 - val_loss: 0.6329 -
learning_rate: 3.1250e-05
Epoch 141/250
157/157 8s 51ms/step -
accuracy: 0.9126 - loss: 0.4994 - val_accuracy: 0.8747 - val_loss: 0.6368 -
learning_rate: 3.1250e-05
Epoch 142/250
157/157 8s 51ms/step -
accuracy: 0.9134 - loss: 0.4922 - val_accuracy: 0.8772 - val_loss: 0.6356 -
learning_rate: 3.1250e-05
Epoch 143/250
157/157 8s 51ms/step -
accuracy: 0.9102 - loss: 0.4952 - val_accuracy: 0.8725 - val_loss: 0.6366 -
learning_rate: 3.1250e-05
Epoch 144/250
157/157 8s 51ms/step -
accuracy: 0.9107 - loss: 0.4926 - val_accuracy: 0.8757 - val_loss: 0.6243 -
learning_rate: 3.1250e-05
Epoch 145/250
157/157 8s 51ms/step -
accuracy: 0.9162 - loss: 0.4801 - val_accuracy: 0.8753 - val_loss: 0.6319 -
learning_rate: 3.1250e-05
Epoch 146/250
157/157 8s 51ms/step -
accuracy: 0.9164 - loss: 0.4823 - val_accuracy: 0.8737 - val_loss: 0.6337 -
learning_rate: 3.1250e-05
Epoch 147/250
157/157 8s 51ms/step -
accuracy: 0.9129 - loss: 0.4896 - val_accuracy: 0.8749 - val_loss: 0.6300 -
learning_rate: 3.1250e-05
Epoch 148/250
157/157 8s 50ms/step -
accuracy: 0.9155 - loss: 0.4825 - val_accuracy: 0.8742 - val_loss: 0.6323 -
learning_rate: 3.1250e-05
Epoch 149/250
157/157 8s 50ms/step -
accuracy: 0.9156 - loss: 0.4795 - val_accuracy: 0.8733 - val_loss: 0.6395 -
learning_rate: 3.1250e-05
Epoch 150/250
157/157 8s 50ms/step -

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accuracy: 0.9166 - loss: 0.4751 - val_accuracy: 0.8794 - val_loss: 0.6148 -
learning_rate: 1.5625e-05
Epoch 151/250
157/157          8s 51ms/step -
accuracy: 0.9184 - loss: 0.4700 - val_accuracy: 0.8773 - val_loss: 0.6198 -
learning_rate: 1.5625e-05
Epoch 152/250
157/157          8s 50ms/step -
accuracy: 0.9209 - loss: 0.4587 - val_accuracy: 0.8780 - val_loss: 0.6129 -
learning_rate: 1.5625e-05
Epoch 153/250
157/157          8s 50ms/step -
accuracy: 0.9206 - loss: 0.4600 - val_accuracy: 0.8752 - val_loss: 0.6205 -
learning_rate: 1.5625e-05
Epoch 154/250
157/157          8s 50ms/step -
accuracy: 0.9222 - loss: 0.4562 - val_accuracy: 0.8785 - val_loss: 0.6138 -
learning_rate: 1.5625e-05
Epoch 155/250
157/157          8s 51ms/step -
accuracy: 0.9185 - loss: 0.4565 - val_accuracy: 0.8792 - val_loss: 0.6162 -
learning_rate: 1.5625e-05
Epoch 156/250
157/157          8s 50ms/step -
accuracy: 0.9214 - loss: 0.4557 - val_accuracy: 0.8785 - val_loss: 0.6127 -
learning_rate: 1.5625e-05
Epoch 157/250
157/157          8s 50ms/step -
accuracy: 0.9221 - loss: 0.4480 - val_accuracy: 0.8775 - val_loss: 0.6150 -
learning_rate: 1.5625e-05
Epoch 158/250
157/157          8s 51ms/step -
accuracy: 0.9209 - loss: 0.4469 - val_accuracy: 0.8768 - val_loss: 0.6175 -
learning_rate: 1.5625e-05
Epoch 159/250
157/157          8s 51ms/step -
accuracy: 0.9225 - loss: 0.4488 - val_accuracy: 0.8786 - val_loss: 0.6122 -
learning_rate: 1.5625e-05
Epoch 160/250
157/157          8s 50ms/step -
accuracy: 0.9214 - loss: 0.4458 - val_accuracy: 0.8780 - val_loss: 0.6100 -
learning_rate: 1.5625e-05
Epoch 161/250
157/157          8s 50ms/step -
accuracy: 0.9255 - loss: 0.4281 - val_accuracy: 0.8814 - val_loss: 0.6023 -
learning_rate: 1.5625e-05
Epoch 162/250
157/157          8s 51ms/step -

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accuracy: 0.9230 - loss: 0.4413 - val_accuracy: 0.8784 - val_loss: 0.6057 -
learning_rate: 1.5625e-05
Epoch 163/250
157/157 8s 50ms/step -
accuracy: 0.9242 - loss: 0.4368 - val_accuracy: 0.8807 - val_loss: 0.5979 -
learning_rate: 1.5625e-05
Epoch 164/250
157/157 8s 51ms/step -
accuracy: 0.9273 - loss: 0.4277 - val_accuracy: 0.8779 - val_loss: 0.6074 -
learning_rate: 1.5625e-05
Epoch 165/250
157/157 8s 51ms/step -
accuracy: 0.9244 - loss: 0.4345 - val_accuracy: 0.8799 - val_loss: 0.6037 -
learning_rate: 1.5625e-05
Epoch 166/250
157/157 8s 50ms/step -
accuracy: 0.9275 - loss: 0.4259 - val_accuracy: 0.8812 - val_loss: 0.6023 -
learning_rate: 1.5625e-05
Epoch 167/250
157/157 8s 50ms/step -
accuracy: 0.9252 - loss: 0.4306 - val_accuracy: 0.8787 - val_loss: 0.6064 -
learning_rate: 1.5625e-05
Epoch 168/250
157/157 8s 50ms/step -
accuracy: 0.9272 - loss: 0.4225 - val_accuracy: 0.8786 - val_loss: 0.6067 -
learning_rate: 1.5625e-05
Epoch 169/250
157/157 8s 50ms/step -
accuracy: 0.9318 - loss: 0.4157 - val_accuracy: 0.8808 - val_loss: 0.5950 -
learning_rate: 7.8125e-06
Epoch 170/250
157/157 8s 50ms/step -
accuracy: 0.9254 - loss: 0.4172 - val_accuracy: 0.8801 - val_loss: 0.5949 -
learning_rate: 7.8125e-06
Epoch 171/250
157/157 8s 50ms/step -
accuracy: 0.9298 - loss: 0.4097 - val_accuracy: 0.8815 - val_loss: 0.5926 -
learning_rate: 7.8125e-06
Epoch 172/250
157/157 8s 50ms/step -
accuracy: 0.9318 - loss: 0.4096 - val_accuracy: 0.8798 - val_loss: 0.5922 -
learning_rate: 7.8125e-06
Epoch 173/250
157/157 8s 50ms/step -
accuracy: 0.9332 - loss: 0.4043 - val_accuracy: 0.8797 - val_loss: 0.5929 -
learning_rate: 7.8125e-06
Epoch 174/250
157/157 8s 50ms/step -

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accuracy: 0.9314 - loss: 0.4049 - val_accuracy: 0.8810 - val_loss: 0.5892 -
learning_rate: 7.8125e-06
Epoch 175/250
157/157          8s 50ms/step -
accuracy: 0.9287 - loss: 0.4088 - val_accuracy: 0.8816 - val_loss: 0.5881 -
learning_rate: 7.8125e-06
Epoch 176/250
157/157          8s 50ms/step -
accuracy: 0.9331 - loss: 0.4021 - val_accuracy: 0.8801 - val_loss: 0.5873 -
learning_rate: 7.8125e-06
Epoch 177/250
157/157          8s 50ms/step -
accuracy: 0.9339 - loss: 0.3963 - val_accuracy: 0.8788 - val_loss: 0.5917 -
learning_rate: 7.8125e-06
Epoch 178/250
157/157          8s 50ms/step -
accuracy: 0.9344 - loss: 0.3955 - val_accuracy: 0.8818 - val_loss: 0.5843 -
learning_rate: 7.8125e-06
Epoch 179/250
157/157          8s 50ms/step -
accuracy: 0.9329 - loss: 0.3979 - val_accuracy: 0.8809 - val_loss: 0.5898 -
learning_rate: 7.8125e-06
Epoch 180/250
157/157          8s 50ms/step -
accuracy: 0.9327 - loss: 0.3986 - val_accuracy: 0.8814 - val_loss: 0.5869 -
learning_rate: 7.8125e-06
Epoch 181/250
157/157          8s 50ms/step -
accuracy: 0.9335 - loss: 0.3984 - val_accuracy: 0.8821 - val_loss: 0.5842 -
learning_rate: 7.8125e-06
Epoch 182/250
157/157          8s 50ms/step -
accuracy: 0.9336 - loss: 0.3937 - val_accuracy: 0.8799 - val_loss: 0.5880 -
learning_rate: 7.8125e-06
Epoch 183/250
157/157          8s 50ms/step -
accuracy: 0.9326 - loss: 0.3968 - val_accuracy: 0.8822 - val_loss: 0.5839 -
learning_rate: 7.8125e-06
Epoch 184/250
157/157          8s 51ms/step -
accuracy: 0.9356 - loss: 0.3921 - val_accuracy: 0.8813 - val_loss: 0.5855 -
learning_rate: 7.8125e-06
Epoch 185/250
157/157          8s 51ms/step -
accuracy: 0.9332 - loss: 0.3906 - val_accuracy: 0.8819 - val_loss: 0.5817 -
learning_rate: 7.8125e-06
Epoch 186/250
157/157          8s 50ms/step -

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accuracy: 0.9345 - loss: 0.3889 - val_accuracy: 0.8793 - val_loss: 0.5864 -
learning_rate: 7.8125e-06
Epoch 187/250
157/157 8s 50ms/step -
accuracy: 0.9341 - loss: 0.3887 - val_accuracy: 0.8808 - val_loss: 0.5834 -
learning_rate: 7.8125e-06
Epoch 188/250
157/157 8s 50ms/step -
accuracy: 0.9344 - loss: 0.3857 - val_accuracy: 0.8809 - val_loss: 0.5831 -
learning_rate: 7.8125e-06
Epoch 189/250
157/157 8s 51ms/step -
accuracy: 0.9369 - loss: 0.3827 - val_accuracy: 0.8800 - val_loss: 0.5873 -
learning_rate: 7.8125e-06
Epoch 190/250
157/157 8s 51ms/step -
accuracy: 0.9349 - loss: 0.3852 - val_accuracy: 0.8798 - val_loss: 0.5833 -
learning_rate: 7.8125e-06
Epoch 191/250
157/157 8s 51ms/step -
accuracy: 0.9367 - loss: 0.3821 - val_accuracy: 0.8801 - val_loss: 0.5851 -
learning_rate: 3.9063e-06
Epoch 192/250
157/157 8s 51ms/step -
accuracy: 0.9371 - loss: 0.3808 - val_accuracy: 0.8803 - val_loss: 0.5818 -
learning_rate: 3.9063e-06
Epoch 193/250
157/157 8s 51ms/step -
accuracy: 0.9395 - loss: 0.3749 - val_accuracy: 0.8808 - val_loss: 0.5822 -
learning_rate: 3.9063e-06
Epoch 194/250
157/157 8s 51ms/step -
accuracy: 0.9364 - loss: 0.3789 - val_accuracy: 0.8814 - val_loss: 0.5801 -
learning_rate: 3.9063e-06
Epoch 195/250
157/157 8s 51ms/step -
accuracy: 0.9366 - loss: 0.3843 - val_accuracy: 0.8827 - val_loss: 0.5756 -
learning_rate: 3.9063e-06
Epoch 196/250
157/157 8s 50ms/step -
accuracy: 0.9366 - loss: 0.3779 - val_accuracy: 0.8818 - val_loss: 0.5761 -
learning_rate: 3.9063e-06
Epoch 197/250
157/157 8s 50ms/step -
accuracy: 0.9398 - loss: 0.3704 - val_accuracy: 0.8828 - val_loss: 0.5768 -
learning_rate: 3.9063e-06
Epoch 198/250
157/157 8s 52ms/step -

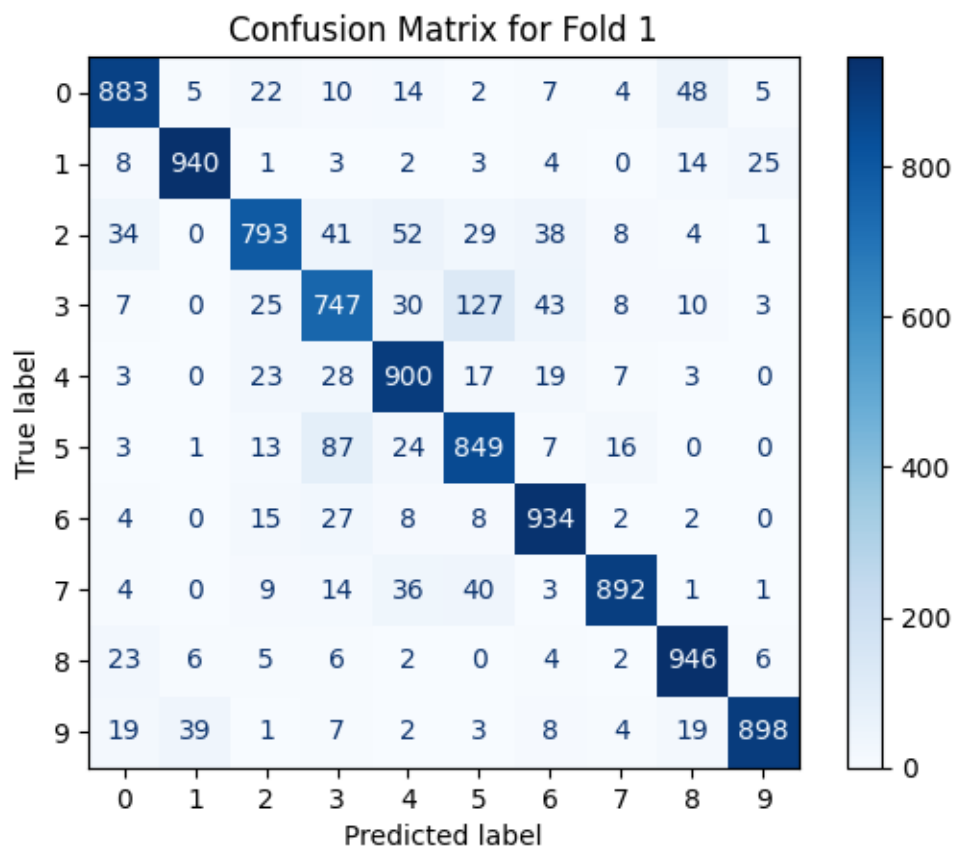
accuracy: 0.9392 - loss: 0.3721 - val_accuracy: 0.8814 - val_loss: 0.5757 -
 learning_rate: 3.9063e-06
 Epoch 199/250
 157/157 8s 51ms/step -
 accuracy: 0.9376 - loss: 0.3747 - val_accuracy: 0.8815 - val_loss: 0.5769 -
 learning_rate: 3.9063e-06
 Epoch 200/250
 157/157 8s 50ms/step -
 accuracy: 0.9348 - loss: 0.3796 - val_accuracy: 0.8811 - val_loss: 0.5774 -
 learning_rate: 3.9063e-06
 Epoch 201/250
 157/157 8s 50ms/step -
 accuracy: 0.9363 - loss: 0.3772 - val_accuracy: 0.8815 - val_loss: 0.5782 -
 learning_rate: 1.9531e-06
 Epoch 202/250
 157/157 8s 50ms/step -
 accuracy: 0.9372 - loss: 0.3730 - val_accuracy: 0.8815 - val_loss: 0.5764 -
 learning_rate: 1.9531e-06
 Epoch 203/250
 157/157 8s 51ms/step -
 accuracy: 0.9384 - loss: 0.3732 - val_accuracy: 0.8825 - val_loss: 0.5759 -
 learning_rate: 1.9531e-06
 Epoch 204/250
 157/157 8s 51ms/step -
 accuracy: 0.9379 - loss: 0.3703 - val_accuracy: 0.8821 - val_loss: 0.5744 -
 learning_rate: 1.9531e-06
 Epoch 205/250
 157/157 8s 50ms/step -
 accuracy: 0.9376 - loss: 0.3721 - val_accuracy: 0.8819 - val_loss: 0.5767 -
 learning_rate: 1.9531e-06
 Epoch 206/250
 157/157 8s 50ms/step -
 accuracy: 0.9370 - loss: 0.3714 - val_accuracy: 0.8816 - val_loss: 0.5768 -
 learning_rate: 1.9531e-06
 Epoch 207/250
 157/157 8s 50ms/step -
 accuracy: 0.9358 - loss: 0.3771 - val_accuracy: 0.8815 - val_loss: 0.5759 -
 learning_rate: 1.9531e-06
 Epoch 208/250
 157/157 8s 50ms/step -
 accuracy: 0.9379 - loss: 0.3741 - val_accuracy: 0.8821 - val_loss: 0.5766 -
 learning_rate: 1.9531e-06
 Epoch 209/250
 157/157 8s 50ms/step -
 accuracy: 0.9402 - loss: 0.3654 - val_accuracy: 0.8817 - val_loss: 0.5758 -
 learning_rate: 1.9531e-06
 Epoch 210/250
 157/157 8s 50ms/step -

```

accuracy: 0.9418 - loss: 0.3661 - val_accuracy: 0.8816 - val_loss: 0.5752 -
learning_rate: 1.0000e-06
Epoch 211/250
157/157          8s 50ms/step -
accuracy: 0.9372 - loss: 0.3715 - val_accuracy: 0.8819 - val_loss: 0.5742 -
learning_rate: 1.0000e-06
Epoch 212/250
157/157          8s 50ms/step -
accuracy: 0.9354 - loss: 0.3784 - val_accuracy: 0.8817 - val_loss: 0.5737 -
learning_rate: 1.0000e-06
Epoch 213/250
157/157          8s 50ms/step -
accuracy: 0.9369 - loss: 0.3754 - val_accuracy: 0.8813 - val_loss: 0.5751 -
learning_rate: 1.0000e-06
Epoch 214/250
157/157          8s 50ms/step -
accuracy: 0.9390 - loss: 0.3675 - val_accuracy: 0.8815 - val_loss: 0.5753 -
learning_rate: 1.0000e-06
Epoch 215/250
157/157          8s 50ms/step -
accuracy: 0.9383 - loss: 0.3703 - val_accuracy: 0.8813 - val_loss: 0.5746 -
learning_rate: 1.0000e-06
Epoch 216/250
157/157          8s 50ms/step -
accuracy: 0.9404 - loss: 0.3670 - val_accuracy: 0.8815 - val_loss: 0.5745 -
learning_rate: 1.0000e-06
Epoch 217/250
157/157          8s 50ms/step -
accuracy: 0.9408 - loss: 0.3622 - val_accuracy: 0.8811 - val_loss: 0.5757 -
learning_rate: 1.0000e-06
Epoch 218/250
157/157          8s 51ms/step -
accuracy: 0.9364 - loss: 0.3696 - val_accuracy: 0.8813 - val_loss: 0.5750 -
learning_rate: 1.0000e-06
Epoch 219/250
157/157          8s 50ms/step -
accuracy: 0.9401 - loss: 0.3655 - val_accuracy: 0.8819 - val_loss: 0.5737 -
learning_rate: 1.0000e-06
Epoch 220/250
157/157          8s 50ms/step -
accuracy: 0.9381 - loss: 0.3680 - val_accuracy: 0.8816 - val_loss: 0.5745 -
learning_rate: 1.0000e-06
Epoch 221/250
157/157          8s 50ms/step -
accuracy: 0.9380 - loss: 0.3685 - val_accuracy: 0.8823 - val_loss: 0.5745 -
learning_rate: 1.0000e-06
Epoch 222/250
157/157          8s 50ms/step -

```

accuracy: 0.9382 - loss: 0.3674 - val_accuracy: 0.8825 - val_loss: 0.5741 -
learning_rate: 1.0000e-06
Epoch 223/250
157/157 8s 50ms/step -
accuracy: 0.9354 - loss: 0.3744 - val_accuracy: 0.8826 - val_loss: 0.5745 -
learning_rate: 1.0000e-06
Epoch 224/250
157/157 8s 50ms/step -
accuracy: 0.9394 - loss: 0.3656 - val_accuracy: 0.8827 - val_loss: 0.5745 -
learning_rate: 1.0000e-06
Epoch 225/250
157/157 8s 51ms/step -
accuracy: 0.9396 - loss: 0.3691 - val_accuracy: 0.8824 - val_loss: 0.5749 -
learning_rate: 1.0000e-06
Epoch 226/250
157/157 8s 50ms/step -
accuracy: 0.9343 - loss: 0.3764 - val_accuracy: 0.8818 - val_loss: 0.5745 -
learning_rate: 1.0000e-06
Epoch 227/250
157/157 8s 51ms/step -
accuracy: 0.9391 - loss: 0.3654 - val_accuracy: 0.8825 - val_loss: 0.5748 -
learning_rate: 1.0000e-06
Score for fold 1: test loss of 0.5992473363876343; test accuracy of
87.81999945640564%
313/313 1s 3ms/step



Classification Report for Fold 1:

	precision	recall	f1-score	support
Class 0	0.89	0.88	0.89	1000
Class 1	0.95	0.94	0.94	1000
Class 2	0.87	0.79	0.83	1000
Class 3	0.77	0.75	0.76	1000
Class 4	0.84	0.90	0.87	1000
Class 5	0.79	0.85	0.82	1000
Class 6	0.88	0.93	0.90	1000
Class 7	0.95	0.89	0.92	1000
Class 8	0.90	0.95	0.92	1000
Class 9	0.96	0.90	0.93	1000
accuracy			0.88	10000
macro avg	0.88	0.88	0.88	10000
weighted avg	0.88	0.88	0.88	10000

/opt/conda/lib/python3.10/site-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not

pass an ``input_shape`/`input_dim`` argument to a layer. When using Sequential models, prefer using an ``Input(shape)`` object as the first layer in the model instead.

```
super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Epoch 1/250

157/157 33s 118ms/step -

accuracy: 0.2058 - loss: 12.5009 - val_accuracy: 0.2148 - val_loss: 6.5778 -
learning_rate: 0.0010

Epoch 2/250

157/157 8s 50ms/step -

accuracy: 0.3882 - loss: 5.1871 - val_accuracy: 0.3086 - val_loss: 3.6255 -
learning_rate: 0.0010

Epoch 3/250

157/157 8s 53ms/step -

accuracy: 0.4876 - loss: 2.9726 - val_accuracy: 0.3569 - val_loss: 2.9844 -
learning_rate: 0.0010

Epoch 4/250

157/157 8s 52ms/step -

accuracy: 0.5610 - loss: 2.4213 - val_accuracy: 0.4924 - val_loss: 2.5237 -
learning_rate: 0.0010

Epoch 5/250

157/157 8s 51ms/step -

accuracy: 0.5869 - loss: 2.3405 - val_accuracy: 0.5243 - val_loss: 2.5396 -
learning_rate: 0.0010

Epoch 6/250

157/157 8s 51ms/step -

accuracy: 0.6177 - loss: 2.2713 - val_accuracy: 0.5436 - val_loss: 2.5934 -
learning_rate: 0.0010

Epoch 7/250

157/157 8s 51ms/step -

accuracy: 0.6237 - loss: 2.2919 - val_accuracy: 0.6441 - val_loss: 2.2900 -
learning_rate: 0.0010

Epoch 8/250

157/157 8s 50ms/step -

accuracy: 0.6378 - loss: 2.2946 - val_accuracy: 0.6144 - val_loss: 2.3613 -
learning_rate: 0.0010

Epoch 9/250

157/157 8s 50ms/step -

accuracy: 0.6409 - loss: 2.2992 - val_accuracy: 0.6386 - val_loss: 2.2519 -
learning_rate: 0.0010

Epoch 10/250

157/157 8s 50ms/step -

accuracy: 0.6472 - loss: 2.2758 - val_accuracy: 0.6602 - val_loss: 2.2060 -
learning_rate: 0.0010

Epoch 11/250

157/157 8s 50ms/step -

accuracy: 0.6600 - loss: 2.2342 - val_accuracy: 0.6711 - val_loss: 2.1670 -

```

learning_rate: 0.0010
Epoch 12/250
157/157          8s 50ms/step -
accuracy: 0.6607 - loss: 2.2406 - val_accuracy: 0.6628 - val_loss: 2.2417 -
learning_rate: 0.0010
Epoch 13/250
157/157          8s 50ms/step -
accuracy: 0.6615 - loss: 2.2553 - val_accuracy: 0.6884 - val_loss: 2.1594 -
learning_rate: 0.0010
Epoch 14/250
157/157          8s 50ms/step -
accuracy: 0.6696 - loss: 2.2394 - val_accuracy: 0.6870 - val_loss: 2.0907 -
learning_rate: 0.0010
Epoch 15/250
157/157          8s 51ms/step -
accuracy: 0.6798 - loss: 2.1709 - val_accuracy: 0.6654 - val_loss: 2.2010 -
learning_rate: 0.0010
Epoch 16/250
157/157          8s 50ms/step -
accuracy: 0.6684 - loss: 2.2336 - val_accuracy: 0.6629 - val_loss: 2.2237 -
learning_rate: 0.0010
Epoch 17/250
157/157          8s 50ms/step -
accuracy: 0.6790 - loss: 2.1986 - val_accuracy: 0.7000 - val_loss: 2.0906 -
learning_rate: 0.0010
Epoch 18/250
157/157          8s 50ms/step -
accuracy: 0.6765 - loss: 2.1947 - val_accuracy: 0.6801 - val_loss: 2.1950 -
learning_rate: 0.0010
Epoch 19/250
157/157          8s 50ms/step -
accuracy: 0.6780 - loss: 2.2007 - val_accuracy: 0.6959 - val_loss: 2.1083 -
learning_rate: 0.0010
Epoch 20/250
157/157          8s 50ms/step -
accuracy: 0.6982 - loss: 2.0171 - val_accuracy: 0.6829 - val_loss: 1.8294 -
learning_rate: 5.0000e-04
Epoch 21/250
157/157          8s 51ms/step -
accuracy: 0.7166 - loss: 1.7297 - val_accuracy: 0.7251 - val_loss: 1.6932 -
learning_rate: 5.0000e-04
Epoch 22/250
157/157          8s 51ms/step -
accuracy: 0.7204 - loss: 1.7222 - val_accuracy: 0.7571 - val_loss: 1.6087 -
learning_rate: 5.0000e-04
Epoch 23/250
157/157          8s 50ms/step -
accuracy: 0.7231 - loss: 1.7244 - val_accuracy: 0.6934 - val_loss: 1.8077 -

```

```

learning_rate: 5.0000e-04
Epoch 24/250
157/157          8s 50ms/step -
accuracy: 0.7225 - loss: 1.7411 - val_accuracy: 0.7658 - val_loss: 1.5793 -
learning_rate: 5.0000e-04
Epoch 25/250
157/157          8s 50ms/step -
accuracy: 0.7285 - loss: 1.7090 - val_accuracy: 0.7405 - val_loss: 1.6494 -
learning_rate: 5.0000e-04
Epoch 26/250
157/157          8s 50ms/step -
accuracy: 0.7269 - loss: 1.7145 - val_accuracy: 0.7630 - val_loss: 1.5883 -
learning_rate: 5.0000e-04
Epoch 27/250
157/157          8s 50ms/step -
accuracy: 0.7354 - loss: 1.6869 - val_accuracy: 0.7493 - val_loss: 1.6237 -
learning_rate: 5.0000e-04
Epoch 28/250
157/157          8s 50ms/step -
accuracy: 0.7339 - loss: 1.6909 - val_accuracy: 0.7449 - val_loss: 1.6531 -
learning_rate: 5.0000e-04
Epoch 29/250
157/157          8s 50ms/step -
accuracy: 0.7363 - loss: 1.6821 - val_accuracy: 0.7293 - val_loss: 1.6988 -
learning_rate: 5.0000e-04
Epoch 30/250
157/157          8s 51ms/step -
accuracy: 0.7543 - loss: 1.5792 - val_accuracy: 0.7669 - val_loss: 1.4114 -
learning_rate: 2.5000e-04
Epoch 31/250
157/157          8s 50ms/step -
accuracy: 0.7728 - loss: 1.3932 - val_accuracy: 0.7756 - val_loss: 1.3326 -
learning_rate: 2.5000e-04
Epoch 32/250
157/157          8s 50ms/step -
accuracy: 0.7730 - loss: 1.3451 - val_accuracy: 0.7713 - val_loss: 1.3223 -
learning_rate: 2.5000e-04
Epoch 33/250
157/157          8s 51ms/step -
accuracy: 0.7734 - loss: 1.3278 - val_accuracy: 0.7479 - val_loss: 1.3987 -
learning_rate: 2.5000e-04
Epoch 34/250
157/157          8s 50ms/step -
accuracy: 0.7817 - loss: 1.2921 - val_accuracy: 0.7901 - val_loss: 1.2669 -
learning_rate: 2.5000e-04
Epoch 35/250
157/157          8s 50ms/step -
accuracy: 0.7846 - loss: 1.2813 - val_accuracy: 0.7798 - val_loss: 1.2860 -

```

```

learning_rate: 2.5000e-04
Epoch 36/250
157/157      8s 51ms/step -
accuracy: 0.7845 - loss: 1.2845 - val_accuracy: 0.7924 - val_loss: 1.2553 -
learning_rate: 2.5000e-04
Epoch 37/250
157/157      8s 51ms/step -
accuracy: 0.7838 - loss: 1.2834 - val_accuracy: 0.7878 - val_loss: 1.2750 -
learning_rate: 2.5000e-04
Epoch 38/250
157/157      8s 51ms/step -
accuracy: 0.7835 - loss: 1.2862 - val_accuracy: 0.7792 - val_loss: 1.2931 -
learning_rate: 2.5000e-04
Epoch 39/250
157/157      8s 51ms/step -
accuracy: 0.7873 - loss: 1.2688 - val_accuracy: 0.8034 - val_loss: 1.2162 -
learning_rate: 2.5000e-04
Epoch 40/250
157/157      8s 50ms/step -
accuracy: 0.7886 - loss: 1.2765 - val_accuracy: 0.8001 - val_loss: 1.2206 -
learning_rate: 2.5000e-04
Epoch 41/250
157/157      8s 51ms/step -
accuracy: 0.7963 - loss: 1.2427 - val_accuracy: 0.7874 - val_loss: 1.2750 -
learning_rate: 2.5000e-04
Epoch 42/250
157/157      8s 50ms/step -
accuracy: 0.7911 - loss: 1.2601 - val_accuracy: 0.7939 - val_loss: 1.2524 -
learning_rate: 2.5000e-04
Epoch 43/250
157/157      8s 50ms/step -
accuracy: 0.7946 - loss: 1.2472 - val_accuracy: 0.8081 - val_loss: 1.2049 -
learning_rate: 2.5000e-04
Epoch 44/250
157/157      8s 50ms/step -
accuracy: 0.7945 - loss: 1.2477 - val_accuracy: 0.7986 - val_loss: 1.2208 -
learning_rate: 2.5000e-04
Epoch 45/250
157/157      8s 50ms/step -
accuracy: 0.7967 - loss: 1.2329 - val_accuracy: 0.7925 - val_loss: 1.2358 -
learning_rate: 2.5000e-04
Epoch 46/250
157/157      8s 50ms/step -
accuracy: 0.7959 - loss: 1.2379 - val_accuracy: 0.8122 - val_loss: 1.2019 -
learning_rate: 2.5000e-04
Epoch 47/250
157/157      8s 50ms/step -
accuracy: 0.7930 - loss: 1.2429 - val_accuracy: 0.8048 - val_loss: 1.2185 -

```

```

learning_rate: 2.5000e-04
Epoch 48/250
157/157          8s 50ms/step -
accuracy: 0.7985 - loss: 1.2317 - val_accuracy: 0.8046 - val_loss: 1.2113 -
learning_rate: 2.5000e-04
Epoch 49/250
157/157          8s 50ms/step -
accuracy: 0.8011 - loss: 1.2213 - val_accuracy: 0.8081 - val_loss: 1.2018 -
learning_rate: 2.5000e-04
Epoch 50/250
157/157          8s 50ms/step -
accuracy: 0.8029 - loss: 1.2308 - val_accuracy: 0.7995 - val_loss: 1.2368 -
learning_rate: 2.5000e-04
Epoch 51/250
157/157          8s 50ms/step -
accuracy: 0.8007 - loss: 1.2259 - val_accuracy: 0.8041 - val_loss: 1.2249 -
learning_rate: 2.5000e-04
Epoch 52/250
157/157          8s 50ms/step -
accuracy: 0.7992 - loss: 1.2204 - val_accuracy: 0.7988 - val_loss: 1.2140 -
learning_rate: 2.5000e-04
Epoch 53/250
157/157          8s 50ms/step -
accuracy: 0.8028 - loss: 1.2182 - val_accuracy: 0.8073 - val_loss: 1.2084 -
learning_rate: 2.5000e-04
Epoch 54/250
157/157          8s 50ms/step -
accuracy: 0.8026 - loss: 1.2147 - val_accuracy: 0.8154 - val_loss: 1.1739 -
learning_rate: 2.5000e-04
Epoch 55/250
157/157          8s 50ms/step -
accuracy: 0.8024 - loss: 1.2219 - val_accuracy: 0.8154 - val_loss: 1.1858 -
learning_rate: 2.5000e-04
Epoch 56/250
157/157          8s 50ms/step -
accuracy: 0.8037 - loss: 1.2174 - val_accuracy: 0.8062 - val_loss: 1.2000 -
learning_rate: 2.5000e-04
Epoch 57/250
157/157          8s 50ms/step -
accuracy: 0.7970 - loss: 1.2264 - val_accuracy: 0.8160 - val_loss: 1.1853 -
learning_rate: 2.5000e-04
Epoch 58/250
157/157          8s 50ms/step -
accuracy: 0.8063 - loss: 1.1988 - val_accuracy: 0.8128 - val_loss: 1.1848 -
learning_rate: 2.5000e-04
Epoch 59/250
157/157          8s 50ms/step -
accuracy: 0.8031 - loss: 1.2194 - val_accuracy: 0.8143 - val_loss: 1.1892 -

```

```

learning_rate: 2.5000e-04
Epoch 60/250
157/157          8s 50ms/step -
accuracy: 0.8159 - loss: 1.1643 - val_accuracy: 0.8362 - val_loss: 1.0789 -
learning_rate: 1.2500e-04
Epoch 61/250
157/157          8s 50ms/step -
accuracy: 0.8300 - loss: 1.0859 - val_accuracy: 0.8364 - val_loss: 1.0401 -
learning_rate: 1.2500e-04
Epoch 62/250
157/157          8s 50ms/step -
accuracy: 0.8313 - loss: 1.0416 - val_accuracy: 0.8302 - val_loss: 1.0264 -
learning_rate: 1.2500e-04
Epoch 63/250
157/157          8s 50ms/step -
accuracy: 0.8381 - loss: 1.0032 - val_accuracy: 0.8351 - val_loss: 1.0098 -
learning_rate: 1.2500e-04
Epoch 64/250
157/157          8s 50ms/step -
accuracy: 0.8378 - loss: 0.9854 - val_accuracy: 0.8315 - val_loss: 1.0042 -
learning_rate: 1.2500e-04
Epoch 65/250
157/157          8s 51ms/step -
accuracy: 0.8378 - loss: 0.9725 - val_accuracy: 0.8458 - val_loss: 0.9482 -
learning_rate: 1.2500e-04
Epoch 66/250
157/157          8s 50ms/step -
accuracy: 0.8425 - loss: 0.9552 - val_accuracy: 0.8415 - val_loss: 0.9510 -
learning_rate: 1.2500e-04
Epoch 67/250
157/157          8s 50ms/step -
accuracy: 0.8470 - loss: 0.9316 - val_accuracy: 0.8341 - val_loss: 0.9613 -
learning_rate: 1.2500e-04
Epoch 68/250
157/157          8s 50ms/step -
accuracy: 0.8407 - loss: 0.9420 - val_accuracy: 0.8303 - val_loss: 0.9848 -
learning_rate: 1.2500e-04
Epoch 69/250
157/157          8s 50ms/step -
accuracy: 0.8446 - loss: 0.9228 - val_accuracy: 0.8375 - val_loss: 0.9637 -
learning_rate: 1.2500e-04
Epoch 70/250
157/157          8s 50ms/step -
accuracy: 0.8418 - loss: 0.9308 - val_accuracy: 0.8428 - val_loss: 0.9320 -
learning_rate: 1.2500e-04
Epoch 71/250
157/157          8s 50ms/step -
accuracy: 0.8377 - loss: 0.9335 - val_accuracy: 0.8350 - val_loss: 0.9547 -

```

```

learning_rate: 1.2500e-04
Epoch 72/250
157/157          8s 50ms/step -
accuracy: 0.8474 - loss: 0.9109 - val_accuracy: 0.8389 - val_loss: 0.9420 -
learning_rate: 1.2500e-04
Epoch 73/250
157/157          8s 50ms/step -
accuracy: 0.8479 - loss: 0.9122 - val_accuracy: 0.8446 - val_loss: 0.9251 -
learning_rate: 1.2500e-04
Epoch 74/250
157/157          8s 50ms/step -
accuracy: 0.8457 - loss: 0.9169 - val_accuracy: 0.8463 - val_loss: 0.9165 -
learning_rate: 1.2500e-04
Epoch 75/250
157/157          8s 50ms/step -
accuracy: 0.8468 - loss: 0.9050 - val_accuracy: 0.8410 - val_loss: 0.9321 -
learning_rate: 1.2500e-04
Epoch 76/250
157/157          8s 50ms/step -
accuracy: 0.8465 - loss: 0.9081 - val_accuracy: 0.8464 - val_loss: 0.9185 -
learning_rate: 1.2500e-04
Epoch 77/250
157/157          8s 50ms/step -
accuracy: 0.8442 - loss: 0.9037 - val_accuracy: 0.8424 - val_loss: 0.9224 -
learning_rate: 1.2500e-04
Epoch 78/250
157/157          8s 50ms/step -
accuracy: 0.8472 - loss: 0.8935 - val_accuracy: 0.8409 - val_loss: 0.9381 -
learning_rate: 1.2500e-04
Epoch 79/250
157/157          8s 50ms/step -
accuracy: 0.8527 - loss: 0.8874 - val_accuracy: 0.8441 - val_loss: 0.9273 -
learning_rate: 1.2500e-04
Epoch 80/250
157/157          8s 50ms/step -
accuracy: 0.8532 - loss: 0.8789 - val_accuracy: 0.8505 - val_loss: 0.8918 -
learning_rate: 6.2500e-05
Epoch 81/250
157/157          8s 51ms/step -
accuracy: 0.8588 - loss: 0.8452 - val_accuracy: 0.8508 - val_loss: 0.8795 -
learning_rate: 6.2500e-05
Epoch 82/250
157/157          8s 50ms/step -
accuracy: 0.8661 - loss: 0.8191 - val_accuracy: 0.8522 - val_loss: 0.8563 -
learning_rate: 6.2500e-05
Epoch 83/250
157/157          8s 51ms/step -
accuracy: 0.8693 - loss: 0.7988 - val_accuracy: 0.8527 - val_loss: 0.8519 -

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learning_rate: 6.2500e-05
Epoch 84/250
157/157          8s 50ms/step -
accuracy: 0.8696 - loss: 0.7800 - val_accuracy: 0.8575 - val_loss: 0.8302 -
learning_rate: 6.2500e-05
Epoch 85/250
157/157          8s 50ms/step -
accuracy: 0.8718 - loss: 0.7674 - val_accuracy: 0.8580 - val_loss: 0.8261 -
learning_rate: 6.2500e-05
Epoch 86/250
157/157          8s 50ms/step -
accuracy: 0.8732 - loss: 0.7597 - val_accuracy: 0.8554 - val_loss: 0.8235 -
learning_rate: 6.2500e-05
Epoch 87/250
157/157          8s 50ms/step -
accuracy: 0.8759 - loss: 0.7438 - val_accuracy: 0.8594 - val_loss: 0.8007 -
learning_rate: 6.2500e-05
Epoch 88/250
157/157          8s 50ms/step -
accuracy: 0.8802 - loss: 0.7270 - val_accuracy: 0.8554 - val_loss: 0.8131 -
learning_rate: 6.2500e-05
Epoch 89/250
157/157          8s 50ms/step -
accuracy: 0.8771 - loss: 0.7269 - val_accuracy: 0.8576 - val_loss: 0.8021 -
learning_rate: 6.2500e-05
Epoch 90/250
157/157          8s 50ms/step -
accuracy: 0.8785 - loss: 0.7172 - val_accuracy: 0.8605 - val_loss: 0.7919 -
learning_rate: 6.2500e-05
Epoch 91/250
157/157          8s 50ms/step -
accuracy: 0.8788 - loss: 0.7076 - val_accuracy: 0.8596 - val_loss: 0.7897 -
learning_rate: 6.2500e-05
Epoch 92/250
157/157          8s 51ms/step -
accuracy: 0.8813 - loss: 0.7026 - val_accuracy: 0.8590 - val_loss: 0.7844 -
learning_rate: 6.2500e-05
Epoch 93/250
157/157          8s 50ms/step -
accuracy: 0.8796 - loss: 0.7005 - val_accuracy: 0.8614 - val_loss: 0.7821 -
learning_rate: 6.2500e-05
Epoch 94/250
157/157          8s 50ms/step -
accuracy: 0.8800 - loss: 0.6960 - val_accuracy: 0.8517 - val_loss: 0.7960 -
learning_rate: 6.2500e-05
Epoch 95/250
157/157          8s 50ms/step -
accuracy: 0.8792 - loss: 0.7012 - val_accuracy: 0.8596 - val_loss: 0.7813 -

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learning_rate: 6.2500e-05
Epoch 96/250
157/157          8s 50ms/step -
accuracy: 0.8838 - loss: 0.6847 - val_accuracy: 0.8534 - val_loss: 0.7967 -
learning_rate: 6.2500e-05
Epoch 97/250
157/157          8s 50ms/step -
accuracy: 0.8796 - loss: 0.6868 - val_accuracy: 0.8576 - val_loss: 0.7753 -
learning_rate: 6.2500e-05
Epoch 98/250
157/157          8s 50ms/step -
accuracy: 0.8855 - loss: 0.6662 - val_accuracy: 0.8609 - val_loss: 0.7582 -
learning_rate: 6.2500e-05
Epoch 99/250
157/157          8s 50ms/step -
accuracy: 0.8826 - loss: 0.6761 - val_accuracy: 0.8591 - val_loss: 0.7720 -
learning_rate: 6.2500e-05
Epoch 100/250
157/157          8s 50ms/step -
accuracy: 0.8819 - loss: 0.6714 - val_accuracy: 0.8606 - val_loss: 0.7582 -
learning_rate: 6.2500e-05
Epoch 101/250
157/157          8s 50ms/step -
accuracy: 0.8839 - loss: 0.6627 - val_accuracy: 0.8576 - val_loss: 0.7710 -
learning_rate: 6.2500e-05
Epoch 102/250
157/157          8s 50ms/step -
accuracy: 0.8881 - loss: 0.6576 - val_accuracy: 0.8576 - val_loss: 0.7653 -
learning_rate: 6.2500e-05
Epoch 103/250
157/157          8s 50ms/step -
accuracy: 0.8853 - loss: 0.6606 - val_accuracy: 0.8616 - val_loss: 0.7663 -
learning_rate: 6.2500e-05
Epoch 104/250
157/157          8s 50ms/step -
accuracy: 0.8913 - loss: 0.6457 - val_accuracy: 0.8643 - val_loss: 0.7460 -
learning_rate: 3.1250e-05
Epoch 105/250
157/157          8s 50ms/step -
accuracy: 0.8908 - loss: 0.6350 - val_accuracy: 0.8631 - val_loss: 0.7433 -
learning_rate: 3.1250e-05
Epoch 106/250
157/157          8s 50ms/step -
accuracy: 0.8944 - loss: 0.6283 - val_accuracy: 0.8703 - val_loss: 0.7201 -
learning_rate: 3.1250e-05
Epoch 107/250
157/157          8s 50ms/step -
accuracy: 0.8975 - loss: 0.6066 - val_accuracy: 0.8681 - val_loss: 0.7230 -

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learning_rate: 3.1250e-05
Epoch 108/250
157/157      8s 50ms/step -
accuracy: 0.8987 - loss: 0.6064 - val_accuracy: 0.8695 - val_loss: 0.7182 -
learning_rate: 3.1250e-05
Epoch 109/250
157/157      8s 50ms/step -
accuracy: 0.8948 - loss: 0.6024 - val_accuracy: 0.8645 - val_loss: 0.7223 -
learning_rate: 3.1250e-05
Epoch 110/250
157/157      8s 50ms/step -
accuracy: 0.9016 - loss: 0.5858 - val_accuracy: 0.8661 - val_loss: 0.7189 -
learning_rate: 3.1250e-05
Epoch 111/250
157/157      8s 50ms/step -
accuracy: 0.8995 - loss: 0.5863 - val_accuracy: 0.8700 - val_loss: 0.7057 -
learning_rate: 3.1250e-05
Epoch 112/250
157/157      8s 50ms/step -
accuracy: 0.9045 - loss: 0.5769 - val_accuracy: 0.8670 - val_loss: 0.7172 -
learning_rate: 3.1250e-05
Epoch 113/250
157/157      8s 50ms/step -
accuracy: 0.9050 - loss: 0.5709 - val_accuracy: 0.8698 - val_loss: 0.7042 -
learning_rate: 3.1250e-05
Epoch 114/250
157/157      8s 50ms/step -
accuracy: 0.9039 - loss: 0.5664 - val_accuracy: 0.8674 - val_loss: 0.7057 -
learning_rate: 3.1250e-05
Epoch 115/250
157/157      8s 50ms/step -
accuracy: 0.9039 - loss: 0.5654 - val_accuracy: 0.8668 - val_loss: 0.7088 -
learning_rate: 3.1250e-05
Epoch 116/250
157/157      8s 50ms/step -
accuracy: 0.9044 - loss: 0.5579 - val_accuracy: 0.8675 - val_loss: 0.7024 -
learning_rate: 3.1250e-05
Epoch 117/250
157/157      8s 50ms/step -
accuracy: 0.9062 - loss: 0.5538 - val_accuracy: 0.8708 - val_loss: 0.6840 -
learning_rate: 3.1250e-05
Epoch 118/250
157/157      8s 50ms/step -
accuracy: 0.9018 - loss: 0.5594 - val_accuracy: 0.8685 - val_loss: 0.6961 -
learning_rate: 3.1250e-05
Epoch 119/250
157/157      8s 50ms/step -
accuracy: 0.9069 - loss: 0.5445 - val_accuracy: 0.8708 - val_loss: 0.6872 -

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learning_rate: 3.1250e-05
Epoch 120/250
157/157          8s 50ms/step -
accuracy: 0.9094 - loss: 0.5325 - val_accuracy: 0.8744 - val_loss: 0.6774 -
learning_rate: 3.1250e-05
Epoch 121/250
157/157          8s 50ms/step -
accuracy: 0.9083 - loss: 0.5406 - val_accuracy: 0.8727 - val_loss: 0.6781 -
learning_rate: 3.1250e-05
Epoch 122/250
157/157          8s 50ms/step -
accuracy: 0.9063 - loss: 0.5385 - val_accuracy: 0.8704 - val_loss: 0.6783 -
learning_rate: 3.1250e-05
Epoch 123/250
157/157          8s 50ms/step -
accuracy: 0.9083 - loss: 0.5308 - val_accuracy: 0.8693 - val_loss: 0.6864 -
learning_rate: 3.1250e-05
Epoch 124/250
157/157          8s 50ms/step -
accuracy: 0.9072 - loss: 0.5309 - val_accuracy: 0.8696 - val_loss: 0.6773 -
learning_rate: 3.1250e-05
Epoch 125/250
157/157          8s 50ms/step -
accuracy: 0.9086 - loss: 0.5269 - val_accuracy: 0.8695 - val_loss: 0.6831 -
learning_rate: 3.1250e-05
Epoch 126/250
157/157          8s 50ms/step -
accuracy: 0.9101 - loss: 0.5203 - val_accuracy: 0.8714 - val_loss: 0.6777 -
learning_rate: 3.1250e-05
Epoch 127/250
157/157          8s 50ms/step -
accuracy: 0.9114 - loss: 0.5194 - val_accuracy: 0.8716 - val_loss: 0.6720 -
learning_rate: 3.1250e-05
Epoch 128/250
157/157          8s 50ms/step -
accuracy: 0.9138 - loss: 0.5054 - val_accuracy: 0.8709 - val_loss: 0.6774 -
learning_rate: 3.1250e-05
Epoch 129/250
157/157          8s 50ms/step -
accuracy: 0.9091 - loss: 0.5189 - val_accuracy: 0.8702 - val_loss: 0.6776 -
learning_rate: 3.1250e-05
Epoch 130/250
157/157          8s 50ms/step -
accuracy: 0.9118 - loss: 0.5109 - val_accuracy: 0.8694 - val_loss: 0.6846 -
learning_rate: 3.1250e-05
Epoch 131/250
157/157          8s 50ms/step -
accuracy: 0.9132 - loss: 0.5027 - val_accuracy: 0.8716 - val_loss: 0.6715 -

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learning_rate: 3.1250e-05
Epoch 132/250
157/157          8s 50ms/step -
accuracy: 0.9121 - loss: 0.5086 - val_accuracy: 0.8692 - val_loss: 0.6745 -
learning_rate: 3.1250e-05
Epoch 133/250
157/157          8s 50ms/step -
accuracy: 0.9133 - loss: 0.5023 - val_accuracy: 0.8681 - val_loss: 0.6676 -
learning_rate: 3.1250e-05
Epoch 134/250
157/157          8s 50ms/step -
accuracy: 0.9137 - loss: 0.4982 - val_accuracy: 0.8717 - val_loss: 0.6633 -
learning_rate: 3.1250e-05
Epoch 135/250
157/157          8s 50ms/step -
accuracy: 0.9148 - loss: 0.4923 - val_accuracy: 0.8733 - val_loss: 0.6632 -
learning_rate: 3.1250e-05
Epoch 136/250
157/157          8s 50ms/step -
accuracy: 0.9132 - loss: 0.4933 - val_accuracy: 0.8731 - val_loss: 0.6612 -
learning_rate: 3.1250e-05
Epoch 137/250
157/157          8s 50ms/step -
accuracy: 0.9147 - loss: 0.4892 - val_accuracy: 0.8747 - val_loss: 0.6508 -
learning_rate: 3.1250e-05
Epoch 138/250
157/157          8s 50ms/step -
accuracy: 0.9162 - loss: 0.4874 - val_accuracy: 0.8679 - val_loss: 0.6716 -
learning_rate: 3.1250e-05
Epoch 139/250
157/157          8s 50ms/step -
accuracy: 0.9167 - loss: 0.4861 - val_accuracy: 0.8701 - val_loss: 0.6559 -
learning_rate: 3.1250e-05
Epoch 140/250
157/157          8s 50ms/step -
accuracy: 0.9180 - loss: 0.4773 - val_accuracy: 0.8733 - val_loss: 0.6590 -
learning_rate: 3.1250e-05
Epoch 141/250
157/157          8s 50ms/step -
accuracy: 0.9173 - loss: 0.4819 - val_accuracy: 0.8729 - val_loss: 0.6503 -
learning_rate: 3.1250e-05
Epoch 142/250
157/157          8s 50ms/step -
accuracy: 0.9116 - loss: 0.4926 - val_accuracy: 0.8738 - val_loss: 0.6467 -
learning_rate: 3.1250e-05
Epoch 143/250
157/157          8s 50ms/step -
accuracy: 0.9168 - loss: 0.4773 - val_accuracy: 0.8742 - val_loss: 0.6490 -

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learning_rate: 3.1250e-05
Epoch 144/250
157/157          10s 50ms/step -
accuracy: 0.9195 - loss: 0.4696 - val_accuracy: 0.8685 - val_loss: 0.6566 -
learning_rate: 3.1250e-05
Epoch 145/250
157/157          8s 50ms/step -
accuracy: 0.9166 - loss: 0.4754 - val_accuracy: 0.8686 - val_loss: 0.6588 -
learning_rate: 3.1250e-05
Epoch 146/250
157/157          8s 50ms/step -
accuracy: 0.9161 - loss: 0.4760 - val_accuracy: 0.8692 - val_loss: 0.6643 -
learning_rate: 3.1250e-05
Epoch 147/250
157/157          8s 50ms/step -
accuracy: 0.9164 - loss: 0.4742 - val_accuracy: 0.8683 - val_loss: 0.6559 -
learning_rate: 3.1250e-05
Epoch 148/250
157/157          8s 50ms/step -
accuracy: 0.9207 - loss: 0.4630 - val_accuracy: 0.8717 - val_loss: 0.6505 -
learning_rate: 1.5625e-05
Epoch 149/250
157/157          8s 50ms/step -
accuracy: 0.9237 - loss: 0.4577 - val_accuracy: 0.8706 - val_loss: 0.6534 -
learning_rate: 1.5625e-05
Epoch 150/250
157/157          8s 50ms/step -
accuracy: 0.9260 - loss: 0.4499 - val_accuracy: 0.8746 - val_loss: 0.6439 -
learning_rate: 1.5625e-05
Epoch 151/250
157/157          8s 50ms/step -
accuracy: 0.9270 - loss: 0.4430 - val_accuracy: 0.8728 - val_loss: 0.6517 -
learning_rate: 1.5625e-05
Epoch 152/250
157/157          8s 50ms/step -
accuracy: 0.9235 - loss: 0.4532 - val_accuracy: 0.8716 - val_loss: 0.6500 -
learning_rate: 1.5625e-05
Epoch 153/250
157/157          8s 50ms/step -
accuracy: 0.9270 - loss: 0.4398 - val_accuracy: 0.8731 - val_loss: 0.6400 -
learning_rate: 1.5625e-05
Epoch 154/250
157/157          8s 50ms/step -
accuracy: 0.9243 - loss: 0.4455 - val_accuracy: 0.8735 - val_loss: 0.6430 -
learning_rate: 1.5625e-05
Epoch 155/250
157/157          8s 50ms/step -
accuracy: 0.9266 - loss: 0.4338 - val_accuracy: 0.8740 - val_loss: 0.6341 -

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learning_rate: 1.5625e-05
Epoch 156/250
157/157      8s 50ms/step -
accuracy: 0.9264 - loss: 0.4383 - val_accuracy: 0.8689 - val_loss: 0.6524 -
learning_rate: 1.5625e-05
Epoch 157/250
157/157      8s 50ms/step -
accuracy: 0.9265 - loss: 0.4375 - val_accuracy: 0.8741 - val_loss: 0.6347 -
learning_rate: 1.5625e-05
Epoch 158/250
157/157      8s 50ms/step -
accuracy: 0.9254 - loss: 0.4329 - val_accuracy: 0.8751 - val_loss: 0.6317 -
learning_rate: 1.5625e-05
Epoch 159/250
157/157      8s 50ms/step -
accuracy: 0.9250 - loss: 0.4353 - val_accuracy: 0.8735 - val_loss: 0.6356 -
learning_rate: 1.5625e-05
Epoch 160/250
157/157      8s 50ms/step -
accuracy: 0.9277 - loss: 0.4240 - val_accuracy: 0.8736 - val_loss: 0.6334 -
learning_rate: 1.5625e-05
Epoch 161/250
157/157      8s 50ms/step -
accuracy: 0.9284 - loss: 0.4237 - val_accuracy: 0.8762 - val_loss: 0.6295 -
learning_rate: 1.5625e-05
Epoch 162/250
157/157      8s 50ms/step -
accuracy: 0.9288 - loss: 0.4211 - val_accuracy: 0.8743 - val_loss: 0.6358 -
learning_rate: 1.5625e-05
Epoch 163/250
157/157      8s 50ms/step -
accuracy: 0.9271 - loss: 0.4257 - val_accuracy: 0.8748 - val_loss: 0.6294 -
learning_rate: 1.5625e-05
Epoch 164/250
157/157      8s 50ms/step -
accuracy: 0.9331 - loss: 0.4113 - val_accuracy: 0.8735 - val_loss: 0.6316 -
learning_rate: 1.5625e-05
Epoch 165/250
157/157      8s 50ms/step -
accuracy: 0.9264 - loss: 0.4244 - val_accuracy: 0.8753 - val_loss: 0.6289 -
learning_rate: 1.5625e-05
Epoch 166/250
157/157      8s 50ms/step -
accuracy: 0.9297 - loss: 0.4158 - val_accuracy: 0.8753 - val_loss: 0.6278 -
learning_rate: 1.5625e-05
Epoch 167/250
157/157      8s 50ms/step -
accuracy: 0.9296 - loss: 0.4122 - val_accuracy: 0.8763 - val_loss: 0.6265 -

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learning_rate: 1.5625e-05
Epoch 168/250
157/157      8s 50ms/step -
accuracy: 0.9313 - loss: 0.4095 - val_accuracy: 0.8740 - val_loss: 0.6240 -
learning_rate: 1.5625e-05
Epoch 169/250
157/157      8s 50ms/step -
accuracy: 0.9304 - loss: 0.4105 - val_accuracy: 0.8746 - val_loss: 0.6303 -
learning_rate: 1.5625e-05
Epoch 170/250
157/157      8s 50ms/step -
accuracy: 0.9306 - loss: 0.4101 - val_accuracy: 0.8754 - val_loss: 0.6233 -
learning_rate: 1.5625e-05
Epoch 171/250
157/157      8s 50ms/step -
accuracy: 0.9347 - loss: 0.4001 - val_accuracy: 0.8750 - val_loss: 0.6246 -
learning_rate: 1.5625e-05
Epoch 172/250
157/157      8s 50ms/step -
accuracy: 0.9310 - loss: 0.4076 - val_accuracy: 0.8780 - val_loss: 0.6200 -
learning_rate: 1.5625e-05
Epoch 173/250
157/157      8s 50ms/step -
accuracy: 0.9317 - loss: 0.4059 - val_accuracy: 0.8757 - val_loss: 0.6219 -
learning_rate: 1.5625e-05
Epoch 174/250
157/157      8s 50ms/step -
accuracy: 0.9311 - loss: 0.4038 - val_accuracy: 0.8777 - val_loss: 0.6166 -
learning_rate: 1.5625e-05
Epoch 175/250
157/157      8s 50ms/step -
accuracy: 0.9332 - loss: 0.3989 - val_accuracy: 0.8765 - val_loss: 0.6194 -
learning_rate: 1.5625e-05
Epoch 176/250
157/157      8s 50ms/step -
accuracy: 0.9327 - loss: 0.3963 - val_accuracy: 0.8741 - val_loss: 0.6241 -
learning_rate: 1.5625e-05
Epoch 177/250
157/157      8s 50ms/step -
accuracy: 0.9295 - loss: 0.3987 - val_accuracy: 0.8741 - val_loss: 0.6230 -
learning_rate: 1.5625e-05
Epoch 178/250
157/157      8s 50ms/step -
accuracy: 0.9354 - loss: 0.3928 - val_accuracy: 0.8744 - val_loss: 0.6172 -
learning_rate: 1.5625e-05
Epoch 179/250
157/157      8s 50ms/step -
accuracy: 0.9335 - loss: 0.3895 - val_accuracy: 0.8751 - val_loss: 0.6272 -

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learning_rate: 1.5625e-05
Epoch 180/250
157/157          8s 50ms/step -
accuracy: 0.9358 - loss: 0.3867 - val_accuracy: 0.8778 - val_loss: 0.6180 -
learning_rate: 7.8125e-06
Epoch 181/250
157/157          8s 50ms/step -
accuracy: 0.9332 - loss: 0.3861 - val_accuracy: 0.8762 - val_loss: 0.6209 -
learning_rate: 7.8125e-06
Epoch 182/250
157/157          8s 50ms/step -
accuracy: 0.9356 - loss: 0.3857 - val_accuracy: 0.8773 - val_loss: 0.6205 -
learning_rate: 7.8125e-06
Epoch 183/250
157/157          8s 50ms/step -
accuracy: 0.9334 - loss: 0.3874 - val_accuracy: 0.8780 - val_loss: 0.6138 -
learning_rate: 7.8125e-06
Epoch 184/250
157/157          8s 50ms/step -
accuracy: 0.9366 - loss: 0.3788 - val_accuracy: 0.8775 - val_loss: 0.6149 -
learning_rate: 7.8125e-06
Epoch 185/250
157/157          8s 50ms/step -
accuracy: 0.9359 - loss: 0.3849 - val_accuracy: 0.8768 - val_loss: 0.6141 -
learning_rate: 7.8125e-06
Epoch 186/250
157/157          8s 50ms/step -
accuracy: 0.9360 - loss: 0.3801 - val_accuracy: 0.8772 - val_loss: 0.6107 -
learning_rate: 7.8125e-06
Epoch 187/250
157/157          8s 50ms/step -
accuracy: 0.9377 - loss: 0.3752 - val_accuracy: 0.8779 - val_loss: 0.6099 -
learning_rate: 7.8125e-06
Epoch 188/250
157/157          8s 50ms/step -
accuracy: 0.9387 - loss: 0.3776 - val_accuracy: 0.8769 - val_loss: 0.6117 -
learning_rate: 7.8125e-06
Epoch 189/250
157/157          8s 50ms/step -
accuracy: 0.9339 - loss: 0.3849 - val_accuracy: 0.8787 - val_loss: 0.6065 -
learning_rate: 7.8125e-06
Epoch 190/250
157/157          8s 50ms/step -
accuracy: 0.9397 - loss: 0.3693 - val_accuracy: 0.8779 - val_loss: 0.6099 -
learning_rate: 7.8125e-06
Epoch 191/250
157/157          8s 50ms/step -
accuracy: 0.9374 - loss: 0.3719 - val_accuracy: 0.8779 - val_loss: 0.6084 -

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learning_rate: 7.8125e-06
Epoch 192/250
157/157          8s 50ms/step -
accuracy: 0.9409 - loss: 0.3660 - val_accuracy: 0.8782 - val_loss: 0.6102 -
learning_rate: 7.8125e-06
Epoch 193/250
157/157          8s 50ms/step -
accuracy: 0.9387 - loss: 0.3694 - val_accuracy: 0.8761 - val_loss: 0.6085 -
learning_rate: 7.8125e-06
Epoch 194/250
157/157          8s 50ms/step -
accuracy: 0.9368 - loss: 0.3725 - val_accuracy: 0.8773 - val_loss: 0.6070 -
learning_rate: 7.8125e-06
Epoch 195/250
157/157          8s 50ms/step -
accuracy: 0.9410 - loss: 0.3605 - val_accuracy: 0.8772 - val_loss: 0.6089 -
learning_rate: 3.9063e-06
Epoch 196/250
157/157          8s 50ms/step -
accuracy: 0.9416 - loss: 0.3591 - val_accuracy: 0.8770 - val_loss: 0.6089 -
learning_rate: 3.9063e-06
Epoch 197/250
157/157          8s 50ms/step -
accuracy: 0.9379 - loss: 0.3697 - val_accuracy: 0.8772 - val_loss: 0.6093 -
learning_rate: 3.9063e-06
Epoch 198/250
157/157          8s 50ms/step -
accuracy: 0.9400 - loss: 0.3672 - val_accuracy: 0.8776 - val_loss: 0.6088 -
learning_rate: 3.9063e-06
Epoch 199/250
157/157          8s 50ms/step -
accuracy: 0.9378 - loss: 0.3662 - val_accuracy: 0.8791 - val_loss: 0.6059 -
learning_rate: 3.9063e-06
Epoch 200/250
157/157          8s 50ms/step -
accuracy: 0.9405 - loss: 0.3597 - val_accuracy: 0.8773 - val_loss: 0.6082 -
learning_rate: 3.9063e-06
Epoch 201/250
157/157          8s 50ms/step -
accuracy: 0.9364 - loss: 0.3656 - val_accuracy: 0.8777 - val_loss: 0.6066 -
learning_rate: 3.9063e-06
Epoch 202/250
157/157          8s 50ms/step -
accuracy: 0.9386 - loss: 0.3641 - val_accuracy: 0.8792 - val_loss: 0.6026 -
learning_rate: 3.9063e-06
Epoch 203/250
157/157          8s 50ms/step -
accuracy: 0.9416 - loss: 0.3588 - val_accuracy: 0.8799 - val_loss: 0.6009 -

```

```

learning_rate: 3.9063e-06
Epoch 204/250
157/157      8s 50ms/step -
accuracy: 0.9435 - loss: 0.3517 - val_accuracy: 0.8785 - val_loss: 0.6030 -
learning_rate: 3.9063e-06
Epoch 205/250
157/157      8s 50ms/step -
accuracy: 0.9415 - loss: 0.3553 - val_accuracy: 0.8775 - val_loss: 0.6049 -
learning_rate: 3.9063e-06
Epoch 206/250
157/157      8s 50ms/step -
accuracy: 0.9409 - loss: 0.3577 - val_accuracy: 0.8767 - val_loss: 0.6059 -
learning_rate: 3.9063e-06
Epoch 207/250
157/157      8s 50ms/step -
accuracy: 0.9402 - loss: 0.3569 - val_accuracy: 0.8761 - val_loss: 0.6053 -
learning_rate: 3.9063e-06
Epoch 208/250
157/157      8s 50ms/step -
accuracy: 0.9419 - loss: 0.3508 - val_accuracy: 0.8777 - val_loss: 0.6004 -
learning_rate: 3.9063e-06
Epoch 209/250
157/157      8s 50ms/step -
accuracy: 0.9414 - loss: 0.3562 - val_accuracy: 0.8770 - val_loss: 0.6043 -
learning_rate: 3.9063e-06
Epoch 210/250
157/157      8s 50ms/step -
accuracy: 0.9425 - loss: 0.3565 - val_accuracy: 0.8766 - val_loss: 0.6057 -
learning_rate: 3.9063e-06
Epoch 211/250
157/157      8s 50ms/step -
accuracy: 0.9426 - loss: 0.3542 - val_accuracy: 0.8771 - val_loss: 0.6031 -
learning_rate: 3.9063e-06
Epoch 212/250
157/157      8s 50ms/step -
accuracy: 0.9430 - loss: 0.3527 - val_accuracy: 0.8765 - val_loss: 0.6049 -
learning_rate: 3.9063e-06
Epoch 213/250
157/157      8s 50ms/step -
accuracy: 0.9438 - loss: 0.3492 - val_accuracy: 0.8777 - val_loss: 0.6011 -
learning_rate: 3.9063e-06
Epoch 214/250
157/157      8s 50ms/step -
accuracy: 0.9442 - loss: 0.3459 - val_accuracy: 0.8786 - val_loss: 0.6002 -
learning_rate: 1.9531e-06
Epoch 215/250
157/157      8s 50ms/step -
accuracy: 0.9433 - loss: 0.3454 - val_accuracy: 0.8773 - val_loss: 0.5997 -

```

```

learning_rate: 1.9531e-06
Epoch 216/250
157/157      8s 50ms/step -
accuracy: 0.9450 - loss: 0.3458 - val_accuracy: 0.8776 - val_loss: 0.5998 -
learning_rate: 1.9531e-06
Epoch 217/250
157/157      8s 50ms/step -
accuracy: 0.9434 - loss: 0.3482 - val_accuracy: 0.8778 - val_loss: 0.6009 -
learning_rate: 1.9531e-06
Epoch 218/250
157/157      8s 50ms/step -
accuracy: 0.9437 - loss: 0.3481 - val_accuracy: 0.8775 - val_loss: 0.6004 -
learning_rate: 1.9531e-06
Epoch 219/250
157/157      8s 50ms/step -
accuracy: 0.9412 - loss: 0.3540 - val_accuracy: 0.8788 - val_loss: 0.5997 -
learning_rate: 1.9531e-06
Epoch 220/250
157/157      8s 50ms/step -
accuracy: 0.9444 - loss: 0.3488 - val_accuracy: 0.8783 - val_loss: 0.6003 -
learning_rate: 1.9531e-06
Epoch 221/250
157/157      8s 50ms/step -
accuracy: 0.9438 - loss: 0.3442 - val_accuracy: 0.8781 - val_loss: 0.6007 -
learning_rate: 1.0000e-06
Epoch 222/250
157/157      8s 50ms/step -
accuracy: 0.9441 - loss: 0.3458 - val_accuracy: 0.8770 - val_loss: 0.6018 -
learning_rate: 1.0000e-06
Epoch 223/250
157/157      8s 50ms/step -
accuracy: 0.9465 - loss: 0.3401 - val_accuracy: 0.8778 - val_loss: 0.6006 -
learning_rate: 1.0000e-06
Epoch 224/250
157/157      8s 50ms/step -
accuracy: 0.9435 - loss: 0.3499 - val_accuracy: 0.8772 - val_loss: 0.6014 -
learning_rate: 1.0000e-06
Epoch 225/250
157/157      8s 50ms/step -
accuracy: 0.9412 - loss: 0.3512 - val_accuracy: 0.8781 - val_loss: 0.6020 -
learning_rate: 1.0000e-06
Epoch 226/250
157/157      8s 50ms/step -
accuracy: 0.9439 - loss: 0.3459 - val_accuracy: 0.8775 - val_loss: 0.6009 -
learning_rate: 1.0000e-06
Epoch 227/250
157/157     10s 50ms/step -
accuracy: 0.9437 - loss: 0.3497 - val_accuracy: 0.8778 - val_loss: 0.5991 -

```

```

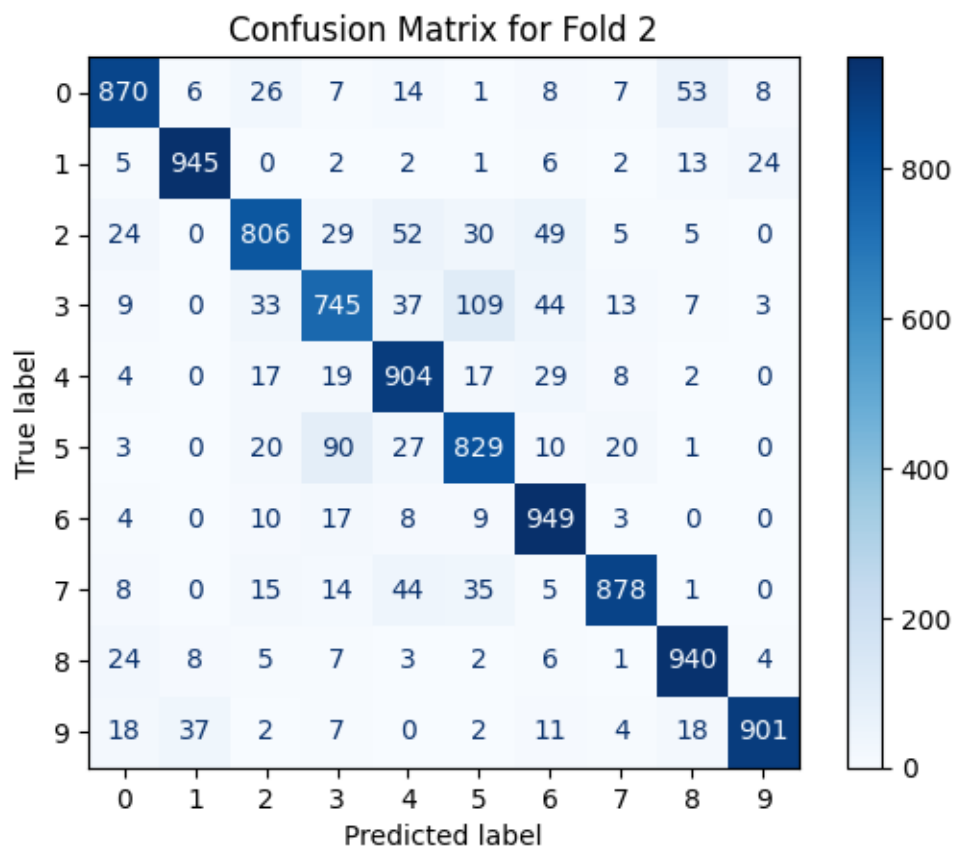
learning_rate: 1.0000e-06
Epoch 228/250
157/157      8s 50ms/step -
accuracy: 0.9433 - loss: 0.3474 - val_accuracy: 0.8775 - val_loss: 0.5993 -
learning_rate: 1.0000e-06
Epoch 229/250
157/157      8s 50ms/step -
accuracy: 0.9434 - loss: 0.3462 - val_accuracy: 0.8774 - val_loss: 0.5991 -
learning_rate: 1.0000e-06
Epoch 230/250
157/157      8s 50ms/step -
accuracy: 0.9422 - loss: 0.3524 - val_accuracy: 0.8776 - val_loss: 0.5987 -
learning_rate: 1.0000e-06
Epoch 231/250
157/157      8s 50ms/step -
accuracy: 0.9433 - loss: 0.3471 - val_accuracy: 0.8773 - val_loss: 0.5987 -
learning_rate: 1.0000e-06
Epoch 232/250
157/157      8s 50ms/step -
accuracy: 0.9446 - loss: 0.3432 - val_accuracy: 0.8772 - val_loss: 0.5989 -
learning_rate: 1.0000e-06
Epoch 233/250
157/157      8s 50ms/step -
accuracy: 0.9429 - loss: 0.3473 - val_accuracy: 0.8775 - val_loss: 0.6000 -
learning_rate: 1.0000e-06
Epoch 234/250
157/157      8s 50ms/step -
accuracy: 0.9461 - loss: 0.3429 - val_accuracy: 0.8780 - val_loss: 0.5989 -
learning_rate: 1.0000e-06
Epoch 235/250
157/157      8s 50ms/step -
accuracy: 0.9460 - loss: 0.3376 - val_accuracy: 0.8773 - val_loss: 0.5979 -
learning_rate: 1.0000e-06
Epoch 236/250
157/157      8s 51ms/step -
accuracy: 0.9458 - loss: 0.3389 - val_accuracy: 0.8780 - val_loss: 0.5966 -
learning_rate: 1.0000e-06
Epoch 237/250
157/157      8s 50ms/step -
accuracy: 0.9431 - loss: 0.3442 - val_accuracy: 0.8777 - val_loss: 0.5978 -
learning_rate: 1.0000e-06
Epoch 238/250
157/157      8s 50ms/step -
accuracy: 0.9458 - loss: 0.3367 - val_accuracy: 0.8778 - val_loss: 0.5973 -
learning_rate: 1.0000e-06
Epoch 239/250
157/157      8s 50ms/step -
accuracy: 0.9442 - loss: 0.3412 - val_accuracy: 0.8774 - val_loss: 0.5995 -

```

```

learning_rate: 1.0000e-06
Epoch 240/250
157/157      8s 50ms/step -
accuracy: 0.9451 - loss: 0.3371 - val_accuracy: 0.8777 - val_loss: 0.5988 -
learning_rate: 1.0000e-06
Epoch 241/250
157/157      8s 50ms/step -
accuracy: 0.9406 - loss: 0.3496 - val_accuracy: 0.8782 - val_loss: 0.5983 -
learning_rate: 1.0000e-06
Epoch 242/250
157/157      8s 50ms/step -
accuracy: 0.9496 - loss: 0.3332 - val_accuracy: 0.8779 - val_loss: 0.5983 -
learning_rate: 1.0000e-06
Epoch 243/250
157/157      8s 50ms/step -
accuracy: 0.9425 - loss: 0.3406 - val_accuracy: 0.8778 - val_loss: 0.5968 -
learning_rate: 1.0000e-06
Epoch 244/250
157/157      8s 50ms/step -
accuracy: 0.9453 - loss: 0.3405 - val_accuracy: 0.8779 - val_loss: 0.5968 -
learning_rate: 1.0000e-06
Epoch 245/250
157/157      8s 50ms/step -
accuracy: 0.9455 - loss: 0.3366 - val_accuracy: 0.8781 - val_loss: 0.5980 -
learning_rate: 1.0000e-06
Epoch 246/250
157/157      8s 50ms/step -
accuracy: 0.9438 - loss: 0.3437 - val_accuracy: 0.8778 - val_loss: 0.5974 -
learning_rate: 1.0000e-06
Epoch 247/250
157/157      8s 50ms/step -
accuracy: 0.9456 - loss: 0.3372 - val_accuracy: 0.8774 - val_loss: 0.5983 -
learning_rate: 1.0000e-06
Epoch 248/250
157/157      8s 50ms/step -
accuracy: 0.9469 - loss: 0.3375 - val_accuracy: 0.8778 - val_loss: 0.5972 -
learning_rate: 1.0000e-06
Epoch 249/250
157/157      8s 50ms/step -
accuracy: 0.9451 - loss: 0.3400 - val_accuracy: 0.8777 - val_loss: 0.5988 -
learning_rate: 1.0000e-06
Epoch 250/250
157/157      8s 50ms/step -
accuracy: 0.9456 - loss: 0.3438 - val_accuracy: 0.8778 - val_loss: 0.5982 -
learning_rate: 1.0000e-06
Score for fold 2: test loss of 0.6011090874671936; test accuracy of
87.66999840736389%
313/313      1s 3ms/step

```



Classification Report for Fold 2:

	precision	recall	f1-score	support
Class 0	0.90	0.87	0.88	1000
Class 1	0.95	0.94	0.95	1000
Class 2	0.86	0.81	0.83	1000
Class 3	0.80	0.74	0.77	1000
Class 4	0.83	0.90	0.86	1000
Class 5	0.80	0.83	0.81	1000
Class 6	0.85	0.95	0.90	1000
Class 7	0.93	0.88	0.90	1000
Class 8	0.90	0.94	0.92	1000
Class 9	0.96	0.90	0.93	1000
accuracy			0.88	10000
macro avg	0.88	0.88	0.88	10000
weighted avg	0.88	0.88	0.88	10000

/opt/conda/lib/python3.10/site-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not

pass an ``input_shape`/`input_dim`` argument to a layer. When using Sequential models, prefer using an ``Input(shape)`` object as the first layer in the model instead.

```
super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Epoch 1/250

157/157 32s 120ms/step -

accuracy: 0.2026 - loss: 12.5387 - val_accuracy: 0.2333 - val_loss: 6.5459 -
learning_rate: 0.0010

Epoch 2/250

157/157 8s 51ms/step -

accuracy: 0.3815 - loss: 5.2183 - val_accuracy: 0.2506 - val_loss: 3.8071 -
learning_rate: 0.0010

Epoch 3/250

157/157 8s 51ms/step -

accuracy: 0.4819 - loss: 3.0669 - val_accuracy: 0.5345 - val_loss: 2.6689 -
learning_rate: 0.0010

Epoch 4/250

157/157 8s 53ms/step -

accuracy: 0.5422 - loss: 2.5477 - val_accuracy: 0.5736 - val_loss: 2.4138 -
learning_rate: 0.0010

Epoch 5/250

157/157 10s 51ms/step -

accuracy: 0.5781 - loss: 2.3737 - val_accuracy: 0.6083 - val_loss: 2.2576 -
learning_rate: 0.0010

Epoch 6/250

157/157 8s 51ms/step -

accuracy: 0.6155 - loss: 2.2964 - val_accuracy: 0.6260 - val_loss: 2.2266 -
learning_rate: 0.0010

Epoch 7/250

157/157 8s 50ms/step -

accuracy: 0.6235 - loss: 2.2874 - val_accuracy: 0.6312 - val_loss: 2.2235 -
learning_rate: 0.0010

Epoch 8/250

157/157 8s 50ms/step -

accuracy: 0.6323 - loss: 2.2379 - val_accuracy: 0.6688 - val_loss: 2.1450 -
learning_rate: 0.0010

Epoch 9/250

157/157 8s 50ms/step -

accuracy: 0.6337 - loss: 2.2890 - val_accuracy: 0.6475 - val_loss: 2.1969 -
learning_rate: 0.0010

Epoch 10/250

157/157 8s 50ms/step -

accuracy: 0.6445 - loss: 2.2522 - val_accuracy: 0.6772 - val_loss: 2.0911 -
learning_rate: 0.0010

Epoch 11/250

157/157 8s 50ms/step -

accuracy: 0.6516 - loss: 2.2164 - val_accuracy: 0.5698 - val_loss: 2.4335 -

learning_rate: 0.0010
Epoch 12/250
157/157 8s 50ms/step -
accuracy: 0.6545 - loss: 2.2397 - val_accuracy: 0.6518 - val_loss: 2.2532 -
learning_rate: 0.0010
Epoch 13/250
157/157 8s 50ms/step -
accuracy: 0.6647 - loss: 2.2475 - val_accuracy: 0.6130 - val_loss: 2.4168 -
learning_rate: 0.0010
Epoch 14/250
157/157 8s 50ms/step -
accuracy: 0.6653 - loss: 2.2512 - val_accuracy: 0.6668 - val_loss: 2.2247 -
learning_rate: 0.0010
Epoch 15/250
157/157 8s 50ms/step -
accuracy: 0.6703 - loss: 2.2299 - val_accuracy: 0.6699 - val_loss: 2.2142 -
learning_rate: 0.0010
Epoch 16/250
157/157 8s 50ms/step -
accuracy: 0.6950 - loss: 2.0549 - val_accuracy: 0.7087 - val_loss: 1.7596 -
learning_rate: 5.0000e-04
Epoch 17/250
157/157 8s 50ms/step -
accuracy: 0.7082 - loss: 1.7847 - val_accuracy: 0.7117 - val_loss: 1.7132 -
learning_rate: 5.0000e-04
Epoch 18/250
157/157 8s 50ms/step -
accuracy: 0.7104 - loss: 1.7419 - val_accuracy: 0.6953 - val_loss: 1.7932 -
learning_rate: 5.0000e-04
Epoch 19/250
157/157 8s 50ms/step -
accuracy: 0.7147 - loss: 1.7611 - val_accuracy: 0.7314 - val_loss: 1.6844 -
learning_rate: 5.0000e-04
Epoch 20/250
157/157 8s 50ms/step -
accuracy: 0.7190 - loss: 1.7481 - val_accuracy: 0.7126 - val_loss: 1.7517 -
learning_rate: 5.0000e-04
Epoch 21/250
157/157 8s 50ms/step -
accuracy: 0.7178 - loss: 1.7566 - val_accuracy: 0.7277 - val_loss: 1.7241 -
learning_rate: 5.0000e-04
Epoch 22/250
157/157 8s 50ms/step -
accuracy: 0.7266 - loss: 1.7152 - val_accuracy: 0.7132 - val_loss: 1.7623 -
learning_rate: 5.0000e-04
Epoch 23/250
157/157 8s 50ms/step -
accuracy: 0.7164 - loss: 1.7515 - val_accuracy: 0.7546 - val_loss: 1.6405 -

```

learning_rate: 5.0000e-04
Epoch 24/250
157/157      8s 50ms/step -
accuracy: 0.7293 - loss: 1.7357 - val_accuracy: 0.7575 - val_loss: 1.6100 -
learning_rate: 5.0000e-04
Epoch 25/250
157/157      8s 50ms/step -
accuracy: 0.7251 - loss: 1.7045 - val_accuracy: 0.7550 - val_loss: 1.6098 -
learning_rate: 5.0000e-04
Epoch 26/250
157/157      8s 50ms/step -
accuracy: 0.7306 - loss: 1.6891 - val_accuracy: 0.7363 - val_loss: 1.6556 -
learning_rate: 5.0000e-04
Epoch 27/250
157/157      8s 50ms/step -
accuracy: 0.7399 - loss: 1.6643 - val_accuracy: 0.7432 - val_loss: 1.6541 -
learning_rate: 5.0000e-04
Epoch 28/250
157/157      8s 50ms/step -
accuracy: 0.7331 - loss: 1.6943 - val_accuracy: 0.7326 - val_loss: 1.6991 -
learning_rate: 5.0000e-04
Epoch 29/250
157/157      8s 50ms/step -
accuracy: 0.7414 - loss: 1.6803 - val_accuracy: 0.7491 - val_loss: 1.6280 -
learning_rate: 5.0000e-04
Epoch 30/250
157/157      8s 50ms/step -
accuracy: 0.7381 - loss: 1.6766 - val_accuracy: 0.7561 - val_loss: 1.6169 -
learning_rate: 5.0000e-04
Epoch 31/250
157/157      8s 50ms/step -
accuracy: 0.7528 - loss: 1.5863 - val_accuracy: 0.7736 - val_loss: 1.4073 -
learning_rate: 2.5000e-04
Epoch 32/250
157/157      8s 50ms/step -
accuracy: 0.7666 - loss: 1.4179 - val_accuracy: 0.7859 - val_loss: 1.3181 -
learning_rate: 2.5000e-04
Epoch 33/250
157/157      8s 50ms/step -
accuracy: 0.7760 - loss: 1.3362 - val_accuracy: 0.7938 - val_loss: 1.2660 -
learning_rate: 2.5000e-04
Epoch 34/250
157/157      8s 50ms/step -
accuracy: 0.7739 - loss: 1.3241 - val_accuracy: 0.7832 - val_loss: 1.2972 -
learning_rate: 2.5000e-04
Epoch 35/250
157/157      8s 50ms/step -
accuracy: 0.7755 - loss: 1.3111 - val_accuracy: 0.7777 - val_loss: 1.3069 -

```

```

learning_rate: 2.5000e-04
Epoch 36/250
157/157          8s 50ms/step -
accuracy: 0.7741 - loss: 1.3166 - val_accuracy: 0.8035 - val_loss: 1.2238 -
learning_rate: 2.5000e-04
Epoch 37/250
157/157          8s 50ms/step -
accuracy: 0.7793 - loss: 1.2971 - val_accuracy: 0.8074 - val_loss: 1.2108 -
learning_rate: 2.5000e-04
Epoch 38/250
157/157          8s 50ms/step -
accuracy: 0.7874 - loss: 1.2746 - val_accuracy: 0.7956 - val_loss: 1.2448 -
learning_rate: 2.5000e-04
Epoch 39/250
157/157          8s 50ms/step -
accuracy: 0.7822 - loss: 1.2780 - val_accuracy: 0.7876 - val_loss: 1.2940 -
learning_rate: 2.5000e-04
Epoch 40/250
157/157          8s 50ms/step -
accuracy: 0.7872 - loss: 1.2663 - val_accuracy: 0.8083 - val_loss: 1.2017 -
learning_rate: 2.5000e-04
Epoch 41/250
157/157          8s 50ms/step -
accuracy: 0.7934 - loss: 1.2611 - val_accuracy: 0.8017 - val_loss: 1.2325 -
learning_rate: 2.5000e-04
Epoch 42/250
157/157          8s 50ms/step -
accuracy: 0.7936 - loss: 1.2563 - val_accuracy: 0.8077 - val_loss: 1.2126 -
learning_rate: 2.5000e-04
Epoch 43/250
157/157          8s 50ms/step -
accuracy: 0.7922 - loss: 1.2580 - val_accuracy: 0.8061 - val_loss: 1.2060 -
learning_rate: 2.5000e-04
Epoch 44/250
157/157          8s 50ms/step -
accuracy: 0.7921 - loss: 1.2586 - val_accuracy: 0.7995 - val_loss: 1.2362 -
learning_rate: 2.5000e-04
Epoch 45/250
157/157          8s 50ms/step -
accuracy: 0.7923 - loss: 1.2561 - val_accuracy: 0.7947 - val_loss: 1.2537 -
learning_rate: 2.5000e-04
Epoch 46/250
157/157          8s 50ms/step -
accuracy: 0.8051 - loss: 1.2083 - val_accuracy: 0.8225 - val_loss: 1.1131 -
learning_rate: 1.2500e-04
Epoch 47/250
157/157          8s 50ms/step -
accuracy: 0.8181 - loss: 1.1178 - val_accuracy: 0.8321 - val_loss: 1.0457 -

```

learning_rate: 1.2500e-04
Epoch 48/250
157/157 8s 50ms/step -
accuracy: 0.8213 - loss: 1.0704 - val_accuracy: 0.8292 - val_loss: 1.0288 -
learning_rate: 1.2500e-04
Epoch 49/250
157/157 8s 50ms/step -
accuracy: 0.8215 - loss: 1.0399 - val_accuracy: 0.8295 - val_loss: 1.0180 -
learning_rate: 1.2500e-04
Epoch 50/250
157/157 8s 50ms/step -
accuracy: 0.8257 - loss: 1.0164 - val_accuracy: 0.8345 - val_loss: 0.9853 -
learning_rate: 1.2500e-04
Epoch 51/250
157/157 8s 50ms/step -
accuracy: 0.8227 - loss: 1.0130 - val_accuracy: 0.8352 - val_loss: 0.9678 -
learning_rate: 1.2500e-04
Epoch 52/250
157/157 8s 50ms/step -
accuracy: 0.8306 - loss: 0.9872 - val_accuracy: 0.8292 - val_loss: 0.9712 -
learning_rate: 1.2500e-04
Epoch 53/250
157/157 8s 50ms/step -
accuracy: 0.8337 - loss: 0.9795 - val_accuracy: 0.8371 - val_loss: 0.9546 -
learning_rate: 1.2500e-04
Epoch 54/250
157/157 8s 50ms/step -
accuracy: 0.8298 - loss: 0.9753 - val_accuracy: 0.8333 - val_loss: 0.9640 -
learning_rate: 1.2500e-04
Epoch 55/250
157/157 8s 50ms/step -
accuracy: 0.8360 - loss: 0.9493 - val_accuracy: 0.8329 - val_loss: 0.9570 -
learning_rate: 1.2500e-04
Epoch 56/250
157/157 8s 50ms/step -
accuracy: 0.8332 - loss: 0.9584 - val_accuracy: 0.8298 - val_loss: 0.9721 -
learning_rate: 1.2500e-04
Epoch 57/250
157/157 8s 50ms/step -
accuracy: 0.8326 - loss: 0.9520 - val_accuracy: 0.8342 - val_loss: 0.9585 -
learning_rate: 1.2500e-04
Epoch 58/250
157/157 8s 51ms/step -
accuracy: 0.8330 - loss: 0.9449 - val_accuracy: 0.8376 - val_loss: 0.9461 -
learning_rate: 1.2500e-04
Epoch 59/250
157/157 8s 50ms/step -
accuracy: 0.8370 - loss: 0.9332 - val_accuracy: 0.8286 - val_loss: 0.9802 -

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learning_rate: 1.2500e-04
Epoch 60/250
157/157          8s 50ms/step -
accuracy: 0.8361 - loss: 0.9362 - val_accuracy: 0.8417 - val_loss: 0.9328 -
learning_rate: 1.2500e-04
Epoch 61/250
157/157          8s 50ms/step -
accuracy: 0.8375 - loss: 0.9242 - val_accuracy: 0.8347 - val_loss: 0.9429 -
learning_rate: 1.2500e-04
Epoch 62/250
157/157          8s 50ms/step -
accuracy: 0.8397 - loss: 0.9261 - val_accuracy: 0.8356 - val_loss: 0.9464 -
learning_rate: 1.2500e-04
Epoch 63/250
157/157          8s 50ms/step -
accuracy: 0.8380 - loss: 0.9252 - val_accuracy: 0.8406 - val_loss: 0.9256 -
learning_rate: 1.2500e-04
Epoch 64/250
157/157         10s 50ms/step -
accuracy: 0.8402 - loss: 0.9166 - val_accuracy: 0.8336 - val_loss: 0.9462 -
learning_rate: 1.2500e-04
Epoch 65/250
157/157          8s 50ms/step -
accuracy: 0.8426 - loss: 0.9059 - val_accuracy: 0.8430 - val_loss: 0.9212 -
learning_rate: 1.2500e-04
Epoch 66/250
157/157          8s 50ms/step -
accuracy: 0.8425 - loss: 0.9040 - val_accuracy: 0.8477 - val_loss: 0.9032 -
learning_rate: 1.2500e-04
Epoch 67/250
157/157          8s 50ms/step -
accuracy: 0.8421 - loss: 0.9195 - val_accuracy: 0.8476 - val_loss: 0.9085 -
learning_rate: 1.2500e-04
Epoch 68/250
157/157          8s 50ms/step -
accuracy: 0.8442 - loss: 0.9090 - val_accuracy: 0.8414 - val_loss: 0.9333 -
learning_rate: 1.2500e-04
Epoch 69/250
157/157          8s 50ms/step -
accuracy: 0.8476 - loss: 0.9016 - val_accuracy: 0.8446 - val_loss: 0.9215 -
learning_rate: 1.2500e-04
Epoch 70/250
157/157          8s 50ms/step -
accuracy: 0.8444 - loss: 0.9032 - val_accuracy: 0.8391 - val_loss: 0.9392 -
learning_rate: 1.2500e-04
Epoch 71/250
157/157          8s 50ms/step -
accuracy: 0.8458 - loss: 0.8992 - val_accuracy: 0.8404 - val_loss: 0.9306 -

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learning_rate: 1.2500e-04
Epoch 72/250
157/157          8s 50ms/step -
accuracy: 0.8529 - loss: 0.8770 - val_accuracy: 0.8561 - val_loss: 0.8705 -
learning_rate: 6.2500e-05
Epoch 73/250
157/157          8s 51ms/step -
accuracy: 0.8612 - loss: 0.8457 - val_accuracy: 0.8591 - val_loss: 0.8525 -
learning_rate: 6.2500e-05
Epoch 74/250
157/157          8s 50ms/step -
accuracy: 0.8610 - loss: 0.8235 - val_accuracy: 0.8505 - val_loss: 0.8638 -
learning_rate: 6.2500e-05
Epoch 75/250
157/157          8s 50ms/step -
accuracy: 0.8670 - loss: 0.8015 - val_accuracy: 0.8547 - val_loss: 0.8411 -
learning_rate: 6.2500e-05
Epoch 76/250
157/157          8s 50ms/step -
accuracy: 0.8615 - loss: 0.7933 - val_accuracy: 0.8567 - val_loss: 0.8315 -
learning_rate: 6.2500e-05
Epoch 77/250
157/157          8s 50ms/step -
accuracy: 0.8702 - loss: 0.7701 - val_accuracy: 0.8580 - val_loss: 0.8259 -
learning_rate: 6.2500e-05
Epoch 78/250
157/157          8s 50ms/step -
accuracy: 0.8695 - loss: 0.7685 - val_accuracy: 0.8595 - val_loss: 0.8080 -
learning_rate: 6.2500e-05
Epoch 79/250
157/157         10s 51ms/step -
accuracy: 0.8693 - loss: 0.7609 - val_accuracy: 0.8620 - val_loss: 0.7973 -
learning_rate: 6.2500e-05
Epoch 80/250
157/157          8s 50ms/step -
accuracy: 0.8783 - loss: 0.7333 - val_accuracy: 0.8610 - val_loss: 0.7961 -
learning_rate: 6.2500e-05
Epoch 81/250
157/157          8s 50ms/step -
accuracy: 0.8770 - loss: 0.7320 - val_accuracy: 0.8613 - val_loss: 0.7935 -
learning_rate: 6.2500e-05
Epoch 82/250
157/157          8s 50ms/step -
accuracy: 0.8763 - loss: 0.7227 - val_accuracy: 0.8612 - val_loss: 0.7942 -
learning_rate: 6.2500e-05
Epoch 83/250
157/157          8s 50ms/step -
accuracy: 0.8738 - loss: 0.7315 - val_accuracy: 0.8616 - val_loss: 0.7888 -

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learning_rate: 6.2500e-05
Epoch 84/250
157/157 8s 50ms/step -
accuracy: 0.8750 - loss: 0.7182 - val_accuracy: 0.8644 - val_loss: 0.7708 -
learning_rate: 6.2500e-05
Epoch 85/250
157/157 8s 50ms/step -
accuracy: 0.8773 - loss: 0.7064 - val_accuracy: 0.8627 - val_loss: 0.7712 -
learning_rate: 6.2500e-05
Epoch 86/250
157/157 8s 50ms/step -
accuracy: 0.8772 - loss: 0.7065 - val_accuracy: 0.8652 - val_loss: 0.7647 -
learning_rate: 6.2500e-05
Epoch 87/250
157/157 8s 50ms/step -
accuracy: 0.8801 - loss: 0.6961 - val_accuracy: 0.8615 - val_loss: 0.7730 -
learning_rate: 6.2500e-05
Epoch 88/250
157/157 8s 50ms/step -
accuracy: 0.8752 - loss: 0.7027 - val_accuracy: 0.8668 - val_loss: 0.7635 -
learning_rate: 6.2500e-05
Epoch 89/250
157/157 8s 50ms/step -
accuracy: 0.8814 - loss: 0.6932 - val_accuracy: 0.8650 - val_loss: 0.7554 -
learning_rate: 6.2500e-05
Epoch 90/250
157/157 8s 50ms/step -
accuracy: 0.8820 - loss: 0.6848 - val_accuracy: 0.8639 - val_loss: 0.7472 -
learning_rate: 6.2500e-05
Epoch 91/250
157/157 8s 50ms/step -
accuracy: 0.8789 - loss: 0.6883 - val_accuracy: 0.8573 - val_loss: 0.7761 -
learning_rate: 6.2500e-05
Epoch 92/250
157/157 8s 50ms/step -
accuracy: 0.8785 - loss: 0.6873 - val_accuracy: 0.8645 - val_loss: 0.7550 -
learning_rate: 6.2500e-05
Epoch 93/250
157/157 8s 50ms/step -
accuracy: 0.8795 - loss: 0.6840 - val_accuracy: 0.8623 - val_loss: 0.7593 -
learning_rate: 6.2500e-05
Epoch 94/250
157/157 8s 50ms/step -
accuracy: 0.8848 - loss: 0.6631 - val_accuracy: 0.8661 - val_loss: 0.7489 -
learning_rate: 6.2500e-05
Epoch 95/250
157/157 8s 50ms/step -
accuracy: 0.8809 - loss: 0.6709 - val_accuracy: 0.8645 - val_loss: 0.7483 -

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learning_rate: 6.2500e-05
Epoch 96/250
157/157      8s 50ms/step -
accuracy: 0.8872 - loss: 0.6615 - val_accuracy: 0.8694 - val_loss: 0.7399 -
learning_rate: 3.1250e-05
Epoch 97/250
157/157      8s 50ms/step -
accuracy: 0.8891 - loss: 0.6466 - val_accuracy: 0.8695 - val_loss: 0.7329 -
learning_rate: 3.1250e-05
Epoch 98/250
157/157      8s 50ms/step -
accuracy: 0.8951 - loss: 0.6257 - val_accuracy: 0.8717 - val_loss: 0.7200 -
learning_rate: 3.1250e-05
Epoch 99/250
157/157      8s 50ms/step -
accuracy: 0.8956 - loss: 0.6201 - val_accuracy: 0.8662 - val_loss: 0.7327 -
learning_rate: 3.1250e-05
Epoch 100/250
157/157      8s 50ms/step -
accuracy: 0.8940 - loss: 0.6239 - val_accuracy: 0.8704 - val_loss: 0.7157 -
learning_rate: 3.1250e-05
Epoch 101/250
157/157      8s 50ms/step -
accuracy: 0.8946 - loss: 0.6129 - val_accuracy: 0.8694 - val_loss: 0.7119 -
learning_rate: 3.1250e-05
Epoch 102/250
157/157      8s 50ms/step -
accuracy: 0.8953 - loss: 0.6061 - val_accuracy: 0.8712 - val_loss: 0.7071 -
learning_rate: 3.1250e-05
Epoch 103/250
157/157      8s 50ms/step -
accuracy: 0.8988 - loss: 0.5950 - val_accuracy: 0.8700 - val_loss: 0.7095 -
learning_rate: 3.1250e-05
Epoch 104/250
157/157      8s 50ms/step -
accuracy: 0.9001 - loss: 0.5898 - val_accuracy: 0.8700 - val_loss: 0.7063 -
learning_rate: 3.1250e-05
Epoch 105/250
157/157      8s 50ms/step -
accuracy: 0.9023 - loss: 0.5819 - val_accuracy: 0.8730 - val_loss: 0.7006 -
learning_rate: 3.1250e-05
Epoch 106/250
157/157      8s 50ms/step -
accuracy: 0.9020 - loss: 0.5817 - val_accuracy: 0.8738 - val_loss: 0.6965 -
learning_rate: 3.1250e-05
Epoch 107/250
157/157      8s 50ms/step -
accuracy: 0.9018 - loss: 0.5730 - val_accuracy: 0.8722 - val_loss: 0.6934 -

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learning_rate: 3.1250e-05
Epoch 108/250
157/157          8s 50ms/step -
accuracy: 0.9030 - loss: 0.5622 - val_accuracy: 0.8752 - val_loss: 0.6862 -
learning_rate: 3.1250e-05
Epoch 109/250
157/157          8s 50ms/step -
accuracy: 0.9001 - loss: 0.5718 - val_accuracy: 0.8777 - val_loss: 0.6812 -
learning_rate: 3.1250e-05
Epoch 110/250
157/157          8s 50ms/step -
accuracy: 0.9034 - loss: 0.5573 - val_accuracy: 0.8749 - val_loss: 0.6835 -
learning_rate: 3.1250e-05
Epoch 111/250
157/157          8s 50ms/step -
accuracy: 0.9051 - loss: 0.5543 - val_accuracy: 0.8758 - val_loss: 0.6815 -
learning_rate: 3.1250e-05
Epoch 112/250
157/157          8s 50ms/step -
accuracy: 0.9053 - loss: 0.5488 - val_accuracy: 0.8741 - val_loss: 0.6819 -
learning_rate: 3.1250e-05
Epoch 113/250
157/157          8s 50ms/step -
accuracy: 0.9036 - loss: 0.5523 - val_accuracy: 0.8738 - val_loss: 0.6847 -
learning_rate: 3.1250e-05
Epoch 114/250
157/157          8s 50ms/step -
accuracy: 0.9056 - loss: 0.5419 - val_accuracy: 0.8736 - val_loss: 0.6817 -
learning_rate: 3.1250e-05
Epoch 115/250
157/157          8s 50ms/step -
accuracy: 0.9058 - loss: 0.5322 - val_accuracy: 0.8740 - val_loss: 0.6755 -
learning_rate: 1.5625e-05
Epoch 116/250
157/157          8s 50ms/step -
accuracy: 0.9081 - loss: 0.5284 - val_accuracy: 0.8758 - val_loss: 0.6756 -
learning_rate: 1.5625e-05
Epoch 117/250
157/157          8s 50ms/step -
accuracy: 0.9115 - loss: 0.5205 - val_accuracy: 0.8762 - val_loss: 0.6684 -
learning_rate: 1.5625e-05
Epoch 118/250
157/157          8s 50ms/step -
accuracy: 0.9084 - loss: 0.5254 - val_accuracy: 0.8768 - val_loss: 0.6660 -
learning_rate: 1.5625e-05
Epoch 119/250
157/157          8s 50ms/step -
accuracy: 0.9109 - loss: 0.5190 - val_accuracy: 0.8769 - val_loss: 0.6662 -

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learning_rate: 1.5625e-05
Epoch 120/250
157/157          8s 50ms/step -
accuracy: 0.9110 - loss: 0.5223 - val_accuracy: 0.8778 - val_loss: 0.6608 -
learning_rate: 1.5625e-05
Epoch 121/250
157/157          8s 50ms/step -
accuracy: 0.9155 - loss: 0.5066 - val_accuracy: 0.8771 - val_loss: 0.6608 -
learning_rate: 1.5625e-05
Epoch 122/250
157/157          8s 50ms/step -
accuracy: 0.9144 - loss: 0.5064 - val_accuracy: 0.8782 - val_loss: 0.6568 -
learning_rate: 1.5625e-05
Epoch 123/250
157/157          8s 50ms/step -
accuracy: 0.9153 - loss: 0.4984 - val_accuracy: 0.8785 - val_loss: 0.6584 -
learning_rate: 1.5625e-05
Epoch 124/250
157/157          8s 50ms/step -
accuracy: 0.9130 - loss: 0.5054 - val_accuracy: 0.8785 - val_loss: 0.6529 -
learning_rate: 1.5625e-05
Epoch 125/250
157/157          8s 50ms/step -
accuracy: 0.9144 - loss: 0.4966 - val_accuracy: 0.8781 - val_loss: 0.6548 -
learning_rate: 1.5625e-05
Epoch 126/250
157/157          8s 50ms/step -
accuracy: 0.9194 - loss: 0.4928 - val_accuracy: 0.8773 - val_loss: 0.6601 -
learning_rate: 1.5625e-05
Epoch 127/250
157/157          8s 50ms/step -
accuracy: 0.9131 - loss: 0.4993 - val_accuracy: 0.8797 - val_loss: 0.6508 -
learning_rate: 1.5625e-05
Epoch 128/250
157/157          8s 50ms/step -
accuracy: 0.9153 - loss: 0.4896 - val_accuracy: 0.8787 - val_loss: 0.6505 -
learning_rate: 1.5625e-05
Epoch 129/250
157/157          8s 50ms/step -
accuracy: 0.9181 - loss: 0.4813 - val_accuracy: 0.8812 - val_loss: 0.6468 -
learning_rate: 1.5625e-05
Epoch 130/250
157/157          8s 50ms/step -
accuracy: 0.9182 - loss: 0.4767 - val_accuracy: 0.8777 - val_loss: 0.6459 -
learning_rate: 1.5625e-05
Epoch 131/250
157/157          8s 50ms/step -
accuracy: 0.9157 - loss: 0.4867 - val_accuracy: 0.8779 - val_loss: 0.6458 -

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learning_rate: 1.5625e-05
Epoch 132/250
157/157          8s 50ms/step -
accuracy: 0.9174 - loss: 0.4770 - val_accuracy: 0.8757 - val_loss: 0.6534 -
learning_rate: 1.5625e-05
Epoch 133/250
157/157          8s 50ms/step -
accuracy: 0.9194 - loss: 0.4712 - val_accuracy: 0.8782 - val_loss: 0.6433 -
learning_rate: 1.5625e-05
Epoch 134/250
157/157          8s 50ms/step -
accuracy: 0.9197 - loss: 0.4667 - val_accuracy: 0.8791 - val_loss: 0.6396 -
learning_rate: 1.5625e-05
Epoch 135/250
157/157          8s 50ms/step -
accuracy: 0.9187 - loss: 0.4710 - val_accuracy: 0.8804 - val_loss: 0.6353 -
learning_rate: 1.5625e-05
Epoch 136/250
157/157          8s 50ms/step -
accuracy: 0.9168 - loss: 0.4689 - val_accuracy: 0.8762 - val_loss: 0.6490 -
learning_rate: 1.5625e-05
Epoch 137/250
157/157          8s 50ms/step -
accuracy: 0.9199 - loss: 0.4678 - val_accuracy: 0.8780 - val_loss: 0.6363 -
learning_rate: 1.5625e-05
Epoch 138/250
157/157          8s 50ms/step -
accuracy: 0.9186 - loss: 0.4637 - val_accuracy: 0.8772 - val_loss: 0.6446 -
learning_rate: 1.5625e-05
Epoch 139/250
157/157          8s 50ms/step -
accuracy: 0.9180 - loss: 0.4730 - val_accuracy: 0.8768 - val_loss: 0.6425 -
learning_rate: 1.5625e-05
Epoch 140/250
157/157          8s 50ms/step -
accuracy: 0.9266 - loss: 0.4470 - val_accuracy: 0.8801 - val_loss: 0.6325 -
learning_rate: 1.5625e-05
Epoch 141/250
157/157          8s 50ms/step -
accuracy: 0.9241 - loss: 0.4515 - val_accuracy: 0.8791 - val_loss: 0.6350 -
learning_rate: 1.5625e-05
Epoch 142/250
157/157          8s 50ms/step -
accuracy: 0.9248 - loss: 0.4488 - val_accuracy: 0.8799 - val_loss: 0.6336 -
learning_rate: 1.5625e-05
Epoch 143/250
157/157          8s 50ms/step -
accuracy: 0.9243 - loss: 0.4445 - val_accuracy: 0.8797 - val_loss: 0.6352 -

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learning_rate: 1.5625e-05
Epoch 144/250
157/157      8s 50ms/step -
accuracy: 0.9254 - loss: 0.4487 - val_accuracy: 0.8788 - val_loss: 0.6346 -
learning_rate: 1.5625e-05
Epoch 145/250
157/157      8s 50ms/step -
accuracy: 0.9229 - loss: 0.4466 - val_accuracy: 0.8773 - val_loss: 0.6353 -
learning_rate: 1.5625e-05
Epoch 146/250
157/157      8s 50ms/step -
accuracy: 0.9248 - loss: 0.4445 - val_accuracy: 0.8781 - val_loss: 0.6286 -
learning_rate: 7.8125e-06
Epoch 147/250
157/157      8s 50ms/step -
accuracy: 0.9197 - loss: 0.4519 - val_accuracy: 0.8786 - val_loss: 0.6285 -
learning_rate: 7.8125e-06
Epoch 148/250
157/157      8s 50ms/step -
accuracy: 0.9256 - loss: 0.4370 - val_accuracy: 0.8793 - val_loss: 0.6267 -
learning_rate: 7.8125e-06
Epoch 149/250
157/157      8s 50ms/step -
accuracy: 0.9265 - loss: 0.4355 - val_accuracy: 0.8811 - val_loss: 0.6225 -
learning_rate: 7.8125e-06
Epoch 150/250
157/157      8s 50ms/step -
accuracy: 0.9266 - loss: 0.4327 - val_accuracy: 0.8808 - val_loss: 0.6222 -
learning_rate: 7.8125e-06
Epoch 151/250
157/157      8s 50ms/step -
accuracy: 0.9265 - loss: 0.4287 - val_accuracy: 0.8811 - val_loss: 0.6240 -
learning_rate: 7.8125e-06
Epoch 152/250
157/157      8s 50ms/step -
accuracy: 0.9271 - loss: 0.4285 - val_accuracy: 0.8815 - val_loss: 0.6203 -
learning_rate: 7.8125e-06
Epoch 153/250
157/157      8s 50ms/step -
accuracy: 0.9255 - loss: 0.4290 - val_accuracy: 0.8805 - val_loss: 0.6211 -
learning_rate: 7.8125e-06
Epoch 154/250
157/157      8s 50ms/step -
accuracy: 0.9279 - loss: 0.4256 - val_accuracy: 0.8799 - val_loss: 0.6192 -
learning_rate: 7.8125e-06
Epoch 155/250
157/157      8s 50ms/step -
accuracy: 0.9296 - loss: 0.4209 - val_accuracy: 0.8817 - val_loss: 0.6212 -

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learning_rate: 7.8125e-06
Epoch 156/250
157/157      8s 50ms/step -
accuracy: 0.9310 - loss: 0.4178 - val_accuracy: 0.8826 - val_loss: 0.6166 -
learning_rate: 7.8125e-06
Epoch 157/250
157/157      8s 50ms/step -
accuracy: 0.9301 - loss: 0.4177 - val_accuracy: 0.8805 - val_loss: 0.6221 -
learning_rate: 7.8125e-06
Epoch 158/250
157/157      8s 50ms/step -
accuracy: 0.9300 - loss: 0.4217 - val_accuracy: 0.8820 - val_loss: 0.6207 -
learning_rate: 7.8125e-06
Epoch 159/250
157/157      8s 50ms/step -
accuracy: 0.9289 - loss: 0.4184 - val_accuracy: 0.8809 - val_loss: 0.6193 -
learning_rate: 7.8125e-06
Epoch 160/250
157/157      8s 50ms/step -
accuracy: 0.9280 - loss: 0.4206 - val_accuracy: 0.8819 - val_loss: 0.6153 -
learning_rate: 7.8125e-06
Epoch 161/250
157/157      8s 50ms/step -
accuracy: 0.9323 - loss: 0.4153 - val_accuracy: 0.8817 - val_loss: 0.6179 -
learning_rate: 7.8125e-06
Epoch 162/250
157/157      8s 50ms/step -
accuracy: 0.9303 - loss: 0.4095 - val_accuracy: 0.8824 - val_loss: 0.6167 -
learning_rate: 7.8125e-06
Epoch 163/250
157/157      8s 50ms/step -
accuracy: 0.9267 - loss: 0.4176 - val_accuracy: 0.8813 - val_loss: 0.6142 -
learning_rate: 7.8125e-06
Epoch 164/250
157/157      8s 50ms/step -
accuracy: 0.9293 - loss: 0.4141 - val_accuracy: 0.8819 - val_loss: 0.6166 -
learning_rate: 7.8125e-06
Epoch 165/250
157/157      8s 50ms/step -
accuracy: 0.9303 - loss: 0.4104 - val_accuracy: 0.8831 - val_loss: 0.6133 -
learning_rate: 7.8125e-06
Epoch 166/250
157/157      8s 50ms/step -
accuracy: 0.9327 - loss: 0.4058 - val_accuracy: 0.8801 - val_loss: 0.6186 -
learning_rate: 7.8125e-06
Epoch 167/250
157/157      8s 50ms/step -
accuracy: 0.9300 - loss: 0.4102 - val_accuracy: 0.8818 - val_loss: 0.6167 -

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learning_rate: 7.8125e-06
Epoch 168/250
157/157      8s 51ms/step -
accuracy: 0.9331 - loss: 0.3999 - val_accuracy: 0.8840 - val_loss: 0.6077 -
learning_rate: 7.8125e-06
Epoch 169/250
157/157      8s 50ms/step -
accuracy: 0.9317 - loss: 0.4073 - val_accuracy: 0.8821 - val_loss: 0.6110 -
learning_rate: 7.8125e-06
Epoch 170/250
157/157      8s 50ms/step -
accuracy: 0.9302 - loss: 0.4078 - val_accuracy: 0.8812 - val_loss: 0.6099 -
learning_rate: 7.8125e-06
Epoch 171/250
157/157      8s 50ms/step -
accuracy: 0.9323 - loss: 0.4032 - val_accuracy: 0.8835 - val_loss: 0.6059 -
learning_rate: 7.8125e-06
Epoch 172/250
157/157      8s 50ms/step -
accuracy: 0.9308 - loss: 0.4061 - val_accuracy: 0.8819 - val_loss: 0.6108 -
learning_rate: 7.8125e-06
Epoch 173/250
157/157      8s 50ms/step -
accuracy: 0.9302 - loss: 0.4072 - val_accuracy: 0.8832 - val_loss: 0.6070 -
learning_rate: 7.8125e-06
Epoch 174/250
157/157      8s 50ms/step -
accuracy: 0.9304 - loss: 0.4047 - val_accuracy: 0.8839 - val_loss: 0.6060 -
learning_rate: 7.8125e-06
Epoch 175/250
157/157      8s 50ms/step -
accuracy: 0.9286 - loss: 0.4051 - val_accuracy: 0.8826 - val_loss: 0.6077 -
learning_rate: 7.8125e-06
Epoch 176/250
157/157      8s 50ms/step -
accuracy: 0.9324 - loss: 0.3993 - val_accuracy: 0.8823 - val_loss: 0.6066 -
learning_rate: 7.8125e-06
Epoch 177/250
157/157      8s 50ms/step -
accuracy: 0.9348 - loss: 0.3896 - val_accuracy: 0.8837 - val_loss: 0.6063 -
learning_rate: 3.9063e-06
Epoch 178/250
157/157      8s 50ms/step -
accuracy: 0.9340 - loss: 0.3927 - val_accuracy: 0.8837 - val_loss: 0.6043 -
learning_rate: 3.9063e-06
Epoch 179/250
157/157      8s 50ms/step -
accuracy: 0.9358 - loss: 0.3911 - val_accuracy: 0.8856 - val_loss: 0.6017 -

```

```

learning_rate: 3.9063e-06
Epoch 180/250
157/157      8s 50ms/step -
accuracy: 0.9350 - loss: 0.3902 - val_accuracy: 0.8841 - val_loss: 0.6050 -
learning_rate: 3.9063e-06
Epoch 181/250
157/157      8s 50ms/step -
accuracy: 0.9355 - loss: 0.3847 - val_accuracy: 0.8840 - val_loss: 0.6038 -
learning_rate: 3.9063e-06
Epoch 182/250
157/157      8s 50ms/step -
accuracy: 0.9338 - loss: 0.3930 - val_accuracy: 0.8835 - val_loss: 0.6031 -
learning_rate: 3.9063e-06
Epoch 183/250
157/157      8s 50ms/step -
accuracy: 0.9364 - loss: 0.3904 - val_accuracy: 0.8847 - val_loss: 0.6025 -
learning_rate: 3.9063e-06
Epoch 184/250
157/157      8s 50ms/step -
accuracy: 0.9314 - loss: 0.3963 - val_accuracy: 0.8842 - val_loss: 0.6015 -
learning_rate: 3.9063e-06
Epoch 185/250
157/157      8s 50ms/step -
accuracy: 0.9330 - loss: 0.3906 - val_accuracy: 0.8827 - val_loss: 0.6012 -
learning_rate: 3.9063e-06
Epoch 186/250
157/157      8s 50ms/step -
accuracy: 0.9338 - loss: 0.3862 - val_accuracy: 0.8841 - val_loss: 0.6009 -
learning_rate: 3.9063e-06
Epoch 187/250
157/157      8s 50ms/step -
accuracy: 0.9368 - loss: 0.3836 - val_accuracy: 0.8845 - val_loss: 0.6012 -
learning_rate: 3.9063e-06
Epoch 188/250
157/157      8s 50ms/step -
accuracy: 0.9351 - loss: 0.3879 - val_accuracy: 0.8842 - val_loss: 0.6003 -
learning_rate: 3.9063e-06
Epoch 189/250
157/157      8s 50ms/step -
accuracy: 0.9329 - loss: 0.3844 - val_accuracy: 0.8838 - val_loss: 0.6010 -
learning_rate: 3.9063e-06
Epoch 190/250
157/157      8s 50ms/step -
accuracy: 0.9357 - loss: 0.3823 - val_accuracy: 0.8845 - val_loss: 0.5987 -
learning_rate: 3.9063e-06
Epoch 191/250
157/157      8s 50ms/step -
accuracy: 0.9350 - loss: 0.3865 - val_accuracy: 0.8834 - val_loss: 0.6001 -

```

```

learning_rate: 3.9063e-06
Epoch 192/250
157/157          8s 50ms/step -
accuracy: 0.9384 - loss: 0.3756 - val_accuracy: 0.8843 - val_loss: 0.5962 -
learning_rate: 3.9063e-06
Epoch 193/250
157/157          8s 50ms/step -
accuracy: 0.9339 - loss: 0.3892 - val_accuracy: 0.8835 - val_loss: 0.6009 -
learning_rate: 3.9063e-06
Epoch 194/250
157/157          8s 50ms/step -
accuracy: 0.9368 - loss: 0.3786 - val_accuracy: 0.8827 - val_loss: 0.6018 -
learning_rate: 3.9063e-06
Epoch 195/250
157/157          8s 50ms/step -
accuracy: 0.9320 - loss: 0.3918 - val_accuracy: 0.8830 - val_loss: 0.5987 -
learning_rate: 3.9063e-06
Epoch 196/250
157/157          8s 50ms/step -
accuracy: 0.9371 - loss: 0.3788 - val_accuracy: 0.8824 - val_loss: 0.6025 -
learning_rate: 3.9063e-06
Epoch 197/250
157/157          8s 50ms/step -
accuracy: 0.9358 - loss: 0.3799 - val_accuracy: 0.8841 - val_loss: 0.5997 -
learning_rate: 3.9063e-06
Epoch 198/250
157/157          8s 50ms/step -
accuracy: 0.9390 - loss: 0.3755 - val_accuracy: 0.8826 - val_loss: 0.6000 -
learning_rate: 1.9531e-06
Epoch 199/250
157/157          8s 50ms/step -
accuracy: 0.9349 - loss: 0.3828 - val_accuracy: 0.8832 - val_loss: 0.5981 -
learning_rate: 1.9531e-06
Epoch 200/250
157/157          8s 50ms/step -
accuracy: 0.9361 - loss: 0.3783 - val_accuracy: 0.8833 - val_loss: 0.5978 -
learning_rate: 1.9531e-06
Epoch 201/250
157/157          8s 50ms/step -
accuracy: 0.9367 - loss: 0.3776 - val_accuracy: 0.8839 - val_loss: 0.5985 -
learning_rate: 1.9531e-06
Epoch 202/250
157/157          8s 50ms/step -
accuracy: 0.9376 - loss: 0.3741 - val_accuracy: 0.8830 - val_loss: 0.5987 -
learning_rate: 1.9531e-06
Epoch 203/250
157/157          8s 50ms/step -
accuracy: 0.9380 - loss: 0.3781 - val_accuracy: 0.8830 - val_loss: 0.5974 -

```



```

learning_rate: 1.0000e-06
Epoch 204/250
157/157          8s 50ms/step -
accuracy: 0.9368 - loss: 0.3737 - val_accuracy: 0.8834 - val_loss: 0.5973 -
learning_rate: 1.0000e-06
Epoch 205/250
157/157          8s 50ms/step -
accuracy: 0.9359 - loss: 0.3740 - val_accuracy: 0.8835 - val_loss: 0.5965 -
learning_rate: 1.0000e-06
Epoch 206/250
157/157          8s 50ms/step -
accuracy: 0.9386 - loss: 0.3758 - val_accuracy: 0.8838 - val_loss: 0.5959 -
learning_rate: 1.0000e-06
Epoch 207/250
157/157          8s 51ms/step -
accuracy: 0.9380 - loss: 0.3759 - val_accuracy: 0.8838 - val_loss: 0.5960 -
learning_rate: 1.0000e-06
Epoch 208/250
157/157          8s 51ms/step -
accuracy: 0.9410 - loss: 0.3691 - val_accuracy: 0.8839 - val_loss: 0.5960 -
learning_rate: 1.0000e-06
Epoch 209/250
157/157          8s 51ms/step -
accuracy: 0.9354 - loss: 0.3774 - val_accuracy: 0.8850 - val_loss: 0.5946 -
learning_rate: 1.0000e-06
Epoch 210/250
157/157          8s 50ms/step -
accuracy: 0.9380 - loss: 0.3754 - val_accuracy: 0.8845 - val_loss: 0.5939 -
learning_rate: 1.0000e-06
Epoch 211/250
157/157          8s 50ms/step -
accuracy: 0.9347 - loss: 0.3840 - val_accuracy: 0.8842 - val_loss: 0.5941 -
learning_rate: 1.0000e-06
Epoch 212/250
157/157          8s 50ms/step -
accuracy: 0.9407 - loss: 0.3655 - val_accuracy: 0.8836 - val_loss: 0.5939 -
learning_rate: 1.0000e-06
Epoch 213/250
157/157          8s 50ms/step -
accuracy: 0.9387 - loss: 0.3715 - val_accuracy: 0.8847 - val_loss: 0.5933 -
learning_rate: 1.0000e-06
Epoch 214/250
157/157          8s 50ms/step -
accuracy: 0.9375 - loss: 0.3734 - val_accuracy: 0.8842 - val_loss: 0.5940 -
learning_rate: 1.0000e-06
Epoch 215/250
157/157          8s 50ms/step -
accuracy: 0.9371 - loss: 0.3749 - val_accuracy: 0.8842 - val_loss: 0.5935 -

```

```

learning_rate: 1.0000e-06
Epoch 216/250
157/157      8s 50ms/step -
accuracy: 0.9388 - loss: 0.3695 - val_accuracy: 0.8844 - val_loss: 0.5935 -
learning_rate: 1.0000e-06
Epoch 217/250
157/157      8s 50ms/step -
accuracy: 0.9405 - loss: 0.3649 - val_accuracy: 0.8843 - val_loss: 0.5933 -
learning_rate: 1.0000e-06
Epoch 218/250
157/157      8s 50ms/step -
accuracy: 0.9416 - loss: 0.3645 - val_accuracy: 0.8847 - val_loss: 0.5931 -
learning_rate: 1.0000e-06
Epoch 219/250
157/157      8s 50ms/step -
accuracy: 0.9380 - loss: 0.3742 - val_accuracy: 0.8846 - val_loss: 0.5941 -
learning_rate: 1.0000e-06
Epoch 220/250
157/157      8s 50ms/step -
accuracy: 0.9369 - loss: 0.3725 - val_accuracy: 0.8847 - val_loss: 0.5937 -
learning_rate: 1.0000e-06
Epoch 221/250
157/157      8s 50ms/step -
accuracy: 0.9353 - loss: 0.3768 - val_accuracy: 0.8841 - val_loss: 0.5951 -
learning_rate: 1.0000e-06
Epoch 222/250
157/157      8s 50ms/step -
accuracy: 0.9384 - loss: 0.3734 - val_accuracy: 0.8839 - val_loss: 0.5947 -
learning_rate: 1.0000e-06
Epoch 223/250
157/157      8s 50ms/step -
accuracy: 0.9380 - loss: 0.3743 - val_accuracy: 0.8841 - val_loss: 0.5944 -
learning_rate: 1.0000e-06
Epoch 224/250
157/157      8s 50ms/step -
accuracy: 0.9380 - loss: 0.3746 - val_accuracy: 0.8844 - val_loss: 0.5950 -
learning_rate: 1.0000e-06
Epoch 225/250
157/157      8s 50ms/step -
accuracy: 0.9405 - loss: 0.3705 - val_accuracy: 0.8842 - val_loss: 0.5939 -
learning_rate: 1.0000e-06
Epoch 226/250
157/157      8s 50ms/step -
accuracy: 0.9402 - loss: 0.3672 - val_accuracy: 0.8841 - val_loss: 0.5944 -
learning_rate: 1.0000e-06
Epoch 227/250
157/157      8s 50ms/step -
accuracy: 0.9408 - loss: 0.3627 - val_accuracy: 0.8834 - val_loss: 0.5950 -

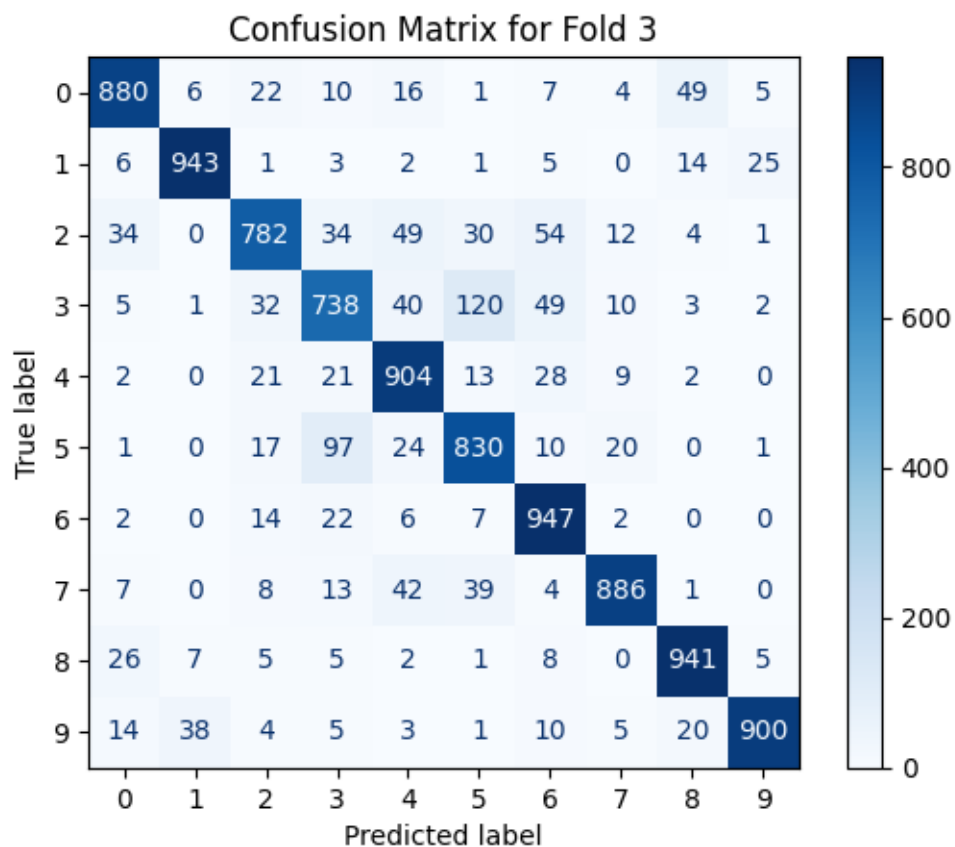
```

learning_rate: 1.0000e-06
Epoch 228/250
157/157 8s 50ms/step -
accuracy: 0.9374 - loss: 0.3746 - val_accuracy: 0.8848 - val_loss: 0.5940 -
learning_rate: 1.0000e-06
Epoch 229/250
157/157 8s 50ms/step -
accuracy: 0.9390 - loss: 0.3654 - val_accuracy: 0.8838 - val_loss: 0.5944 -
learning_rate: 1.0000e-06
Epoch 230/250
157/157 8s 50ms/step -
accuracy: 0.9391 - loss: 0.3687 - val_accuracy: 0.8842 - val_loss: 0.5939 -
learning_rate: 1.0000e-06
Epoch 231/250
157/157 8s 50ms/step -
accuracy: 0.9369 - loss: 0.3700 - val_accuracy: 0.8842 - val_loss: 0.5934 -
learning_rate: 1.0000e-06
Epoch 232/250
157/157 8s 50ms/step -
accuracy: 0.9406 - loss: 0.3647 - val_accuracy: 0.8847 - val_loss: 0.5930 -
learning_rate: 1.0000e-06
Epoch 233/250
157/157 8s 50ms/step -
accuracy: 0.9390 - loss: 0.3662 - val_accuracy: 0.8842 - val_loss: 0.5932 -
learning_rate: 1.0000e-06
Epoch 234/250
157/157 8s 50ms/step -
accuracy: 0.9387 - loss: 0.3632 - val_accuracy: 0.8839 - val_loss: 0.5932 -
learning_rate: 1.0000e-06
Epoch 235/250
157/157 8s 50ms/step -
accuracy: 0.9427 - loss: 0.3635 - val_accuracy: 0.8842 - val_loss: 0.5926 -
learning_rate: 1.0000e-06
Epoch 236/250
157/157 8s 50ms/step -
accuracy: 0.9387 - loss: 0.3643 - val_accuracy: 0.8844 - val_loss: 0.5936 -
learning_rate: 1.0000e-06
Epoch 237/250
157/157 8s 50ms/step -
accuracy: 0.9396 - loss: 0.3676 - val_accuracy: 0.8842 - val_loss: 0.5931 -
learning_rate: 1.0000e-06
Epoch 238/250
157/157 8s 50ms/step -
accuracy: 0.9391 - loss: 0.3683 - val_accuracy: 0.8842 - val_loss: 0.5939 -
learning_rate: 1.0000e-06
Epoch 239/250
157/157 8s 50ms/step -
accuracy: 0.9376 - loss: 0.3724 - val_accuracy: 0.8843 - val_loss: 0.5938 -

```

learning_rate: 1.0000e-06
Epoch 240/250
157/157      8s 50ms/step -
accuracy: 0.9366 - loss: 0.3717 - val_accuracy: 0.8843 - val_loss: 0.5932 -
learning_rate: 1.0000e-06
Epoch 241/250
157/157      8s 50ms/step -
accuracy: 0.9372 - loss: 0.3733 - val_accuracy: 0.8847 - val_loss: 0.5935 -
learning_rate: 1.0000e-06
Epoch 242/250
157/157      8s 50ms/step -
accuracy: 0.9374 - loss: 0.3704 - val_accuracy: 0.8842 - val_loss: 0.5925 -
learning_rate: 1.0000e-06
Epoch 243/250
157/157      8s 50ms/step -
accuracy: 0.9385 - loss: 0.3714 - val_accuracy: 0.8846 - val_loss: 0.5927 -
learning_rate: 1.0000e-06
Epoch 244/250
157/157      8s 50ms/step -
accuracy: 0.9392 - loss: 0.3645 - val_accuracy: 0.8847 - val_loss: 0.5931 -
learning_rate: 1.0000e-06
Epoch 245/250
157/157      8s 50ms/step -
accuracy: 0.9406 - loss: 0.3637 - val_accuracy: 0.8847 - val_loss: 0.5925 -
learning_rate: 1.0000e-06
Epoch 246/250
157/157      8s 50ms/step -
accuracy: 0.9368 - loss: 0.3718 - val_accuracy: 0.8842 - val_loss: 0.5931 -
learning_rate: 1.0000e-06
Epoch 247/250
157/157      8s 50ms/step -
accuracy: 0.9376 - loss: 0.3679 - val_accuracy: 0.8842 - val_loss: 0.5926 -
learning_rate: 1.0000e-06
Epoch 248/250
157/157      8s 50ms/step -
accuracy: 0.9404 - loss: 0.3610 - val_accuracy: 0.8846 - val_loss: 0.5927 -
learning_rate: 1.0000e-06
Epoch 249/250
157/157      8s 50ms/step -
accuracy: 0.9392 - loss: 0.3640 - val_accuracy: 0.8838 - val_loss: 0.5918 -
learning_rate: 1.0000e-06
Epoch 250/250
157/157      8s 50ms/step -
accuracy: 0.9392 - loss: 0.3675 - val_accuracy: 0.8841 - val_loss: 0.5915 -
learning_rate: 1.0000e-06
Score for fold 3: test loss of 0.6123397350311279; test accuracy of
87.51000165939331%
313/313      1s 3ms/step

```



Classification Report for Fold 3:

	precision	recall	f1-score	support
Class 0	0.90	0.88	0.89	1000
Class 1	0.95	0.94	0.95	1000
Class 2	0.86	0.78	0.82	1000
Class 3	0.78	0.74	0.76	1000
Class 4	0.83	0.90	0.87	1000
Class 5	0.80	0.83	0.81	1000
Class 6	0.84	0.95	0.89	1000
Class 7	0.93	0.89	0.91	1000
Class 8	0.91	0.94	0.93	1000
Class 9	0.96	0.90	0.93	1000
accuracy			0.88	10000
macro avg	0.88	0.88	0.87	10000
weighted avg	0.88	0.88	0.87	10000

/opt/conda/lib/python3.10/site-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not

pass an ``input_shape`/`input_dim`` argument to a layer. When using Sequential models, prefer using an ``Input(shape)`` object as the first layer in the model instead.

```
super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Epoch 1/250

157/157 32s 119ms/step -

accuracy: 0.2064 - loss: 12.5284 - val_accuracy: 0.1842 - val_loss: 6.5860 -
learning_rate: 0.0010

Epoch 2/250

157/157 8s 50ms/step -

accuracy: 0.3745 - loss: 5.2654 - val_accuracy: 0.2903 - val_loss: 3.6002 -
learning_rate: 0.0010

Epoch 3/250

157/157 8s 51ms/step -

accuracy: 0.4777 - loss: 2.9898 - val_accuracy: 0.4624 - val_loss: 2.6778 -
learning_rate: 0.0010

Epoch 4/250

157/157 8s 51ms/step -

accuracy: 0.5452 - loss: 2.4948 - val_accuracy: 0.5853 - val_loss: 2.3156 -
learning_rate: 0.0010

Epoch 5/250

157/157 8s 51ms/step -

accuracy: 0.5838 - loss: 2.3576 - val_accuracy: 0.5793 - val_loss: 2.3510 -
learning_rate: 0.0010

Epoch 6/250

157/157 8s 51ms/step -

accuracy: 0.6094 - loss: 2.3002 - val_accuracy: 0.5722 - val_loss: 2.3504 -
learning_rate: 0.0010

Epoch 7/250

157/157 8s 51ms/step -

accuracy: 0.6277 - loss: 2.2729 - val_accuracy: 0.5498 - val_loss: 2.4736 -
learning_rate: 0.0010

Epoch 8/250

157/157 8s 50ms/step -

accuracy: 0.6382 - loss: 2.2800 - val_accuracy: 0.6740 - val_loss: 2.1104 -
learning_rate: 0.0010

Epoch 9/250

157/157 8s 50ms/step -

accuracy: 0.6401 - loss: 2.2421 - val_accuracy: 0.6042 - val_loss: 2.3867 -
learning_rate: 0.0010

Epoch 10/250

157/157 8s 50ms/step -

accuracy: 0.6494 - loss: 2.2744 - val_accuracy: 0.5926 - val_loss: 2.3896 -
learning_rate: 0.0010

Epoch 11/250

157/157 8s 50ms/step -

accuracy: 0.6502 - loss: 2.2583 - val_accuracy: 0.5804 - val_loss: 2.4032 -

```

learning_rate: 0.0010
Epoch 12/250
157/157          8s 50ms/step -
accuracy: 0.6533 - loss: 2.2483 - val_accuracy: 0.6703 - val_loss: 2.1737 -
learning_rate: 0.0010
Epoch 13/250
157/157          8s 50ms/step -
accuracy: 0.6581 - loss: 2.2353 - val_accuracy: 0.6625 - val_loss: 2.1791 -
learning_rate: 0.0010
Epoch 14/250
157/157          8s 50ms/step -
accuracy: 0.6892 - loss: 2.0228 - val_accuracy: 0.7163 - val_loss: 1.7549 -
learning_rate: 5.0000e-04
Epoch 15/250
157/157          8s 51ms/step -
accuracy: 0.7065 - loss: 1.7834 - val_accuracy: 0.7283 - val_loss: 1.6986 -
learning_rate: 5.0000e-04
Epoch 16/250
157/157          8s 50ms/step -
accuracy: 0.7111 - loss: 1.7630 - val_accuracy: 0.7324 - val_loss: 1.6732 -
learning_rate: 5.0000e-04
Epoch 17/250
157/157          8s 50ms/step -
accuracy: 0.7122 - loss: 1.7558 - val_accuracy: 0.7254 - val_loss: 1.7006 -
learning_rate: 5.0000e-04
Epoch 18/250
157/157          8s 50ms/step -
accuracy: 0.7133 - loss: 1.7701 - val_accuracy: 0.7192 - val_loss: 1.7270 -
learning_rate: 5.0000e-04
Epoch 19/250
157/157          8s 50ms/step -
accuracy: 0.7200 - loss: 1.7427 - val_accuracy: 0.7425 - val_loss: 1.6442 -
learning_rate: 5.0000e-04
Epoch 20/250
157/157         10s 50ms/step -
accuracy: 0.7201 - loss: 1.7406 - val_accuracy: 0.7287 - val_loss: 1.6837 -
learning_rate: 5.0000e-04
Epoch 21/250
157/157          8s 50ms/step -
accuracy: 0.7217 - loss: 1.7452 - val_accuracy: 0.7468 - val_loss: 1.6347 -
learning_rate: 5.0000e-04
Epoch 22/250
157/157          8s 50ms/step -
accuracy: 0.7268 - loss: 1.7188 - val_accuracy: 0.7597 - val_loss: 1.6219 -
learning_rate: 5.0000e-04
Epoch 23/250
157/157          8s 50ms/step -
accuracy: 0.7245 - loss: 1.7346 - val_accuracy: 0.7522 - val_loss: 1.6283 -

```

```

learning_rate: 5.0000e-04
Epoch 24/250
157/157          8s 50ms/step -
accuracy: 0.7274 - loss: 1.7221 - val_accuracy: 0.7518 - val_loss: 1.6043 -
learning_rate: 5.0000e-04
Epoch 25/250
157/157          8s 50ms/step -
accuracy: 0.7262 - loss: 1.7065 - val_accuracy: 0.7617 - val_loss: 1.6143 -
learning_rate: 5.0000e-04
Epoch 26/250
157/157          8s 50ms/step -
accuracy: 0.7323 - loss: 1.6981 - val_accuracy: 0.7550 - val_loss: 1.6312 -
learning_rate: 5.0000e-04
Epoch 27/250
157/157          8s 51ms/step -
accuracy: 0.7339 - loss: 1.7060 - val_accuracy: 0.7508 - val_loss: 1.6375 -
learning_rate: 5.0000e-04
Epoch 28/250
157/157          8s 51ms/step -
accuracy: 0.7324 - loss: 1.6886 - val_accuracy: 0.7643 - val_loss: 1.5944 -
learning_rate: 5.0000e-04
Epoch 29/250
157/157          8s 50ms/step -
accuracy: 0.7350 - loss: 1.6817 - val_accuracy: 0.7321 - val_loss: 1.6886 -
learning_rate: 5.0000e-04
Epoch 30/250
157/157          8s 50ms/step -
accuracy: 0.7355 - loss: 1.6902 - val_accuracy: 0.7562 - val_loss: 1.5946 -
learning_rate: 5.0000e-04
Epoch 31/250
157/157          8s 51ms/step -
accuracy: 0.7365 - loss: 1.6742 - val_accuracy: 0.7369 - val_loss: 1.6561 -
learning_rate: 5.0000e-04
Epoch 32/250
157/157          8s 50ms/step -
accuracy: 0.7339 - loss: 1.6886 - val_accuracy: 0.7502 - val_loss: 1.6207 -
learning_rate: 5.0000e-04
Epoch 33/250
157/157          8s 50ms/step -
accuracy: 0.7401 - loss: 1.6732 - val_accuracy: 0.7571 - val_loss: 1.5987 -
learning_rate: 5.0000e-04
Epoch 34/250
157/157          8s 50ms/step -
accuracy: 0.7584 - loss: 1.5754 - val_accuracy: 0.7812 - val_loss: 1.3779 -
learning_rate: 2.5000e-04
Epoch 35/250
157/157          8s 50ms/step -
accuracy: 0.7731 - loss: 1.3958 - val_accuracy: 0.7877 - val_loss: 1.3156 -

```



```

learning_rate: 2.5000e-04
Epoch 36/250
157/157          8s 50ms/step -
accuracy: 0.7751 - loss: 1.3447 - val_accuracy: 0.7903 - val_loss: 1.2718 -
learning_rate: 2.5000e-04
Epoch 37/250
157/157          8s 50ms/step -
accuracy: 0.7766 - loss: 1.3332 - val_accuracy: 0.7900 - val_loss: 1.2599 -
learning_rate: 2.5000e-04
Epoch 38/250
157/157          8s 50ms/step -
accuracy: 0.7776 - loss: 1.3168 - val_accuracy: 0.7861 - val_loss: 1.2791 -
learning_rate: 2.5000e-04
Epoch 39/250
157/157          8s 50ms/step -
accuracy: 0.7820 - loss: 1.2982 - val_accuracy: 0.7935 - val_loss: 1.2476 -
learning_rate: 2.5000e-04
Epoch 40/250
157/157          8s 50ms/step -
accuracy: 0.7853 - loss: 1.2897 - val_accuracy: 0.8035 - val_loss: 1.2207 -
learning_rate: 2.5000e-04
Epoch 41/250
157/157          8s 50ms/step -
accuracy: 0.7868 - loss: 1.2805 - val_accuracy: 0.7892 - val_loss: 1.2476 -
learning_rate: 2.5000e-04
Epoch 42/250
157/157          8s 50ms/step -
accuracy: 0.7820 - loss: 1.2882 - val_accuracy: 0.7709 - val_loss: 1.2876 -
learning_rate: 2.5000e-04
Epoch 43/250
157/157          8s 50ms/step -
accuracy: 0.7900 - loss: 1.2654 - val_accuracy: 0.8007 - val_loss: 1.2116 -
learning_rate: 2.5000e-04
Epoch 44/250
157/157          8s 51ms/step -
accuracy: 0.7857 - loss: 1.2697 - val_accuracy: 0.8123 - val_loss: 1.1887 -
learning_rate: 2.5000e-04
Epoch 45/250
157/157          8s 50ms/step -
accuracy: 0.7921 - loss: 1.2627 - val_accuracy: 0.7987 - val_loss: 1.2305 -
learning_rate: 2.5000e-04
Epoch 46/250
157/157          8s 50ms/step -
accuracy: 0.7901 - loss: 1.2645 - val_accuracy: 0.8114 - val_loss: 1.1871 -
learning_rate: 2.5000e-04
Epoch 47/250
157/157          8s 50ms/step -
accuracy: 0.7892 - loss: 1.2644 - val_accuracy: 0.8133 - val_loss: 1.2017 -

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learning_rate: 2.5000e-04
Epoch 48/250
157/157          8s 50ms/step -
accuracy: 0.7955 - loss: 1.2564 - val_accuracy: 0.8047 - val_loss: 1.2079 -
learning_rate: 2.5000e-04
Epoch 49/250
157/157          8s 50ms/step -
accuracy: 0.7935 - loss: 1.2461 - val_accuracy: 0.8129 - val_loss: 1.1936 -
learning_rate: 2.5000e-04
Epoch 50/250
157/157          8s 50ms/step -
accuracy: 0.7979 - loss: 1.2459 - val_accuracy: 0.8229 - val_loss: 1.1652 -
learning_rate: 2.5000e-04
Epoch 51/250
157/157          8s 50ms/step -
accuracy: 0.7951 - loss: 1.2556 - val_accuracy: 0.8115 - val_loss: 1.1900 -
learning_rate: 2.5000e-04
Epoch 52/250
157/157          8s 50ms/step -
accuracy: 0.7985 - loss: 1.2338 - val_accuracy: 0.8054 - val_loss: 1.2024 -
learning_rate: 2.5000e-04
Epoch 53/250
157/157          8s 50ms/step -
accuracy: 0.7951 - loss: 1.2489 - val_accuracy: 0.8180 - val_loss: 1.1838 -
learning_rate: 2.5000e-04
Epoch 54/250
157/157          8s 50ms/step -
accuracy: 0.8004 - loss: 1.2279 - val_accuracy: 0.8101 - val_loss: 1.1981 -
learning_rate: 2.5000e-04
Epoch 55/250
157/157          8s 50ms/step -
accuracy: 0.7979 - loss: 1.2349 - val_accuracy: 0.8221 - val_loss: 1.1647 -
learning_rate: 2.5000e-04
Epoch 56/250
157/157          8s 50ms/step -
accuracy: 0.7974 - loss: 1.2312 - val_accuracy: 0.8066 - val_loss: 1.2100 -
learning_rate: 2.5000e-04
Epoch 57/250
157/157          8s 50ms/step -
accuracy: 0.8010 - loss: 1.2283 - val_accuracy: 0.8177 - val_loss: 1.1762 -
learning_rate: 2.5000e-04
Epoch 58/250
157/157          8s 50ms/step -
accuracy: 0.7981 - loss: 1.2329 - val_accuracy: 0.8137 - val_loss: 1.1761 -
learning_rate: 2.5000e-04
Epoch 59/250
157/157          8s 50ms/step -
accuracy: 0.8006 - loss: 1.2272 - val_accuracy: 0.8149 - val_loss: 1.1906 -

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learning_rate: 2.5000e-04
Epoch 60/250
157/157      8s 50ms/step -
accuracy: 0.8016 - loss: 1.2338 - val_accuracy: 0.8075 - val_loss: 1.1948 -
learning_rate: 2.5000e-04
Epoch 61/250
157/157      8s 50ms/step -
accuracy: 0.8114 - loss: 1.1878 - val_accuracy: 0.8261 - val_loss: 1.1008 -
learning_rate: 1.2500e-04
Epoch 62/250
157/157      8s 50ms/step -
accuracy: 0.8222 - loss: 1.1167 - val_accuracy: 0.8371 - val_loss: 1.0420 -
learning_rate: 1.2500e-04
Epoch 63/250
157/157      8s 50ms/step -
accuracy: 0.8292 - loss: 1.0623 - val_accuracy: 0.8297 - val_loss: 1.0291 -
learning_rate: 1.2500e-04
Epoch 64/250
157/157      8s 50ms/step -
accuracy: 0.8324 - loss: 1.0190 - val_accuracy: 0.8436 - val_loss: 0.9826 -
learning_rate: 1.2500e-04
Epoch 65/250
157/157      8s 50ms/step -
accuracy: 0.8305 - loss: 1.0097 - val_accuracy: 0.8377 - val_loss: 0.9712 -
learning_rate: 1.2500e-04
Epoch 66/250
157/157      8s 50ms/step -
accuracy: 0.8334 - loss: 0.9855 - val_accuracy: 0.8405 - val_loss: 0.9557 -
learning_rate: 1.2500e-04
Epoch 67/250
157/157      8s 50ms/step -
accuracy: 0.8312 - loss: 0.9858 - val_accuracy: 0.8463 - val_loss: 0.9340 -
learning_rate: 1.2500e-04
Epoch 68/250
157/157      8s 50ms/step -
accuracy: 0.8369 - loss: 0.9604 - val_accuracy: 0.8461 - val_loss: 0.9330 -
learning_rate: 1.2500e-04
Epoch 69/250
157/157      8s 50ms/step -
accuracy: 0.8393 - loss: 0.9487 - val_accuracy: 0.8463 - val_loss: 0.9230 -
learning_rate: 1.2500e-04
Epoch 70/250
157/157      8s 50ms/step -
accuracy: 0.8381 - loss: 0.9513 - val_accuracy: 0.8474 - val_loss: 0.9170 -
learning_rate: 1.2500e-04
Epoch 71/250
157/157      8s 50ms/step -
accuracy: 0.8354 - loss: 0.9383 - val_accuracy: 0.8323 - val_loss: 0.9565 -

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learning_rate: 1.2500e-04
Epoch 72/250
157/157          8s 50ms/step -
accuracy: 0.8404 - loss: 0.9342 - val_accuracy: 0.8392 - val_loss: 0.9486 -
learning_rate: 1.2500e-04
Epoch 73/250
157/157          8s 50ms/step -
accuracy: 0.8419 - loss: 0.9297 - val_accuracy: 0.8464 - val_loss: 0.9099 -
learning_rate: 1.2500e-04
Epoch 74/250
157/157          8s 50ms/step -
accuracy: 0.8403 - loss: 0.9330 - val_accuracy: 0.8509 - val_loss: 0.8924 -
learning_rate: 1.2500e-04
Epoch 75/250
157/157          8s 50ms/step -
accuracy: 0.8389 - loss: 0.9286 - val_accuracy: 0.8442 - val_loss: 0.9147 -
learning_rate: 1.2500e-04
Epoch 76/250
157/157          8s 50ms/step -
accuracy: 0.8422 - loss: 0.9179 - val_accuracy: 0.8416 - val_loss: 0.9268 -
learning_rate: 1.2500e-04
Epoch 77/250
157/157          8s 50ms/step -
accuracy: 0.8445 - loss: 0.9164 - val_accuracy: 0.8527 - val_loss: 0.8979 -
learning_rate: 1.2500e-04
Epoch 78/250
157/157          8s 50ms/step -
accuracy: 0.8465 - loss: 0.9148 - val_accuracy: 0.8502 - val_loss: 0.8972 -
learning_rate: 1.2500e-04
Epoch 79/250
157/157          8s 50ms/step -
accuracy: 0.8466 - loss: 0.9074 - val_accuracy: 0.8361 - val_loss: 0.9432 -
learning_rate: 1.2500e-04
Epoch 80/250
157/157          8s 51ms/step -
accuracy: 0.8527 - loss: 0.8847 - val_accuracy: 0.8543 - val_loss: 0.8741 -
learning_rate: 6.2500e-05
Epoch 81/250
157/157          8s 51ms/step -
accuracy: 0.8558 - loss: 0.8562 - val_accuracy: 0.8565 - val_loss: 0.8494 -
learning_rate: 6.2500e-05
Epoch 82/250
157/157          8s 50ms/step -
accuracy: 0.8602 - loss: 0.8397 - val_accuracy: 0.8596 - val_loss: 0.8396 -
learning_rate: 6.2500e-05
Epoch 83/250
157/157          8s 50ms/step -
accuracy: 0.8643 - loss: 0.8144 - val_accuracy: 0.8565 - val_loss: 0.8264 -

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learning_rate: 6.2500e-05
Epoch 84/250
157/157      8s 50ms/step -
accuracy: 0.8697 - loss: 0.7857 - val_accuracy: 0.8585 - val_loss: 0.8171 -
learning_rate: 6.2500e-05
Epoch 85/250
157/157      8s 50ms/step -
accuracy: 0.8707 - loss: 0.7784 - val_accuracy: 0.8645 - val_loss: 0.7924 -
learning_rate: 6.2500e-05
Epoch 86/250
157/157      8s 50ms/step -
accuracy: 0.8690 - loss: 0.7670 - val_accuracy: 0.8674 - val_loss: 0.7773 -
learning_rate: 6.2500e-05
Epoch 87/250
157/157      8s 50ms/step -
accuracy: 0.8700 - loss: 0.7663 - val_accuracy: 0.8640 - val_loss: 0.7854 -
learning_rate: 6.2500e-05
Epoch 88/250
157/157      8s 50ms/step -
accuracy: 0.8730 - loss: 0.7471 - val_accuracy: 0.8580 - val_loss: 0.7881 -
learning_rate: 6.2500e-05
Epoch 89/250
157/157      8s 50ms/step -
accuracy: 0.8739 - loss: 0.7339 - val_accuracy: 0.8647 - val_loss: 0.7631 -
learning_rate: 6.2500e-05
Epoch 90/250
157/157      8s 50ms/step -
accuracy: 0.8785 - loss: 0.7239 - val_accuracy: 0.8602 - val_loss: 0.7824 -
learning_rate: 6.2500e-05
Epoch 91/250
157/157      8s 50ms/step -
accuracy: 0.8741 - loss: 0.7290 - val_accuracy: 0.8610 - val_loss: 0.7649 -
learning_rate: 6.2500e-05
Epoch 92/250
157/157      8s 50ms/step -
accuracy: 0.8766 - loss: 0.7156 - val_accuracy: 0.8617 - val_loss: 0.7564 -
learning_rate: 6.2500e-05
Epoch 93/250
157/157      8s 50ms/step -
accuracy: 0.8764 - loss: 0.7170 - val_accuracy: 0.8624 - val_loss: 0.7616 -
learning_rate: 6.2500e-05
Epoch 94/250
157/157      8s 50ms/step -
accuracy: 0.8815 - loss: 0.6986 - val_accuracy: 0.8667 - val_loss: 0.7393 -
learning_rate: 6.2500e-05
Epoch 95/250
157/157      8s 51ms/step -
accuracy: 0.8774 - loss: 0.7032 - val_accuracy: 0.8678 - val_loss: 0.7392 -

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learning_rate: 6.2500e-05
Epoch 96/250
157/157          8s 51ms/step -
accuracy: 0.8806 - loss: 0.6943 - val_accuracy: 0.8623 - val_loss: 0.7480 -
learning_rate: 6.2500e-05
Epoch 97/250
157/157          8s 51ms/step -
accuracy: 0.8778 - loss: 0.6944 - val_accuracy: 0.8634 - val_loss: 0.7476 -
learning_rate: 6.2500e-05
Epoch 98/250
157/157          8s 50ms/step -
accuracy: 0.8808 - loss: 0.6821 - val_accuracy: 0.8654 - val_loss: 0.7396 -
learning_rate: 6.2500e-05
Epoch 99/250
157/157          8s 50ms/step -
accuracy: 0.8795 - loss: 0.6899 - val_accuracy: 0.8682 - val_loss: 0.7253 -
learning_rate: 6.2500e-05
Epoch 100/250
157/157          8s 50ms/step -
accuracy: 0.8793 - loss: 0.6820 - val_accuracy: 0.8691 - val_loss: 0.7301 -
learning_rate: 6.2500e-05
Epoch 101/250
157/157          8s 50ms/step -
accuracy: 0.8826 - loss: 0.6741 - val_accuracy: 0.8714 - val_loss: 0.7184 -
learning_rate: 6.2500e-05
Epoch 102/250
157/157          8s 50ms/step -
accuracy: 0.8812 - loss: 0.6716 - val_accuracy: 0.8641 - val_loss: 0.7344 -
learning_rate: 6.2500e-05
Epoch 103/250
157/157          8s 50ms/step -
accuracy: 0.8814 - loss: 0.6681 - val_accuracy: 0.8667 - val_loss: 0.7291 -
learning_rate: 6.2500e-05
Epoch 104/250
157/157          8s 50ms/step -
accuracy: 0.8853 - loss: 0.6640 - val_accuracy: 0.8655 - val_loss: 0.7296 -
learning_rate: 6.2500e-05
Epoch 105/250
157/157          8s 50ms/step -
accuracy: 0.8829 - loss: 0.6596 - val_accuracy: 0.8655 - val_loss: 0.7219 -
learning_rate: 6.2500e-05
Epoch 106/250
157/157          8s 50ms/step -
accuracy: 0.8843 - loss: 0.6630 - val_accuracy: 0.8664 - val_loss: 0.7265 -
learning_rate: 6.2500e-05
Epoch 107/250
157/157          8s 51ms/step -
accuracy: 0.8865 - loss: 0.6480 - val_accuracy: 0.8724 - val_loss: 0.7001 -

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learning_rate: 3.1250e-05
Epoch 108/250
157/157          8s 51ms/step -
accuracy: 0.8919 - loss: 0.6351 - val_accuracy: 0.8723 - val_loss: 0.6987 -
learning_rate: 3.1250e-05
Epoch 109/250
157/157          8s 50ms/step -
accuracy: 0.8958 - loss: 0.6204 - val_accuracy: 0.8763 - val_loss: 0.6876 -
learning_rate: 3.1250e-05
Epoch 110/250
157/157          8s 51ms/step -
accuracy: 0.8963 - loss: 0.6160 - val_accuracy: 0.8753 - val_loss: 0.6819 -
learning_rate: 3.1250e-05
Epoch 111/250
157/157          8s 50ms/step -
accuracy: 0.8925 - loss: 0.6130 - val_accuracy: 0.8753 - val_loss: 0.6824 -
learning_rate: 3.1250e-05
Epoch 112/250
157/157          8s 50ms/step -
accuracy: 0.8967 - loss: 0.6000 - val_accuracy: 0.8712 - val_loss: 0.6969 -
learning_rate: 3.1250e-05
Epoch 113/250
157/157          8s 50ms/step -
accuracy: 0.8988 - loss: 0.5892 - val_accuracy: 0.8722 - val_loss: 0.6857 -
learning_rate: 3.1250e-05
Epoch 114/250
157/157          8s 50ms/step -
accuracy: 0.9025 - loss: 0.5815 - val_accuracy: 0.8758 - val_loss: 0.6736 -
learning_rate: 3.1250e-05
Epoch 115/250
157/157          8s 50ms/step -
accuracy: 0.9034 - loss: 0.5757 - val_accuracy: 0.8759 - val_loss: 0.6716 -
learning_rate: 3.1250e-05
Epoch 116/250
157/157          8s 51ms/step -
accuracy: 0.8999 - loss: 0.5894 - val_accuracy: 0.8772 - val_loss: 0.6682 -
learning_rate: 3.1250e-05
Epoch 117/250
157/157          8s 50ms/step -
accuracy: 0.9024 - loss: 0.5704 - val_accuracy: 0.8767 - val_loss: 0.6657 -
learning_rate: 3.1250e-05
Epoch 118/250
157/157          8s 50ms/step -
accuracy: 0.9037 - loss: 0.5693 - val_accuracy: 0.8764 - val_loss: 0.6644 -
learning_rate: 3.1250e-05
Epoch 119/250
157/157          8s 50ms/step -
accuracy: 0.9029 - loss: 0.5668 - val_accuracy: 0.8782 - val_loss: 0.6475 -

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learning_rate: 3.1250e-05
Epoch 120/250
157/157          8s 50ms/step -
accuracy: 0.9057 - loss: 0.5574 - val_accuracy: 0.8750 - val_loss: 0.6557 -
learning_rate: 3.1250e-05
Epoch 121/250
157/157          8s 50ms/step -
accuracy: 0.9038 - loss: 0.5591 - val_accuracy: 0.8743 - val_loss: 0.6559 -
learning_rate: 3.1250e-05
Epoch 122/250
157/157          8s 50ms/step -
accuracy: 0.9068 - loss: 0.5470 - val_accuracy: 0.8726 - val_loss: 0.6630 -
learning_rate: 3.1250e-05
Epoch 123/250
157/157          8s 50ms/step -
accuracy: 0.9085 - loss: 0.5357 - val_accuracy: 0.8761 - val_loss: 0.6560 -
learning_rate: 3.1250e-05
Epoch 124/250
157/157          8s 51ms/step -
accuracy: 0.9069 - loss: 0.5374 - val_accuracy: 0.8769 - val_loss: 0.6484 -
learning_rate: 3.1250e-05
Epoch 125/250
157/157          8s 50ms/step -
accuracy: 0.9114 - loss: 0.5262 - val_accuracy: 0.8761 - val_loss: 0.6450 -
learning_rate: 1.5625e-05
Epoch 126/250
157/157          8s 50ms/step -
accuracy: 0.9105 - loss: 0.5314 - val_accuracy: 0.8811 - val_loss: 0.6310 -
learning_rate: 1.5625e-05
Epoch 127/250
157/157          8s 50ms/step -
accuracy: 0.9132 - loss: 0.5235 - val_accuracy: 0.8793 - val_loss: 0.6354 -
learning_rate: 1.5625e-05
Epoch 128/250
157/157          8s 50ms/step -
accuracy: 0.9126 - loss: 0.5210 - val_accuracy: 0.8776 - val_loss: 0.6397 -
learning_rate: 1.5625e-05
Epoch 129/250
157/157          8s 50ms/step -
accuracy: 0.9147 - loss: 0.5111 - val_accuracy: 0.8776 - val_loss: 0.6321 -
learning_rate: 1.5625e-05
Epoch 130/250
157/157          8s 50ms/step -
accuracy: 0.9112 - loss: 0.5095 - val_accuracy: 0.8790 - val_loss: 0.6304 -
learning_rate: 1.5625e-05
Epoch 131/250
157/157          8s 50ms/step -
accuracy: 0.9165 - loss: 0.5033 - val_accuracy: 0.8805 - val_loss: 0.6259 -

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learning_rate: 1.5625e-05
Epoch 132/250
157/157          8s 50ms/step -
accuracy: 0.9083 - loss: 0.5175 - val_accuracy: 0.8804 - val_loss: 0.6227 -
learning_rate: 1.5625e-05
Epoch 133/250
157/157          8s 50ms/step -
accuracy: 0.9166 - loss: 0.4970 - val_accuracy: 0.8786 - val_loss: 0.6279 -
learning_rate: 1.5625e-05
Epoch 134/250
157/157          8s 50ms/step -
accuracy: 0.9133 - loss: 0.5042 - val_accuracy: 0.8801 - val_loss: 0.6202 -
learning_rate: 1.5625e-05
Epoch 135/250
157/157          8s 50ms/step -
accuracy: 0.9172 - loss: 0.4953 - val_accuracy: 0.8794 - val_loss: 0.6214 -
learning_rate: 1.5625e-05
Epoch 136/250
157/157          8s 50ms/step -
accuracy: 0.9183 - loss: 0.4915 - val_accuracy: 0.8808 - val_loss: 0.6195 -
learning_rate: 1.5625e-05
Epoch 137/250
157/157          8s 50ms/step -
accuracy: 0.9157 - loss: 0.4937 - val_accuracy: 0.8801 - val_loss: 0.6159 -
learning_rate: 1.5625e-05
Epoch 138/250
157/157          8s 50ms/step -
accuracy: 0.9170 - loss: 0.4839 - val_accuracy: 0.8806 - val_loss: 0.6134 -
learning_rate: 1.5625e-05
Epoch 139/250
157/157          8s 50ms/step -
accuracy: 0.9182 - loss: 0.4876 - val_accuracy: 0.8822 - val_loss: 0.6116 -
learning_rate: 1.5625e-05
Epoch 140/250
157/157          8s 50ms/step -
accuracy: 0.9196 - loss: 0.4807 - val_accuracy: 0.8805 - val_loss: 0.6130 -
learning_rate: 1.5625e-05
Epoch 141/250
157/157          8s 50ms/step -
accuracy: 0.9159 - loss: 0.4798 - val_accuracy: 0.8781 - val_loss: 0.6186 -
learning_rate: 1.5625e-05
Epoch 142/250
157/157          8s 50ms/step -
accuracy: 0.9209 - loss: 0.4719 - val_accuracy: 0.8820 - val_loss: 0.6113 -
learning_rate: 1.5625e-05
Epoch 143/250
157/157          8s 50ms/step -
accuracy: 0.9189 - loss: 0.4732 - val_accuracy: 0.8819 - val_loss: 0.6094 -

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learning_rate: 1.5625e-05
Epoch 144/250
157/157          8s 50ms/step -
accuracy: 0.9190 - loss: 0.4684 - val_accuracy: 0.8802 - val_loss: 0.6123 -
learning_rate: 1.5625e-05
Epoch 145/250
157/157          8s 50ms/step -
accuracy: 0.9195 - loss: 0.4680 - val_accuracy: 0.8796 - val_loss: 0.6111 -
learning_rate: 1.5625e-05
Epoch 146/250
157/157          8s 50ms/step -
accuracy: 0.9234 - loss: 0.4600 - val_accuracy: 0.8796 - val_loss: 0.6135 -
learning_rate: 1.5625e-05
Epoch 147/250
157/157          8s 50ms/step -
accuracy: 0.9232 - loss: 0.4630 - val_accuracy: 0.8817 - val_loss: 0.6075 -
learning_rate: 1.5625e-05
Epoch 148/250
157/157          8s 50ms/step -
accuracy: 0.9245 - loss: 0.4558 - val_accuracy: 0.8822 - val_loss: 0.6032 -
learning_rate: 1.5625e-05
Epoch 149/250
157/157          8s 50ms/step -
accuracy: 0.9221 - loss: 0.4559 - val_accuracy: 0.8816 - val_loss: 0.6015 -
learning_rate: 1.5625e-05
Epoch 150/250
157/157          8s 50ms/step -
accuracy: 0.9234 - loss: 0.4513 - val_accuracy: 0.8808 - val_loss: 0.6049 -
learning_rate: 1.5625e-05
Epoch 151/250
157/157          8s 50ms/step -
accuracy: 0.9203 - loss: 0.4557 - val_accuracy: 0.8814 - val_loss: 0.6019 -
learning_rate: 1.5625e-05
Epoch 152/250
157/157          8s 50ms/step -
accuracy: 0.9234 - loss: 0.4481 - val_accuracy: 0.8810 - val_loss: 0.6049 -
learning_rate: 1.5625e-05
Epoch 153/250
157/157          10s 50ms/step -
accuracy: 0.9239 - loss: 0.4481 - val_accuracy: 0.8822 - val_loss: 0.6010 -
learning_rate: 1.5625e-05
Epoch 154/250
157/157          8s 50ms/step -
accuracy: 0.9244 - loss: 0.4435 - val_accuracy: 0.8813 - val_loss: 0.6010 -
learning_rate: 1.5625e-05
Epoch 155/250
157/157          8s 50ms/step -
accuracy: 0.9237 - loss: 0.4427 - val_accuracy: 0.8828 - val_loss: 0.5965 -

```

```

learning_rate: 1.5625e-05
Epoch 156/250
157/157          8s 50ms/step -
accuracy: 0.9226 - loss: 0.4486 - val_accuracy: 0.8800 - val_loss: 0.6004 -
learning_rate: 1.5625e-05
Epoch 157/250
157/157          8s 50ms/step -
accuracy: 0.9261 - loss: 0.4354 - val_accuracy: 0.8782 - val_loss: 0.6048 -
learning_rate: 1.5625e-05
Epoch 158/250
157/157          8s 50ms/step -
accuracy: 0.9252 - loss: 0.4384 - val_accuracy: 0.8821 - val_loss: 0.5964 -
learning_rate: 1.5625e-05
Epoch 159/250
157/157          8s 50ms/step -
accuracy: 0.9277 - loss: 0.4299 - val_accuracy: 0.8824 - val_loss: 0.5979 -
learning_rate: 1.5625e-05
Epoch 160/250
157/157          8s 51ms/step -
accuracy: 0.9252 - loss: 0.4377 - val_accuracy: 0.8829 - val_loss: 0.5906 -
learning_rate: 1.5625e-05
Epoch 161/250
157/157          8s 50ms/step -
accuracy: 0.9264 - loss: 0.4298 - val_accuracy: 0.8841 - val_loss: 0.5900 -
learning_rate: 1.5625e-05
Epoch 162/250
157/157          8s 50ms/step -
accuracy: 0.9279 - loss: 0.4270 - val_accuracy: 0.8838 - val_loss: 0.5854 -
learning_rate: 1.5625e-05
Epoch 163/250
157/157          8s 50ms/step -
accuracy: 0.9253 - loss: 0.4287 - val_accuracy: 0.8817 - val_loss: 0.5903 -
learning_rate: 1.5625e-05
Epoch 164/250
157/157          8s 50ms/step -
accuracy: 0.9266 - loss: 0.4325 - val_accuracy: 0.8799 - val_loss: 0.5918 -
learning_rate: 1.5625e-05
Epoch 165/250
157/157          8s 51ms/step -
accuracy: 0.9270 - loss: 0.4264 - val_accuracy: 0.8815 - val_loss: 0.5994 -
learning_rate: 1.5625e-05
Epoch 166/250
157/157          8s 51ms/step -
accuracy: 0.9266 - loss: 0.4247 - val_accuracy: 0.8789 - val_loss: 0.6018 -
learning_rate: 1.5625e-05
Epoch 167/250
157/157          8s 50ms/step -
accuracy: 0.9281 - loss: 0.4203 - val_accuracy: 0.8782 - val_loss: 0.6021 -

```

```

learning_rate: 1.5625e-05
Epoch 168/250
157/157      8s 50ms/step -
accuracy: 0.9292 - loss: 0.4188 - val_accuracy: 0.8818 - val_loss: 0.5907 -
learning_rate: 7.8125e-06
Epoch 169/250
157/157      8s 50ms/step -
accuracy: 0.9295 - loss: 0.4165 - val_accuracy: 0.8824 - val_loss: 0.5892 -
learning_rate: 7.8125e-06
Epoch 170/250
157/157      8s 50ms/step -
accuracy: 0.9306 - loss: 0.4143 - val_accuracy: 0.8826 - val_loss: 0.5862 -
learning_rate: 7.8125e-06
Epoch 171/250
157/157      8s 50ms/step -
accuracy: 0.9328 - loss: 0.4053 - val_accuracy: 0.8822 - val_loss: 0.5840 -
learning_rate: 7.8125e-06
Epoch 172/250
157/157      8s 50ms/step -
accuracy: 0.9288 - loss: 0.4125 - val_accuracy: 0.8820 - val_loss: 0.5877 -
learning_rate: 7.8125e-06
Epoch 173/250
157/157      8s 50ms/step -
accuracy: 0.9322 - loss: 0.4095 - val_accuracy: 0.8827 - val_loss: 0.5851 -
learning_rate: 7.8125e-06
Epoch 174/250
157/157      8s 50ms/step -
accuracy: 0.9311 - loss: 0.4091 - val_accuracy: 0.8824 - val_loss: 0.5828 -
learning_rate: 7.8125e-06
Epoch 175/250
157/157      8s 50ms/step -
accuracy: 0.9291 - loss: 0.4103 - val_accuracy: 0.8821 - val_loss: 0.5835 -
learning_rate: 7.8125e-06
Epoch 176/250
157/157      8s 50ms/step -
accuracy: 0.9315 - loss: 0.4025 - val_accuracy: 0.8841 - val_loss: 0.5809 -
learning_rate: 7.8125e-06
Epoch 177/250
157/157      8s 50ms/step -
accuracy: 0.9309 - loss: 0.4043 - val_accuracy: 0.8850 - val_loss: 0.5809 -
learning_rate: 7.8125e-06
Epoch 178/250
157/157      8s 50ms/step -
accuracy: 0.9309 - loss: 0.4033 - val_accuracy: 0.8820 - val_loss: 0.5845 -
learning_rate: 7.8125e-06
Epoch 179/250
157/157      8s 50ms/step -
accuracy: 0.9312 - loss: 0.4005 - val_accuracy: 0.8823 - val_loss: 0.5816 -

```

```

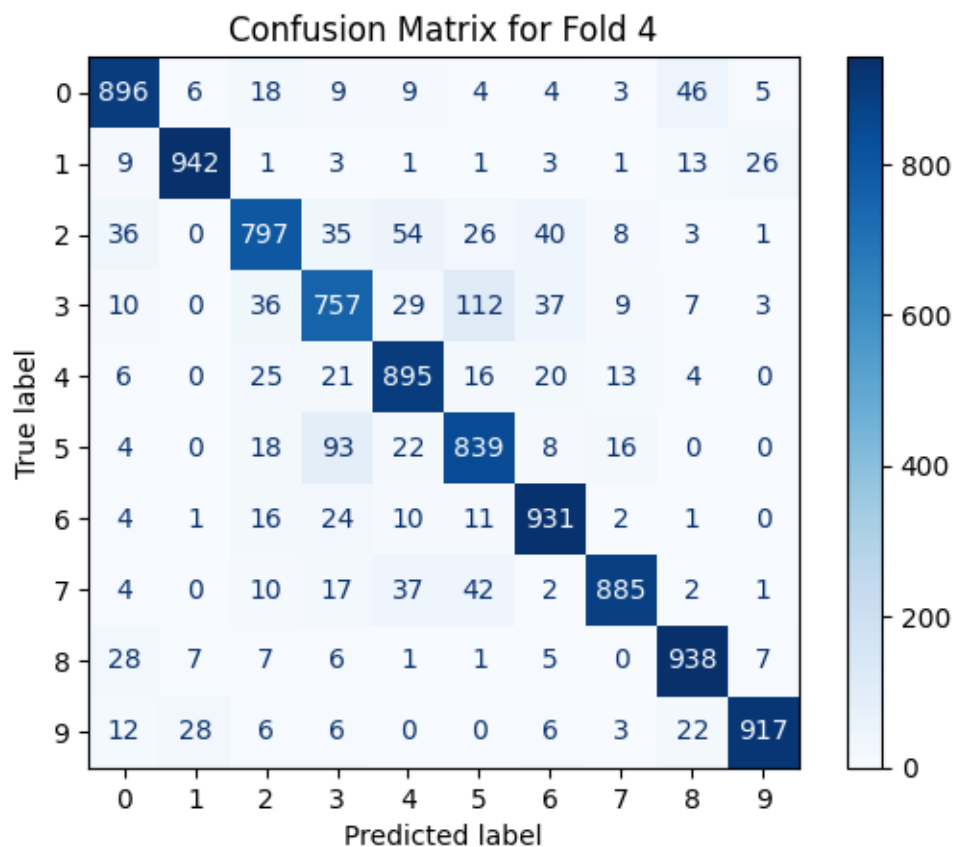
learning_rate: 7.8125e-06
Epoch 180/250
157/157          8s 50ms/step -
accuracy: 0.9363 - loss: 0.3900 - val_accuracy: 0.8809 - val_loss: 0.5838 -
learning_rate: 7.8125e-06
Epoch 181/250
157/157          8s 50ms/step -
accuracy: 0.9326 - loss: 0.3991 - val_accuracy: 0.8827 - val_loss: 0.5783 -
learning_rate: 7.8125e-06
Epoch 182/250
157/157          8s 50ms/step -
accuracy: 0.9322 - loss: 0.3968 - val_accuracy: 0.8801 - val_loss: 0.5812 -
learning_rate: 7.8125e-06
Epoch 183/250
157/157          8s 50ms/step -
accuracy: 0.9329 - loss: 0.3947 - val_accuracy: 0.8806 - val_loss: 0.5795 -
learning_rate: 7.8125e-06
Epoch 184/250
157/157          8s 50ms/step -
accuracy: 0.9314 - loss: 0.3975 - val_accuracy: 0.8795 - val_loss: 0.5803 -
learning_rate: 7.8125e-06
Epoch 185/250
157/157          8s 50ms/step -
accuracy: 0.9343 - loss: 0.3917 - val_accuracy: 0.8827 - val_loss: 0.5759 -
learning_rate: 7.8125e-06
Epoch 186/250
157/157          8s 50ms/step -
accuracy: 0.9305 - loss: 0.3944 - val_accuracy: 0.8841 - val_loss: 0.5704 -
learning_rate: 7.8125e-06
Epoch 187/250
157/157          8s 50ms/step -
accuracy: 0.9341 - loss: 0.3897 - val_accuracy: 0.8829 - val_loss: 0.5750 -
learning_rate: 7.8125e-06
Epoch 188/250
157/157          8s 50ms/step -
accuracy: 0.9327 - loss: 0.3902 - val_accuracy: 0.8838 - val_loss: 0.5736 -
learning_rate: 7.8125e-06
Epoch 189/250
157/157          8s 50ms/step -
accuracy: 0.9355 - loss: 0.3863 - val_accuracy: 0.8826 - val_loss: 0.5736 -
learning_rate: 7.8125e-06
Epoch 190/250
157/157          8s 50ms/step -
accuracy: 0.9347 - loss: 0.3867 - val_accuracy: 0.8836 - val_loss: 0.5787 -
learning_rate: 7.8125e-06
Epoch 191/250
157/157          8s 50ms/step -
accuracy: 0.9338 - loss: 0.3905 - val_accuracy: 0.8822 - val_loss: 0.5763 -

```

```

learning_rate: 7.8125e-06
Epoch 192/250
157/157          8s 50ms/step -
accuracy: 0.9366 - loss: 0.3783 - val_accuracy: 0.8832 - val_loss: 0.5748 -
learning_rate: 3.9063e-06
Epoch 193/250
157/157          8s 50ms/step -
accuracy: 0.9367 - loss: 0.3777 - val_accuracy: 0.8827 - val_loss: 0.5763 -
learning_rate: 3.9063e-06
Epoch 194/250
157/157          8s 50ms/step -
accuracy: 0.9345 - loss: 0.3797 - val_accuracy: 0.8828 - val_loss: 0.5739 -
learning_rate: 3.9063e-06
Epoch 195/250
157/157          8s 50ms/step -
accuracy: 0.9370 - loss: 0.3752 - val_accuracy: 0.8829 - val_loss: 0.5727 -
learning_rate: 3.9063e-06
Epoch 196/250
157/157          8s 50ms/step -
accuracy: 0.9379 - loss: 0.3768 - val_accuracy: 0.8821 - val_loss: 0.5757 -
learning_rate: 3.9063e-06
Epoch 197/250
157/157          8s 50ms/step -
accuracy: 0.9360 - loss: 0.3824 - val_accuracy: 0.8823 - val_loss: 0.5744 -
learning_rate: 1.9531e-06
Epoch 198/250
157/157          8s 50ms/step -
accuracy: 0.9367 - loss: 0.3803 - val_accuracy: 0.8830 - val_loss: 0.5739 -
learning_rate: 1.9531e-06
Epoch 199/250
157/157          8s 50ms/step -
accuracy: 0.9380 - loss: 0.3708 - val_accuracy: 0.8830 - val_loss: 0.5723 -
learning_rate: 1.9531e-06
Epoch 200/250
157/157          8s 50ms/step -
accuracy: 0.9388 - loss: 0.3732 - val_accuracy: 0.8833 - val_loss: 0.5726 -
learning_rate: 1.9531e-06
Epoch 201/250
157/157          8s 50ms/step -
accuracy: 0.9356 - loss: 0.3798 - val_accuracy: 0.8831 - val_loss: 0.5708 -
learning_rate: 1.9531e-06
Score for fold 4: test loss of 0.5966102480888367; test accuracy of
87.97000050544739%
313/313          1s 3ms/step

```



Classification Report for Fold 4:

	precision	recall	f1-score	support
Class 0	0.89	0.90	0.89	1000
Class 1	0.96	0.94	0.95	1000
Class 2	0.85	0.80	0.82	1000
Class 3	0.78	0.76	0.77	1000
Class 4	0.85	0.90	0.87	1000
Class 5	0.80	0.84	0.82	1000
Class 6	0.88	0.93	0.91	1000
Class 7	0.94	0.89	0.91	1000
Class 8	0.91	0.94	0.92	1000
Class 9	0.96	0.92	0.94	1000
accuracy			0.88	10000
macro avg	0.88	0.88	0.88	10000
weighted avg	0.88	0.88	0.88	10000

/opt/conda/lib/python3.10/site-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not

pass an ``input_shape`/`input_dim`` argument to a layer. When using Sequential models, prefer using an ``Input(shape)`` object as the first layer in the model instead.

```
super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Epoch 1/250

157/157 34s 125ms/step -

accuracy: 0.1974 - loss: 12.5903 - val_accuracy: 0.2296 - val_loss: 6.5739 -
learning_rate: 0.0010

Epoch 2/250

157/157 8s 51ms/step -

accuracy: 0.3780 - loss: 5.2844 - val_accuracy: 0.3102 - val_loss: 3.7279 -
learning_rate: 0.0010

Epoch 3/250

157/157 8s 51ms/step -

accuracy: 0.4826 - loss: 3.0743 - val_accuracy: 0.4859 - val_loss: 2.6392 -
learning_rate: 0.0010

Epoch 4/250

157/157 8s 52ms/step -

accuracy: 0.5524 - loss: 2.4996 - val_accuracy: 0.4693 - val_loss: 2.7227 -
learning_rate: 0.0010

Epoch 5/250

157/157 8s 51ms/step -

accuracy: 0.5933 - loss: 2.3765 - val_accuracy: 0.5262 - val_loss: 2.5900 -
learning_rate: 0.0010

Epoch 6/250

157/157 8s 51ms/step -

accuracy: 0.6090 - loss: 2.3408 - val_accuracy: 0.6585 - val_loss: 2.2079 -
learning_rate: 0.0010

Epoch 7/250

157/157 8s 51ms/step -

accuracy: 0.6270 - loss: 2.3026 - val_accuracy: 0.6754 - val_loss: 2.2055 -
learning_rate: 0.0010

Epoch 8/250

157/157 8s 50ms/step -

accuracy: 0.6365 - loss: 2.2949 - val_accuracy: 0.5940 - val_loss: 2.4691 -
learning_rate: 0.0010

Epoch 9/250

157/157 8s 50ms/step -

accuracy: 0.6425 - loss: 2.2683 - val_accuracy: 0.6107 - val_loss: 2.3593 -
learning_rate: 0.0010

Epoch 10/250

157/157 8s 50ms/step -

accuracy: 0.6530 - loss: 2.2336 - val_accuracy: 0.6803 - val_loss: 2.1462 -
learning_rate: 0.0010

Epoch 11/250

157/157 8s 50ms/step -

accuracy: 0.6547 - loss: 2.2623 - val_accuracy: 0.5730 - val_loss: 2.4314 -


```

learning_rate: 0.0010
Epoch 12/250
157/157          8s 50ms/step -
accuracy: 0.6579 - loss: 2.2564 - val_accuracy: 0.6526 - val_loss: 2.2341 -
learning_rate: 0.0010
Epoch 13/250
157/157          8s 50ms/step -
accuracy: 0.6628 - loss: 2.2342 - val_accuracy: 0.7066 - val_loss: 2.1235 -
learning_rate: 0.0010
Epoch 14/250
157/157          8s 51ms/step -
accuracy: 0.6644 - loss: 2.2540 - val_accuracy: 0.6657 - val_loss: 2.2195 -
learning_rate: 0.0010
Epoch 15/250
157/157          8s 51ms/step -
accuracy: 0.6672 - loss: 2.2625 - val_accuracy: 0.6894 - val_loss: 2.1334 -
learning_rate: 0.0010
Epoch 16/250
157/157          8s 51ms/step -
accuracy: 0.6690 - loss: 2.2546 - val_accuracy: 0.7200 - val_loss: 2.0448 -
learning_rate: 0.0010
Epoch 17/250
157/157          8s 51ms/step -
accuracy: 0.6691 - loss: 2.2211 - val_accuracy: 0.6752 - val_loss: 2.1108 -
learning_rate: 0.0010
Epoch 18/250
157/157          8s 50ms/step -
accuracy: 0.6747 - loss: 2.1820 - val_accuracy: 0.7018 - val_loss: 2.1225 -
learning_rate: 0.0010
Epoch 19/250
157/157          8s 50ms/step -
accuracy: 0.6748 - loss: 2.2341 - val_accuracy: 0.6794 - val_loss: 2.1887 -
learning_rate: 0.0010
Epoch 20/250
157/157          8s 50ms/step -
accuracy: 0.6784 - loss: 2.2523 - val_accuracy: 0.5728 - val_loss: 2.4408 -
learning_rate: 0.0010
Epoch 21/250
157/157          8s 50ms/step -
accuracy: 0.6808 - loss: 2.2246 - val_accuracy: 0.6582 - val_loss: 2.2355 -
learning_rate: 0.0010
Epoch 22/250
157/157          8s 50ms/step -
accuracy: 0.7052 - loss: 2.0129 - val_accuracy: 0.6999 - val_loss: 1.7620 -
learning_rate: 5.0000e-04
Epoch 23/250
157/157          8s 50ms/step -
accuracy: 0.7204 - loss: 1.7337 - val_accuracy: 0.7330 - val_loss: 1.6786 -

```

```

learning_rate: 5.0000e-04
Epoch 24/250
157/157          8s 50ms/step -
accuracy: 0.7261 - loss: 1.7113 - val_accuracy: 0.7425 - val_loss: 1.6492 -
learning_rate: 5.0000e-04
Epoch 25/250
157/157          8s 50ms/step -
accuracy: 0.7278 - loss: 1.7280 - val_accuracy: 0.7203 - val_loss: 1.7049 -
learning_rate: 5.0000e-04
Epoch 26/250
157/157          8s 51ms/step -
accuracy: 0.7306 - loss: 1.7158 - val_accuracy: 0.7643 - val_loss: 1.6036 -
learning_rate: 5.0000e-04
Epoch 27/250
157/157          8s 50ms/step -
accuracy: 0.7354 - loss: 1.6853 - val_accuracy: 0.7469 - val_loss: 1.6326 -
learning_rate: 5.0000e-04
Epoch 28/250
157/157          8s 50ms/step -
accuracy: 0.7316 - loss: 1.6863 - val_accuracy: 0.7161 - val_loss: 1.7352 -
learning_rate: 5.0000e-04
Epoch 29/250
157/157         10s 51ms/step -
accuracy: 0.7374 - loss: 1.6974 - val_accuracy: 0.7597 - val_loss: 1.6006 -
learning_rate: 5.0000e-04
Epoch 30/250
157/157          8s 51ms/step -
accuracy: 0.7387 - loss: 1.6790 - val_accuracy: 0.7514 - val_loss: 1.6227 -
learning_rate: 5.0000e-04
Epoch 31/250
157/157          8s 50ms/step -
accuracy: 0.7372 - loss: 1.6784 - val_accuracy: 0.7340 - val_loss: 1.6524 -
learning_rate: 5.0000e-04
Epoch 32/250
157/157          8s 50ms/step -
accuracy: 0.7465 - loss: 1.6466 - val_accuracy: 0.7422 - val_loss: 1.6348 -
learning_rate: 5.0000e-04
Epoch 33/250
157/157          8s 50ms/step -
accuracy: 0.7365 - loss: 1.6971 - val_accuracy: 0.7650 - val_loss: 1.5852 -
learning_rate: 5.0000e-04
Epoch 34/250
157/157          8s 50ms/step -
accuracy: 0.7459 - loss: 1.6771 - val_accuracy: 0.7344 - val_loss: 1.6676 -
learning_rate: 5.0000e-04
Epoch 35/250
157/157          8s 50ms/step -
accuracy: 0.7429 - loss: 1.6460 - val_accuracy: 0.7414 - val_loss: 1.6577 -

```

```

learning_rate: 5.0000e-04
Epoch 36/250
157/157      8s 50ms/step -
accuracy: 0.7455 - loss: 1.6661 - val_accuracy: 0.7626 - val_loss: 1.5935 -
learning_rate: 5.0000e-04
Epoch 37/250
157/157      8s 50ms/step -
accuracy: 0.7487 - loss: 1.6469 - val_accuracy: 0.7601 - val_loss: 1.5914 -
learning_rate: 5.0000e-04
Epoch 38/250
157/157      8s 50ms/step -
accuracy: 0.7441 - loss: 1.6528 - val_accuracy: 0.7747 - val_loss: 1.5577 -
learning_rate: 5.0000e-04
Epoch 39/250
157/157      8s 50ms/step -
accuracy: 0.7511 - loss: 1.6401 - val_accuracy: 0.7701 - val_loss: 1.5691 -
learning_rate: 5.0000e-04
Epoch 40/250
157/157      8s 50ms/step -
accuracy: 0.7503 - loss: 1.6420 - val_accuracy: 0.7114 - val_loss: 1.7416 -
learning_rate: 5.0000e-04
Epoch 41/250
157/157      8s 50ms/step -
accuracy: 0.7544 - loss: 1.6233 - val_accuracy: 0.7571 - val_loss: 1.5895 -
learning_rate: 5.0000e-04
Epoch 42/250
157/157      8s 50ms/step -
accuracy: 0.7569 - loss: 1.6298 - val_accuracy: 0.7810 - val_loss: 1.5325 -
learning_rate: 5.0000e-04
Epoch 43/250
157/157      8s 50ms/step -
accuracy: 0.7511 - loss: 1.6230 - val_accuracy: 0.7475 - val_loss: 1.6165 -
learning_rate: 5.0000e-04
Epoch 44/250
157/157      8s 50ms/step -
accuracy: 0.7521 - loss: 1.6194 - val_accuracy: 0.7719 - val_loss: 1.5653 -
learning_rate: 5.0000e-04
Epoch 45/250
157/157      8s 50ms/step -
accuracy: 0.7549 - loss: 1.6148 - val_accuracy: 0.7723 - val_loss: 1.5538 -
learning_rate: 5.0000e-04
Epoch 46/250
157/157      8s 50ms/step -
accuracy: 0.7560 - loss: 1.6201 - val_accuracy: 0.7478 - val_loss: 1.6287 -
learning_rate: 5.0000e-04
Epoch 47/250
157/157      8s 51ms/step -
accuracy: 0.7537 - loss: 1.6133 - val_accuracy: 0.7852 - val_loss: 1.5263 -

```

```

learning_rate: 5.0000e-04
Epoch 48/250
157/157          8s 50ms/step -
accuracy: 0.7538 - loss: 1.6175 - val_accuracy: 0.7691 - val_loss: 1.5581 -
learning_rate: 5.0000e-04
Epoch 49/250
157/157          8s 50ms/step -
accuracy: 0.7528 - loss: 1.6178 - val_accuracy: 0.7766 - val_loss: 1.5373 -
learning_rate: 5.0000e-04
Epoch 50/250
157/157          8s 50ms/step -
accuracy: 0.7559 - loss: 1.6182 - val_accuracy: 0.7889 - val_loss: 1.4982 -
learning_rate: 5.0000e-04
Epoch 51/250
157/157          8s 50ms/step -
accuracy: 0.7541 - loss: 1.6137 - val_accuracy: 0.7565 - val_loss: 1.5761 -
learning_rate: 5.0000e-04
Epoch 52/250
157/157          8s 50ms/step -
accuracy: 0.7600 - loss: 1.5872 - val_accuracy: 0.7683 - val_loss: 1.5482 -
learning_rate: 5.0000e-04
Epoch 53/250
157/157          8s 51ms/step -
accuracy: 0.7566 - loss: 1.6022 - val_accuracy: 0.7629 - val_loss: 1.5650 -
learning_rate: 5.0000e-04
Epoch 54/250
157/157          8s 50ms/step -
accuracy: 0.7621 - loss: 1.5821 - val_accuracy: 0.7500 - val_loss: 1.5943 -
learning_rate: 5.0000e-04
Epoch 55/250
157/157          8s 50ms/step -
accuracy: 0.7604 - loss: 1.5925 - val_accuracy: 0.7490 - val_loss: 1.6041 -
learning_rate: 5.0000e-04
Epoch 56/250
157/157          8s 50ms/step -
accuracy: 0.7755 - loss: 1.5081 - val_accuracy: 0.7835 - val_loss: 1.3596 -
learning_rate: 2.5000e-04
Epoch 57/250
157/157          8s 50ms/step -
accuracy: 0.7891 - loss: 1.3407 - val_accuracy: 0.7913 - val_loss: 1.2768 -
learning_rate: 2.5000e-04
Epoch 58/250
157/157          8s 50ms/step -
accuracy: 0.7909 - loss: 1.2783 - val_accuracy: 0.7976 - val_loss: 1.2380 -
learning_rate: 2.5000e-04
Epoch 59/250
157/157          8s 50ms/step -
accuracy: 0.7960 - loss: 1.2537 - val_accuracy: 0.8033 - val_loss: 1.2182 -

```

```

learning_rate: 2.5000e-04
Epoch 60/250
157/157          8s 50ms/step -
accuracy: 0.7915 - loss: 1.2505 - val_accuracy: 0.8009 - val_loss: 1.2134 -
learning_rate: 2.5000e-04
Epoch 61/250
157/157          8s 50ms/step -
accuracy: 0.7931 - loss: 1.2386 - val_accuracy: 0.8019 - val_loss: 1.2235 -
learning_rate: 2.5000e-04
Epoch 62/250
157/157          8s 50ms/step -
accuracy: 0.7959 - loss: 1.2390 - val_accuracy: 0.8088 - val_loss: 1.1869 -
learning_rate: 2.5000e-04
Epoch 63/250
157/157          8s 50ms/step -
accuracy: 0.8016 - loss: 1.2216 - val_accuracy: 0.8151 - val_loss: 1.1642 -
learning_rate: 2.5000e-04
Epoch 64/250
157/157          8s 50ms/step -
accuracy: 0.8009 - loss: 1.2173 - val_accuracy: 0.8027 - val_loss: 1.1948 -
learning_rate: 2.5000e-04
Epoch 65/250
157/157          8s 50ms/step -
accuracy: 0.8039 - loss: 1.2101 - val_accuracy: 0.8197 - val_loss: 1.1533 -
learning_rate: 2.5000e-04
Epoch 66/250
157/157          8s 51ms/step -
accuracy: 0.8023 - loss: 1.2132 - val_accuracy: 0.8094 - val_loss: 1.1752 -
learning_rate: 2.5000e-04
Epoch 67/250
157/157          8s 51ms/step -
accuracy: 0.8030 - loss: 1.2048 - val_accuracy: 0.8048 - val_loss: 1.1897 -
learning_rate: 2.5000e-04
Epoch 68/250
157/157          8s 50ms/step -
accuracy: 0.8043 - loss: 1.2007 - val_accuracy: 0.8100 - val_loss: 1.1756 -
learning_rate: 2.5000e-04
Epoch 69/250
157/157          8s 50ms/step -
accuracy: 0.8068 - loss: 1.1900 - val_accuracy: 0.8105 - val_loss: 1.1753 -
learning_rate: 2.5000e-04
Epoch 70/250
157/157          8s 50ms/step -
accuracy: 0.8009 - loss: 1.2075 - val_accuracy: 0.8170 - val_loss: 1.1583 -
learning_rate: 2.5000e-04
Epoch 71/250
157/157          8s 50ms/step -
accuracy: 0.8136 - loss: 1.1621 - val_accuracy: 0.8224 - val_loss: 1.1035 -

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learning_rate: 1.2500e-04
Epoch 72/250
157/157          8s 50ms/step -
accuracy: 0.8270 - loss: 1.0802 - val_accuracy: 0.8325 - val_loss: 1.0504 -
learning_rate: 1.2500e-04
Epoch 73/250
157/157          8s 50ms/step -
accuracy: 0.8332 - loss: 1.0239 - val_accuracy: 0.8318 - val_loss: 1.0086 -
learning_rate: 1.2500e-04
Epoch 74/250
157/157          8s 51ms/step -
accuracy: 0.8335 - loss: 0.9984 - val_accuracy: 0.8340 - val_loss: 0.9795 -
learning_rate: 1.2500e-04
Epoch 75/250
157/157          10s 50ms/step -
accuracy: 0.8324 - loss: 0.9841 - val_accuracy: 0.8416 - val_loss: 0.9460 -
learning_rate: 1.2500e-04
Epoch 76/250
157/157          8s 50ms/step -
accuracy: 0.8372 - loss: 0.9632 - val_accuracy: 0.8492 - val_loss: 0.9118 -
learning_rate: 1.2500e-04
Epoch 77/250
157/157          8s 50ms/step -
accuracy: 0.8376 - loss: 0.9460 - val_accuracy: 0.8371 - val_loss: 0.9536 -
learning_rate: 1.2500e-04
Epoch 78/250
157/157          8s 50ms/step -
accuracy: 0.8363 - loss: 0.9404 - val_accuracy: 0.8438 - val_loss: 0.9153 -
learning_rate: 1.2500e-04
Epoch 79/250
157/157          8s 50ms/step -
accuracy: 0.8398 - loss: 0.9278 - val_accuracy: 0.8311 - val_loss: 0.9471 -
learning_rate: 1.2500e-04
Epoch 80/250
157/157          8s 50ms/step -
accuracy: 0.8417 - loss: 0.9127 - val_accuracy: 0.8455 - val_loss: 0.9085 -
learning_rate: 1.2500e-04
Epoch 81/250
157/157          8s 50ms/step -
accuracy: 0.8382 - loss: 0.9183 - val_accuracy: 0.8390 - val_loss: 0.9218 -
learning_rate: 1.2500e-04
Epoch 82/250
157/157          8s 50ms/step -
accuracy: 0.8429 - loss: 0.9046 - val_accuracy: 0.8381 - val_loss: 0.9392 -
learning_rate: 1.2500e-04
Epoch 83/250
157/157          8s 50ms/step -
accuracy: 0.8423 - loss: 0.9047 - val_accuracy: 0.8484 - val_loss: 0.8882 -

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learning_rate: 1.2500e-04
Epoch 84/250
157/157      8s 50ms/step -
accuracy: 0.8440 - loss: 0.8981 - val_accuracy: 0.8434 - val_loss: 0.9038 -
learning_rate: 1.2500e-04
Epoch 85/250
157/157      8s 50ms/step -
accuracy: 0.8456 - loss: 0.9002 - val_accuracy: 0.8494 - val_loss: 0.8892 -
learning_rate: 1.2500e-04
Epoch 86/250
157/157      8s 50ms/step -
accuracy: 0.8445 - loss: 0.8926 - val_accuracy: 0.8429 - val_loss: 0.9093 -
learning_rate: 1.2500e-04
Epoch 87/250
157/157      8s 50ms/step -
accuracy: 0.8473 - loss: 0.8840 - val_accuracy: 0.8461 - val_loss: 0.8977 -
learning_rate: 1.2500e-04
Epoch 88/250
157/157      8s 50ms/step -
accuracy: 0.8500 - loss: 0.8800 - val_accuracy: 0.8449 - val_loss: 0.9185 -
learning_rate: 1.2500e-04
Epoch 89/250
157/157      8s 50ms/step -
accuracy: 0.8557 - loss: 0.8553 - val_accuracy: 0.8502 - val_loss: 0.8753 -
learning_rate: 6.2500e-05
Epoch 90/250
157/157      8s 50ms/step -
accuracy: 0.8600 - loss: 0.8316 - val_accuracy: 0.8503 - val_loss: 0.8638 -
learning_rate: 6.2500e-05
Epoch 91/250
157/157      8s 50ms/step -
accuracy: 0.8624 - loss: 0.8104 - val_accuracy: 0.8536 - val_loss: 0.8345 -
learning_rate: 6.2500e-05
Epoch 92/250
157/157      8s 50ms/step -
accuracy: 0.8662 - loss: 0.7889 - val_accuracy: 0.8528 - val_loss: 0.8363 -
learning_rate: 6.2500e-05
Epoch 93/250
157/157      8s 50ms/step -
accuracy: 0.8735 - loss: 0.7630 - val_accuracy: 0.8564 - val_loss: 0.8158 -
learning_rate: 6.2500e-05
Epoch 94/250
157/157      8s 50ms/step -
accuracy: 0.8738 - loss: 0.7515 - val_accuracy: 0.8582 - val_loss: 0.7843 -
learning_rate: 6.2500e-05
Epoch 95/250
157/157      8s 50ms/step -
accuracy: 0.8723 - loss: 0.7447 - val_accuracy: 0.8499 - val_loss: 0.8170 -

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learning_rate: 6.2500e-05
Epoch 96/250
157/157          8s 50ms/step -
accuracy: 0.8771 - loss: 0.7287 - val_accuracy: 0.8546 - val_loss: 0.7975 -
learning_rate: 6.2500e-05
Epoch 97/250
157/157          8s 50ms/step -
accuracy: 0.8728 - loss: 0.7344 - val_accuracy: 0.8585 - val_loss: 0.7786 -
learning_rate: 6.2500e-05
Epoch 98/250
157/157          8s 50ms/step -
accuracy: 0.8764 - loss: 0.7156 - val_accuracy: 0.8510 - val_loss: 0.7916 -
learning_rate: 6.2500e-05
Epoch 99/250
157/157          8s 50ms/step -
accuracy: 0.8787 - loss: 0.7051 - val_accuracy: 0.8590 - val_loss: 0.7720 -
learning_rate: 6.2500e-05
Epoch 100/250
157/157          8s 50ms/step -
accuracy: 0.8817 - loss: 0.6931 - val_accuracy: 0.8552 - val_loss: 0.7775 -
learning_rate: 6.2500e-05
Epoch 101/250
157/157          8s 50ms/step -
accuracy: 0.8724 - loss: 0.7040 - val_accuracy: 0.8569 - val_loss: 0.7709 -
learning_rate: 6.2500e-05
Epoch 102/250
157/157          8s 50ms/step -
accuracy: 0.8866 - loss: 0.6750 - val_accuracy: 0.8647 - val_loss: 0.7476 -
learning_rate: 6.2500e-05
Epoch 103/250
157/157          8s 50ms/step -
accuracy: 0.8789 - loss: 0.6815 - val_accuracy: 0.8594 - val_loss: 0.7566 -
learning_rate: 6.2500e-05
Epoch 104/250
157/157          8s 50ms/step -
accuracy: 0.8819 - loss: 0.6740 - val_accuracy: 0.8600 - val_loss: 0.7497 -
learning_rate: 6.2500e-05
Epoch 105/250
157/157          8s 50ms/step -
accuracy: 0.8786 - loss: 0.6804 - val_accuracy: 0.8538 - val_loss: 0.7745 -
learning_rate: 6.2500e-05
Epoch 106/250
157/157          8s 50ms/step -
accuracy: 0.8854 - loss: 0.6580 - val_accuracy: 0.8582 - val_loss: 0.7605 -
learning_rate: 6.2500e-05
Epoch 107/250
157/157          8s 50ms/step -
accuracy: 0.8878 - loss: 0.6525 - val_accuracy: 0.8549 - val_loss: 0.7639 -

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learning_rate: 6.2500e-05
Epoch 108/250
157/157 8s 50ms/step -
accuracy: 0.8875 - loss: 0.6498 - val_accuracy: 0.8609 - val_loss: 0.7396 -
learning_rate: 3.1250e-05
Epoch 109/250
157/157 8s 50ms/step -
accuracy: 0.8879 - loss: 0.6414 - val_accuracy: 0.8648 - val_loss: 0.7197 -
learning_rate: 3.1250e-05
Epoch 110/250
157/157 8s 50ms/step -
accuracy: 0.8948 - loss: 0.6229 - val_accuracy: 0.8650 - val_loss: 0.7173 -
learning_rate: 3.1250e-05
Epoch 111/250
157/157 8s 50ms/step -
accuracy: 0.8958 - loss: 0.6075 - val_accuracy: 0.8670 - val_loss: 0.7077 -
learning_rate: 3.1250e-05
Epoch 112/250
157/157 8s 50ms/step -
accuracy: 0.8934 - loss: 0.6139 - val_accuracy: 0.8657 - val_loss: 0.7142 -
learning_rate: 3.1250e-05
Epoch 113/250
157/157 8s 50ms/step -
accuracy: 0.9011 - loss: 0.5942 - val_accuracy: 0.8673 - val_loss: 0.7048 -
learning_rate: 3.1250e-05
Epoch 114/250
157/157 8s 50ms/step -
accuracy: 0.8950 - loss: 0.5964 - val_accuracy: 0.8697 - val_loss: 0.6910 -
learning_rate: 3.1250e-05
Epoch 115/250
157/157 8s 50ms/step -
accuracy: 0.8988 - loss: 0.5913 - val_accuracy: 0.8648 - val_loss: 0.7039 -
learning_rate: 3.1250e-05
Epoch 116/250
157/157 8s 50ms/step -
accuracy: 0.8993 - loss: 0.5857 - val_accuracy: 0.8681 - val_loss: 0.6893 -
learning_rate: 3.1250e-05
Epoch 117/250
157/157 8s 50ms/step -
accuracy: 0.8996 - loss: 0.5827 - val_accuracy: 0.8665 - val_loss: 0.6937 -
learning_rate: 3.1250e-05
Epoch 118/250
157/157 8s 50ms/step -
accuracy: 0.9010 - loss: 0.5719 - val_accuracy: 0.8720 - val_loss: 0.6713 -
learning_rate: 3.1250e-05
Epoch 119/250
157/157 8s 50ms/step -
accuracy: 0.9030 - loss: 0.5621 - val_accuracy: 0.8721 - val_loss: 0.6702 -

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learning_rate: 3.1250e-05
Epoch 120/250
157/157          8s 50ms/step -
accuracy: 0.9059 - loss: 0.5541 - val_accuracy: 0.8689 - val_loss: 0.6847 -
learning_rate: 3.1250e-05
Epoch 121/250
157/157          8s 50ms/step -
accuracy: 0.9026 - loss: 0.5545 - val_accuracy: 0.8719 - val_loss: 0.6671 -
learning_rate: 3.1250e-05
Epoch 122/250
157/157          8s 50ms/step -
accuracy: 0.9032 - loss: 0.5550 - val_accuracy: 0.8708 - val_loss: 0.6688 -
learning_rate: 3.1250e-05
Epoch 123/250
157/157          8s 50ms/step -
accuracy: 0.9055 - loss: 0.5474 - val_accuracy: 0.8709 - val_loss: 0.6709 -
learning_rate: 3.1250e-05
Epoch 124/250
157/157          8s 50ms/step -
accuracy: 0.9045 - loss: 0.5414 - val_accuracy: 0.8704 - val_loss: 0.6713 -
learning_rate: 3.1250e-05
Epoch 125/250
157/157          8s 50ms/step -
accuracy: 0.9085 - loss: 0.5291 - val_accuracy: 0.8711 - val_loss: 0.6632 -
learning_rate: 3.1250e-05
Epoch 126/250
157/157          8s 50ms/step -
accuracy: 0.9040 - loss: 0.5447 - val_accuracy: 0.8680 - val_loss: 0.6779 -
learning_rate: 3.1250e-05
Epoch 127/250
157/157          8s 50ms/step -
accuracy: 0.9077 - loss: 0.5310 - val_accuracy: 0.8695 - val_loss: 0.6640 -
learning_rate: 3.1250e-05
Epoch 128/250
157/157          8s 50ms/step -
accuracy: 0.9046 - loss: 0.5286 - val_accuracy: 0.8737 - val_loss: 0.6496 -
learning_rate: 3.1250e-05
Epoch 129/250
157/157          8s 50ms/step -
accuracy: 0.9079 - loss: 0.5283 - val_accuracy: 0.8719 - val_loss: 0.6588 -
learning_rate: 3.1250e-05
Epoch 130/250
157/157          8s 50ms/step -
accuracy: 0.9088 - loss: 0.5193 - val_accuracy: 0.8722 - val_loss: 0.6601 -
learning_rate: 3.1250e-05
Epoch 131/250
157/157          8s 50ms/step -
accuracy: 0.9096 - loss: 0.5195 - val_accuracy: 0.8720 - val_loss: 0.6551 -

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learning_rate: 3.1250e-05
Epoch 132/250
157/157          8s 50ms/step -
accuracy: 0.9109 - loss: 0.5095 - val_accuracy: 0.8759 - val_loss: 0.6462 -
learning_rate: 3.1250e-05
Epoch 133/250
157/157          8s 50ms/step -
accuracy: 0.9115 - loss: 0.5032 - val_accuracy: 0.8726 - val_loss: 0.6525 -
learning_rate: 3.1250e-05
Epoch 134/250
157/157          8s 50ms/step -
accuracy: 0.9120 - loss: 0.5059 - val_accuracy: 0.8734 - val_loss: 0.6484 -
learning_rate: 3.1250e-05
Epoch 135/250
157/157          8s 50ms/step -
accuracy: 0.9121 - loss: 0.5070 - val_accuracy: 0.8723 - val_loss: 0.6485 -
learning_rate: 3.1250e-05
Epoch 136/250
157/157          8s 50ms/step -
accuracy: 0.9088 - loss: 0.5065 - val_accuracy: 0.8717 - val_loss: 0.6428 -
learning_rate: 3.1250e-05
Epoch 137/250
157/157          8s 50ms/step -
accuracy: 0.9117 - loss: 0.4927 - val_accuracy: 0.8747 - val_loss: 0.6370 -
learning_rate: 3.1250e-05
Epoch 138/250
157/157          8s 50ms/step -
accuracy: 0.9147 - loss: 0.4886 - val_accuracy: 0.8774 - val_loss: 0.6269 -
learning_rate: 3.1250e-05
Epoch 139/250
157/157          8s 50ms/step -
accuracy: 0.9154 - loss: 0.4891 - val_accuracy: 0.8717 - val_loss: 0.6421 -
learning_rate: 3.1250e-05
Epoch 140/250
157/157          8s 50ms/step -
accuracy: 0.9120 - loss: 0.4947 - val_accuracy: 0.8715 - val_loss: 0.6471 -
learning_rate: 3.1250e-05
Epoch 141/250
157/157          8s 50ms/step -
accuracy: 0.9158 - loss: 0.4849 - val_accuracy: 0.8690 - val_loss: 0.6512 -
learning_rate: 3.1250e-05
Epoch 142/250
157/157          8s 50ms/step -
accuracy: 0.9143 - loss: 0.4899 - val_accuracy: 0.8705 - val_loss: 0.6468 -
learning_rate: 3.1250e-05
Epoch 143/250
157/157          8s 50ms/step -
accuracy: 0.9127 - loss: 0.4903 - val_accuracy: 0.8689 - val_loss: 0.6434 -

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learning_rate: 3.1250e-05
Epoch 144/250
157/157          8s 50ms/step -
accuracy: 0.9142 - loss: 0.4833 - val_accuracy: 0.8725 - val_loss: 0.6300 -
learning_rate: 1.5625e-05
Epoch 145/250
157/157          8s 50ms/step -
accuracy: 0.9140 - loss: 0.4732 - val_accuracy: 0.8752 - val_loss: 0.6294 -
learning_rate: 1.5625e-05
Epoch 146/250
157/157          8s 50ms/step -
accuracy: 0.9202 - loss: 0.4614 - val_accuracy: 0.8758 - val_loss: 0.6252 -
learning_rate: 1.5625e-05
Epoch 147/250
157/157          8s 50ms/step -
accuracy: 0.9197 - loss: 0.4664 - val_accuracy: 0.8758 - val_loss: 0.6255 -
learning_rate: 1.5625e-05
Epoch 148/250
157/157          8s 50ms/step -
accuracy: 0.9169 - loss: 0.4620 - val_accuracy: 0.8743 - val_loss: 0.6315 -
learning_rate: 1.5625e-05
Epoch 149/250
157/157          8s 50ms/step -
accuracy: 0.9232 - loss: 0.4476 - val_accuracy: 0.8763 - val_loss: 0.6216 -
learning_rate: 1.5625e-05
Epoch 150/250
157/157          8s 50ms/step -
accuracy: 0.9195 - loss: 0.4648 - val_accuracy: 0.8744 - val_loss: 0.6201 -
learning_rate: 1.5625e-05
Epoch 151/250
157/157          8s 50ms/step -
accuracy: 0.9197 - loss: 0.4579 - val_accuracy: 0.8748 - val_loss: 0.6190 -
learning_rate: 1.5625e-05
Epoch 152/250
157/157          8s 50ms/step -
accuracy: 0.9235 - loss: 0.4490 - val_accuracy: 0.8757 - val_loss: 0.6117 -
learning_rate: 1.5625e-05
Epoch 153/250
157/157          8s 50ms/step -
accuracy: 0.9201 - loss: 0.4556 - val_accuracy: 0.8764 - val_loss: 0.6170 -
learning_rate: 1.5625e-05
Epoch 154/250
157/157          8s 50ms/step -
accuracy: 0.9235 - loss: 0.4460 - val_accuracy: 0.8776 - val_loss: 0.6141 -
learning_rate: 1.5625e-05
Epoch 155/250
157/157          8s 50ms/step -
accuracy: 0.9261 - loss: 0.4358 - val_accuracy: 0.8787 - val_loss: 0.6090 -

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learning_rate: 1.5625e-05
Epoch 156/250
157/157      8s 50ms/step -
accuracy: 0.9263 - loss: 0.4370 - val_accuracy: 0.8743 - val_loss: 0.6169 -
learning_rate: 1.5625e-05
Epoch 157/250
157/157      8s 50ms/step -
accuracy: 0.9234 - loss: 0.4377 - val_accuracy: 0.8748 - val_loss: 0.6119 -
learning_rate: 1.5625e-05
Epoch 158/250
157/157      8s 50ms/step -
accuracy: 0.9245 - loss: 0.4349 - val_accuracy: 0.8736 - val_loss: 0.6206 -
learning_rate: 1.5625e-05
Epoch 159/250
157/157      8s 50ms/step -
accuracy: 0.9203 - loss: 0.4406 - val_accuracy: 0.8781 - val_loss: 0.6107 -
learning_rate: 1.5625e-05
Epoch 160/250
157/157      8s 51ms/step -
accuracy: 0.9266 - loss: 0.4226 - val_accuracy: 0.8746 - val_loss: 0.6143 -
learning_rate: 1.5625e-05
Epoch 161/250
157/157      8s 50ms/step -
accuracy: 0.9254 - loss: 0.4215 - val_accuracy: 0.8766 - val_loss: 0.6075 -
learning_rate: 7.8125e-06
Epoch 162/250
157/157      8s 50ms/step -
accuracy: 0.9289 - loss: 0.4187 - val_accuracy: 0.8783 - val_loss: 0.6059 -
learning_rate: 7.8125e-06
Epoch 163/250
157/157     10s 50ms/step -
accuracy: 0.9258 - loss: 0.4275 - val_accuracy: 0.8784 - val_loss: 0.6059 -
learning_rate: 7.8125e-06
Epoch 164/250
157/157      8s 50ms/step -
accuracy: 0.9269 - loss: 0.4205 - val_accuracy: 0.8777 - val_loss: 0.6058 -
learning_rate: 7.8125e-06
Epoch 165/250
157/157      8s 50ms/step -
accuracy: 0.9285 - loss: 0.4209 - val_accuracy: 0.8770 - val_loss: 0.6054 -
learning_rate: 7.8125e-06
Epoch 166/250
157/157      8s 50ms/step -
accuracy: 0.9313 - loss: 0.4140 - val_accuracy: 0.8796 - val_loss: 0.6006 -
learning_rate: 7.8125e-06
Epoch 167/250
157/157      8s 50ms/step -
accuracy: 0.9301 - loss: 0.4160 - val_accuracy: 0.8791 - val_loss: 0.5961 -

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learning_rate: 7.8125e-06
Epoch 168/250
157/157          8s 50ms/step -
accuracy: 0.9325 - loss: 0.4048 - val_accuracy: 0.8796 - val_loss: 0.5963 -
learning_rate: 7.8125e-06
Epoch 169/250
157/157          8s 50ms/step -
accuracy: 0.9267 - loss: 0.4128 - val_accuracy: 0.8776 - val_loss: 0.5985 -
learning_rate: 7.8125e-06
Epoch 170/250
157/157          8s 50ms/step -
accuracy: 0.9309 - loss: 0.4077 - val_accuracy: 0.8771 - val_loss: 0.5978 -
learning_rate: 7.8125e-06
Epoch 171/250
157/157          8s 50ms/step -
accuracy: 0.9298 - loss: 0.4101 - val_accuracy: 0.8794 - val_loss: 0.5951 -
learning_rate: 7.8125e-06
Epoch 172/250
157/157          8s 50ms/step -
accuracy: 0.9321 - loss: 0.4070 - val_accuracy: 0.8763 - val_loss: 0.6006 -
learning_rate: 7.8125e-06
Epoch 173/250
157/157          8s 50ms/step -
accuracy: 0.9326 - loss: 0.4032 - val_accuracy: 0.8772 - val_loss: 0.5987 -
learning_rate: 7.8125e-06
Epoch 174/250
157/157          8s 50ms/step -
accuracy: 0.9302 - loss: 0.4020 - val_accuracy: 0.8782 - val_loss: 0.5918 -
learning_rate: 7.8125e-06
Epoch 175/250
157/157          8s 50ms/step -
accuracy: 0.9307 - loss: 0.4043 - val_accuracy: 0.8759 - val_loss: 0.5981 -
learning_rate: 7.8125e-06
Epoch 176/250
157/157          8s 50ms/step -
accuracy: 0.9331 - loss: 0.4012 - val_accuracy: 0.8775 - val_loss: 0.5993 -
learning_rate: 7.8125e-06
Epoch 177/250
157/157          8s 50ms/step -
accuracy: 0.9325 - loss: 0.3986 - val_accuracy: 0.8774 - val_loss: 0.5934 -
learning_rate: 7.8125e-06
Epoch 178/250
157/157          8s 50ms/step -
accuracy: 0.9321 - loss: 0.3975 - val_accuracy: 0.8769 - val_loss: 0.5947 -
learning_rate: 7.8125e-06
Epoch 179/250
157/157          8s 50ms/step -
accuracy: 0.9317 - loss: 0.3973 - val_accuracy: 0.8768 - val_loss: 0.5989 -

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learning_rate: 7.8125e-06
Epoch 180/250
157/157          8s 50ms/step -
accuracy: 0.9339 - loss: 0.3914 - val_accuracy: 0.8783 - val_loss: 0.5921 -
learning_rate: 3.9063e-06
Epoch 181/250
157/157          8s 50ms/step -
accuracy: 0.9354 - loss: 0.3909 - val_accuracy: 0.8782 - val_loss: 0.5923 -
learning_rate: 3.9063e-06
Epoch 182/250
157/157          8s 50ms/step -
accuracy: 0.9326 - loss: 0.3944 - val_accuracy: 0.8780 - val_loss: 0.5936 -
learning_rate: 3.9063e-06
Epoch 183/250
157/157          8s 50ms/step -
accuracy: 0.9330 - loss: 0.3935 - val_accuracy: 0.8778 - val_loss: 0.5923 -
learning_rate: 3.9063e-06
Epoch 184/250
157/157          8s 50ms/step -
accuracy: 0.9320 - loss: 0.3913 - val_accuracy: 0.8783 - val_loss: 0.5887 -
learning_rate: 3.9063e-06
Epoch 185/250
157/157          8s 50ms/step -
accuracy: 0.9308 - loss: 0.3960 - val_accuracy: 0.8786 - val_loss: 0.5913 -
learning_rate: 3.9063e-06
Epoch 186/250
157/157          8s 50ms/step -
accuracy: 0.9333 - loss: 0.3858 - val_accuracy: 0.8789 - val_loss: 0.5889 -
learning_rate: 3.9063e-06
Epoch 187/250
157/157          8s 50ms/step -
accuracy: 0.9330 - loss: 0.3899 - val_accuracy: 0.8784 - val_loss: 0.5876 -
learning_rate: 3.9063e-06
Epoch 188/250
157/157          8s 50ms/step -
accuracy: 0.9334 - loss: 0.3878 - val_accuracy: 0.8785 - val_loss: 0.5874 -
learning_rate: 3.9063e-06
Epoch 189/250
157/157          8s 50ms/step -
accuracy: 0.9347 - loss: 0.3877 - val_accuracy: 0.8783 - val_loss: 0.5888 -
learning_rate: 3.9063e-06
Epoch 190/250
157/157          8s 50ms/step -
accuracy: 0.9358 - loss: 0.3813 - val_accuracy: 0.8787 - val_loss: 0.5879 -
learning_rate: 3.9063e-06
Epoch 191/250
157/157          8s 51ms/step -
accuracy: 0.9353 - loss: 0.3844 - val_accuracy: 0.8784 - val_loss: 0.5898 -

```

```

learning_rate: 3.9063e-06
Epoch 192/250
157/157      8s 51ms/step -
accuracy: 0.9389 - loss: 0.3807 - val_accuracy: 0.8786 - val_loss: 0.5887 -
learning_rate: 3.9063e-06
Epoch 193/250
157/157      8s 50ms/step -
accuracy: 0.9377 - loss: 0.3800 - val_accuracy: 0.8774 - val_loss: 0.5905 -
learning_rate: 3.9063e-06
Epoch 194/250
157/157      8s 50ms/step -
accuracy: 0.9356 - loss: 0.3816 - val_accuracy: 0.8780 - val_loss: 0.5907 -
learning_rate: 1.9531e-06
Epoch 195/250
157/157      8s 50ms/step -
accuracy: 0.9366 - loss: 0.3770 - val_accuracy: 0.8778 - val_loss: 0.5883 -
learning_rate: 1.9531e-06
Epoch 196/250
157/157      8s 50ms/step -
accuracy: 0.9346 - loss: 0.3823 - val_accuracy: 0.8797 - val_loss: 0.5858 -
learning_rate: 1.9531e-06
Epoch 197/250
157/157      8s 50ms/step -
accuracy: 0.9387 - loss: 0.3718 - val_accuracy: 0.8791 - val_loss: 0.5869 -
learning_rate: 1.9531e-06
Epoch 198/250
157/157      8s 50ms/step -
accuracy: 0.9361 - loss: 0.3762 - val_accuracy: 0.8783 - val_loss: 0.5896 -
learning_rate: 1.9531e-06
Epoch 199/250
157/157      8s 50ms/step -
accuracy: 0.9353 - loss: 0.3791 - val_accuracy: 0.8785 - val_loss: 0.5880 -
learning_rate: 1.9531e-06
Epoch 200/250
157/157      8s 50ms/step -
accuracy: 0.9379 - loss: 0.3792 - val_accuracy: 0.8783 - val_loss: 0.5869 -
learning_rate: 1.9531e-06
Epoch 201/250
157/157      8s 50ms/step -
accuracy: 0.9390 - loss: 0.3728 - val_accuracy: 0.8791 - val_loss: 0.5859 -
learning_rate: 1.9531e-06
Epoch 202/250
157/157      8s 50ms/step -
accuracy: 0.9343 - loss: 0.3822 - val_accuracy: 0.8795 - val_loss: 0.5856 -
learning_rate: 1.0000e-06
Epoch 203/250
157/157      8s 50ms/step -
accuracy: 0.9372 - loss: 0.3794 - val_accuracy: 0.8796 - val_loss: 0.5861 -

```

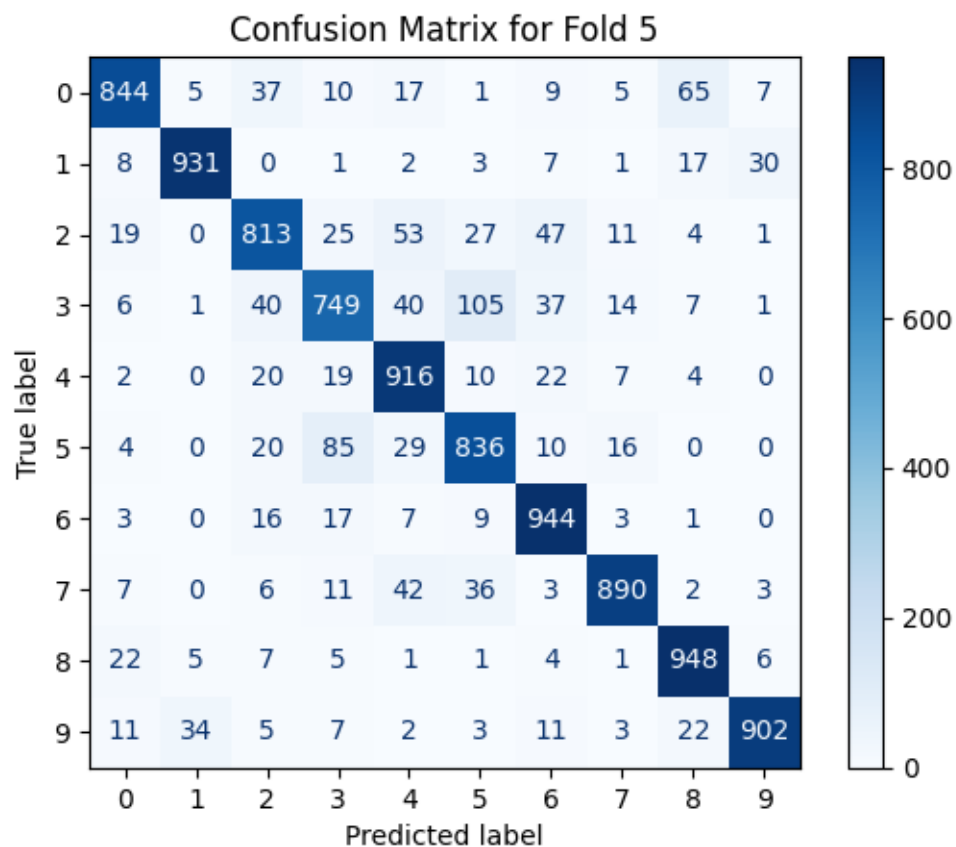


```

learning_rate: 1.0000e-06
Epoch 204/250
157/157          8s 50ms/step -
accuracy: 0.9354 - loss: 0.3824 - val_accuracy: 0.8796 - val_loss: 0.5842 -
learning_rate: 1.0000e-06
Epoch 205/250
157/157          8s 50ms/step -
accuracy: 0.9358 - loss: 0.3781 - val_accuracy: 0.8795 - val_loss: 0.5833 -
learning_rate: 1.0000e-06
Epoch 206/250
157/157          8s 50ms/step -
accuracy: 0.9366 - loss: 0.3751 - val_accuracy: 0.8796 - val_loss: 0.5842 -
learning_rate: 1.0000e-06
Epoch 207/250
157/157          8s 50ms/step -
accuracy: 0.9364 - loss: 0.3794 - val_accuracy: 0.8796 - val_loss: 0.5840 -
learning_rate: 1.0000e-06
Epoch 208/250
157/157          8s 50ms/step -
accuracy: 0.9417 - loss: 0.3646 - val_accuracy: 0.8795 - val_loss: 0.5845 -
learning_rate: 1.0000e-06
Epoch 209/250
157/157          8s 50ms/step -
accuracy: 0.9343 - loss: 0.3820 - val_accuracy: 0.8798 - val_loss: 0.5847 -
learning_rate: 1.0000e-06
Epoch 210/250
157/157          8s 50ms/step -
accuracy: 0.9350 - loss: 0.3815 - val_accuracy: 0.8796 - val_loss: 0.5855 -
learning_rate: 1.0000e-06
Epoch 211/250
157/157          8s 50ms/step -
accuracy: 0.9404 - loss: 0.3678 - val_accuracy: 0.8792 - val_loss: 0.5838 -
learning_rate: 1.0000e-06
Epoch 212/250
157/157          8s 50ms/step -
accuracy: 0.9376 - loss: 0.3726 - val_accuracy: 0.8794 - val_loss: 0.5846 -
learning_rate: 1.0000e-06
Epoch 213/250
157/157          8s 50ms/step -
accuracy: 0.9358 - loss: 0.3808 - val_accuracy: 0.8793 - val_loss: 0.5850 -
learning_rate: 1.0000e-06
Epoch 214/250
157/157          8s 50ms/step -
accuracy: 0.9360 - loss: 0.3789 - val_accuracy: 0.8795 - val_loss: 0.5836 -
learning_rate: 1.0000e-06
Epoch 215/250
157/157          8s 50ms/step -
accuracy: 0.9346 - loss: 0.3800 - val_accuracy: 0.8797 - val_loss: 0.5847 -

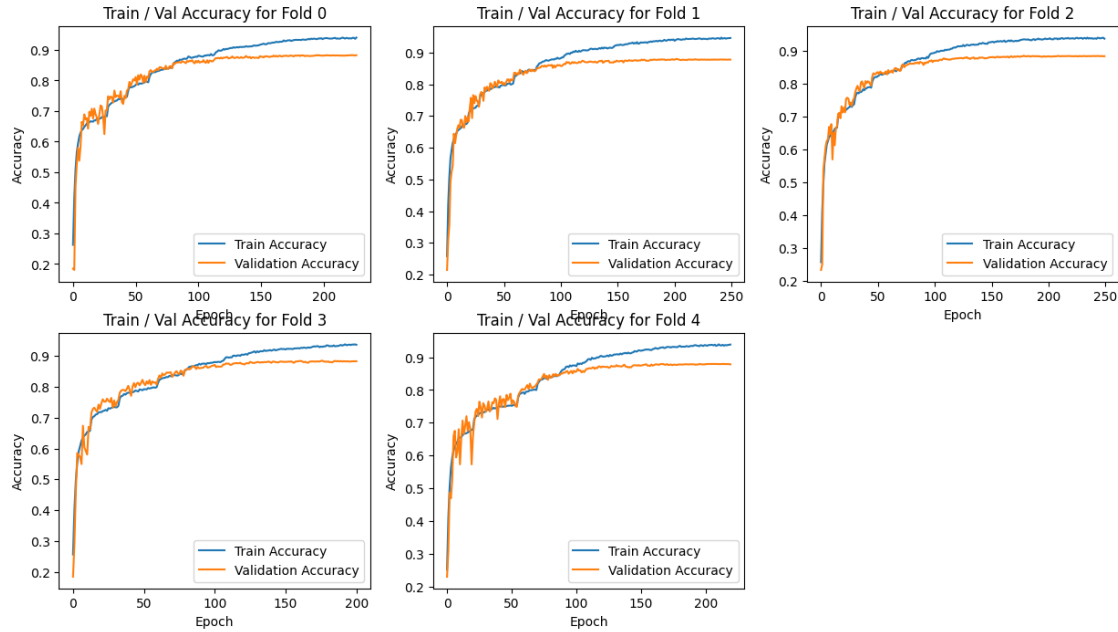
```

```
learning_rate: 1.0000e-06
Epoch 216/250
157/157      8s 50ms/step -
accuracy: 0.9370 - loss: 0.3761 - val_accuracy: 0.8794 - val_loss: 0.5840 -
learning_rate: 1.0000e-06
Epoch 217/250
157/157      8s 50ms/step -
accuracy: 0.9371 - loss: 0.3753 - val_accuracy: 0.8792 - val_loss: 0.5840 -
learning_rate: 1.0000e-06
Epoch 218/250
157/157      8s 50ms/step -
accuracy: 0.9378 - loss: 0.3721 - val_accuracy: 0.8795 - val_loss: 0.5837 -
learning_rate: 1.0000e-06
Epoch 219/250
157/157      8s 50ms/step -
accuracy: 0.9377 - loss: 0.3683 - val_accuracy: 0.8790 - val_loss: 0.5843 -
learning_rate: 1.0000e-06
Epoch 220/250
157/157      8s 50ms/step -
accuracy: 0.9386 - loss: 0.3704 - val_accuracy: 0.8785 - val_loss: 0.5863 -
learning_rate: 1.0000e-06
Score for fold 5: test loss of 0.6042349338531494; test accuracy of
87.73000240325928%
313/313      1s 3ms/step
```



Classification Report for Fold 5:

	precision	recall	f1-score	support
Class 0	0.91	0.84	0.88	1000
Class 1	0.95	0.93	0.94	1000
Class 2	0.84	0.81	0.83	1000
Class 3	0.81	0.75	0.78	1000
Class 4	0.83	0.92	0.87	1000
Class 5	0.81	0.84	0.82	1000
Class 6	0.86	0.94	0.90	1000
Class 7	0.94	0.89	0.91	1000
Class 8	0.89	0.95	0.92	1000
Class 9	0.95	0.90	0.93	1000
accuracy			0.88	10000
macro avg	0.88	0.88	0.88	10000
weighted avg	0.88	0.88	0.88	10000



Average test loss = 0.6027082681655884; Average test accuracy = 87.7400004863739%

Comment on the results of the above experiment, including which classes were difficult to classify and your opinion. Mention whether you think the experiment was successful, and what your learnt from it.

Answer (to write answers edit this cell)

An optimum cross validation accuracy of approximately 88%, of the CNN after many tested network architectures and hyperparameters was achieved. The network architectures were tested, changing the number of convolutional layers, dense layers, regularization methods, and learning rate sheuling methods. The hyperparameters including batch size, leraning rate, l2 regularization coefficient, number of layers in each convolution/dense layer, dropout ratios etc. were changed to obtain a higher accuracy of the system.

The experiment was a success resulting a high accuracy. The above hyperparameters were chosen after many attempts. The second set execution is slightly better than the first one when these two are compared.

I was able to dive deep into how a CNN works, and how I could change the hyperparameters to increase the performance. Also I was able to practically apply the theoritical knowledge by training the dataset.