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# 1 COMP5318 Assignment 2: Image Classification

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This notebook includes the code to load the Fashion-MNIST dataset using Keras, and a skeleton for the main sections that should be included in the notebook. Please see the assignment specification for more detail. You may wish to add extra subsections where appropriate.

Please focus on making your code clear, with appropriate variable names and whitespace. Include comments and markdown text to aid the readability of your code where relevant.

## 1.1 Setup and dependencies

Please use this section to list and set up all your required libraries/dependencies and your plotting environment.

```
[2]: import numpy as np
import tensorflow as tf
from tensorflow import keras
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
from sklearn import metrics
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.model_selection import GridSearchCV
from scikeras.wrappers import KerasClassifier
from itertools import product
from keras import optimizers
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings("ignore")
import logging
logging.getLogger("tensorflow").setLevel(logging.ERROR)
```

## 1.2 1. Data loading, preprocessing, and exploration

We have included the code to load the dataset below. Please proceed with your data exploration and preprocessing steps, including creating any relevant data subsets required. The documentation for the data loading function can be accessed [here](#).

```
[3]: # Load the Fashion-MNIST dataset training and test sets as numpy arrays
(X_train, y_train), (X_test, y_test) = keras.datasets.fashion_mnist.load_data()
assert X_train.shape == (60000, 28, 28)
assert X_test.shape == (10000, 28, 28)
assert y_train.shape == (60000,)
assert y_test.shape == (10000,)
```

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/train-labels-idx1-ubyte.gz
29515/29515 [=====] - 0s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/train-images-idx3-ubyte.gz
26421880/26421880 [=====] - 0s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/t10k-labels-idx1-ubyte.gz
5148/5148 [=====] - 0s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/t10k-images-idx3-ubyte.gz
4422102/4422102 [=====] - 0s 0us/step
```

```
[4]: # An ordered list of the class names
class_names = ["T-shirt/top",
               "Trouser",
               "Pullover",
               "Dress",
               "Coat",
               "Sandal",
               "Shirt",
               "Sneaker",
               "Bag",
               "Ankle boot"
              ]
```

```
[5]: # Show part of the Fashion_MNIST dataset
def plot_examples(data, label, n_rows=4, n_cols=10):

    # Size figure depending on the size of the grid
    plt.figure(figsize=(n_cols * 1.5, n_rows * 1.5))

    for row in range(n_rows):
        for col in range(n_cols):

            # Get next index of image
            index = n_cols * row + col

            # Plot the image at appropriate place in grid
            plt.subplot(n_rows, n_cols, index + 1).
            ↪set_title(class_names[label[index]])
```

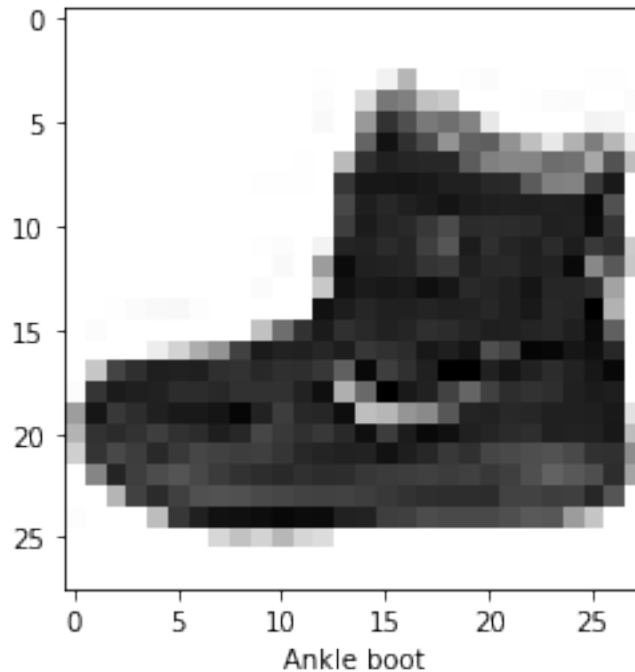
```
plt.imshow(data[index], cmap="binary")
plt.axis('off')

plt.savefig('figure_1')
plt.show()

plot_examples(X_train,y_train)
```



```
[6]: # Show the first data of Fashion_MNIST dataset
plt.imshow(X_train[0], cmap="binary")
plt.xlabel(class_names[y_train[0]])
plt.savefig('figure_2')
plt.show()
```



```
[7]: # Normalize the Fashion_MNIST dataset
```

```
X_train = X_train / 255.
```

```
X_test = X_test / 255.
```

```
[8]: # Convert the Fashion_MNIST dataset into a two-dimensional array for use in the
      ↪ random forest algorithm
```

```
X_train_rf = X_train.reshape(X_train.shape[0], 28*28)
```

```
X_test_rf = X_test.reshape(X_test.shape[0], 28*28)
```

```
y_train_rf = y_train
```

```
print(f"New shape of X_train_rf: {X_train_rf.shape}")
```

```
print(f"New shape of X_test_rf: {X_test_rf.shape}")
```

```
New shape of X_train_rf: (60000, 784)
```

```
New shape of X_test_rf: (10000, 784)
```

```
[9]: # Dividing the data into training and validation sets
```

```
X_train, X_valid, y_train, y_valid = train_test_split(X_train, y_train,
      ↪ train_size=0.9)
```

```
[10]: # Add an extra dimension to our data
```

```
X_train_cnn = np.expand_dims(X_train, -1)
```

```
X_valid_cnn = np.expand_dims(X_valid, -1)
```

```
X_test_cnn = np.expand_dims(X_test, -1)
```

```
print(f"New shape of X_train_cnn: {X_train_cnn.shape}")
print(f"New shape of X_valid_cnn: {X_valid_cnn.shape}")
```

New shape of X\_train\_cnn: (54000, 28, 28, 1)

New shape of X\_valid\_cnn: (6000, 28, 28, 1)

## 1.3 2. Algorithm design and setup

### 1.3.1 Algorithm of choice from first six weeks of course

```
[11]: from sklearn.ensemble import RandomForestClassifier
# Create the Random Forest classifier and train the data
rf = RandomForestClassifier()
rf.fit(X_train_rf, y_train_rf)

# Predict the test set data and get the preliminary accuracy
y_pred = rf.predict(X_test_rf)
accuracy_rf = metrics.accuracy_score(y_test, y_pred)
print('RF accuracy: %.2f%%' % (100 * accuracy_rf))
```

RF accuracy: 87.71%

### 1.3.2 Fully connected neural network

```
[12]: # Create functions for building multilayer perceptron models
def build_mlp(activation_function1, activation_function2, optimizer_lr):

    model = keras.models.Sequential()

    # Add the input layer
    model.add(keras.layers.Flatten(input_shape=[28, 28]))

    # Add the hidden layers with desired size and activation function
    model.add(keras.layers.Dense(300, activation=activation_function1))

    model.add(keras.layers.Dense(100, activation=activation_function2))

    # Add the output layer for 10 class classification
    model.add(keras.layers.Dense(10, activation="softmax"))

    # Compile optimization functions
    opt = keras.optimizers.SGD(learning_rate=optimizer_lr)
    model.compile(loss='sparse_categorical_crossentropy',
                  optimizer=opt,
                  metrics=['accuracy'])

    return model
```

```
[13]: model = build_mlp('tanh','tanh',5e-2)
      model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
flatten (Flatten)	(None, 784)	0
dense (Dense)	(None, 300)	235500
dense_1 (Dense)	(None, 100)	30100
dense_2 (Dense)	(None, 10)	1010

=====  
Total params: 266,610  
Trainable params: 266,610  
Non-trainable params: 0  
=====

```
[14]: history = model.fit(X_train, y_train, epochs=30,
                          validation_data=(X_valid, y_valid))
```

```
Epoch 1/30
1688/1688 [=====] - 6s 2ms/step - loss: 0.5318 -
accuracy: 0.8094 - val_loss: 0.4320 - val_accuracy: 0.8440
Epoch 2/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.4088 -
accuracy: 0.8508 - val_loss: 0.4556 - val_accuracy: 0.8260
Epoch 3/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3720 -
accuracy: 0.8661 - val_loss: 0.3755 - val_accuracy: 0.8593
Epoch 4/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3470 -
accuracy: 0.8725 - val_loss: 0.3562 - val_accuracy: 0.8715
Epoch 5/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3303 -
accuracy: 0.8794 - val_loss: 0.3464 - val_accuracy: 0.8728
Epoch 6/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3128 -
accuracy: 0.8844 - val_loss: 0.3314 - val_accuracy: 0.8797
Epoch 7/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3022 -
accuracy: 0.8894 - val_loss: 0.3276 - val_accuracy: 0.8813
Epoch 8/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2896 -
accuracy: 0.8938 - val_loss: 0.3193 - val_accuracy: 0.8815
```

Epoch 9/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2801 - accuracy: 0.8974 - val\_loss: 0.3621 - val\_accuracy: 0.8638

Epoch 10/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2713 - accuracy: 0.8997 - val\_loss: 0.3541 - val\_accuracy: 0.8762

Epoch 11/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2627 - accuracy: 0.9030 - val\_loss: 0.3055 - val\_accuracy: 0.8878

Epoch 12/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2556 - accuracy: 0.9046 - val\_loss: 0.3914 - val\_accuracy: 0.8543

Epoch 13/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2484 - accuracy: 0.9081 - val\_loss: 0.3035 - val\_accuracy: 0.8915

Epoch 14/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2406 - accuracy: 0.9107 - val\_loss: 0.3044 - val\_accuracy: 0.8908

Epoch 15/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2353 - accuracy: 0.9127 - val\_loss: 0.2877 - val\_accuracy: 0.8952

Epoch 16/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2298 - accuracy: 0.9144 - val\_loss: 0.2943 - val\_accuracy: 0.8975

Epoch 17/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2242 - accuracy: 0.9173 - val\_loss: 0.2882 - val\_accuracy: 0.8940

Epoch 18/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2177 - accuracy: 0.9187 - val\_loss: 0.3189 - val\_accuracy: 0.8798

Epoch 19/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2114 - accuracy: 0.9227 - val\_loss: 0.2957 - val\_accuracy: 0.8930

Epoch 20/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2061 - accuracy: 0.9240 - val\_loss: 0.2998 - val\_accuracy: 0.8960

Epoch 21/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2012 - accuracy: 0.9242 - val\_loss: 0.2898 - val\_accuracy: 0.8997

Epoch 22/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.1970 - accuracy: 0.9274 - val\_loss: 0.2973 - val\_accuracy: 0.8967

Epoch 23/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.1917 - accuracy: 0.9285 - val\_loss: 0.2918 - val\_accuracy: 0.9013

Epoch 24/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.1881 - accuracy: 0.9296 - val\_loss: 0.2928 - val\_accuracy: 0.8963

```

Epoch 25/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1818 -
accuracy: 0.9326 - val_loss: 0.3100 - val_accuracy: 0.8955
Epoch 26/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1781 -
accuracy: 0.9338 - val_loss: 0.3107 - val_accuracy: 0.8918
Epoch 27/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1734 -
accuracy: 0.9349 - val_loss: 0.2975 - val_accuracy: 0.8955
Epoch 28/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1690 -
accuracy: 0.9372 - val_loss: 0.2929 - val_accuracy: 0.8980
Epoch 29/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1659 -
accuracy: 0.9376 - val_loss: 0.2980 - val_accuracy: 0.8988
Epoch 30/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1612 -
accuracy: 0.9409 - val_loss: 0.3350 - val_accuracy: 0.8872

```

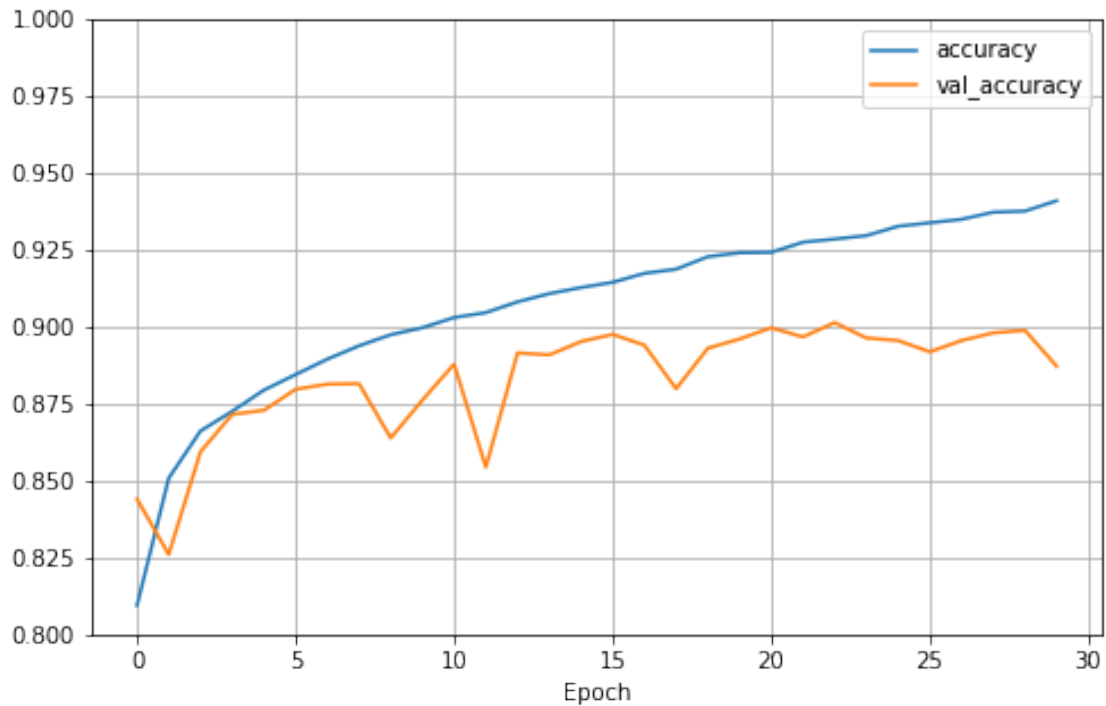
```

[15]: # Convert the history dictionary to a Pandas dataframe and extract the
      ↪ accuracies
      accuracies = pd.DataFrame(history.history)[['accuracy', 'val_accuracy']]

      # Plot the accuracies
      accuracies.plot(figsize=(8, 5))
      plt.grid(True)
      plt.gca().set_ylim(0.8, 1)
      plt.xlabel('Epoch')
      plt.savefig('figure_3')
      plt.show()

```





```
[16]: loss, accuracy = model.evaluate(X_test, y_test)
      print(f"Accuracy on test data: {accuracy:.4f}")
```

```
313/313 [=====] - 1s 2ms/step - loss: 0.3668 -
accuracy: 0.8754
Accuracy on test data: 0.8754
```

### 1.3.3 Convolutional neural network

```
[17]: def build_model(ks, strides, lrs):
      cnn_model = keras.Sequential([
          # Specify the input shape
          keras.Input(shape=(28, 28, 1)),

          # Conv and pool block 1
          keras.layers.Conv2D(filters = 32, kernel_size=(ks, ks),
          ↳strides=strides, padding="same", activation="relu"),
          keras.layers.MaxPooling2D(pool_size=(2, 2)),

          # Conv and pool block 2
          keras.layers.Conv2D(filters = 64, kernel_size=(ks, ks),
          ↳strides=strides, padding="same", activation="relu"),
          keras.layers.MaxPooling2D(pool_size=(2, 2)),
```

```

        # Flatten and classify using dense output layer
        keras.layers.Flatten(),
        keras.layers.Dropout(0.5),
        keras.layers.Dense(10, activation="softmax"),
    ])

    opt = tf.keras.optimizers.Adam(learning_rate=lrs)
    cnn_model.compile(loss='sparse_categorical_crossentropy', optimizer=opt,
        metrics=['accuracy'])

    return cnn_model

```

```

[18]: model= build_model(3, 1, 0.01)
      history = model.fit(X_train_cnn, y_train, batch_size=128, epochs=100,
        validation_data=(X_valid_cnn, y_valid))

```

```

Epoch 1/100
422/422 [=====] - 8s 4ms/step - loss: 0.4950 -
accuracy: 0.8217 - val_loss: 0.3396 - val_accuracy: 0.8783
Epoch 2/100
422/422 [=====] - 2s 4ms/step - loss: 0.3719 -
accuracy: 0.8677 - val_loss: 0.2965 - val_accuracy: 0.8947
Epoch 3/100
422/422 [=====] - 2s 4ms/step - loss: 0.3463 -
accuracy: 0.8741 - val_loss: 0.2856 - val_accuracy: 0.8967
Epoch 4/100
422/422 [=====] - 2s 4ms/step - loss: 0.3328 -
accuracy: 0.8792 - val_loss: 0.2805 - val_accuracy: 0.9007
Epoch 5/100
422/422 [=====] - 2s 4ms/step - loss: 0.3230 -
accuracy: 0.8819 - val_loss: 0.2664 - val_accuracy: 0.9053
Epoch 6/100
422/422 [=====] - 2s 4ms/step - loss: 0.3163 -
accuracy: 0.8841 - val_loss: 0.2742 - val_accuracy: 0.9037
Epoch 7/100
422/422 [=====] - 2s 4ms/step - loss: 0.3114 -
accuracy: 0.8883 - val_loss: 0.2553 - val_accuracy: 0.9095
Epoch 8/100
422/422 [=====] - 2s 4ms/step - loss: 0.3097 -
accuracy: 0.8858 - val_loss: 0.2501 - val_accuracy: 0.9108
Epoch 9/100
422/422 [=====] - 2s 4ms/step - loss: 0.3071 -
accuracy: 0.8883 - val_loss: 0.2709 - val_accuracy: 0.9005
Epoch 10/100
422/422 [=====] - 2s 4ms/step - loss: 0.3021 -
accuracy: 0.8893 - val_loss: 0.2620 - val_accuracy: 0.9037
Epoch 11/100
422/422 [=====] - 2s 4ms/step - loss: 0.2974 -

```

accuracy: 0.8897 - val\_loss: 0.2607 - val\_accuracy: 0.9062  
Epoch 12/100  
422/422 [=====] - 2s 4ms/step - loss: 0.3013 -  
accuracy: 0.8884 - val\_loss: 0.2630 - val\_accuracy: 0.9038  
Epoch 13/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2932 -  
accuracy: 0.8919 - val\_loss: 0.2617 - val\_accuracy: 0.9090  
Epoch 14/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2947 -  
accuracy: 0.8924 - val\_loss: 0.2506 - val\_accuracy: 0.9145  
Epoch 15/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2951 -  
accuracy: 0.8924 - val\_loss: 0.2489 - val\_accuracy: 0.9083  
Epoch 16/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2908 -  
accuracy: 0.8927 - val\_loss: 0.2510 - val\_accuracy: 0.9113  
Epoch 17/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2934 -  
accuracy: 0.8936 - val\_loss: 0.2571 - val\_accuracy: 0.9063  
Epoch 18/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2878 -  
accuracy: 0.8944 - val\_loss: 0.2709 - val\_accuracy: 0.9027  
Epoch 19/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2867 -  
accuracy: 0.8939 - val\_loss: 0.2554 - val\_accuracy: 0.9122  
Epoch 20/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2872 -  
accuracy: 0.8943 - val\_loss: 0.2520 - val\_accuracy: 0.9110  
Epoch 21/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2825 -  
accuracy: 0.8963 - val\_loss: 0.2537 - val\_accuracy: 0.9103  
Epoch 22/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2824 -  
accuracy: 0.8943 - val\_loss: 0.2680 - val\_accuracy: 0.9080  
Epoch 23/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2861 -  
accuracy: 0.8962 - val\_loss: 0.2491 - val\_accuracy: 0.9150  
Epoch 24/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2826 -  
accuracy: 0.8961 - val\_loss: 0.2747 - val\_accuracy: 0.9083  
Epoch 25/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2820 -  
accuracy: 0.8974 - val\_loss: 0.2695 - val\_accuracy: 0.9058  
Epoch 26/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2854 -  
accuracy: 0.8957 - val\_loss: 0.2638 - val\_accuracy: 0.9082  
Epoch 27/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2811 -

accuracy: 0.8955 - val\_loss: 0.2464 - val\_accuracy: 0.9148  
 Epoch 28/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2758 -  
 accuracy: 0.8986 - val\_loss: 0.2545 - val\_accuracy: 0.9133  
 Epoch 29/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2745 -  
 accuracy: 0.8994 - val\_loss: 0.2579 - val\_accuracy: 0.9108  
 Epoch 30/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2780 -  
 accuracy: 0.8998 - val\_loss: 0.2859 - val\_accuracy: 0.9018  
 Epoch 31/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2809 -  
 accuracy: 0.8974 - val\_loss: 0.2732 - val\_accuracy: 0.9120  
 Epoch 32/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2795 -  
 accuracy: 0.8963 - val\_loss: 0.2636 - val\_accuracy: 0.9053  
 Epoch 33/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2736 -  
 accuracy: 0.9004 - val\_loss: 0.2548 - val\_accuracy: 0.9128  
 Epoch 34/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2754 -  
 accuracy: 0.8986 - val\_loss: 0.2627 - val\_accuracy: 0.9070  
 Epoch 35/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2775 -  
 accuracy: 0.8983 - val\_loss: 0.2593 - val\_accuracy: 0.9087  
 Epoch 36/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2721 -  
 accuracy: 0.8994 - val\_loss: 0.2525 - val\_accuracy: 0.9113  
 Epoch 37/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2797 -  
 accuracy: 0.8972 - val\_loss: 0.2663 - val\_accuracy: 0.9102  
 Epoch 38/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2782 -  
 accuracy: 0.8967 - val\_loss: 0.2661 - val\_accuracy: 0.9043  
 Epoch 39/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2688 -  
 accuracy: 0.9028 - val\_loss: 0.2667 - val\_accuracy: 0.9100  
 Epoch 40/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2694 -  
 accuracy: 0.9008 - val\_loss: 0.2723 - val\_accuracy: 0.9057  
 Epoch 41/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2741 -  
 accuracy: 0.8991 - val\_loss: 0.2615 - val\_accuracy: 0.9082  
 Epoch 42/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2735 -  
 accuracy: 0.8997 - val\_loss: 0.2747 - val\_accuracy: 0.9053  
 Epoch 43/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2745 -

accuracy: 0.8988 - val\_loss: 0.2737 - val\_accuracy: 0.9073  
Epoch 44/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2741 -  
accuracy: 0.8994 - val\_loss: 0.2667 - val\_accuracy: 0.9095  
Epoch 45/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2699 -  
accuracy: 0.9009 - val\_loss: 0.2632 - val\_accuracy: 0.9100  
Epoch 46/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2706 -  
accuracy: 0.9005 - val\_loss: 0.2589 - val\_accuracy: 0.9088  
Epoch 47/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2752 -  
accuracy: 0.8992 - val\_loss: 0.2542 - val\_accuracy: 0.9118  
Epoch 48/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2840 -  
accuracy: 0.8960 - val\_loss: 0.2646 - val\_accuracy: 0.9052  
Epoch 49/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2752 -  
accuracy: 0.8987 - val\_loss: 0.2864 - val\_accuracy: 0.9015  
Epoch 50/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2707 -  
accuracy: 0.9000 - val\_loss: 0.2734 - val\_accuracy: 0.9003  
Epoch 51/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2730 -  
accuracy: 0.8995 - val\_loss: 0.2659 - val\_accuracy: 0.9100  
Epoch 52/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2748 -  
accuracy: 0.8998 - val\_loss: 0.2742 - val\_accuracy: 0.9072  
Epoch 53/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2757 -  
accuracy: 0.8992 - val\_loss: 0.2575 - val\_accuracy: 0.9070  
Epoch 54/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2826 -  
accuracy: 0.8961 - val\_loss: 0.2683 - val\_accuracy: 0.9047  
Epoch 55/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2713 -  
accuracy: 0.8990 - val\_loss: 0.2598 - val\_accuracy: 0.9155  
Epoch 56/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2701 -  
accuracy: 0.9014 - val\_loss: 0.2743 - val\_accuracy: 0.9113  
Epoch 57/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2698 -  
accuracy: 0.9005 - val\_loss: 0.2592 - val\_accuracy: 0.9110  
Epoch 58/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2739 -  
accuracy: 0.8994 - val\_loss: 0.2574 - val\_accuracy: 0.9105  
Epoch 59/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2636 -

accuracy: 0.9028 - val\_loss: 0.2615 - val\_accuracy: 0.9097  
 Epoch 60/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2780 -  
 accuracy: 0.8981 - val\_loss: 0.2682 - val\_accuracy: 0.9077  
 Epoch 61/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2687 -  
 accuracy: 0.9012 - val\_loss: 0.2526 - val\_accuracy: 0.9117  
 Epoch 62/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2679 -  
 accuracy: 0.9029 - val\_loss: 0.2714 - val\_accuracy: 0.9065  
 Epoch 63/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2751 -  
 accuracy: 0.8989 - val\_loss: 0.3214 - val\_accuracy: 0.9038  
 Epoch 64/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2739 -  
 accuracy: 0.9007 - val\_loss: 0.2726 - val\_accuracy: 0.9027  
 Epoch 65/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2727 -  
 accuracy: 0.8995 - val\_loss: 0.2643 - val\_accuracy: 0.9138  
 Epoch 66/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2734 -  
 accuracy: 0.9006 - val\_loss: 0.2734 - val\_accuracy: 0.9078  
 Epoch 67/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2706 -  
 accuracy: 0.9020 - val\_loss: 0.2663 - val\_accuracy: 0.9107  
 Epoch 68/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2647 -  
 accuracy: 0.9022 - val\_loss: 0.2770 - val\_accuracy: 0.9052  
 Epoch 69/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2707 -  
 accuracy: 0.9014 - val\_loss: 0.2729 - val\_accuracy: 0.9057  
 Epoch 70/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2686 -  
 accuracy: 0.9003 - val\_loss: 0.2670 - val\_accuracy: 0.9053  
 Epoch 71/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2739 -  
 accuracy: 0.9001 - val\_loss: 0.2625 - val\_accuracy: 0.9125  
 Epoch 72/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2718 -  
 accuracy: 0.9013 - val\_loss: 0.2935 - val\_accuracy: 0.8973  
 Epoch 73/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2699 -  
 accuracy: 0.9010 - val\_loss: 0.2620 - val\_accuracy: 0.9087  
 Epoch 74/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2687 -  
 accuracy: 0.9008 - val\_loss: 0.2668 - val\_accuracy: 0.9090  
 Epoch 75/100  
 422/422 [=====] - 2s 4ms/step - loss: 0.2644 -

accuracy: 0.9038 - val\_loss: 0.2737 - val\_accuracy: 0.9082  
Epoch 76/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2685 -  
accuracy: 0.9016 - val\_loss: 0.2855 - val\_accuracy: 0.9043  
Epoch 77/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2713 -  
accuracy: 0.9001 - val\_loss: 0.2895 - val\_accuracy: 0.9063  
Epoch 78/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2683 -  
accuracy: 0.9013 - val\_loss: 0.2610 - val\_accuracy: 0.9055  
Epoch 79/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2750 -  
accuracy: 0.8993 - val\_loss: 0.2733 - val\_accuracy: 0.9025  
Epoch 80/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2725 -  
accuracy: 0.9016 - val\_loss: 0.2698 - val\_accuracy: 0.9125  
Epoch 81/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2703 -  
accuracy: 0.9013 - val\_loss: 0.2676 - val\_accuracy: 0.9098  
Epoch 82/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2716 -  
accuracy: 0.8989 - val\_loss: 0.2720 - val\_accuracy: 0.9058  
Epoch 83/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2674 -  
accuracy: 0.9018 - val\_loss: 0.2748 - val\_accuracy: 0.9043  
Epoch 84/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2640 -  
accuracy: 0.9034 - val\_loss: 0.2742 - val\_accuracy: 0.9100  
Epoch 85/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2701 -  
accuracy: 0.9008 - val\_loss: 0.3109 - val\_accuracy: 0.9042  
Epoch 86/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2656 -  
accuracy: 0.9019 - val\_loss: 0.2969 - val\_accuracy: 0.9005  
Epoch 87/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2691 -  
accuracy: 0.9029 - val\_loss: 0.2704 - val\_accuracy: 0.9055  
Epoch 88/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2667 -  
accuracy: 0.9023 - val\_loss: 0.2836 - val\_accuracy: 0.8970  
Epoch 89/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2688 -  
accuracy: 0.9007 - val\_loss: 0.2749 - val\_accuracy: 0.9057  
Epoch 90/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2705 -  
accuracy: 0.8994 - val\_loss: 0.2662 - val\_accuracy: 0.9092  
Epoch 91/100  
422/422 [=====] - 2s 4ms/step - loss: 0.2690 -

```

accuracy: 0.9011 - val_loss: 0.2670 - val_accuracy: 0.9060
Epoch 92/100
422/422 [=====] - 2s 4ms/step - loss: 0.2639 -
accuracy: 0.9035 - val_loss: 0.2822 - val_accuracy: 0.9087
Epoch 93/100
422/422 [=====] - 2s 4ms/step - loss: 0.2739 -
accuracy: 0.8999 - val_loss: 0.2705 - val_accuracy: 0.9125
Epoch 94/100
422/422 [=====] - 2s 4ms/step - loss: 0.2754 -
accuracy: 0.8991 - val_loss: 0.2605 - val_accuracy: 0.9115
Epoch 95/100
422/422 [=====] - 2s 4ms/step - loss: 0.2679 -
accuracy: 0.9006 - val_loss: 0.2680 - val_accuracy: 0.9117
Epoch 96/100
422/422 [=====] - 2s 4ms/step - loss: 0.2660 -
accuracy: 0.9032 - val_loss: 0.2638 - val_accuracy: 0.9130
Epoch 97/100
422/422 [=====] - 2s 4ms/step - loss: 0.2712 -
accuracy: 0.8998 - val_loss: 0.2689 - val_accuracy: 0.9065
Epoch 98/100
422/422 [=====] - 2s 4ms/step - loss: 0.2683 -
accuracy: 0.9012 - val_loss: 0.2921 - val_accuracy: 0.9068
Epoch 99/100
422/422 [=====] - 2s 4ms/step - loss: 0.2672 -
accuracy: 0.9012 - val_loss: 0.2832 - val_accuracy: 0.9050
Epoch 100/100
422/422 [=====] - 2s 4ms/step - loss: 0.2670 -
accuracy: 0.9018 - val_loss: 0.2783 - val_accuracy: 0.9098

```

```

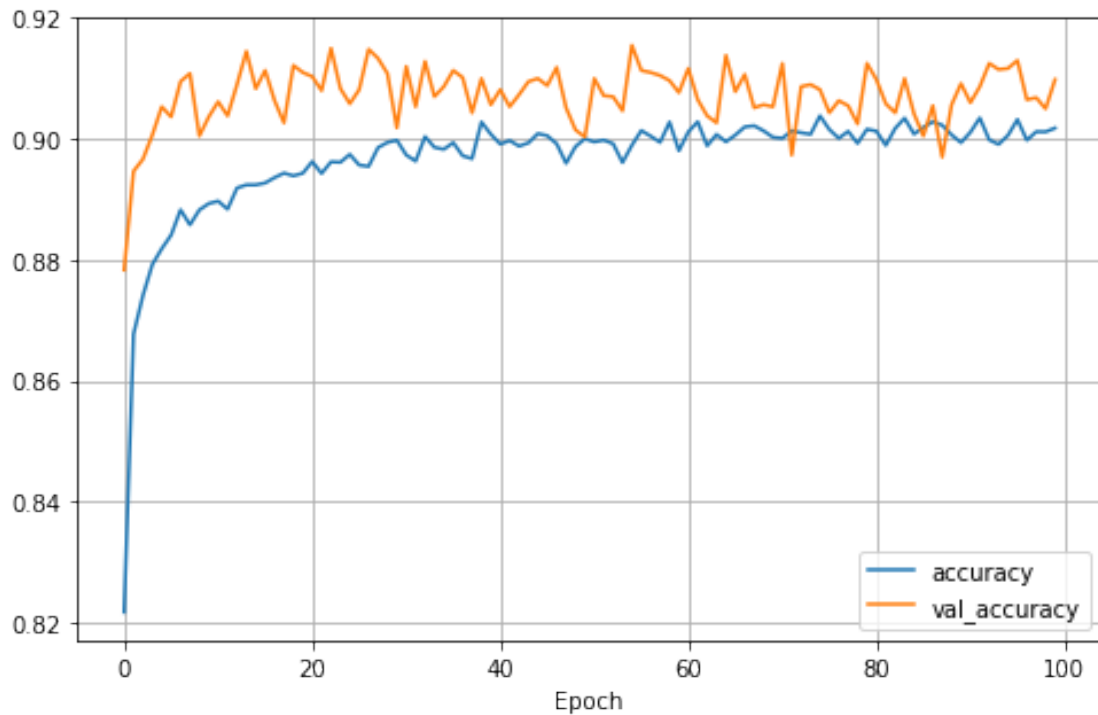
[19]: # Convert the history dictionary to a Pandas dataframe and extract the
      ↪ accuracies
      accuracies = pd.DataFrame(history.history)[['accuracy', 'val_accuracy']]

      # Plot the accuracies
      accuracies.plot(figsize=(8, 5))
      plt.grid(True)
      plt.xlabel('Epoch')
      plt.savefig('figure_4')
      plt.show()

      #From the graph, approximately 30 epochs is optimal, as learning efficiency
      ↪ decreases and does not improve much from thirty onwards.

```





```
[20]: loss, accuracy = model.evaluate(X_test_cnn, y_test)
      print(f"Accuracy on test data: {accuracy:.4f}")
```

```
313/313 [=====] - 1s 2ms/step - loss: 0.3176 -
accuracy: 0.8961
Accuracy on test data: 0.8961
```

## 1.4 3. Hyperparameter tuning

### 1.4.1 Algorithm of choice from first six weeks of course

```
[21]: # Combine the parameters that need to be tuned
      criterion = ['gini', 'entropy', 'log_loss']
      n_estimators = [50,100,150,200]
      max_leaf_nodes = [3000,4000,5000,None]
      param_grid = {"criterion": criterion,
                    "n_estimators": n_estimators,
                    "max_leaf_nodes":max_leaf_nodes}

      # Create the Random Forest classifier
      rf = RandomForestClassifier()
      # Set estimator for grid search
      grid_search_cv = GridSearchCV(rf, param_grid, cv=3, return_train_score=True,
      ↪ verbose=2)
```

```
# Import the training set
grid_search_cv.fit(X_train_rf, y_train_rf)
# Save the best params
best_params_rf = grid_search_cv.best_params_
```

Fitting 3 folds for each of 48 candidates, totalling 144 fits

```
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=50; total time=
23.5s
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=50; total time=
25.5s
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=50; total time=
25.6s
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=100; total time=
50.4s
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=100; total time=
50.6s
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=100; total time=
50.3s
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=150; total time=
1.2min
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=150; total time=
1.2min
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=150; total time=
1.2min
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=200; total time=
1.5min
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=200; total time=
1.5min
[CV] END criterion=gini, max_leaf_nodes=3000, n_estimators=200; total time=
1.5min
[CV] END criterion=gini, max_leaf_nodes=4000, n_estimators=50; total time=
25.4s
[CV] END criterion=gini, max_leaf_nodes=4000, n_estimators=50; total time=
25.5s
[CV] END criterion=gini, max_leaf_nodes=4000, n_estimators=50; total time=
25.5s
[CV] END criterion=gini, max_leaf_nodes=4000, n_estimators=100; total time=
50.4s
[CV] END criterion=gini, max_leaf_nodes=4000, n_estimators=100; total time=
50.3s
[CV] END criterion=gini, max_leaf_nodes=4000, n_estimators=100; total time=
50.9s
[CV] END criterion=gini, max_leaf_nodes=4000, n_estimators=150; total time=
1.3min
[CV] END criterion=gini, max_leaf_nodes=4000, n_estimators=150; total time=
1.3min
[CV] END criterion=gini, max_leaf_nodes=4000, n_estimators=150; total time=
1.3min
```

[CV] END criterion=gini, max\_leaf\_nodes=4000, n\_estimators=200; total time=1.7min

[CV] END criterion=gini, max\_leaf\_nodes=4000, n\_estimators=200; total time=1.7min

[CV] END criterion=gini, max\_leaf\_nodes=4000, n\_estimators=200; total time=1.7min

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=50; total time=25.7s

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=50; total time=25.8s

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=50; total time=25.8s

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=100; total time=51.5s

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=100; total time=50.2s

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=100; total time=49.9s

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[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=150; total time=1.2min

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=150; total time=1.2min

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=200; total time=1.7min

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=200; total time=1.7min

[CV] END criterion=gini, max\_leaf\_nodes=5000, n\_estimators=200; total time=1.7min

[CV] END criterion=gini, max\_leaf\_nodes=None, n\_estimators=50; total time=23.1s

[CV] END criterion=gini, max\_leaf\_nodes=None, n\_estimators=50; total time=23.4s

[CV] END criterion=gini, max\_leaf\_nodes=None, n\_estimators=50; total time=23.2s

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[CV] END criterion=gini, max\_leaf\_nodes=None, n\_estimators=150; total time=1.2min

[CV] END criterion=gini, max\_leaf\_nodes=None, n\_estimators=150; total time=1.2min

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[CV] END criterion=gini, max\_leaf\_nodes=None, n\_estimators=200; total time=1.6min

[CV] END criterion=gini, max\_leaf\_nodes=None, n\_estimators=200; total time=1.6min

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[CV] END criterion=entropy, max\_leaf\_nodes=3000, n\_estimators=50; total time=35.1s

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[CV] END criterion=entropy, max\_leaf\_nodes=3000, n\_estimators=100; total time=1.2min

[CV] END criterion=entropy, max\_leaf\_nodes=3000, n\_estimators=100; total time=1.2min

[CV] END criterion=entropy, max\_leaf\_nodes=3000, n\_estimators=150; total time=1.7min

[CV] END criterion=entropy, max\_leaf\_nodes=3000, n\_estimators=150; total time=1.7min

[CV] END criterion=entropy, max\_leaf\_nodes=3000, n\_estimators=150; total time=1.8min

[CV] END criterion=entropy, max\_leaf\_nodes=3000, n\_estimators=200; total time=2.3min

[CV] END criterion=entropy, max\_leaf\_nodes=3000, n\_estimators=200; total time=2.3min

[CV] END criterion=entropy, max\_leaf\_nodes=3000, n\_estimators=200; total time=2.3min

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[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=50; total time=35.2s

[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=50; total time=35.6s

[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=100; total time=1.2min

[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=100; total time=1.2min

[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=100; total time=1.2min

[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=150; total time=1.8min

[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=150; total time=1.8min

[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=150; total time=1.8min

[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=200; total time=2.3min

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[CV] END criterion=entropy, max\_leaf\_nodes=4000, n\_estimators=200; total time=2.3min

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[CV] END criterion=entropy, max\_leaf\_nodes=5000, n\_estimators=150; total time=1.7min

[CV] END criterion=entropy, max\_leaf\_nodes=5000, n\_estimators=150; total time=1.8min

[CV] END criterion=entropy, max\_leaf\_nodes=5000, n\_estimators=150; total time=1.8min

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[CV] END criterion=entropy, max\_leaf\_nodes=5000, n\_estimators=200; total time=2.3min

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[CV] END criterion=entropy, max\_leaf\_nodes=None, n\_estimators=50; total time=33.6s

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[CV] END criterion=entropy, max\_leaf\_nodes=None, n\_estimators=100; total time=1.1min

[CV] END criterion=entropy, max\_leaf\_nodes=None, n\_estimators=150; total time=1.7min

[CV] END criterion=entropy, max\_leaf\_nodes=None, n\_estimators=150; total time=1.7min

[CV] END criterion=entropy, max\_leaf\_nodes=None, n\_estimators=150; total time=1.7min

[CV] END criterion=entropy, max\_leaf\_nodes=None, n\_estimators=200; total time=2.2min

[CV] END criterion=entropy, max\_leaf\_nodes=None, n\_estimators=200; total time=2.2min

[CV] END criterion=entropy, max\_leaf\_nodes=None, n\_estimators=200; total time=2.2min

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[CV] END criterion=log\_loss, max\_leaf\_nodes=3000, n\_estimators=100; total time=0.2s

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[CV] END criterion=log\_loss, max\_leaf\_nodes=3000, n\_estimators=150; total time=0.2s

[CV] END criterion=log\_loss, max\_leaf\_nodes=3000, n\_estimators=150; total time=0.2s

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[CV] END criterion=log\_loss, max\_leaf\_nodes=4000, n\_estimators=50; total time=0.2s

[CV] END criterion=log\_loss, max\_leaf\_nodes=4000, n\_estimators=50; total time=0.2s

[CV] END criterion=log\_loss, max\_leaf\_nodes=4000, n\_estimators=100; total time=0.2s

[CV] END criterion=log\_loss, max\_leaf\_nodes=4000, n\_estimators=100; total time=0.2s

[CV] END criterion=log\_loss, max\_leaf\_nodes=4000, n\_estimators=100; total time=0.2s

[CV] END criterion=log\_loss, max\_leaf\_nodes=4000, n\_estimators=150; total time=0.2s

[CV] END criterion=log\_loss, max\_leaf\_nodes=4000, n\_estimators=150; total time=0.2s

[CV] END criterion=log\_loss, max\_leaf\_nodes=4000, n\_estimators=150; total time=0.2s



```
[CV] END criterion=log_loss, max_leaf_nodes=None, n_estimators=200; total time=0.2s
[CV] END criterion=log_loss, max_leaf_nodes=None, n_estimators=200; total time=0.2s
[CV] END criterion=log_loss, max_leaf_nodes=None, n_estimators=200; total time=0.2s
```

```
[22]: print('RF Best params: ',best_params_rf)
      print('RF Best scores: ',grid_search_cv.best_score_)
```

```
RF Best params:  {'criterion': 'entropy', 'max_leaf_nodes': None,
'n_estimators': 200}
RF Best scores:  0.8823500000000001
```

### 1.4.2 Fully connected neural network

```
[23]: # Multilayer perceptron model without activation function
      model_no_activation = build_mlp(None,None,0.1)
      history = model_no_activation.fit(X_train, y_train, epochs=30,
                                       validation_data=(X_valid, y_valid))
```

```
Epoch 1/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 2/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 3/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 4/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 5/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 6/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 7/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 8/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 9/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 10/30
```



1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 11/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 12/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 13/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 14/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 15/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 16/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 17/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 18/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 19/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 20/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 21/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 22/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 23/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 24/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 25/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 26/30

```

1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 27/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 28/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 29/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 30/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047

```

```

[24]: loss, accuracy = model_no_activation.evaluate(X_test, y_test)
print(f"Accuracy on test data: {accuracy:.4f}")

```

```

313/313 [=====] - 1s 2ms/step - loss: nan - accuracy:
0.1000
Accuracy on test data: 0.1000

```

```

[25]: # Wrapping multilayer perceptron models with keras for compatibility with the
↳GridSearchCV
keras_classifier = KerasClassifier(build_mlp,
                                   activation_function1 = "relu",
                                   activation_function2 = "relu",
                                   optimizer_lr = 1e-1
)

# Combine the parameters that need to be tuned
param_grid = {
    "activation_function1": ["relu", "sigmoid", "tanh"],
    "activation_function2": ["relu", "sigmoid", "tanh"],
    "optimizer_lr": [1e-1, 1e-2, 1e-3]
}

# Set estimator for grid search
grid_search_cv = GridSearchCV(keras_classifier, param_grid, cv=3, verbose=2)
# Import the training set
grid_search_cv.fit(X_train, y_train, epochs=30)
# Save the best params
best_params_mlp = grid_search_cv.best_params_

```

5000

```

1125/1125 [=====] - 2s 2ms/step - loss: 0.2498 -
accuracy: 0.9051
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2394 -

```

accuracy: 0.9092  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2311 -  
accuracy: 0.9117  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2240 -  
accuracy: 0.9138  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2149 -  
accuracy: 0.9175  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2101 -  
accuracy: 0.9206  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2027 -  
accuracy: 0.9222  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1954 -  
accuracy: 0.9255  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1917 -  
accuracy: 0.9268  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1828 -  
accuracy: 0.9312  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1780 -  
accuracy: 0.9327  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1734 -  
accuracy: 0.9340  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1669 -  
accuracy: 0.9361  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1656 -  
accuracy: 0.9369  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1610 -  
accuracy: 0.9395  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1587 -  
accuracy: 0.9390  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1527 -  
accuracy: 0.9417  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1449 -

```

accuracy: 0.9445
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1408 -
accuracy: 0.9463
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1382 -
accuracy: 0.9474
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=relu, optimizer_lr=0.1;
total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5808 -
accuracy: 0.7939
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4152 -
accuracy: 0.8456
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3726 -
accuracy: 0.8606
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3435 -
accuracy: 0.8710
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3229 -
accuracy: 0.8779
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3065 -
accuracy: 0.8854
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2916 -
accuracy: 0.8901
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2791 -
accuracy: 0.8964
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2676 -
accuracy: 0.9012
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2557 -
accuracy: 0.9032
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2473 -
accuracy: 0.9075
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2388 -
accuracy: 0.9085
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2284 -

```

```

accuracy: 0.9136
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2221 -
accuracy: 0.9154
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2154 -
accuracy: 0.9174
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2101 -
accuracy: 0.9195
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2009 -
accuracy: 0.9240
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1953 -
accuracy: 0.9261
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1922 -
accuracy: 0.9269
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1848 -
accuracy: 0.9294
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1780 -
accuracy: 0.9328
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1732 -
accuracy: 0.9335
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1671 -
accuracy: 0.9364
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1638 -
accuracy: 0.9368
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1599 -
accuracy: 0.9399
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1596 -
accuracy: 0.9394
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1481 -
accuracy: 0.9444
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1438 -
accuracy: 0.9436
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1413 -

```

```

accuracy: 0.9447
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1383 -
accuracy: 0.9467
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=relu, optimizer_lr=0.1;
total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8236 -
accuracy: 0.7327
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5267 -
accuracy: 0.8201
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4756 -
accuracy: 0.8351
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4457 -
accuracy: 0.8428
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4230 -
accuracy: 0.8520
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4068 -
accuracy: 0.8576
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3927 -
accuracy: 0.8619
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3798 -
accuracy: 0.8661
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3684 -
accuracy: 0.8711
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3603 -
accuracy: 0.8712
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3518 -
accuracy: 0.8736
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3429 -
accuracy: 0.8774
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3358 -
accuracy: 0.8810
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3295 -

```

```

accuracy: 0.8821
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3213 -
accuracy: 0.8841
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3162 -
accuracy: 0.8871
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3097 -
accuracy: 0.8889
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3043 -
accuracy: 0.8919
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2989 -
accuracy: 0.8927
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2950 -
accuracy: 0.8940
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2886 -
accuracy: 0.8963
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2833 -
accuracy: 0.8990
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2790 -
accuracy: 0.8997
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2751 -
accuracy: 0.9003
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2701 -
accuracy: 0.9027
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2650 -
accuracy: 0.9048
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2612 -
accuracy: 0.9073
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2572 -
accuracy: 0.9082
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2531 -
accuracy: 0.9100
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2483 -

```

```

accuracy: 0.9106
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=relu,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8000 -
accuracy: 0.7411
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5337 -
accuracy: 0.8166
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4796 -
accuracy: 0.8321
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4494 -
accuracy: 0.8422
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4281 -
accuracy: 0.8496
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4112 -
accuracy: 0.8552
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3963 -
accuracy: 0.8605
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3842 -
accuracy: 0.8648
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3733 -
accuracy: 0.8688
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3636 -
accuracy: 0.8702
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3556 -
accuracy: 0.8748
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3462 -
accuracy: 0.8764
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3405 -
accuracy: 0.8786
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3331 -
accuracy: 0.8817
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3248 -

```



```

accuracy: 0.8830
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3184 -
accuracy: 0.8858
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3126 -
accuracy: 0.8879
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3075 -
accuracy: 0.8902
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3013 -
accuracy: 0.8910
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2956 -
accuracy: 0.8935
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2898 -
accuracy: 0.8971
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2850 -
accuracy: 0.8976
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2795 -
accuracy: 0.9006
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2748 -
accuracy: 0.9016
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2708 -
accuracy: 0.9033
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2669 -
accuracy: 0.9048
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2614 -
accuracy: 0.9062
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2575 -
accuracy: 0.9072
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2538 -
accuracy: 0.9093
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2493 -
accuracy: 0.9103
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=relu,

```

```

optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8177 -
accuracy: 0.7341
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5330 -
accuracy: 0.8159
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4809 -
accuracy: 0.8328
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4489 -
accuracy: 0.8436
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4268 -
accuracy: 0.8506
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4091 -
accuracy: 0.8567
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3956 -
accuracy: 0.8604
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3829 -
accuracy: 0.8654
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3736 -
accuracy: 0.8700
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3622 -
accuracy: 0.8728
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3547 -
accuracy: 0.8751
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3464 -
accuracy: 0.8778
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3392 -
accuracy: 0.8804
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3325 -
accuracy: 0.8813
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3253 -
accuracy: 0.8846
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3184 -

```

```

accuracy: 0.8863
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3144 -
accuracy: 0.8878
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3063 -
accuracy: 0.8907
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3020 -
accuracy: 0.8919
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2960 -
accuracy: 0.8939
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2913 -
accuracy: 0.8951
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2861 -
accuracy: 0.8982
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2809 -
accuracy: 0.8984
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2768 -
accuracy: 0.8991
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2725 -
accuracy: 0.9020
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2669 -
accuracy: 0.9038
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2645 -
accuracy: 0.9041
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2588 -
accuracy: 0.9072
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2555 -
accuracy: 0.9086
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2519 -
accuracy: 0.9098
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=relu,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6591 -

```

```

accuracy: 0.5434
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0322 -
accuracy: 0.6860
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8377 -
accuracy: 0.7266
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7457 -
accuracy: 0.7576
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6889 -
accuracy: 0.7778
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6489 -
accuracy: 0.7897
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6184 -
accuracy: 0.7986
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5944 -
accuracy: 0.8055
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5752 -
accuracy: 0.8093
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5589 -
accuracy: 0.8148
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5449 -
accuracy: 0.8188
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5334 -
accuracy: 0.8219
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5227 -
accuracy: 0.8245
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5135 -
accuracy: 0.8271
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5053 -
accuracy: 0.8297
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4980 -
accuracy: 0.8320
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4912 -

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accuracy: 0.8344
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4853 -
accuracy: 0.8354
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4799 -
accuracy: 0.8379
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4741 -
accuracy: 0.8396
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4698 -
accuracy: 0.8412
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4651 -
accuracy: 0.8413
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4607 -
accuracy: 0.8434
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4567 -
accuracy: 0.8451
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4529 -
accuracy: 0.8467
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4492 -
accuracy: 0.8456
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4458 -
accuracy: 0.8483
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4425 -
accuracy: 0.8489
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4393 -
accuracy: 0.8504
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4362 -
accuracy: 0.8508
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=relu,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6456 -
accuracy: 0.5227
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0104 -

```

```

accuracy: 0.6869
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8250 -
accuracy: 0.7266
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7387 -
accuracy: 0.7505
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6848 -
accuracy: 0.7689
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6462 -
accuracy: 0.7831
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6163 -
accuracy: 0.7937
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5926 -
accuracy: 0.8008
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5729 -
accuracy: 0.8086
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5566 -
accuracy: 0.8132
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5426 -
accuracy: 0.8175
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5302 -
accuracy: 0.8217
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5196 -
accuracy: 0.8256
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5102 -
accuracy: 0.8286
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5017 -
accuracy: 0.8313
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4942 -
accuracy: 0.8339
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4870 -
accuracy: 0.8347
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4809 -

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```

accuracy: 0.8357
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4751 -
accuracy: 0.8386
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4698 -
accuracy: 0.8400
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4646 -
accuracy: 0.8409
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4606 -
accuracy: 0.8433
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4563 -
accuracy: 0.8429
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4521 -
accuracy: 0.8445
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4479 -
accuracy: 0.8463
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4447 -
accuracy: 0.8468
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4411 -
accuracy: 0.8477
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4383 -
accuracy: 0.8492
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4348 -
accuracy: 0.8502
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4321 -
accuracy: 0.8507
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=relu,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6616 -
accuracy: 0.5326
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0272 -
accuracy: 0.7004
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8307 -

```

accuracy: 0.7453  
Epoch 4/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7395 -  
accuracy: 0.7709  
Epoch 5/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6829 -  
accuracy: 0.7856  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6431 -  
accuracy: 0.7980  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6128 -  
accuracy: 0.8060  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5882 -  
accuracy: 0.8105  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5688 -  
accuracy: 0.8162  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5524 -  
accuracy: 0.8206  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5384 -  
accuracy: 0.8230  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5256 -  
accuracy: 0.8266  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5153 -  
accuracy: 0.8290  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5058 -  
accuracy: 0.8310  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4978 -  
accuracy: 0.8324  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4903 -  
accuracy: 0.8347  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4834 -  
accuracy: 0.8372  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4774 -  
accuracy: 0.8376  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4717 -



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accuracy: 0.8389
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4665 -
accuracy: 0.8409
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4619 -
accuracy: 0.8429
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4573 -
accuracy: 0.8437
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4527 -
accuracy: 0.8462
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4487 -
accuracy: 0.8449
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4451 -
accuracy: 0.8479
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4418 -
accuracy: 0.8478
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4384 -
accuracy: 0.8499
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4351 -
accuracy: 0.8503
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4320 -
accuracy: 0.8522
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4294 -
accuracy: 0.8523
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=relu,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6958 -
accuracy: 0.7572
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4681 -
accuracy: 0.8284
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4194 -
accuracy: 0.8462
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3912 -

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accuracy: 0.8575  
Epoch 5/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3694 -  
accuracy: 0.8652  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3514 -  
accuracy: 0.8701  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3368 -  
accuracy: 0.8760  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3236 -  
accuracy: 0.8813  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3119 -  
accuracy: 0.8839  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2996 -  
accuracy: 0.8901  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2922 -  
accuracy: 0.8917  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2822 -  
accuracy: 0.8962  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2755 -  
accuracy: 0.8976  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2656 -  
accuracy: 0.9010  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2587 -  
accuracy: 0.9039  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2510 -  
accuracy: 0.9065  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2447 -  
accuracy: 0.9094  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2378 -  
accuracy: 0.9125  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2318 -  
accuracy: 0.9138  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2255 -

```

accuracy: 0.9176
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2209 -
accuracy: 0.9189
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2143 -
accuracy: 0.9197
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2074 -
accuracy: 0.9233
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2033 -
accuracy: 0.9238
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1993 -
accuracy: 0.9265
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1936 -
accuracy: 0.9288
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1887 -
accuracy: 0.9299
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1845 -
accuracy: 0.9319
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1791 -
accuracy: 0.9341
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1750 -
accuracy: 0.9362
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=sigmoid,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7011 -
accuracy: 0.7558
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4671 -
accuracy: 0.8307
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4211 -
accuracy: 0.8479
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3918 -
accuracy: 0.8569
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3716 -

```

accuracy: 0.8651  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3544 -  
accuracy: 0.8698  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3390 -  
accuracy: 0.8754  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3281 -  
accuracy: 0.8802  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3168 -  
accuracy: 0.8831  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3059 -  
accuracy: 0.8871  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2969 -  
accuracy: 0.8887  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2878 -  
accuracy: 0.8937  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2776 -  
accuracy: 0.8979  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2699 -  
accuracy: 0.9005  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2640 -  
accuracy: 0.9025  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2556 -  
accuracy: 0.9058  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2485 -  
accuracy: 0.9081  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2420 -  
accuracy: 0.9092  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2353 -  
accuracy: 0.9127  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2299 -  
accuracy: 0.9149  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2246 -

```

accuracy: 0.9159
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2185 -
accuracy: 0.9193
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2141 -
accuracy: 0.9207
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2054 -
accuracy: 0.9243
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2016 -
accuracy: 0.9250
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1972 -
accuracy: 0.9269
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1922 -
accuracy: 0.9292
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1862 -
accuracy: 0.9307
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1828 -
accuracy: 0.9309
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1800 -
accuracy: 0.9329
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=sigmoid,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6895 -
accuracy: 0.7632
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4651 -
accuracy: 0.8320
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4208 -
accuracy: 0.8471
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3903 -
accuracy: 0.8578
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3688 -
accuracy: 0.8659
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3513 -

```

accuracy: 0.8712  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3347 -  
accuracy: 0.8775  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3239 -  
accuracy: 0.8798  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3130 -  
accuracy: 0.8846  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3026 -  
accuracy: 0.8881  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2940 -  
accuracy: 0.8906  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2846 -  
accuracy: 0.8937  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2775 -  
accuracy: 0.8964  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2686 -  
accuracy: 0.9005  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2618 -  
accuracy: 0.9017  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2549 -  
accuracy: 0.9041  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2494 -  
accuracy: 0.9058  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2432 -  
accuracy: 0.9092  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2354 -  
accuracy: 0.9129  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2304 -  
accuracy: 0.9143  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2247 -  
accuracy: 0.9175  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2181 -

```

accuracy: 0.9198
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2133 -
accuracy: 0.9204
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2069 -
accuracy: 0.9234
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2027 -
accuracy: 0.9259
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1997 -
accuracy: 0.9250
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1949 -
accuracy: 0.9279
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1885 -
accuracy: 0.9301
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1838 -
accuracy: 0.9314
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1804 -
accuracy: 0.9319
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=sigmoid,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3947 -
accuracy: 0.6177
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8148 -
accuracy: 0.7446
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6743 -
accuracy: 0.7706
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6066 -
accuracy: 0.7889
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5624 -
accuracy: 0.8030
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5309 -
accuracy: 0.8142
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5069 -

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```

accuracy: 0.8217
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4890 -
accuracy: 0.8283
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4742 -
accuracy: 0.8339
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4620 -
accuracy: 0.8375
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4519 -
accuracy: 0.8398
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4428 -
accuracy: 0.8431
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4349 -
accuracy: 0.8454
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4272 -
accuracy: 0.8491
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4209 -
accuracy: 0.8509
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4149 -
accuracy: 0.8523
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4089 -
accuracy: 0.8563
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4035 -
accuracy: 0.8560
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3990 -
accuracy: 0.8584
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3946 -
accuracy: 0.8599
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3898 -
accuracy: 0.8610
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3861 -
accuracy: 0.8626
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3820 -

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accuracy: 0.8640
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3784 -
accuracy: 0.8659
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3749 -
accuracy: 0.8662
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3714 -
accuracy: 0.8676
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3680 -
accuracy: 0.8676
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3648 -
accuracy: 0.8698
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3617 -
accuracy: 0.8702
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3589 -
accuracy: 0.8719
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=sigmoid,
optimizer_lr=0.01; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3598 -
accuracy: 0.6567
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7768 -
accuracy: 0.7538
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6518 -
accuracy: 0.7767
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5891 -
accuracy: 0.7968
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5482 -
accuracy: 0.8104
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5188 -
accuracy: 0.8191
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4976 -
accuracy: 0.8261
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4814 -

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accuracy: 0.8298  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4679 -  
accuracy: 0.8349  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4569 -  
accuracy: 0.8386  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4477 -  
accuracy: 0.8424  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4392 -  
accuracy: 0.8442  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4311 -  
accuracy: 0.8467  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4246 -  
accuracy: 0.8494  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4176 -  
accuracy: 0.8511  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4114 -  
accuracy: 0.8539  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4064 -  
accuracy: 0.8565  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4012 -  
accuracy: 0.8567  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3970 -  
accuracy: 0.8596  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3919 -  
accuracy: 0.8613  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3887 -  
accuracy: 0.8622  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3845 -  
accuracy: 0.8628  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3812 -  
accuracy: 0.8650  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3774 -

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accuracy: 0.8662
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3741 -
accuracy: 0.8665
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3715 -
accuracy: 0.8675
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3677 -
accuracy: 0.8685
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3641 -
accuracy: 0.8700
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3618 -
accuracy: 0.8723
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3590 -
accuracy: 0.8717
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=sigmoid,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3772 -
accuracy: 0.6353
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7954 -
accuracy: 0.7452
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6625 -
accuracy: 0.7739
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5960 -
accuracy: 0.7956
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5522 -
accuracy: 0.8096
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5209 -
accuracy: 0.8206
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4978 -
accuracy: 0.8266
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4798 -
accuracy: 0.8325
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4663 -

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accuracy: 0.8360
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4545 -
accuracy: 0.8401
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4446 -
accuracy: 0.8428
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4361 -
accuracy: 0.8459
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4285 -
accuracy: 0.8494
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4211 -
accuracy: 0.8509
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4157 -
accuracy: 0.8521
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4099 -
accuracy: 0.8547
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4040 -
accuracy: 0.8569
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3998 -
accuracy: 0.8582
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3945 -
accuracy: 0.8593
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3901 -
accuracy: 0.8615
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3865 -
accuracy: 0.8626
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3821 -
accuracy: 0.8642
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3788 -
accuracy: 0.8645
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3756 -
accuracy: 0.8656
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3721 -

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accuracy: 0.8679
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3680 -
accuracy: 0.8695
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3657 -
accuracy: 0.8702
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3627 -
accuracy: 0.8714
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3592 -
accuracy: 0.8728
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3563 -
accuracy: 0.8730
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=sigmoid,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.2160 -
accuracy: 0.2825
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.9477 -
accuracy: 0.5721
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.7234 -
accuracy: 0.6572
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5286 -
accuracy: 0.6769
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3721 -
accuracy: 0.6938
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2484 -
accuracy: 0.7022
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1504 -
accuracy: 0.7104
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0721 -
accuracy: 0.7172
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0085 -
accuracy: 0.7225
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9562 -

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accuracy: 0.7272  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.9127 -  
accuracy: 0.7319  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8764 -  
accuracy: 0.7358  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8456 -  
accuracy: 0.7406  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8190 -  
accuracy: 0.7437  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7961 -  
accuracy: 0.7477  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7759 -  
accuracy: 0.7494  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7579 -  
accuracy: 0.7539  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7418 -  
accuracy: 0.7568  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7272 -  
accuracy: 0.7600  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7139 -  
accuracy: 0.7621  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7019 -  
accuracy: 0.7648  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6905 -  
accuracy: 0.7673  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6803 -  
accuracy: 0.7688  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6705 -  
accuracy: 0.7724  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6616 -  
accuracy: 0.7749  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6531 -

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accuracy: 0.7774
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6450 -
accuracy: 0.7805
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6375 -
accuracy: 0.7824
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6303 -
accuracy: 0.7851
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6235 -
accuracy: 0.7873
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=sigmoid,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1605 -
accuracy: 0.3522
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.9011 -
accuracy: 0.6298
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6662 -
accuracy: 0.6568
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4666 -
accuracy: 0.6787
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3124 -
accuracy: 0.6971
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1961 -
accuracy: 0.7113
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1072 -
accuracy: 0.7174
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0376 -
accuracy: 0.7230
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9816 -
accuracy: 0.7274
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9356 -
accuracy: 0.7307
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8972 -

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accuracy: 0.7349  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8647 -  
accuracy: 0.7376  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8367 -  
accuracy: 0.7400  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8123 -  
accuracy: 0.7441  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7910 -  
accuracy: 0.7463  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7720 -  
accuracy: 0.7501  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7549 -  
accuracy: 0.7531  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7396 -  
accuracy: 0.7554  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7256 -  
accuracy: 0.7581  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7128 -  
accuracy: 0.7622  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7010 -  
accuracy: 0.7644  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6901 -  
accuracy: 0.7675  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6799 -  
accuracy: 0.7694  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6703 -  
accuracy: 0.7722  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6614 -  
accuracy: 0.7743  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6530 -  
accuracy: 0.7770  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6451 -



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accuracy: 0.7789
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6375 -
accuracy: 0.7823
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6304 -
accuracy: 0.7849
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6237 -
accuracy: 0.7864
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=sigmoid,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1922 -
accuracy: 0.3319
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.9062 -
accuracy: 0.5673
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6781 -
accuracy: 0.6093
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4824 -
accuracy: 0.6507
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3293 -
accuracy: 0.6769
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2131 -
accuracy: 0.6971
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1241 -
accuracy: 0.7074
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0537 -
accuracy: 0.7150
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9968 -
accuracy: 0.7232
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9497 -
accuracy: 0.7273
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9102 -
accuracy: 0.7339
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8765 -

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accuracy: 0.7372
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8474 -
accuracy: 0.7409
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8220 -
accuracy: 0.7444
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7996 -
accuracy: 0.7471
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7797 -
accuracy: 0.7512
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7619 -
accuracy: 0.7543
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7458 -
accuracy: 0.7569
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7311 -
accuracy: 0.7603
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7178 -
accuracy: 0.7621
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7055 -
accuracy: 0.7651
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6941 -
accuracy: 0.7674
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6836 -
accuracy: 0.7699
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6737 -
accuracy: 0.7719
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6644 -
accuracy: 0.7748
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6558 -
accuracy: 0.7769
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6475 -
accuracy: 0.7797
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6397 -

```

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accuracy: 0.7819
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6324 -
accuracy: 0.7841
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6253 -
accuracy: 0.7864
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=sigmoid,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5631 -
accuracy: 0.7939
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4149 -
accuracy: 0.8473
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3679 -
accuracy: 0.8633
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3386 -
accuracy: 0.8734
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3216 -
accuracy: 0.8778
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3007 -
accuracy: 0.8873
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2863 -
accuracy: 0.8940
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2716 -
accuracy: 0.8974
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2619 -
accuracy: 0.9009
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2483 -
accuracy: 0.9062
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2420 -
accuracy: 0.9074
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2323 -
accuracy: 0.9118
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2238 -

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accuracy: 0.9145  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2153 -  
accuracy: 0.9172  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2088 -  
accuracy: 0.9210  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2002 -  
accuracy: 0.9236  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1934 -  
accuracy: 0.9253  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1888 -  
accuracy: 0.9284  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1809 -  
accuracy: 0.9317  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1750 -  
accuracy: 0.9336  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1704 -  
accuracy: 0.9350  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1647 -  
accuracy: 0.9367  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1592 -  
accuracy: 0.9397  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1553 -  
accuracy: 0.9402  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1491 -  
accuracy: 0.9432  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1475 -  
accuracy: 0.9448  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1433 -  
accuracy: 0.9467  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1355 -  
accuracy: 0.9492  
Epoch 29/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1343 -

```

accuracy: 0.9487
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1275 -
accuracy: 0.9523
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=tanh, optimizer_lr=0.1;
total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5608 -
accuracy: 0.7949
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4132 -
accuracy: 0.8469
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3691 -
accuracy: 0.8634
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3419 -
accuracy: 0.8719
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3239 -
accuracy: 0.8767
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3046 -
accuracy: 0.8859
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2896 -
accuracy: 0.8912
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2802 -
accuracy: 0.8943
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2668 -
accuracy: 0.9003
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2557 -
accuracy: 0.9020
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2476 -
accuracy: 0.9061
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2364 -
accuracy: 0.9102
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2291 -
accuracy: 0.9126
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2217 -

```

accuracy: 0.9156  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2150 -  
accuracy: 0.9190  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2070 -  
accuracy: 0.9208  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2008 -  
accuracy: 0.9240  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1946 -  
accuracy: 0.9251  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1882 -  
accuracy: 0.9295  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1829 -  
accuracy: 0.9316  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1747 -  
accuracy: 0.9349  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1724 -  
accuracy: 0.9365  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1672 -  
accuracy: 0.9369  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1622 -  
accuracy: 0.9372  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1541 -  
accuracy: 0.9418  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1513 -  
accuracy: 0.9423  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1464 -  
accuracy: 0.9454  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1442 -  
accuracy: 0.9451  
Epoch 29/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1384 -  
accuracy: 0.9476  
Epoch 30/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1350 -

```

accuracy: 0.9491
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=tanh, optimizer_lr=0.1;
total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5553 -
accuracy: 0.7982
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4131 -
accuracy: 0.8483
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3678 -
accuracy: 0.8643
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3403 -
accuracy: 0.8723
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3207 -
accuracy: 0.8810
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3032 -
accuracy: 0.8864
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2887 -
accuracy: 0.8907
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2752 -
accuracy: 0.8954
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2643 -
accuracy: 0.8994
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2552 -
accuracy: 0.9022
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2417 -
accuracy: 0.9092
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2363 -
accuracy: 0.9104
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2288 -
accuracy: 0.9114
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2194 -
accuracy: 0.9179
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2131 -

```

```

accuracy: 0.9189
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2076 -
accuracy: 0.9199
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2005 -
accuracy: 0.9225
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1939 -
accuracy: 0.9258
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1859 -
accuracy: 0.9296
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1818 -
accuracy: 0.9309
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1767 -
accuracy: 0.9329
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1692 -
accuracy: 0.9358
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1666 -
accuracy: 0.9349
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1599 -
accuracy: 0.9381
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1558 -
accuracy: 0.9413
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1522 -
accuracy: 0.9422
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1434 -
accuracy: 0.9458
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1420 -
accuracy: 0.9457
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1355 -
accuracy: 0.9487
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1317 -
accuracy: 0.9503
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=tanh, optimizer_lr=0.1;

```



```

total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7869 -
accuracy: 0.7478
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5162 -
accuracy: 0.8213
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4639 -
accuracy: 0.8368
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4338 -
accuracy: 0.8452
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4138 -
accuracy: 0.8529
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3982 -
accuracy: 0.8580
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3853 -
accuracy: 0.8634
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3738 -
accuracy: 0.8658
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3640 -
accuracy: 0.8705
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3559 -
accuracy: 0.8728
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3471 -
accuracy: 0.8752
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3405 -
accuracy: 0.8767
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3348 -
accuracy: 0.8794
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3276 -
accuracy: 0.8824
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3222 -
accuracy: 0.8833
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3157 -

```

```

accuracy: 0.8863
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3104 -
accuracy: 0.8888
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3052 -
accuracy: 0.8890
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2998 -
accuracy: 0.8916
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2955 -
accuracy: 0.8941
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2911 -
accuracy: 0.8962
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2862 -
accuracy: 0.8960
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2816 -
accuracy: 0.8980
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2771 -
accuracy: 0.8999
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2725 -
accuracy: 0.9012
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2697 -
accuracy: 0.9013
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2657 -
accuracy: 0.9043
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2619 -
accuracy: 0.9062
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2581 -
accuracy: 0.9061
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2535 -
accuracy: 0.9082
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=tanh,
optimizer_lr=0.01; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7720 -

```

accuracy: 0.7508  
Epoch 2/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5117 -  
accuracy: 0.8226  
Epoch 3/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4611 -  
accuracy: 0.8380  
Epoch 4/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4337 -  
accuracy: 0.8457  
Epoch 5/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4124 -  
accuracy: 0.8534  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3973 -  
accuracy: 0.8581  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3854 -  
accuracy: 0.8643  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3739 -  
accuracy: 0.8658  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3647 -  
accuracy: 0.8694  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3566 -  
accuracy: 0.8730  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3485 -  
accuracy: 0.8765  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3412 -  
accuracy: 0.8769  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3343 -  
accuracy: 0.8802  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3273 -  
accuracy: 0.8817  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3214 -  
accuracy: 0.8840  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3152 -  
accuracy: 0.8867  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3098 -

```

accuracy: 0.8895
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3064 -
accuracy: 0.8895
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3006 -
accuracy: 0.8914
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2943 -
accuracy: 0.8935
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2909 -
accuracy: 0.8948
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2859 -
accuracy: 0.8967
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2807 -
accuracy: 0.8985
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2763 -
accuracy: 0.9008
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2725 -
accuracy: 0.9018
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2695 -
accuracy: 0.9041
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2641 -
accuracy: 0.9049
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2603 -
accuracy: 0.9061
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2575 -
accuracy: 0.9078
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2537 -
accuracy: 0.9093
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=tanh,
optimizer_lr=0.01; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7703 -
accuracy: 0.7566
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5094 -

```

```

accuracy: 0.8230
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4588 -
accuracy: 0.8379
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4296 -
accuracy: 0.8485
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4101 -
accuracy: 0.8547
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3938 -
accuracy: 0.8593
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3824 -
accuracy: 0.8637
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3713 -
accuracy: 0.8683
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3620 -
accuracy: 0.8704
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3546 -
accuracy: 0.8733
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3465 -
accuracy: 0.8769
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3397 -
accuracy: 0.8784
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3332 -
accuracy: 0.8819
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3275 -
accuracy: 0.8834
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3212 -
accuracy: 0.8867
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3169 -
accuracy: 0.8866
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3108 -
accuracy: 0.8902
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3069 -

```

```

accuracy: 0.8912
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3019 -
accuracy: 0.8916
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2968 -
accuracy: 0.8928
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2919 -
accuracy: 0.8957
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2880 -
accuracy: 0.8965
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2843 -
accuracy: 0.8976
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2802 -
accuracy: 0.8988
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2758 -
accuracy: 0.9009
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2722 -
accuracy: 0.9022
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2675 -
accuracy: 0.9047
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2640 -
accuracy: 0.9047
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2599 -
accuracy: 0.9072
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2568 -
accuracy: 0.9060
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=tanh,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5042 -
accuracy: 0.5651
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9461 -
accuracy: 0.7190
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7968 -

```

```

accuracy: 0.7541
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7188 -
accuracy: 0.7759
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6680 -
accuracy: 0.7883
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6309 -
accuracy: 0.7964
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6025 -
accuracy: 0.8040
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5798 -
accuracy: 0.8095
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5613 -
accuracy: 0.8146
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5458 -
accuracy: 0.8173
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5325 -
accuracy: 0.8215
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5210 -
accuracy: 0.8251
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5110 -
accuracy: 0.8269
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5021 -
accuracy: 0.8288
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4938 -
accuracy: 0.8323
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4867 -
accuracy: 0.8346
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4803 -
accuracy: 0.8353
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4742 -
accuracy: 0.8379
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4683 -

```

```

accuracy: 0.8400
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4633 -
accuracy: 0.8404
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4586 -
accuracy: 0.8425
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4542 -
accuracy: 0.8428
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4495 -
accuracy: 0.8454
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4458 -
accuracy: 0.8464
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4419 -
accuracy: 0.8478
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4382 -
accuracy: 0.8482
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4349 -
accuracy: 0.8490
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4316 -
accuracy: 0.8505
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4284 -
accuracy: 0.8504
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4256 -
accuracy: 0.8517
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=tanh,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4934 -
accuracy: 0.5888
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9538 -
accuracy: 0.7061
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8025 -
accuracy: 0.7466
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7231 -

```



accuracy: 0.7723  
Epoch 5/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6708 -  
accuracy: 0.7864  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6331 -  
accuracy: 0.7981  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6048 -  
accuracy: 0.8049  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5820 -  
accuracy: 0.8107  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5634 -  
accuracy: 0.8146  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5483 -  
accuracy: 0.8179  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5353 -  
accuracy: 0.8218  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5241 -  
accuracy: 0.8235  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5141 -  
accuracy: 0.8259  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5054 -  
accuracy: 0.8269  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4974 -  
accuracy: 0.8301  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4902 -  
accuracy: 0.8316  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4837 -  
accuracy: 0.8333  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4778 -  
accuracy: 0.8349  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4721 -  
accuracy: 0.8365  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4666 -

```

accuracy: 0.8381
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4621 -
accuracy: 0.8392
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4577 -
accuracy: 0.8403
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4532 -
accuracy: 0.8418
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4494 -
accuracy: 0.8428
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4459 -
accuracy: 0.8444
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4421 -
accuracy: 0.8454
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4387 -
accuracy: 0.8463
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4357 -
accuracy: 0.8474
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4324 -
accuracy: 0.8483
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4294 -
accuracy: 0.8499
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=tanh,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5564 -
accuracy: 0.5538
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9940 -
accuracy: 0.7027
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8270 -
accuracy: 0.7429
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7422 -
accuracy: 0.7641
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6875 -

```

accuracy: 0.7784  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6479 -  
accuracy: 0.7893  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6171 -  
accuracy: 0.7971  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5929 -  
accuracy: 0.8041  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5729 -  
accuracy: 0.8088  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5561 -  
accuracy: 0.8138  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5420 -  
accuracy: 0.8180  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5294 -  
accuracy: 0.8208  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5186 -  
accuracy: 0.8234  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5090 -  
accuracy: 0.8262  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5006 -  
accuracy: 0.8287  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4929 -  
accuracy: 0.8304  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4859 -  
accuracy: 0.8323  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4797 -  
accuracy: 0.8346  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4739 -  
accuracy: 0.8349  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4685 -  
accuracy: 0.8371  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4635 -

```

accuracy: 0.8385
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4588 -
accuracy: 0.8399
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4548 -
accuracy: 0.8403
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4507 -
accuracy: 0.8418
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4469 -
accuracy: 0.8426
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4432 -
accuracy: 0.8438
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4397 -
accuracy: 0.8447
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4364 -
accuracy: 0.8457
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4335 -
accuracy: 0.8465
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4304 -
accuracy: 0.8476
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=relu, activation_function2=tanh,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7308 -
accuracy: 0.7260
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4938 -
accuracy: 0.8181
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4443 -
accuracy: 0.8373
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4163 -
accuracy: 0.8474
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3943 -
accuracy: 0.8553
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3783 -

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accuracy: 0.8616  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3642 -  
accuracy: 0.8674  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3550 -  
accuracy: 0.8705  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3424 -  
accuracy: 0.8746  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3331 -  
accuracy: 0.8762  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3256 -  
accuracy: 0.8796  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3165 -  
accuracy: 0.8831  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3091 -  
accuracy: 0.8844  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3016 -  
accuracy: 0.8881  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2948 -  
accuracy: 0.8894  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2900 -  
accuracy: 0.8931  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2826 -  
accuracy: 0.8943  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2775 -  
accuracy: 0.8964  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2713 -  
accuracy: 0.8985  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2665 -  
accuracy: 0.9014  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2608 -  
accuracy: 0.9018  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2568 -

```

accuracy: 0.9040
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2527 -
accuracy: 0.9051
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2483 -
accuracy: 0.9077
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2417 -
accuracy: 0.9094
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2378 -
accuracy: 0.9109
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2344 -
accuracy: 0.9127
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2293 -
accuracy: 0.9137
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2271 -
accuracy: 0.9149
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2221 -
accuracy: 0.9165
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=relu,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.7332 -
accuracy: 0.7274
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4968 -
accuracy: 0.8182
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4474 -
accuracy: 0.8365
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4206 -
accuracy: 0.8473
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3988 -
accuracy: 0.8557
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3844 -
accuracy: 0.8596
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3705 -

```

```

accuracy: 0.8636
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3586 -
accuracy: 0.8678
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3474 -
accuracy: 0.8726
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3396 -
accuracy: 0.8745
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3300 -
accuracy: 0.8780
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3205 -
accuracy: 0.8825
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3145 -
accuracy: 0.8840
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3063 -
accuracy: 0.8872
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3002 -
accuracy: 0.8891
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2945 -
accuracy: 0.8905
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2868 -
accuracy: 0.8935
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2826 -
accuracy: 0.8953
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2766 -
accuracy: 0.8968
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2709 -
accuracy: 0.8989
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2666 -
accuracy: 0.9014
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2618 -
accuracy: 0.9032
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2567 -

```

```

accuracy: 0.9055
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2514 -
accuracy: 0.9087
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2472 -
accuracy: 0.9078
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2424 -
accuracy: 0.9091
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2367 -
accuracy: 0.9123
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2336 -
accuracy: 0.9128
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2302 -
accuracy: 0.9136
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2247 -
accuracy: 0.9151
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=relu,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7357 -
accuracy: 0.7286
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4959 -
accuracy: 0.8167
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4467 -
accuracy: 0.8365
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4173 -
accuracy: 0.8472
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3960 -
accuracy: 0.8548
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3791 -
accuracy: 0.8626
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3664 -
accuracy: 0.8654
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3545 -

```



```

accuracy: 0.8705
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3429 -
accuracy: 0.8723
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3346 -
accuracy: 0.8772
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3264 -
accuracy: 0.8802
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3169 -
accuracy: 0.8826
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3093 -
accuracy: 0.8856
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3024 -
accuracy: 0.8869
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2963 -
accuracy: 0.8911
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2903 -
accuracy: 0.8909
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2841 -
accuracy: 0.8942
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2793 -
accuracy: 0.8952
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2722 -
accuracy: 0.8976
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2681 -
accuracy: 0.8999
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2610 -
accuracy: 0.9018
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2582 -
accuracy: 0.9036
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2526 -
accuracy: 0.9049
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2469 -

```

```

accuracy: 0.9076
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2434 -
accuracy: 0.9093
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2382 -
accuracy: 0.9102
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2347 -
accuracy: 0.9115
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2302 -
accuracy: 0.9132
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2264 -
accuracy: 0.9141
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2227 -
accuracy: 0.9163
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=relu,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3164 -
accuracy: 0.6184
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7357 -
accuracy: 0.7455
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6313 -
accuracy: 0.7730
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5808 -
accuracy: 0.7910
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5468 -
accuracy: 0.8043
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5240 -
accuracy: 0.8131
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5060 -
accuracy: 0.8194
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4912 -
accuracy: 0.8236
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4795 -

```

accuracy: 0.8297  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4699 -  
accuracy: 0.8326  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4618 -  
accuracy: 0.8368  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4543 -  
accuracy: 0.8389  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4467 -  
accuracy: 0.8420  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4402 -  
accuracy: 0.8434  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4348 -  
accuracy: 0.8451  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4304 -  
accuracy: 0.8480  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4256 -  
accuracy: 0.8483  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4210 -  
accuracy: 0.8506  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4165 -  
accuracy: 0.8509  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4131 -  
accuracy: 0.8519  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4089 -  
accuracy: 0.8537  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4059 -  
accuracy: 0.8559  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4015 -  
accuracy: 0.8579  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4006 -  
accuracy: 0.8585  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3963 -

```

accuracy: 0.8591
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3942 -
accuracy: 0.8594
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3906 -
accuracy: 0.8613
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3878 -
accuracy: 0.8626
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3852 -
accuracy: 0.8621
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3829 -
accuracy: 0.8642
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=relu,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2824 -
accuracy: 0.6364
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7272 -
accuracy: 0.7505
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6280 -
accuracy: 0.7739
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5779 -
accuracy: 0.7944
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5448 -
accuracy: 0.8069
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5212 -
accuracy: 0.8141
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5024 -
accuracy: 0.8224
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4891 -
accuracy: 0.8268
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4761 -
accuracy: 0.8320
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4674 -

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accuracy: 0.8350  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4596 -  
accuracy: 0.8375  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4512 -  
accuracy: 0.8414  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4451 -  
accuracy: 0.8432  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4405 -  
accuracy: 0.8446  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4348 -  
accuracy: 0.8465  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4292 -  
accuracy: 0.8491  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4255 -  
accuracy: 0.8499  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4219 -  
accuracy: 0.8501  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4163 -  
accuracy: 0.8532  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4131 -  
accuracy: 0.8540  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4091 -  
accuracy: 0.8566  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4067 -  
accuracy: 0.8568  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4032 -  
accuracy: 0.8574  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3999 -  
accuracy: 0.8575  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3967 -  
accuracy: 0.8602  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3952 -

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accuracy: 0.8597
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3909 -
accuracy: 0.8624
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3877 -
accuracy: 0.8621
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3858 -
accuracy: 0.8633
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3842 -
accuracy: 0.8628
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=relu,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2775 -
accuracy: 0.6318
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7219 -
accuracy: 0.7478
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6224 -
accuracy: 0.7756
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5729 -
accuracy: 0.7948
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5387 -
accuracy: 0.8078
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5161 -
accuracy: 0.8169
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4992 -
accuracy: 0.8242
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4853 -
accuracy: 0.8275
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4739 -
accuracy: 0.8305
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4643 -
accuracy: 0.8349
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4571 -

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accuracy: 0.8389
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4492 -
accuracy: 0.8413
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4426 -
accuracy: 0.8434
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4374 -
accuracy: 0.8455
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4317 -
accuracy: 0.8469
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4271 -
accuracy: 0.8488
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4225 -
accuracy: 0.8515
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4185 -
accuracy: 0.8529
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4152 -
accuracy: 0.8536
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4100 -
accuracy: 0.8548
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4075 -
accuracy: 0.8572
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4030 -
accuracy: 0.8588
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4013 -
accuracy: 0.8590
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3982 -
accuracy: 0.8592
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3949 -
accuracy: 0.8602
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3923 -
accuracy: 0.8612
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3894 -

```

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accuracy: 0.8621
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3865 -
accuracy: 0.8626
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3847 -
accuracy: 0.8650
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3809 -
accuracy: 0.8646
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=relu,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1647 -
accuracy: 0.3865
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8458 -
accuracy: 0.5714
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5627 -
accuracy: 0.6294
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3406 -
accuracy: 0.6713
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1821 -
accuracy: 0.6928
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0696 -
accuracy: 0.7049
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9874 -
accuracy: 0.7133
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9251 -
accuracy: 0.7202
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8768 -
accuracy: 0.7254
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8382 -
accuracy: 0.7300
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8065 -
accuracy: 0.7349
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7801 -

```



accuracy: 0.7380  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7579 -  
accuracy: 0.7431  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7385 -  
accuracy: 0.7465  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7217 -  
accuracy: 0.7493  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7072 -  
accuracy: 0.7518  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6941 -  
accuracy: 0.7547  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6824 -  
accuracy: 0.7582  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6718 -  
accuracy: 0.7598  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6623 -  
accuracy: 0.7630  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6534 -  
accuracy: 0.7656  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6449 -  
accuracy: 0.7681  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6373 -  
accuracy: 0.7697  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6302 -  
accuracy: 0.7719  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6234 -  
accuracy: 0.7747  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6171 -  
accuracy: 0.7776  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6111 -  
accuracy: 0.7791  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6052 -

```

accuracy: 0.7815
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6000 -
accuracy: 0.7833
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5946 -
accuracy: 0.7867
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=relu,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1489 -
accuracy: 0.3607
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8569 -
accuracy: 0.5701
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5819 -
accuracy: 0.6337
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3606 -
accuracy: 0.6736
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2021 -
accuracy: 0.6922
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0893 -
accuracy: 0.7074
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0062 -
accuracy: 0.7162
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9425 -
accuracy: 0.7218
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8921 -
accuracy: 0.7274
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8512 -
accuracy: 0.7331
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8173 -
accuracy: 0.7369
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7893 -
accuracy: 0.7419
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7650 -

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accuracy: 0.7445  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7441 -  
accuracy: 0.7491  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7263 -  
accuracy: 0.7510  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7104 -  
accuracy: 0.7540  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6963 -  
accuracy: 0.7567  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6837 -  
accuracy: 0.7604  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6723 -  
accuracy: 0.7624  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6620 -  
accuracy: 0.7641  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6524 -  
accuracy: 0.7669  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6437 -  
accuracy: 0.7703  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6354 -  
accuracy: 0.7734  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6278 -  
accuracy: 0.7755  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6204 -  
accuracy: 0.7776  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6137 -  
accuracy: 0.7811  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6074 -  
accuracy: 0.7836  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6014 -  
accuracy: 0.7863  
Epoch 29/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5958 -

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accuracy: 0.7891
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5902 -
accuracy: 0.7918
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=relu,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1391 -
accuracy: 0.4079
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8642 -
accuracy: 0.5630
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6031 -
accuracy: 0.6254
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3873 -
accuracy: 0.6699
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2265 -
accuracy: 0.6942
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1080 -
accuracy: 0.7101
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0200 -
accuracy: 0.7171
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9518 -
accuracy: 0.7256
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8977 -
accuracy: 0.7312
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8535 -
accuracy: 0.7361
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8168 -
accuracy: 0.7406
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7870 -
accuracy: 0.7429
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7620 -
accuracy: 0.7470
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7410 -

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```

accuracy: 0.7508
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7229 -
accuracy: 0.7538
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7071 -
accuracy: 0.7562
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6934 -
accuracy: 0.7585
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6814 -
accuracy: 0.7617
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6701 -
accuracy: 0.7635
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6602 -
accuracy: 0.7669
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6512 -
accuracy: 0.7692
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6426 -
accuracy: 0.7708
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6349 -
accuracy: 0.7742
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6275 -
accuracy: 0.7764
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6203 -
accuracy: 0.7799
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6142 -
accuracy: 0.7816
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6079 -
accuracy: 0.7838
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6020 -
accuracy: 0.7857
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5963 -
accuracy: 0.7880
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5910 -

```

```

accuracy: 0.7913
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=relu,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0423 -
accuracy: 0.6386
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5905 -
accuracy: 0.7830
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5159 -
accuracy: 0.8139
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4788 -
accuracy: 0.8281
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4546 -
accuracy: 0.8350
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4379 -
accuracy: 0.8432
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4227 -
accuracy: 0.8474
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4123 -
accuracy: 0.8518
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4011 -
accuracy: 0.8558
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3919 -
accuracy: 0.8589
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3835 -
accuracy: 0.8624
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3755 -
accuracy: 0.8647
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3712 -
accuracy: 0.8652
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3635 -
accuracy: 0.8685
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3587 -

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accuracy: 0.8698
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3514 -
accuracy: 0.8733
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3468 -
accuracy: 0.8745
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3407 -
accuracy: 0.8760
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3358 -
accuracy: 0.8767
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3306 -
accuracy: 0.8811
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3243 -
accuracy: 0.8813
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3216 -
accuracy: 0.8834
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3174 -
accuracy: 0.8844
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3125 -
accuracy: 0.8878
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3087 -
accuracy: 0.8882
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3045 -
accuracy: 0.8887
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3013 -
accuracy: 0.8885
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2970 -
accuracy: 0.8922
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2927 -
accuracy: 0.8925
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2902 -
accuracy: 0.8945
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=sigmoid,

```

```

optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0334 -
accuracy: 0.6457
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5855 -
accuracy: 0.7851
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5134 -
accuracy: 0.8146
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4794 -
accuracy: 0.8287
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4566 -
accuracy: 0.8338
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4409 -
accuracy: 0.8425
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4261 -
accuracy: 0.8481
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4149 -
accuracy: 0.8509
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4035 -
accuracy: 0.8556
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3955 -
accuracy: 0.8580
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3868 -
accuracy: 0.8604
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3776 -
accuracy: 0.8635
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3725 -
accuracy: 0.8662
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3650 -
accuracy: 0.8674
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3590 -
accuracy: 0.8703
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3530 -

```



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accuracy: 0.8707
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3469 -
accuracy: 0.8749
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3417 -
accuracy: 0.8759
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3376 -
accuracy: 0.8774
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3327 -
accuracy: 0.8785
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3275 -
accuracy: 0.8803
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3252 -
accuracy: 0.8809
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3204 -
accuracy: 0.8823
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3155 -
accuracy: 0.8858
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3104 -
accuracy: 0.8867
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3074 -
accuracy: 0.8877
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3026 -
accuracy: 0.8907
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2995 -
accuracy: 0.8905
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2947 -
accuracy: 0.8917
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2926 -
accuracy: 0.8930
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=sigmoid,
optimizer_lr=0.1; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.0290 -

```

accuracy: 0.6473  
Epoch 2/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5834 -  
accuracy: 0.7873  
Epoch 3/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5070 -  
accuracy: 0.8174  
Epoch 4/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4710 -  
accuracy: 0.8306  
Epoch 5/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4491 -  
accuracy: 0.8393  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4320 -  
accuracy: 0.8455  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4176 -  
accuracy: 0.8501  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4055 -  
accuracy: 0.8544  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3954 -  
accuracy: 0.8573  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3865 -  
accuracy: 0.8617  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3780 -  
accuracy: 0.8633  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3712 -  
accuracy: 0.8655  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3647 -  
accuracy: 0.8676  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3588 -  
accuracy: 0.8704  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3508 -  
accuracy: 0.8734  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3460 -  
accuracy: 0.8742  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3411 -

```

accuracy: 0.8780
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3355 -
accuracy: 0.8785
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3315 -
accuracy: 0.8807
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3268 -
accuracy: 0.8809
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3220 -
accuracy: 0.8828
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3180 -
accuracy: 0.8838
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3149 -
accuracy: 0.8851
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3108 -
accuracy: 0.8878
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3057 -
accuracy: 0.8889
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3031 -
accuracy: 0.8890
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2982 -
accuracy: 0.8910
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2948 -
accuracy: 0.8917
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2909 -
accuracy: 0.8934
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2888 -
accuracy: 0.8920
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=sigmoid,
optimizer_lr=0.1; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1203 -
accuracy: 0.4012
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5484 -

```

```

accuracy: 0.6142
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1629 -
accuracy: 0.6753
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9730 -
accuracy: 0.7089
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8571 -
accuracy: 0.7262
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7792 -
accuracy: 0.7379
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7265 -
accuracy: 0.7444
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6898 -
accuracy: 0.7528
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6622 -
accuracy: 0.7600
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6407 -
accuracy: 0.7659
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6226 -
accuracy: 0.7720
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6069 -
accuracy: 0.7785
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5931 -
accuracy: 0.7840
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5805 -
accuracy: 0.7901
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5686 -
accuracy: 0.7947
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5582 -
accuracy: 0.8009
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5483 -
accuracy: 0.8051
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5392 -

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accuracy: 0.8079
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5311 -
accuracy: 0.8123
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5236 -
accuracy: 0.8147
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5163 -
accuracy: 0.8173
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5098 -
accuracy: 0.8198
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5034 -
accuracy: 0.8226
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4978 -
accuracy: 0.8242
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4926 -
accuracy: 0.8254
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4875 -
accuracy: 0.8283
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4829 -
accuracy: 0.8290
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4783 -
accuracy: 0.8309
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4739 -
accuracy: 0.8323
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4701 -
accuracy: 0.8340
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=sigmoid,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1041 -
accuracy: 0.4009
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5253 -
accuracy: 0.5998
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1582 -

```

```

accuracy: 0.6737
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9695 -
accuracy: 0.7078
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8535 -
accuracy: 0.7258
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7771 -
accuracy: 0.7382
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7252 -
accuracy: 0.7462
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6889 -
accuracy: 0.7527
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6619 -
accuracy: 0.7599
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6404 -
accuracy: 0.7670
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6220 -
accuracy: 0.7719
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6068 -
accuracy: 0.7789
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5924 -
accuracy: 0.7858
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5800 -
accuracy: 0.7912
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5683 -
accuracy: 0.7962
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5578 -
accuracy: 0.8014
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5479 -
accuracy: 0.8041
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5390 -
accuracy: 0.8074
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5305 -

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```

accuracy: 0.8105
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5232 -
accuracy: 0.8130
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5157 -
accuracy: 0.8165
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5091 -
accuracy: 0.8196
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5031 -
accuracy: 0.8207
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4974 -
accuracy: 0.8232
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4919 -
accuracy: 0.8254
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4871 -
accuracy: 0.8275
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4825 -
accuracy: 0.8293
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4786 -
accuracy: 0.8303
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4742 -
accuracy: 0.8319
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4704 -
accuracy: 0.8340
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=sigmoid,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1181 -
accuracy: 0.4084
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5588 -
accuracy: 0.5891
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1787 -
accuracy: 0.6574
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9872 -

```

```

accuracy: 0.6983
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8692 -
accuracy: 0.7195
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7890 -
accuracy: 0.7339
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7329 -
accuracy: 0.7441
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6930 -
accuracy: 0.7534
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6630 -
accuracy: 0.7602
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6397 -
accuracy: 0.7673
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6201 -
accuracy: 0.7742
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6032 -
accuracy: 0.7810
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5880 -
accuracy: 0.7881
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5743 -
accuracy: 0.7946
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5618 -
accuracy: 0.7984
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5502 -
accuracy: 0.8041
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5400 -
accuracy: 0.8087
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5309 -
accuracy: 0.8122
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5222 -
accuracy: 0.8146
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5139 -

```



```

accuracy: 0.8188
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5070 -
accuracy: 0.8203
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5004 -
accuracy: 0.8230
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4944 -
accuracy: 0.8254
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4890 -
accuracy: 0.8282
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4837 -
accuracy: 0.8307
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4785 -
accuracy: 0.8316
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4741 -
accuracy: 0.8338
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4697 -
accuracy: 0.8335
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4657 -
accuracy: 0.8360
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4617 -
accuracy: 0.8364
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=sigmoid,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.3328 -
accuracy: 0.1590
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.2503 -
accuracy: 0.3291
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.2187 -
accuracy: 0.4615
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1849 -
accuracy: 0.5070
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1476 -

```

```

accuracy: 0.5327
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1062 -
accuracy: 0.5514
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.0593 -
accuracy: 0.5704
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.0068 -
accuracy: 0.5865
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.9483 -
accuracy: 0.6014
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8850 -
accuracy: 0.6154
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8182 -
accuracy: 0.6208
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.7503 -
accuracy: 0.6272
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6831 -
accuracy: 0.6267
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6188 -
accuracy: 0.6244
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5582 -
accuracy: 0.6286
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5019 -
accuracy: 0.6381
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4501 -
accuracy: 0.6396
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4023 -
accuracy: 0.6451
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3586 -
accuracy: 0.6464
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3184 -
accuracy: 0.6544
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2815 -

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```

accuracy: 0.6608
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2474 -
accuracy: 0.6637
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2160 -
accuracy: 0.6674
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1870 -
accuracy: 0.6743
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1600 -
accuracy: 0.6779
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1349 -
accuracy: 0.6833
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1116 -
accuracy: 0.6844
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0896 -
accuracy: 0.6874
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0691 -
accuracy: 0.6925
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0499 -
accuracy: 0.6929
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=sigmoid,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.3125 -
accuracy: 0.1421
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.2524 -
accuracy: 0.3363
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.2158 -
accuracy: 0.4262
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1763 -
accuracy: 0.4532
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1326 -
accuracy: 0.4841
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.0838 -

```

```

accuracy: 0.4848
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.0290 -
accuracy: 0.4987
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.9683 -
accuracy: 0.5028
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.9023 -
accuracy: 0.5128
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8331 -
accuracy: 0.5219
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.7630 -
accuracy: 0.5372
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6943 -
accuracy: 0.5515
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6289 -
accuracy: 0.5602
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5682 -
accuracy: 0.5759
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5126 -
accuracy: 0.5894
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4620 -
accuracy: 0.6036
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4160 -
accuracy: 0.6116
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3743 -
accuracy: 0.6194
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3363 -
accuracy: 0.6293
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3016 -
accuracy: 0.6351
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2698 -
accuracy: 0.6434
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2405 -

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accuracy: 0.6472
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2134 -
accuracy: 0.6552
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1883 -
accuracy: 0.6570
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1648 -
accuracy: 0.6631
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1429 -
accuracy: 0.6676
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1223 -
accuracy: 0.6700
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1029 -
accuracy: 0.6739
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0845 -
accuracy: 0.6789
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0670 -
accuracy: 0.6829
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=sigmoid,
optimizer_lr=0.001; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.3086 -
accuracy: 0.1533
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.2608 -
accuracy: 0.3173
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.2269 -
accuracy: 0.4161
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1912 -
accuracy: 0.4615
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1523 -
accuracy: 0.4883
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1090 -
accuracy: 0.4933
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.0603 -

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accuracy: 0.5192
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.0055 -
accuracy: 0.5164
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.9448 -
accuracy: 0.5146
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8788 -
accuracy: 0.5364
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8096 -
accuracy: 0.5383
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.7395 -
accuracy: 0.5525
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6710 -
accuracy: 0.5662
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.6062 -
accuracy: 0.5801
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5463 -
accuracy: 0.5939
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4917 -
accuracy: 0.6106
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4420 -
accuracy: 0.6276
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3973 -
accuracy: 0.6326
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3568 -
accuracy: 0.6396
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3199 -
accuracy: 0.6526
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2864 -
accuracy: 0.6578
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2557 -
accuracy: 0.6637
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2272 -

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accuracy: 0.6695
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2010 -
accuracy: 0.6728
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1764 -
accuracy: 0.6772
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1535 -
accuracy: 0.6818
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1320 -
accuracy: 0.6837
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1117 -
accuracy: 0.6885
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0925 -
accuracy: 0.6917
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0744 -
accuracy: 0.6940
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=sigmoid,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7104 -
accuracy: 0.7387
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4942 -
accuracy: 0.8199
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4515 -
accuracy: 0.8371
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4245 -
accuracy: 0.8462
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4053 -
accuracy: 0.8523
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3880 -
accuracy: 0.8591
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3763 -
accuracy: 0.8631
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3638 -

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accuracy: 0.8677
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3540 -
accuracy: 0.8698
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3455 -
accuracy: 0.8737
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3355 -
accuracy: 0.8761
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3291 -
accuracy: 0.8783
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3203 -
accuracy: 0.8810
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3142 -
accuracy: 0.8837
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3075 -
accuracy: 0.8838
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3017 -
accuracy: 0.8896
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2936 -
accuracy: 0.8909
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2897 -
accuracy: 0.8924
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2828 -
accuracy: 0.8953
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2789 -
accuracy: 0.8957
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2730 -
accuracy: 0.9009
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2681 -
accuracy: 0.8997
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2627 -
accuracy: 0.9015
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2595 -

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accuracy: 0.9037
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2565 -
accuracy: 0.9046
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2504 -
accuracy: 0.9059
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2457 -
accuracy: 0.9079
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2431 -
accuracy: 0.9102
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2381 -
accuracy: 0.9105
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2350 -
accuracy: 0.9126
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=tanh,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7063 -
accuracy: 0.7416
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4920 -
accuracy: 0.8215
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4495 -
accuracy: 0.8362
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4245 -
accuracy: 0.8457
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4058 -
accuracy: 0.8529
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3906 -
accuracy: 0.8588
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3779 -
accuracy: 0.8625
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3660 -
accuracy: 0.8669
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3555 -

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accuracy: 0.8701
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3461 -
accuracy: 0.8727
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3393 -
accuracy: 0.8756
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3302 -
accuracy: 0.8778
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3230 -
accuracy: 0.8814
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3151 -
accuracy: 0.8844
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3090 -
accuracy: 0.8854
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3033 -
accuracy: 0.8872
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2966 -
accuracy: 0.8891
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2931 -
accuracy: 0.8903
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2872 -
accuracy: 0.8925
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2813 -
accuracy: 0.8957
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2764 -
accuracy: 0.8985
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2726 -
accuracy: 0.8995
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2663 -
accuracy: 0.9011
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2628 -
accuracy: 0.9016
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2583 -

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accuracy: 0.9045
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2523 -
accuracy: 0.9053
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2501 -
accuracy: 0.9070
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2457 -
accuracy: 0.9084
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2402 -
accuracy: 0.9096
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2389 -
accuracy: 0.9101
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=tanh,
optimizer_lr=0.1; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6995 -
accuracy: 0.7436
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4872 -
accuracy: 0.8226
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4476 -
accuracy: 0.8371
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4219 -
accuracy: 0.8479
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4020 -
accuracy: 0.8541
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3865 -
accuracy: 0.8590
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3736 -
accuracy: 0.8651
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3634 -
accuracy: 0.8678
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3514 -
accuracy: 0.8717
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3423 -

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accuracy: 0.8736
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3340 -
accuracy: 0.8772
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3257 -
accuracy: 0.8801
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3190 -
accuracy: 0.8822
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3105 -
accuracy: 0.8858
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3047 -
accuracy: 0.8873
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2985 -
accuracy: 0.8903
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2921 -
accuracy: 0.8901
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2866 -
accuracy: 0.8934
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2808 -
accuracy: 0.8963
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2766 -
accuracy: 0.8967
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2704 -
accuracy: 0.8993
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2661 -
accuracy: 0.9004
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2602 -
accuracy: 0.9028
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2566 -
accuracy: 0.9044
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2520 -
accuracy: 0.9054
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2487 -

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accuracy: 0.9071
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2436 -
accuracy: 0.9078
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2382 -
accuracy: 0.9103
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2353 -
accuracy: 0.9119
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2309 -
accuracy: 0.9125
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=tanh,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2166 -
accuracy: 0.6525
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7102 -
accuracy: 0.7552
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6135 -
accuracy: 0.7808
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5640 -
accuracy: 0.8013
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5316 -
accuracy: 0.8107
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5091 -
accuracy: 0.8195
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4935 -
accuracy: 0.8245
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4810 -
accuracy: 0.8292
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4710 -
accuracy: 0.8327
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4624 -
accuracy: 0.8355
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4543 -

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accuracy: 0.8404  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4480 -  
accuracy: 0.8409  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4417 -  
accuracy: 0.8430  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4359 -  
accuracy: 0.8447  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4312 -  
accuracy: 0.8461  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4268 -  
accuracy: 0.8485  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4226 -  
accuracy: 0.8500  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4178 -  
accuracy: 0.8505  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4146 -  
accuracy: 0.8516  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4103 -  
accuracy: 0.8552  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4079 -  
accuracy: 0.8544  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4053 -  
accuracy: 0.8570  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4018 -  
accuracy: 0.8548  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3982 -  
accuracy: 0.8580  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3958 -  
accuracy: 0.8593  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3922 -  
accuracy: 0.8601  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3902 -

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accuracy: 0.8624
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3868 -
accuracy: 0.8620
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3854 -
accuracy: 0.8615
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3828 -
accuracy: 0.8642
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=tanh,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1969 -
accuracy: 0.6535
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7088 -
accuracy: 0.7572
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6157 -
accuracy: 0.7817
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5667 -
accuracy: 0.7990
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5351 -
accuracy: 0.8106
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5122 -
accuracy: 0.8191
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4960 -
accuracy: 0.8246
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4827 -
accuracy: 0.8287
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4716 -
accuracy: 0.8329
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4628 -
accuracy: 0.8372
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4542 -
accuracy: 0.8382
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4474 -

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accuracy: 0.8401  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4416 -  
accuracy: 0.8424  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4358 -  
accuracy: 0.8446  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4309 -  
accuracy: 0.8467  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4262 -  
accuracy: 0.8480  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4215 -  
accuracy: 0.8500  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4176 -  
accuracy: 0.8524  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4143 -  
accuracy: 0.8529  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4105 -  
accuracy: 0.8533  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4062 -  
accuracy: 0.8558  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4034 -  
accuracy: 0.8584  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4003 -  
accuracy: 0.8578  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3979 -  
accuracy: 0.8582  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3939 -  
accuracy: 0.8612  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3915 -  
accuracy: 0.8599  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3898 -  
accuracy: 0.8608  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3869 -



```

accuracy: 0.8630
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3839 -
accuracy: 0.8643
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3825 -
accuracy: 0.8639
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=tanh,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2376 -
accuracy: 0.6526
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7044 -
accuracy: 0.7619
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6100 -
accuracy: 0.7873
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5613 -
accuracy: 0.8034
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5304 -
accuracy: 0.8138
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5077 -
accuracy: 0.8235
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4904 -
accuracy: 0.8279
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4775 -
accuracy: 0.8314
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4664 -
accuracy: 0.8349
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4576 -
accuracy: 0.8390
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4495 -
accuracy: 0.8417
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4427 -
accuracy: 0.8441
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4371 -

```

accuracy: 0.8456  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4317 -  
accuracy: 0.8479  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4268 -  
accuracy: 0.8494  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4226 -  
accuracy: 0.8503  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4173 -  
accuracy: 0.8527  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4134 -  
accuracy: 0.8543  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4102 -  
accuracy: 0.8556  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4069 -  
accuracy: 0.8562  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4040 -  
accuracy: 0.8569  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4005 -  
accuracy: 0.8579  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3982 -  
accuracy: 0.8593  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3941 -  
accuracy: 0.8610  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3918 -  
accuracy: 0.8622  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3898 -  
accuracy: 0.8614  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3868 -  
accuracy: 0.8632  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3838 -  
accuracy: 0.8641  
Epoch 29/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3821 -

```

accuracy: 0.8648
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3797 -
accuracy: 0.8656
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=tanh,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.0952 -
accuracy: 0.4383
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.7087 -
accuracy: 0.6437
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4107 -
accuracy: 0.6810
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2101 -
accuracy: 0.7017
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0785 -
accuracy: 0.7152
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9878 -
accuracy: 0.7240
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9218 -
accuracy: 0.7309
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8715 -
accuracy: 0.7356
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8318 -
accuracy: 0.7406
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7996 -
accuracy: 0.7444
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7728 -
accuracy: 0.7472
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7503 -
accuracy: 0.7504
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7313 -
accuracy: 0.7533
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7145 -

```

accuracy: 0.7568  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6999 -  
accuracy: 0.7596  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6869 -  
accuracy: 0.7623  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6752 -  
accuracy: 0.7648  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6649 -  
accuracy: 0.7671  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6551 -  
accuracy: 0.7696  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6462 -  
accuracy: 0.7721  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6381 -  
accuracy: 0.7742  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6305 -  
accuracy: 0.7765  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6232 -  
accuracy: 0.7787  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6164 -  
accuracy: 0.7814  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6100 -  
accuracy: 0.7843  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.6042 -  
accuracy: 0.7852  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5984 -  
accuracy: 0.7875  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5931 -  
accuracy: 0.7895  
Epoch 29/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5878 -  
accuracy: 0.7918  
Epoch 30/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5828 -

```

accuracy: 0.7931
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=tanh,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1637 -
accuracy: 0.3423
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8005 -
accuracy: 0.5507
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5085 -
accuracy: 0.6181
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2985 -
accuracy: 0.6606
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1547 -
accuracy: 0.6864
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0530 -
accuracy: 0.7001
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9777 -
accuracy: 0.7111
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9195 -
accuracy: 0.7189
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8729 -
accuracy: 0.7265
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8352 -
accuracy: 0.7324
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8041 -
accuracy: 0.7368
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7778 -
accuracy: 0.7409
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7557 -
accuracy: 0.7451
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7365 -
accuracy: 0.7484
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7196 -

```

```

accuracy: 0.7508
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7051 -
accuracy: 0.7555
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6919 -
accuracy: 0.7581
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6800 -
accuracy: 0.7609
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6696 -
accuracy: 0.7635
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6598 -
accuracy: 0.7661
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6507 -
accuracy: 0.7682
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6425 -
accuracy: 0.7707
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6347 -
accuracy: 0.7741
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6274 -
accuracy: 0.7759
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6206 -
accuracy: 0.7792
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6140 -
accuracy: 0.7806
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6080 -
accuracy: 0.7833
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6020 -
accuracy: 0.7844
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5964 -
accuracy: 0.7879
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5912 -
accuracy: 0.7898
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=tanh,

```

```

optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1391 -
accuracy: 0.3967
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.7530 -
accuracy: 0.6383
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4444 -
accuracy: 0.6718
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2348 -
accuracy: 0.6952
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0952 -
accuracy: 0.7094
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9988 -
accuracy: 0.7210
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9293 -
accuracy: 0.7274
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8763 -
accuracy: 0.7347
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8347 -
accuracy: 0.7391
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8013 -
accuracy: 0.7444
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7733 -
accuracy: 0.7482
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7504 -
accuracy: 0.7526
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7304 -
accuracy: 0.7545
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7131 -
accuracy: 0.7592
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6980 -
accuracy: 0.7619
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6845 -

```

```

accuracy: 0.7639
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6724 -
accuracy: 0.7667
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6615 -
accuracy: 0.7703
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6513 -
accuracy: 0.7726
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6422 -
accuracy: 0.7746
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6337 -
accuracy: 0.7775
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6257 -
accuracy: 0.7804
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6184 -
accuracy: 0.7835
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6112 -
accuracy: 0.7856
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6048 -
accuracy: 0.7879
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5985 -
accuracy: 0.7898
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5926 -
accuracy: 0.7915
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5869 -
accuracy: 0.7945
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5815 -
accuracy: 0.7960
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5765 -
accuracy: 0.7972
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=sigmoid, activation_function2=tanh,
optimizer_lr=0.001; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5669 -

```



accuracy: 0.7908  
Epoch 2/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4158 -  
accuracy: 0.8477  
Epoch 3/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3742 -  
accuracy: 0.8614  
Epoch 4/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3481 -  
accuracy: 0.8702  
Epoch 5/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3310 -  
accuracy: 0.8773  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3105 -  
accuracy: 0.8823  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2995 -  
accuracy: 0.8869  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2865 -  
accuracy: 0.8917  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2747 -  
accuracy: 0.8968  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2628 -  
accuracy: 0.9015  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2542 -  
accuracy: 0.9032  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2465 -  
accuracy: 0.9061  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2363 -  
accuracy: 0.9100  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2308 -  
accuracy: 0.9134  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2246 -  
accuracy: 0.9138  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2156 -  
accuracy: 0.9169  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2108 -

```

accuracy: 0.9190
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2034 -
accuracy: 0.9235
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1996 -
accuracy: 0.9230
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1923 -
accuracy: 0.9269
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1869 -
accuracy: 0.9287
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1797 -
accuracy: 0.9319
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1755 -
accuracy: 0.9330
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1699 -
accuracy: 0.9345
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1672 -
accuracy: 0.9374
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1639 -
accuracy: 0.9367
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1579 -
accuracy: 0.9392
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1533 -
accuracy: 0.9414
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1532 -
accuracy: 0.9411
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1479 -
accuracy: 0.9437
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=relu, optimizer_lr=0.1;
total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5649 -
accuracy: 0.7935
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4167 -

```

accuracy: 0.8468  
Epoch 3/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3743 -  
accuracy: 0.8606  
Epoch 4/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3488 -  
accuracy: 0.8693  
Epoch 5/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3255 -  
accuracy: 0.8783  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3109 -  
accuracy: 0.8825  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2959 -  
accuracy: 0.8898  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2886 -  
accuracy: 0.8910  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2745 -  
accuracy: 0.8967  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2649 -  
accuracy: 0.9010  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2549 -  
accuracy: 0.9029  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2478 -  
accuracy: 0.9066  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2409 -  
accuracy: 0.9074  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2337 -  
accuracy: 0.9118  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2271 -  
accuracy: 0.9134  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2194 -  
accuracy: 0.9151  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2133 -  
accuracy: 0.9182  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2070 -

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accuracy: 0.9209
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1996 -
accuracy: 0.9236
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1951 -
accuracy: 0.9246
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1882 -
accuracy: 0.9284
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1825 -
accuracy: 0.9298
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1772 -
accuracy: 0.9314
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1705 -
accuracy: 0.9345
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1685 -
accuracy: 0.9357
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1653 -
accuracy: 0.9366
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1578 -
accuracy: 0.9387
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1560 -
accuracy: 0.9409
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1485 -
accuracy: 0.9428
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1459 -
accuracy: 0.9443
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=relu, optimizer_lr=0.1;
total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5670 -
accuracy: 0.7924
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4165 -
accuracy: 0.8462
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3723 -

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accuracy: 0.8615  
Epoch 4/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3458 -  
accuracy: 0.8707  
Epoch 5/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3223 -  
accuracy: 0.8817  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3093 -  
accuracy: 0.8842  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2927 -  
accuracy: 0.8902  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2807 -  
accuracy: 0.8957  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2716 -  
accuracy: 0.8981  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2621 -  
accuracy: 0.9010  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2529 -  
accuracy: 0.9048  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2439 -  
accuracy: 0.9079  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2343 -  
accuracy: 0.9116  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2280 -  
accuracy: 0.9126  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2185 -  
accuracy: 0.9156  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2165 -  
accuracy: 0.9177  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2065 -  
accuracy: 0.9216  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2035 -  
accuracy: 0.9224  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1956 -

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accuracy: 0.9258
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.1894 -
accuracy: 0.9280
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1861 -
accuracy: 0.9285
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1808 -
accuracy: 0.9305
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1721 -
accuracy: 0.9337
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1686 -
accuracy: 0.9357
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1670 -
accuracy: 0.9361
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1620 -
accuracy: 0.9388
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1560 -
accuracy: 0.9404
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1497 -
accuracy: 0.9431
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1482 -
accuracy: 0.9427
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1420 -
accuracy: 0.9448
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=relu, optimizer_lr=0.1;
total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7548 -
accuracy: 0.7538
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5072 -
accuracy: 0.8238
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4586 -
accuracy: 0.8368
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4332 -

```

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accuracy: 0.8461
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4147 -
accuracy: 0.8538
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4010 -
accuracy: 0.8561
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3881 -
accuracy: 0.8620
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3774 -
accuracy: 0.8649
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3695 -
accuracy: 0.8671
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3614 -
accuracy: 0.8714
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3538 -
accuracy: 0.8746
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3476 -
accuracy: 0.8759
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3406 -
accuracy: 0.8788
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3350 -
accuracy: 0.8799
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3299 -
accuracy: 0.8802
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3248 -
accuracy: 0.8834
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3191 -
accuracy: 0.8844
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3142 -
accuracy: 0.8861
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3091 -
accuracy: 0.8876
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3053 -

```

```

accuracy: 0.8886
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2999 -
accuracy: 0.8921
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2966 -
accuracy: 0.8932
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2918 -
accuracy: 0.8946
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2890 -
accuracy: 0.8953
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2852 -
accuracy: 0.8968
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2819 -
accuracy: 0.8980
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2782 -
accuracy: 0.8981
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2736 -
accuracy: 0.9004
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2703 -
accuracy: 0.9016
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2675 -
accuracy: 0.9026
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=relu,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7674 -
accuracy: 0.7500
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5103 -
accuracy: 0.8232
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4625 -
accuracy: 0.8379
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4374 -
accuracy: 0.8462
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4165 -

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accuracy: 0.8531
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4032 -
accuracy: 0.8572
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3920 -
accuracy: 0.8606
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3806 -
accuracy: 0.8650
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3722 -
accuracy: 0.8667
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3645 -
accuracy: 0.8703
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3562 -
accuracy: 0.8728
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3502 -
accuracy: 0.8737
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3430 -
accuracy: 0.8773
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3378 -
accuracy: 0.8792
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3321 -
accuracy: 0.8812
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3269 -
accuracy: 0.8820
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3223 -
accuracy: 0.8851
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3170 -
accuracy: 0.8859
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3132 -
accuracy: 0.8874
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3092 -
accuracy: 0.8884
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3046 -

```

```

accuracy: 0.8911
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2995 -
accuracy: 0.8915
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2961 -
accuracy: 0.8938
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2931 -
accuracy: 0.8946
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2894 -
accuracy: 0.8955
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2845 -
accuracy: 0.8974
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2814 -
accuracy: 0.8992
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2772 -
accuracy: 0.8990
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2751 -
accuracy: 0.9003
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2714 -
accuracy: 0.9010
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=relu,
optimizer_lr=0.01; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7574 -
accuracy: 0.7537
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5050 -
accuracy: 0.8242
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4600 -
accuracy: 0.8392
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4352 -
accuracy: 0.8463
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4174 -
accuracy: 0.8511
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4032 -

```

```

accuracy: 0.8574
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3919 -
accuracy: 0.8596
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3827 -
accuracy: 0.8629
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3726 -
accuracy: 0.8671
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3654 -
accuracy: 0.8710
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3582 -
accuracy: 0.8715
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3523 -
accuracy: 0.8749
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3458 -
accuracy: 0.8775
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3405 -
accuracy: 0.8781
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3355 -
accuracy: 0.8796
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3296 -
accuracy: 0.8818
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3235 -
accuracy: 0.8844
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3199 -
accuracy: 0.8844
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3160 -
accuracy: 0.8873
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3113 -
accuracy: 0.8898
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3065 -
accuracy: 0.8902
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3027 -

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accuracy: 0.8911
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2985 -
accuracy: 0.8922
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2958 -
accuracy: 0.8933
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2930 -
accuracy: 0.8933
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2897 -
accuracy: 0.8953
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2842 -
accuracy: 0.8966
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2816 -
accuracy: 0.8979
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2787 -
accuracy: 0.8993
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2741 -
accuracy: 0.9011
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=relu,
optimizer_lr=0.01; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.5358 -
accuracy: 0.5704
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9478 -
accuracy: 0.7079
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7908 -
accuracy: 0.7478
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7106 -
accuracy: 0.7722
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6596 -
accuracy: 0.7845
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6231 -
accuracy: 0.7949
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5953 -

```

```

accuracy: 0.8037
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5733 -
accuracy: 0.8083
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5553 -
accuracy: 0.8133
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5402 -
accuracy: 0.8181
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5279 -
accuracy: 0.8208
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5169 -
accuracy: 0.8252
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5073 -
accuracy: 0.8269
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4989 -
accuracy: 0.8291
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4915 -
accuracy: 0.8319
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4846 -
accuracy: 0.8335
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4787 -
accuracy: 0.8348
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4730 -
accuracy: 0.8364
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4680 -
accuracy: 0.8371
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4631 -
accuracy: 0.8388
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4591 -
accuracy: 0.8400
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4550 -
accuracy: 0.8418
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4510 -

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```

accuracy: 0.8415
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4473 -
accuracy: 0.8437
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4440 -
accuracy: 0.8440
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4407 -
accuracy: 0.8460
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4377 -
accuracy: 0.8466
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4346 -
accuracy: 0.8473
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4320 -
accuracy: 0.8483
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4293 -
accuracy: 0.8491
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=relu,
optimizer_lr=0.001; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4907 -
accuracy: 0.5604
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9501 -
accuracy: 0.7026
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7969 -
accuracy: 0.7402
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7179 -
accuracy: 0.7636
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6662 -
accuracy: 0.7801
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6287 -
accuracy: 0.7918
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5999 -
accuracy: 0.7996
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5773 -

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accuracy: 0.8062  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5588 -  
accuracy: 0.8116  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5436 -  
accuracy: 0.8162  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5307 -  
accuracy: 0.8197  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5197 -  
accuracy: 0.8227  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5101 -  
accuracy: 0.8259  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5017 -  
accuracy: 0.8277  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4942 -  
accuracy: 0.8306  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4873 -  
accuracy: 0.8323  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4812 -  
accuracy: 0.8337  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4757 -  
accuracy: 0.8347  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4702 -  
accuracy: 0.8362  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4658 -  
accuracy: 0.8374  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4612 -  
accuracy: 0.8393  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4571 -  
accuracy: 0.8403  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4531 -  
accuracy: 0.8411  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4495 -

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accuracy: 0.8424
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4460 -
accuracy: 0.8435
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4427 -
accuracy: 0.8446
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4396 -
accuracy: 0.8459
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4367 -
accuracy: 0.8473
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4338 -
accuracy: 0.8480
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4312 -
accuracy: 0.8477
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=relu,
optimizer_lr=0.001; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.4733 -
accuracy: 0.5723
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9252 -
accuracy: 0.7173
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7713 -
accuracy: 0.7535
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6950 -
accuracy: 0.7740
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6466 -
accuracy: 0.7883
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6122 -
accuracy: 0.7976
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5857 -
accuracy: 0.8049
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5647 -
accuracy: 0.8122
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5478 -

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accuracy: 0.8169
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5334 -
accuracy: 0.8213
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5214 -
accuracy: 0.8235
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5109 -
accuracy: 0.8268
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5015 -
accuracy: 0.8289
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4937 -
accuracy: 0.8306
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4861 -
accuracy: 0.8324
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4797 -
accuracy: 0.8341
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4739 -
accuracy: 0.8359
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4684 -
accuracy: 0.8370
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4637 -
accuracy: 0.8382
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4590 -
accuracy: 0.8395
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4548 -
accuracy: 0.8421
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4508 -
accuracy: 0.8424
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4468 -
accuracy: 0.8436
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4434 -
accuracy: 0.8445
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4400 -

```

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accuracy: 0.8451
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4370 -
accuracy: 0.8471
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4338 -
accuracy: 0.8473
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4311 -
accuracy: 0.8479
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4281 -
accuracy: 0.8495
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4259 -
accuracy: 0.8500
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=relu,
optimizer_lr=0.001; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.6819 -
accuracy: 0.7694
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4634 -
accuracy: 0.8326
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4211 -
accuracy: 0.8477
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3935 -
accuracy: 0.8586
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3761 -
accuracy: 0.8611
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3592 -
accuracy: 0.8691
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3456 -
accuracy: 0.8744
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3339 -
accuracy: 0.8775
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3230 -
accuracy: 0.8810
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3136 -

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accuracy: 0.8841
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3038 -
accuracy: 0.8884
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2966 -
accuracy: 0.8914
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2886 -
accuracy: 0.8938
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2810 -
accuracy: 0.8956
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2737 -
accuracy: 0.8997
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2657 -
accuracy: 0.9013
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2604 -
accuracy: 0.9030
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2541 -
accuracy: 0.9054
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2489 -
accuracy: 0.9067
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2419 -
accuracy: 0.9098
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2367 -
accuracy: 0.9116
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2305 -
accuracy: 0.9146
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2274 -
accuracy: 0.9144
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2207 -
accuracy: 0.9182
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2179 -
accuracy: 0.9200
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2129 -

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accuracy: 0.9202
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2072 -
accuracy: 0.9230
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2026 -
accuracy: 0.9242
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1987 -
accuracy: 0.9264
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1953 -
accuracy: 0.9271
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=sigmoid,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6797 -
accuracy: 0.7679
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4628 -
accuracy: 0.8329
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4227 -
accuracy: 0.8470
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3962 -
accuracy: 0.8563
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3768 -
accuracy: 0.8617
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3591 -
accuracy: 0.8696
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3487 -
accuracy: 0.8709
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3346 -
accuracy: 0.8784
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3269 -
accuracy: 0.8800
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3158 -
accuracy: 0.8829
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3054 -

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accuracy: 0.8880
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2971 -
accuracy: 0.8902
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2897 -
accuracy: 0.8940
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2823 -
accuracy: 0.8944
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2755 -
accuracy: 0.8994
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2688 -
accuracy: 0.9004
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2640 -
accuracy: 0.9009
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2549 -
accuracy: 0.9054
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2508 -
accuracy: 0.9063
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2437 -
accuracy: 0.9096
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2382 -
accuracy: 0.9121
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2332 -
accuracy: 0.9131
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2281 -
accuracy: 0.9149
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2226 -
accuracy: 0.9166
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2169 -
accuracy: 0.9187
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2133 -
accuracy: 0.9213
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2102 -

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accuracy: 0.9218
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2061 -
accuracy: 0.9244
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1995 -
accuracy: 0.9254
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1952 -
accuracy: 0.9281
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=sigmoid,
optimizer_lr=0.1; total time= 1.1min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6717 -
accuracy: 0.7706
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4582 -
accuracy: 0.8328
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4153 -
accuracy: 0.8492
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3896 -
accuracy: 0.8585
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3724 -
accuracy: 0.8650
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3576 -
accuracy: 0.8689
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3463 -
accuracy: 0.8736
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3328 -
accuracy: 0.8784
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3222 -
accuracy: 0.8814
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3133 -
accuracy: 0.8847
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3043 -
accuracy: 0.8883
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2966 -

```

accuracy: 0.8903  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2896 -  
accuracy: 0.8932  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2821 -  
accuracy: 0.8956  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2754 -  
accuracy: 0.8976  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2699 -  
accuracy: 0.8991  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2634 -  
accuracy: 0.9032  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2567 -  
accuracy: 0.9053  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2524 -  
accuracy: 0.9066  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2466 -  
accuracy: 0.9087  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2421 -  
accuracy: 0.9101  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2358 -  
accuracy: 0.9132  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2310 -  
accuracy: 0.9130  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2224 -  
accuracy: 0.9183  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2211 -  
accuracy: 0.9186  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2150 -  
accuracy: 0.9201  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2103 -  
accuracy: 0.9227  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2058 -

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accuracy: 0.9232
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2032 -
accuracy: 0.9244
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1983 -
accuracy: 0.9253
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=sigmoid,
optimizer_lr=0.1; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.3519 -
accuracy: 0.6487
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7992 -
accuracy: 0.7446
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6677 -
accuracy: 0.7707
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6016 -
accuracy: 0.7911
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5583 -
accuracy: 0.8061
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5281 -
accuracy: 0.8160
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5056 -
accuracy: 0.8227
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4883 -
accuracy: 0.8280
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4748 -
accuracy: 0.8328
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4630 -
accuracy: 0.8361
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4531 -
accuracy: 0.8393
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4441 -
accuracy: 0.8432
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4360 -

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accuracy: 0.8458  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4289 -  
accuracy: 0.8478  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4221 -  
accuracy: 0.8499  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4161 -  
accuracy: 0.8523  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4106 -  
accuracy: 0.8528  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4050 -  
accuracy: 0.8562  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4003 -  
accuracy: 0.8575  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3955 -  
accuracy: 0.8593  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3913 -  
accuracy: 0.8603  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3870 -  
accuracy: 0.8613  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3831 -  
accuracy: 0.8638  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3793 -  
accuracy: 0.8649  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3759 -  
accuracy: 0.8668  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3727 -  
accuracy: 0.8671  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3692 -  
accuracy: 0.8685  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3662 -  
accuracy: 0.8696  
Epoch 29/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3631 -

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accuracy: 0.8722
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3601 -
accuracy: 0.8728
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=sigmoid,
optimizer_lr=0.01; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3463 -
accuracy: 0.6410
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7956 -
accuracy: 0.7441
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6643 -
accuracy: 0.7736
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5972 -
accuracy: 0.7944
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5536 -
accuracy: 0.8078
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5231 -
accuracy: 0.8177
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5004 -
accuracy: 0.8259
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4830 -
accuracy: 0.8309
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4689 -
accuracy: 0.8363
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4577 -
accuracy: 0.8383
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4476 -
accuracy: 0.8424
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4391 -
accuracy: 0.8438
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4312 -
accuracy: 0.8476
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4239 -

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accuracy: 0.8499  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4175 -  
accuracy: 0.8525  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4118 -  
accuracy: 0.8549  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4068 -  
accuracy: 0.8554  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4014 -  
accuracy: 0.8582  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3970 -  
accuracy: 0.8597  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3930 -  
accuracy: 0.8604  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3885 -  
accuracy: 0.8624  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3842 -  
accuracy: 0.8641  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3807 -  
accuracy: 0.8647  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3773 -  
accuracy: 0.8648  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3739 -  
accuracy: 0.8664  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3704 -  
accuracy: 0.8674  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3679 -  
accuracy: 0.8687  
Epoch 28/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3648 -  
accuracy: 0.8704  
Epoch 29/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3618 -  
accuracy: 0.8710  
Epoch 30/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3587 -

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accuracy: 0.8727
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=sigmoid,
optimizer_lr=0.01; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3620 -
accuracy: 0.6500
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7901 -
accuracy: 0.7507
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.6584 -
accuracy: 0.7790
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5922 -
accuracy: 0.8000
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5493 -
accuracy: 0.8116
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5189 -
accuracy: 0.8216
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4966 -
accuracy: 0.8273
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4795 -
accuracy: 0.8325
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4656 -
accuracy: 0.8363
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4540 -
accuracy: 0.8404
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4445 -
accuracy: 0.8431
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4359 -
accuracy: 0.8461
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4279 -
accuracy: 0.8479
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4211 -
accuracy: 0.8507
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4148 -

```

```

accuracy: 0.8536
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4092 -
accuracy: 0.8551
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4037 -
accuracy: 0.8559
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3984 -
accuracy: 0.8581
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3940 -
accuracy: 0.8593
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3894 -
accuracy: 0.8607
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3855 -
accuracy: 0.8639
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3813 -
accuracy: 0.8648
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3776 -
accuracy: 0.8652
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3746 -
accuracy: 0.8669
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3707 -
accuracy: 0.8681
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3680 -
accuracy: 0.8682
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3646 -
accuracy: 0.8700
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3616 -
accuracy: 0.8718
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3586 -
accuracy: 0.8714
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3560 -
accuracy: 0.8732
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=sigmoid,

```

```

optimizer_lr=0.01; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 2.1484 -
accuracy: 0.3711
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8164 -
accuracy: 0.6060
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5778 -
accuracy: 0.6437
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.4027 -
accuracy: 0.6635
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2725 -
accuracy: 0.6829
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1728 -
accuracy: 0.6918
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0941 -
accuracy: 0.7020
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0307 -
accuracy: 0.7101
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9785 -
accuracy: 0.7188
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9349 -
accuracy: 0.7245
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8979 -
accuracy: 0.7305
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8661 -
accuracy: 0.7360
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8385 -
accuracy: 0.7416
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8142 -
accuracy: 0.7456
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7927 -
accuracy: 0.7494
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7735 -

```

```

accuracy: 0.7546
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7562 -
accuracy: 0.7573
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7405 -
accuracy: 0.7614
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7261 -
accuracy: 0.7641
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7131 -
accuracy: 0.7666
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7009 -
accuracy: 0.7689
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6897 -
accuracy: 0.7711
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6793 -
accuracy: 0.7741
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6695 -
accuracy: 0.7770
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6604 -
accuracy: 0.7793
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6518 -
accuracy: 0.7812
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6437 -
accuracy: 0.7837
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6360 -
accuracy: 0.7855
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6287 -
accuracy: 0.7879
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6218 -
accuracy: 0.7898
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=sigmoid,
optimizer_lr=0.001; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 2.1582 -

```

```

accuracy: 0.3738
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8037 -
accuracy: 0.6051
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.5630 -
accuracy: 0.6654
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3871 -
accuracy: 0.6888
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.2576 -
accuracy: 0.7058
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.1591 -
accuracy: 0.7124
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0814 -
accuracy: 0.7217
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.0189 -
accuracy: 0.7278
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9672 -
accuracy: 0.7324
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9239 -
accuracy: 0.7381
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8871 -
accuracy: 0.7415
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8554 -
accuracy: 0.7457
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8278 -
accuracy: 0.7494
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8036 -
accuracy: 0.7526
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7821 -
accuracy: 0.7552
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7631 -
accuracy: 0.7588
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7458 -

```



```

accuracy: 0.7614
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7302 -
accuracy: 0.7644
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7161 -
accuracy: 0.7669
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7031 -
accuracy: 0.7698
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6912 -
accuracy: 0.7716
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6801 -
accuracy: 0.7748
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6698 -
accuracy: 0.7771
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.6603 -
accuracy: 0.7788
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6514 -
accuracy: 0.7803
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6429 -
accuracy: 0.7819
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6351 -
accuracy: 0.7840
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6276 -
accuracy: 0.7862
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6205 -
accuracy: 0.7884
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6137 -
accuracy: 0.7903
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=sigmoid,
optimizer_lr=0.001; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 2.1345 -
accuracy: 0.3645
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.8200 -

```

accuracy: 0.5857  
Epoch 3/30  
1125/1125 [=====] - 2s 2ms/step - loss: 1.5837 -  
accuracy: 0.6352  
Epoch 4/30  
1125/1125 [=====] - 2s 2ms/step - loss: 1.4079 -  
accuracy: 0.6647  
Epoch 5/30  
1125/1125 [=====] - 2s 2ms/step - loss: 1.2768 -  
accuracy: 0.6846  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 1.1762 -  
accuracy: 0.6948  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 1.0968 -  
accuracy: 0.7032  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 1.0326 -  
accuracy: 0.7098  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.9800 -  
accuracy: 0.7160  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.9359 -  
accuracy: 0.7226  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8987 -  
accuracy: 0.7279  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8668 -  
accuracy: 0.7323  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8391 -  
accuracy: 0.7371  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.8149 -  
accuracy: 0.7409  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7934 -  
accuracy: 0.7461  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7743 -  
accuracy: 0.7498  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7571 -  
accuracy: 0.7536  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.7414 -

```

accuracy: 0.7574
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7272 -
accuracy: 0.7597
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7141 -
accuracy: 0.7634
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7020 -
accuracy: 0.7669
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6907 -
accuracy: 0.7700
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6802 -
accuracy: 0.7730
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6705 -
accuracy: 0.7755
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6613 -
accuracy: 0.7780
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6525 -
accuracy: 0.7812
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6444 -
accuracy: 0.7843
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6367 -
accuracy: 0.7855
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6293 -
accuracy: 0.7876
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6223 -
accuracy: 0.7902
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=sigmoid,
optimizer_lr=0.001; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5575 -
accuracy: 0.7952
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4220 -
accuracy: 0.8448
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3818 -

```

```

accuracy: 0.8590
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3553 -
accuracy: 0.8673
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3335 -
accuracy: 0.8773
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3161 -
accuracy: 0.8816
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3043 -
accuracy: 0.8859
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2899 -
accuracy: 0.8924
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2765 -
accuracy: 0.8976
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2695 -
accuracy: 0.8987
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2593 -
accuracy: 0.9017
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2503 -
accuracy: 0.9059
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2442 -
accuracy: 0.9081
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2346 -
accuracy: 0.9122
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2293 -
accuracy: 0.9138
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2203 -
accuracy: 0.9176
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2128 -
accuracy: 0.9193
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2081 -
accuracy: 0.9208
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2009 -

```

```

accuracy: 0.9238
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1960 -
accuracy: 0.9262
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1887 -
accuracy: 0.9302
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1852 -
accuracy: 0.9293
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1803 -
accuracy: 0.9312
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1718 -
accuracy: 0.9352
Epoch 25/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.1684 -
accuracy: 0.9369
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1627 -
accuracy: 0.9382
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1596 -
accuracy: 0.9401
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1552 -
accuracy: 0.9407
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1473 -
accuracy: 0.9442
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1448 -
accuracy: 0.9470
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=tanh, optimizer_lr=0.1;
total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5606 -
accuracy: 0.7943
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4246 -
accuracy: 0.8433
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3833 -
accuracy: 0.8575
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3550 -

```

```

accuracy: 0.8695
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3354 -
accuracy: 0.8762
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3184 -
accuracy: 0.8818
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3039 -
accuracy: 0.8867
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2913 -
accuracy: 0.8906
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2791 -
accuracy: 0.8976
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2708 -
accuracy: 0.8987
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2598 -
accuracy: 0.9032
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2522 -
accuracy: 0.9041
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2436 -
accuracy: 0.9082
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2362 -
accuracy: 0.9107
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2286 -
accuracy: 0.9136
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2205 -
accuracy: 0.9180
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2144 -
accuracy: 0.9189
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2080 -
accuracy: 0.9216
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2007 -
accuracy: 0.9237
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1975 -

```

```

accuracy: 0.9258
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1904 -
accuracy: 0.9292
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1829 -
accuracy: 0.9314
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1781 -
accuracy: 0.9346
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1736 -
accuracy: 0.9355
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1669 -
accuracy: 0.9377
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1619 -
accuracy: 0.9385
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1582 -
accuracy: 0.9400
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1544 -
accuracy: 0.9429
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1504 -
accuracy: 0.9434
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1465 -
accuracy: 0.9456
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=tanh, optimizer_lr=0.1;
total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5550 -
accuracy: 0.7962
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4214 -
accuracy: 0.8448
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3805 -
accuracy: 0.8597
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3535 -
accuracy: 0.8697
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3324 -

```

accuracy: 0.8770  
Epoch 6/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3158 -  
accuracy: 0.8844  
Epoch 7/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3027 -  
accuracy: 0.8868  
Epoch 8/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2899 -  
accuracy: 0.8933  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2781 -  
accuracy: 0.8968  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2672 -  
accuracy: 0.9003  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2585 -  
accuracy: 0.9024  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2511 -  
accuracy: 0.9065  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2441 -  
accuracy: 0.9106  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2347 -  
accuracy: 0.9126  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2261 -  
accuracy: 0.9150  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2216 -  
accuracy: 0.9175  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2141 -  
accuracy: 0.9202  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2054 -  
accuracy: 0.9239  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2004 -  
accuracy: 0.9266  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1934 -  
accuracy: 0.9284  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.1914 -



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accuracy: 0.9290
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1826 -
accuracy: 0.9325
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1751 -
accuracy: 0.9336
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1725 -
accuracy: 0.9355
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1680 -
accuracy: 0.9372
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1612 -
accuracy: 0.9400
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1571 -
accuracy: 0.9411
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1522 -
accuracy: 0.9431
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1474 -
accuracy: 0.9444
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.1434 -
accuracy: 0.9468
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=tanh, optimizer_lr=0.1;
total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7376 -
accuracy: 0.7567
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5044 -
accuracy: 0.8236
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4586 -
accuracy: 0.8377
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4342 -
accuracy: 0.8455
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4167 -
accuracy: 0.8530
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4023 -

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accuracy: 0.8566
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3908 -
accuracy: 0.8602
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3820 -
accuracy: 0.8633
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3729 -
accuracy: 0.8670
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3657 -
accuracy: 0.8699
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3585 -
accuracy: 0.8727
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3525 -
accuracy: 0.8744
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3467 -
accuracy: 0.8758
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3403 -
accuracy: 0.8784
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3360 -
accuracy: 0.8791
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3313 -
accuracy: 0.8812
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3263 -
accuracy: 0.8831
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3221 -
accuracy: 0.8840
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3176 -
accuracy: 0.8853
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3144 -
accuracy: 0.8877
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3100 -
accuracy: 0.8889
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3061 -

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accuracy: 0.8896
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3024 -
accuracy: 0.8914
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2994 -
accuracy: 0.8931
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2962 -
accuracy: 0.8932
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2931 -
accuracy: 0.8944
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2887 -
accuracy: 0.8957
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2869 -
accuracy: 0.8962
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2833 -
accuracy: 0.8974
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2794 -
accuracy: 0.9002
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=tanh,
optimizer_lr=0.01; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.7379 -
accuracy: 0.7610
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5070 -
accuracy: 0.8240
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4624 -
accuracy: 0.8387
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4367 -
accuracy: 0.8454
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4183 -
accuracy: 0.8519
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4059 -
accuracy: 0.8553
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3932 -

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accuracy: 0.8606
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3839 -
accuracy: 0.8631
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3752 -
accuracy: 0.8661
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3675 -
accuracy: 0.8688
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3622 -
accuracy: 0.8709
Epoch 12/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3550 -
accuracy: 0.8728
Epoch 13/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3490 -
accuracy: 0.8752
Epoch 14/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3428 -
accuracy: 0.8767
Epoch 15/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3382 -
accuracy: 0.8781
Epoch 16/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3328 -
accuracy: 0.8814
Epoch 17/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3294 -
accuracy: 0.8819
Epoch 18/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3244 -
accuracy: 0.8832
Epoch 19/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3205 -
accuracy: 0.8848
Epoch 20/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3158 -
accuracy: 0.8865
Epoch 21/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3115 -
accuracy: 0.8891
Epoch 22/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3079 -
accuracy: 0.8892
Epoch 23/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3043 -

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accuracy: 0.8908
Epoch 24/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3015 -
accuracy: 0.8923
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2967 -
accuracy: 0.8931
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2943 -
accuracy: 0.8930
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2910 -
accuracy: 0.8959
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2878 -
accuracy: 0.8958
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2846 -
accuracy: 0.8974
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2813 -
accuracy: 0.8984
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=tanh,
optimizer_lr=0.01; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.7412 -
accuracy: 0.7549
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5076 -
accuracy: 0.8233
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4605 -
accuracy: 0.8372
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4351 -
accuracy: 0.8434
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4156 -
accuracy: 0.8514
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4019 -
accuracy: 0.8558
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3893 -
accuracy: 0.8620
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.3802 -

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accuracy: 0.8637  
Epoch 9/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3711 -  
accuracy: 0.8681  
Epoch 10/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3642 -  
accuracy: 0.8689  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3565 -  
accuracy: 0.8731  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3506 -  
accuracy: 0.8742  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3451 -  
accuracy: 0.8763  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3393 -  
accuracy: 0.8777  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3340 -  
accuracy: 0.8792  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3292 -  
accuracy: 0.8828  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3251 -  
accuracy: 0.8840  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3198 -  
accuracy: 0.8848  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3166 -  
accuracy: 0.8865  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3116 -  
accuracy: 0.8877  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3082 -  
accuracy: 0.8877  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3047 -  
accuracy: 0.8891  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.3014 -  
accuracy: 0.8905  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.2974 -

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accuracy: 0.8938
Epoch 25/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2936 -
accuracy: 0.8934
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2900 -
accuracy: 0.8953
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2879 -
accuracy: 0.8943
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2836 -
accuracy: 0.8979
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2804 -
accuracy: 0.8989
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.2789 -
accuracy: 0.8995
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=tanh,
optimizer_lr=0.01; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.4052 -
accuracy: 0.5693
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9138 -
accuracy: 0.7156
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7799 -
accuracy: 0.7534
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7079 -
accuracy: 0.7741
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6602 -
accuracy: 0.7865
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6256 -
accuracy: 0.7966
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5991 -
accuracy: 0.8030
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5779 -
accuracy: 0.8071
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5607 -

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accuracy: 0.8115  
Epoch 10/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.5461 -  
accuracy: 0.8143  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5336 -  
accuracy: 0.8178  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5229 -  
accuracy: 0.8204  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5137 -  
accuracy: 0.8242  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5052 -  
accuracy: 0.8254  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4978 -  
accuracy: 0.8275  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4912 -  
accuracy: 0.8290  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4851 -  
accuracy: 0.8307  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4795 -  
accuracy: 0.8324  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4743 -  
accuracy: 0.8348  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4696 -  
accuracy: 0.8373  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4652 -  
accuracy: 0.8386  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4610 -  
accuracy: 0.8389  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4572 -  
accuracy: 0.8408  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4535 -  
accuracy: 0.8414  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4500 -



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accuracy: 0.8424
Epoch 26/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4467 -
accuracy: 0.8445
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4436 -
accuracy: 0.8454
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4406 -
accuracy: 0.8462
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4376 -
accuracy: 0.8471
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4348 -
accuracy: 0.8477
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=tanh,
optimizer_lr=0.001; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 2s 2ms/step - loss: 1.3672 -
accuracy: 0.6050
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.8873 -
accuracy: 0.7211
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7619 -
accuracy: 0.7527
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6937 -
accuracy: 0.7732
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6479 -
accuracy: 0.7869
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6146 -
accuracy: 0.7976
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5886 -
accuracy: 0.8055
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5677 -
accuracy: 0.8113
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5509 -
accuracy: 0.8158
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5365 -

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accuracy: 0.8197  
Epoch 11/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5247 -  
accuracy: 0.8229  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5142 -  
accuracy: 0.8260  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5050 -  
accuracy: 0.8279  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4969 -  
accuracy: 0.8299  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4898 -  
accuracy: 0.8318  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4832 -  
accuracy: 0.8329  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4775 -  
accuracy: 0.8352  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4721 -  
accuracy: 0.8359  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4672 -  
accuracy: 0.8371  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4627 -  
accuracy: 0.8386  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4584 -  
accuracy: 0.8395  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4545 -  
accuracy: 0.8416  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4506 -  
accuracy: 0.8417  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4472 -  
accuracy: 0.8435  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4437 -  
accuracy: 0.8446  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4409 -

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accuracy: 0.8448
Epoch 27/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4378 -
accuracy: 0.8464
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4347 -
accuracy: 0.8476
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4322 -
accuracy: 0.8486
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4296 -
accuracy: 0.8503
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=tanh,
optimizer_lr=0.001; total time= 1.2min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.4677 -
accuracy: 0.5422
Epoch 2/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.9034 -
accuracy: 0.7319
Epoch 3/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.7638 -
accuracy: 0.7632
Epoch 4/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6922 -
accuracy: 0.7798
Epoch 5/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6463 -
accuracy: 0.7912
Epoch 6/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.6131 -
accuracy: 0.7996
Epoch 7/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5873 -
accuracy: 0.8061
Epoch 8/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5671 -
accuracy: 0.8113
Epoch 9/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5503 -
accuracy: 0.8156
Epoch 10/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5364 -
accuracy: 0.8201
Epoch 11/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.5246 -

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accuracy: 0.8224  
Epoch 12/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5143 -  
accuracy: 0.8264  
Epoch 13/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.5054 -  
accuracy: 0.8282  
Epoch 14/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4973 -  
accuracy: 0.8298  
Epoch 15/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4905 -  
accuracy: 0.8317  
Epoch 16/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4840 -  
accuracy: 0.8336  
Epoch 17/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4782 -  
accuracy: 0.8344  
Epoch 18/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4728 -  
accuracy: 0.8371  
Epoch 19/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4678 -  
accuracy: 0.8378  
Epoch 20/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4633 -  
accuracy: 0.8388  
Epoch 21/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4592 -  
accuracy: 0.8400  
Epoch 22/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4551 -  
accuracy: 0.8416  
Epoch 23/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4515 -  
accuracy: 0.8425  
Epoch 24/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4478 -  
accuracy: 0.8432  
Epoch 25/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4446 -  
accuracy: 0.8444  
Epoch 26/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4413 -  
accuracy: 0.8453  
Epoch 27/30  
1125/1125 [=====] - 2s 2ms/step - loss: 0.4385 -

```

accuracy: 0.8462
Epoch 28/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4358 -
accuracy: 0.8474
Epoch 29/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4329 -
accuracy: 0.8487
Epoch 30/30
1125/1125 [=====] - 2s 2ms/step - loss: 0.4304 -
accuracy: 0.8493
563/563 [=====] - 1s 1ms/step
[CV] END activation_function1=tanh, activation_function2=tanh,
optimizer_lr=0.001; total time= 1.2min
Epoch 1/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.6248 -
accuracy: 0.7815
Epoch 2/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.4337 -
accuracy: 0.8421
Epoch 3/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3923 -
accuracy: 0.8578
Epoch 4/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3648 -
accuracy: 0.8674
Epoch 5/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3452 -
accuracy: 0.8733
Epoch 6/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3306 -
accuracy: 0.8789
Epoch 7/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3156 -
accuracy: 0.8839
Epoch 8/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3045 -
accuracy: 0.8870
Epoch 9/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2940 -
accuracy: 0.8914
Epoch 10/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2835 -
accuracy: 0.8936
Epoch 11/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2735 -
accuracy: 0.8977
Epoch 12/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2645 -

```

```

accuracy: 0.9020
Epoch 13/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2570 -
accuracy: 0.9040
Epoch 14/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2506 -
accuracy: 0.9065
Epoch 15/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2440 -
accuracy: 0.9079
Epoch 16/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2372 -
accuracy: 0.9119
Epoch 17/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2310 -
accuracy: 0.9132
Epoch 18/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2249 -
accuracy: 0.9166
Epoch 19/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2190 -
accuracy: 0.9187
Epoch 20/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2136 -
accuracy: 0.9210
Epoch 21/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2091 -
accuracy: 0.9225
Epoch 22/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2026 -
accuracy: 0.9247
Epoch 23/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1976 -
accuracy: 0.9262
Epoch 24/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1931 -
accuracy: 0.9277
Epoch 25/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1882 -
accuracy: 0.9296
Epoch 26/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1824 -
accuracy: 0.9319
Epoch 27/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1794 -
accuracy: 0.9325
Epoch 28/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1745 -

```

```

accuracy: 0.9349
Epoch 29/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1700 -
accuracy: 0.9365
Epoch 30/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1657 -
accuracy: 0.9386

```

```

[26]: print('MLP Best params: ',best_params_mlp)
      print('MLP Best scores: ',grid_search_cv.best_score_)

```

```

MLP Best params: {'activation_function1': 'relu', 'activation_function2':
'sigmoid', 'optimizer_lr': 0.1}
MLP Best scores: 0.8897777777777778

```

### 1.4.3 Convolutional neural network

```

[36]: # CNN model with default parameter
      model_default = build_model(3,1,1e-2)
      history = model_no_activation.fit(X_train, y_train, epochs=30,
                                         validation_data=(X_valid, y_valid))

```

```

Epoch 1/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 2/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 3/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 4/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 5/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 6/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 7/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 8/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 9/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047

```

Epoch 10/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 11/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 12/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 13/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 14/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 15/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 16/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 17/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 18/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 19/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 20/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 21/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 22/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 23/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 24/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047  
Epoch 25/30  
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:  
0.0995 - val\_loss: nan - val\_accuracy: 0.1047



```

Epoch 26/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 27/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 28/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 29/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047
Epoch 30/30
1688/1688 [=====] - 4s 2ms/step - loss: nan - accuracy:
0.0995 - val_loss: nan - val_accuracy: 0.1047

```

```

[37]: loss, accuracy = model_default.evaluate(X_test, y_test)
print(f"Accuracy on test data: {accuracy:.4f}")

```

```

313/313 [=====] - 1s 2ms/step - loss: 2.2963 -
accuracy: 0.1124
Accuracy on test data: 0.1124

```

```

[27]: # Create a KerasClassifier object which works with sklearn grid searches
# We need to pass default values of arguments in build_mlp if we wish to tune
      ↪ them
keras_classifier = KerasClassifier(build_model,
                                   ks=3,
                                   strides=1,
                                   lrs=1e-2,
                                   )

param_grid = {
    "ks": [2, 3, 4],
    "strides": [1, 2, 3],
    "lrs": [1e-2, 1e-3, 5e-3, 5e-4]
}

grid_search_cv = GridSearchCV(keras_classifier, param_grid, cv=3, verbose=2)
grid_search_cv.fit(X_train_cnn, y_train, epochs=30)
best_param_cnn = grid_search_cv.best_params_

```

5000

```

1125/1125 [=====] - 3s 2ms/step - loss: 0.3039 -
accuracy: 0.8919
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2980 -
accuracy: 0.8926
Epoch 13/30

```

1125/1125 [=====] - 3s 3ms/step - loss: 0.2897 -  
 accuracy: 0.8961  
 Epoch 14/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.2878 -  
 accuracy: 0.8948  
 Epoch 15/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.2807 -  
 accuracy: 0.8987  
 Epoch 16/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2795 -  
 accuracy: 0.8991  
 Epoch 17/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2695 -  
 accuracy: 0.9026  
 Epoch 18/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2660 -  
 accuracy: 0.9055  
 Epoch 19/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.2643 -  
 accuracy: 0.9059  
 Epoch 20/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2603 -  
 accuracy: 0.9064  
 Epoch 21/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2527 -  
 accuracy: 0.9090  
 Epoch 22/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2530 -  
 accuracy: 0.9082  
 Epoch 23/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2476 -  
 accuracy: 0.9098  
 Epoch 24/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.2480 -  
 accuracy: 0.9090  
 Epoch 25/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2419 -  
 accuracy: 0.9115  
 Epoch 26/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2412 -  
 accuracy: 0.9119  
 Epoch 27/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.2409 -  
 accuracy: 0.9132  
 Epoch 28/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.2356 -  
 accuracy: 0.9149  
 Epoch 29/30

```

1125/1125 [=====] - 3s 3ms/step - loss: 0.2342 -
accuracy: 0.9143
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2302 -
accuracy: 0.9168
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=2, lrs=0.0005, strides=1; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6579 -
accuracy: 0.7647
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4514 -
accuracy: 0.8390
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4103 -
accuracy: 0.8531
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3821 -
accuracy: 0.8640
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3610 -
accuracy: 0.8725
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3472 -
accuracy: 0.8758
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3346 -
accuracy: 0.8816
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3247 -
accuracy: 0.8845
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3129 -
accuracy: 0.8888
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3066 -
accuracy: 0.8884
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3002 -
accuracy: 0.8919
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2925 -
accuracy: 0.8964
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2889 -
accuracy: 0.8960
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2796 -

```

accuracy: 0.9009  
Epoch 15/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2764 -  
accuracy: 0.9013  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2733 -  
accuracy: 0.9006  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2667 -  
accuracy: 0.9042  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2592 -  
accuracy: 0.9061  
Epoch 19/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2607 -  
accuracy: 0.9063  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2532 -  
accuracy: 0.9072  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2499 -  
accuracy: 0.9107  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2485 -  
accuracy: 0.9096  
Epoch 23/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2434 -  
accuracy: 0.9128  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2428 -  
accuracy: 0.9111  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2394 -  
accuracy: 0.9138  
Epoch 26/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2357 -  
accuracy: 0.9145  
Epoch 27/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2342 -  
accuracy: 0.9151  
Epoch 28/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2308 -  
accuracy: 0.9183  
Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2251 -  
accuracy: 0.9187  
Epoch 30/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2292 -

```

accuracy: 0.9159
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=2, lrs=0.0005, strides=1; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 1.1903 -
accuracy: 0.5891
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7388 -
accuracy: 0.7361
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6513 -
accuracy: 0.7675
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5998 -
accuracy: 0.7850
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5671 -
accuracy: 0.7960
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5459 -
accuracy: 0.8021
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5255 -
accuracy: 0.8113
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5128 -
accuracy: 0.8167
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5015 -
accuracy: 0.8179
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4912 -
accuracy: 0.8245
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4815 -
accuracy: 0.8271
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4774 -
accuracy: 0.8299
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4726 -
accuracy: 0.8301
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4624 -
accuracy: 0.8342
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4564 -
accuracy: 0.8367

```

```

Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4545 -
accuracy: 0.8366
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4500 -
accuracy: 0.8381
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4474 -
accuracy: 0.8396
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4398 -
accuracy: 0.8419
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4405 -
accuracy: 0.8417
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4346 -
accuracy: 0.8454
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4338 -
accuracy: 0.8431
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4323 -
accuracy: 0.8441
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4295 -
accuracy: 0.8478
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4258 -
accuracy: 0.8481
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4242 -
accuracy: 0.8476
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4216 -
accuracy: 0.8497
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4183 -
accuracy: 0.8503
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4210 -
accuracy: 0.8503
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4117 -
accuracy: 0.8534
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=2, lrs=0.0005, strides=2; total time= 2.4min
Epoch 1/30

```

```

1125/1125 [=====] - 3s 3ms/step - loss: 1.1617 -
accuracy: 0.5964
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7193 -
accuracy: 0.7406
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6339 -
accuracy: 0.7701
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5901 -
accuracy: 0.7864
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5579 -
accuracy: 0.7993
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5341 -
accuracy: 0.8081
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5156 -
accuracy: 0.8137
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5038 -
accuracy: 0.8194
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4918 -
accuracy: 0.8216
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4820 -
accuracy: 0.8277
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4758 -
accuracy: 0.8284
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4693 -
accuracy: 0.8323
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4628 -
accuracy: 0.8339
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4568 -
accuracy: 0.8359
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4511 -
accuracy: 0.8374
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4476 -
accuracy: 0.8407
Epoch 17/30

```

```

1125/1125 [=====] - 3s 3ms/step - loss: 0.4417 -
accuracy: 0.8417
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4392 -
accuracy: 0.8436
Epoch 19/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4388 -
accuracy: 0.8420
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4308 -
accuracy: 0.8461
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4334 -
accuracy: 0.8450
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4275 -
accuracy: 0.8455
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4239 -
accuracy: 0.8472
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4203 -
accuracy: 0.8519
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4173 -
accuracy: 0.8502
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4206 -
accuracy: 0.8513
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4235 -
accuracy: 0.8484
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4155 -
accuracy: 0.8510
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4110 -
accuracy: 0.8535
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4147 -
accuracy: 0.8522
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=2, lrs=0.0005, strides=2; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 1.1740 -
accuracy: 0.5941
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7326 -

```



accuracy: 0.7366  
Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.6472 -  
accuracy: 0.7673  
Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5948 -  
accuracy: 0.7874  
Epoch 5/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.5645 -  
accuracy: 0.7966  
Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5448 -  
accuracy: 0.8037  
Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5237 -  
accuracy: 0.8129  
Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5129 -  
accuracy: 0.8164  
Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4983 -  
accuracy: 0.8206  
Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4891 -  
accuracy: 0.8263  
Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4834 -  
accuracy: 0.8264  
Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4761 -  
accuracy: 0.8309  
Epoch 13/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4691 -  
accuracy: 0.8334  
Epoch 14/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4697 -  
accuracy: 0.8329  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4619 -  
accuracy: 0.8344  
Epoch 16/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4547 -  
accuracy: 0.8389  
Epoch 17/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4504 -  
accuracy: 0.8401  
Epoch 18/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4466 -

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accuracy: 0.8405
Epoch 19/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4448 -
accuracy: 0.8393
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4375 -
accuracy: 0.8436
Epoch 21/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4365 -
accuracy: 0.8447
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4359 -
accuracy: 0.8438
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4321 -
accuracy: 0.8446
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4308 -
accuracy: 0.8474
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4243 -
accuracy: 0.8489
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4249 -
accuracy: 0.8461
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4254 -
accuracy: 0.8463
Epoch 28/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4242 -
accuracy: 0.8476
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4209 -
accuracy: 0.8508
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4169 -
accuracy: 0.8494
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=2, lrs=0.0005, strides=2; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.5766 -
accuracy: 0.4010
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.1503 -
accuracy: 0.5533
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.0473 -
accuracy: 0.5955

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Epoch 4/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.9964 -  
accuracy: 0.6197

Epoch 5/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.9643 -  
accuracy: 0.6322

Epoch 6/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.9442 -  
accuracy: 0.6400

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.9273 -  
accuracy: 0.6471

Epoch 8/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.9150 -  
accuracy: 0.6522

Epoch 9/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.9062 -  
accuracy: 0.6572

Epoch 10/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8955 -  
accuracy: 0.6612

Epoch 11/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8844 -  
accuracy: 0.6650

Epoch 12/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8783 -  
accuracy: 0.6681

Epoch 13/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8665 -  
accuracy: 0.6718

Epoch 14/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8603 -  
accuracy: 0.6724

Epoch 15/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8574 -  
accuracy: 0.6772

Epoch 16/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8492 -  
accuracy: 0.6779

Epoch 17/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8489 -  
accuracy: 0.6755

Epoch 18/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8395 -  
accuracy: 0.6836

Epoch 19/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8396 -  
accuracy: 0.6825

Epoch 20/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8367 -  
accuracy: 0.6845

Epoch 21/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8316 -  
accuracy: 0.6855

Epoch 22/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8272 -  
accuracy: 0.6859

Epoch 23/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8228 -  
accuracy: 0.6886

Epoch 24/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8223 -  
accuracy: 0.6895

Epoch 25/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8195 -  
accuracy: 0.6903

Epoch 26/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8128 -  
accuracy: 0.6922

Epoch 27/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8102 -  
accuracy: 0.6942

Epoch 28/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8104 -  
accuracy: 0.6960

Epoch 29/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8076 -  
accuracy: 0.6945

Epoch 30/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8016 -  
accuracy: 0.6977

563/563 [=====] - 1s 1ms/step  
[CV] END ...ks=2, lrs=0.0005, strides=3; total time= 1.4min

Epoch 1/30  
1125/1125 [=====] - 3s 2ms/step - loss: 1.5775 -  
accuracy: 0.3959

Epoch 2/30  
1125/1125 [=====] - 3s 2ms/step - loss: 1.1598 -  
accuracy: 0.5472

Epoch 3/30  
1125/1125 [=====] - 3s 2ms/step - loss: 1.0625 -  
accuracy: 0.5864

Epoch 4/30  
1125/1125 [=====] - 3s 2ms/step - loss: 1.0136 -  
accuracy: 0.6093

Epoch 5/30

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1125/1125 [=====] - 3s 2ms/step - loss: 0.9793 -
accuracy: 0.6228
Epoch 6/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9579 -
accuracy: 0.6307
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9339 -
accuracy: 0.6429
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9213 -
accuracy: 0.6501
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9055 -
accuracy: 0.6529
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8943 -
accuracy: 0.6582
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8854 -
accuracy: 0.6617
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8768 -
accuracy: 0.6650
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8661 -
accuracy: 0.6708
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8603 -
accuracy: 0.6726
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8519 -
accuracy: 0.6736
Epoch 16/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8488 -
accuracy: 0.6747
Epoch 17/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8498 -
accuracy: 0.6767
Epoch 18/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8396 -
accuracy: 0.6781
Epoch 19/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8318 -
accuracy: 0.6820
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8327 -
accuracy: 0.6805
Epoch 21/30

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1125/1125 [=====] - 3s 2ms/step - loss: 0.8270 -
accuracy: 0.6865
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8275 -
accuracy: 0.6878
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8232 -
accuracy: 0.6875
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8164 -
accuracy: 0.6918
Epoch 25/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8174 -
accuracy: 0.6909
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8084 -
accuracy: 0.6935
Epoch 27/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8125 -
accuracy: 0.6917
Epoch 28/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8062 -
accuracy: 0.6924
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8028 -
accuracy: 0.6966
Epoch 30/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.7949 -
accuracy: 0.6993
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=2, lrs=0.0005, strides=3; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.5539 -
accuracy: 0.4032
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.1419 -
accuracy: 0.5498
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.0502 -
accuracy: 0.5930
Epoch 4/30
1125/1125 [=====] - 3s 2ms/step - loss: 1.0093 -
accuracy: 0.6124
Epoch 5/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9821 -
accuracy: 0.6249
Epoch 6/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9549 -

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accuracy: 0.6369
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9332 -
accuracy: 0.6410
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9191 -
accuracy: 0.6534
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9088 -
accuracy: 0.6574
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8984 -
accuracy: 0.6614
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8884 -
accuracy: 0.6648
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8786 -
accuracy: 0.6693
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8733 -
accuracy: 0.6709
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.8706 -
accuracy: 0.6753
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8673 -
accuracy: 0.6739
Epoch 16/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8571 -
accuracy: 0.6779
Epoch 17/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8532 -
accuracy: 0.6792
Epoch 18/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8507 -
accuracy: 0.6781
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.8424 -
accuracy: 0.6822
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8406 -
accuracy: 0.6849
Epoch 21/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8362 -
accuracy: 0.6812
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8349 -

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accuracy: 0.6851
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8274 -
accuracy: 0.6887
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8298 -
accuracy: 0.6893
Epoch 25/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8261 -
accuracy: 0.6914
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8184 -
accuracy: 0.6948
Epoch 27/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8231 -
accuracy: 0.6902
Epoch 28/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8190 -
accuracy: 0.6914
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8195 -
accuracy: 0.6905
Epoch 30/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8144 -
accuracy: 0.6914
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=2, lrs=0.0005, strides=3; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5209 -
accuracy: 0.8121
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4260 -
accuracy: 0.8498
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4069 -
accuracy: 0.8521
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3986 -
accuracy: 0.8553
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3953 -
accuracy: 0.8569
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3907 -
accuracy: 0.8590
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3832 -
accuracy: 0.8603

```



Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3832 -  
accuracy: 0.8608

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3855 -  
accuracy: 0.8588

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3872 -  
accuracy: 0.8587

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3764 -  
accuracy: 0.8621

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3794 -  
accuracy: 0.8593

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3744 -  
accuracy: 0.8649

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3793 -  
accuracy: 0.8600

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3713 -  
accuracy: 0.8621

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3730 -  
accuracy: 0.8628

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3735 -  
accuracy: 0.8627

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3669 -  
accuracy: 0.8666

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3745 -  
accuracy: 0.8642

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3702 -  
accuracy: 0.8659

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3681 -  
accuracy: 0.8665

Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3682 -  
accuracy: 0.8664

Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3636 -  
accuracy: 0.8664

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3618 -  
accuracy: 0.8674

Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3680 -  
accuracy: 0.8645

Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3591 -  
accuracy: 0.8666

Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3622 -  
accuracy: 0.8670

Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3700 -  
accuracy: 0.8647

Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3634 -  
accuracy: 0.8675

Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3643 -  
accuracy: 0.8660

563/563 [=====] - 1s 2ms/step  
[CV] END ...ks=3, lrs=0.01, strides=1; total time= 1.5min

Epoch 1/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5273 -  
accuracy: 0.8140

Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4410 -  
accuracy: 0.8418

Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4093 -  
accuracy: 0.8531

Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3999 -  
accuracy: 0.8552

Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4003 -  
accuracy: 0.8530

Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3887 -  
accuracy: 0.8594

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3839 -  
accuracy: 0.8618

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3817 -  
accuracy: 0.8631

Epoch 9/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3857 -
accuracy: 0.8592
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3793 -
accuracy: 0.8613
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3832 -
accuracy: 0.8602
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3775 -
accuracy: 0.8613
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3708 -
accuracy: 0.8654
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3756 -
accuracy: 0.8632
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3681 -
accuracy: 0.8660
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3716 -
accuracy: 0.8636
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3692 -
accuracy: 0.8657
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3732 -
accuracy: 0.8639
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3774 -
accuracy: 0.8609
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3644 -
accuracy: 0.8662
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3669 -
accuracy: 0.8662
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3770 -
accuracy: 0.8622
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3763 -
accuracy: 0.8635
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3627 -
accuracy: 0.8669
Epoch 25/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3681 -
accuracy: 0.8653
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3703 -
accuracy: 0.8646
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3755 -
accuracy: 0.8635
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3695 -
accuracy: 0.8652
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3619 -
accuracy: 0.8681
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3699 -
accuracy: 0.8650
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.01, strides=1; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5293 -
accuracy: 0.8123
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4310 -
accuracy: 0.8443
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4082 -
accuracy: 0.8525
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3960 -
accuracy: 0.8588
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3915 -
accuracy: 0.8594
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3832 -
accuracy: 0.8615
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3843 -
accuracy: 0.8595
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3836 -
accuracy: 0.8606
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3790 -
accuracy: 0.8622
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3721 -

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accuracy: 0.8627  
Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3762 -  
accuracy: 0.8621  
Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3753 -  
accuracy: 0.8634  
Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3761 -  
accuracy: 0.8628  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3729 -  
accuracy: 0.8610  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3778 -  
accuracy: 0.8626  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3722 -  
accuracy: 0.8645  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3689 -  
accuracy: 0.8653  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3732 -  
accuracy: 0.8658  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3714 -  
accuracy: 0.8614  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3743 -  
accuracy: 0.8618  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3730 -  
accuracy: 0.8651  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3756 -  
accuracy: 0.8618  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3717 -  
accuracy: 0.8643  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3745 -  
accuracy: 0.8611  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3711 -  
accuracy: 0.8645  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3694 -

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accuracy: 0.8656
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3660 -
accuracy: 0.8652
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3722 -
accuracy: 0.8646
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3661 -
accuracy: 0.8667
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3657 -
accuracy: 0.8651
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.01, strides=1; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.6634 -
accuracy: 0.7599
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5239 -
accuracy: 0.8112
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4985 -
accuracy: 0.8202
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4919 -
accuracy: 0.8219
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4813 -
accuracy: 0.8254
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4820 -
accuracy: 0.8276
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4801 -
accuracy: 0.8241
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4704 -
accuracy: 0.8308
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4658 -
accuracy: 0.8312
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4625 -
accuracy: 0.8304
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4558 -
accuracy: 0.8323

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Epoch 12/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4614 -  
accuracy: 0.8314  
Epoch 13/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4561 -  
accuracy: 0.8324  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4571 -  
accuracy: 0.8364  
Epoch 15/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4563 -  
accuracy: 0.8359  
Epoch 16/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4488 -  
accuracy: 0.8370  
Epoch 17/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4539 -  
accuracy: 0.8328  
Epoch 18/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4440 -  
accuracy: 0.8388  
Epoch 19/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4518 -  
accuracy: 0.8351  
Epoch 20/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4506 -  
accuracy: 0.8348  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4505 -  
accuracy: 0.8357  
Epoch 22/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4499 -  
accuracy: 0.8367  
Epoch 23/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4473 -  
accuracy: 0.8370  
Epoch 24/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4496 -  
accuracy: 0.8354  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4508 -  
accuracy: 0.8361  
Epoch 26/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4450 -  
accuracy: 0.8379  
Epoch 27/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4478 -  
accuracy: 0.8381

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Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4467 -
accuracy: 0.8363
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4411 -
accuracy: 0.8388
Epoch 30/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4321 -
accuracy: 0.8390
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.01, strides=2; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.6698 -
accuracy: 0.7564
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5328 -
accuracy: 0.8068
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5069 -
accuracy: 0.8156
Epoch 4/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4922 -
accuracy: 0.8232
Epoch 5/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4818 -
accuracy: 0.8236
Epoch 6/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4701 -
accuracy: 0.8276
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4641 -
accuracy: 0.8309
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4631 -
accuracy: 0.8310
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4628 -
accuracy: 0.8314
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4601 -
accuracy: 0.8325
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4547 -
accuracy: 0.8333
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4607 -
accuracy: 0.8346
Epoch 13/30

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1125/1125 [=====] - 3s 2ms/step - loss: 0.4464 -  
accuracy: 0.8373  
Epoch 14/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4497 -  
accuracy: 0.8365  
Epoch 15/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4469 -  
accuracy: 0.8375  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4467 -  
accuracy: 0.8386  
Epoch 17/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4453 -  
accuracy: 0.8361  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4511 -  
accuracy: 0.8366  
Epoch 19/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4413 -  
accuracy: 0.8383  
Epoch 20/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4425 -  
accuracy: 0.8385  
Epoch 21/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4505 -  
accuracy: 0.8376  
Epoch 22/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4424 -  
accuracy: 0.8391  
Epoch 23/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4382 -  
accuracy: 0.8411  
Epoch 24/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4353 -  
accuracy: 0.8414  
Epoch 25/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4368 -  
accuracy: 0.8399  
Epoch 26/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4505 -  
accuracy: 0.8357  
Epoch 27/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4532 -  
accuracy: 0.8321  
Epoch 28/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4433 -  
accuracy: 0.8379  
Epoch 29/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.4361 -
accuracy: 0.8401
Epoch 30/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4454 -
accuracy: 0.8376
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.01, strides=2; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.6734 -
accuracy: 0.7610
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5302 -
accuracy: 0.8080
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5056 -
accuracy: 0.8186
Epoch 4/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4904 -
accuracy: 0.8259
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4811 -
accuracy: 0.8267
Epoch 6/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4788 -
accuracy: 0.8279
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4692 -
accuracy: 0.8292
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4681 -
accuracy: 0.8312
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4591 -
accuracy: 0.8332
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4611 -
accuracy: 0.8336
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4582 -
accuracy: 0.8343
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4607 -
accuracy: 0.8321
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4593 -
accuracy: 0.8310
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4580 -

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accuracy: 0.8341
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4544 -
accuracy: 0.8375
Epoch 16/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4511 -
accuracy: 0.8360
Epoch 17/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4529 -
accuracy: 0.8343
Epoch 18/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4500 -
accuracy: 0.8354
Epoch 19/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4496 -
accuracy: 0.8375
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4480 -
accuracy: 0.8368
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4489 -
accuracy: 0.8353
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4452 -
accuracy: 0.8390
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4449 -
accuracy: 0.8374
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4442 -
accuracy: 0.8376
Epoch 25/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4431 -
accuracy: 0.8371
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4473 -
accuracy: 0.8359
Epoch 27/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4445 -
accuracy: 0.8369
Epoch 28/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4511 -
accuracy: 0.8363
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4381 -
accuracy: 0.8412
Epoch 30/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4424 -

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accuracy: 0.8376
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.01, strides=2; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7744 -
accuracy: 0.7101
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6335 -
accuracy: 0.7632
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5982 -
accuracy: 0.7793
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5819 -
accuracy: 0.7824
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5656 -
accuracy: 0.7904
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5525 -
accuracy: 0.7934
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5534 -
accuracy: 0.7955
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5539 -
accuracy: 0.7977
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5461 -
accuracy: 0.8007
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5446 -
accuracy: 0.7993
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5402 -
accuracy: 0.8002
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5382 -
accuracy: 0.7985
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5404 -
accuracy: 0.8015
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5309 -
accuracy: 0.8039
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5313 -
accuracy: 0.8029

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Epoch 16/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5430 -  
 accuracy: 0.7993  
 Epoch 17/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5375 -  
 accuracy: 0.8005  
 Epoch 18/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5351 -  
 accuracy: 0.8021  
 Epoch 19/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5265 -  
 accuracy: 0.8072  
 Epoch 20/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5271 -  
 accuracy: 0.8025  
 Epoch 21/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5258 -  
 accuracy: 0.8080  
 Epoch 22/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5167 -  
 accuracy: 0.8080  
 Epoch 23/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5245 -  
 accuracy: 0.8082  
 Epoch 24/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5194 -  
 accuracy: 0.8077  
 Epoch 25/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5195 -  
 accuracy: 0.8061  
 Epoch 26/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5174 -  
 accuracy: 0.8095  
 Epoch 27/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5192 -  
 accuracy: 0.8091  
 Epoch 28/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5191 -  
 accuracy: 0.8059  
 Epoch 29/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5217 -  
 accuracy: 0.8084  
 Epoch 30/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.5241 -  
 accuracy: 0.8098  
 563/563 [=====] - 1s 1ms/step  
 [CV] END ...ks=3, lrs=0.01, strides=3; total time= 1.4min  
 Epoch 1/30

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1125/1125 [=====] - 3s 2ms/step - loss: 0.7721 -
accuracy: 0.7121
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.6224 -
accuracy: 0.7708
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5843 -
accuracy: 0.7859
Epoch 4/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5749 -
accuracy: 0.7891
Epoch 5/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5565 -
accuracy: 0.7946
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5551 -
accuracy: 0.7927
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5401 -
accuracy: 0.8003
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5455 -
accuracy: 0.8012
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5452 -
accuracy: 0.7977
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5351 -
accuracy: 0.8017
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5368 -
accuracy: 0.8008
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5399 -
accuracy: 0.8033
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5377 -
accuracy: 0.8016
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5294 -
accuracy: 0.8015
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5290 -
accuracy: 0.8027
Epoch 16/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5257 -
accuracy: 0.8056
Epoch 17/30

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1125/1125 [=====] - 3s 2ms/step - loss: 0.5346 -
accuracy: 0.8017
Epoch 18/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5248 -
accuracy: 0.8067
Epoch 19/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5210 -
accuracy: 0.8053
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5231 -
accuracy: 0.8059
Epoch 21/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5224 -
accuracy: 0.8079
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5156 -
accuracy: 0.8086
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5233 -
accuracy: 0.8072
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5190 -
accuracy: 0.8052
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5183 -
accuracy: 0.8082
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5225 -
accuracy: 0.8059
Epoch 27/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5180 -
accuracy: 0.8069
Epoch 28/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5107 -
accuracy: 0.8116
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5131 -
accuracy: 0.8100
Epoch 30/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5118 -
accuracy: 0.8098
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.01, strides=3; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7780 -
accuracy: 0.7084
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.6300 -

```

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accuracy: 0.7651
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5982 -
accuracy: 0.7760
Epoch 4/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5876 -
accuracy: 0.7812
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5772 -
accuracy: 0.7877
Epoch 6/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5646 -
accuracy: 0.7889
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5622 -
accuracy: 0.7937
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5614 -
accuracy: 0.7930
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5434 -
accuracy: 0.7984
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5487 -
accuracy: 0.7970
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5494 -
accuracy: 0.7942
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5431 -
accuracy: 0.7986
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5452 -
accuracy: 0.7966
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5368 -
accuracy: 0.8018
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5329 -
accuracy: 0.8023
Epoch 16/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5299 -
accuracy: 0.8041
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5366 -
accuracy: 0.7992
Epoch 18/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5302 -

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accuracy: 0.8021
Epoch 19/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5297 -
accuracy: 0.8045
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5248 -
accuracy: 0.8033
Epoch 21/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5353 -
accuracy: 0.8036
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5236 -
accuracy: 0.8053
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5240 -
accuracy: 0.8054
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5176 -
accuracy: 0.8070
Epoch 25/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5209 -
accuracy: 0.8080
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5265 -
accuracy: 0.8056
Epoch 27/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5240 -
accuracy: 0.8054
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5170 -
accuracy: 0.8071
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5261 -
accuracy: 0.8040
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5233 -
accuracy: 0.8063
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.01, strides=3; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5452 -
accuracy: 0.8002
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3809 -
accuracy: 0.8635
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3379 -
accuracy: 0.8777

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Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3105 -  
accuracy: 0.8879

Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2900 -  
accuracy: 0.8954

Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2747 -  
accuracy: 0.8996

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2619 -  
accuracy: 0.9042

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2514 -  
accuracy: 0.9083

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2420 -  
accuracy: 0.9133

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2314 -  
accuracy: 0.9141

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2265 -  
accuracy: 0.9165

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2159 -  
accuracy: 0.9204

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2139 -  
accuracy: 0.9215

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2093 -  
accuracy: 0.9223

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2076 -  
accuracy: 0.9225

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2014 -  
accuracy: 0.9250

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1922 -  
accuracy: 0.9294

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1915 -  
accuracy: 0.9294

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1894 -  
accuracy: 0.9299

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1862 -  
accuracy: 0.9308  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1801 -  
accuracy: 0.9338  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1782 -  
accuracy: 0.9336  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1741 -  
accuracy: 0.9343  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1718 -  
accuracy: 0.9371  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1709 -  
accuracy: 0.9354  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1691 -  
accuracy: 0.9373  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1643 -  
accuracy: 0.9395  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1635 -  
accuracy: 0.9386  
Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1596 -  
accuracy: 0.9390  
Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1592 -  
accuracy: 0.9410  
563/563 [=====] - 1s 2ms/step  
[CV] END ...ks=3, lrs=0.001, strides=1; total time= 1.5min  
Epoch 1/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5523 -  
accuracy: 0.7996  
Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3835 -  
accuracy: 0.8639  
Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3431 -  
accuracy: 0.8779  
Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3140 -  
accuracy: 0.8894  
Epoch 5/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.2934 -
accuracy: 0.8948
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2779 -
accuracy: 0.8991
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2680 -
accuracy: 0.9027
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2521 -
accuracy: 0.9101
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2437 -
accuracy: 0.9114
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2366 -
accuracy: 0.9131
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2317 -
accuracy: 0.9152
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2218 -
accuracy: 0.9179
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2160 -
accuracy: 0.9207
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2117 -
accuracy: 0.9236
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2056 -
accuracy: 0.9237
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2027 -
accuracy: 0.9244
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1980 -
accuracy: 0.9266
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1955 -
accuracy: 0.9276
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1935 -
accuracy: 0.9276
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1873 -
accuracy: 0.9303
Epoch 21/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.1826 -
accuracy: 0.9317
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1812 -
accuracy: 0.9329
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1782 -
accuracy: 0.9339
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1773 -
accuracy: 0.9343
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1702 -
accuracy: 0.9369
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1703 -
accuracy: 0.9364
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1693 -
accuracy: 0.9370
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1662 -
accuracy: 0.9387
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1635 -
accuracy: 0.9379
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1639 -
accuracy: 0.9401
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.001, strides=1; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5485 -
accuracy: 0.8007
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3835 -
accuracy: 0.8635
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3418 -
accuracy: 0.8797
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3129 -
accuracy: 0.8869
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2960 -
accuracy: 0.8924
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2831 -

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accuracy: 0.8984
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2636 -
accuracy: 0.9047
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2544 -
accuracy: 0.9074
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2466 -
accuracy: 0.9118
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2378 -
accuracy: 0.9132
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2295 -
accuracy: 0.9158
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2240 -
accuracy: 0.9178
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2175 -
accuracy: 0.9216
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2120 -
accuracy: 0.9222
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2064 -
accuracy: 0.9247
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2015 -
accuracy: 0.9273
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2003 -
accuracy: 0.9269
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1972 -
accuracy: 0.9268
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1878 -
accuracy: 0.9312
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1873 -
accuracy: 0.9298
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1847 -
accuracy: 0.9317
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1824 -

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accuracy: 0.9327
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1771 -
accuracy: 0.9351
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1747 -
accuracy: 0.9357
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1689 -
accuracy: 0.9371
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1697 -
accuracy: 0.9366
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1649 -
accuracy: 0.9400
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1645 -
accuracy: 0.9404
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1631 -
accuracy: 0.9401
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1599 -
accuracy: 0.9412
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.001, strides=1; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8316 -
accuracy: 0.7064
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5405 -
accuracy: 0.8040
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4704 -
accuracy: 0.8292
Epoch 4/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4354 -
accuracy: 0.8426
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4109 -
accuracy: 0.8525
Epoch 6/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3923 -
accuracy: 0.8595
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3802 -
accuracy: 0.8615

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Epoch 8/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3726 -  
accuracy: 0.8645

Epoch 9/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3604 -  
accuracy: 0.8694

Epoch 10/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3534 -  
accuracy: 0.8725

Epoch 11/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3477 -  
accuracy: 0.8734

Epoch 12/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3368 -  
accuracy: 0.8780

Epoch 13/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3343 -  
accuracy: 0.8793

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3304 -  
accuracy: 0.8808

Epoch 15/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3218 -  
accuracy: 0.8827

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3178 -  
accuracy: 0.8850

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3140 -  
accuracy: 0.8854

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3118 -  
accuracy: 0.8867

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3093 -  
accuracy: 0.8875

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3067 -  
accuracy: 0.8881

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3033 -  
accuracy: 0.8891

Epoch 22/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2999 -  
accuracy: 0.8904

Epoch 23/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2931 -  
accuracy: 0.8907



Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2934 -  
accuracy: 0.8930  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2916 -  
accuracy: 0.8933  
Epoch 26/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2877 -  
accuracy: 0.8942  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2886 -  
accuracy: 0.8935  
Epoch 28/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2835 -  
accuracy: 0.8951  
Epoch 29/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2813 -  
accuracy: 0.8947  
Epoch 30/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.2783 -  
accuracy: 0.8967  
563/563 [=====] - 1s 1ms/step  
[CV] END ...ks=3, lrs=0.001, strides=2; total time= 1.4min  
Epoch 1/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.8415 -  
accuracy: 0.7024  
Epoch 2/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.5508 -  
accuracy: 0.8017  
Epoch 3/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4876 -  
accuracy: 0.8242  
Epoch 4/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4523 -  
accuracy: 0.8368  
Epoch 5/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4283 -  
accuracy: 0.8455  
Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4073 -  
accuracy: 0.8532  
Epoch 7/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3931 -  
accuracy: 0.8596  
Epoch 8/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3848 -  
accuracy: 0.8617  
Epoch 9/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3726 -
accuracy: 0.8657
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3638 -
accuracy: 0.8689
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3601 -
accuracy: 0.8702
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3495 -
accuracy: 0.8758
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3482 -
accuracy: 0.8752
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3405 -
accuracy: 0.8775
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3337 -
accuracy: 0.8790
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3296 -
accuracy: 0.8817
Epoch 17/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3281 -
accuracy: 0.8803
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3253 -
accuracy: 0.8821
Epoch 19/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3196 -
accuracy: 0.8835
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3174 -
accuracy: 0.8846
Epoch 21/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3139 -
accuracy: 0.8861
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3083 -
accuracy: 0.8878
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3031 -
accuracy: 0.8890
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3097 -
accuracy: 0.8877
Epoch 25/30

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1125/1125 [=====] - 3s 2ms/step - loss: 0.3024 -
accuracy: 0.8892
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2982 -
accuracy: 0.8899
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2972 -
accuracy: 0.8915
Epoch 28/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2933 -
accuracy: 0.8914
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2913 -
accuracy: 0.8931
Epoch 30/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2896 -
accuracy: 0.8945
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.001, strides=2; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.8537 -
accuracy: 0.6938
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5606 -
accuracy: 0.7973
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4871 -
accuracy: 0.8243
Epoch 4/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4510 -
accuracy: 0.8376
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4253 -
accuracy: 0.8490
Epoch 6/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4075 -
accuracy: 0.8521
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3918 -
accuracy: 0.8601
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3770 -
accuracy: 0.8643
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3719 -
accuracy: 0.8679
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3608 -

```

```

accuracy: 0.8706
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3568 -
accuracy: 0.8721
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3500 -
accuracy: 0.8744
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3417 -
accuracy: 0.8752
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3373 -
accuracy: 0.8784
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3338 -
accuracy: 0.8798
Epoch 16/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3295 -
accuracy: 0.8816
Epoch 17/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3224 -
accuracy: 0.8826
Epoch 18/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3166 -
accuracy: 0.8856
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3157 -
accuracy: 0.8852
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3131 -
accuracy: 0.8866
Epoch 21/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3117 -
accuracy: 0.8888
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3053 -
accuracy: 0.8902
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3014 -
accuracy: 0.8902
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2986 -
accuracy: 0.8915
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2993 -
accuracy: 0.8906
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2952 -

```

```

accuracy: 0.8938
Epoch 27/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2917 -
accuracy: 0.8934
Epoch 28/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.2940 -
accuracy: 0.8924
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2862 -
accuracy: 0.8958
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2859 -
accuracy: 0.8966
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.001, strides=2; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.9818 -
accuracy: 0.6414
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6778 -
accuracy: 0.7537
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6207 -
accuracy: 0.7732
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5851 -
accuracy: 0.7880
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5582 -
accuracy: 0.7985
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5385 -
accuracy: 0.8054
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5246 -
accuracy: 0.8103
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5097 -
accuracy: 0.8165
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4975 -
accuracy: 0.8209
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4892 -
accuracy: 0.8227
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4793 -
accuracy: 0.8279

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Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4719 -  
accuracy: 0.8301

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4686 -  
accuracy: 0.8303

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4650 -  
accuracy: 0.8301

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4567 -  
accuracy: 0.8339

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4558 -  
accuracy: 0.8366

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4489 -  
accuracy: 0.8373

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4467 -  
accuracy: 0.8386

Epoch 19/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4397 -  
accuracy: 0.8384

Epoch 20/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4370 -  
accuracy: 0.8407

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4297 -  
accuracy: 0.8447

Epoch 22/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4329 -  
accuracy: 0.8449

Epoch 23/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4248 -  
accuracy: 0.8458

Epoch 24/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4278 -  
accuracy: 0.8435

Epoch 25/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4168 -  
accuracy: 0.8485

Epoch 26/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4207 -  
accuracy: 0.8468

Epoch 27/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4132 -  
accuracy: 0.8499

Epoch 28/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.4139 -  
 accuracy: 0.8497  
 Epoch 29/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.4073 -  
 accuracy: 0.8526  
 Epoch 30/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.4085 -  
 accuracy: 0.8518  
 563/563 [=====] - 1s 1ms/step  
 [CV] END ...ks=3, lrs=0.001, strides=3; total time= 1.5min  
 Epoch 1/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.9783 -  
 accuracy: 0.6430  
 Epoch 2/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.6696 -  
 accuracy: 0.7559  
 Epoch 3/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.6070 -  
 accuracy: 0.7809  
 Epoch 4/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.5676 -  
 accuracy: 0.7959  
 Epoch 5/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.5395 -  
 accuracy: 0.8045  
 Epoch 6/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.5202 -  
 accuracy: 0.8124  
 Epoch 7/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.5073 -  
 accuracy: 0.8165  
 Epoch 8/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.4914 -  
 accuracy: 0.8217  
 Epoch 9/30  
 1125/1125 [=====] - 3s 2ms/step - loss: 0.4865 -  
 accuracy: 0.8246  
 Epoch 10/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.4730 -  
 accuracy: 0.8304  
 Epoch 11/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.4613 -  
 accuracy: 0.8324  
 Epoch 12/30  
 1125/1125 [=====] - 3s 3ms/step - loss: 0.4581 -  
 accuracy: 0.8327  
 Epoch 13/30

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1125/1125 [=====] - 3s 2ms/step - loss: 0.4542 -
accuracy: 0.8360
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4502 -
accuracy: 0.8367
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4376 -
accuracy: 0.8411
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4341 -
accuracy: 0.8446
Epoch 17/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4308 -
accuracy: 0.8439
Epoch 18/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4260 -
accuracy: 0.8452
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4234 -
accuracy: 0.8479
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4165 -
accuracy: 0.8492
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4129 -
accuracy: 0.8492
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4106 -
accuracy: 0.8513
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4130 -
accuracy: 0.8484
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4043 -
accuracy: 0.8549
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4024 -
accuracy: 0.8524
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4063 -
accuracy: 0.8522
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3988 -
accuracy: 0.8551
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3942 -
accuracy: 0.8580
Epoch 29/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3931 -
accuracy: 0.8553
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3914 -
accuracy: 0.8573
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.001, strides=3; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.9699 -
accuracy: 0.6465
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6634 -
accuracy: 0.7539
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6045 -
accuracy: 0.7784
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5687 -
accuracy: 0.7925
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5435 -
accuracy: 0.8032
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5273 -
accuracy: 0.8093
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5116 -
accuracy: 0.8126
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4987 -
accuracy: 0.8201
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4940 -
accuracy: 0.8203
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4821 -
accuracy: 0.8248
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4760 -
accuracy: 0.8291
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4660 -
accuracy: 0.8294
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4608 -
accuracy: 0.8342
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4602 -

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```

accuracy: 0.8324
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4506 -
accuracy: 0.8371
Epoch 16/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4450 -
accuracy: 0.8391
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4424 -
accuracy: 0.8386
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4395 -
accuracy: 0.8395
Epoch 19/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4355 -
accuracy: 0.8418
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4340 -
accuracy: 0.8425
Epoch 21/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4267 -
accuracy: 0.8463
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4208 -
accuracy: 0.8452
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4178 -
accuracy: 0.8487
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4180 -
accuracy: 0.8478
Epoch 25/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4142 -
accuracy: 0.8488
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4117 -
accuracy: 0.8507
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4078 -
accuracy: 0.8496
Epoch 28/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4066 -
accuracy: 0.8521
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3982 -
accuracy: 0.8522
Epoch 30/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4056 -

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accuracy: 0.8501
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.001, strides=3; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4886 -
accuracy: 0.8243
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3746 -
accuracy: 0.8653
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3440 -
accuracy: 0.8744
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3255 -
accuracy: 0.8821
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3158 -
accuracy: 0.8847
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3037 -
accuracy: 0.8891
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2970 -
accuracy: 0.8922
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2924 -
accuracy: 0.8933
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2884 -
accuracy: 0.8929
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2837 -
accuracy: 0.8959
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2827 -
accuracy: 0.8950
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2749 -
accuracy: 0.8989
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2733 -
accuracy: 0.8984
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2770 -
accuracy: 0.8989
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2698 -
accuracy: 0.9018

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```

Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2649 -
accuracy: 0.9031
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2639 -
accuracy: 0.9043
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2689 -
accuracy: 0.8995
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2607 -
accuracy: 0.9038
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2596 -
accuracy: 0.9037
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2584 -
accuracy: 0.9056
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2504 -
accuracy: 0.9068
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2548 -
accuracy: 0.9058
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2534 -
accuracy: 0.9076
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2515 -
accuracy: 0.9070
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2574 -
accuracy: 0.9061
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2533 -
accuracy: 0.9057
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2473 -
accuracy: 0.9084
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2498 -
accuracy: 0.9083
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2544 -
accuracy: 0.9063
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.005, strides=1; total time= 1.5min
Epoch 1/30

```

1125/1125 [=====] - 3s 3ms/step - loss: 0.4891 -  
accuracy: 0.8260  
Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3700 -  
accuracy: 0.8667  
Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3450 -  
accuracy: 0.8750  
Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3321 -  
accuracy: 0.8788  
Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3202 -  
accuracy: 0.8840  
Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3148 -  
accuracy: 0.8841  
Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3096 -  
accuracy: 0.8875  
Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2989 -  
accuracy: 0.8898  
Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2936 -  
accuracy: 0.8931  
Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2863 -  
accuracy: 0.8940  
Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2868 -  
accuracy: 0.8945  
Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2794 -  
accuracy: 0.8972  
Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2770 -  
accuracy: 0.8988  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2787 -  
accuracy: 0.8978  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2755 -  
accuracy: 0.8978  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2741 -  
accuracy: 0.8980  
Epoch 17/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.2712 -
accuracy: 0.8986
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2701 -
accuracy: 0.8989
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2679 -
accuracy: 0.9022
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2689 -
accuracy: 0.9000
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2643 -
accuracy: 0.9037
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2541 -
accuracy: 0.9060
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2612 -
accuracy: 0.9046
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2586 -
accuracy: 0.9031
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2572 -
accuracy: 0.9076
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2567 -
accuracy: 0.9056
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2573 -
accuracy: 0.9054
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2568 -
accuracy: 0.9049
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2521 -
accuracy: 0.9054
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2543 -
accuracy: 0.9066
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.005, strides=1; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4929 -
accuracy: 0.8237
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3766 -

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```

accuracy: 0.8657
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3464 -
accuracy: 0.8737
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3335 -
accuracy: 0.8778
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3172 -
accuracy: 0.8854
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3101 -
accuracy: 0.8892
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3065 -
accuracy: 0.8864
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2989 -
accuracy: 0.8893
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2961 -
accuracy: 0.8926
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2892 -
accuracy: 0.8936
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2850 -
accuracy: 0.8944
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2799 -
accuracy: 0.8980
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2845 -
accuracy: 0.8964
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2797 -
accuracy: 0.8975
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2760 -
accuracy: 0.8987
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2734 -
accuracy: 0.9018
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2720 -
accuracy: 0.8991
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2732 -

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accuracy: 0.9008
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2651 -
accuracy: 0.9036
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2647 -
accuracy: 0.9024
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2657 -
accuracy: 0.9023
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2602 -
accuracy: 0.9049
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2614 -
accuracy: 0.9031
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2568 -
accuracy: 0.9044
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2569 -
accuracy: 0.9044
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2615 -
accuracy: 0.9057
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2556 -
accuracy: 0.9053
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2525 -
accuracy: 0.9071
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2573 -
accuracy: 0.9067
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2569 -
accuracy: 0.9053
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.005, strides=1; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6623 -
accuracy: 0.7599
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4809 -
accuracy: 0.8252
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4409 -
accuracy: 0.8410

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Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4223 -  
accuracy: 0.8454

Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4038 -  
accuracy: 0.8517

Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3962 -  
accuracy: 0.8549

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3900 -  
accuracy: 0.8579

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3816 -  
accuracy: 0.8582

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3792 -  
accuracy: 0.8613

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3778 -  
accuracy: 0.8612

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3688 -  
accuracy: 0.8648

Epoch 12/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3647 -  
accuracy: 0.8666

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3605 -  
accuracy: 0.8683

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3584 -  
accuracy: 0.8668

Epoch 15/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3568 -  
accuracy: 0.8698

Epoch 16/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3486 -  
accuracy: 0.8710

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3485 -  
accuracy: 0.8701

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3469 -  
accuracy: 0.8719

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3455 -  
accuracy: 0.8726

Epoch 20/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3456 -  
accuracy: 0.8740

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3400 -  
accuracy: 0.8750

Epoch 22/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3407 -  
accuracy: 0.8745

Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3365 -  
accuracy: 0.8766

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3365 -  
accuracy: 0.8759

Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3383 -  
accuracy: 0.8740

Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3318 -  
accuracy: 0.8788

Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3361 -  
accuracy: 0.8769

Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3334 -  
accuracy: 0.8769

Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3297 -  
accuracy: 0.8785

Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3317 -  
accuracy: 0.8778

563/563 [=====] - 1s 2ms/step  
[CV] END ...ks=3, lrs=0.005, strides=2; total time= 1.5min

Epoch 1/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.6600 -  
accuracy: 0.7609

Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4825 -  
accuracy: 0.8265

Epoch 3/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4443 -  
accuracy: 0.8405

Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4246 -  
accuracy: 0.8446

Epoch 5/30

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1125/1125 [=====] - 3s 2ms/step - loss: 0.4107 -
accuracy: 0.8521
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4026 -
accuracy: 0.8531
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3914 -
accuracy: 0.8555
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3863 -
accuracy: 0.8591
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3878 -
accuracy: 0.8576
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3810 -
accuracy: 0.8629
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3811 -
accuracy: 0.8608
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3736 -
accuracy: 0.8646
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3679 -
accuracy: 0.8635
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3663 -
accuracy: 0.8646
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3658 -
accuracy: 0.8668
Epoch 16/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3560 -
accuracy: 0.8670
Epoch 17/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3624 -
accuracy: 0.8671
Epoch 18/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3514 -
accuracy: 0.8707
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3548 -
accuracy: 0.8705
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3516 -
accuracy: 0.8700
Epoch 21/30

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1125/1125 [=====] - 3s 2ms/step - loss: 0.3527 -
accuracy: 0.8700
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3481 -
accuracy: 0.8696
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3432 -
accuracy: 0.8739
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3421 -
accuracy: 0.8748
Epoch 25/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3492 -
accuracy: 0.8708
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3421 -
accuracy: 0.8748
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3399 -
accuracy: 0.8745
Epoch 28/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3355 -
accuracy: 0.8773
Epoch 29/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3415 -
accuracy: 0.8733
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3366 -
accuracy: 0.8742
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.005, strides=2; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6534 -
accuracy: 0.7651
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4645 -
accuracy: 0.8302
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4328 -
accuracy: 0.8436
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4113 -
accuracy: 0.8506
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3955 -
accuracy: 0.8562
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3835 -

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accuracy: 0.8603
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3776 -
accuracy: 0.8623
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3685 -
accuracy: 0.8661
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3677 -
accuracy: 0.8669
Epoch 10/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3619 -
accuracy: 0.8675
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3554 -
accuracy: 0.8716
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3528 -
accuracy: 0.8709
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3546 -
accuracy: 0.8716
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3490 -
accuracy: 0.8715
Epoch 15/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3476 -
accuracy: 0.8729
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3482 -
accuracy: 0.8718
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3420 -
accuracy: 0.8733
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3382 -
accuracy: 0.8760
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3410 -
accuracy: 0.8746
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3350 -
accuracy: 0.8772
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3392 -
accuracy: 0.8744
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3357 -

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accuracy: 0.8758
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3350 -
accuracy: 0.8769
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3309 -
accuracy: 0.8789
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3268 -
accuracy: 0.8789
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3298 -
accuracy: 0.8808
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3315 -
accuracy: 0.8788
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3257 -
accuracy: 0.8803
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3214 -
accuracy: 0.8844
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3228 -
accuracy: 0.8814
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.005, strides=2; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7677 -
accuracy: 0.7168
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5916 -
accuracy: 0.7811
Epoch 3/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5505 -
accuracy: 0.7995
Epoch 4/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5260 -
accuracy: 0.8060
Epoch 5/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5103 -
accuracy: 0.8110
Epoch 6/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4992 -
accuracy: 0.8161
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4909 -
accuracy: 0.8198

```

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4850 -  
accuracy: 0.8217

Epoch 9/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4719 -  
accuracy: 0.8237

Epoch 10/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4744 -  
accuracy: 0.8258

Epoch 11/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4668 -  
accuracy: 0.8262

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4642 -  
accuracy: 0.8289

Epoch 13/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4614 -  
accuracy: 0.8309

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4587 -  
accuracy: 0.8305

Epoch 15/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4520 -  
accuracy: 0.8333

Epoch 16/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4521 -  
accuracy: 0.8322

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4462 -  
accuracy: 0.8348

Epoch 18/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4442 -  
accuracy: 0.8351

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4415 -  
accuracy: 0.8352

Epoch 20/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4359 -  
accuracy: 0.8366

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4340 -  
accuracy: 0.8363

Epoch 22/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4340 -  
accuracy: 0.8385

Epoch 23/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4335 -  
accuracy: 0.8396

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4336 -  
accuracy: 0.8396  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4282 -  
accuracy: 0.8424  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4316 -  
accuracy: 0.8402  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4244 -  
accuracy: 0.8441  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4213 -  
accuracy: 0.8416  
Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4265 -  
accuracy: 0.8420  
Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4272 -  
accuracy: 0.8420  
563/563 [=====] - 1s 1ms/step  
[CV] END ...ks=3, lrs=0.005, strides=3; total time= 1.4min  
Epoch 1/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.7488 -  
accuracy: 0.7243  
Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5759 -  
accuracy: 0.7892  
Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5420 -  
accuracy: 0.7991  
Epoch 4/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.5184 -  
accuracy: 0.8106  
Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4947 -  
accuracy: 0.8179  
Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4840 -  
accuracy: 0.8231  
Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4697 -  
accuracy: 0.8281  
Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4659 -  
accuracy: 0.8304  
Epoch 9/30



1125/1125 [=====] - 3s 3ms/step - loss: 0.4601 -  
accuracy: 0.8320  
Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4544 -  
accuracy: 0.8338  
Epoch 11/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4544 -  
accuracy: 0.8315  
Epoch 12/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4477 -  
accuracy: 0.8339  
Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4435 -  
accuracy: 0.8364  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4370 -  
accuracy: 0.8378  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4344 -  
accuracy: 0.8388  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4327 -  
accuracy: 0.8416  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4291 -  
accuracy: 0.8427  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4275 -  
accuracy: 0.8411  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4240 -  
accuracy: 0.8436  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4168 -  
accuracy: 0.8456  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4204 -  
accuracy: 0.8433  
Epoch 22/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4182 -  
accuracy: 0.8422  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4143 -  
accuracy: 0.8463  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4107 -  
accuracy: 0.8466  
Epoch 25/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.4114 -
accuracy: 0.8484
Epoch 26/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4067 -
accuracy: 0.8496
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4097 -
accuracy: 0.8485
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4074 -
accuracy: 0.8493
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4151 -
accuracy: 0.8476
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4084 -
accuracy: 0.8503
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.005, strides=3; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7731 -
accuracy: 0.7101
Epoch 2/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5892 -
accuracy: 0.7833
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5548 -
accuracy: 0.7959
Epoch 4/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5303 -
accuracy: 0.8036
Epoch 5/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.5208 -
accuracy: 0.8082
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5072 -
accuracy: 0.8124
Epoch 7/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4953 -
accuracy: 0.8171
Epoch 8/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4870 -
accuracy: 0.8213
Epoch 9/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4854 -
accuracy: 0.8207
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4802 -

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accuracy: 0.8214
Epoch 11/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4740 -
accuracy: 0.8252
Epoch 12/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4729 -
accuracy: 0.8264
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4675 -
accuracy: 0.8252
Epoch 14/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4638 -
accuracy: 0.8271
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4615 -
accuracy: 0.8301
Epoch 16/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4563 -
accuracy: 0.8316
Epoch 17/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4524 -
accuracy: 0.8332
Epoch 18/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4521 -
accuracy: 0.8326
Epoch 19/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4539 -
accuracy: 0.8292
Epoch 20/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4473 -
accuracy: 0.8324
Epoch 21/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4532 -
accuracy: 0.8316
Epoch 22/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4472 -
accuracy: 0.8349
Epoch 23/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4460 -
accuracy: 0.8324
Epoch 24/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4410 -
accuracy: 0.8351
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4465 -
accuracy: 0.8333
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4379 -

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accuracy: 0.8376
Epoch 27/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4450 -
accuracy: 0.8354
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4355 -
accuracy: 0.8387
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4380 -
accuracy: 0.8354
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4416 -
accuracy: 0.8348
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.005, strides=3; total time= 1.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6280 -
accuracy: 0.7723
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4204 -
accuracy: 0.8492
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3741 -
accuracy: 0.8668
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3446 -
accuracy: 0.8767
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3259 -
accuracy: 0.8829
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3064 -
accuracy: 0.8886
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2929 -
accuracy: 0.8950
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2851 -
accuracy: 0.8966
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2714 -
accuracy: 0.9029
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2640 -
accuracy: 0.9046
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2557 -
accuracy: 0.9064

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Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2466 -  
accuracy: 0.9098  
Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2401 -  
accuracy: 0.9112  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2365 -  
accuracy: 0.9141  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2304 -  
accuracy: 0.9153  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2271 -  
accuracy: 0.9163  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2218 -  
accuracy: 0.9193  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2189 -  
accuracy: 0.9187  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2138 -  
accuracy: 0.9221  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2123 -  
accuracy: 0.9212  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2045 -  
accuracy: 0.9252  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2028 -  
accuracy: 0.9258  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1991 -  
accuracy: 0.9269  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1975 -  
accuracy: 0.9269  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1942 -  
accuracy: 0.9283  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1923 -  
accuracy: 0.9290  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1895 -  
accuracy: 0.9293

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Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1837 -
accuracy: 0.9328
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1834 -
accuracy: 0.9328
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1846 -
accuracy: 0.9328
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.0005, strides=1; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6100 -
accuracy: 0.7799
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4170 -
accuracy: 0.8501
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3737 -
accuracy: 0.8659
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3410 -
accuracy: 0.8781
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3227 -
accuracy: 0.8830
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3037 -
accuracy: 0.8917
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2949 -
accuracy: 0.8938
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2812 -
accuracy: 0.9001
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2705 -
accuracy: 0.9025
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2610 -
accuracy: 0.9068
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2543 -
accuracy: 0.9094
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2477 -
accuracy: 0.9115
Epoch 13/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.2399 -  
accuracy: 0.9138  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2373 -  
accuracy: 0.9136  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2312 -  
accuracy: 0.9161  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2279 -  
accuracy: 0.9163  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2204 -  
accuracy: 0.9188  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2170 -  
accuracy: 0.9207  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2132 -  
accuracy: 0.9234  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2110 -  
accuracy: 0.9240  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2049 -  
accuracy: 0.9260  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2059 -  
accuracy: 0.9251  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1976 -  
accuracy: 0.9271  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1966 -  
accuracy: 0.9281  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1936 -  
accuracy: 0.9294  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1939 -  
accuracy: 0.9284  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1887 -  
accuracy: 0.9309  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1881 -  
accuracy: 0.9309  
Epoch 29/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.1834 -
accuracy: 0.9324
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1847 -
accuracy: 0.9329
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.0005, strides=1; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6301 -
accuracy: 0.7713
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4216 -
accuracy: 0.8488
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3783 -
accuracy: 0.8664
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3502 -
accuracy: 0.8761
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3281 -
accuracy: 0.8832
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3108 -
accuracy: 0.8890
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3005 -
accuracy: 0.8916
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2875 -
accuracy: 0.8992
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2796 -
accuracy: 0.8999
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2693 -
accuracy: 0.9029
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2611 -
accuracy: 0.9059
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2528 -
accuracy: 0.9093
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2475 -
accuracy: 0.9100
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2418 -

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accuracy: 0.9121
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2339 -
accuracy: 0.9149
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2305 -
accuracy: 0.9155
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2240 -
accuracy: 0.9188
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2165 -
accuracy: 0.9208
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2166 -
accuracy: 0.9202
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2111 -
accuracy: 0.9246
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2073 -
accuracy: 0.9236
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2048 -
accuracy: 0.9260
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2020 -
accuracy: 0.9269
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1991 -
accuracy: 0.9272
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1988 -
accuracy: 0.9275
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1944 -
accuracy: 0.9296
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1924 -
accuracy: 0.9303
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1904 -
accuracy: 0.9318
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1888 -
accuracy: 0.9311
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1853 -

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accuracy: 0.9336
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.0005, strides=1; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 4s 3ms/step - loss: 0.9902 -
accuracy: 0.6540
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6362 -
accuracy: 0.7685
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5639 -
accuracy: 0.7954
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5169 -
accuracy: 0.8154
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4841 -
accuracy: 0.8233
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4623 -
accuracy: 0.8323
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4396 -
accuracy: 0.8424
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4247 -
accuracy: 0.8490
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4115 -
accuracy: 0.8527
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3997 -
accuracy: 0.8573
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3902 -
accuracy: 0.8617
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3797 -
accuracy: 0.8643
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3722 -
accuracy: 0.8645
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3663 -
accuracy: 0.8685
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3604 -
accuracy: 0.8706

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Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3545 -  
accuracy: 0.8711  
Epoch 17/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.3515 -  
accuracy: 0.8737  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3446 -  
accuracy: 0.8758  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3413 -  
accuracy: 0.8749  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3348 -  
accuracy: 0.8779  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3358 -  
accuracy: 0.8785  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3320 -  
accuracy: 0.8795  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3259 -  
accuracy: 0.8814  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3258 -  
accuracy: 0.8804  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3222 -  
accuracy: 0.8849  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3209 -  
accuracy: 0.8844  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3197 -  
accuracy: 0.8831  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3130 -  
accuracy: 0.8859  
Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3159 -  
accuracy: 0.8849  
Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3106 -  
accuracy: 0.8887  
563/563 [=====] - 1s 1ms/step  
[CV] END ...ks=3, lrs=0.0005, strides=2; total time= 1.5min  
Epoch 1/30

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1125/1125 [=====] - 3s 3ms/step - loss: 1.0280 -
accuracy: 0.6438
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6626 -
accuracy: 0.7615
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5862 -
accuracy: 0.7856
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5378 -
accuracy: 0.8033
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5040 -
accuracy: 0.8162
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4874 -
accuracy: 0.8237
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4648 -
accuracy: 0.8306
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4490 -
accuracy: 0.8403
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4362 -
accuracy: 0.8417
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4208 -
accuracy: 0.8478
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4107 -
accuracy: 0.8509
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4018 -
accuracy: 0.8538
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3930 -
accuracy: 0.8584
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3889 -
accuracy: 0.8601
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3771 -
accuracy: 0.8630
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3725 -
accuracy: 0.8669
Epoch 17/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3664 -
accuracy: 0.8671
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3637 -
accuracy: 0.8676
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3559 -
accuracy: 0.8707
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3542 -
accuracy: 0.8710
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3459 -
accuracy: 0.8748
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3373 -
accuracy: 0.8770
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3390 -
accuracy: 0.8768
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3381 -
accuracy: 0.8770
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3320 -
accuracy: 0.8783
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3293 -
accuracy: 0.8795
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3278 -
accuracy: 0.8813
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3215 -
accuracy: 0.8816
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3219 -
accuracy: 0.8833
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3165 -
accuracy: 0.8863
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=3, lrs=0.0005, strides=2; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.9881 -
accuracy: 0.6528
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6350 -

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accuracy: 0.7699
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5578 -
accuracy: 0.7986
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5203 -
accuracy: 0.8129
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4860 -
accuracy: 0.8268
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4672 -
accuracy: 0.8315
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4500 -
accuracy: 0.8374
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4364 -
accuracy: 0.8436
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4230 -
accuracy: 0.8478
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4128 -
accuracy: 0.8518
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4041 -
accuracy: 0.8558
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3949 -
accuracy: 0.8583
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3851 -
accuracy: 0.8626
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3810 -
accuracy: 0.8640
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3773 -
accuracy: 0.8638
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3700 -
accuracy: 0.8675
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3625 -
accuracy: 0.8703
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3608 -

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accuracy: 0.8722
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3555 -
accuracy: 0.8709
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3499 -
accuracy: 0.8737
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3492 -
accuracy: 0.8735
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3407 -
accuracy: 0.8783
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3438 -
accuracy: 0.8768
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3362 -
accuracy: 0.8797
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3370 -
accuracy: 0.8803
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3334 -
accuracy: 0.8816
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3269 -
accuracy: 0.8827
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3266 -
accuracy: 0.8823
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3227 -
accuracy: 0.8834
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3219 -
accuracy: 0.8848
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.0005, strides=2; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 1.1292 -
accuracy: 0.6050
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7191 -
accuracy: 0.7410
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6412 -
accuracy: 0.7708

```

Epoch 4/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.6013 -  
accuracy: 0.7840

Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5706 -  
accuracy: 0.7951

Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5528 -  
accuracy: 0.8012

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5338 -  
accuracy: 0.8100

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5232 -  
accuracy: 0.8120

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5119 -  
accuracy: 0.8171

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4988 -  
accuracy: 0.8215

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4912 -  
accuracy: 0.8241

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4845 -  
accuracy: 0.8243

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4733 -  
accuracy: 0.8277

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4732 -  
accuracy: 0.8303

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4635 -  
accuracy: 0.8336

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4582 -  
accuracy: 0.8345

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4538 -  
accuracy: 0.8353

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4452 -  
accuracy: 0.8383

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4439 -  
accuracy: 0.8394



Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4381 -  
accuracy: 0.8420  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4338 -  
accuracy: 0.8427  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4295 -  
accuracy: 0.8442  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4321 -  
accuracy: 0.8457  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4241 -  
accuracy: 0.8452  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4197 -  
accuracy: 0.8476  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4173 -  
accuracy: 0.8486  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4173 -  
accuracy: 0.8489  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4115 -  
accuracy: 0.8499  
Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4070 -  
accuracy: 0.8535  
Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4058 -  
accuracy: 0.8524  
563/563 [=====] - 1s 2ms/step  
[CV] END ...ks=3, lrs=0.0005, strides=3; total time= 1.5min  
Epoch 1/30  
1125/1125 [=====] - 3s 3ms/step - loss: 1.1460 -  
accuracy: 0.5938  
Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.7429 -  
accuracy: 0.7314  
Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.6677 -  
accuracy: 0.7556  
Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.6188 -  
accuracy: 0.7729  
Epoch 5/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.5893 -
accuracy: 0.7844
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5683 -
accuracy: 0.7938
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5533 -
accuracy: 0.8002
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5375 -
accuracy: 0.8081
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5268 -
accuracy: 0.8102
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5209 -
accuracy: 0.8116
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5091 -
accuracy: 0.8161
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5020 -
accuracy: 0.8176
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4893 -
accuracy: 0.8232
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4909 -
accuracy: 0.8253
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4843 -
accuracy: 0.8267
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4752 -
accuracy: 0.8304
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4755 -
accuracy: 0.8297
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4661 -
accuracy: 0.8314
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4649 -
accuracy: 0.8331
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4601 -
accuracy: 0.8345
Epoch 21/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.4562 -
accuracy: 0.8367
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4488 -
accuracy: 0.8371
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4488 -
accuracy: 0.8389
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4433 -
accuracy: 0.8391
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4411 -
accuracy: 0.8424
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4366 -
accuracy: 0.8435
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4379 -
accuracy: 0.8424
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4363 -
accuracy: 0.8413
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4309 -
accuracy: 0.8447
Epoch 30/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4251 -
accuracy: 0.8449
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.0005, strides=3; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 1.1301 -
accuracy: 0.5993
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7339 -
accuracy: 0.7309
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6566 -
accuracy: 0.7589
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6116 -
accuracy: 0.7775
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5855 -
accuracy: 0.7862
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5662 -

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accuracy: 0.7952  
Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5489 -  
accuracy: 0.8021  
Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5379 -  
accuracy: 0.8044  
Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5263 -  
accuracy: 0.8088  
Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5172 -  
accuracy: 0.8133  
Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5064 -  
accuracy: 0.8177  
Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4993 -  
accuracy: 0.8206  
Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4877 -  
accuracy: 0.8242  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4883 -  
accuracy: 0.8249  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4765 -  
accuracy: 0.8284  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4782 -  
accuracy: 0.8281  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4703 -  
accuracy: 0.8311  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4645 -  
accuracy: 0.8314  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4598 -  
accuracy: 0.8349  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4538 -  
accuracy: 0.8378  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4568 -  
accuracy: 0.8379  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4484 -

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accuracy: 0.8395
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4448 -
accuracy: 0.8401
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4422 -
accuracy: 0.8409
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4376 -
accuracy: 0.8419
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4347 -
accuracy: 0.8428
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4316 -
accuracy: 0.8431
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4317 -
accuracy: 0.8450
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4282 -
accuracy: 0.8469
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4255 -
accuracy: 0.8453
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=3, lrs=0.0005, strides=3; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5351 -
accuracy: 0.8065
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4353 -
accuracy: 0.8421
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4215 -
accuracy: 0.8479
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4139 -
accuracy: 0.8532
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4053 -
accuracy: 0.8518
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4021 -
accuracy: 0.8537
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4013 -
accuracy: 0.8561

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Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4000 -  
accuracy: 0.8553

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3985 -  
accuracy: 0.8565

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3801 -  
accuracy: 0.8631

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3869 -  
accuracy: 0.8583

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3903 -  
accuracy: 0.8578

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3824 -  
accuracy: 0.8608

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3911 -  
accuracy: 0.8577

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3824 -  
accuracy: 0.8621

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3873 -  
accuracy: 0.8607

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3837 -  
accuracy: 0.8593

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3806 -  
accuracy: 0.8608

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3793 -  
accuracy: 0.8591

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3748 -  
accuracy: 0.8608

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3786 -  
accuracy: 0.8635

Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3827 -  
accuracy: 0.8630

Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3790 -  
accuracy: 0.8622

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3865 -  
accuracy: 0.8589

Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3792 -  
accuracy: 0.8614

Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3753 -  
accuracy: 0.8624

Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3790 -  
accuracy: 0.8620

Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3767 -  
accuracy: 0.8606

Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3745 -  
accuracy: 0.8646

Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3762 -  
accuracy: 0.8627

563/563 [=====] - 1s 2ms/step  
[CV] END ...ks=4, lrs=0.01, strides=1; total time= 1.6min

Epoch 1/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5456 -  
accuracy: 0.8067

Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4388 -  
accuracy: 0.8422

Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4205 -  
accuracy: 0.8497

Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4172 -  
accuracy: 0.8489

Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4053 -  
accuracy: 0.8543

Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3989 -  
accuracy: 0.8551

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3921 -  
accuracy: 0.8566

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3889 -  
accuracy: 0.8582

Epoch 9/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3897 -
accuracy: 0.8593
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3901 -
accuracy: 0.8568
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3911 -
accuracy: 0.8589
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3902 -
accuracy: 0.8582
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3922 -
accuracy: 0.8576
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3875 -
accuracy: 0.8569
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3859 -
accuracy: 0.8605
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3852 -
accuracy: 0.8594
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3930 -
accuracy: 0.8583
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3861 -
accuracy: 0.8591
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3852 -
accuracy: 0.8616
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3812 -
accuracy: 0.8606
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3828 -
accuracy: 0.8613
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3851 -
accuracy: 0.8595
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3883 -
accuracy: 0.8576
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3862 -
accuracy: 0.8587
Epoch 25/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3871 -
accuracy: 0.8578
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3844 -
accuracy: 0.8604
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3829 -
accuracy: 0.8610
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3861 -
accuracy: 0.8596
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3866 -
accuracy: 0.8603
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3842 -
accuracy: 0.8612
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.01, strides=1; total time= 1.6min
Epoch 1/30
1125/1125 [=====] - 4s 3ms/step - loss: 0.5311 -
accuracy: 0.8099
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4400 -
accuracy: 0.8443
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4196 -
accuracy: 0.8476
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4086 -
accuracy: 0.8524
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4042 -
accuracy: 0.8554
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3998 -
accuracy: 0.8536
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3921 -
accuracy: 0.8579
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3900 -
accuracy: 0.8591
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3917 -
accuracy: 0.8588
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3875 -

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```
accuracy: 0.8585
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3902 -
accuracy: 0.8569
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3841 -
accuracy: 0.8582
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3826 -
accuracy: 0.8629
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3842 -
accuracy: 0.8583
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3877 -
accuracy: 0.8581
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3772 -
accuracy: 0.8612
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3836 -
accuracy: 0.8587
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3861 -
accuracy: 0.8598
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3787 -
accuracy: 0.8629
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3816 -
accuracy: 0.8589
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3794 -
accuracy: 0.8608
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3808 -
accuracy: 0.8601
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3720 -
accuracy: 0.8618
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3769 -
accuracy: 0.8617
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3827 -
accuracy: 0.8605
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3760 -
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accuracy: 0.8611
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3810 -
accuracy: 0.8606
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3771 -
accuracy: 0.8618
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3777 -
accuracy: 0.8632
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3722 -
accuracy: 0.8626
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.01, strides=1; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6078 -
accuracy: 0.7799
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4893 -
accuracy: 0.8236
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4702 -
accuracy: 0.8294
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4550 -
accuracy: 0.8351
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4544 -
accuracy: 0.8355
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4437 -
accuracy: 0.8382
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4354 -
accuracy: 0.8412
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4401 -
accuracy: 0.8407
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4315 -
accuracy: 0.8428
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4286 -
accuracy: 0.8437
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4333 -
accuracy: 0.8443

```

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4263 -  
accuracy: 0.8447

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4234 -  
accuracy: 0.8452

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4291 -  
accuracy: 0.8458

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4199 -  
accuracy: 0.8464

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4266 -  
accuracy: 0.8451

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4218 -  
accuracy: 0.8462

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4192 -  
accuracy: 0.8474

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4266 -  
accuracy: 0.8449

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4178 -  
accuracy: 0.8486

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4202 -  
accuracy: 0.8468

Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4217 -  
accuracy: 0.8473

Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4179 -  
accuracy: 0.8484

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4199 -  
accuracy: 0.8456

Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4150 -  
accuracy: 0.8485

Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4088 -  
accuracy: 0.8516

Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4126 -  
accuracy: 0.8512

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Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4161 -
accuracy: 0.8481
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4200 -
accuracy: 0.8479
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4123 -
accuracy: 0.8494
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.01, strides=2; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6370 -
accuracy: 0.7663
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5054 -
accuracy: 0.8176
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4884 -
accuracy: 0.8225
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4748 -
accuracy: 0.8248
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4578 -
accuracy: 0.8337
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4628 -
accuracy: 0.8302
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4521 -
accuracy: 0.8356
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4533 -
accuracy: 0.8341
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4469 -
accuracy: 0.8362
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4521 -
accuracy: 0.8351
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4384 -
accuracy: 0.8370
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4392 -
accuracy: 0.8375
Epoch 13/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.4374 -  
accuracy: 0.8406  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4270 -  
accuracy: 0.8433  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4359 -  
accuracy: 0.8418  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4321 -  
accuracy: 0.8417  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4305 -  
accuracy: 0.8447  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4277 -  
accuracy: 0.8441  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4299 -  
accuracy: 0.8441  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4356 -  
accuracy: 0.8396  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4310 -  
accuracy: 0.8411  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4286 -  
accuracy: 0.8444  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4235 -  
accuracy: 0.8446  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4188 -  
accuracy: 0.8464  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4210 -  
accuracy: 0.8462  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4249 -  
accuracy: 0.8445  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4200 -  
accuracy: 0.8462  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4218 -  
accuracy: 0.8449  
Epoch 29/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.4268 -
accuracy: 0.8460
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4198 -
accuracy: 0.8469
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.01, strides=2; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6546 -
accuracy: 0.7611
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5110 -
accuracy: 0.8155
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4855 -
accuracy: 0.8260
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4788 -
accuracy: 0.8301
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4724 -
accuracy: 0.8299
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4683 -
accuracy: 0.8311
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4591 -
accuracy: 0.8353
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4535 -
accuracy: 0.8344
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4624 -
accuracy: 0.8309
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4546 -
accuracy: 0.8347
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4464 -
accuracy: 0.8380
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4465 -
accuracy: 0.8371
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4443 -
accuracy: 0.8381
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4401 -

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accuracy: 0.8407  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4387 -  
accuracy: 0.8405  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4418 -  
accuracy: 0.8382  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4414 -  
accuracy: 0.8396  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4388 -  
accuracy: 0.8412  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4358 -  
accuracy: 0.8424  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4410 -  
accuracy: 0.8413  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4303 -  
accuracy: 0.8437  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4366 -  
accuracy: 0.8424  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4349 -  
accuracy: 0.8404  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4281 -  
accuracy: 0.8431  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4361 -  
accuracy: 0.8429  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4301 -  
accuracy: 0.8442  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4360 -  
accuracy: 0.8420  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4353 -  
accuracy: 0.8407  
Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4338 -  
accuracy: 0.8407  
Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4229 -



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accuracy: 0.8454
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.01, strides=2; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7083 -
accuracy: 0.7402
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5782 -
accuracy: 0.7877
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5436 -
accuracy: 0.7997
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5260 -
accuracy: 0.8034
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5189 -
accuracy: 0.8084
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5095 -
accuracy: 0.8100
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4996 -
accuracy: 0.8145
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4949 -
accuracy: 0.8147
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4891 -
accuracy: 0.8167
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4856 -
accuracy: 0.8171
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4889 -
accuracy: 0.8191
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4852 -
accuracy: 0.8191
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4862 -
accuracy: 0.8184
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4849 -
accuracy: 0.8184
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4740 -
accuracy: 0.8226

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Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4776 -
accuracy: 0.8248
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4746 -
accuracy: 0.8227
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4792 -
accuracy: 0.8229
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4742 -
accuracy: 0.8258
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4729 -
accuracy: 0.8236
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4717 -
accuracy: 0.8258
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4775 -
accuracy: 0.8234
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4731 -
accuracy: 0.8234
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4653 -
accuracy: 0.8266
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4604 -
accuracy: 0.8278
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4700 -
accuracy: 0.8234
Epoch 27/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4612 -
accuracy: 0.8274
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4651 -
accuracy: 0.8278
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4669 -
accuracy: 0.8274
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4694 -
accuracy: 0.8267
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.01, strides=3; total time= 1.5min
Epoch 1/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.7094 -
accuracy: 0.7382
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5690 -
accuracy: 0.7885
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5413 -
accuracy: 0.7998
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5247 -
accuracy: 0.8054
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5141 -
accuracy: 0.8118
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5117 -
accuracy: 0.8104
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5010 -
accuracy: 0.8159
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4980 -
accuracy: 0.8160
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4985 -
accuracy: 0.8150
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4903 -
accuracy: 0.8178
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4863 -
accuracy: 0.8209
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5010 -
accuracy: 0.8174
Epoch 13/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.4925 -
accuracy: 0.8190
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4909 -
accuracy: 0.8187
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4849 -
accuracy: 0.8201
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4826 -
accuracy: 0.8183
Epoch 17/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.4818 -
accuracy: 0.8239
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4801 -
accuracy: 0.8226
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4783 -
accuracy: 0.8216
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4807 -
accuracy: 0.8229
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4823 -
accuracy: 0.8216
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4753 -
accuracy: 0.8261
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4769 -
accuracy: 0.8230
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4860 -
accuracy: 0.8181
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4687 -
accuracy: 0.8261
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4726 -
accuracy: 0.8251
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4704 -
accuracy: 0.8239
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4751 -
accuracy: 0.8223
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4744 -
accuracy: 0.8228
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4682 -
accuracy: 0.8267
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.01, strides=3; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7073 -
accuracy: 0.7408
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5775 -

```

accuracy: 0.7882  
Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5475 -  
accuracy: 0.7977  
Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5359 -  
accuracy: 0.8034  
Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5209 -  
accuracy: 0.8101  
Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5126 -  
accuracy: 0.8122  
Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5121 -  
accuracy: 0.8121  
Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5040 -  
accuracy: 0.8142  
Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4984 -  
accuracy: 0.8162  
Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4984 -  
accuracy: 0.8150  
Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4925 -  
accuracy: 0.8181  
Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4902 -  
accuracy: 0.8167  
Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4833 -  
accuracy: 0.8208  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4882 -  
accuracy: 0.8178  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4873 -  
accuracy: 0.8212  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4908 -  
accuracy: 0.8207  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4857 -  
accuracy: 0.8196  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4734 -

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accuracy: 0.8232
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4746 -
accuracy: 0.8242
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4797 -
accuracy: 0.8225
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4734 -
accuracy: 0.8240
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4726 -
accuracy: 0.8269
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4758 -
accuracy: 0.8245
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4741 -
accuracy: 0.8251
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4681 -
accuracy: 0.8259
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4760 -
accuracy: 0.8235
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4743 -
accuracy: 0.8257
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4744 -
accuracy: 0.8255
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4649 -
accuracy: 0.8262
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4651 -
accuracy: 0.8276
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.01, strides=3; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5357 -
accuracy: 0.8058
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3664 -
accuracy: 0.8698
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3218 -
accuracy: 0.8838

```

Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2964 -  
accuracy: 0.8926

Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2761 -  
accuracy: 0.9003

Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2620 -  
accuracy: 0.9050

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2491 -  
accuracy: 0.9081

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2391 -  
accuracy: 0.9135

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2311 -  
accuracy: 0.9151

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2224 -  
accuracy: 0.9175

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2164 -  
accuracy: 0.9213

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2076 -  
accuracy: 0.9228

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2043 -  
accuracy: 0.9243

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1985 -  
accuracy: 0.9279

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1942 -  
accuracy: 0.9279

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1877 -  
accuracy: 0.9298

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1802 -  
accuracy: 0.9329

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1795 -  
accuracy: 0.9335

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1738 -  
accuracy: 0.9358

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1724 -  
accuracy: 0.9356  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1663 -  
accuracy: 0.9391  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1637 -  
accuracy: 0.9384  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1612 -  
accuracy: 0.9402  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1574 -  
accuracy: 0.9412  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1568 -  
accuracy: 0.9405  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1530 -  
accuracy: 0.9434  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1501 -  
accuracy: 0.9440  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1471 -  
accuracy: 0.9444  
Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1447 -  
accuracy: 0.9448  
Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1434 -  
accuracy: 0.9468  
563/563 [=====] - 1s 2ms/step  
[CV] END ...ks=4, lrs=0.001, strides=1; total time= 2.4min  
Epoch 1/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5386 -  
accuracy: 0.8062  
Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3611 -  
accuracy: 0.8708  
Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3184 -  
accuracy: 0.8863  
Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2964 -  
accuracy: 0.8926  
Epoch 5/30



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1125/1125 [=====] - 3s 3ms/step - loss: 0.2744 -
accuracy: 0.8994
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2606 -
accuracy: 0.9051
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2482 -
accuracy: 0.9089
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2379 -
accuracy: 0.9134
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2303 -
accuracy: 0.9150
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2190 -
accuracy: 0.9196
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2139 -
accuracy: 0.9226
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2040 -
accuracy: 0.9247
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2011 -
accuracy: 0.9267
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1958 -
accuracy: 0.9276
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1854 -
accuracy: 0.9329
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1833 -
accuracy: 0.9327
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1829 -
accuracy: 0.9320
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1756 -
accuracy: 0.9367
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1726 -
accuracy: 0.9375
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1683 -
accuracy: 0.9385
Epoch 21/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.1639 -
accuracy: 0.9381
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1620 -
accuracy: 0.9398
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1609 -
accuracy: 0.9408
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1569 -
accuracy: 0.9406
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1542 -
accuracy: 0.9424
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1480 -
accuracy: 0.9453
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1501 -
accuracy: 0.9433
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1468 -
accuracy: 0.9466
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1429 -
accuracy: 0.9469
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1439 -
accuracy: 0.9465
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.001, strides=1; total time= 1.6min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5331 -
accuracy: 0.8067
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3663 -
accuracy: 0.8711
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3244 -
accuracy: 0.8839
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2978 -
accuracy: 0.8923
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2798 -
accuracy: 0.8977
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2635 -

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accuracy: 0.9045
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2522 -
accuracy: 0.9093
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2399 -
accuracy: 0.9125
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2357 -
accuracy: 0.9146
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2220 -
accuracy: 0.9196
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2181 -
accuracy: 0.9213
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2081 -
accuracy: 0.9253
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2057 -
accuracy: 0.9256
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1965 -
accuracy: 0.9281
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1900 -
accuracy: 0.9308
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1878 -
accuracy: 0.9310
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1809 -
accuracy: 0.9336
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1775 -
accuracy: 0.9343
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1738 -
accuracy: 0.9357
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1684 -
accuracy: 0.9384
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1656 -
accuracy: 0.9388
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1612 -

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accuracy: 0.9400
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1572 -
accuracy: 0.9420
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1556 -
accuracy: 0.9424
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1515 -
accuracy: 0.9444
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1497 -
accuracy: 0.9447
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1475 -
accuracy: 0.9452
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1449 -
accuracy: 0.9466
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1422 -
accuracy: 0.9473
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1397 -
accuracy: 0.9486
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.001, strides=1; total time= 1.6min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7664 -
accuracy: 0.7255
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4859 -
accuracy: 0.8261
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4210 -
accuracy: 0.8486
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3904 -
accuracy: 0.8592
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3686 -
accuracy: 0.8667
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3499 -
accuracy: 0.8740
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3383 -
accuracy: 0.8796

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Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3274 -  
accuracy: 0.8810

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3164 -  
accuracy: 0.8866

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3108 -  
accuracy: 0.8866

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3027 -  
accuracy: 0.8900

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2972 -  
accuracy: 0.8916

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2908 -  
accuracy: 0.8942

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2838 -  
accuracy: 0.8960

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2800 -  
accuracy: 0.8968

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2723 -  
accuracy: 0.9003

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2753 -  
accuracy: 0.8990

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2652 -  
accuracy: 0.9011

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2634 -  
accuracy: 0.9030

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2590 -  
accuracy: 0.9042

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2538 -  
accuracy: 0.9072

Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2488 -  
accuracy: 0.9061

Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2458 -  
accuracy: 0.9084

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2436 -  
accuracy: 0.9083

Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2415 -  
accuracy: 0.9115

Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2379 -  
accuracy: 0.9114

Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2341 -  
accuracy: 0.9126

Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2317 -  
accuracy: 0.9117

Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2274 -  
accuracy: 0.9149

Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2229 -  
accuracy: 0.9165

563/563 [=====] - 1s 2ms/step  
[CV] END ...ks=4, lrs=0.001, strides=2; total time= 1.5min

Epoch 1/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.7566 -  
accuracy: 0.7310

Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4832 -  
accuracy: 0.8281

Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4224 -  
accuracy: 0.8489

Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3924 -  
accuracy: 0.8602

Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3685 -  
accuracy: 0.8672

Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3526 -  
accuracy: 0.8721

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3407 -  
accuracy: 0.8764

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3259 -  
accuracy: 0.8825

Epoch 9/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3210 -
accuracy: 0.8839
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3113 -
accuracy: 0.8867
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3045 -
accuracy: 0.8898
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2941 -
accuracy: 0.8936
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2880 -
accuracy: 0.8942
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2826 -
accuracy: 0.8967
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2793 -
accuracy: 0.8971
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2749 -
accuracy: 0.9008
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2699 -
accuracy: 0.9021
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2643 -
accuracy: 0.9024
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2596 -
accuracy: 0.9068
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2574 -
accuracy: 0.9049
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2544 -
accuracy: 0.9059
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2499 -
accuracy: 0.9094
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2488 -
accuracy: 0.9091
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2448 -
accuracy: 0.9111
Epoch 25/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.2430 -
accuracy: 0.9123
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2350 -
accuracy: 0.9132
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2357 -
accuracy: 0.9131
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2312 -
accuracy: 0.9142
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2317 -
accuracy: 0.9143
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2282 -
accuracy: 0.9159
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.001, strides=2; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7536 -
accuracy: 0.7295
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4901 -
accuracy: 0.8236
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4308 -
accuracy: 0.8470
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3983 -
accuracy: 0.8554
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3747 -
accuracy: 0.8649
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3557 -
accuracy: 0.8724
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3442 -
accuracy: 0.8730
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3392 -
accuracy: 0.8777
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3274 -
accuracy: 0.8814
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3196 -

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accuracy: 0.8862  
Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3117 -  
accuracy: 0.8861  
Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3011 -  
accuracy: 0.8886  
Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3023 -  
accuracy: 0.8898  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2944 -  
accuracy: 0.8914  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2912 -  
accuracy: 0.8941  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2854 -  
accuracy: 0.8966  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2843 -  
accuracy: 0.8956  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2765 -  
accuracy: 0.8982  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2712 -  
accuracy: 0.9003  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2682 -  
accuracy: 0.9008  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2646 -  
accuracy: 0.9011  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2602 -  
accuracy: 0.9051  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2585 -  
accuracy: 0.9058  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2519 -  
accuracy: 0.9069  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2549 -  
accuracy: 0.9069  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2503 -

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accuracy: 0.9055
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2436 -
accuracy: 0.9098
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2415 -
accuracy: 0.9103
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2426 -
accuracy: 0.9099
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2365 -
accuracy: 0.9136
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.001, strides=2; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.8623 -
accuracy: 0.6883
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5896 -
accuracy: 0.7856
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5308 -
accuracy: 0.8094
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4978 -
accuracy: 0.8209
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4703 -
accuracy: 0.8297
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4541 -
accuracy: 0.8336
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4417 -
accuracy: 0.8405
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4273 -
accuracy: 0.8445
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4160 -
accuracy: 0.8490
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4046 -
accuracy: 0.8534
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4014 -
accuracy: 0.8539

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Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3947 -  
accuracy: 0.8568

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3915 -  
accuracy: 0.8568

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3799 -  
accuracy: 0.8604

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3774 -  
accuracy: 0.8616

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3703 -  
accuracy: 0.8640

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3656 -  
accuracy: 0.8648

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3609 -  
accuracy: 0.8678

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3553 -  
accuracy: 0.8693

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3565 -  
accuracy: 0.8685

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3487 -  
accuracy: 0.8698

Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3469 -  
accuracy: 0.8712

Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3425 -  
accuracy: 0.8745

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3387 -  
accuracy: 0.8733

Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3391 -  
accuracy: 0.8739

Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3321 -  
accuracy: 0.8768

Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3318 -  
accuracy: 0.8772

```

Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3272 -
accuracy: 0.8801
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3266 -
accuracy: 0.8786
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3238 -
accuracy: 0.8789
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.001, strides=3; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.8583 -
accuracy: 0.6918
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5947 -
accuracy: 0.7890
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5321 -
accuracy: 0.8090
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4974 -
accuracy: 0.8207
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4748 -
accuracy: 0.8305
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4584 -
accuracy: 0.8344
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4396 -
accuracy: 0.8411
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4279 -
accuracy: 0.8449
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4230 -
accuracy: 0.8484
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4104 -
accuracy: 0.8512
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4005 -
accuracy: 0.8549
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3970 -
accuracy: 0.8553
Epoch 13/30

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```

1125/1125 [=====] - 3s 3ms/step - loss: 0.3864 -
accuracy: 0.8611
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3822 -
accuracy: 0.8604
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3775 -
accuracy: 0.8619
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3745 -
accuracy: 0.8631
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3669 -
accuracy: 0.8657
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3645 -
accuracy: 0.8661
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3583 -
accuracy: 0.8694
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3562 -
accuracy: 0.8687
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3577 -
accuracy: 0.8694
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3523 -
accuracy: 0.8711
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3458 -
accuracy: 0.8710
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3420 -
accuracy: 0.8765
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3356 -
accuracy: 0.8758
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3409 -
accuracy: 0.8772
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3330 -
accuracy: 0.8765
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3350 -
accuracy: 0.8778
Epoch 29/30

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```

1125/1125 [=====] - 3s 3ms/step - loss: 0.3314 -
accuracy: 0.8771
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3279 -
accuracy: 0.8791
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.001, strides=3; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.8895 -
accuracy: 0.6789
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6145 -
accuracy: 0.7760
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5587 -
accuracy: 0.7992
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5249 -
accuracy: 0.8110
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4998 -
accuracy: 0.8199
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4819 -
accuracy: 0.8252
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4719 -
accuracy: 0.8275
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4563 -
accuracy: 0.8354
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4423 -
accuracy: 0.8384
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4380 -
accuracy: 0.8413
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4237 -
accuracy: 0.8470
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4239 -
accuracy: 0.8486
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4109 -
accuracy: 0.8504
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4084 -

```

```

accuracy: 0.8520
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3990 -
accuracy: 0.8539
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3963 -
accuracy: 0.8561
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3906 -
accuracy: 0.8556
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3852 -
accuracy: 0.8584
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3807 -
accuracy: 0.8631
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3732 -
accuracy: 0.8619
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3723 -
accuracy: 0.8634
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3676 -
accuracy: 0.8645
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3664 -
accuracy: 0.8661
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3669 -
accuracy: 0.8680
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3622 -
accuracy: 0.8656
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3579 -
accuracy: 0.8686
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3569 -
accuracy: 0.8698
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3477 -
accuracy: 0.8732
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3484 -
accuracy: 0.8719
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3476 -

```

```

accuracy: 0.8733
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.001, strides=3; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4911 -
accuracy: 0.8224
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3816 -
accuracy: 0.8626
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3486 -
accuracy: 0.8747
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3383 -
accuracy: 0.8776
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3231 -
accuracy: 0.8824
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3169 -
accuracy: 0.8842
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3062 -
accuracy: 0.8879
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2982 -
accuracy: 0.8929
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2950 -
accuracy: 0.8917
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2956 -
accuracy: 0.8916
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2858 -
accuracy: 0.8959
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2842 -
accuracy: 0.8965
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2841 -
accuracy: 0.8976
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2852 -
accuracy: 0.8964
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2758 -
accuracy: 0.9003

```



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Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2696 -
accuracy: 0.8997
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2753 -
accuracy: 0.9003
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2663 -
accuracy: 0.9036
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2656 -
accuracy: 0.9039
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2674 -
accuracy: 0.9023
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2637 -
accuracy: 0.9036
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2627 -
accuracy: 0.9053
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2643 -
accuracy: 0.9044
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2604 -
accuracy: 0.9061
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2615 -
accuracy: 0.9054
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2515 -
accuracy: 0.9080
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2510 -
accuracy: 0.9084
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2518 -
accuracy: 0.9087
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2539 -
accuracy: 0.9088
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2508 -
accuracy: 0.9082
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.005, strides=1; total time= 1.6min
Epoch 1/30

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```

1125/1125 [=====] - 3s 3ms/step - loss: 0.4936 -
accuracy: 0.8220
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3756 -
accuracy: 0.8639
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3459 -
accuracy: 0.8749
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3316 -
accuracy: 0.8777
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3175 -
accuracy: 0.8846
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3133 -
accuracy: 0.8855
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3040 -
accuracy: 0.8899
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3008 -
accuracy: 0.8894
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2935 -
accuracy: 0.8939
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2912 -
accuracy: 0.8949
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2851 -
accuracy: 0.8960
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2833 -
accuracy: 0.8955
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2770 -
accuracy: 0.8995
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2781 -
accuracy: 0.9002
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2710 -
accuracy: 0.9005
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2760 -
accuracy: 0.8969
Epoch 17/30

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```

1125/1125 [=====] - 3s 3ms/step - loss: 0.2711 -
accuracy: 0.9029
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2728 -
accuracy: 0.9016
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2694 -
accuracy: 0.9023
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2716 -
accuracy: 0.9020
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2638 -
accuracy: 0.9044
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2594 -
accuracy: 0.9057
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2630 -
accuracy: 0.9030
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2576 -
accuracy: 0.9059
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2632 -
accuracy: 0.9037
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2585 -
accuracy: 0.9055
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2573 -
accuracy: 0.9056
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2631 -
accuracy: 0.9054
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2582 -
accuracy: 0.9067
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2515 -
accuracy: 0.9091
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.005, strides=1; total time= 1.6min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4941 -
accuracy: 0.8224
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3863 -

```

```

accuracy: 0.8617
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3579 -
accuracy: 0.8700
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3378 -
accuracy: 0.8759
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3250 -
accuracy: 0.8823
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3233 -
accuracy: 0.8827
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3074 -
accuracy: 0.8881
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3026 -
accuracy: 0.8892
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3054 -
accuracy: 0.8876
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2901 -
accuracy: 0.8934
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2890 -
accuracy: 0.8944
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2832 -
accuracy: 0.8961
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2872 -
accuracy: 0.8964
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2864 -
accuracy: 0.8964
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2761 -
accuracy: 0.8981
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2744 -
accuracy: 0.8996
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2771 -
accuracy: 0.8967
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2713 -

```

```

accuracy: 0.9019
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2658 -
accuracy: 0.9022
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2655 -
accuracy: 0.9027
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2659 -
accuracy: 0.9038
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2650 -
accuracy: 0.9042
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2616 -
accuracy: 0.9036
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2576 -
accuracy: 0.9065
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2573 -
accuracy: 0.9065
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2605 -
accuracy: 0.9063
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2608 -
accuracy: 0.9045
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2535 -
accuracy: 0.9091
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2572 -
accuracy: 0.9051
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2514 -
accuracy: 0.9081
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.005, strides=1; total time= 1.6min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6188 -
accuracy: 0.7758
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4385 -
accuracy: 0.8399
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4046 -
accuracy: 0.8517

```

Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3830 -  
accuracy: 0.8600

Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3724 -  
accuracy: 0.8631

Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3588 -  
accuracy: 0.8685

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3562 -  
accuracy: 0.8695

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3440 -  
accuracy: 0.8733

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3399 -  
accuracy: 0.8733

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3357 -  
accuracy: 0.8775

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3267 -  
accuracy: 0.8789

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3318 -  
accuracy: 0.8773

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3258 -  
accuracy: 0.8798

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3233 -  
accuracy: 0.8804

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3247 -  
accuracy: 0.8818

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3116 -  
accuracy: 0.8842

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3136 -  
accuracy: 0.8833

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3082 -  
accuracy: 0.8865

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3115 -  
accuracy: 0.8832

```

Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3027 -
accuracy: 0.8868
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3033 -
accuracy: 0.8881
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2966 -
accuracy: 0.8888
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2938 -
accuracy: 0.8916
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2975 -
accuracy: 0.8891
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2964 -
accuracy: 0.8909
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2895 -
accuracy: 0.8935
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2891 -
accuracy: 0.8939
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2968 -
accuracy: 0.8896
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2878 -
accuracy: 0.8933
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2890 -
accuracy: 0.8945
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.005, strides=2; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6122 -
accuracy: 0.7790
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4435 -
accuracy: 0.8381
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4094 -
accuracy: 0.8507
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3911 -
accuracy: 0.8561
Epoch 5/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3762 -
accuracy: 0.8617
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3649 -
accuracy: 0.8647
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3566 -
accuracy: 0.8691
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3480 -
accuracy: 0.8716
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3473 -
accuracy: 0.8723
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3433 -
accuracy: 0.8723
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3362 -
accuracy: 0.8767
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3315 -
accuracy: 0.8772
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3320 -
accuracy: 0.8784
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3246 -
accuracy: 0.8808
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3239 -
accuracy: 0.8794
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3207 -
accuracy: 0.8813
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3128 -
accuracy: 0.8836
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3125 -
accuracy: 0.8841
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3188 -
accuracy: 0.8836
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3133 -
accuracy: 0.8843
Epoch 21/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3070 -
accuracy: 0.8875
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3081 -
accuracy: 0.8842
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3022 -
accuracy: 0.8898
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2997 -
accuracy: 0.8892
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3008 -
accuracy: 0.8896
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2967 -
accuracy: 0.8921
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3074 -
accuracy: 0.8888
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2905 -
accuracy: 0.8906
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2944 -
accuracy: 0.8904
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2919 -
accuracy: 0.8912
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.005, strides=2; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6159 -
accuracy: 0.7767
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4414 -
accuracy: 0.8404
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4016 -
accuracy: 0.8525
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3825 -
accuracy: 0.8607
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3706 -
accuracy: 0.8650
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3623 -

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accuracy: 0.8692
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3564 -
accuracy: 0.8704
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3470 -
accuracy: 0.8731
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3386 -
accuracy: 0.8771
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3353 -
accuracy: 0.8789
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3296 -
accuracy: 0.8783
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3230 -
accuracy: 0.8786
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3258 -
accuracy: 0.8808
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3247 -
accuracy: 0.8819
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3174 -
accuracy: 0.8825
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3141 -
accuracy: 0.8838
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3112 -
accuracy: 0.8856
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3120 -
accuracy: 0.8858
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3096 -
accuracy: 0.8860
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3052 -
accuracy: 0.8858
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3055 -
accuracy: 0.8877
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3021 -

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accuracy: 0.8876
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2921 -
accuracy: 0.8927
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2954 -
accuracy: 0.8901
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3047 -
accuracy: 0.8876
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2887 -
accuracy: 0.8940
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2955 -
accuracy: 0.8922
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2932 -
accuracy: 0.8899
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2900 -
accuracy: 0.8928
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2863 -
accuracy: 0.8968
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.005, strides=2; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7321 -
accuracy: 0.7278
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5609 -
accuracy: 0.7944
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5170 -
accuracy: 0.8092
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4899 -
accuracy: 0.8179
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4701 -
accuracy: 0.8296
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4575 -
accuracy: 0.8308
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4465 -
accuracy: 0.8371

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Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4276 -  
accuracy: 0.8403

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4275 -  
accuracy: 0.8400

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4223 -  
accuracy: 0.8426

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4175 -  
accuracy: 0.8444

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4128 -  
accuracy: 0.8485

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4102 -  
accuracy: 0.8470

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4074 -  
accuracy: 0.8483

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4009 -  
accuracy: 0.8499

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4023 -  
accuracy: 0.8508

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3988 -  
accuracy: 0.8510

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3873 -  
accuracy: 0.8568

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3904 -  
accuracy: 0.8529

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3856 -  
accuracy: 0.8559

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3828 -  
accuracy: 0.8557

Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3870 -  
accuracy: 0.8532

Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3795 -  
accuracy: 0.8588

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3827 -  
accuracy: 0.8542  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3785 -  
accuracy: 0.8552  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3737 -  
accuracy: 0.8593  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3794 -  
accuracy: 0.8578  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3691 -  
accuracy: 0.8607  
Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3645 -  
accuracy: 0.8638  
Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3691 -  
accuracy: 0.8602  
563/563 [=====] - 1s 1ms/step  
[CV] END ...ks=4, lrs=0.005, strides=3; total time= 1.5min  
Epoch 1/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.7099 -  
accuracy: 0.7380  
Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5480 -  
accuracy: 0.7994  
Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5054 -  
accuracy: 0.8156  
Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4831 -  
accuracy: 0.8248  
Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4668 -  
accuracy: 0.8293  
Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4513 -  
accuracy: 0.8337  
Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4435 -  
accuracy: 0.8372  
Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4374 -  
accuracy: 0.8384  
Epoch 9/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.4330 -
accuracy: 0.8391
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4281 -
accuracy: 0.8420
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4193 -
accuracy: 0.8471
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4123 -
accuracy: 0.8465
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4088 -
accuracy: 0.8488
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4109 -
accuracy: 0.8466
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4020 -
accuracy: 0.8523
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3991 -
accuracy: 0.8508
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4025 -
accuracy: 0.8509
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3946 -
accuracy: 0.8511
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3953 -
accuracy: 0.8539
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3879 -
accuracy: 0.8564
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3851 -
accuracy: 0.8568
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3844 -
accuracy: 0.8553
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3840 -
accuracy: 0.8552
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3775 -
accuracy: 0.8588
Epoch 25/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.3796 -
accuracy: 0.8575
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3792 -
accuracy: 0.8606
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3800 -
accuracy: 0.8576
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3803 -
accuracy: 0.8571
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3731 -
accuracy: 0.8598
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3760 -
accuracy: 0.8616
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.005, strides=3; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.7233 -
accuracy: 0.7346
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5470 -
accuracy: 0.7997
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5064 -
accuracy: 0.8140
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4810 -
accuracy: 0.8234
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4636 -
accuracy: 0.8285
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4561 -
accuracy: 0.8327
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4412 -
accuracy: 0.8362
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4394 -
accuracy: 0.8387
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4323 -
accuracy: 0.8386
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4239 -

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accuracy: 0.8442
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4220 -
accuracy: 0.8431
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4151 -
accuracy: 0.8463
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4075 -
accuracy: 0.8512
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4070 -
accuracy: 0.8481
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3966 -
accuracy: 0.8524
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3977 -
accuracy: 0.8544
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3942 -
accuracy: 0.8534
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3937 -
accuracy: 0.8539
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3907 -
accuracy: 0.8543
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3890 -
accuracy: 0.8551
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3846 -
accuracy: 0.8571
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3835 -
accuracy: 0.8567
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3853 -
accuracy: 0.8556
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3847 -
accuracy: 0.8550
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3789 -
accuracy: 0.8599
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3753 -

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accuracy: 0.8574
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3753 -
accuracy: 0.8581
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3780 -
accuracy: 0.8591
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3709 -
accuracy: 0.8604
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3731 -
accuracy: 0.8605
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.005, strides=3; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6275 -
accuracy: 0.7721
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4170 -
accuracy: 0.8480
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3631 -
accuracy: 0.8699
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3303 -
accuracy: 0.8814
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3114 -
accuracy: 0.8883
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2916 -
accuracy: 0.8949
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2805 -
accuracy: 0.8990
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2640 -
accuracy: 0.9037
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2572 -
accuracy: 0.9044
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2488 -
accuracy: 0.9089
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2389 -
accuracy: 0.9131

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Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2322 -  
accuracy: 0.9153

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2261 -  
accuracy: 0.9160

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2232 -  
accuracy: 0.9174

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2130 -  
accuracy: 0.9218

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2129 -  
accuracy: 0.9220

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2054 -  
accuracy: 0.9238

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2034 -  
accuracy: 0.9252

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1968 -  
accuracy: 0.9287

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1905 -  
accuracy: 0.9309

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1875 -  
accuracy: 0.9310

Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1841 -  
accuracy: 0.9323

Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1818 -  
accuracy: 0.9330

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1828 -  
accuracy: 0.9321

Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1766 -  
accuracy: 0.9348

Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1747 -  
accuracy: 0.9354

Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1709 -  
accuracy: 0.9354

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Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1664 -
accuracy: 0.9390
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1658 -
accuracy: 0.9401
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1621 -
accuracy: 0.9400
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.0005, strides=1; total time= 1.6min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6140 -
accuracy: 0.7794
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4020 -
accuracy: 0.8568
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3539 -
accuracy: 0.8737
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3245 -
accuracy: 0.8848
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3014 -
accuracy: 0.8929
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2862 -
accuracy: 0.8976
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2737 -
accuracy: 0.9021
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2638 -
accuracy: 0.9055
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2556 -
accuracy: 0.9084
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2448 -
accuracy: 0.9099
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2375 -
accuracy: 0.9143
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2310 -
accuracy: 0.9165
Epoch 13/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.2229 -
accuracy: 0.9184
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2189 -
accuracy: 0.9224
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2130 -
accuracy: 0.9226
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2096 -
accuracy: 0.9229
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2035 -
accuracy: 0.9274
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1981 -
accuracy: 0.9273
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1956 -
accuracy: 0.9279
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1912 -
accuracy: 0.9300
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1887 -
accuracy: 0.9309
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1835 -
accuracy: 0.9323
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1824 -
accuracy: 0.9333
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1801 -
accuracy: 0.9332
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1772 -
accuracy: 0.9334
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1735 -
accuracy: 0.9362
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1717 -
accuracy: 0.9363
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1670 -
accuracy: 0.9378
Epoch 29/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.1593 -
accuracy: 0.9399
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.1612 -
accuracy: 0.9402
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.0005, strides=1; total time= 1.6min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6124 -
accuracy: 0.7775
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4123 -
accuracy: 0.8528
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3635 -
accuracy: 0.8729
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3324 -
accuracy: 0.8824
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3112 -
accuracy: 0.8889
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2928 -
accuracy: 0.8953
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2788 -
accuracy: 0.9011
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2680 -
accuracy: 0.9028
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2590 -
accuracy: 0.9081
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2513 -
accuracy: 0.9085
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2455 -
accuracy: 0.9128
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2339 -
accuracy: 0.9146
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2274 -
accuracy: 0.9171
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2233 -

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accuracy: 0.9199  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2152 -  
accuracy: 0.9212  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2110 -  
accuracy: 0.9242  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2079 -  
accuracy: 0.9244  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2023 -  
accuracy: 0.9261  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1996 -  
accuracy: 0.9272  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1937 -  
accuracy: 0.9302  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1874 -  
accuracy: 0.9310  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1867 -  
accuracy: 0.9318  
Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1840 -  
accuracy: 0.9330  
Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1816 -  
accuracy: 0.9339  
Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1761 -  
accuracy: 0.9356  
Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1728 -  
accuracy: 0.9357  
Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1722 -  
accuracy: 0.9370  
Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1691 -  
accuracy: 0.9382  
Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1669 -  
accuracy: 0.9396  
Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.1629 -

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accuracy: 0.9396
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.0005, strides=1; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.8931 -
accuracy: 0.6811
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5625 -
accuracy: 0.7962
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4845 -
accuracy: 0.8257
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4438 -
accuracy: 0.8413
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4114 -
accuracy: 0.8518
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3948 -
accuracy: 0.8581
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3772 -
accuracy: 0.8649
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3611 -
accuracy: 0.8708
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3531 -
accuracy: 0.8712
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3415 -
accuracy: 0.8782
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3366 -
accuracy: 0.8783
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3289 -
accuracy: 0.8810
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3230 -
accuracy: 0.8851
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3177 -
accuracy: 0.8835
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3115 -
accuracy: 0.8865

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Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3048 -
accuracy: 0.8889
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3032 -
accuracy: 0.8891
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2961 -
accuracy: 0.8929
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2894 -
accuracy: 0.8954
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2910 -
accuracy: 0.8938
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2869 -
accuracy: 0.8941
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2842 -
accuracy: 0.8980
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2803 -
accuracy: 0.8978
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2762 -
accuracy: 0.8980
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2738 -
accuracy: 0.8999
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2684 -
accuracy: 0.9013
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2670 -
accuracy: 0.9023
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2669 -
accuracy: 0.9030
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2632 -
accuracy: 0.9051
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2594 -
accuracy: 0.9058
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.0005, strides=2; total time= 1.5min
Epoch 1/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.8977 -
accuracy: 0.6844
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5514 -
accuracy: 0.8020
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4775 -
accuracy: 0.8286
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4374 -
accuracy: 0.8449
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4124 -
accuracy: 0.8518
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3893 -
accuracy: 0.8593
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3736 -
accuracy: 0.8664
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3615 -
accuracy: 0.8704
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3516 -
accuracy: 0.8740
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3404 -
accuracy: 0.8774
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3375 -
accuracy: 0.8782
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3299 -
accuracy: 0.8817
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3218 -
accuracy: 0.8843
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3150 -
accuracy: 0.8866
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3096 -
accuracy: 0.8869
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3070 -
accuracy: 0.8899
Epoch 17/30

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1125/1125 [=====] - 3s 3ms/step - loss: 0.2991 -
accuracy: 0.8928
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2986 -
accuracy: 0.8917
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2936 -
accuracy: 0.8949
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2902 -
accuracy: 0.8953
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2828 -
accuracy: 0.8976
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2808 -
accuracy: 0.8965
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2782 -
accuracy: 0.8977
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2761 -
accuracy: 0.8992
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2744 -
accuracy: 0.9002
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2684 -
accuracy: 0.9030
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2667 -
accuracy: 0.9020
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2648 -
accuracy: 0.9033
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2607 -
accuracy: 0.9060
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2594 -
accuracy: 0.9066
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.0005, strides=2; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.8966 -
accuracy: 0.6804
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5683 -

```

accuracy: 0.7951  
Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4883 -  
accuracy: 0.8255  
Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4412 -  
accuracy: 0.8416  
Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4143 -  
accuracy: 0.8526  
Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3921 -  
accuracy: 0.8593  
Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3752 -  
accuracy: 0.8666  
Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3598 -  
accuracy: 0.8714  
Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3513 -  
accuracy: 0.8752  
Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3449 -  
accuracy: 0.8757  
Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3340 -  
accuracy: 0.8804  
Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3276 -  
accuracy: 0.8816  
Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3220 -  
accuracy: 0.8855  
Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3160 -  
accuracy: 0.8871  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3069 -  
accuracy: 0.8899  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3046 -  
accuracy: 0.8909  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2988 -  
accuracy: 0.8924  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.2957 -

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accuracy: 0.8934
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2935 -
accuracy: 0.8937
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2858 -
accuracy: 0.8953
Epoch 21/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2848 -
accuracy: 0.8961
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2792 -
accuracy: 0.8973
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2800 -
accuracy: 0.9001
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2735 -
accuracy: 0.9001
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2737 -
accuracy: 0.9005
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2687 -
accuracy: 0.9015
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2647 -
accuracy: 0.9040
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2617 -
accuracy: 0.9046
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2621 -
accuracy: 0.9043
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.2581 -
accuracy: 0.9051
563/563 [=====] - 1s 2ms/step
[CV] END ...ks=4, lrs=0.0005, strides=2; total time= 2.4min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 1.0127 -
accuracy: 0.6431
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6799 -
accuracy: 0.7549
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6108 -
accuracy: 0.7799

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Epoch 4/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.5694 -  
accuracy: 0.7946

Epoch 5/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5424 -  
accuracy: 0.8058

Epoch 6/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5218 -  
accuracy: 0.8110

Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5046 -  
accuracy: 0.8179

Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4880 -  
accuracy: 0.8253

Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4792 -  
accuracy: 0.8291

Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4657 -  
accuracy: 0.8315

Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4580 -  
accuracy: 0.8352

Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4468 -  
accuracy: 0.8395

Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4389 -  
accuracy: 0.8418

Epoch 14/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4281 -  
accuracy: 0.8439

Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4237 -  
accuracy: 0.8469

Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4220 -  
accuracy: 0.8460

Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4127 -  
accuracy: 0.8521

Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4046 -  
accuracy: 0.8528

Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3973 -  
accuracy: 0.8560

Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3966 -  
accuracy: 0.8560

Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3905 -  
accuracy: 0.8594

Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3864 -  
accuracy: 0.8615

Epoch 23/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3869 -  
accuracy: 0.8600

Epoch 24/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3758 -  
accuracy: 0.8620

Epoch 25/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3726 -  
accuracy: 0.8639

Epoch 26/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3693 -  
accuracy: 0.8638

Epoch 27/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3673 -  
accuracy: 0.8681

Epoch 28/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3632 -  
accuracy: 0.8664

Epoch 29/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3617 -  
accuracy: 0.8684

Epoch 30/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3614 -  
accuracy: 0.8672

563/563 [=====] - 1s 1ms/step  
[CV] END ...ks=4, lrs=0.0005, strides=3; total time= 1.5min

Epoch 1/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.9933 -  
accuracy: 0.6489

Epoch 2/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.6647 -  
accuracy: 0.7582

Epoch 3/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5950 -  
accuracy: 0.7854

Epoch 4/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.5599 -  
accuracy: 0.7983

Epoch 5/30

```

1125/1125 [=====] - 3s 3ms/step - loss: 0.5299 -
accuracy: 0.8108
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5083 -
accuracy: 0.8165
Epoch 7/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4967 -
accuracy: 0.8209
Epoch 8/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4767 -
accuracy: 0.8291
Epoch 9/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4681 -
accuracy: 0.8317
Epoch 10/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4587 -
accuracy: 0.8359
Epoch 11/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4464 -
accuracy: 0.8389
Epoch 12/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4420 -
accuracy: 0.8407
Epoch 13/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4322 -
accuracy: 0.8419
Epoch 14/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4240 -
accuracy: 0.8462
Epoch 15/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4172 -
accuracy: 0.8501
Epoch 16/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4139 -
accuracy: 0.8502
Epoch 17/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4086 -
accuracy: 0.8526
Epoch 18/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4036 -
accuracy: 0.8549
Epoch 19/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3981 -
accuracy: 0.8559
Epoch 20/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3961 -
accuracy: 0.8567
Epoch 21/30

```

```

1125/1125 [=====] - 3s 3ms/step - loss: 0.3894 -
accuracy: 0.8605
Epoch 22/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3872 -
accuracy: 0.8596
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3803 -
accuracy: 0.8617
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3801 -
accuracy: 0.8631
Epoch 25/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3757 -
accuracy: 0.8639
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3736 -
accuracy: 0.8646
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3687 -
accuracy: 0.8662
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3692 -
accuracy: 0.8666
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3630 -
accuracy: 0.8683
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3622 -
accuracy: 0.8698
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.0005, strides=3; total time= 1.5min
Epoch 1/30
1125/1125 [=====] - 3s 3ms/step - loss: 1.0069 -
accuracy: 0.6416
Epoch 2/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.6528 -
accuracy: 0.7657
Epoch 3/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5871 -
accuracy: 0.7916
Epoch 4/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5483 -
accuracy: 0.8041
Epoch 5/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.5214 -
accuracy: 0.8127
Epoch 6/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.4965 -

```



accuracy: 0.8218  
Epoch 7/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4866 -  
accuracy: 0.8273  
Epoch 8/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4705 -  
accuracy: 0.8313  
Epoch 9/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4566 -  
accuracy: 0.8360  
Epoch 10/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4443 -  
accuracy: 0.8379  
Epoch 11/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4373 -  
accuracy: 0.8415  
Epoch 12/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4253 -  
accuracy: 0.8454  
Epoch 13/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4237 -  
accuracy: 0.8473  
Epoch 14/30  
1125/1125 [=====] - 3s 2ms/step - loss: 0.4125 -  
accuracy: 0.8529  
Epoch 15/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4062 -  
accuracy: 0.8542  
Epoch 16/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.4062 -  
accuracy: 0.8539  
Epoch 17/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3973 -  
accuracy: 0.8563  
Epoch 18/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3952 -  
accuracy: 0.8572  
Epoch 19/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3889 -  
accuracy: 0.8591  
Epoch 20/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3837 -  
accuracy: 0.8604  
Epoch 21/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3788 -  
accuracy: 0.8633  
Epoch 22/30  
1125/1125 [=====] - 3s 3ms/step - loss: 0.3782 -

```

accuracy: 0.8635
Epoch 23/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3751 -
accuracy: 0.8639
Epoch 24/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3669 -
accuracy: 0.8655
Epoch 25/30
1125/1125 [=====] - 3s 2ms/step - loss: 0.3671 -
accuracy: 0.8663
Epoch 26/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3660 -
accuracy: 0.8670
Epoch 27/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3637 -
accuracy: 0.8688
Epoch 28/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3584 -
accuracy: 0.8702
Epoch 29/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3573 -
accuracy: 0.8712
Epoch 30/30
1125/1125 [=====] - 3s 3ms/step - loss: 0.3511 -
accuracy: 0.8721
563/563 [=====] - 1s 1ms/step
[CV] END ...ks=4, lrs=0.0005, strides=3; total time= 1.5min
Epoch 1/30
1688/1688 [=====] - 6s 3ms/step - loss: 0.5457 -
accuracy: 0.7995
Epoch 2/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.3759 -
accuracy: 0.8671
Epoch 3/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.3305 -
accuracy: 0.8836
Epoch 4/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.3039 -
accuracy: 0.8915
Epoch 5/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.2828 -
accuracy: 0.8992
Epoch 6/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.2673 -
accuracy: 0.9024
Epoch 7/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.2548 -
accuracy: 0.9077

```

Epoch 8/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.2462 -  
accuracy: 0.9106

Epoch 9/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.2375 -  
accuracy: 0.9145

Epoch 10/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.2298 -  
accuracy: 0.9167

Epoch 11/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.2254 -  
accuracy: 0.9184

Epoch 12/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.2176 -  
accuracy: 0.9200

Epoch 13/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.2130 -  
accuracy: 0.9233

Epoch 14/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.2074 -  
accuracy: 0.9236

Epoch 15/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.2045 -  
accuracy: 0.9246

Epoch 16/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.2012 -  
accuracy: 0.9258

Epoch 17/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.1948 -  
accuracy: 0.9297

Epoch 18/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.1941 -  
accuracy: 0.9295

Epoch 19/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.1894 -  
accuracy: 0.9311

Epoch 20/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.1872 -  
accuracy: 0.9307

Epoch 21/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.1834 -  
accuracy: 0.9324

Epoch 22/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.1800 -  
accuracy: 0.9336

Epoch 23/30  
1688/1688 [=====] - 5s 3ms/step - loss: 0.1776 -  
accuracy: 0.9352

```

Epoch 24/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.1761 -
accuracy: 0.9348
Epoch 25/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.1704 -
accuracy: 0.9378
Epoch 26/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.1711 -
accuracy: 0.9369
Epoch 27/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.1680 -
accuracy: 0.9379
Epoch 28/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.1654 -
accuracy: 0.9390
Epoch 29/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.1636 -
accuracy: 0.9389
Epoch 30/30
1688/1688 [=====] - 5s 3ms/step - loss: 0.1625 -
accuracy: 0.9399

```

```

[29]: print('CNN Best params: ',best_param_cnn)
      print('CNN Best scores: ',grid_search_cv.best_score_)

```

```

CNN Best params: {'ks': 4, 'lrs': 0.0005, 'strides': 1}
CNN Best scores: 0.922037037037037

```

## 1.5 4. Final models

In this section, please ensure to include cells to train each model with its best hyperparameter combination independently of the hyperparameter tuning cells, i.e. don't rely on the hyperparameter tuning cells having been run.

### 1.5.1 Algorithm of choice from first six weeks of course

```

[30]: # Set the model to the optimal hyperparameter result, train it and then predict
      ↪ the accuracy in the test set
rf = RandomForestClassifier(criterion = best_params_rf['criterion'],
                           n_estimators = best_params_rf['n_estimators'],
                           max_leaf_nodes = best_params_rf['max_leaf_nodes'])
rf.fit(X_train_rf, y_train_rf)
y_pred = rf.predict(X_test_rf)
accuracy_rf = metrics.accuracy_score(y_test,y_pred)
print('RF accuracy: %.2f%%' % (100 * accuracy_rf))

```

```

RF accuracy: 87.66%

```

### 1.5.2 Fully connected neural network

```
[31]: # Set the model to the optimal hyperparameter result
model = keras.models.Sequential([
    keras.layers.Flatten(input_shape=[28, 28]),
    keras.layers.Dense(300, activation=best_params_mlp['activation_function1']),
    keras.layers.Dense(100, activation=best_params_mlp['activation_function2']),
    keras.layers.Dense(10, activation="softmax")
])
opt = keras.optimizers.SGD(learning_rate=best_params_mlp['optimizer_lr'])
model.compile(loss='sparse_categorical_crossentropy',
              optimizer=opt,
              metrics=['accuracy'])
```

```
[32]: # Train the multilayer perceptron model
history = model.fit(X_train, y_train, epochs=30,
                    validation_data=(X_valid, y_valid))
```

```
Epoch 1/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.6253 -
accuracy: 0.7829 - val_loss: 0.4438 - val_accuracy: 0.8423
Epoch 2/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.4297 -
accuracy: 0.8437 - val_loss: 0.4655 - val_accuracy: 0.8207
Epoch 3/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3886 -
accuracy: 0.8583 - val_loss: 0.3999 - val_accuracy: 0.8477
Epoch 4/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3638 -
accuracy: 0.8670 - val_loss: 0.3769 - val_accuracy: 0.8562
Epoch 5/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3436 -
accuracy: 0.8746 - val_loss: 0.3422 - val_accuracy: 0.8762
Epoch 6/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3280 -
accuracy: 0.8788 - val_loss: 0.3383 - val_accuracy: 0.8737
Epoch 7/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3129 -
accuracy: 0.8847 - val_loss: 0.3452 - val_accuracy: 0.8722
Epoch 8/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.3019 -
accuracy: 0.8882 - val_loss: 0.3406 - val_accuracy: 0.8762
Epoch 9/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2904 -
accuracy: 0.8915 - val_loss: 0.3165 - val_accuracy: 0.8842
Epoch 10/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.2809 -
accuracy: 0.8955 - val_loss: 0.3108 - val_accuracy: 0.8797
```

Epoch 11/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2727 -  
accuracy: 0.8988 - val\_loss: 0.3045 - val\_accuracy: 0.8830

Epoch 12/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2627 -  
accuracy: 0.9024 - val\_loss: 0.2966 - val\_accuracy: 0.8912

Epoch 13/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2554 -  
accuracy: 0.9050 - val\_loss: 0.3215 - val\_accuracy: 0.8827

Epoch 14/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2482 -  
accuracy: 0.9061 - val\_loss: 0.2984 - val\_accuracy: 0.8925

Epoch 15/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2416 -  
accuracy: 0.9091 - val\_loss: 0.2758 - val\_accuracy: 0.9002

Epoch 16/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2344 -  
accuracy: 0.9127 - val\_loss: 0.2854 - val\_accuracy: 0.8962

Epoch 17/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2286 -  
accuracy: 0.9141 - val\_loss: 0.3020 - val\_accuracy: 0.8857

Epoch 18/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2229 -  
accuracy: 0.9170 - val\_loss: 0.2848 - val\_accuracy: 0.9008

Epoch 19/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2165 -  
accuracy: 0.9192 - val\_loss: 0.3099 - val\_accuracy: 0.8917

Epoch 20/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2113 -  
accuracy: 0.9200 - val\_loss: 0.2924 - val\_accuracy: 0.8952

Epoch 21/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2059 -  
accuracy: 0.9226 - val\_loss: 0.2837 - val\_accuracy: 0.8947

Epoch 22/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.2007 -  
accuracy: 0.9252 - val\_loss: 0.2859 - val\_accuracy: 0.8987

Epoch 23/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.1958 -  
accuracy: 0.9265 - val\_loss: 0.2906 - val\_accuracy: 0.8963

Epoch 24/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.1913 -  
accuracy: 0.9288 - val\_loss: 0.2854 - val\_accuracy: 0.8997

Epoch 25/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.1860 -  
accuracy: 0.9304 - val\_loss: 0.2802 - val\_accuracy: 0.9015

Epoch 26/30  
1688/1688 [=====] - 4s 2ms/step - loss: 0.1811 -  
accuracy: 0.9327 - val\_loss: 0.3043 - val\_accuracy: 0.8960

```
Epoch 27/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1771 -
accuracy: 0.9342 - val_loss: 0.2979 - val_accuracy: 0.8992
Epoch 28/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1720 -
accuracy: 0.9356 - val_loss: 0.3017 - val_accuracy: 0.8928
Epoch 29/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1684 -
accuracy: 0.9375 - val_loss: 0.2809 - val_accuracy: 0.9012
Epoch 30/30
1688/1688 [=====] - 4s 2ms/step - loss: 0.1638 -
accuracy: 0.9382 - val_loss: 0.3413 - val_accuracy: 0.8838
```

```
[33]: # Predict the accuracy in the test set
loss, accuracy = model.evaluate(X_test, y_test)
print(f"Accuracy on test data: {accuracy:.4f}")
```

```
313/313 [=====] - 1s 2ms/step - loss: 0.3846 -
accuracy: 0.8729
Accuracy on test data: 0.8729
```

### 1.5.3 Convolutional neural network

```
[34]: ks = best_param_cnn['ks']
strides = best_param_cnn['strides']
lrs = best_param_cnn['lrs']
```

```
[35]: cnn_final_model = keras.Sequential([

# Specify the input shape
keras.Input(shape=(28, 28, 1)),

# Conv and pool block 1
keras.layers.Conv2D(filters = 32, kernel_size=(ks, ks), strides=strides,
    ↪activation='relu'),
keras.layers.MaxPooling2D(pool_size=(2, 2)),

# Conv and pool block 2
keras.layers.Conv2D(filters = 64, kernel_size=(ks, ks), strides=strides,
    ↪activation='relu'),
keras.layers.MaxPooling2D(pool_size=(2, 2)),

# Flatten and classify using dense output layer
keras.layers.Flatten(),
keras.layers.Dropout(0.5),
keras.layers.Dense(10, activation="softmax"),
])
```

```

opt = tf.keras.optimizers.Adam(learning_rate=lrs)

# Compile model with loss, optimiser, and metrics
cnn_final_model.compile(loss='sparse_categorical_crossentropy',
                        optimizer=opt,
                        metrics=['accuracy'])

# Train the model for 30 epochs with batch size 128
batch_size = 128
epochs = 30
history = cnn_final_model.fit(X_train_cnn, y_train, batch_size=batch_size,
                             epochs=epochs, validation_data=(X_valid_cnn, y_valid))

# Evaluate the classifier on the test data.
loss, accuracy = cnn_final_model.evaluate(X_test_cnn, y_test)
print(f"Accuracy on test data: {accuracy:.4f}")

```

```

Epoch 1/30
422/422 [=====] - 2s 4ms/step - loss: 0.8428 -
accuracy: 0.7023 - val_loss: 0.5346 - val_accuracy: 0.8107
Epoch 2/30
422/422 [=====] - 1s 3ms/step - loss: 0.5345 -
accuracy: 0.8066 - val_loss: 0.4577 - val_accuracy: 0.8408
Epoch 3/30
422/422 [=====] - 1s 3ms/step - loss: 0.4713 -
accuracy: 0.8295 - val_loss: 0.4138 - val_accuracy: 0.8487
Epoch 4/30
422/422 [=====] - 1s 3ms/step - loss: 0.4379 -
accuracy: 0.8423 - val_loss: 0.3817 - val_accuracy: 0.8600
Epoch 5/30
422/422 [=====] - 1s 3ms/step - loss: 0.4091 -
accuracy: 0.8542 - val_loss: 0.3711 - val_accuracy: 0.8665
Epoch 6/30
422/422 [=====] - 1s 3ms/step - loss: 0.3912 -
accuracy: 0.8602 - val_loss: 0.3592 - val_accuracy: 0.8738
Epoch 7/30
422/422 [=====] - 1s 3ms/step - loss: 0.3776 -
accuracy: 0.8651 - val_loss: 0.3371 - val_accuracy: 0.8805
Epoch 8/30
422/422 [=====] - 1s 3ms/step - loss: 0.3648 -
accuracy: 0.8681 - val_loss: 0.3231 - val_accuracy: 0.8863
Epoch 9/30
422/422 [=====] - 1s 3ms/step - loss: 0.3563 -
accuracy: 0.8724 - val_loss: 0.3177 - val_accuracy: 0.8865
Epoch 10/30
422/422 [=====] - 1s 3ms/step - loss: 0.3485 -
accuracy: 0.8736 - val_loss: 0.3105 - val_accuracy: 0.8928
Epoch 11/30

```



422/422 [=====] - 1s 3ms/step - loss: 0.3395 -  
accuracy: 0.8774 - val\_loss: 0.3083 - val\_accuracy: 0.8928  
Epoch 12/30  
422/422 [=====] - 1s 3ms/step - loss: 0.3310 -  
accuracy: 0.8804 - val\_loss: 0.3043 - val\_accuracy: 0.8937  
Epoch 13/30  
422/422 [=====] - 1s 3ms/step - loss: 0.3259 -  
accuracy: 0.8814 - val\_loss: 0.2961 - val\_accuracy: 0.8962  
Epoch 14/30  
422/422 [=====] - 2s 4ms/step - loss: 0.3225 -  
accuracy: 0.8839 - val\_loss: 0.2948 - val\_accuracy: 0.8948  
Epoch 15/30  
422/422 [=====] - 1s 3ms/step - loss: 0.3157 -  
accuracy: 0.8856 - val\_loss: 0.2958 - val\_accuracy: 0.8952  
Epoch 16/30  
422/422 [=====] - 1s 3ms/step - loss: 0.3116 -  
accuracy: 0.8869 - val\_loss: 0.2826 - val\_accuracy: 0.9018  
Epoch 17/30  
422/422 [=====] - 1s 3ms/step - loss: 0.3103 -  
accuracy: 0.8877 - val\_loss: 0.2912 - val\_accuracy: 0.8940  
Epoch 18/30  
422/422 [=====] - 1s 3ms/step - loss: 0.3049 -  
accuracy: 0.8906 - val\_loss: 0.2811 - val\_accuracy: 0.9020  
Epoch 19/30  
422/422 [=====] - 1s 3ms/step - loss: 0.3012 -  
accuracy: 0.8911 - val\_loss: 0.2781 - val\_accuracy: 0.9040  
Epoch 20/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2978 -  
accuracy: 0.8916 - val\_loss: 0.2809 - val\_accuracy: 0.9002  
Epoch 21/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2946 -  
accuracy: 0.8934 - val\_loss: 0.2869 - val\_accuracy: 0.8950  
Epoch 22/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2876 -  
accuracy: 0.8970 - val\_loss: 0.2682 - val\_accuracy: 0.9062  
Epoch 23/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2844 -  
accuracy: 0.8968 - val\_loss: 0.2768 - val\_accuracy: 0.8990  
Epoch 24/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2823 -  
accuracy: 0.8971 - val\_loss: 0.2778 - val\_accuracy: 0.9005  
Epoch 25/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2787 -  
accuracy: 0.9001 - val\_loss: 0.2630 - val\_accuracy: 0.9025  
Epoch 26/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2801 -  
accuracy: 0.8985 - val\_loss: 0.2703 - val\_accuracy: 0.9043  
Epoch 27/30

```
422/422 [=====] - 1s 3ms/step - loss: 0.2786 -  
accuracy: 0.8994 - val_loss: 0.2671 - val_accuracy: 0.9005  
Epoch 28/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2746 -  
accuracy: 0.9012 - val_loss: 0.2566 - val_accuracy: 0.9083  
Epoch 29/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2715 -  
accuracy: 0.9016 - val_loss: 0.2696 - val_accuracy: 0.8987  
Epoch 30/30  
422/422 [=====] - 1s 3ms/step - loss: 0.2693 -  
accuracy: 0.9035 - val_loss: 0.2726 - val_accuracy: 0.9018  
313/313 [=====] - 1s 2ms/step - loss: 0.2885 -  
accuracy: 0.8958  
Accuracy on test data: 0.8958
```