Assignment_1_rsingav1

September 24, 2023

1 Assignment 1

2 Reference book: Deep Learning with Python by Francois Chollet

3 Installing required packages needed to accomplish this assignment. Firstly i installed pandas using pip and every other packages are already installed. Importing the python packages needed.

[1]:
```
# !pip install pandas
from tensorflow import keras
from tensorflow.keras import layers
from tensorflow.keras.datasets import imdb
from tensorflow.keras.layers import Dropout, BatchNormalization
from tensorflow.keras.layers import LSTM
import gc
import pandas as pd
import numpy as np
import tensorflow as tf
```

4 Load the IMDB dataset, splitting it into training data and labels, as well as testing data and labels. Only include the top 10,000 frequently used words in the dataset. Set a seed for randomization, ensuring consistent results

[2]:
```
(train_data, train_labels), (test_data, test_labels) = imdb.
↪load_data(num_words=10000, seed =4546)
```

4.1 Decoding one of these reviews back to English words:

[3]:
```
### Retrieve the word index from the IMDB dataset.
word_index = imdb.get_word_index()

### Create a reverse word index by swapping keys and values.
reverse_word_index = dict(
    [(value, key) for (key, value) in word_index.items()])

### Decode a review by converting a sequence of indices back into words,␣
↪replacing any unknown tokens with a question mark.
decoded_review = " ".join(
    [reverse_word_index.get(i - 3, "?") for i in train_data[0]])
```

4.2 Defining a function vectorize_sequences that converts a list of sequences into a binary matrix representation, where each row corresponds to a sequence and each column represents the presence of a specific word in that sequence. The default dimension is set to 10,000 for the vocabulary size.

[4]:
```
def vectorize_sequences(sequences, dimension=10000):
    # Initialize a matrix filled with zeros. Each row corresponds to a␣
↪sequence, and each column to a word.
    results = np.zeros((len(sequences), dimension))
    # Iterate over each sequence and its index in the list.
    for i, sequence in enumerate(sequences):
        # Iterate over the indices in the current sequence.
        for j in sequence:
            # Set the corresponding element in the matrix to 1, indicating the␣
↪presence of a word in the sequence.
            results[i, j] = 1.
    return results
```

[5]:
```
x_train = vectorize_sequences(train_data)
x_test = vectorize_sequences(test_data)
```

[6]:
```
y_train = np.asarray(train_labels).astype("float32")
y_test = np.asarray(test_labels).astype("float32")
```

[7]:
```
final_eval_x_test_data = x_test[20000:]
final_eval_y_test_data = y_test[20000:]
final_train_x_data = np.concatenate((x_train, x_test[:20000]), axis=0)
final_train_y_data = np.concatenate((y_train, y_test[:20000]), axis=0)
```

5 Deleting all the variables that are not needed downstream as we can release some memory and using garbage collection to remove them too.

[8]:
```
del train_data, train_labels, test_data, test_labels
gc.collect()
```

[8]:
```
0
```

6 Creating a Keras model configuration with 2 layers with relu activation, using rmsprop optimizer, loss type as binary crossentropy as it is two categories in the response variable

[57]:
```
model = keras.Sequential([
    layers.Dense(16, activation="relu"),
    layers.Dense(16, activation="relu"),
    layers.Dense(1, activation="sigmoid")
])
```

[58]:
```
model.compile(optimizer="rmsprop",
              loss="binary_crossentropy",
              metrics=["accuracy"])
```

7 Creating validation dataset and partial training data set

[59]:
```
x_val = x_train[:10000]
partial_x_train = x_train[10000:]
y_val = y_train[:10000]
partial_y_train = y_train[10000:]
```

8 Fit the neural network we specified above with batch_size of 512 and 20 epochs

[61]:
```
history = model.fit(partial_x_train,
                    partial_y_train,
                    epochs=20,
                    batch_size=512,
                    validation_data=(x_val, y_val))
```

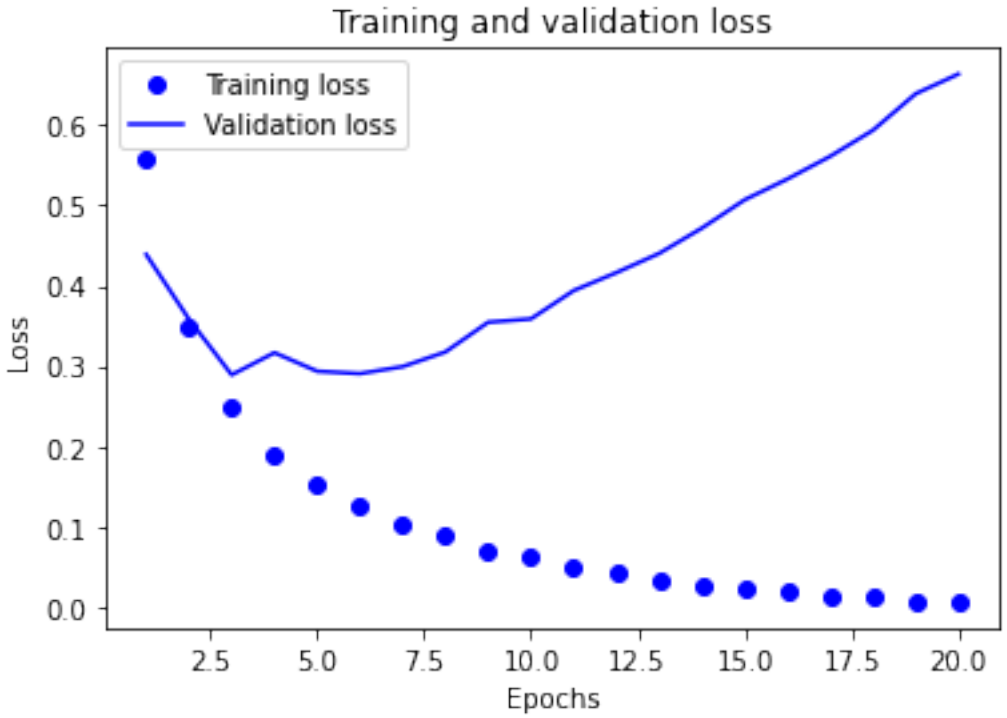
```
Epoch 1/20
30/30 [==============================] - 2s 39ms/step - loss: 0.5595 - accuracy:
0.7615 - val_loss: 0.4390 - val_accuracy: 0.8752
Epoch 2/20
```

```
30/30 [==============================] - 1s 30ms/step - loss: 0.3492 - accuracy:
0.8988 - val_loss: 0.3584 - val_accuracy: 0.8567
Epoch 3/20
30/30 [==============================] - 1s 44ms/step - loss: 0.2504 - accuracy:
0.9261 - val_loss: 0.2890 - val_accuracy: 0.8929
Epoch 4/20
30/30 [==============================] - 1s 42ms/step - loss: 0.1902 - accuracy:
0.9440 - val_loss: 0.3166 - val_accuracy: 0.8735
Epoch 5/20
30/30 [==============================] - 1s 31ms/step - loss: 0.1541 - accuracy:
0.9530 - val_loss: 0.2935 - val_accuracy: 0.8822
Epoch 6/20
30/30 [==============================] - 1s 21ms/step - loss: 0.1270 - accuracy:
0.9644 - val_loss: 0.2906 - val_accuracy: 0.8879
Epoch 7/20
30/30 [==============================] - 1s 21ms/step - loss: 0.1035 - accuracy:
0.9722 - val_loss: 0.2993 - val_accuracy: 0.8871
Epoch 8/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0897 - accuracy:
0.9751 - val_loss: 0.3176 - val_accuracy: 0.8842
Epoch 9/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0708 - accuracy:
0.9825 - val_loss: 0.3546 - val_accuracy: 0.8767
Epoch 10/20
30/30 [==============================] - 1s 23ms/step - loss: 0.0614 - accuracy:
0.9865 - val_loss: 0.3587 - val_accuracy: 0.8809
Epoch 11/20
30/30 [==============================] - 1s 21ms/step - loss: 0.0477 - accuracy:
0.9903 - val_loss: 0.3940 - val_accuracy: 0.8767
Epoch 12/20
30/30 [==============================] - 1s 23ms/step - loss: 0.0415 - accuracy:
0.9917 - val_loss: 0.4164 - val_accuracy: 0.8775
Epoch 13/20
30/30 [==============================] - 1s 24ms/step - loss: 0.0343 - accuracy:
0.9943 - val_loss: 0.4403 - val_accuracy: 0.8758
Epoch 14/20
30/30 [==============================] - 1s 24ms/step - loss: 0.0264 - accuracy:
0.9956 - val_loss: 0.4719 - val_accuracy: 0.8733
Epoch 15/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0218 - accuracy:
0.9966 - val_loss: 0.5071 - val_accuracy: 0.8722
Epoch 16/20
30/30 [==============================] - 1s 25ms/step - loss: 0.0178 - accuracy:
0.9971 - val_loss: 0.5330 - val_accuracy: 0.8714
Epoch 17/20
30/30 [==============================] - 1s 28ms/step - loss: 0.0132 - accuracy:
0.9981 - val_loss: 0.5612 - val_accuracy: 0.8692
Epoch 18/20
```

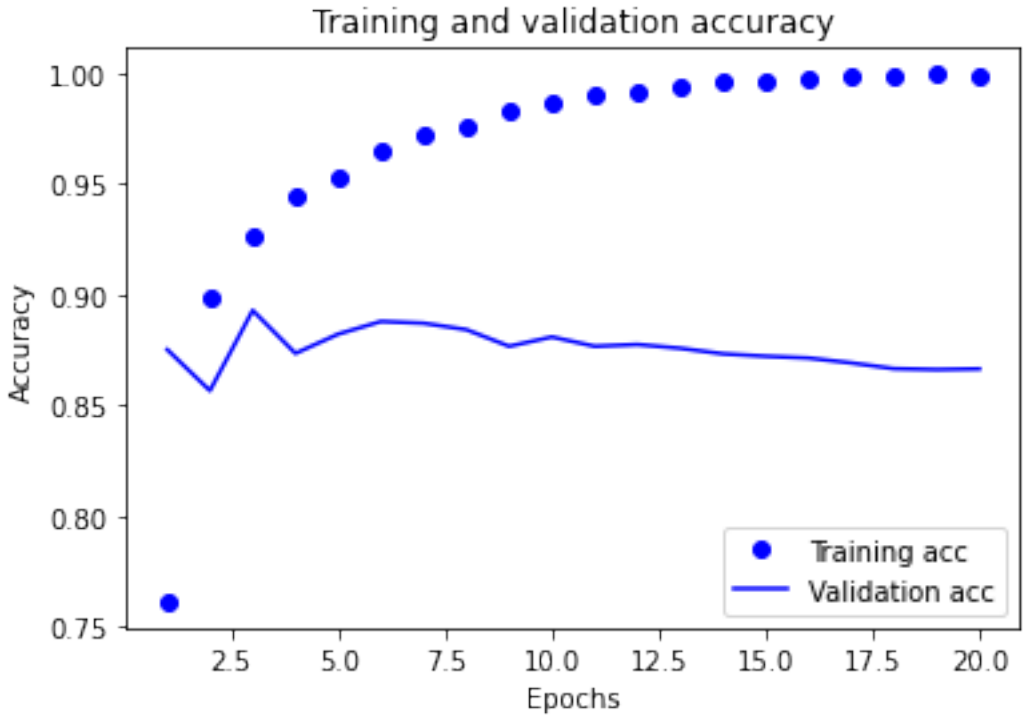
```
30/30 [==============================] - 1s 24ms/step - loss: 0.0115 - accuracy:
0.9985 - val_loss: 0.5937 - val_accuracy: 0.8666
Epoch 19/20
30/30 [==============================] - 1s 24ms/step - loss: 0.0064 - accuracy:
0.9995 - val_loss: 0.6392 - val_accuracy: 0.8662
Epoch 20/20
30/30 [==============================] - 1s 23ms/step - loss: 0.0075 - accuracy:
0.9989 - val_loss: 0.6638 - val_accuracy: 0.8665
```

9 Plotting the training and validation accuracy and loss over number of epochs

[63]:
```
import matplotlib.pyplot as plt
history_dict = history.history
loss_values = history_dict["loss"]
val_loss_values = history_dict["val_loss"]
epochs = range(1, len(loss_values) + 1)
plt.plot(epochs, loss_values, "bo", label="Training loss")
plt.plot(epochs, val_loss_values, "b", label="Validation loss")
plt.title("Training and validation loss")
plt.xlabel("Epochs")
plt.ylabel("Loss")
plt.legend()
plt.show()
```



[64]:
```
plt.clf()
acc = history_dict["accuracy"]
val_acc = history_dict["val_accuracy"]
plt.plot(epochs, acc, "bo", label="Training acc")
plt.plot(epochs, val_acc, "b", label="Validation acc")
plt.title("Training and validation accuracy")
plt.xlabel("Epochs")
plt.ylabel("Accuracy")
plt.legend()
plt.show()
```



10 It seems like 3 or 4 epochs seems to be doing a good job from the above plots, but they have almost the same loss and the accuracy. I will be using 4 epochs because the validation loss/accuracy values seem to be the same for 3 or 4 epochs

11 Initial Keras model

11.1 Configuration:

4 epochs, 512 batch_size using rmsprop optimizer and binary_crossentropy as loss type. Activation functions used for hidden layers is relu

[77]:
```
# Setting seed to 4546 to nor randomize in the future
tf.random.set_seed(4546)
model = keras.Sequential([
    layers.Dense(16, activation="relu"),
    layers.Dense(16, activation="relu"),
    layers.Dense(1, activation="sigmoid")
])
model.compile(optimizer="rmsprop",
              loss="binary_crossentropy",
              metrics=["accuracy"])
model.fit(x_train, y_train, epochs=4, batch_size=512)
results = model.evaluate(x_test, y_test)
```

```
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.4732 - accuracy:
0.8094
Epoch 2/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2706 - accuracy:
0.9081
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.2066 - accuracy:
0.9274
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1728 - accuracy:
0.9400
782/782 [==============================] - 1s 680us/step - loss: 0.2904 -
accuracy: 0.8850
```

[78]:
```
print(results)
```

```
[0.2904352843761444, 0.8850399851799011]
```

11.1.1 The validation loss is 0.885 and we can probably do better with hyperparameter tuning below.

12 Assigment questions:

12.0.1 - You used two hidden layers. Try using one or three hidden layers and see how doing so affects validation and test accuracy.

12.0.2 - Try using layers with more hidden units or fewer hidden units: 32 units, 64 units, and so on.

12.0.3 - Try using the mse loss function instead of binary_crossentropy.

12.0.4 - Try using the tanh activation (an activation that was popular in the early days of neural networks) instead of relu.

12.0.5 - Use any technique we studied in class, and these include regularization, dropout, etc., to get your model to perform better on validation

13 I have written a code to iterate through

- List of layers that i want to use as per the question(1, 2, 3)
- List of hidden units to use in the neural network(16, 32, 64)
- List of activation functions(tanh, relu)
- List of regularizations(dropout, batchnormalization and no regularozation)
- List of optimizers(adam, rmsprop)
- List of loss_types to use(mse, binary cross entropy)

I used 4 epochs as per the above plots.

[9]:
```
# Define the number of training epochs (in this case, only 4 epochs are␣
 ↪specified)
num_epochs = [4]
tf.random.set_seed(4546) # setting seed to 4546
# Define the hyperparameters to test
num_layers = [1, 2, 3]  # Number of layers in the neural network
num_units = [16, 32, 64]  # Number of units/neurons in each layer
activations = ['tanh', 'relu']  # Activation functions to test
batch_sizes = [128, 512]  # Batch sizes for training
regularizations = [None, 'dropout', 'batchnorm']  # Regularization techniques␣
 ↪to test
optimizers = ['adam', 'rmsprop']  # Optimization algorithms to test
loss_types =['mse', 'binary_crossentropy']  # Loss functions to test

# Initialize a list to store the results
results = []

# Iterating through the list of hyperparameters:
for layer in num_layers:  # Iterate over different numbers of layers
    for unit in num_units:  # Iterate over different numbers of units/neurons
```

```
      for activation in activations:  # Iterate over different activation␣
↪functions
          for batch_size in batch_sizes:  # Iterate over different batch sizes
              for regularization in regularizations:  # Iterate over␣
↪different regularization techniques
                  for optimize_algo in optimizers:  # Iterate over different␣
↪optimization algorithms
                      for losstype in loss_types:  # Iterate over different␣
↪loss functions
                          for epoch in num_epochs:  # Iterate over different␣
↪numbers of epochs
                              # Build the model
                              model = keras.Sequential()

                              # Add Dense layers
                              for i in range(layer):  # Add the specified␣
↪number of layers to the model
                                  model.add(layers.Dense(unit,␣
↪activation=activation))
                                  if regularization == 'dropout':  # Add␣
↪dropout regularization if specified
                                      model.add(Dropout(0.5))
                                  elif regularization == 'batchnorm':  # Add␣
↪batch normalization if specified
                                      model.add(BatchNormalization())

                              model.add(layers.Dense(1,␣
↪activation="sigmoid"))  # Output layer with sigmoid activation

                              # Compile and train the model
                              model.compile(optimizer=optimize_algo,␣
↪loss=losstype, metrics=["accuracy"])
                              model.fit(x_train, y_train, epochs=epoch,␣
↪batch_size=batch_size)

                              # Evaluate the model
                              result = model.evaluate(x_test, y_test)

                              # Extend the result list with additional␣
↪information
                              result.extend([epoch, layer, unit, activation,␣
↪batch_size, regularization, optimize_algo, losstype])
                              results.append(result)

                              # Delete the model to free up memory
                              del model, result
```

```
                                # Collect garbage to free up any unused memory
                                gc.collect()
```

```
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1074 -
accuracy: 0.8640
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0583 -
accuracy: 0.9272
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0440 -
accuracy: 0.9487
Epoch 4/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0349 -
accuracy: 0.9614
782/782 [==============================] - 1s 608us/step - loss: 0.0969 -
accuracy: 0.8711
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.3517 -
accuracy: 0.8619
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2031 -
accuracy: 0.9231
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1564 -
accuracy: 0.9456
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1267 -
accuracy: 0.9566
782/782 [==============================] - 1s 760us/step - loss: 0.3566 -
accuracy: 0.8722
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1061 -
accuracy: 0.8684
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0606 -
accuracy: 0.9228
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0476 -
accuracy: 0.9400
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0398 -
accuracy: 0.9504
782/782 [==============================] - 1s 593us/step - loss: 0.1012 -
accuracy: 0.8672
Epoch 1/4
```

```
196/196 [==============================] - 1s 5ms/step - loss: 0.3535 -
accuracy: 0.8644
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2090 -
accuracy: 0.9206
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1703 -
accuracy: 0.9370
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1482 -
accuracy: 0.9456
782/782 [==============================] - 1s 605us/step - loss: 0.3685 -
accuracy: 0.8629
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1261 -
accuracy: 0.8444
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0687 -
accuracy: 0.9189
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0540 -
accuracy: 0.9348
Epoch 4/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0448 -
accuracy: 0.9496
782/782 [==============================] - 1s 621us/step - loss: 0.0886 -
accuracy: 0.8796
Epoch 1/4
196/196 [==============================] - 2s 11ms/step - loss: 0.3926 -
accuracy: 0.8455
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.2340 -
accuracy: 0.9148
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1874 -
accuracy: 0.9343
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1582 -
accuracy: 0.9464
782/782 [==============================] - 1s 650us/step - loss: 0.3134 -
accuracy: 0.8785
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1185 -
accuracy: 0.8535
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0701 -
accuracy: 0.9130
Epoch 3/4
```

```
196/196 [==============================] - 1s 6ms/step - loss: 0.0569 -
accuracy: 0.9275
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0500 -
accuracy: 0.9366
782/782 [==============================] - 1s 588us/step - loss: 0.0881 -
accuracy: 0.8814
Epoch 1/4
196/196 [==============================] - 1s 4ms/step - loss: 0.3698 -
accuracy: 0.8552
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2357 -
accuracy: 0.9128
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2007 -
accuracy: 0.9270
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1790 -
accuracy: 0.9363
782/782 [==============================] - 1s 639us/step - loss: 0.3048 -
accuracy: 0.8815
Epoch 1/4
196/196 [==============================] - 2s 10ms/step - loss: 0.1025 -
accuracy: 0.8585
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0576 -
accuracy: 0.9271
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0456 -
accuracy: 0.9436
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0392 -
accuracy: 0.9525
782/782 [==============================] - 1s 707us/step - loss: 0.1080 -
accuracy: 0.8602
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3262 -
accuracy: 0.8609
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1930 -
accuracy: 0.9267
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1554 -
accuracy: 0.9427
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1254 -
accuracy: 0.9534
782/782 [==============================] - 1s 676us/step - loss: 0.3998 -
```

```
accuracy: 0.8599
Epoch 1/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1029 -
accuracy: 0.8562
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0630 -
accuracy: 0.9174
Epoch 3/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0498 -
accuracy: 0.9369
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0418 -
accuracy: 0.9477
782/782 [==============================] - 1s 610us/step - loss: 0.1028 -
accuracy: 0.8648
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.3209 -
accuracy: 0.8638: 0s - loss: 0.3769 - accu
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2064 -
accuracy: 0.9197
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1687 -
accuracy: 0.9362
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1460 -
accuracy: 0.9452
782/782 [==============================] - 1s 636us/step - loss: 0.3553 -
accuracy: 0.8657
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1408 - accuracy:
0.8281
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0766 - accuracy:
0.9153
Epoch 3/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0594 - accuracy:
0.9353
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0494 - accuracy:
0.9483
782/782 [==============================] - 1s 601us/step - loss: 0.0905 -
accuracy: 0.8776
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4476 - accuracy:
0.8213
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2685 - accuracy:
```

```
0.9087
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.2119 - accuracy:
0.9291
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1777 - accuracy:
0.9422
782/782 [==============================] - 1s 570us/step - loss: 0.2840 -
accuracy: 0.8868
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1434 - accuracy:
0.8266
Epoch 2/4
49/49 [==============================] - 1s 16ms/step - loss: 0.0805 - accuracy:
0.9117
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0616 - accuracy:
0.9290
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0510 - accuracy:
0.9411
782/782 [==============================] - 1s 758us/step - loss: 0.0870 -
accuracy: 0.8836
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.4443 - accuracy:
0.8298
Epoch 2/4
49/49 [==============================] - 1s 27ms/step - loss: 0.2750 - accuracy:
0.9086
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.2147 - accuracy:
0.9267
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1800 - accuracy:
0.9394
782/782 [==============================] - 1s 655us/step - loss: 0.2891 -
accuracy: 0.8815
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1704 - accuracy:
0.7990
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0999 - accuracy:
0.8950
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0778 - accuracy:
0.9172
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0654 - accuracy:
```

```
0.9302
782/782 [==============================] - 1s 597us/step - loss: 0.0871 -
accuracy: 0.8859
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4785 - accuracy:
0.7985
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2989 - accuracy:
0.8991
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2410 - accuracy:
0.9214
Epoch 4/4
49/49 [==============================] - 1s 16ms/step - loss: 0.2064 - accuracy:
0.9349
782/782 [==============================] - 1s 646us/step - loss: 0.2784 -
accuracy: 0.8885
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1479 - accuracy:
0.8119
Epoch 2/4
49/49 [==============================] - 2s 29ms/step - loss: 0.0879 - accuracy:
0.8994
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0683 - accuracy:
0.9227
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0588 - accuracy:
0.9324
782/782 [==============================] - 1s 652us/step - loss: 0.0832 -
accuracy: 0.8886
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.4703 - accuracy:
0.8086
Epoch 2/4
49/49 [==============================] - 1s 16ms/step - loss: 0.3002 - accuracy:
0.9020
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.2452 - accuracy:
0.9170
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2092 - accuracy:
0.9291
782/782 [==============================] - 1s 563us/step - loss: 0.2759 -
accuracy: 0.8886
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1176 - accuracy:
0.8367
```

```
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0608 - accuracy:
0.9274
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0462 - accuracy:
0.9492
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0366 - accuracy:
0.9610
782/782 [==============================] - 1s 751us/step - loss: 0.1065 -
accuracy: 0.8560
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.3695 - accuracy:
0.8375
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1929 - accuracy:
0.9298
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1519 - accuracy:
0.9476
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1246 - accuracy:
0.9582
782/782 [==============================] - 1s 679us/step - loss: 0.3361 -
accuracy: 0.8577
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1090 - accuracy:
0.8474
Epoch 2/4
49/49 [==============================] - 1s 18ms/step - loss: 0.0597 - accuracy:
0.9253
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0468 - accuracy:
0.9432
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0387 - accuracy:
0.9544
782/782 [==============================] - 1s 682us/step - loss: 0.0981 -
accuracy: 0.8660
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.3513 - accuracy:
0.8498
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.2024 - accuracy:
0.9230
Epoch 3/4
49/49 [==============================] - 1s 16ms/step - loss: 0.1610 - accuracy:
0.9412
```

```
Epoch 4/4
49/49 [==============================] - 1s 16ms/step - loss: 0.1352 - accuracy:
0.9525
782/782 [==============================] - 1s 749us/step - loss: 0.3337 -
accuracy: 0.8597
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1107 -
accuracy: 0.8608
Epoch 2/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0589 -
accuracy: 0.9296
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0449 -
accuracy: 0.9478
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0364 -
accuracy: 0.9605
782/782 [==============================] - 1s 613us/step - loss: 0.0939 -
accuracy: 0.8738
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3715 -
accuracy: 0.8512
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2094 -
accuracy: 0.9245
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1628 -
accuracy: 0.9420
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1335 -
accuracy: 0.9538
782/782 [==============================] - 1s 612us/step - loss: 0.3404 -
accuracy: 0.8712
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1123 -
accuracy: 0.8621
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0637 -
accuracy: 0.9204
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0506 -
accuracy: 0.9372
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0428 -
accuracy: 0.9479
782/782 [==============================] - 1s 637us/step - loss: 0.0901 -
accuracy: 0.8799
Epoch 1/4
```

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196/196 [==============================] - 2s 6ms/step - loss: 0.3583 -
accuracy: 0.8623
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2173 -
accuracy: 0.9184
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1774 -
accuracy: 0.9358
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1538 -
accuracy: 0.9445
782/782 [==============================] - 1s 623us/step - loss: 0.3149 -
accuracy: 0.8795
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1448 -
accuracy: 0.8061
Epoch 2/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0829 -
accuracy: 0.8979
Epoch 3/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0660 -
accuracy: 0.9204
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0548 -
accuracy: 0.9351
782/782 [==============================] - 1s 569us/step - loss: 0.0835 -
accuracy: 0.8858
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.4411 -
accuracy: 0.7996
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2735 -
accuracy: 0.9020
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2223 -
accuracy: 0.9232
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1910 -
accuracy: 0.9358
782/782 [==============================] - 1s 598us/step - loss: 0.2841 -
accuracy: 0.8853
Epoch 1/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1370 -
accuracy: 0.8224
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0824 -
accuracy: 0.8966
Epoch 3/4
```

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196/196 [==============================] - 1s 5ms/step - loss: 0.0677 -
accuracy: 0.9161
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0591 -
accuracy: 0.9273
782/782 [==============================] - 1s 681us/step - loss: 0.0839 -
accuracy: 0.8867
Epoch 1/4
196/196 [==============================] - 1s 4ms/step - loss: 0.4171 -
accuracy: 0.8235
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2745 -
accuracy: 0.8992
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2289 -
accuracy: 0.9169
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2064 -
accuracy: 0.9291
782/782 [==============================] - 1s 636us/step - loss: 0.2877 -
accuracy: 0.8890
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1029 -
accuracy: 0.8591
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0519 -
accuracy: 0.9365
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0321 -
accuracy: 0.9642
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0195 -
accuracy: 0.9806
782/782 [==============================] - 1s 661us/step - loss: 0.1168 -
accuracy: 0.8488
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3365 -
accuracy: 0.8516
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1741 -
accuracy: 0.9355
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1033 -
accuracy: 0.9655
Epoch 4/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0577 -
accuracy: 0.9840
782/782 [==============================] - 1s 630us/step - loss: 0.4333 -
```

```
accuracy: 0.8583
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1030 -
accuracy: 0.8548
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0574 -
accuracy: 0.9257
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0380 -
accuracy: 0.9540
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0245 -
accuracy: 0.9721
782/782 [==============================] - 1s 676us/step - loss: 0.1023 -
accuracy: 0.8631
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.3303 -
accuracy: 0.8580
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1924 -
accuracy: 0.9261
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1315 -
accuracy: 0.9532
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0892 -
accuracy: 0.9702
782/782 [==============================] - 1s 607us/step - loss: 0.3923 -
accuracy: 0.8646
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1526 - accuracy:
0.8173
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0793 - accuracy:
0.9114
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0616 - accuracy:
0.9335
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0515 - accuracy:
0.9465
782/782 [==============================] - 1s 614us/step - loss: 0.0869 -
accuracy: 0.8847
Epoch 1/4
49/49 [==============================] - 2s 15ms/step - loss: 0.4559 - accuracy:
0.8186
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2594 - accuracy:
```

```
0.9092
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2049 - accuracy:
0.9306
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1741 - accuracy:
0.9416
782/782 [==============================] - 1s 563us/step - loss: 0.2862 -
accuracy: 0.8854
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1416 - accuracy:
0.8335
Epoch 2/4
49/49 [==============================] - 1s 16ms/step - loss: 0.0821 - accuracy:
0.9112
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0635 - accuracy:
0.9282
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0531 - accuracy:
0.9411
782/782 [==============================] - 1s 625us/step - loss: 0.0852 -
accuracy: 0.8865
Epoch 1/4
49/49 [==============================] - 2s 15ms/step - loss: 0.4435 - accuracy:
0.8237
Epoch 2/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2653 - accuracy:
0.9106
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.2107 - accuracy:
0.9286
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1807 - accuracy:
0.9385
782/782 [==============================] - 1s 626us/step - loss: 0.2920 -
accuracy: 0.8831
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1845 - accuracy:
0.7495
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1139 - accuracy:
0.8714
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0898 - accuracy:
0.8981
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0755 - accuracy:
```

```
0.9141
782/782 [==============================] - 1s 555us/step - loss: 0.0860 -
accuracy: 0.8886
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.5234 - accuracy:
0.7572
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.3392 - accuracy:
0.8744
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2754 - accuracy:
0.9022
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2396 - accuracy:
0.9145
782/782 [==============================] - 1s 548us/step - loss: 0.2779 -
accuracy: 0.8895
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1660 - accuracy:
0.7794
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1064 - accuracy:
0.8780
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0849 - accuracy:
0.9022
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0710 - accuracy:
0.9189
782/782 [==============================] - 0s 541us/step - loss: 0.0832 -
accuracy: 0.8892
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4892 - accuracy:
0.7818
Epoch 2/4
49/49 [==============================] - 1s 15ms/step - loss: 0.3363 - accuracy:
0.8752
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.2792 - accuracy:
0.9006
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.2401 - accuracy:
0.9160
782/782 [==============================] - 1s 643us/step - loss: 0.2798 -
accuracy: 0.8875
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1272 - accuracy:
0.8228
```

```
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0598 - accuracy:
0.9297
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0395 - accuracy:
0.9599
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0252 - accuracy:
0.9781
782/782 [==============================] - 1s 713us/step - loss: 0.1103 -
accuracy: 0.8691
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.3796 - accuracy:
0.8290
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1912 - accuracy:
0.9328
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1338 - accuracy:
0.9576
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0904 - accuracy:
0.9754
782/782 [==============================] - 1s 606us/step - loss: 0.3530 -
accuracy: 0.8653
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1120 - accuracy:
0.8459
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0572 - accuracy:
0.9298
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0394 - accuracy:
0.9554
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0260 - accuracy:
0.9727
782/782 [==============================] - 1s 641us/step - loss: 0.1061 -
accuracy: 0.8692
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.3502 - accuracy:
0.8452
Epoch 2/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1862 - accuracy:
0.9306
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1276 - accuracy:
0.9572
```

```
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0843 - accuracy:
0.9754
782/782 [==============================] - 1s 671us/step - loss: 0.3454 -
accuracy: 0.8620
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1079 -
accuracy: 0.8623
Epoch 2/4
196/196 [==============================] - 1s 8ms/step - loss: 0.0568 -
accuracy: 0.9282
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0426 -
accuracy: 0.9490
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0335 -
accuracy: 0.9626
782/782 [==============================] - 1s 687us/step - loss: 0.1016 -
accuracy: 0.86800s - loss: 0.1026 - accura
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.3344 -
accuracy: 0.8637
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1908 -
accuracy: 0.9277
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1464 -
accuracy: 0.9466
Epoch 4/4
196/196 [==============================] - 1s 8ms/step - loss: 0.1188 -
accuracy: 0.9578
782/782 [==============================] - 1s 579us/step - loss: 0.3958 -
accuracy: 0.8625
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1032 -
accuracy: 0.8640
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0590 -
accuracy: 0.9225
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0464 -
accuracy: 0.9409
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0386 -
accuracy: 0.9528
782/782 [==============================] - 1s 618us/step - loss: 0.0995 -
accuracy: 0.8724
Epoch 1/4
```

```
196/196 [==============================] - 2s 6ms/step - loss: 0.3293 -
accuracy: 0.8649
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2017 -
accuracy: 0.9216
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1655 -
accuracy: 0.9376
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1428 -
accuracy: 0.9493
782/782 [==============================] - 1s 625us/step - loss: 0.3679 -
accuracy: 0.8677
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1121 -
accuracy: 0.8562
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0624 -
accuracy: 0.9225
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0481 -
accuracy: 0.9432
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0403 -
accuracy: 0.9525
782/782 [==============================] - 1s 634us/step - loss: 0.0936 -
accuracy: 0.8748
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.3609 -
accuracy: 0.8527
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.2113 -
accuracy: 0.9218
Epoch 3/4
196/196 [==============================] - 1s 8ms/step - loss: 0.1676 -
accuracy: 0.9382
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1454 -
accuracy: 0.9480
782/782 [==============================] - 1s 672us/step - loss: 0.3457 -
accuracy: 0.8731
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1115 -
accuracy: 0.8584
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0653 -
accuracy: 0.9152
Epoch 3/4
```

```
196/196 [==============================] - 1s 7ms/step - loss: 0.0533 -
accuracy: 0.9324
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0461 -
accuracy: 0.9422
782/782 [==============================] - 1s 597us/step - loss: 0.0886 -
accuracy: 0.8822
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.3497 -
accuracy: 0.8595
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2218 -
accuracy: 0.9165
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1873 -
accuracy: 0.9322
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1666 -
accuracy: 0.9388
782/782 [==============================] - 1s 682us/step - loss: 0.3165 -
accuracy: 0.8791
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1034 -
accuracy: 0.8574
Epoch 2/4
196/196 [==============================] - 1s 8ms/step - loss: 0.0571 -
accuracy: 0.9272
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0458 -
accuracy: 0.9433
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0378 -
accuracy: 0.9545
782/782 [==============================] - 1s 629us/step - loss: 0.1053 -
accuracy: 0.8638
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.3299 -
accuracy: 0.8595
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1882 -
accuracy: 0.9283
Epoch 3/4
196/196 [==============================] - 1s 8ms/step - loss: 0.1532 -
accuracy: 0.9422
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1222 -
accuracy: 0.9548
782/782 [==============================] - 1s 694us/step - loss: 0.4322 -
```

```
accuracy: 0.8472
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1057 -
accuracy: 0.8549
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0631 -
accuracy: 0.9173
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0495 -
accuracy: 0.9371
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0421 -
accuracy: 0.9474
782/782 [==============================] - 1s 680us/step - loss: 0.1042 -
accuracy: 0.8647
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3294 -
accuracy: 0.8609
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2046 -
accuracy: 0.9217
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1650 -
accuracy: 0.9368
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1418 -
accuracy: 0.9469
782/782 [==============================] - 1s 676us/step - loss: 0.3631 -
accuracy: 0.8662
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1413 - accuracy:
0.8264
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0730 - accuracy:
0.9166
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0554 - accuracy:
0.9390
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0447 - accuracy:
0.9524
782/782 [==============================] - 1s 567us/step - loss: 0.0878 -
accuracy: 0.8811
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.4185 - accuracy:
0.8379
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.2381 - accuracy:
```

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0.9170
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1852 - accuracy:
0.9365
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1531 - accuracy:
0.9491
782/782 [==============================] - 1s 576us/step - loss: 0.2948 -
accuracy: 0.8817
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1346 - accuracy:
0.8313
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0724 - accuracy:
0.9151
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0555 - accuracy:
0.9338
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0456 - accuracy:
0.9450
782/782 [==============================] - 1s 573us/step - loss: 0.0870 -
accuracy: 0.8822
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.4128 - accuracy:
0.8364
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2479 - accuracy:
0.9132
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1922 - accuracy:
0.9300
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1613 - accuracy:
0.9424
782/782 [==============================] - 1s 678us/step - loss: 0.3036 -
accuracy: 0.8790
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1466 - accuracy:
0.8168
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0794 - accuracy:
0.9101
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0617 - accuracy:
0.9305
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0515 - accuracy:
```

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0.9428
782/782 [==============================] - 1s 575us/step - loss: 0.0859 -
accuracy: 0.8834
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.4418 - accuracy:
0.8175
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.2622 - accuracy:
0.9100
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2081 - accuracy:
0.9277
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1762 - accuracy:
0.9410
782/782 [==============================] - 1s 609us/step - loss: 0.2848 -
accuracy: 0.8852
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1374 - accuracy:
0.8259
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0781 - accuracy:
0.9080
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0615 - accuracy:
0.9280
Epoch 4/4
49/49 [==============================] - 1s 18ms/step - loss: 0.0518 - accuracy:
0.9387
782/782 [==============================] - 1s 611us/step - loss: 0.0843 -
accuracy: 0.8860
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4362 - accuracy:
0.8223
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2673 - accuracy:
0.9056
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2164 - accuracy:
0.9228
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1830 - accuracy:
0.9364
782/782 [==============================] - 1s 690us/step - loss: 0.2817 -
accuracy: 0.8864
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1101 - accuracy:
0.8458
```

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Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0548 - accuracy:
0.9322
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0420 - accuracy:
0.9520
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0335 - accuracy:
0.9644
782/782 [==============================] - 1s 690us/step - loss: 0.1079 -
accuracy: 0.8501
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.3640 - accuracy:
0.8430
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1791 - accuracy:
0.9358
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1413 - accuracy:
0.9511
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1165 - accuracy:
0.9591
782/782 [==============================] - 1s 748us/step - loss: 0.3365 -
accuracy: 0.8593
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1072 - accuracy:
0.8495
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0592 - accuracy:
0.9252
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0456 - accuracy:
0.9449
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0377 - accuracy:
0.9556
782/782 [==============================] - 1s 636us/step - loss: 0.0992 -
accuracy: 0.8639
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.3398 - accuracy:
0.8524
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1991 - accuracy:
0.9242
Epoch 3/4
49/49 [==============================] - 1s 18ms/step - loss: 0.1595 - accuracy:
0.9391
```

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Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1319 - accuracy:
0.9510 0s - loss: 0.1209 - accuracy
782/782 [==============================] - 1s 706us/step - loss: 0.3297 -
accuracy: 0.8600
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1090 -
accuracy: 0.8576
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0573 -
accuracy: 0.9306
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0435 -
accuracy: 0.9496
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0346 -
accuracy: 0.9618
782/782 [==============================] - 1s 612us/step - loss: 0.0969 -
accuracy: 0.8715
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.3443 -
accuracy: 0.8598
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1966 -
accuracy: 0.9286
Epoch 3/4
196/196 [==============================] - 1s 8ms/step - loss: 0.1501 -
accuracy: 0.9465
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1196 -
accuracy: 0.9582
782/782 [==============================] - 1s 611us/step - loss: 0.3680 -
accuracy: 0.8687
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1058 -
accuracy: 0.8652
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0608 -
accuracy: 0.9220
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0480 -
accuracy: 0.9408
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0403 -
accuracy: 0.9503
782/782 [==============================] - 1s 591us/step - loss: 0.0992 -
accuracy: 0.8689
Epoch 1/4
```

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196/196 [==============================] - 2s 6ms/step - loss: 0.3423 -
accuracy: 0.8633
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2089 -
accuracy: 0.9216
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1712 -
accuracy: 0.9362
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1463 -
accuracy: 0.9470
782/782 [==============================] - 1s 706us/step - loss: 0.3508 -
accuracy: 0.8710
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1267 -
accuracy: 0.8324
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0702 -
accuracy: 0.9122
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0541 -
accuracy: 0.9345
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0436 -
accuracy: 0.9500
782/782 [==============================] - 1s 582us/step - loss: 0.0884 -
accuracy: 0.8814
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.3974 -
accuracy: 0.8332
Epoch 2/4
196/196 [==============================] - 1s 8ms/step - loss: 0.2328 -
accuracy: 0.9124
Epoch 3/4
196/196 [==============================] - 1s 8ms/step - loss: 0.1820 -
accuracy: 0.9340
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1488 -
accuracy: 0.9465
782/782 [==============================] - 1s 581us/step - loss: 0.2976 -
accuracy: 0.8830
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1219 -
accuracy: 0.8418
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0714 -
accuracy: 0.9093
Epoch 3/4
```

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196/196 [==============================] - 1s 6ms/step - loss: 0.0578 -
accuracy: 0.9275
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0494 -
accuracy: 0.9396
782/782 [==============================] - 1s 617us/step - loss: 0.0871 -
accuracy: 0.8822
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3878 -
accuracy: 0.8388
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2459 -
accuracy: 0.9074
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2035 -
accuracy: 0.9260
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1794 -
accuracy: 0.9342
782/782 [==============================] - 1s 671us/step - loss: 0.3089 -
accuracy: 0.8822
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.1055 -
accuracy: 0.8547
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0526 -
accuracy: 0.9347
Epoch 3/4
196/196 [==============================] - 1s 8ms/step - loss: 0.0325 -
accuracy: 0.9632
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0195 -
accuracy: 0.9804
782/782 [==============================] - 1s 813us/step - loss: 0.1047 -
accuracy: 0.8639
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.3323 -
accuracy: 0.8580
Epoch 2/4
196/196 [==============================] - 1s 8ms/step - loss: 0.1648 -
accuracy: 0.9388
Epoch 3/4
196/196 [==============================] - 1s 8ms/step - loss: 0.0881 -
accuracy: 0.9718
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0412 -
accuracy: 0.9897
782/782 [==============================] - 1s 682us/step - loss: 0.4447 -
```

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accuracy: 0.8589
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1010 -
accuracy: 0.8610
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0556 -
accuracy: 0.9273
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0326 -
accuracy: 0.9621
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0186 -
accuracy: 0.9800
782/782 [==============================] - 1s 688us/step - loss: 0.1052 -
accuracy: 0.8624
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.3204 -
accuracy: 0.8646
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1827 -
accuracy: 0.9306
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1103 -
accuracy: 0.9601
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0586 -
accuracy: 0.9832
782/782 [==============================] - 1s 756us/step - loss: 0.4237 -
accuracy: 0.8649
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1355 - accuracy:
0.8304
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0680 - accuracy:
0.9210
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0523 - accuracy:
0.9426
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0432 - accuracy:
0.9540
782/782 [==============================] - 1s 670us/step - loss: 0.0876 -
accuracy: 0.8817
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.4315 - accuracy:
0.8253
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2381 - accuracy:
```

```
0.9169
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1852 - accuracy:
0.9366
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1541 - accuracy:
0.9491
782/782 [==============================] - 1s 572us/step - loss: 0.2969 -
accuracy: 0.8821
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1339 - accuracy:
0.8294
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0746 - accuracy:
0.9136
Epoch 3/4
49/49 [==============================] - 1s 18ms/step - loss: 0.0583 - accuracy:
0.9324
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0490 - accuracy:
0.9443
782/782 [==============================] - 1s 638us/step - loss: 0.0867 -
accuracy: 0.8830
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4182 - accuracy:
0.8309
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2500 - accuracy:
0.9125
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1989 - accuracy:
0.9311
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1716 - accuracy:
0.9411
782/782 [==============================] - 1s 639us/step - loss: 0.2899 -
accuracy: 0.8846
Epoch 1/4
49/49 [==============================] - 2s 25ms/step - loss: 0.1597 - accuracy:
0.7812
Epoch 2/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0867 - accuracy:
0.8962
Epoch 3/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0682 - accuracy:
0.9194
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0565 - accuracy:
```

```
0.9353
782/782 [==============================] - 1s 584us/step - loss: 0.0834 -
accuracy: 0.8872
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.4849 - accuracy:
0.7860
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2951 - accuracy:
0.8918
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2319 - accuracy:
0.9180
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1965 - accuracy:
0.9316
782/782 [==============================] - 1s 715us/step - loss: 0.2754 -
accuracy: 0.8883
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1476 - accuracy:
0.8052
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0879 - accuracy:
0.8958
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0696 - accuracy:
0.9172
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0593 - accuracy:
0.9299
782/782 [==============================] - 1s 647us/step - loss: 0.0853 -
accuracy: 0.8850
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.4592 - accuracy:
0.8028
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2957 - accuracy:
0.8910
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2390 - accuracy:
0.9128
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2042 - accuracy:
0.9269
782/782 [==============================] - 1s 656us/step - loss: 0.2737 -
accuracy: 0.8908
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1140 - accuracy:
0.8380
```

```
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0505 - accuracy:
0.9385
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0315 - accuracy:
0.9668
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0177 - accuracy:
0.9849
782/782 [==============================] - 1s 639us/step - loss: 0.1074 -
accuracy: 0.8685
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.3583 - accuracy:
0.8404
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1585 - accuracy:
0.9439
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0972 - accuracy:
0.9716
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0531 - accuracy:
0.9898
782/782 [==============================] - 1s 662us/step - loss: 0.3430 -
accuracy: 0.8662
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1062 - accuracy:
0.8522
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0502 - accuracy:
0.9384
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0282 - accuracy:
0.9698
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0153 - accuracy:
0.9863
782/782 [==============================] - 1s 624us/step - loss: 0.1133 -
accuracy: 0.8560
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.3404 - accuracy:
0.8547
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1765 - accuracy:
0.9344
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1066 - accuracy:
0.9661
```

```
Epoch 4/4
49/49 [==============================] - 1s 18ms/step - loss: 0.0602 - accuracy:
0.9850
782/782 [==============================] - 1s 657us/step - loss: 0.3460 -
accuracy: 0.8578
Epoch 1/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0987 -
accuracy: 0.8682
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0543 -
accuracy: 0.9297
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0412 -
accuracy: 0.9502
Epoch 4/4
196/196 [==============================] - 2s 10ms/step - loss: 0.0330 -
accuracy: 0.9618
782/782 [==============================] - 1s 871us/step - loss: 0.1073 -
accuracy: 0.8649
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.3210 -
accuracy: 0.8680
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1859 -
accuracy: 0.9306
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1430 -
accuracy: 0.9470
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1194 -
accuracy: 0.9561
782/782 [==============================] - 1s 953us/step - loss: 0.4228 -
accuracy: 0.8616
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.1013 -
accuracy: 0.8641
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0590 -
accuracy: 0.9251
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0470 -
accuracy: 0.9414
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0388 -
accuracy: 0.9529
782/782 [==============================] - 1s 872us/step - loss: 0.1074 -
accuracy: 0.8640
Epoch 1/4
```

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196/196 [==============================] - 3s 11ms/step - loss: 0.3276 -
accuracy: 0.8660
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.2019 -
accuracy: 0.9223
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1668 -
accuracy: 0.9377
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1432 -
accuracy: 0.9458
782/782 [==============================] - 1s 937us/step - loss: 0.3580 -
accuracy: 0.8687
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.1050 -
accuracy: 0.8604 1s - loss:
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0587 -
accuracy: 0.9262
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0459 -
accuracy: 0.9441 0s - loss: 0.0459 - accuracy:
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0373 -
accuracy: 0.9561
782/782 [==============================] - 1s 985us/step - loss: 0.0994 -
accuracy: 0.8700
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.3368 -
accuracy: 0.8602
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.2023 -
accuracy: 0.9224
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1605 -
accuracy: 0.9411
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1358 -
accuracy: 0.9507
782/782 [==============================] - 1s 878us/step - loss: 0.3712 -
accuracy: 0.8692
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1055 -
accuracy: 0.8593
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0633 -
accuracy: 0.9175
Epoch 3/4
```

```
196/196 [==============================] - 2s 11ms/step - loss: 0.0519 -
accuracy: 0.9330
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0454 -
accuracy: 0.9422
782/782 [==============================] - 1s 747us/step - loss: 0.0927 -
accuracy: 0.8774
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.3368 -
accuracy: 0.8589
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.2150 -
accuracy: 0.9168
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1812 -
accuracy: 0.9315
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1627 -
accuracy: 0.9402
782/782 [==============================] - 1s 750us/step - loss: 0.3239 -
accuracy: 0.8778
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.1100 -
accuracy: 0.8549
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0616 -
accuracy: 0.9211
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0475 -
accuracy: 0.9425
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0389 -
accuracy: 0.9541
782/782 [==============================] - 1s 929us/step - loss: 0.1046 -
accuracy: 0.8668
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.3383 -
accuracy: 0.8612
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1841 -
accuracy: 0.9293
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1515 -
accuracy: 0.9422
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1192 -
accuracy: 0.9541
782/782 [==============================] - 1s 867us/step - loss: 0.4779 -
```

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accuracy: 0.8372
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.1098 -
accuracy: 0.8553
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0651 -
accuracy: 0.9146
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0503 -
accuracy: 0.9360
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0420 -
accuracy: 0.9476
782/782 [==============================] - 1s 969us/step - loss: 0.1032 -
accuracy: 0.8665
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.3353 -
accuracy: 0.8599
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.2053 -
accuracy: 0.9194
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1637 -
accuracy: 0.9388
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1391 -
accuracy: 0.9488
782/782 [==============================] - 1s 1ms/step - loss: 0.3595 -
accuracy: 0.8674
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.1194 - accuracy:
0.8488
Epoch 2/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0600 - accuracy:
0.9281
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0453 - accuracy:
0.9497
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0363 - accuracy:
0.9618
782/782 [==============================] - 1s 713us/step - loss: 0.0923 -
accuracy: 0.8749
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.3889 - accuracy:
0.8384
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.2124 - accuracy:
```

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0.9233
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1632 - accuracy:
0.9437
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1319 - accuracy:
0.9551
782/782 [==============================] - 1s 904us/step - loss: 0.3267 -
accuracy: 0.8753
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1376 - accuracy:
0.8159
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0710 - accuracy:
0.9122
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0535 - accuracy:
0.9331
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0442 - accuracy:
0.9458
782/782 [==============================] - 1s 802us/step - loss: 0.0904 -
accuracy: 0.8785
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.4088 - accuracy:
0.8306
Epoch 2/4
49/49 [==============================] - 1s 27ms/step - loss: 0.2330 - accuracy:
0.9135
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1817 - accuracy:
0.9323
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1525 - accuracy:
0.9444
782/782 [==============================] - 1s 767us/step - loss: 0.3595 -
accuracy: 0.8648
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1291 - accuracy:
0.8319
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0682 - accuracy:
0.9183
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0528 - accuracy:
0.9384
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0439 - accuracy:
```

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0.9506
782/782 [==============================] - 1s 969us/step - loss: 0.0872 -
accuracy: 0.8826
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.4030 - accuracy:
0.8324
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.2287 - accuracy:
0.9178
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1802 - accuracy:
0.9366
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1508 - accuracy:
0.9480
782/782 [==============================] - 1s 833us/step - loss: 0.3017 -
accuracy: 0.8814
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1345 - accuracy:
0.8206
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0736 - accuracy:
0.9102
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0590 - accuracy:
0.9258
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0494 - accuracy:
0.9382
782/782 [==============================] - 1s 815us/step - loss: 0.0872 -
accuracy: 0.8824
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.4099 - accuracy:
0.8280
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.2483 - accuracy:
0.9078
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1959 - accuracy:
0.9278
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1726 - accuracy:
0.9367
782/782 [==============================] - 1s 905us/step - loss: 0.2957 -
accuracy: 0.8824
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1156 - accuracy:
0.8438
```

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Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0574 - accuracy:
0.9293
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0427 - accuracy:
0.9501
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0357 - accuracy:
0.9599
782/782 [==============================] - 1s 877us/step - loss: 0.0986 -
accuracy: 0.8641
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.3702 - accuracy:
0.8436
Epoch 2/4
49/49 [==============================] - 2s 35ms/step - loss: 0.1702 - accuracy:
0.9362
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1335 - accuracy:
0.9529
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1117 - accuracy:
0.9604
782/782 [==============================] - 1s 988us/step - loss: 0.3309 -
accuracy: 0.8604
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.1143 - accuracy:
0.8438
Epoch 2/4
49/49 [==============================] - 2s 35ms/step - loss: 0.0621 - accuracy:
0.9202
Epoch 3/4
49/49 [==============================] - 2s 36ms/step - loss: 0.0474 - accuracy:
0.9422
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0397 - accuracy:
0.9530
782/782 [==============================] - 1s 978us/step - loss: 0.1070 -
accuracy: 0.8528
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.3715 - accuracy:
0.8493
Epoch 2/4
49/49 [==============================] - 1s 31ms/step - loss: 0.1968 - accuracy:
0.9264
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1570 - accuracy:
0.9411
```

```
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1294 - accuracy:
0.9520
782/782 [==============================] - 1s 1ms/step - loss: 0.3311 -
accuracy: 0.8580
Epoch 1/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1019 -
accuracy: 0.8667
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0557 -
accuracy: 0.9293
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0415 -
accuracy: 0.9522
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0319 -
accuracy: 0.9641
782/782 [==============================] - 1s 719us/step - loss: 0.1001 -
accuracy: 0.8688
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.3303 -
accuracy: 0.8654
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1872 -
accuracy: 0.9297
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1447 -
accuracy: 0.9473
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1108 -
accuracy: 0.9602
782/782 [==============================] - 1s 921us/step - loss: 0.3953 -
accuracy: 0.8654
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.1033 -
accuracy: 0.8638
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0597 -
accuracy: 0.9242
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0466 -
accuracy: 0.9411
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0386 -
accuracy: 0.9527
782/782 [==============================] - 1s 860us/step - loss: 0.1058 -
accuracy: 0.8629
Epoch 1/4
```

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196/196 [==============================] - 3s 12ms/step - loss: 0.3322 -
accuracy: 0.8660
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.2050 -
accuracy: 0.9215
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1664 -
accuracy: 0.9366
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1377 -
accuracy: 0.9492
782/782 [==============================] - 1s 835us/step - loss: 0.4008 -
accuracy: 0.8587
Epoch 1/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1175 -
accuracy: 0.8426
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0633 -
accuracy: 0.9198
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0481 -
accuracy: 0.9409
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0370 -
accuracy: 0.9578
782/782 [==============================] - 1s 753us/step - loss: 0.0896 -
accuracy: 0.8784
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.3601 -
accuracy: 0.8483
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.2093 -
accuracy: 0.9205
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1565 -
accuracy: 0.9445 0s - loss: 0.1516
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1227 -
accuracy: 0.9568
782/782 [==============================] - 1s 904us/step - loss: 0.3204 -
accuracy: 0.8786
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.1131 -
accuracy: 0.8526
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0655 -
accuracy: 0.9166
Epoch 3/4
```

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196/196 [==============================] - 2s 11ms/step - loss: 0.0526 -
accuracy: 0.9327
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0441 -
accuracy: 0.9441
782/782 [==============================] - 1s 787us/step - loss: 0.0875 -
accuracy: 0.8831
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.3596 -
accuracy: 0.8510
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.2250 -
accuracy: 0.9134
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1877 -
accuracy: 0.9302
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1631 -
accuracy: 0.9410
782/782 [==============================] - 1s 812us/step - loss: 0.3218 -
accuracy: 0.8826
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.1017 -
accuracy: 0.8600
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0468 -
accuracy: 0.9417
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0238 -
accuracy: 0.9749
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0118 -
accuracy: 0.9891
782/782 [==============================] - 1s 1ms/step - loss: 0.1048 -
accuracy: 0.8615
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.3255 -
accuracy: 0.8593
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1488 -
accuracy: 0.9462
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0646 -
accuracy: 0.9806
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0194 -
accuracy: 0.9974
782/782 [==============================] - 1s 1ms/step - loss: 0.4375 -
```

```
accuracy: 0.8615
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1018 -
accuracy: 0.8593
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0538 -
accuracy: 0.9303
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0279 -
accuracy: 0.9686
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0140 -
accuracy: 0.9860
782/782 [==============================] - 1s 820us/step - loss: 0.1015 -
accuracy: 0.8642
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.3263 -
accuracy: 0.8615
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1802 -
accuracy: 0.9315
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0909 -
accuracy: 0.9680
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0337 -
accuracy: 0.9912
782/782 [==============================] - 1s 901us/step - loss: 0.4214 -
accuracy: 0.8622
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.1265 - accuracy:
0.8398
Epoch 2/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0626 - accuracy:
0.9258
Epoch 3/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0478 - accuracy:
0.9460
Epoch 4/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0385 - accuracy:
0.9587
782/782 [==============================] - 1s 820us/step - loss: 0.0931 -
accuracy: 0.8738
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.3944 - accuracy:
0.8391
Epoch 2/4
49/49 [==============================] - 1s 27ms/step - loss: 0.2100 - accuracy:
```

```
0.9249
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1630 - accuracy:
0.9445
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1342 - accuracy:
0.9554
782/782 [==============================] - 1s 863us/step - loss: 0.3214 -
accuracy: 0.8758
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1342 - accuracy:
0.8215
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0711 - accuracy:
0.9143
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0559 - accuracy:
0.9318
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0464 - accuracy:
0.9447
782/782 [==============================] - 1s 924us/step - loss: 0.0879 -
accuracy: 0.8811
Epoch 1/4
49/49 [==============================] - 3s 39ms/step - loss: 0.4020 - accuracy:
0.8368
Epoch 2/4
49/49 [==============================] - 2s 37ms/step - loss: 0.2389 - accuracy:
0.9140
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1896 - accuracy:
0.9324
Epoch 4/4
49/49 [==============================] - 1s 26ms/step - loss: 0.1598 - accuracy:
0.9439
782/782 [==============================] - 1s 912us/step - loss: 0.2995 -
accuracy: 0.8817
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.1459 - accuracy:
0.8042
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0761 - accuracy:
0.9070
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0581 - accuracy:
0.9313
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0479 - accuracy:
```

```
0.9447
782/782 [==============================] - 1s 899us/step - loss: 0.0845 -
accuracy: 0.8866
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.4454 - accuracy:
0.8084
Epoch 2/4
49/49 [==============================] - 1s 27ms/step - loss: 0.2560 - accuracy:
0.9053
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.2011 - accuracy:
0.9276
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1656 - accuracy:
0.9399
782/782 [==============================] - 1s 763us/step - loss: 0.2825 -
accuracy: 0.8860
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1433 - accuracy:
0.8058
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0815 - accuracy:
0.9005
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0637 - accuracy:
0.9216
Epoch 4/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0539 - accuracy:
0.9348
782/782 [==============================] - 1s 949us/step - loss: 0.0830 -
accuracy: 0.8868
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.4387 - accuracy:
0.8084
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.2716 - accuracy:
0.9002
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.2183 - accuracy:
0.9194
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1823 - accuracy:
0.9334
782/782 [==============================] - 1s 812us/step - loss: 0.2779 -
accuracy: 0.8885
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.1119 - accuracy:
0.8431
```

```
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0429 - accuracy:
0.9495
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0221 - accuracy:
0.9784
Epoch 4/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0110 - accuracy:
0.9906
782/782 [==============================] - 1s 957us/step - loss: 0.1083 -
accuracy: 0.8676
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.3466 - accuracy:
0.8494
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.1444 - accuracy:
0.9504
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0759 - accuracy:
0.9800
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0314 - accuracy:
0.9958
782/782 [==============================] - 1s 1ms/step - loss: 0.3389 -
accuracy: 0.8650
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1049 - accuracy:
0.8546
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0473 - accuracy:
0.9410
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0237 - accuracy:
0.9743
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0109 - accuracy:
0.9898
782/782 [==============================] - 1s 876us/step - loss: 0.1094 -
accuracy: 0.8591
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.3353 - accuracy:
0.8561
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.1650 - accuracy:
0.9385
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0851 - accuracy:
0.9732
```

```
Epoch 4/4
49/49 [==============================] - 1s 26ms/step - loss: 0.0344 - accuracy:
0.9926
782/782 [==============================] - 1s 899us/step - loss: 0.3399 -
accuracy: 0.8598
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1060 -
accuracy: 0.8632
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0552 -
accuracy: 0.9292
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0416 -
accuracy: 0.9492
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0327 -
accuracy: 0.9619
782/782 [==============================] - 1s 633us/step - loss: 0.1090 -
accuracy: 0.8651
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3402 -
accuracy: 0.8600
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1871 -
accuracy: 0.9285
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1391 -
accuracy: 0.9499
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1095 -
accuracy: 0.9641
782/782 [==============================] - 1s 580us/step - loss: 0.3952 -
accuracy: 0.8666
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1035 -
accuracy: 0.8653
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0586 -
accuracy: 0.9228
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0460 -
accuracy: 0.9424: 0s - loss: 0.0458 - accuracy: 0.94
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0385 -
accuracy: 0.9529
782/782 [==============================] - 1s 564us/step - loss: 0.1037 -
accuracy: 0.8675
Epoch 1/4
```

```
196/196 [==============================] - 1s 5ms/step - loss: 0.3251 -
accuracy: 0.8644
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1997 -
accuracy: 0.9256
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1642 -
accuracy: 0.9382
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1402 -
accuracy: 0.9486
782/782 [==============================] - 1s 600us/step - loss: 0.3504 -
accuracy: 0.8688
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1335 -
accuracy: 0.8227
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0729 -
accuracy: 0.9084
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0582 -
accuracy: 0.9279
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0501 -
accuracy: 0.9397
782/782 [==============================] - 1s 665us/step - loss: 0.1008 -
accuracy: 0.8732
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.4151 -
accuracy: 0.8211
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2538 -
accuracy: 0.9077
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2070 -
accuracy: 0.9284
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1771 -
accuracy: 0.9384
782/782 [==============================] - 1s 684us/step - loss: 0.3613 -
accuracy: 0.8700
Epoch 1/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1299 -
accuracy: 0.8279
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0746 -
accuracy: 0.9064
Epoch 3/4
```

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196/196 [==============================] - 1s 4ms/step - loss: 0.0614 -
accuracy: 0.9231
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0533 -
accuracy: 0.9331
782/782 [==============================] - 1s 680us/step - loss: 0.1060 -
accuracy: 0.8676
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.4233 -
accuracy: 0.8173
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2584 -
accuracy: 0.9044
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2173 -
accuracy: 0.9230
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1919 -
accuracy: 0.9342
782/782 [==============================] - 1s 648us/step - loss: 0.3176 -
accuracy: 0.8815
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1041 -
accuracy: 0.8537
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0535 -
accuracy: 0.9324
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0389 -
accuracy: 0.9530
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0282 -
accuracy: 0.9681
782/782 [==============================] - 1s 760us/step - loss: 0.1104 -
accuracy: 0.8569
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.3391 -
accuracy: 0.8554
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1812 -
accuracy: 0.9309
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1305 -
accuracy: 0.9508
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0925 -
accuracy: 0.9659
782/782 [==============================] - 1s 687us/step - loss: 0.4108 -
```

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accuracy: 0.8623
Epoch 1/4
196/196 [==============================] - 2s 5ms/step - loss: 0.1040 -
accuracy: 0.8557
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0591 -
accuracy: 0.9217
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0442 -
accuracy: 0.9434
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0332 -
accuracy: 0.9596
782/782 [==============================] - 1s 672us/step - loss: 0.1033 -
accuracy: 0.8638
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3274 -
accuracy: 0.8596
Epoch 2/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1913 -
accuracy: 0.9242
Epoch 3/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1412 -
accuracy: 0.9458
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1003 -
accuracy: 0.9635
782/782 [==============================] - 1s 678us/step - loss: 0.3663 -
accuracy: 0.8660
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1416 - accuracy:
0.8200
Epoch 2/4
49/49 [==============================] - 1s 18ms/step - loss: 0.0659 - accuracy:
0.9209
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0472 - accuracy:
0.9447
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0363 - accuracy:
0.9602
782/782 [==============================] - 1s 637us/step - loss: 0.0940 -
accuracy: 0.8727
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4494 - accuracy:
0.8244
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2355 - accuracy:
```

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0.9143
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.1714 - accuracy:
0.9415
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1333 - accuracy:
0.9573
782/782 [==============================] - 1s 657us/step - loss: 0.3200 -
accuracy: 0.8758
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1372 - accuracy:
0.8245
Epoch 2/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0689 - accuracy:
0.9150
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0512 - accuracy:
0.9356
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0415 - accuracy:
0.9484
782/782 [==============================] - 1s 618us/step - loss: 0.0929 -
accuracy: 0.8772
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.4350 - accuracy:
0.8235
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.2387 - accuracy:
0.9136
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1798 - accuracy:
0.9346
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.1484 - accuracy:
0.9468
782/782 [==============================] - 1s 653us/step - loss: 0.3273 -
accuracy: 0.8766
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1853 - accuracy:
0.7458
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1021 - accuracy:
0.8874
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0743 - accuracy:
0.9156
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0587 - accuracy:
```

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0.9346
782/782 [==============================] - 1s 620us/step - loss: 0.0838 -
accuracy: 0.8866
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.5160 - accuracy:
0.7704
Epoch 2/4
49/49 [==============================] - 1s 18ms/step - loss: 0.3142 - accuracy:
0.8930
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2404 - accuracy:
0.9206
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2001 - accuracy:
0.9356
782/782 [==============================] - 1s 592us/step - loss: 0.2877 -
accuracy: 0.8862
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1561 - accuracy:
0.7966
Epoch 2/4
49/49 [==============================] - 1s 16ms/step - loss: 0.0913 - accuracy:
0.8938
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0693 - accuracy:
0.9165
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0576 - accuracy:
0.9311
782/782 [==============================] - 1s 608us/step - loss: 0.0856 -
accuracy: 0.8862
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.4789 - accuracy:
0.7966
Epoch 2/4
49/49 [==============================] - 1s 16ms/step - loss: 0.3011 - accuracy:
0.8939
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.2380 - accuracy:
0.9160
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.2052 - accuracy:
0.9289
782/782 [==============================] - 1s 586us/step - loss: 0.2960 -
accuracy: 0.8848
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1168 - accuracy:
0.8335
```

```
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0529 - accuracy:
0.9346
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0373 - accuracy:
0.9573
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0282 - accuracy:
0.9702
782/782 [==============================] - 1s 646us/step - loss: 0.1023 -
accuracy: 0.8610
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.3731 - accuracy:
0.8334
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1797 - accuracy:
0.9352
Epoch 3/4
49/49 [==============================] - 1s 16ms/step - loss: 0.1253 - accuracy:
0.9579
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0897 - accuracy:
0.9722
782/782 [==============================] - 1s 658us/step - loss: 0.3289 -
accuracy: 0.8658
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1107 - accuracy:
0.8458
Epoch 2/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0560 - accuracy:
0.9278
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0401 - accuracy:
0.9513
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0309 - accuracy:
0.9638
782/782 [==============================] - 1s 721us/step - loss: 0.1322 -
accuracy: 0.8204
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.3508 - accuracy:
0.8467
Epoch 2/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1794 - accuracy:
0.9324
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.1292 - accuracy:
0.9526
```

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Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0972 - accuracy:
0.9648
782/782 [==============================] - 1s 717us/step - loss: 0.3375 -
accuracy: 0.8629
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1218 -
accuracy: 0.8456
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0584 -
accuracy: 0.9268
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0425 -
accuracy: 0.9500
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0334 -
accuracy: 0.9620
782/782 [==============================] - 1s 716us/step - loss: 0.1007 -
accuracy: 0.8697
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3586 -
accuracy: 0.8548
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1958 -
accuracy: 0.9270
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1440 -
accuracy: 0.9483
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1120 -
accuracy: 0.9598
782/782 [==============================] - 1s 664us/step - loss: 0.3933 -
accuracy: 0.8656
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1095 -
accuracy: 0.8593
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0606 -
accuracy: 0.9213
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0477 -
accuracy: 0.9402
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0391 -
accuracy: 0.9532
782/782 [==============================] - 1s 632us/step - loss: 0.0973 -
accuracy: 0.8724
Epoch 1/4
```

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196/196 [==============================] - 1s 5ms/step - loss: 0.3648 -
accuracy: 0.8568
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2112 -
accuracy: 0.9203
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1707 -
accuracy: 0.9371
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1465 -
accuracy: 0.9464
782/782 [==============================] - 1s 608us/step - loss: 0.3608 -
accuracy: 0.8711
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1778 -
accuracy: 0.7378
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1019 -
accuracy: 0.8688
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0806 -
accuracy: 0.8960
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0675 -
accuracy: 0.9131
782/782 [==============================] - 1s 577us/step - loss: 0.0866 -
accuracy: 0.8856
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.5609 -
accuracy: 0.7095
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.3611 -
accuracy: 0.8626
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2846 -
accuracy: 0.8954
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2529 -
accuracy: 0.9093
782/782 [==============================] - 1s 589us/step - loss: 0.3148 -
accuracy: 0.8794
Epoch 1/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1980 -
accuracy: 0.7458
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1342 -
accuracy: 0.8666: 0s - loss: 0.1396 - accuracy:
Epoch 3/4
```

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196/196 [==============================] - 1s 4ms/step - loss: 0.1026 -
accuracy: 0.8868
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0877 -
accuracy: 0.9002
782/782 [==============================] - 1s 714us/step - loss: 0.0974 -
accuracy: 0.8766
Epoch 1/4
196/196 [==============================] - 1s 4ms/step - loss: 0.5182 -
accuracy: 0.7566
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.3550 -
accuracy: 0.8653
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2979 -
accuracy: 0.8928
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2771 -
accuracy: 0.9040
782/782 [==============================] - 1s 691us/step - loss: 0.3049 -
accuracy: 0.8874
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1178 -
accuracy: 0.8346
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0533 -
accuracy: 0.9332
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0348 -
accuracy: 0.9590
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0240 -
accuracy: 0.9729
782/782 [==============================] - 1s 697us/step - loss: 0.1061 -
accuracy: 0.8626
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3580 -
accuracy: 0.8429
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1667 -
accuracy: 0.9390
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0948 -
accuracy: 0.9690
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0476 -
accuracy: 0.9865
782/782 [==============================] - 1s 731us/step - loss: 0.4536 -
```

```
accuracy: 0.8545
Epoch 1/4
196/196 [==============================] - 2s 5ms/step - loss: 0.1115 -
accuracy: 0.8421
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0560 -
accuracy: 0.9287
Epoch 3/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0344 -
accuracy: 0.9584
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0222 -
accuracy: 0.9747
782/782 [==============================] - 1s 763us/step - loss: 0.1044 -
accuracy: 0.8638
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3480 -
accuracy: 0.8465
Epoch 2/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1826 -
accuracy: 0.9309
Epoch 3/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1136 -
accuracy: 0.9595
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0684 -
accuracy: 0.9785
782/782 [==============================] - 1s 687us/step - loss: 0.4174 -
accuracy: 0.8607
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1802 - accuracy:
0.7725
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0805 - accuracy:
0.9104
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0558 - accuracy:
0.9367
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0434 - accuracy:
0.9526
782/782 [==============================] - 1s 560us/step - loss: 0.0871 -
accuracy: 0.8824
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.5433 - accuracy:
0.7660
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2903 - accuracy:
```

```
0.9058
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1977 - accuracy:
0.9324
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1540 - accuracy:
0.9487
782/782 [==============================] - 1s 639us/step - loss: 0.3035 -
accuracy: 0.8799
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1617 - accuracy:
0.8038
Epoch 2/4
49/49 [==============================] - 1s 16ms/step - loss: 0.0803 - accuracy:
0.9093
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0602 - accuracy:
0.9288
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0480 - accuracy:
0.9442
782/782 [==============================] - 1s 627us/step - loss: 0.0903 -
accuracy: 0.8774
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4599 - accuracy:
0.8204
Epoch 2/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2680 - accuracy:
0.9084
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.2059 - accuracy:
0.9281
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1705 - accuracy:
0.9399
782/782 [==============================] - 1s 692us/step - loss: 0.3654 -
accuracy: 0.8570
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.2109 - accuracy:
0.6696
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1401 - accuracy:
0.8286
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1058 - accuracy:
0.8744
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0840 - accuracy:
```

```
0.9044
782/782 [==============================] - 1s 662us/step - loss: 0.0835 -
accuracy: 0.8878
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.6145 - accuracy:
0.6584
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.4531 - accuracy:
0.8042
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.3628 - accuracy:
0.8614
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.3036 - accuracy:
0.8880
782/782 [==============================] - 1s 702us/step - loss: 0.2758 -
accuracy: 0.8906
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.2072 - accuracy:
0.6806
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1454 - accuracy:
0.8136
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.1111 - accuracy:
0.8626
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0916 - accuracy:
0.8904
782/782 [==============================] - 1s 593us/step - loss: 0.0827 -
accuracy: 0.8882
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.6150 - accuracy:
0.6515
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.4671 - accuracy:
0.7942
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.3790 - accuracy:
0.8525
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.3150 - accuracy:
0.8859
782/782 [==============================] - 1s 568us/step - loss: 0.2798 -
accuracy: 0.8890
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1375 - accuracy:
0.8076
```

```
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0584 - accuracy:
0.9303
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0357 - accuracy:
0.9629
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0211 - accuracy:
0.9808
782/782 [==============================] - 1s 679us/step - loss: 0.1123 -
accuracy: 0.8673
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4322 - accuracy:
0.7969
Epoch 2/4
49/49 [==============================] - 1s 18ms/step - loss: 0.1887 - accuracy:
0.9328
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1141 - accuracy:
0.9637
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0656 - accuracy:
0.9850
782/782 [==============================] - 1s 721us/step - loss: 0.3701 -
accuracy: 0.8445
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1293 - accuracy:
0.8172
Epoch 2/4
49/49 [==============================] - 1s 16ms/step - loss: 0.0564 - accuracy:
0.9305
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0328 - accuracy:
0.9642
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0188 - accuracy:
0.9807
782/782 [==============================] - 1s 667us/step - loss: 0.1202 -
accuracy: 0.8586
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.3827 - accuracy:
0.8322
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1837 - accuracy:
0.9318
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.1128 - accuracy:
0.9642
```

```
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0648 - accuracy:
0.9824
782/782 [==============================] - 1s 674us/step - loss: 0.3326 -
accuracy: 0.8638
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1007 -
accuracy: 0.8597: 1s - loss: 0.125
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0535 -
accuracy: 0.9320
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0409 -
accuracy: 0.9494
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0348 -
accuracy: 0.9586
782/782 [==============================] - 1s 670us/step - loss: 0.1103 -
accuracy: 0.8651
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.3237 -
accuracy: 0.8622
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1807 -
accuracy: 0.9300
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1376 -
accuracy: 0.9485
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1038 -
accuracy: 0.9609
782/782 [==============================] - 1s 713us/step - loss: 0.4474 -
accuracy: 0.8544
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1014 -
accuracy: 0.8617
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0595 -
accuracy: 0.9212
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0472 -
accuracy: 0.9396
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0391 -
accuracy: 0.9523
782/782 [==============================] - 1s 611us/step - loss: 0.1074 -
accuracy: 0.8652
Epoch 1/4
```

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196/196 [==============================] - 2s 7ms/step - loss: 0.3238 -
accuracy: 0.8660
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2005 -
accuracy: 0.9207
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1620 -
accuracy: 0.9409
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1390 -
accuracy: 0.9492
782/782 [==============================] - 1s 677us/step - loss: 0.3629 -
accuracy: 0.8649
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1173 -
accuracy: 0.8385
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0660 -
accuracy: 0.9144
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0536 -
accuracy: 0.9325
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0466 -
accuracy: 0.9422
782/782 [==============================] - 1s 631us/step - loss: 0.1012 -
accuracy: 0.8734
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.3752 -
accuracy: 0.8361
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.2272 -
accuracy: 0.9154
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1839 -
accuracy: 0.9325: 2s
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1542 -
accuracy: 0.9446
782/782 [==============================] - 1s 733us/step - loss: 0.3686 -
accuracy: 0.8690
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1182 -
accuracy: 0.8399
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0694 -
accuracy: 0.9108
Epoch 3/4
```

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196/196 [==============================] - 1s 6ms/step - loss: 0.0578 -
accuracy: 0.9252
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0514 -
accuracy: 0.9347
782/782 [==============================] - 1s 643us/step - loss: 0.0949 -
accuracy: 0.8782
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3649 -
accuracy: 0.8418
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2358 -
accuracy: 0.9107
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2011 -
accuracy: 0.9261
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1794 -
accuracy: 0.9348
782/782 [==============================] - 1s 768us/step - loss: 0.3196 -
accuracy: 0.8791
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1024 -
accuracy: 0.8573
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0497 -
accuracy: 0.9375
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0319 -
accuracy: 0.9640
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0204 -
accuracy: 0.9791
782/782 [==============================] - 1s 711us/step - loss: 0.1038 -
accuracy: 0.8638
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.3246 -
accuracy: 0.8627
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1573 -
accuracy: 0.9400: 1s - loss: 0
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0963 -
accuracy: 0.9642
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0592 -
accuracy: 0.9819
782/782 [==============================] - 1s 702us/step - loss: 0.4226 -
```

```
accuracy: 0.8656
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1002 -
accuracy: 0.8608
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0563 -
accuracy: 0.9262
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0381 -
accuracy: 0.9536
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0258 -
accuracy: 0.9706
782/782 [==============================] - 1s 736us/step - loss: 0.1009 -
accuracy: 0.8644
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.3194 -
accuracy: 0.8628
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1784 -
accuracy: 0.9299
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1170 -
accuracy: 0.9568
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0780 -
accuracy: 0.9742
782/782 [==============================] - 1s 813us/step - loss: 0.3729 -
accuracy: 0.8634
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1213 - accuracy:
0.8386
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0556 - accuracy:
0.9296
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0394 - accuracy:
0.9538
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0299 - accuracy:
0.9667
782/782 [==============================] - 1s 611us/step - loss: 0.1018 -
accuracy: 0.8706
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.4023 - accuracy:
0.8349
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1990 - accuracy:
```

```
0.9243
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1451 - accuracy:
0.9496
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1124 - accuracy:
0.9636
782/782 [==============================] - 1s 702us/step - loss: 0.3885 -
accuracy: 0.86850s - loss: 0.3895 - accura
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1307 - accuracy:
0.8198
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0653 - accuracy:
0.9144
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0507 - accuracy:
0.9352
Epoch 4/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0437 - accuracy:
0.9448
782/782 [==============================] - 1s 636us/step - loss: 0.1094 -
accuracy: 0.8595
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.4109 - accuracy:
0.8216
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2237 - accuracy:
0.9143
Epoch 3/4
49/49 [==============================] - 1s 18ms/step - loss: 0.1760 - accuracy:
0.9347
Epoch 4/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1494 - accuracy:
0.9450
782/782 [==============================] - 1s 648us/step - loss: 0.3319 -
accuracy: 0.8757
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1599 - accuracy:
0.7792
Epoch 2/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0769 - accuracy:
0.9040
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0574 - accuracy:
0.9296
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0473 - accuracy:
```

```
0.9423
782/782 [==============================] - 1s 663us/step - loss: 0.0901 -
accuracy: 0.8804
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.4405 - accuracy:
0.8065
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.2456 - accuracy:
0.9074
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1949 - accuracy:
0.9282
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1607 - accuracy:
0.9428
782/782 [==============================] - 1s 684us/step - loss: 0.3341 -
accuracy: 0.8781
Epoch 1/4
49/49 [==============================] - 2s 25ms/step - loss: 0.1445 - accuracy:
0.8002
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0773 - accuracy:
0.9031
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0628 - accuracy:
0.9200
Epoch 4/4
49/49 [==============================] - 1s 18ms/step - loss: 0.0546 - accuracy:
0.9306
782/782 [==============================] - 1s 647us/step - loss: 0.0962 -
accuracy: 0.8750
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.4507 - accuracy:
0.8006
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2684 - accuracy:
0.8993
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2167 - accuracy:
0.9184
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1889 - accuracy:
0.9313
782/782 [==============================] - 1s 695us/step - loss: 0.3404 -
accuracy: 0.8715
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1108 - accuracy:
0.8441
```

```
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0466 - accuracy:
0.9432
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0311 - accuracy:
0.9651
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0215 - accuracy:
0.9786
782/782 [==============================] - 1s 719us/step - loss: 0.0976 -
accuracy: 0.8658
Epoch 1/4
49/49 [==============================] - 2s 25ms/step - loss: 0.3560 - accuracy:
0.8416
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1554 - accuracy:
0.9443
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1016 - accuracy:
0.9659
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0704 - accuracy:
0.9784
782/782 [==============================] - 1s 770us/step - loss: 0.3361 -
accuracy: 0.8658
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1082 - accuracy:
0.8485
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0499 - accuracy:
0.9382
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0337 - accuracy:
0.9612
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0233 - accuracy:
0.9743
782/782 [==============================] - 1s 736us/step - loss: 0.1006 -
accuracy: 0.8609
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.3369 - accuracy:
0.8556
Epoch 2/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1635 - accuracy:
0.9361
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1087 - accuracy:
0.9602
```

```
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0725 - accuracy:
0.9762
782/782 [==============================] - 1s 752us/step - loss: 0.3550 -
accuracy: 0.8578
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1082 -
accuracy: 0.8600
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0546 -
accuracy: 0.9300
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0396 -
accuracy: 0.9530
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0298 -
accuracy: 0.9670
782/782 [==============================] - 1s 649us/step - loss: 0.1061 -
accuracy: 0.8674
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.3442 -
accuracy: 0.8575
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1877 -
accuracy: 0.9301
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1348 -
accuracy: 0.9501
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0946 -
accuracy: 0.9668
782/782 [==============================] - 1s 655us/step - loss: 0.4472 -
accuracy: 0.8588
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1075 -
accuracy: 0.8576
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0599 -
accuracy: 0.9221
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0461 -
accuracy: 0.9420
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0365 -
accuracy: 0.9552
782/782 [==============================] - 1s 642us/step - loss: 0.0987 -
accuracy: 0.8719
Epoch 1/4
```

```
196/196 [==============================] - 2s 7ms/step - loss: 0.3401 -
accuracy: 0.8611
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2062 -
accuracy: 0.9214
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1641 -
accuracy: 0.9389
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1293 -
accuracy: 0.9526
782/782 [==============================] - 1s 640us/step - loss: 0.3713 -
accuracy: 0.8712
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1469 -
accuracy: 0.7926
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0774 -
accuracy: 0.9019
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0588 -
accuracy: 0.9267
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0489 -
accuracy: 0.9401
782/782 [==============================] - 1s 652us/step - loss: 0.0910 -
accuracy: 0.8832
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.4610 -
accuracy: 0.7789
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.2561 -
accuracy: 0.9037
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.2013 -
accuracy: 0.9250
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1595 -
accuracy: 0.9444
782/782 [==============================] - 1s 687us/step - loss: 0.3183 -
accuracy: 0.8806
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1506 -
accuracy: 0.7891: 0s - loss: 0.2054 -
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0812 -
accuracy: 0.8955
Epoch 3/4
```

```
196/196 [==============================] - 1s 6ms/step - loss: 0.0651 -
accuracy: 0.9156
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0548 -
accuracy: 0.9322
782/782 [==============================] - 1s 674us/step - loss: 0.0897 -
accuracy: 0.8850
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.4586 -
accuracy: 0.7918
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2812 -
accuracy: 0.8973
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2339 -
accuracy: 0.9179
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2071 -
accuracy: 0.9285
782/782 [==============================] - 1s 660us/step - loss: 0.3417 -
accuracy: 0.8812
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1092 -
accuracy: 0.8462
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0457 -
accuracy: 0.9430
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0246 -
accuracy: 0.9740
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0129 -
accuracy: 0.9882
782/782 [==============================] - 1s 793us/step - loss: 0.1074 -
accuracy: 0.8604
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.3463 -
accuracy: 0.8458
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1522 -
accuracy: 0.9458
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0728 -
accuracy: 0.9766
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0349 -
accuracy: 0.9910
782/782 [==============================] - 1s 752us/step - loss: 0.4793 -
```

```
accuracy: 0.8567
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1062 -
accuracy: 0.8518
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0505 -
accuracy: 0.9344
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0269 -
accuracy: 0.9678
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0145 -
accuracy: 0.9838
782/782 [==============================] - 1s 768us/step - loss: 0.1094 -
accuracy: 0.8582
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.3375 -
accuracy: 0.8535
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1628 -
accuracy: 0.9392
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0837 -
accuracy: 0.9722
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0374 -
accuracy: 0.9892
782/782 [==============================] - 1s 689us/step - loss: 0.4863 -
accuracy: 0.8608
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1346 - accuracy:
0.8323
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0604 - accuracy:
0.9260
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0434 - accuracy:
0.9497
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0333 - accuracy:
0.9645
782/782 [==============================] - 1s 657us/step - loss: 0.0961 -
accuracy: 0.8718
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.4331 - accuracy:
0.8181
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.2110 - accuracy:
```

```
0.9219
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1501 - accuracy:
0.9479
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1156 - accuracy:
0.9611
782/782 [==============================] - 1s 630us/step - loss: 0.3633 -
accuracy: 0.8710
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1396 - accuracy:
0.8189
Epoch 2/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0724 - accuracy:
0.9096
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0566 - accuracy:
0.9298
Epoch 4/4
49/49 [==============================] - 1s 18ms/step - loss: 0.0452 - accuracy:
0.9439
782/782 [==============================] - 1s 603us/step - loss: 0.0870 -
accuracy: 0.8823
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.4215 - accuracy:
0.8168
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.2350 - accuracy:
0.9151
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1877 - accuracy:
0.9308
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1552 - accuracy:
0.9419
782/782 [==============================] - 1s 730us/step - loss: 0.3978 -
accuracy: 0.8547
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1865 - accuracy:
0.7242
Epoch 2/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1006 - accuracy:
0.8760
Epoch 3/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0723 - accuracy:
0.9113
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0566 - accuracy:
```

```
0.9336
782/782 [==============================] - 1s 696us/step - loss: 0.0843 -
accuracy: 0.8864
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.5986 - accuracy:
0.6684
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.3696 - accuracy:
0.8586
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2693 - accuracy:
0.9036
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2138 - accuracy:
0.9262
782/782 [==============================] - 1s 605us/step - loss: 0.2802 -
accuracy: 0.8878
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1776 - accuracy:
0.7476
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1024 - accuracy:
0.8763
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0766 - accuracy:
0.9070
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0620 - accuracy:
0.9248
782/782 [==============================] - 1s 597us/step - loss: 0.0824 -
accuracy: 0.8904
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.5264 - accuracy:
0.7472
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.3401 - accuracy:
0.8719
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2582 - accuracy:
0.9084
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2133 - accuracy:
0.9251
782/782 [==============================] - 1s 659us/step - loss: 0.3019 -
accuracy: 0.8836
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1269 - accuracy:
0.8184
```

```
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0480 - accuracy:
0.9431
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0257 - accuracy:
0.9745
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0133 - accuracy:
0.9894
782/782 [==============================] - 1s 721us/step - loss: 0.1187 -
accuracy: 0.8386
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.4077 - accuracy:
0.8112
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.1559 - accuracy:
0.9472
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0825 - accuracy:
0.9798
Epoch 4/4
49/49 [==============================] - 1s 20ms/step - loss: 0.0396 - accuracy:
0.9939
782/782 [==============================] - 1s 688us/step - loss: 0.4201 -
accuracy: 0.8042
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1108 - accuracy:
0.8431
Epoch 2/4
49/49 [==============================] - 1s 22ms/step - loss: 0.0470 - accuracy:
0.9417
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0244 - accuracy:
0.9741
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0122 - accuracy:
0.9891
782/782 [==============================] - 1s 713us/step - loss: 0.1151 -
accuracy: 0.8473
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.3610 - accuracy:
0.8408
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1555 - accuracy:
0.9450
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0772 - accuracy:
0.9769
```

```
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0325 - accuracy:
0.9930
782/782 [==============================] - 1s 696us/step - loss: 0.3596 -
accuracy: 0.8430
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1000 -
accuracy: 0.8651
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0542 -
accuracy: 0.9314
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0424 -
accuracy: 0.9475
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0329 -
accuracy: 0.9607
782/782 [==============================] - 1s 750us/step - loss: 0.1130 -
accuracy: 0.8634
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.3132 -
accuracy: 0.8684
Epoch 2/4
196/196 [==============================] - 2s 13ms/step - loss: 0.1802 -
accuracy: 0.9312
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1316 -
accuracy: 0.9493
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1005 -
accuracy: 0.9596
782/782 [==============================] - 1s 847us/step - loss: 0.4373 -
accuracy: 0.8603
Epoch 1/4
196/196 [==============================] - 3s 11ms/step - loss: 0.1019 -
accuracy: 0.8596
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0601 -
accuracy: 0.9219
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0483 -
accuracy: 0.9379
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0395 -
accuracy: 0.9512
782/782 [==============================] - 1s 990us/step - loss: 0.1047 -
accuracy: 0.8644
Epoch 1/4
```

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196/196 [==============================] - 3s 12ms/step - loss: 0.3228 -
accuracy: 0.8629
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.2019 -
accuracy: 0.9201
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1628 -
accuracy: 0.9366
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1349 -
accuracy: 0.9479
782/782 [==============================] - 1s 776us/step - loss: 0.3538 -
accuracy: 0.8689
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.1119 -
accuracy: 0.8432
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0632 -
accuracy: 0.9190
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0506 -
accuracy: 0.9357
Epoch 4/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0429 -
accuracy: 0.9466
782/782 [==============================] - 1s 842us/step - loss: 0.1054 -
accuracy: 0.8692
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.3540 -
accuracy: 0.8429
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.2158 -
accuracy: 0.9182
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1701 -
accuracy: 0.9360
Epoch 4/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1477 -
accuracy: 0.9448
782/782 [==============================] - 1s 846us/step - loss: 0.3843 -
accuracy: 0.8661
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1122 -
accuracy: 0.8433
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0683 -
accuracy: 0.9122
Epoch 3/4
```

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196/196 [==============================] - 2s 12ms/step - loss: 0.0568 -
accuracy: 0.9268
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0483 -
accuracy: 0.9388
782/782 [==============================] - 1s 875us/step - loss: 0.0965 -
accuracy: 0.8775
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.3526 -
accuracy: 0.8482
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.2257 -
accuracy: 0.9134
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1862 -
accuracy: 0.9292
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1675 -
accuracy: 0.9379
782/782 [==============================] - 1s 842us/step - loss: 0.3478 -
accuracy: 0.8685
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.1034 -
accuracy: 0.8575
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0465 -
accuracy: 0.9425 1s - loss: 0.0
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0275 -
accuracy: 0.9698
Epoch 4/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0160 -
accuracy: 0.9844
782/782 [==============================] - 1s 931us/step - loss: 0.1046 -
accuracy: 0.8601
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.3213 -
accuracy: 0.8611
Epoch 2/4
196/196 [==============================] - 3s 15ms/step - loss: 0.1434 -
accuracy: 0.9446
Epoch 3/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0810 -
accuracy: 0.9724
Epoch 4/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0443 -
accuracy: 0.9879
782/782 [==============================] - 1s 990us/step - loss: 0.4140 -
```

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accuracy: 0.8641
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1027 -
accuracy: 0.8572
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0527 -
accuracy: 0.9324
Epoch 3/4
196/196 [==============================] - 2s 13ms/step - loss: 0.0304 -
accuracy: 0.9647
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0174 -
accuracy: 0.9826
782/782 [==============================] - 1s 1ms/step - loss: 0.1004 -
accuracy: 0.8645
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.3249 -
accuracy: 0.8611
Epoch 2/4
196/196 [==============================] - 2s 13ms/step - loss: 0.1682 -
accuracy: 0.9347
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1004 -
accuracy: 0.9642
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0533 -
accuracy: 0.9842
782/782 [==============================] - 1s 1ms/step - loss: 0.3828 -
accuracy: 0.8650
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1147 - accuracy:
0.8402
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0533 - accuracy:
0.9325
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0385 - accuracy:
0.9544
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0297 - accuracy:
0.9663
782/782 [==============================] - 1s 801us/step - loss: 0.1090 -
accuracy: 0.8653
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.3579 - accuracy:
0.8515
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.1827 - accuracy:
```

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0.9311
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1343 - accuracy:
0.9520
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1047 - accuracy:
0.9639
782/782 [==============================] - 1s 960us/step - loss: 0.4407 -
accuracy: 0.8617
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1299 - accuracy:
0.8184
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0654 - accuracy:
0.9158
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0540 - accuracy:
0.9302
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0442 - accuracy:
0.9436
782/782 [==============================] - 1s 812us/step - loss: 0.0985 -
accuracy: 0.8741
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.3927 - accuracy:
0.8294
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.2229 - accuracy:
0.9135
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1779 - accuracy:
0.9308
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1558 - accuracy:
0.9418
782/782 [==============================] - 1s 1ms/step - loss: 0.4373 -
accuracy: 0.8402
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1343 - accuracy:
0.8104
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0655 - accuracy:
0.9142
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0505 - accuracy:
0.9366
Epoch 4/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0422 - accuracy:
```

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0.9489
782/782 [==============================] - 1s 1ms/step - loss: 0.0986 -
accuracy: 0.8730
Epoch 1/4
49/49 [==============================] - 2s 34ms/step - loss: 0.4159 - accuracy:
0.8090
Epoch 2/4
49/49 [==============================] - 2s 39ms/step - loss: 0.2197 - accuracy:
0.9146
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1746 - accuracy:
0.9345
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1457 - accuracy:
0.9479
782/782 [==============================] - 1s 834us/step - loss: 0.3720 -
accuracy: 0.8702
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1391 - accuracy:
0.8009
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0743 - accuracy:
0.9026
Epoch 3/4
49/49 [==============================] - 1s 28ms/step - loss: 0.0622 - accuracy:
0.9179
Epoch 4/4
49/49 [==============================] - 1s 26ms/step - loss: 0.0529 - accuracy:
0.9328
782/782 [==============================] - 1s 901us/step - loss: 0.0996 -
accuracy: 0.8702
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.4321 - accuracy:
0.8041
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.2556 - accuracy:
0.8996
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.2150 - accuracy:
0.9186
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1840 - accuracy:
0.9312
782/782 [==============================] - 1s 949us/step - loss: 0.3838 -
accuracy: 0.8592
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.1093 - accuracy:
0.8461
```

```
Epoch 2/4
49/49 [==============================] - 1s 31ms/step - loss: 0.0407 - accuracy:
0.9521
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0232 - accuracy:
0.9763
Epoch 4/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0137 - accuracy:
0.9884
782/782 [==============================] - 1s 1ms/step - loss: 0.0951 -
accuracy: 0.8689
Epoch 1/4
49/49 [==============================] - 3s 29ms/step - loss: 0.3397 - accuracy:
0.8497
Epoch 2/4
49/49 [==============================] - 1s 31ms/step - loss: 0.1314 - accuracy:
0.9523
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0756 - accuracy:
0.9761
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0446 - accuracy:
0.9888
782/782 [==============================] - 1s 1ms/step - loss: 0.3655 -
accuracy: 0.8586
Epoch 1/4
49/49 [==============================] - 3s 29ms/step - loss: 0.1084 - accuracy:
0.8486
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0472 - accuracy:
0.9405
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0289 - accuracy:
0.9674
Epoch 4/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0177 - accuracy:
0.9828
782/782 [==============================] - 1s 1ms/step - loss: 0.1139 -
accuracy: 0.8422
Epoch 1/4
49/49 [==============================] - 3s 29ms/step - loss: 0.3318 - accuracy:
0.8549
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.1559 - accuracy:
0.9415
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0972 - accuracy:
0.9662
```

```
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0590 - accuracy:
0.9822
782/782 [==============================] - 1s 1ms/step - loss: 0.4609 -
accuracy: 0.8190
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1039 -
accuracy: 0.8612
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0554 -
accuracy: 0.9294
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0386 -
accuracy: 0.9532
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0255 -
accuracy: 0.9714
782/782 [==============================] - 1s 933us/step - loss: 0.1082 -
accuracy: 0.8653
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.3356 -
accuracy: 0.8575
Epoch 2/4
196/196 [==============================] - 2s 13ms/step - loss: 0.1829 -
accuracy: 0.9312
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1252 -
accuracy: 0.9525
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0688 -
accuracy: 0.9761
782/782 [==============================] - 1s 958us/step - loss: 0.4493 -
accuracy: 0.8608
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1054 -
accuracy: 0.8556
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0590 -
accuracy: 0.9228
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0414 -
accuracy: 0.9477
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0257 -
accuracy: 0.9696
782/782 [==============================] - 1s 826us/step - loss: 0.0985 -
accuracy: 0.8728
Epoch 1/4
```

```
196/196 [==============================] - 3s 13ms/step - loss: 0.3355 -
accuracy: 0.8595
Epoch 2/4
196/196 [==============================] - 2s 11ms/step - loss: 0.1961 -
accuracy: 0.9252
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1341 -
accuracy: 0.9512
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0871 -
accuracy: 0.9689 0s - loss: 0.0800
782/782 [==============================] - 1s 987us/step - loss: 0.4603 -
accuracy: 0.8682
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.1344 -
accuracy: 0.8073
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0689 -
accuracy: 0.9106
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0513 -
accuracy: 0.9353
Epoch 4/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0395 -
accuracy: 0.9509
782/782 [==============================] - 1s 855us/step - loss: 0.0930 -
accuracy: 0.8766
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.4071 -
accuracy: 0.8164
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.2229 -
accuracy: 0.9152
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1647 -
accuracy: 0.9388
Epoch 4/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1208 -
accuracy: 0.9583
782/782 [==============================] - 1s 923us/step - loss: 0.3540 -
accuracy: 0.8779
Epoch 1/4
196/196 [==============================] - 3s 12ms/step - loss: 0.1276 -
accuracy: 0.8238
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0715 -
accuracy: 0.9060
Epoch 3/4
```

```
196/196 [==============================] - 2s 12ms/step - loss: 0.0560 -
accuracy: 0.9287
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0461 -
accuracy: 0.9421
782/782 [==============================] - 1s 859us/step - loss: 0.0931 -
accuracy: 0.8810
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.3989 -
accuracy: 0.8269
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.2451 -
accuracy: 0.9072
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.2067 -
accuracy: 0.9268
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1729 -
accuracy: 0.9399
782/782 [==============================] - 1s 838us/step - loss: 0.3604 -
accuracy: 0.8786
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.1053 -
accuracy: 0.8535
Epoch 2/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0397 -
accuracy: 0.9516
Epoch 3/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0184 -
accuracy: 0.9809
Epoch 4/4
196/196 [==============================] - 3s 17ms/step - loss: 0.0088 -
accuracy: 0.9919
782/782 [==============================] - 1s 1ms/step - loss: 0.1041 -
accuracy: 0.8641
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.3326 -
accuracy: 0.8542
Epoch 2/4
196/196 [==============================] - 3s 14ms/step - loss: 0.1200 -
accuracy: 0.9586 0s - loss: 0.1192 - accuracy: 0.
Epoch 3/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0414 -
accuracy: 0.9884
Epoch 4/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0132 -
accuracy: 0.9976
782/782 [==============================] - 1s 825us/step - loss: 0.4739 -
```

```
accuracy: 0.8649
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1039 -
accuracy: 0.8568
Epoch 2/4
196/196 [==============================] - 3s 15ms/step - loss: 0.0460 -
accuracy: 0.9420
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0201 -
accuracy: 0.9782
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0111 -
accuracy: 0.9880
782/782 [==============================] - 1s 1ms/step - loss: 0.1136 -
accuracy: 0.8558
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.3282 -
accuracy: 0.8591
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1415 -
accuracy: 0.9484
Epoch 3/4
196/196 [==============================] - 2s 13ms/step - loss: 0.0489 -
accuracy: 0.9849
Epoch 4/4
196/196 [==============================] - 2s 13ms/step - loss: 0.0178 -
accuracy: 0.9956
782/782 [==============================] - 1s 1ms/step - loss: 0.4943 -
accuracy: 0.8628
Epoch 1/4
49/49 [==============================] - 2s 32ms/step - loss: 0.1257 - accuracy:
0.8398
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0552 - accuracy:
0.9300
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0383 - accuracy:
0.9553
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0267 - accuracy:
0.9726
782/782 [==============================] - 1s 869us/step - loss: 0.1006 -
accuracy: 0.8692
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.3940 - accuracy:
0.8415
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.1900 - accuracy:
```

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0.9295
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1357 - accuracy:
0.9507
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0991 - accuracy:
0.9662
782/782 [==============================] - 1s 850us/step - loss: 0.4174 -
accuracy: 0.8656
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1368 - accuracy:
0.8030
Epoch 2/4
49/49 [==============================] - 2s 35ms/step - loss: 0.0688 - accuracy:
0.9124
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0531 - accuracy:
0.9322
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0423 - accuracy:
0.9468
782/782 [==============================] - 1s 795us/step - loss: 0.1033 -
accuracy: 0.8631
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.4223 - accuracy:
0.8089
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.2393 - accuracy:
0.9072
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1805 - accuracy:
0.9324
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1478 - accuracy:
0.9449
782/782 [==============================] - 1s 830us/step - loss: 0.3209 -
accuracy: 0.8777
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1711 - accuracy:
0.7491
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0823 - accuracy:
0.8951
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0590 - accuracy:
0.9271
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0451 - accuracy:
```

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0.9457
782/782 [==============================] - 1s 800us/step - loss: 0.0867 -
accuracy: 0.8838
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.5178 - accuracy:
0.7485
Epoch 2/4
49/49 [==============================] - 1s 31ms/step - loss: 0.2757 - accuracy:
0.8964
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1972 - accuracy:
0.9276
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1494 - accuracy:
0.9483
782/782 [==============================] - 1s 1ms/step - loss: 0.3139 -
accuracy: 0.8830
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1611 - accuracy:
0.7713
Epoch 2/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0863 - accuracy:
0.8904
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0658 - accuracy:
0.9156
Epoch 4/4
49/49 [==============================] - 2s 32ms/step - loss: 0.0532 - accuracy:
0.9327
782/782 [==============================] - 1s 991us/step - loss: 0.0851 -
accuracy: 0.8859
Epoch 1/4
49/49 [==============================] - 2s 34ms/step - loss: 0.4897 - accuracy:
0.7702
Epoch 2/4
49/49 [==============================] - 2s 42ms/step - loss: 0.2886 - accuracy:
0.8891
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.2224 - accuracy:
0.9169
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1812 - accuracy:
0.9331
782/782 [==============================] - 1s 867us/step - loss: 0.2949 -
accuracy: 0.8873
Epoch 1/4
49/49 [==============================] - 3s 33ms/step - loss: 0.1171 - accuracy:
0.8324
```

```
Epoch 2/4
49/49 [==============================] - 1s 31ms/step - loss: 0.0362 - accuracy:
0.9583
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0158 - accuracy:
0.9860
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0072 - accuracy:
0.9944
782/782 [==============================] - 1s 1ms/step - loss: 0.1216 -
accuracy: 0.8302
Epoch 1/4
49/49 [==============================] - 3s 29ms/step - loss: 0.3711 - accuracy:
0.8298
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.1146 - accuracy:
0.9636
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0436 - accuracy:
0.9912
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0150 - accuracy:
0.9989
782/782 [==============================] - 1s 1ms/step - loss: 0.3761 -
accuracy: 0.8329
Epoch 1/4
49/49 [==============================] - 3s 29ms/step - loss: 0.1091 - accuracy:
0.8468
Epoch 2/4
49/49 [==============================] - 2s 30ms/step - loss: 0.0375 - accuracy:
0.9557
Epoch 3/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0153 - accuracy:
0.9858
Epoch 4/4
49/49 [==============================] - 2s 33ms/step - loss: 0.0066 - accuracy:
0.9941
782/782 [==============================] - 1s 1ms/step - loss: 0.1453 -
accuracy: 0.7840
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.3394 - accuracy:
0.8489
Epoch 2/4
49/49 [==============================] - 2s 40ms/step - loss: 0.1270 - accuracy:
0.9570
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0455 - accuracy:
0.9881
```

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Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0123 - accuracy:
0.9979
782/782 [==============================] - 1s 1ms/step - loss: 0.4176 -
accuracy: 0.8129
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1062 -
accuracy: 0.8601
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0551 -
accuracy: 0.9308
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0421 -
accuracy: 0.9489
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0345 -
accuracy: 0.9606
782/782 [==============================] - 1s 662us/step - loss: 0.1104 -
accuracy: 0.8655
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3345 -
accuracy: 0.8621
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1855 -
accuracy: 0.9320
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1356 -
accuracy: 0.9537
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1089 -
accuracy: 0.9613
782/782 [==============================] - 1s 657us/step - loss: 0.4100 -
accuracy: 0.8611
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1025 -
accuracy: 0.8626
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0590 -
accuracy: 0.9244
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0471 -
accuracy: 0.9409
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0399 -
accuracy: 0.9504
782/782 [==============================] - 1s 625us/step - loss: 0.1003 -
accuracy: 0.8716
Epoch 1/4
```

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196/196 [==============================] - 1s 5ms/step - loss: 0.3274 -
accuracy: 0.8648
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2009 -
accuracy: 0.9246
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1609 -
accuracy: 0.9427
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1367 -
accuracy: 0.9496
782/782 [==============================] - 1s 612us/step - loss: 0.3596 -
accuracy: 0.8681
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1601 -
accuracy: 0.7609
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0862 -
accuracy: 0.8928
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0691 -
accuracy: 0.9150
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0625 -
accuracy: 0.9229
782/782 [==============================] - 1s 598us/step - loss: 0.1015 -
accuracy: 0.8778
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.4437 -
accuracy: 0.7966
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2812 -
accuracy: 0.8981
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2352 -
accuracy: 0.9214
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2031 -
accuracy: 0.9338
782/782 [==============================] - 1s 739us/step - loss: 0.3589 -
accuracy: 0.8741
Epoch 1/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1496 -
accuracy: 0.7827
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0854 -
accuracy: 0.8919
Epoch 3/4
```

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196/196 [==============================] - 1s 4ms/step - loss: 0.0707 -
accuracy: 0.9117
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0615 -
accuracy: 0.9238
782/782 [==============================] - 1s 730us/step - loss: 0.1069 -
accuracy: 0.8705
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.4618 -
accuracy: 0.7819
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2894 -
accuracy: 0.8970
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2354 -
accuracy: 0.9190
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2153 -
accuracy: 0.9290
782/782 [==============================] - 1s 603us/step - loss: 0.3289 -
accuracy: 0.8828
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1077 -
accuracy: 0.8513
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0544 -
accuracy: 0.9306
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0379 -
accuracy: 0.9538
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0264 -
accuracy: 0.9706
782/782 [==============================] - 1s 731us/step - loss: 0.1070 -
accuracy: 0.8598
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.3437 -
accuracy: 0.8508
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1729 -
accuracy: 0.9324
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1136 -
accuracy: 0.9578
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0752 -
accuracy: 0.9734
782/782 [==============================] - 1s 746us/step - loss: 0.4139 -
```

```
accuracy: 0.8606
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1052 -
accuracy: 0.8545
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0598 -
accuracy: 0.9214
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0440 -
accuracy: 0.9452
Epoch 4/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0319 -
accuracy: 0.9622
782/782 [==============================] - 1s 722us/step - loss: 0.1050 -
accuracy: 0.8606
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3391 -
accuracy: 0.8572
Epoch 2/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1907 -
accuracy: 0.9238
Epoch 3/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1322 -
accuracy: 0.9474
Epoch 4/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0970 -
accuracy: 0.9645
782/782 [==============================] - 1s 806us/step - loss: 0.3721 -
accuracy: 0.8672
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1403 - accuracy:
0.8263
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0616 - accuracy:
0.9235
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0424 - accuracy:
0.9500
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0316 - accuracy:
0.9650
782/782 [==============================] - 1s 685us/step - loss: 0.0986 -
accuracy: 0.8743
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.3972 - accuracy:
0.8336
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1990 - accuracy:
```

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0.9266
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1440 - accuracy:
0.9520
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1109 - accuracy:
0.9645
782/782 [==============================] - 1s 673us/step - loss: 0.3899 -
accuracy: 0.8681
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1322 - accuracy:
0.8312
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0652 - accuracy:
0.9165
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0500 - accuracy:
0.9348
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0431 - accuracy:
0.9454
782/782 [==============================] - 1s 661us/step - loss: 0.0971 -
accuracy: 0.8736
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.4074 - accuracy:
0.8312
Epoch 2/4
49/49 [==============================] - 1s 16ms/step - loss: 0.2211 - accuracy:
0.9166
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1751 - accuracy:
0.9363
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.1440 - accuracy:
0.9490
782/782 [==============================] - 1s 673us/step - loss: 0.3847 -
accuracy: 0.8600
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.2038 - accuracy:
0.6808
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1154 - accuracy:
0.8612
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0804 - accuracy:
0.9038
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0646 - accuracy:
```

```
0.9232
782/782 [==============================] - 1s 644us/step - loss: 0.0908 -
accuracy: 0.8836
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.5694 - accuracy:
0.7002
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.3510 - accuracy:
0.8710
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2709 - accuracy:
0.9096
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2245 - accuracy:
0.9262
782/782 [==============================] - 1s 735us/step - loss: 0.3160 -
accuracy: 0.8836
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1836 - accuracy:
0.7423
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1043 - accuracy:
0.8748
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0782 - accuracy:
0.9042
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0644 - accuracy:
0.9213
782/782 [==============================] - 1s 577us/step - loss: 0.0943 -
accuracy: 0.8804
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.5474 - accuracy:
0.7288
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.3527 - accuracy:
0.8701
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.2779 - accuracy:
0.9027
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.2355 - accuracy:
0.9198
782/782 [==============================] - 1s 677us/step - loss: 0.3281 -
accuracy: 0.8766
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1238 - accuracy:
0.8275
```

```
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0506 - accuracy:
0.9379
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0327 - accuracy:
0.9646
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0227 - accuracy:
0.9778
782/782 [==============================] - 1s 805us/step - loss: 0.0984 -
accuracy: 0.8657
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.3922 - accuracy:
0.8236
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1838 - accuracy:
0.9333
Epoch 3/4
49/49 [==============================] - 1s 16ms/step - loss: 0.1204 - accuracy:
0.9614
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0855 - accuracy:
0.9727
782/782 [==============================] - 1s 830us/step - loss: 0.3412 -
accuracy: 0.8655
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1102 - accuracy:
0.8458
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0540 - accuracy:
0.9305
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0378 - accuracy:
0.9533
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0268 - accuracy:
0.9692
782/782 [==============================] - 1s 785us/step - loss: 0.1014 -
accuracy: 0.8624
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.3513 - accuracy:
0.8496
Epoch 2/4
49/49 [==============================] - 1s 18ms/step - loss: 0.1853 - accuracy:
0.9317
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.1238 - accuracy:
0.9563
```

```
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0865 - accuracy:
0.9708
782/782 [==============================] - 1s 838us/step - loss: 0.3680 -
accuracy: 0.8542
Epoch 1/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1207 -
accuracy: 0.8368
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0562 -
accuracy: 0.9286
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0399 -
accuracy: 0.9528
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0308 -
accuracy: 0.9649
782/782 [==============================] - 1s 635us/step - loss: 0.1076 -
accuracy: 0.8655
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3831 -
accuracy: 0.8289
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1961 -
accuracy: 0.9276
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1422 -
accuracy: 0.9481
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1066 -
accuracy: 0.9622
782/782 [==============================] - 1s 699us/step - loss: 0.4202 -
accuracy: 0.8640
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1187 -
accuracy: 0.8490
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0610 -
accuracy: 0.9214
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0457 -
accuracy: 0.9431
Epoch 4/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0356 -
accuracy: 0.9558
782/782 [==============================] - 1s 662us/step - loss: 0.1039 -
accuracy: 0.8674
Epoch 1/4
```

```
196/196 [==============================] - 1s 5ms/step - loss: 0.3513 -
accuracy: 0.8585
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.2066 -
accuracy: 0.9218
Epoch 3/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1675 -
accuracy: 0.9375
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1367 -
accuracy: 0.9502
782/782 [==============================] - 1s 702us/step - loss: 0.3889 -
accuracy: 0.8665
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.2178 -
accuracy: 0.6396
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1327 -
accuracy: 0.8232
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1033 -
accuracy: 0.8686
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0920 -
accuracy: 0.8828
782/782 [==============================] - 1s 663us/step - loss: 0.0941 -
accuracy: 0.8777
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.5919 -
accuracy: 0.7012
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.3888 -
accuracy: 0.8571
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.3135 -
accuracy: 0.8885
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2755 -
accuracy: 0.9060
782/782 [==============================] - 1s 673us/step - loss: 0.2996 -
accuracy: 0.8802
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.2053 -
accuracy: 0.6929
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.1238 -
accuracy: 0.8454
Epoch 3/4
```

```
196/196 [==============================] - 1s 4ms/step - loss: 0.0987 -
accuracy: 0.8781
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.0870 -
accuracy: 0.8945
782/782 [==============================] - 1s 689us/step - loss: 0.0909 -
accuracy: 0.8846
Epoch 1/4
196/196 [==============================] - 1s 5ms/step - loss: 0.6106 -
accuracy: 0.6443
Epoch 2/4
196/196 [==============================] - 1s 4ms/step - loss: 0.4333 -
accuracy: 0.8295
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.3545 -
accuracy: 0.8712
Epoch 4/4
196/196 [==============================] - 1s 4ms/step - loss: 0.3191 -
accuracy: 0.8884
782/782 [==============================] - 1s 666us/step - loss: 0.3171 -
accuracy: 0.8805
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1259 -
accuracy: 0.8212
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0558 -
accuracy: 0.9281
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0359 -
accuracy: 0.9564
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0251 -
accuracy: 0.9699
782/782 [==============================] - 1s 773us/step - loss: 0.1149 -
accuracy: 0.8533
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.3946 -
accuracy: 0.8200
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2051 -
accuracy: 0.9227
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1396 -
accuracy: 0.9499
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0965 -
accuracy: 0.9666
782/782 [==============================] - 1s 823us/step - loss: 0.4285 -
```

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accuracy: 0.8598
Epoch 1/4
196/196 [==============================] - 2s 5ms/step - loss: 0.1311 -
accuracy: 0.8066
Epoch 2/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0619 -
accuracy: 0.9176
Epoch 3/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0404 -
accuracy: 0.9484
Epoch 4/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0261 -
accuracy: 0.9688
782/782 [==============================] - 1s 754us/step - loss: 0.1095 -
accuracy: 0.8610
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.3871 -
accuracy: 0.8219
Epoch 2/4
196/196 [==============================] - 1s 5ms/step - loss: 0.2007 -
accuracy: 0.9228
Epoch 3/4
196/196 [==============================] - 1s 5ms/step - loss: 0.1269 -
accuracy: 0.9542
Epoch 4/4
196/196 [==============================] - 1s 5ms/step - loss: 0.0791 -
accuracy: 0.9725
782/782 [==============================] - 1s 737us/step - loss: 0.4340 -
accuracy: 0.8626
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.1731 - accuracy:
0.7974
Epoch 2/4
49/49 [==============================] - 1s 18ms/step - loss: 0.0728 - accuracy:
0.9149
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0496 - accuracy:
0.9412
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0378 - accuracy:
0.9590
782/782 [==============================] - 1s 705us/step - loss: 0.0903 -
accuracy: 0.8782
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.4851 - accuracy:
0.8046
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2337 - accuracy:
```

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0.9155
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1666 - accuracy:
0.9411
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1309 - accuracy:
0.9558
782/782 [==============================] - 1s 703us/step - loss: 0.3454 -
accuracy: 0.8753
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1590 - accuracy:
0.8121
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0779 - accuracy:
0.9102
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.0581 - accuracy:
0.9313
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0467 - accuracy:
0.9445
782/782 [==============================] - 1s 643us/step - loss: 0.0875 -
accuracy: 0.8807
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.4578 - accuracy:
0.8185
Epoch 2/4
49/49 [==============================] - 1s 15ms/step - loss: 0.2504 - accuracy:
0.9079
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1943 - accuracy:
0.9280
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1582 - accuracy:
0.9422
782/782 [==============================] - 1s 660us/step - loss: 0.3410 -
accuracy: 0.8683
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.2425 - accuracy:
0.5633
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1919 - accuracy:
0.7352
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1381 - accuracy:
0.8267
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.1059 - accuracy:
```

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0.8654
782/782 [==============================] - 1s 606us/step - loss: 0.0839 -
accuracy: 0.8872
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.6637 - accuracy:
0.6179
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.5482 - accuracy:
0.8047
Epoch 3/4
49/49 [==============================] - 1s 15ms/step - loss: 0.4689 - accuracy:
0.8658
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.4089 - accuracy:
0.8886
782/782 [==============================] - 1s 610us/step - loss: 0.4010 -
accuracy: 0.8779
Epoch 1/4
49/49 [==============================] - 2s 15ms/step - loss: 0.2337 - accuracy:
0.5895
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1847 - accuracy:
0.7304
Epoch 3/4
49/49 [==============================] - 1s 14ms/step - loss: 0.1454 - accuracy:
0.8051
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1192 - accuracy:
0.8485
782/782 [==============================] - 1s 640us/step - loss: 0.0849 -
accuracy: 0.8870
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.6441 - accuracy:
0.6640
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.5345 - accuracy:
0.8169
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.4623 - accuracy:
0.8647
Epoch 4/4
49/49 [==============================] - 1s 14ms/step - loss: 0.4131 - accuracy:
0.8796
782/782 [==============================] - 1s 666us/step - loss: 0.3903 -
accuracy: 0.8703
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1541 - accuracy:
0.7732
```

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Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0657 - accuracy:
0.9161
Epoch 3/4
49/49 [==============================] - 1s 16ms/step - loss: 0.0403 - accuracy:
0.9536
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0254 - accuracy:
0.9730
782/782 [==============================] - 1s 698us/step - loss: 0.1003 -
accuracy: 0.8685
Epoch 1/4
49/49 [==============================] - 2s 17ms/step - loss: 0.4960 - accuracy:
0.7568
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2314 - accuracy:
0.9181
Epoch 3/4
49/49 [==============================] - 1s 16ms/step - loss: 0.1396 - accuracy:
0.9573
Epoch 4/4
49/49 [==============================] - 1s 15ms/step - loss: 0.0824 - accuracy:
0.9795
782/782 [==============================] - 1s 774us/step - loss: 0.3220 -
accuracy: 0.8666
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1437 - accuracy:
0.7927
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0632 - accuracy:
0.9197
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0369 - accuracy:
0.9555
Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0222 - accuracy:
0.9751
782/782 [==============================] - 1s 802us/step - loss: 0.1093 -
accuracy: 0.8540
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4264 - accuracy:
0.8072
Epoch 2/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2020 - accuracy:
0.9290
Epoch 3/4
49/49 [==============================] - 1s 13ms/step - loss: 0.1146 - accuracy:
0.9634
```

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Epoch 4/4
49/49 [==============================] - 1s 13ms/step - loss: 0.0621 - accuracy:
0.9816
782/782 [==============================] - 1s 778us/step - loss: 0.3883 -
accuracy: 0.8346
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0996 -
accuracy: 0.8656
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0541 -
accuracy: 0.9309: 0s - loss: 0.0535 - accuracy: 0.93
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0417 -
accuracy: 0.9495
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0350 -
accuracy: 0.9578
782/782 [==============================] - 1s 707us/step - loss: 0.1068 -
accuracy: 0.8666
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.3218 -
accuracy: 0.8633
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1814 -
accuracy: 0.9316
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1374 -
accuracy: 0.9488
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1096 -
accuracy: 0.9586
782/782 [==============================] - 1s 694us/step - loss: 0.4001 -
accuracy: 0.8632
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1008 -
accuracy: 0.8610
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0606 -
accuracy: 0.9206
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0482 -
accuracy: 0.9380
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0398 -
accuracy: 0.9508
782/782 [==============================] - 1s 713us/step - loss: 0.1058 -
accuracy: 0.8648
Epoch 1/4
```

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196/196 [==============================] - 2s 7ms/step - loss: 0.3240 -
accuracy: 0.8623
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2006 -
accuracy: 0.9218
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1572 -
accuracy: 0.9405
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1333 -
accuracy: 0.9491
782/782 [==============================] - 1s 686us/step - loss: 0.3617 -
accuracy: 0.8697
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1301 -
accuracy: 0.8143
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0750 -
accuracy: 0.9038
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0603 -
accuracy: 0.9256
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0525 -
accuracy: 0.9354
782/782 [==============================] - 1s 683us/step - loss: 0.1022 -
accuracy: 0.8748
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.4042 -
accuracy: 0.8187
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.2477 -
accuracy: 0.9104
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.2096 -
accuracy: 0.9257
Epoch 4/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1738 -
accuracy: 0.9406
782/782 [==============================] - 1s 630us/step - loss: 0.3675 -
accuracy: 0.8707
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1291 -
accuracy: 0.8176
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0757 -
accuracy: 0.9014
Epoch 3/4
```

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196/196 [==============================] - 1s 6ms/step - loss: 0.0628 -
accuracy: 0.9195
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0543 -
accuracy: 0.9328
782/782 [==============================] - 1s 639us/step - loss: 0.1044 -
accuracy: 0.8710
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.3985 -
accuracy: 0.8242
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.2546 -
accuracy: 0.9075
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2138 -
accuracy: 0.9236
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1920 -
accuracy: 0.9337
782/782 [==============================] - 1s 752us/step - loss: 0.3289 -
accuracy: 0.8796
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1070 -
accuracy: 0.8517
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0484 -
accuracy: 0.9393
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0290 -
accuracy: 0.9665
Epoch 4/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0175 -
accuracy: 0.9817
782/782 [==============================] - 1s 812us/step - loss: 0.1030 -
accuracy: 0.8641
Epoch 1/4
196/196 [==============================] - 3s 9ms/step - loss: 0.3324 -
accuracy: 0.8554
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1580 -
accuracy: 0.9387
Epoch 3/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0905 -
accuracy: 0.9686
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0517 -
accuracy: 0.9839
782/782 [==============================] - 1s 806us/step - loss: 0.4565 -
```

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accuracy: 0.8548
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1042 -
accuracy: 0.8540
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0551 -
accuracy: 0.9296
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0352 -
accuracy: 0.9567: 0s - loss: 0.0349 - accu
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0219 -
accuracy: 0.9752
782/782 [==============================] - 1s 774us/step - loss: 0.1041 -
accuracy: 0.8619
Epoch 1/4
196/196 [==============================] - 2s 8ms/step - loss: 0.3268 -
accuracy: 0.8599
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1748 -
accuracy: 0.9296
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1067 -
accuracy: 0.9606
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0612 -
accuracy: 0.9788
782/782 [==============================] - 1s 862us/step - loss: 0.3940 -
accuracy: 0.8608
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1201 - accuracy:
0.8395
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0539 - accuracy:
0.9316
Epoch 3/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0394 - accuracy:
0.9526
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0307 - accuracy:
0.9651
782/782 [==============================] - 1s 629us/step - loss: 0.1067 -
accuracy: 0.8668
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.3836 - accuracy:
0.8374
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1851 - accuracy:
```

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0.9318
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1331 - accuracy:
0.9564
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1072 - accuracy:
0.9654
782/782 [==============================] - 1s 704us/step - loss: 0.4344 -
accuracy: 0.8603
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.1298 - accuracy:
0.8167
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0668 - accuracy:
0.9115
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0538 - accuracy:
0.9302
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0434 - accuracy:
0.9447
782/782 [==============================] - 1s 635us/step - loss: 0.1073 -
accuracy: 0.8632
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.3918 - accuracy:
0.8280
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2193 - accuracy:
0.9147
Epoch 3/4
49/49 [==============================] - 1s 18ms/step - loss: 0.1753 - accuracy:
0.9348
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1541 - accuracy:
0.9425
782/782 [==============================] - 1s 640us/step - loss: 0.3832 -
accuracy: 0.8523
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1667 - accuracy:
0.7514
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0809 - accuracy:
0.8946
Epoch 3/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0630 - accuracy:
0.9199
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0535 - accuracy:
```

```
0.9335
782/782 [==============================] - 1s 620us/step - loss: 0.0945 -
accuracy: 0.8800
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.5134 - accuracy:
0.7455
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.2786 - accuracy:
0.8962
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2133 - accuracy:
0.9249
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1791 - accuracy:
0.9383
782/782 [==============================] - 1s 684us/step - loss: 0.3545 -
accuracy: 0.8766
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1517 - accuracy:
0.7812
Epoch 2/4
49/49 [==============================] - 2s 34ms/step - loss: 0.0859 - accuracy:
0.8868
Epoch 3/4
49/49 [==============================] - 1s 22ms/step - loss: 0.0683 - accuracy:
0.9133
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0601 - accuracy:
0.9239
782/782 [==============================] - 1s 702us/step - loss: 0.0957 -
accuracy: 0.8797
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.4708 - accuracy:
0.7796
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2880 - accuracy:
0.8907
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2366 - accuracy:
0.9143
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2099 - accuracy:
0.9276
782/782 [==============================] - 1s 735us/step - loss: 0.3127 -
accuracy: 0.8832
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1165 - accuracy:
0.8350
```

```
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0439 - accuracy:
0.9469
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0244 - accuracy:
0.9754
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0146 - accuracy:
0.9864
782/782 [==============================] - 1s 787us/step - loss: 0.1034 -
accuracy: 0.8593
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.3634 - accuracy:
0.8408
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1397 - accuracy:
0.9502
Epoch 3/4
49/49 [==============================] - 1s 20ms/step - loss: 0.0772 - accuracy:
0.9775
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0455 - accuracy:
0.9890
782/782 [==============================] - 1s 815us/step - loss: 0.3635 -
accuracy: 0.8656
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1073 - accuracy:
0.8509
Epoch 2/4
49/49 [==============================] - 1s 22ms/step - loss: 0.0518 - accuracy:
0.9342
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0321 - accuracy:
0.9630
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0195 - accuracy:
0.9794
782/782 [==============================] - 1s 808us/step - loss: 0.1059 -
accuracy: 0.8572
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.3448 - accuracy:
0.8501
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1623 - accuracy:
0.9378
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0987 - accuracy:
0.9649
```

```
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0575 - accuracy:
0.9827
782/782 [==============================] - 1s 789us/step - loss: 0.3728 -
accuracy: 0.8609
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1091 -
accuracy: 0.8505
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0546 -
accuracy: 0.9302
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0390 -
accuracy: 0.9526
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0289 -
accuracy: 0.9669
782/782 [==============================] - 1s 686us/step - loss: 0.1099 -
accuracy: 0.8656
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.3443 -
accuracy: 0.8589
Epoch 2/4
196/196 [==============================] - 2s 10ms/step - loss: 0.1822 -
accuracy: 0.9321
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1337 -
accuracy: 0.9501
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0899 -
accuracy: 0.9678
782/782 [==============================] - 1s 684us/step - loss: 0.4430 -
accuracy: 0.8592
Epoch 1/4
196/196 [==============================] - 2s 6ms/step - loss: 0.1073 -
accuracy: 0.8552
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0603 -
accuracy: 0.9224
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0454 -
accuracy: 0.9436
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0342 -
accuracy: 0.9590
782/782 [==============================] - 1s 697us/step - loss: 0.1010 -
accuracy: 0.8735
Epoch 1/4
```

```
196/196 [==============================] - 2s 6ms/step - loss: 0.3418 -
accuracy: 0.8593
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2077 -
accuracy: 0.9203
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1594 -
accuracy: 0.9397
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.1221 -
accuracy: 0.9554
782/782 [==============================] - 1s 667us/step - loss: 0.3822 -
accuracy: 0.8694
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1841 -
accuracy: 0.7315
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0976 -
accuracy: 0.8784
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0791 -
accuracy: 0.9046
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0676 -
accuracy: 0.9177
782/782 [==============================] - 1s 731us/step - loss: 0.0931 -
accuracy: 0.8794
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.5466 -
accuracy: 0.7039
Epoch 2/4
196/196 [==============================] - 2s 9ms/step - loss: 0.3164 -
accuracy: 0.8816
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.2435 -
accuracy: 0.9122
Epoch 4/4
196/196 [==============================] - 2s 9ms/step - loss: 0.2047 -
accuracy: 0.9244
782/782 [==============================] - 1s 727us/step - loss: 0.3155 -
accuracy: 0.8802
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1738 -
accuracy: 0.7427: 0s - loss: 0.2067 - accu
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0905 -
accuracy: 0.8879
Epoch 3/4
```

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196/196 [==============================] - 1s 6ms/step - loss: 0.0715 -
accuracy: 0.9114
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.0618 -
accuracy: 0.9228
782/782 [==============================] - 1s 674us/step - loss: 0.0926 -
accuracy: 0.88610s - loss: 0.0928 - accuracy
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.5145 -
accuracy: 0.7412
Epoch 2/4
196/196 [==============================] - 1s 6ms/step - loss: 0.3246 -
accuracy: 0.8844
Epoch 3/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2653 -
accuracy: 0.9089
Epoch 4/4
196/196 [==============================] - 1s 6ms/step - loss: 0.2359 -
accuracy: 0.9214
782/782 [==============================] - 1s 636us/step - loss: 0.3226 -
accuracy: 0.8798
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.1190 -
accuracy: 0.8291
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0490 -
accuracy: 0.9385
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0280 -
accuracy: 0.9672
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0174 -
accuracy: 0.9802
782/782 [==============================] - 1s 831us/step - loss: 0.1109 -
accuracy: 0.8572
Epoch 1/4
196/196 [==============================] - 2s 9ms/step - loss: 0.3720 -
accuracy: 0.8305
Epoch 2/4
196/196 [==============================] - 2s 8ms/step - loss: 0.1591 -
accuracy: 0.9420
Epoch 3/4
196/196 [==============================] - 2s 9ms/step - loss: 0.0770 -
accuracy: 0.9754
Epoch 4/4
196/196 [==============================] - 2s 8ms/step - loss: 0.0352 -
accuracy: 0.9894
782/782 [==============================] - 1s 795us/step - loss: 0.5441 -
```

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accuracy: 0.8441
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.1136 -
accuracy: 0.8377
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0526 -
accuracy: 0.9330
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0292 -
accuracy: 0.9652
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0175 -
accuracy: 0.9792
782/782 [==============================] - 1s 807us/step - loss: 0.1144 -
accuracy: 0.8550
Epoch 1/4
196/196 [==============================] - 2s 7ms/step - loss: 0.3463 -
accuracy: 0.8474
Epoch 2/4
196/196 [==============================] - 1s 7ms/step - loss: 0.1818 -
accuracy: 0.9276
Epoch 3/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0993 -
accuracy: 0.9653
Epoch 4/4
196/196 [==============================] - 1s 7ms/step - loss: 0.0511 -
accuracy: 0.9823
782/782 [==============================] - 1s 783us/step - loss: 0.4861 -
accuracy: 0.8558
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1386 - accuracy:
0.8211
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.0579 - accuracy:
0.9254
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0401 - accuracy:
0.9520
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0308 - accuracy:
0.9656
782/782 [==============================] - 1s 767us/step - loss: 0.1013 -
accuracy: 0.8704
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.4454 - accuracy:
0.7983
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2058 - accuracy:
```

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0.9245
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1455 - accuracy:
0.9492
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1111 - accuracy:
0.9615
782/782 [==============================] - 1s 683us/step - loss: 0.3941 -
accuracy: 0.8687
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1416 - accuracy:
0.8099
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0707 - accuracy:
0.9117
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0549 - accuracy:
0.9305
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0431 - accuracy:
0.9469
782/782 [==============================] - 1s 672us/step - loss: 0.0907 -
accuracy: 0.8787
Epoch 1/4
49/49 [==============================] - 2s 19ms/step - loss: 0.4450 - accuracy:
0.8063
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2373 - accuracy:
0.9112
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1923 - accuracy:
0.9280
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.1560 - accuracy:
0.9426
782/782 [==============================] - 1s 670us/step - loss: 0.3227 -
accuracy: 0.8801
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.2265 - accuracy:
0.6208
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.1379 - accuracy:
0.8230
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0925 - accuracy:
0.8860
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0713 - accuracy:
```

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0.9104
782/782 [==============================] - 1s 659us/step - loss: 0.0871 -
accuracy: 0.8859
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.6434 - accuracy:
0.6139
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.4166 - accuracy:
0.8338
Epoch 3/4
49/49 [==============================] - 1s 21ms/step - loss: 0.2944 - accuracy:
0.8964
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.2341 - accuracy:
0.9195
782/782 [==============================] - 1s 700us/step - loss: 0.2927 -
accuracy: 0.8861
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.2065 - accuracy:
0.6795
Epoch 2/4
49/49 [==============================] - 1s 19ms/step - loss: 0.1212 - accuracy:
0.8461
Epoch 3/4
49/49 [==============================] - 1s 17ms/step - loss: 0.0876 - accuracy:
0.8928
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0686 - accuracy:
0.9147
782/782 [==============================] - 1s 716us/step - loss: 0.0951 -
accuracy: 0.8774
Epoch 1/4
49/49 [==============================] - 2s 27ms/step - loss: 0.6080 - accuracy:
0.6716
Epoch 2/4
49/49 [==============================] - 1s 25ms/step - loss: 0.4198 - accuracy:
0.8414
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.3160 - accuracy:
0.8888
Epoch 4/4
49/49 [==============================] - 1s 17ms/step - loss: 0.2559 - accuracy:
0.9108
782/782 [==============================] - 1s 659us/step - loss: 0.2916 -
accuracy: 0.8849
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.1373 - accuracy:
0.8003
```

```
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0473 - accuracy:
0.9430
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0231 - accuracy:
0.9761
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0116 - accuracy:
0.9896
782/782 [==============================] - 1s 753us/step - loss: 0.1027 -
accuracy: 0.8638
Epoch 1/4
49/49 [==============================] - 2s 23ms/step - loss: 0.4513 - accuracy:
0.7810
Epoch 2/4
49/49 [==============================] - 1s 23ms/step - loss: 0.1804 - accuracy:
0.9358
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0942 - accuracy:
0.9721
Epoch 4/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0436 - accuracy:
0.9902
782/782 [==============================] - 1s 811us/step - loss: 0.4557 -
accuracy: 0.7983
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.1269 - accuracy:
0.8158
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.0492 - accuracy:
0.9399
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0237 - accuracy:
0.9744
Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0119 - accuracy:
0.9876
782/782 [==============================] - 1s 826us/step - loss: 0.1708 -
accuracy: 0.7532
Epoch 1/4
49/49 [==============================] - 2s 21ms/step - loss: 0.3800 - accuracy:
0.8284
Epoch 2/4
49/49 [==============================] - 1s 21ms/step - loss: 0.1615 - accuracy:
0.9421
Epoch 3/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0779 - accuracy:
0.9749
```

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Epoch 4/4
49/49 [==============================] - 1s 19ms/step - loss: 0.0290 - accuracy:
0.9931
782/782 [==============================] - 1s 848us/step - loss: 0.3315 -
accuracy: 0.8613
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0987 -
accuracy: 0.8644
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0549 -
accuracy: 0.9286
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0412 -
accuracy: 0.9486
Epoch 4/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0354 -
accuracy: 0.9571
782/782 [==============================] - 1s 1ms/step - loss: 0.1082 -
accuracy: 0.8654
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.3163 -
accuracy: 0.8651
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1768 -
accuracy: 0.9298
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1252 -
accuracy: 0.9486
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0940 -
accuracy: 0.9616
782/782 [==============================] - 1s 1ms/step - loss: 0.4450 -
accuracy: 0.8636
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1024 -
accuracy: 0.8596
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0613 -
accuracy: 0.9193
Epoch 3/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0478 -
accuracy: 0.9393
Epoch 4/4
196/196 [==============================] - 2s 11ms/step - loss: 0.0399 -
accuracy: 0.9499
782/782 [==============================] - 1s 874us/step - loss: 0.1120 -
accuracy: 0.8574
Epoch 1/4
```

```
196/196 [==============================] - 3s 12ms/step - loss: 0.3233 -
accuracy: 0.8598
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1999 -
accuracy: 0.9204
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1530 -
accuracy: 0.9411
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1209 -
accuracy: 0.9524
782/782 [==============================] - 1s 778us/step - loss: 0.3739 -
accuracy: 0.8698
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.1203 -
accuracy: 0.8282
Epoch 2/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0700 -
accuracy: 0.9093
Epoch 3/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0555 -
accuracy: 0.9291
Epoch 4/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0486 -
accuracy: 0.9395
782/782 [==============================] - 1s 911us/step - loss: 0.1037 -
accuracy: 0.8725
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.3835 -
accuracy: 0.8262
Epoch 2/4
196/196 [==============================] - 3s 15ms/step - loss: 0.2278 -
accuracy: 0.9143
Epoch 3/4
196/196 [==============================] - 3s 14ms/step - loss: 0.1912 -
accuracy: 0.9300
Epoch 4/4
196/196 [==============================] - 3s 14ms/step - loss: 0.1574 -
accuracy: 0.9448
782/782 [==============================] - 1s 937us/step - loss: 0.3715 -
accuracy: 0.8715
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1199 -
accuracy: 0.8306
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0740 -
accuracy: 0.9038
Epoch 3/4
```

```
196/196 [==============================] - 3s 13ms/step - loss: 0.0598 -
accuracy: 0.9231
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0512 -
accuracy: 0.9344
782/782 [==============================] - 1s 861us/step - loss: 0.1032 -
accuracy: 0.8714
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.3727 -
accuracy: 0.8370
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.2431 -
accuracy: 0.9074
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.2006 -
accuracy: 0.9268
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1785 -
accuracy: 0.9350
782/782 [==============================] - 1s 1ms/step - loss: 0.3348 -
accuracy: 0.8800
Epoch 1/4
196/196 [==============================] - 4s 15ms/step - loss: 0.1046 -
accuracy: 0.8551
Epoch 2/4
196/196 [==============================] - 3s 15ms/step - loss: 0.0455 -
accuracy: 0.9423
Epoch 3/4
196/196 [==============================] - 3s 15ms/step - loss: 0.0240 -
accuracy: 0.9736
Epoch 4/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0135 -
accuracy: 0.9867
782/782 [==============================] - 1s 1ms/step - loss: 0.1017 -
accuracy: 0.8664
Epoch 1/4
196/196 [==============================] - 4s 15ms/step - loss: 0.3283 -
accuracy: 0.8588
Epoch 2/4
196/196 [==============================] - 3s 15ms/step - loss: 0.1369 -
accuracy: 0.9494
Epoch 3/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0636 -
accuracy: 0.9797
Epoch 4/4
196/196 [==============================] - 3s 15ms/step - loss: 0.0323 -
accuracy: 0.9912
782/782 [==============================] - 1s 1ms/step - loss: 0.4646 -
```

```
accuracy: 0.8625
Epoch 1/4
196/196 [==============================] - 4s 14ms/step - loss: 0.1046 -
accuracy: 0.8546
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0522 -
accuracy: 0.9329
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0285 -
accuracy: 0.9668
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0153 -
accuracy: 0.9833
782/782 [==============================] - 1s 1ms/step - loss: 0.1122 -
accuracy: 0.8551
Epoch 1/4
196/196 [==============================] - 4s 14ms/step - loss: 0.3234 -
accuracy: 0.8620
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1599 -
accuracy: 0.9368
Epoch 3/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0777 -
accuracy: 0.9734
Epoch 4/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0364 -
accuracy: 0.9888
782/782 [==============================] - 1s 1ms/step - loss: 0.4843 -
accuracy: 0.8516
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1160 - accuracy:
0.8368
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.0525 - accuracy:
0.9326
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0372 - accuracy:
0.9560
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0302 - accuracy:
0.9655
782/782 [==============================] - 1s 802us/step - loss: 0.1127 -
accuracy: 0.8642
Epoch 1/4
49/49 [==============================] - 2s 32ms/step - loss: 0.3518 - accuracy:
0.8483
Epoch 2/4
49/49 [==============================] - 2s 33ms/step - loss: 0.1747 - accuracy:
```

```
0.9351
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1296 - accuracy:
0.9558
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1050 - accuracy:
0.9642
782/782 [==============================] - 1s 1ms/step - loss: 0.4501 -
accuracy: 0.8565
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1304 - accuracy:
0.8130
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0654 - accuracy:
0.9136
Epoch 3/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0530 - accuracy:
0.9315
Epoch 4/4
49/49 [==============================] - 1s 26ms/step - loss: 0.0447 - accuracy:
0.9438
782/782 [==============================] - 1s 897us/step - loss: 0.1285 -
accuracy: 0.8395
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.4044 - accuracy:
0.8182
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.2284 - accuracy:
0.9098
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1853 - accuracy:
0.9285
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1539 - accuracy:
0.9423
782/782 [==============================] - 1s 989us/step - loss: 0.3357 -
accuracy: 0.87250s - loss: 0.350
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.1462 - accuracy:
0.7823
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0711 - accuracy:
0.9055
Epoch 3/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0558 - accuracy:
0.9283
Epoch 4/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0461 - accuracy:
```

```
0.9429
782/782 [==============================] - 1s 965us/step - loss: 0.0978 -
accuracy: 0.8770
Epoch 1/4
49/49 [==============================] - 2s 31ms/step - loss: 0.4510 - accuracy:
0.7800
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.2428 - accuracy:
0.9088
Epoch 3/4
49/49 [==============================] - 1s 29ms/step - loss: 0.1904 - accuracy:
0.9317
Epoch 4/4
49/49 [==============================] - 1s 29ms/step - loss: 0.1631 - accuracy:
0.9428
782/782 [==============================] - 1s 956us/step - loss: 0.3696 -
accuracy: 0.8749
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1493 - accuracy:
0.7798
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0825 - accuracy:
0.8911
Epoch 3/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0680 - accuracy:
0.9126
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0584 - accuracy:
0.9258
782/782 [==============================] - 1s 841us/step - loss: 0.0911 -
accuracy: 0.8832
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.4551 - accuracy:
0.7831
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.2718 - accuracy:
0.8943
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.2312 - accuracy:
0.9120
Epoch 4/4
49/49 [==============================] - 1s 26ms/step - loss: 0.2046 - accuracy:
0.9247
782/782 [==============================] - 1s 970us/step - loss: 0.3076 -
accuracy: 0.8820
Epoch 1/4
49/49 [==============================] - 3s 32ms/step - loss: 0.1086 - accuracy:
0.8489
```

```
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.0393 - accuracy:
0.9528
Epoch 3/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0204 - accuracy:
0.9798
Epoch 4/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0121 - accuracy:
0.9895
782/782 [==============================] - 1s 1ms/step - loss: 0.0949 -
accuracy: 0.8701
Epoch 1/4
49/49 [==============================] - 3s 34ms/step - loss: 0.3425 - accuracy:
0.8504
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1206 - accuracy:
0.9573
Epoch 3/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0582 - accuracy:
0.9844
Epoch 4/4
49/49 [==============================] - 1s 28ms/step - loss: 0.0281 - accuracy:
0.9938
782/782 [==============================] - 1s 1ms/step - loss: 0.3786 -
accuracy: 0.8676
Epoch 1/4
49/49 [==============================] - 3s 32ms/step - loss: 0.1108 - accuracy:
0.8444
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0438 - accuracy:
0.9465
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0236 - accuracy:
0.9747
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0130 - accuracy:
0.9869
782/782 [==============================] - 1s 1ms/step - loss: 0.1105 -
accuracy: 0.8496
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.3354 - accuracy:
0.8539
Epoch 2/4
49/49 [==============================] - 1s 31ms/step - loss: 0.1429 - accuracy:
0.9458
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0793 - accuracy:
0.9740
```

```
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0387 - accuracy:
0.9893
782/782 [==============================] - 1s 1ms/step - loss: 0.3556 -
accuracy: 0.8677
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1041 -
accuracy: 0.8608
Epoch 2/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0537 -
accuracy: 0.9332
Epoch 3/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0358 -
accuracy: 0.9581
Epoch 4/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0235 -
accuracy: 0.9737
782/782 [==============================] - 1s 932us/step - loss: 0.1121 -
accuracy: 0.8665
Epoch 1/4
196/196 [==============================] - 3s 14ms/step - loss: 0.3353 -
accuracy: 0.8548
Epoch 2/4
196/196 [==============================] - 3s 14ms/step - loss: 0.1754 -
accuracy: 0.9334
Epoch 3/4
196/196 [==============================] - 2s 12ms/step - loss: 0.0522 -
accuracy: 0.9357
782/782 [==============================] - 1s 895us/step - loss: 0.0930 -
accuracy: 0.8828
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.4487 -
accuracy: 0.7907
Epoch 2/4
196/196 [==============================] - 2s 12ms/step - loss: 0.2716 -
accuracy: 0.9020
Epoch 3/4
196/196 [==============================] - 2s 13ms/step - loss: 0.2236 -
accuracy: 0.9230
Epoch 4/4
196/196 [==============================] - 2s 12ms/step - loss: 0.1942 -
accuracy: 0.9342
782/782 [==============================] - 1s 1ms/step - loss: 0.3326 -
accuracy: 0.8830
Epoch 1/4
196/196 [==============================] - 4s 15ms/step - loss: 0.1124 -
accuracy: 0.8414
Epoch 2/4
```

```
196/196 [==============================] - 3s 14ms/step - loss: 0.0406 -
accuracy: 0.9499
Epoch 3/4
196/196 [==============================] - 3s 15ms/step - loss: 0.0184 -
accuracy: 0.9798
Epoch 4/4
196/196 [==============================] - 3s 15ms/step - loss: 0.0107 -
accuracy: 0.9888
782/782 [==============================] - 1s 1ms/step - loss: 0.1099 -
accuracy: 0.8601
Epoch 1/4
196/196 [==============================] - 4s 15ms/step - loss: 0.3522 -
accuracy: 0.8416
Epoch 2/4
196/196 [==============================] - 3s 15ms/step - loss: 0.1394 -
accuracy: 0.9470
Epoch 3/4
196/196 [==============================] - 3s 15ms/step - loss: 0.0536 -
accuracy: 0.9828
Epoch 4/4
196/196 [==============================] - 3s 14ms/step - loss: 0.0236 -
accuracy: 0.9934
782/782 [==============================] - 1s 1ms/step - loss: 0.5199 -
accuracy: 0.8572
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1083 -
accuracy: 0.8479
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0509 -
accuracy: 0.9337
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0245 -
accuracy: 0.9708
Epoch 4/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0140 -
accuracy: 0.9835
782/782 [==============================] - 1s 986us/step - loss: 0.1225 -
accuracy: 0.8492
Epoch 1/4
196/196 [==============================] - 3s 13ms/step - loss: 0.3443 -
accuracy: 0.8481
Epoch 2/4
196/196 [==============================] - 3s 13ms/step - loss: 0.1590 -
accuracy: 0.9400
Epoch 3/4
196/196 [==============================] - 3s 13ms/step - loss: 0.0643 -
accuracy: 0.9778
Epoch 4/4
```

```
196/196 [==============================] - 3s 13ms/step - loss: 0.0273 -
accuracy: 0.9913
782/782 [==============================] - 1s 1ms/step - loss: 0.5988 -
accuracy: 0.8591
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1276 - accuracy:
0.8386
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.0552 - accuracy:
0.9302
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0361 - accuracy:
0.9581
Epoch 4/4
49/49 [==============================] - 1s 28ms/step - loss: 0.0267 - accuracy:
0.9703
782/782 [==============================] - 1s 851us/step - loss: 0.1089 -
accuracy: 0.8640
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.3900 - accuracy:
0.8396
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1877 - accuracy:
0.9300
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1266 - accuracy:
0.9564
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0828 - accuracy:
0.9726
782/782 [==============================] - 1s 987us/step - loss: 0.4728 -
accuracy: 0.8614
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.1367 - accuracy:
0.8113
Epoch 2/4
49/49 [==============================] - 2s 38ms/step - loss: 0.0709 - accuracy:
0.9071
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0510 - accuracy:
0.9356
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.0393 - accuracy:
0.9512
782/782 [==============================] - 1s 934us/step - loss: 0.0925 -
accuracy: 0.8789
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.4302 - accuracy:
```

```
0.8064
Epoch 2/4
49/49 [==============================] - 2s 32ms/step - loss: 0.2322 - accuracy:
0.9114
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1774 - accuracy:
0.9305
Epoch 4/4
49/49 [==============================] - 1s 25ms/step - loss: 0.1279 - accuracy:
0.9508
782/782 [==============================] - 1s 892us/step - loss: 0.3390 -
accuracy: 0.8780
Epoch 1/4
49/49 [==============================] - 3s 36ms/step - loss: 0.2067 - accuracy:
0.6706
Epoch 2/4
49/49 [==============================] - 2s 42ms/step - loss: 0.0959 - accuracy:
0.8777
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0656 - accuracy:
0.9188
Epoch 4/4
49/49 [==============================] - 1s 28ms/step - loss: 0.0513 - accuracy:
0.9374
782/782 [==============================] - 1s 909us/step - loss: 0.0895 -
accuracy: 0.8844
Epoch 1/4
49/49 [==============================] - 2s 33ms/step - loss: 0.5955 - accuracy:
0.6646
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.3157 - accuracy:
0.8822
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.2196 - accuracy:
0.9205
Epoch 4/4
49/49 [==============================] - 1s 29ms/step - loss: 0.1677 - accuracy:
0.9445
782/782 [==============================] - 1s 823us/step - loss: 0.3287 -
accuracy: 0.8805
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.1756 - accuracy:
0.7399
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0926 - accuracy:
0.8816
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0694 - accuracy:
```

```
0.9118
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0545 - accuracy:
0.9310
782/782 [==============================] - 1s 876us/step - loss: 0.0874 -
accuracy: 0.8888
Epoch 1/4
49/49 [==============================] - 2s 29ms/step - loss: 0.5340 - accuracy:
0.7276
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.3113 - accuracy:
0.8825
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.2307 - accuracy:
0.9164
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.1870 - accuracy:
0.9334
782/782 [==============================] - 1s 822us/step - loss: 0.3355 -
accuracy: 0.8757
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.1260 - accuracy:
0.8214
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.0381 - accuracy:
0.9549
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0161 - accuracy:
0.9841
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0076 - accuracy:
0.9932
782/782 [==============================] - 1s 1ms/step - loss: 0.1235 -
accuracy: 0.8250
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.4014 - accuracy:
0.8135
Epoch 2/4
49/49 [==============================] - 2s 31ms/step - loss: 0.1247 - accuracy:
0.9596
Epoch 3/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0461 - accuracy:
0.9894
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0135 - accuracy:
0.9984
782/782 [==============================] - 1s 1ms/step - loss: 0.3497 -
accuracy: 0.8502
```

```
Epoch 1/4
49/49 [==============================] - 3s 31ms/step - loss: 0.1162 - accuracy:
0.8366
Epoch 2/4
49/49 [==============================] - 1s 29ms/step - loss: 0.0403 - accuracy:
0.9512
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0182 - accuracy:
0.9808
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0087 - accuracy:
0.9917
782/782 [==============================] - 1s 1ms/step - loss: 0.1178 -
accuracy: 0.8370
Epoch 1/4
49/49 [==============================] - 3s 29ms/step - loss: 0.3738 - accuracy:
0.8332
Epoch 2/4
49/49 [==============================] - 1s 31ms/step - loss: 0.1244 - accuracy:
0.9560
Epoch 3/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0414 - accuracy:
0.9889
Epoch 4/4
49/49 [==============================] - 1s 27ms/step - loss: 0.0138 - accuracy:
0.9970
782/782 [==============================] - 1s 1ms/step - loss: 0.3592 -
accuracy: 0.8503
```

[ ]:
```
final_df =pd.DataFrame(results, columns=['loss_val', 'validation_accuracy_val',␣
↪'epoch', 'layers', 'units', 'activation', 'batch_size','regularization',␣
↪'optimizer_name','loss_type'])
```

[11]:
```
final_df.to_csv('more_combinations_model_accuracies.csv',index=False)
```

[13]:
```
final_df = pd.read_csv('more_combinations_model_accuracies.csv')
```

[85]:
```
# get the maximum validation accuracy from the various models we tried
final_df['validation_accuracy_val'].max() # 0.8907999992370605
```

[85]:
```
0.8907999992370605
```

[87]:
```
# get the minimum loss from the various models we tried
final_df['loss_val'].min() # 0.08239934593439102
```

[87]:
```
0.08239934593439102
```

[86]:
```
final_df[final_df.validation_accuracy_val==0.8907999992370605] # Accuracy of␣
↪the best model is 0.8908 that is slightly higher than 0.885
```

[86]:

	loss_val	validation_accuracy_val	epoch	layers	units	activation	batch_size	regularization	optimizer_name	loss_type
91	0.273701	0.8908	4	1	32	relu	512	dropout	rmsprop	binary_crossentropy

[88]:
```
final_df[final_df.loss_val==0.08239934593439102] # Loss is 0.08 which is way␣
↪lower than the initial model with 0.29 loss
```

[88]:

	loss_val	validation_accuracy_val	epoch	layers	units	activation	batch_size	regularization	optimizer_name	loss_type
234	0.082399	0.89036	4	2	32	relu	512	dropout	rmsprop	mse

14 Now training the 2 best models as per the hyperparameter tuning results considering the maximum validation accuracy and minimum validation_loss

- 4 epochs, 1 layer, 32 hidden units, relu activation, 512 batch_size, dropout(0.5), rmsprop optimizer and binary_crossentropy as loss_type

[9]:
```
tf.random.set_seed(4546)
model_final_1 = keras.Sequential()
model_final_1.add(layers.Dense(32, activation='relu'))
model_final_1.add(Dropout(0.5))
model_final_1.add(layers.Dense(1, activation="sigmoid"))
model_final_1.compile(optimizer='rmsprop',
              loss='binary_crossentropy',
              metrics=["accuracy"])
model_final_1.fit(final_train_x_data, final_train_y_data, epochs=4,␣
↪batch_size=512)
# Evaluate the model on the final testing(unseen) data
results = model_final_1.evaluate(final_eval_x_test_data, final_eval_y_test_data)
print(results)
```

```
Epoch 1/4
88/88 [==============================] - 3s 24ms/step - loss: 0.4024 - accuracy:
0.8313
Epoch 2/4
88/88 [==============================] - 2s 21ms/step - loss: 0.2623 - accuracy:
0.9023
Epoch 3/4
```

```
88/88 [==============================] - 2s 20ms/step - loss: 0.2211 - accuracy:
0.9169 0s - loss: 0.2198 - accuracy: 0.
Epoch 4/4
88/88 [==============================] - 2s 16ms/step - loss: 0.1993 - accuracy:
0.9258
157/157 [==============================] - 0s 711us/step - loss: 0.2405 -
accuracy: 0.9028
[0.24047331511974335, 0.9028000235557556]
```

15 Awesome, we got a 0.903 on the unseen data which means this model architecture seems to be doing really well and there is no overfitting and, model generalized well

15.1 Training second model on all the training and validation above keeping last 5000 data points as unseen data to test to check overfitting or perfomance

- 4 epochs, 2 layers, 32 hidden units, relu activation, 512 batch_size, dropout(0.5), rmsprop optimizer and mse as loss_type

[9]:
```
tf.random.set_seed(4546)
model_final_2 = keras.Sequential()
model_final_2.add(layers.Dense(32, activation='relu'))
model_final_2.add(Dropout(0.5))
model_final_2.add(layers.Dense(32, activation='relu'))
model_final_2.add(Dropout(0.5))
model_final_2.add(layers.Dense(1, activation="sigmoid"))
model_final_2.compile(optimizer='rmsprop',
              loss='mse',
              metrics=["accuracy"])
model_final_2.fit(final_train_x_data, final_train_y_data, epochs=4,␣
 ↪batch_size=512)
# Evaluate the model on the final testing(unseen) data
results = model_final_2.evaluate(final_eval_x_test_data, final_eval_y_test_data)
```

```
Epoch 1/4
88/88 [==============================] - 3s 26ms/step - loss: 0.1505 - accuracy:
0.7937
Epoch 2/4
88/88 [==============================] - 2s 21ms/step - loss: 0.0859 - accuracy:
0.8930
Epoch 3/4
88/88 [==============================] - 2s 21ms/step - loss: 0.0690 - accuracy:
0.9137
Epoch 4/4
88/88 [==============================] - 2s 17ms/step - loss: 0.0604 - accuracy:
0.9249
157/157 [==============================] - 0s 703us/step - loss: 0.0737 -
```

```
accuracy: 0.9014
```

16 Awesome, we got a 0.9014 with the second model on the unseen data which means this model architecture seems to be doing really well and there is no overfitting and, model generalized well

17 But i would choose the first model as it is slightly better in generalization(not a lot) with 0.903 compared to 0.901 in terms of validation accuracy

[10]:
```
print(results)
```

```
[0.07373055070638657, 0.9014000296592712]
```

18 From the summary table below of all the models i tried, I have generated few insights:

18.1 Dropout Outperforming Batch Normalization:

Dropout and batch normalization are both techniques used to regularize neural networks and improve their generalization performance. Models using dropout as a regularization technique tend to achieve better performance (in terms of accuracy or loss) compared to models using batch normalization.

18.2 RMSprop as the Best Optimizer:

Among the optimizers tested (which includes algorithms like Adam and RMSprop), RMSprop is identified as the best performer. This means that models trained with RMSprop tend to converge faster or achieve better results on the specific dataset being used.

18.3 ReLU Activation as the Best Performer:

Among the activation functions tested (Tanh and ReLU), ReLU (Rectified Linear Unit) is identified as the best performer. ReLU is known for its simplicity and effectiveness in deep learning models. It allows the model to learn complex patterns by maintaining positive gradients during training.

18.4 32 Hidden Units as the Best Performer:

Among the tested configurations for the number of hidden units in the neural network layers, models with 32 hidden units are identified as the best performers. This indicates that a moderate complexity, represented by 32 hidden units, strikes a good balance for this specific dataset and task.

[21]:
```
```

```
# Summary table of all the models i tried and showed the Validation Accuracy␣
 ↪and Loss:
pd.options.display.max_rows = 432
final_df.sort_values(by=['epoch',␣
 ↪'layers','units','activation','batch_size','regularization','optimizer_name']).
 ↪reset_index(drop=True)
```

[21]:

	loss_val	validation_accuracy_val	epoch	layers	units	activation
0	0.116801	0.84884	4	1	16	relu
1	0.433328	0.85828	4	1	16	relu
2	0.102287	0.86312	4	1	16	relu
3	0.392313	0.86456	4	1	16	relu
4	0.083540	0.88584	4	1	16	relu
5	0.284089	0.88528	4	1	16	relu
6	0.083928	0.88672	4	1	16	relu
7	0.287721	0.88900	4	1	16	relu
8	0.093890	0.87376	4	1	16	relu
9	0.340389	0.87116	4	1	16	relu
10	0.090064	0.87988	4	1	16	relu
11	0.314851	0.87952	4	1	16	relu
12	0.110299	0.86908	4	1	16	relu
13	0.352977	0.86532	4	1	16	relu
14	0.106135	0.86916	4	1	16	relu
15	0.345413	0.86204	4	1	16	relu
16	0.086000	0.88864	4	1	16	relu
17	0.277887	0.88952	4	1	16	relu
18	0.083175	0.88920	4	1	16	relu
19	0.279836	0.88748	4	1	16	relu
20	0.086891	0.88468	4	1	16	relu
21	0.286192	0.88540	4	1	16	relu
22	0.085152	0.88652	4	1	16	relu
23	0.291994	0.88308	4	1	16	relu
24	0.108008	0.86024	4	1	16	tanh
25	0.399816	0.85992	4	1	16	tanh
26	0.102839	0.86480	4	1	16	tanh
27	0.355335	0.86568	4	1	16	tanh
28	0.088599	0.87964	4	1	16	tanh
29	0.313415	0.87852	4	1	16	tanh
30	0.088110	0.88144	4	1	16	tanh
31	0.304813	0.88148	4	1	16	tanh
32	0.096944	0.87108	4	1	16	tanh
33	0.356565	0.87216	4	1	16	tanh
34	0.101169	0.86724	4	1	16	tanh
35	0.368511	0.86288	4	1	16	tanh
36	0.106499	0.85604	4	1	16	tanh
37	0.336127	0.85772	4	1	16	tanh
38	0.098115	0.86604	4	1	16	tanh

39	0.333693	0.85972	4	1	16	tanh
40	0.087069	0.88588	4	1	16	tanh
41	0.278375	0.88848	4	1	16	tanh
42	0.083172	0.88856	4	1	16	tanh
43	0.275926	0.88856	4	1	16	tanh
44	0.090454	0.87764	4	1	16	tanh
45	0.284039	0.88680	4	1	16	tanh
46	0.086974	0.88360	4	1	16	tanh
47	0.289072	0.88152	4	1	16	tanh
48	0.104683	0.86388	4	1	32	relu
49	0.444670	0.85892	4	1	32	relu
50	0.105213	0.86240	4	1	32	relu
51	0.423727	0.86492	4	1	32	relu
52	0.088361	0.88136	4	1	32	relu
53	0.297645	0.88304	4	1	32	relu
54	0.087102	0.88224	4	1	32	relu
55	0.308942	0.88216	4	1	32	relu
56	0.096886	0.87152	4	1	32	relu
57	0.367965	0.86872	4	1	32	relu
58	0.099157	0.86888	4	1	32	relu
59	0.350797	0.87100	4	1	32	relu
60	0.107354	0.86848	4	1	32	relu
61	0.343028	0.86624	4	1	32	relu
62	0.113258	0.85600	4	1	32	relu
63	0.346011	0.85780	4	1	32	relu
64	0.083359	0.88720	4	1	32	relu
65	0.275426	0.88828	4	1	32	relu
66	0.085252	0.88500	4	1	32	relu
67	0.273701	0.89080	4	1	32	relu
68	0.087613	0.88168	4	1	32	relu
69	0.296930	0.88212	4	1	32	relu
70	0.086686	0.88296	4	1	32	relu
71	0.289911	0.88456	4	1	32	relu
72	0.105329	0.86384	4	1	32	tanh
73	0.432208	0.84716	4	1	32	tanh
74	0.104206	0.86468	4	1	32	tanh
75	0.363099	0.86620	4	1	32	tanh
76	0.093643	0.87480	4	1	32	tanh
77	0.345745	0.87312	4	1	32	tanh
78	0.088570	0.88220	4	1	32	tanh
79	0.316491	0.87912	4	1	32	tanh
80	0.101607	0.86800	4	1	32	tanh
81	0.395799	0.86248	4	1	32	tanh
82	0.099537	0.87240	4	1	32	tanh
83	0.367872	0.86768	4	1	32	tanh
84	0.107867	0.85012	4	1	32	tanh
85	0.336505	0.85932	4	1	32	tanh

86	0.099191	0.86388	4	1	32	tanh
87	0.329700	0.85996	4	1	32	tanh
88	0.085927	0.88336	4	1	32	tanh
89	0.284783	0.88520	4	1	32	tanh
90	0.084271	0.88596	4	1	32	tanh
91	0.281668	0.88644	4	1	32	tanh
92	0.087763	0.88112	4	1	32	tanh
93	0.294842	0.88172	4	1	32	tanh
94	0.086956	0.88224	4	1	32	tanh
95	0.303560	0.87896	4	1	32	tanh
96	0.104758	0.86148	4	1	64	relu
97	0.437547	0.86152	4	1	64	relu
98	0.101489	0.86416	4	1	64	relu
99	0.421418	0.86220	4	1	64	relu
100	0.089552	0.87844	4	1	64	relu
101	0.320402	0.87860	4	1	64	relu
102	0.087504	0.88308	4	1	64	relu
103	0.321794	0.88264	4	1	64	relu
104	0.100068	0.86876	4	1	64	relu
105	0.395316	0.86544	4	1	64	relu
106	0.105751	0.86288	4	1	64	relu
107	0.400829	0.85868	4	1	64	relu
108	0.108311	0.86764	4	1	64	relu
109	0.338875	0.86500	4	1	64	relu
110	0.109405	0.85912	4	1	64	relu
111	0.339891	0.85976	4	1	64	relu
112	0.084467	0.88664	4	1	64	relu
113	0.282476	0.88596	4	1	64	relu
114	0.082993	0.88680	4	1	64	relu
115	0.277930	0.88852	4	1	64	relu
116	0.093107	0.87380	4	1	64	relu
117	0.321377	0.87584	4	1	64	relu
118	0.087855	0.88112	4	1	64	relu
119	0.299522	0.88168	4	1	64	relu
120	0.104583	0.86684	4	1	64	tanh
121	0.477876	0.83720	4	1	64	tanh
122	0.103247	0.86648	4	1	64	tanh
123	0.359493	0.86744	4	1	64	tanh
124	0.099400	0.87004	4	1	64	tanh
125	0.371212	0.86916	4	1	64	tanh
126	0.092666	0.87740	4	1	64	tanh
127	0.323909	0.87776	4	1	64	tanh
128	0.107253	0.86492	4	1	64	tanh
129	0.422827	0.86164	4	1	64	tanh
130	0.107394	0.86396	4	1	64	tanh
131	0.358027	0.86872	4	1	64	tanh
132	0.098607	0.86408	4	1	64	tanh

133	0.330886	0.86040	4	1	64	tanh
134	0.106983	0.85276	4	1	64	tanh
135	0.331065	0.85804	4	1	64	tanh
136	0.087212	0.88264	4	1	64	tanh
137	0.301695	0.88144	4	1	64	tanh
138	0.087187	0.88244	4	1	64	tanh
139	0.295686	0.88236	4	1	64	tanh
140	0.092318	0.87488	4	1	64	tanh
141	0.326720	0.87532	4	1	64	tanh
142	0.090414	0.87852	4	1	64	tanh
143	0.359504	0.86484	4	1	64	tanh
144	0.106148	0.86264	4	2	16	relu
145	0.453590	0.85452	4	2	16	relu
146	0.104450	0.86380	4	2	16	relu
147	0.417393	0.86068	4	2	16	relu
148	0.086631	0.88560	4	2	16	relu
149	0.314836	0.87940	4	2	16	relu
150	0.097357	0.87656	4	2	16	relu
151	0.304924	0.88736	4	2	16	relu
152	0.100733	0.86968	4	2	16	relu
153	0.393276	0.86560	4	2	16	relu
154	0.097267	0.87244	4	2	16	relu
155	0.360779	0.87112	4	2	16	relu
156	0.112261	0.86732	4	2	16	relu
157	0.370137	0.84448	4	2	16	relu
158	0.120171	0.85864	4	2	16	relu
159	0.332588	0.86380	4	2	16	relu
160	0.083486	0.88776	4	2	16	relu
161	0.275780	0.89056	4	2	16	relu
162	0.082686	0.88816	4	2	16	relu
163	0.279848	0.88900	4	2	16	relu
164	0.087087	0.88236	4	2	16	relu
165	0.303495	0.87988	4	2	16	relu
166	0.090311	0.87740	4	2	16	relu
167	0.365388	0.85704	4	2	16	relu
168	0.110382	0.85692	4	2	16	tanh
169	0.410790	0.86232	4	2	16	tanh
170	0.103279	0.86380	4	2	16	tanh
171	0.366270	0.86604	4	2	16	tanh
172	0.100791	0.87316	4	2	16	tanh
173	0.361264	0.87000	4	2	16	tanh
174	0.105958	0.86756	4	2	16	tanh
175	0.317595	0.88152	4	2	16	tanh
176	0.109026	0.86512	4	2	16	tanh
177	0.395161	0.86664	4	2	16	tanh
178	0.103711	0.86748	4	2	16	tanh
179	0.350435	0.86880	4	2	16	tanh

180	0.102337	0.86100	4	2	16	tanh
181	0.328853	0.86584	4	2	16	tanh
182	0.132169	0.82036	4	2	16	tanh
183	0.337481	0.86292	4	2	16	tanh
184	0.083770	0.88656	4	2	16	tanh
185	0.287708	0.88624	4	2	16	tanh
186	0.085620	0.88616	4	2	16	tanh
187	0.296037	0.88484	4	2	16	tanh
188	0.093951	0.87268	4	2	16	tanh
189	0.320048	0.87584	4	2	16	tanh
190	0.092872	0.87724	4	2	16	tanh
191	0.327282	0.87664	4	2	16	tanh
192	0.107428	0.86044	4	2	32	relu
193	0.479307	0.85672	4	2	32	relu
194	0.109395	0.85820	4	2	32	relu
195	0.486259	0.86076	4	2	32	relu
196	0.090981	0.88320	4	2	32	relu
197	0.318271	0.88056	4	2	32	relu
198	0.089725	0.88496	4	2	32	relu
199	0.341741	0.88120	4	2	32	relu
200	0.106091	0.86740	4	2	32	relu
201	0.447192	0.85880	4	2	32	relu
202	0.098716	0.87188	4	2	32	relu
203	0.371291	0.87116	4	2	32	relu
204	0.118659	0.83864	4	2	32	relu
205	0.420078	0.80424	4	2	32	relu
206	0.115052	0.84732	4	2	32	relu
207	0.359590	0.84300	4	2	32	relu
208	0.084274	0.88636	4	2	32	relu
209	0.280193	0.88776	4	2	32	relu
210	0.082399	0.89036	4	2	32	relu
211	0.301898	0.88356	4	2	32	relu
212	0.096073	0.87180	4	2	32	relu
213	0.363308	0.87100	4	2	32	relu
214	0.086970	0.88232	4	2	32	relu
215	0.397754	0.85472	4	2	32	relu
216	0.103808	0.86384	4	2	32	tanh
217	0.422560	0.86564	4	2	32	tanh
218	0.100940	0.86444	4	2	32	tanh
219	0.372912	0.86340	4	2	32	tanh
220	0.101154	0.87344	4	2	32	tanh
221	0.368596	0.86904	4	2	32	tanh
222	0.094904	0.87824	4	2	32	tanh
223	0.319627	0.87908	4	2	32	tanh
224	0.110301	0.86508	4	2	32	tanh
225	0.447401	0.85436	4	2	32	tanh
226	0.107363	0.86516	4	2	32	tanh

227	0.362912	0.86492	4	2	32	tanh
228	0.097593	0.86584	4	2	32	tanh
229	0.336082	0.86580	4	2	32	tanh
230	0.100559	0.86088	4	2	32	tanh
231	0.354959	0.85780	4	2	32	tanh
232	0.090055	0.88040	4	2	32	tanh
233	0.334111	0.87808	4	2	32	tanh
234	0.096152	0.87504	4	2	32	tanh
235	0.340387	0.87152	4	2	32	tanh
236	0.101819	0.87064	4	2	32	tanh
237	0.388520	0.86848	4	2	32	tanh
238	0.109419	0.85952	4	2	32	tanh
239	0.331874	0.87572	4	2	32	tanh
240	0.104092	0.86408	4	2	64	relu
241	0.473903	0.86488	4	2	64	relu
242	0.113618	0.85576	4	2	64	relu
243	0.494252	0.86280	4	2	64	relu
244	0.092992	0.87664	4	2	64	relu
245	0.353957	0.87792	4	2	64	relu
246	0.093078	0.88104	4	2	64	relu
247	0.360392	0.87864	4	2	64	relu
248	0.108162	0.86532	4	2	64	relu
249	0.449278	0.86076	4	2	64	relu
250	0.098487	0.87280	4	2	64	relu
251	0.460290	0.86824	4	2	64	relu
252	0.121617	0.83020	4	2	64	relu
253	0.376091	0.83292	4	2	64	relu
254	0.145344	0.78404	4	2	64	relu
255	0.417649	0.81288	4	2	64	relu
256	0.086700	0.88376	4	2	64	relu
257	0.313941	0.88296	4	2	64	relu
258	0.085132	0.88588	4	2	64	relu
259	0.294942	0.88728	4	2	64	relu
260	0.100583	0.86920	4	2	64	relu
261	0.417427	0.86564	4	2	64	relu
262	0.103312	0.86308	4	2	64	relu
263	0.320851	0.87772	4	2	64	relu
264	0.104598	0.86012	4	2	64	tanh
265	0.414007	0.86412	4	2	64	tanh
266	0.100411	0.86448	4	2	64	tanh
267	0.382818	0.86500	4	2	64	tanh
268	0.105369	0.86924	4	2	64	tanh
269	0.384303	0.86612	4	2	64	tanh
270	0.096540	0.87752	4	2	64	tanh
271	0.347817	0.86848	4	2	64	tanh
272	0.112957	0.86340	4	2	64	tanh
273	0.437343	0.86028	4	2	64	tanh

274	0.104732	0.86440	4	2	64	tanh
275	0.353779	0.86888	4	2	64	tanh
276	0.095122	0.86892	4	2	64	tanh
277	0.365477	0.85864	4	2	64	tanh
278	0.113871	0.84220	4	2	64	tanh
279	0.460894	0.81896	4	2	64	tanh
280	0.098582	0.87300	4	2	64	tanh
281	0.371989	0.87020	4	2	64	tanh
282	0.099630	0.87016	4	2	64	tanh
283	0.383835	0.85916	4	2	64	tanh
284	0.109013	0.86532	4	2	64	tanh
285	0.440673	0.86172	4	2	64	tanh
286	0.098494	0.87412	4	2	64	tanh
287	0.437285	0.84024	4	2	64	tanh
288	0.114876	0.85328	4	3	16	relu
289	0.428532	0.85984	4	3	16	relu
290	0.109458	0.86096	4	3	16	relu
291	0.434049	0.86256	4	3	16	relu
292	0.094138	0.87768	4	3	16	relu
293	0.299568	0.88016	4	3	16	relu
294	0.090865	0.88460	4	3	16	relu
295	0.317136	0.88052	4	3	16	relu
296	0.107555	0.86552	4	3	16	relu
297	0.420239	0.86396	4	3	16	relu
298	0.103882	0.86736	4	3	16	relu
299	0.388857	0.86652	4	3	16	relu
300	0.100294	0.86848	4	3	16	relu
301	0.321992	0.86656	4	3	16	relu
302	0.109269	0.85404	4	3	16	relu
303	0.388259	0.83464	4	3	16	relu
304	0.083864	0.88724	4	3	16	relu
305	0.400993	0.87792	4	3	16	relu
306	0.084871	0.88700	4	3	16	relu
307	0.390271	0.87028	4	3	16	relu
308	0.090279	0.87824	4	3	16	relu
309	0.345409	0.87528	4	3	16	relu
310	0.087533	0.88072	4	3	16	relu
311	0.340962	0.86832	4	3	16	relu
312	0.106981	0.85984	4	3	16	tanh
313	0.413875	0.86056	4	3	16	tanh
314	0.105033	0.86064	4	3	16	tanh
315	0.372107	0.86716	4	3	16	tanh
316	0.101465	0.87776	4	3	16	tanh
317	0.358876	0.87412	4	3	16	tanh
318	0.106870	0.87052	4	3	16	tanh
319	0.328923	0.88276	4	3	16	tanh
320	0.110390	0.86552	4	3	16	tanh

321	0.409952	0.86112	4	3	16	tanh
322	0.100255	0.87156	4	3	16	tanh
323	0.359576	0.86812	4	3	16	tanh
324	0.098368	0.86568	4	3	16	tanh
325	0.341201	0.86548	4	3	16	tanh
326	0.101436	0.86236	4	3	16	tanh
327	0.368029	0.85416	4	3	16	tanh
328	0.090824	0.88356	4	3	16	tanh
329	0.316004	0.88364	4	3	16	tanh
330	0.094341	0.88036	4	3	16	tanh
331	0.328089	0.87664	4	3	16	tanh
332	0.098630	0.87432	4	3	16	tanh
333	0.389918	0.86812	4	3	16	tanh
334	0.097138	0.87364	4	3	16	tanh
335	0.384723	0.86004	4	3	16	tanh
336	0.110881	0.85716	4	3	32	relu
337	0.544111	0.84408	4	3	32	relu
338	0.114365	0.85496	4	3	32	relu
339	0.486086	0.85580	4	3	32	relu
340	0.093122	0.87944	4	3	32	relu
341	0.315465	0.88024	4	3	32	relu
342	0.092552	0.88612	4	3	32	relu
343	0.322599	0.87984	4	3	32	relu
344	0.109947	0.86564	4	3	32	relu
345	0.443020	0.85916	4	3	32	relu
346	0.100985	0.87348	4	3	32	relu
347	0.382160	0.86944	4	3	32	relu
348	0.102734	0.86384	4	3	32	relu
349	0.455655	0.79832	4	3	32	relu
350	0.170802	0.75324	4	3	32	relu
351	0.331490	0.86128	4	3	32	relu
352	0.087063	0.88588	4	3	32	relu
353	0.292746	0.88612	4	3	32	relu
354	0.095114	0.87736	4	3	32	relu
355	0.291558	0.88488	4	3	32	relu
356	0.101276	0.87040	4	3	32	relu
357	0.394112	0.86868	4	3	32	relu
358	0.090749	0.87872	4	3	32	relu
359	0.322732	0.88012	4	3	32	relu
360	0.103031	0.86408	4	3	32	tanh
361	0.456492	0.85480	4	3	32	tanh
362	0.104087	0.86188	4	3	32	tanh
363	0.393961	0.86080	4	3	32	tanh
364	0.102228	0.87480	4	3	32	tanh
365	0.367490	0.87068	4	3	32	tanh
366	0.104356	0.87100	4	3	32	tanh
367	0.328867	0.87964	4	3	32	tanh

368	0.106805	0.86656	4	3	32	tanh
369	0.400139	0.86320	4	3	32	tanh
370	0.105785	0.86480	4	3	32	tanh
371	0.361727	0.86968	4	3	32	tanh
372	0.103399	0.85932	4	3	32	tanh
373	0.363475	0.86556	4	3	32	tanh
374	0.105931	0.85716	4	3	32	tanh
375	0.372846	0.86092	4	3	32	tanh
376	0.094478	0.88004	4	3	32	tanh
377	0.354464	0.87660	4	3	32	tanh
378	0.095694	0.87972	4	3	32	tanh
379	0.312725	0.88316	4	3	32	tanh
380	0.106717	0.86676	4	3	32	tanh
381	0.434352	0.86032	4	3	32	tanh
382	0.107251	0.86320	4	3	32	tanh
383	0.383164	0.85232	4	3	32	tanh
384	0.109943	0.86008	4	3	64	relu
385	0.519909	0.85716	4	3	64	relu
386	0.122535	0.84920	4	3	64	relu
387	0.598768	0.85912	4	3	64	relu
388	0.093063	0.88076	4	3	64	relu
389	0.333320	0.87656	4	3	64	relu
390	0.093027	0.88276	4	3	64	relu
391	0.332636	0.88296	4	3	64	relu
392	0.112092	0.86652	4	3	64	relu
393	0.545746	0.85148	4	3	64	relu
394	0.106764	0.86992	4	3	64	relu
395	0.514291	0.86672	4	3	64	relu
396	0.123469	0.82496	4	3	64	relu
397	0.349650	0.85016	4	3	64	relu
398	0.117842	0.83704	4	3	64	relu
399	0.359178	0.85032	4	3	64	relu
400	0.089500	0.88436	4	3	64	relu
401	0.328713	0.88048	4	3	64	relu
402	0.087367	0.88876	4	3	64	relu
403	0.335485	0.87572	4	3	64	relu
404	0.108907	0.86400	4	3	64	relu
405	0.472845	0.86136	4	3	64	relu
406	0.092505	0.87888	4	3	64	relu
407	0.339014	0.87804	4	3	64	relu
408	0.101693	0.86644	4	3	64	tanh
409	0.464617	0.86248	4	3	64	tanh
410	0.112214	0.85508	4	3	64	tanh
411	0.484254	0.85156	4	3	64	tanh
412	0.103730	0.87252	4	3	64	tanh
413	0.371515	0.87152	4	3	64	tanh
414	0.103190	0.87136	4	3	64	tanh

415	0.334846	0.88000	4	3	64	tanh
416	0.108191	0.86544	4	3	64	tanh
417	0.445009	0.86360	4	3	64	tanh
418	0.112033	0.85744	4	3	64	tanh
419	0.373944	0.86976	4	3	64	tanh
420	0.094912	0.87008	4	3	64	tanh
421	0.378629	0.86756	4	3	64	tanh
422	0.110465	0.84956	4	3	64	tanh
423	0.355618	0.86772	4	3	64	tanh
424	0.097840	0.87700	4	3	64	tanh
425	0.369599	0.87492	4	3	64	tanh
426	0.091124	0.88324	4	3	64	tanh
427	0.307593	0.88200	4	3	64	tanh
428	0.112658	0.86424	4	3	64	tanh
429	0.450067	0.85648	4	3	64	tanh
430	0.128530	0.83948	4	3	64	tanh
431	0.335743	0.87248	4	3	64	tanh

	batch_size	regularization	optimizer_name	loss_type
0	128	batchnorm	adam	mse
1	128	batchnorm	adam	binary_crossentropy
2	128	batchnorm	rmsprop	mse
3	128	batchnorm	rmsprop	binary_crossentropy
4	128	dropout	adam	mse
5	128	dropout	adam	binary_crossentropy
6	128	dropout	rmsprop	mse
7	128	dropout	rmsprop	binary_crossentropy
8	128	NaN	adam	mse
9	128	NaN	adam	binary_crossentropy
10	128	NaN	rmsprop	mse
11	128	NaN	rmsprop	binary_crossentropy
12	512	batchnorm	adam	mse
13	512	batchnorm	adam	binary_crossentropy
14	512	batchnorm	rmsprop	mse
15	512	batchnorm	rmsprop	binary_crossentropy
16	512	dropout	adam	mse
17	512	dropout	adam	binary_crossentropy
18	512	dropout	rmsprop	mse
19	512	dropout	rmsprop	binary_crossentropy
20	512	NaN	adam	mse
21	512	NaN	adam	binary_crossentropy
22	512	NaN	rmsprop	mse
23	512	NaN	rmsprop	binary_crossentropy
24	128	batchnorm	adam	mse
25	128	batchnorm	adam	binary_crossentropy
26	128	batchnorm	rmsprop	mse
27	128	batchnorm	rmsprop	binary_crossentropy

28	128	dropout	adam	mse
29	128	dropout	adam	binary_crossentropy
30	128	dropout	rmsprop	mse
31	128	dropout	rmsprop	binary_crossentropy
32	128	NaN	adam	mse
33	128	NaN	adam	binary_crossentropy
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19 Next steps:

- Adding LSTM layers might improve the performance
- Engineering features might also improve the performance and get us better models
- Recently, hugging face released the state of the art model for sentiment classification and can be used to get the supreme model