lab-solution

November 26, 2023

1 Assignment: Neural Networks for Music Classification

Fraida Fund

TODO: Edit this cell to fill in your NYU Net ID and your name:

- **Net ID**:
- **Name**:

Note: This experiment is designed to run on a Google Colab **GPU** runtime. You should use a GPU runtime on Colab to work on this assignment. You should not run it outside of Google Colab. However, if you have been using Colab GPU runtimes a lot, you may be alerted that you have exhausted the "free" compute units allocated to you by Google Colab. If that happens, you do not have to purchase compute units - use a CPU runtime instead, and modify the experiment as instructed for CPU-only runtime.

In this assignment, we will look at an audio classification problem. Given a sample of music, we want to determine which instrument (e.g. trumpet, violin, piano) is playing.

This assignment is closely based on one by Sundeep Rangan, from his IntroML GitHub repo.

[ ]:
```
import tensorflow as tf
import numpy as np
import matplotlib
import matplotlib.pyplot as plt
import seaborn as sns
import time
%matplotlib inline
```

1.1 Audio Feature Extraction with Librosa

The key to audio classification is to extract the correct features. The `librosa` package in python has a rich set of methods for extracting the features of audio samples commonly used in machine learning tasks, such as speech recognition and sound classification.

[ ]:
```
import librosa
import librosa.display
import librosa.feature
```

In this lab, we will use a set of music samples from the website:

http://theremin.music.uiowa.edu

This website has a great set of samples for audio processing.

We will use the `wget` command to retrieve one file to our Google Colab storage area. (We can run `wget` and many other basic Linux commands in Colab by prefixing them with a `!` or `%`.)

[ ]:
```
!wget "http://theremin.music.uiowa.edu/sound files/MIS/Woodwinds/
↪sopranosaxophone/SopSax.Vib.pp.C6Eb6.aiff"
```

```
--2023-11-24 01:25:48--  http://theremin.music.uiowa.edu/sound%20files/MIS/Woodw
inds/sopranosaxophone/SopSax.Vib.pp.C6Eb6.aiff
Resolving theremin.music.uiowa.edu (theremin.music.uiowa.edu)… 128.255.102.97,
2620:0:e50:680c::4e
Connecting to theremin.music.uiowa.edu
(theremin.music.uiowa.edu)|128.255.102.97|:80… connected.
HTTP request sent, awaiting response… 301 Moved Permanently
Location: https://theremin.music.uiowa.edu/sound%20files/MIS/Woodwinds/sopranosa
xophone/SopSax.Vib.pp.C6Eb6.aiff [following]
--2023-11-24 01:25:49--  https://theremin.music.uiowa.edu/sound%20files/MIS/Wood
winds/sopranosaxophone/SopSax.Vib.pp.C6Eb6.aiff
Connecting to theremin.music.uiowa.edu
(theremin.music.uiowa.edu)|128.255.102.97|:443… connected.
HTTP request sent, awaiting response… 200 OK
Length: 1418242 (1.4M) [audio/aiff]
Saving to: ‘SopSax.Vib.pp.C6Eb6.aiff.1’

SopSax.Vib.pp.C6Eb6 100%[===================>]   1.35M   698KB/s    in 2.0s

2023-11-24 01:25:52 (698 KB/s) - ‘SopSax.Vib.pp.C6Eb6.aiff.1’ saved
[1418242/1418242]
```

Now, if you click on the small folder icon on the far left of the Colab interface, you can see the files in your Colab storage. You should see the "SopSax.Vib.pp.C6Eb6.aiff" file appear there.

In order to listen to this file, we'll first convert it into the `wav` format. Again, we'll use a magic command to run a basic command-line utility: `ffmpeg`, a powerful tool for working with audio and video files.

[ ]:
```
aiff_file = 'SopSax.Vib.pp.C6Eb6.aiff'
wav_file = 'SopSax.Vib.pp.C6Eb6.wav'

!ffmpeg -y -i $aiff_file $wav_file
```

```
ffmpeg version 4.4.2-0ubuntu0.22.04.1 Copyright (c) 2000-2021 the FFmpeg
developers
  built with gcc 11 (Ubuntu 11.2.0-19ubuntu1)
  configuration: --prefix=/usr --extra-version=0ubuntu0.22.04.1
--toolchain=hardened --libdir=/usr/lib/x86_64-linux-gnu
```

```
--incdir=/usr/include/x86_64-linux-gnu --arch=amd64 --enable-gpl --disable-
stripping --enable-gnutls --enable-ladspa --enable-libaom --enable-libass
--enable-libbluray --enable-libbs2b --enable-libcaca --enable-libcdio --enable-
libcodec2 --enable-libdav1d --enable-libflite --enable-libfontconfig --enable-
libfreetype --enable-libfribidi --enable-libgme --enable-libgsm --enable-libjack
--enable-libmp3lame --enable-libmysofa --enable-libopenjpeg --enable-libopenmpt
--enable-libopus --enable-libpulse --enable-librabbitmq --enable-librubberband
--enable-libshine --enable-libsnappy --enable-libsoxr --enable-libspeex
--enable-libsrt --enable-libssh --enable-libtheora --enable-libtwolame --enable-
libvidstab --enable-libvorbis --enable-libvpx --enable-libwebp --enable-libx265
--enable-libxml2 --enable-libxvid --enable-libzimg --enable-libzmq --enable-
libzvbi --enable-lv2 --enable-omx --enable-openal --enable-opencl --enable-
opengl --enable-sdl2 --enable-pocketsphinx --enable-librsvg --enable-libmfx
--enable-libdc1394 --enable-libdrm --enable-libiec61883 --enable-chromaprint
--enable-frei0r --enable-libx264 --enable-shared
  libavutil      56. 70.100 / 56. 70.100
  libavcodec     58.134.100 / 58.134.100
  libavformat    58. 76.100 / 58. 76.100
  libavdevice    58. 13.100 / 58. 13.100
  libavfilter     7.110.100 /  7.110.100
  libswscale      5.  9.100 /  5.  9.100
  libswresample   3.  9.100 /  3.  9.100
  libpostproc    55.  9.100 / 55.  9.100
Guessed Channel Layout for Input Stream #0.0 : mono

Input #0, aiff, from 'SopSax.Vib.pp.C6Eb6.aiff':
  Duration: 00:00:16.07, start: 0.000000, bitrate: 705 kb/s
  Stream #0:0: Audio: pcm_s16be, 44100 Hz, mono, s16, 705 kb/s
Stream mapping:
  Stream #0:0 -> #0:0 (pcm_s16be (native) -> pcm_s16le (native))
Press [q] to stop, [?] for help
Output #0, wav, to 'SopSax.Vib.pp.C6Eb6.wav':
  Metadata:
    ISFT            : Lavf58.76.100
  Stream #0:0: Audio: pcm_s16le ([1][0][0][0] / 0x0001), 44100 Hz, mono, s16,
705 kb/s
    Metadata:
      encoder         : Lavc58.134.100 pcm_s16le
size=    1385kB time=00:00:16.06 bitrate= 705.9kbits/s speed= 586x
video:0kB audio:1384kB subtitle:0kB other streams:0kB global headers:0kB muxing
overhead: 0.005502%
```

Now, we can play the file directly from Colab. If you press the button, you will hear a soprano saxaphone (with vibrato) playing four notes (C, C#, D, Eb).

[ ]:
```
import IPython.display as ipd
ipd.Audio(wav_file)
```

[ ]: <IPython.lib.display.Audio object>

Next, use `librosa` command `librosa.load` to read the audio file with filename `audio_file` and get the samples `y` and sample rate `sr`.

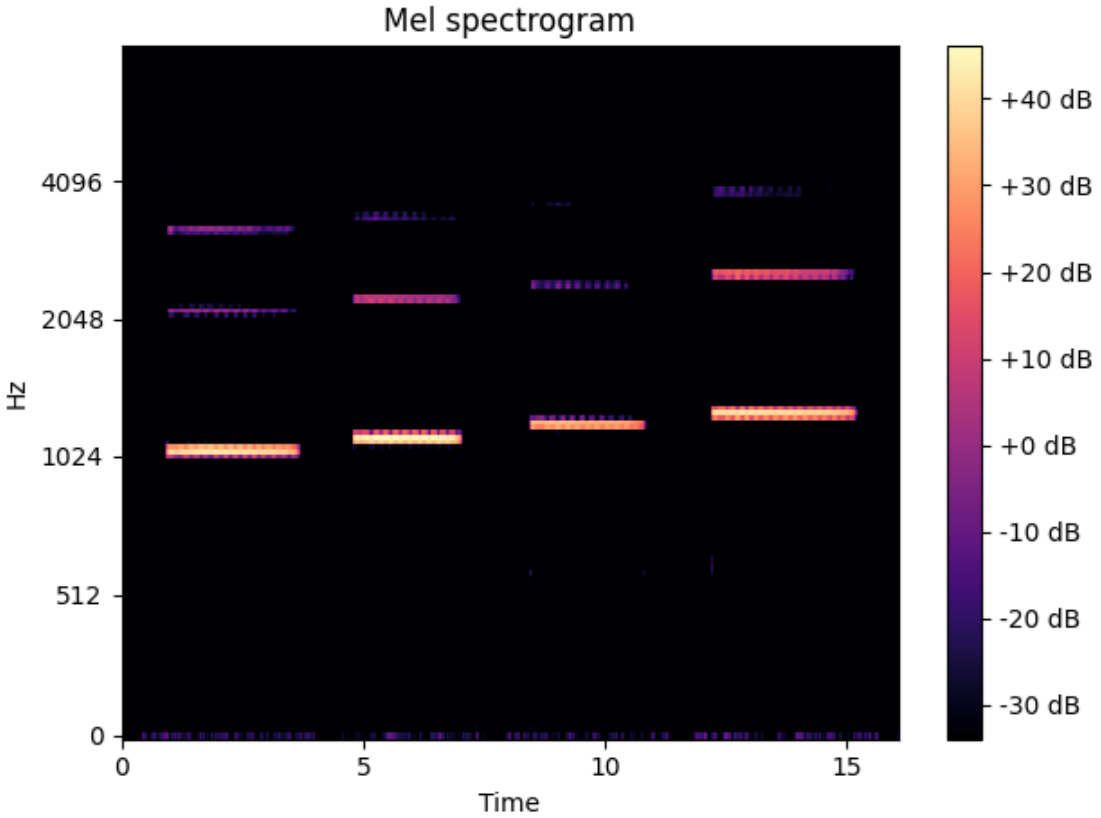
[ ]:
```
y, sr = librosa.load(aiff_file)
```

Feature engineering from audio files is an entire subject in its own right. A commonly used set of features are called the Mel Frequency Cepstral Coefficients (MFCCs). These are derived from the so-called mel spectrogram, which is something like a regular spectrogram, but the power and frequency are represented in log scale, which more naturally aligns with human perceptual processing.

You can run the code below to display the mel spectrogram from the audio sample.

You can easily see the four notes played in the audio track. You also see the 'harmonics' of each notes, which are other tones at integer multiples of the fundamental frequency of each note.

[ ]:
```
S = librosa.feature.melspectrogram(y=y, sr=sr, n_mels=128, fmax=8000)
librosa.display.specshow(librosa.amplitude_to_db(S),
                         y_axis='mel', fmax=8000, x_axis='time')
plt.colorbar(format='%+2.0f dB')
plt.title('Mel spectrogram')
plt.tight_layout()
```



1.2 Downloading the Data

Using the MFCC features described above, Prof. Juan Bello at NYU Steinhardt and his former PhD student Eric Humphrey have created a complete data set that can used for instrument classification. Essentially, they collected a number of data files from the website above. For each audio file, the segmented the track into notes and then extracted 120 MFCCs for each note. The goal is to recognize the instrument from the 120 MFCCs. The process of feature extraction is quite involved. So, we will just use their processed data.

To retrieve their data, visit

https://github.com/marl/dl4mir-tutorial/tree/master

and note the password listed on that page. Click on the link for "Instrument Dataset", enter the password, click on `instrument_dataset` to open the folder, and download it. (You can "direct download" straight from this site, you don't need a Dropbox account.) Depending on your laptop OS and on how you download the data, you may need to "unzip" or otherwise extract the four `.npy` files from an archive.

Then, upload the files to your Google Colab storage: click on the folder icon on the left to see your storage, if it isn't already open, and then click on "Upload".

Wait until *all* uploads have completed and the orange "circles" indicating uploads in progress are *gone*. (The training data especially will take some time to upload.)

Then, load the files with:

[ ]:
```
Xtr = np.load('uiowa_train_data.npy')
ytr = np.load('uiowa_train_labels.npy')
Xts = np.load('uiowa_test_data.npy')
yts = np.load('uiowa_test_labels.npy')
```

Examine the data you have just loaded in:

- How many training samples are there?
- How many test samples are there?
- What is the number of features for each sample?
- How many classes (i.e. instruments) are there?

Write some code to find these values and print them.

[ ]:
```
len(np.unique(ytr))
```

[ ]:
```
10
```

[ ]:
```
# TODO -  get basic details of the data
# compute these values from the data, don't hard-code them
n_tr    = Xtr.shape[0]
n_ts    = Xts.shape[0]
n_feat  = Xtr.shape[1]
```

```
n_class = len(np.unique(ytr))
```

[ ]:
```
# now print those details
print("Num training= %d" % n_tr)
print("Num test=     %d" % n_ts)
print("Num features= %d" % n_feat)
print("Num classes=  %d" % n_class)
```

```
Num training= 66247
Num test=     14904
Num features= 120
Num classes=  10
```

Then, standardize the training and test data, `Xtr` and `Xts`, by removing the mean of each feature and scaling to unit variance.

You can do this manually, or using `sklearn`'s StandardScaler. (For an example showing how to use a `StandardScaler`, you can refer to the notebook on regularization.)

Although you will scale both the training and test data, you should make sure that both are scaled according to the mean and variance statistics from the *training data only*.

Standardizing the input data can make the gradient descent work better, by making the loss function "easier" to descend.

[ ]:
```
# TODO - Standardize the training and test data
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
Xtr_scale = scaler.fit_transform(Xtr)
Xts_scale = scaler.transform(Xts)
```

1.3 Building a Neural Network Classifier

Following the example in the demos you have seen, clear the keras session. Then, create a neural network `model` with:

- `nh=256` hidden units in a single dense hidden layer
- `sigmoid` activation at hidden units
- select the input and output shapes, and output activation, according to the problem requirements. Use the variables you defined earlier (`n_tr`, `n_ts`, `n_feat`, `n_class`) as applicable, rather than hard-coding numbers.

Print the model summary.

[ ]:
```
from tensorflow.keras.models import Model, Sequential
from tensorflow.keras.layers import Dense, Activation
from tensorflow.keras import optimizers
from tensorflow.keras import callbacks
from tensorflow.keras.optimizers import Adam
import tensorflow.keras.backend as K
```

[ ]:
```
# TODO - construct the model
nh = 256

# Initialize the model
model = Sequential()

# Add a dense hidden layer
model.add(Dense(nh, input_shape=(n_feat,), activation='sigmoid'))

# Add the output layer
model.add(Dense(n_class, activation='softmax'))
```

[ ]:
```
# show the model summary
model.summary()
```

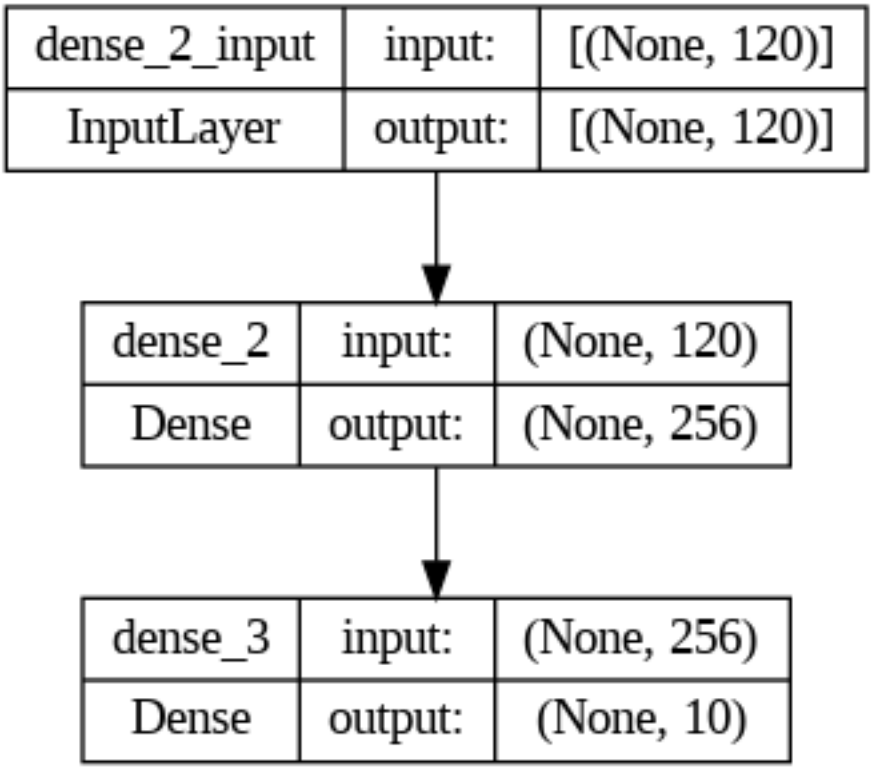
```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_2 (Dense)             (None, 256)               30976

 dense_3 (Dense)             (None, 10)                2570

=================================================================
Total params: 33546 (131.04 KB)
Trainable params: 33546 (131.04 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

[ ]:
```
# you can also visualize the model with
tf.keras.utils.plot_model(model, show_shapes=True)
```

[ ]:



Create an optimizer and compile the model. Select the appropriate loss function for this multi-class classification problem, and use an accuracy metric. For the optimizer, use the Adam optimizer with a learning rate of 0.001

[ ]:
```
# TODO - create optimizer and compile the model
opt = Adam(learning_rate=0.001)
model.compile(optimizer=Adam(learning_rate=0.001),
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy'])
```

Fit the model for 10 epochs using the scaled data for both training and validation, and save the training history in 'hist.

Use the `validation_data` option to pass the *test* data. (This is OK because we are not going to use this data as part of the training process, such as for early stopping - we're just going to compute the accuracy on the data so that we can see how training and test loss changes as the model is trained.)

Use a batch size of 128. Your final accuracy should be greater than 99%.

[ ]:
```
# TODO - fit model and save training history
hist = model.fit(Xtr_scale, ytr,
                 epochs=10,
                 batch_size=128,
```

```
                    validation_data=(Xts_scale, yts))
```

```
Epoch 1/10
518/518 [==============================] - 3s 4ms/step - loss: 0.4081 -
accuracy: 0.8887 - val_loss: 0.2246 - val_accuracy: 0.9298
Epoch 2/10
518/518 [==============================] - 2s 5ms/step - loss: 0.1219 -
accuracy: 0.9704 - val_loss: 0.1130 - val_accuracy: 0.9681
Epoch 3/10
518/518 [==============================] - 2s 4ms/step - loss: 0.0718 -
accuracy: 0.9832 - val_loss: 0.0695 - val_accuracy: 0.9825
Epoch 4/10
518/518 [==============================] - 2s 3ms/step - loss: 0.0504 -
accuracy: 0.9878 - val_loss: 0.0581 - val_accuracy: 0.9864
Epoch 5/10
518/518 [==============================] - 2s 3ms/step - loss: 0.0383 -
accuracy: 0.9905 - val_loss: 0.0462 - val_accuracy: 0.9882
Epoch 6/10
518/518 [==============================] - 2s 3ms/step - loss: 0.0307 -
accuracy: 0.9921 - val_loss: 0.0373 - val_accuracy: 0.9895
Epoch 7/10
518/518 [==============================] - 2s 3ms/step - loss: 0.0251 -
accuracy: 0.9934 - val_loss: 0.0430 - val_accuracy: 0.9876
Epoch 8/10
518/518 [==============================] - 2s 3ms/step - loss: 0.0210 -
accuracy: 0.9946 - val_loss: 0.0320 - val_accuracy: 0.9911
Epoch 9/10
518/518 [==============================] - 2s 4ms/step - loss: 0.0179 -
accuracy: 0.9953 - val_loss: 0.0290 - val_accuracy: 0.9908
Epoch 10/10
518/518 [==============================] - 3s 5ms/step - loss: 0.0157 -
accuracy: 0.9962 - val_loss: 0.0290 - val_accuracy: 0.9901
```

Plot the training and validation accuracy saved in `hist.history` dictionary, on the same plot. This gives one accuracy value per epoch. You should see that the validation accuracy saturates around 99%. After that it may "bounce around" a little due to the noise in the stochastic mini-batch gradient descent.

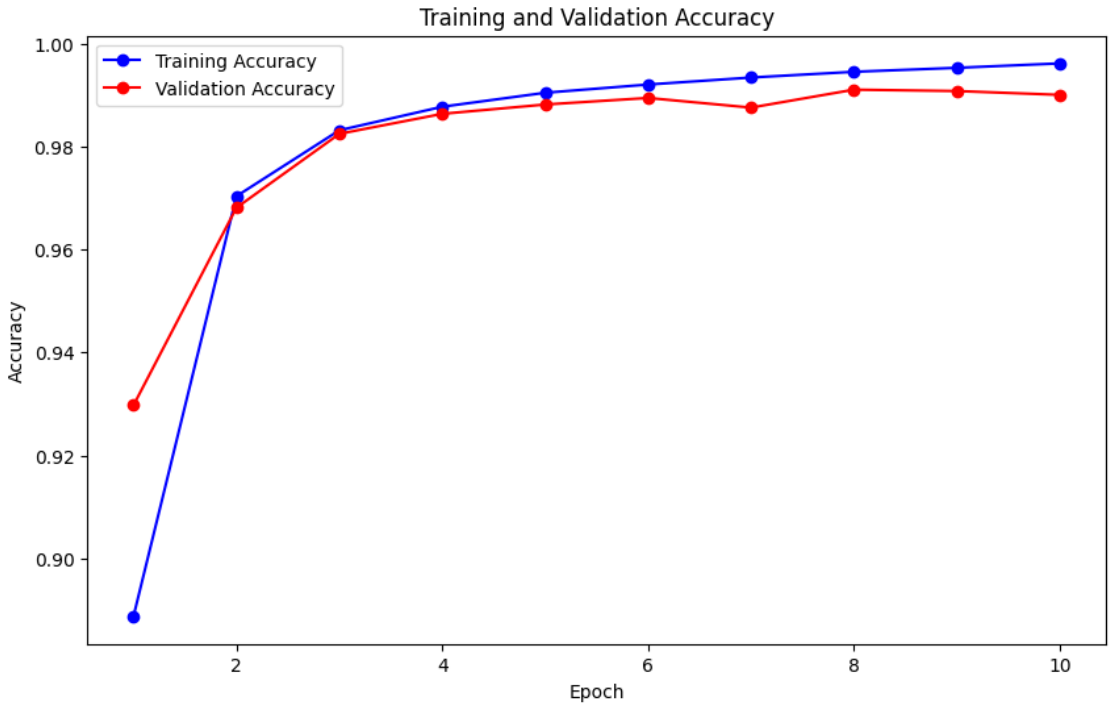
Make sure to label each axis, and each series (training vs. validation/test).

[ ]:
```
# TODO - plot the training and validation accuracy in one plot
train_acc = hist.history['accuracy']
val_acc = hist.history['val_accuracy']
epochs = range(1, len(train_acc) + 1)

# Plotting training and validation accuracy
plt.figure(figsize=(10, 6))
plt.plot(epochs, train_acc, 'bo-', label='Training Accuracy')
```

```
plt.plot(epochs, val_acc, 'ro-', label='Validation Accuracy')
plt.title('Training and Validation Accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()

plt.show()
```



Plot the training and validation loss values saved in the `hist.history` dictionary, on the same plot. You should see that the training loss is steadily decreasing. Use the `semilogy` plot so that the y-axis is log scale.

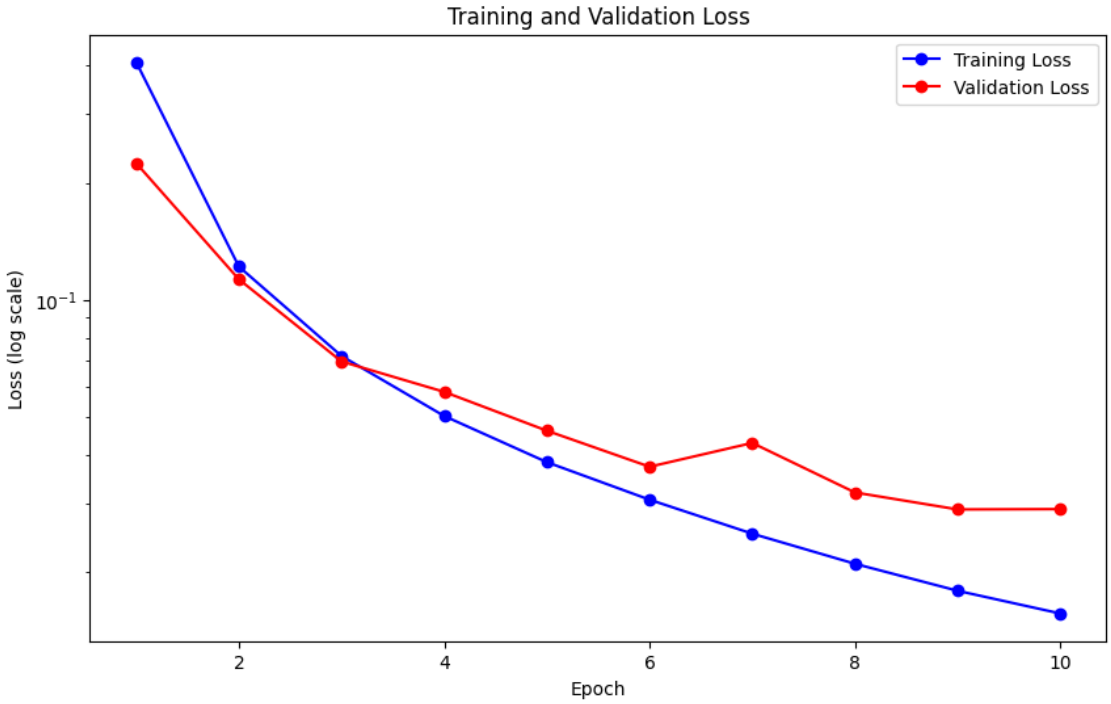
Make sure to label each axis, and each series (training vs. validation/test).

[ ]:
```
# TODO - plot the training and validation loss in one plot
train_loss = hist.history['loss']
val_loss = hist.history['val_loss']
epochs = range(1, len(train_loss) + 1)

# Plotting training and validation loss with a logarithmic scale for the y-axis
plt.figure(figsize=(10, 6))
plt.semilogy(epochs, train_loss, 'bo-', label='Training Loss')
plt.semilogy(epochs, val_loss, 'ro-', label='Validation Loss')
plt.title('Training and Validation Loss')
plt.xlabel('Epoch')
```

```
plt.ylabel('Loss (log scale)')
plt.legend()

plt.show()
```



1.4 Varying training hyperparameters

One challenge in training neural networks is the selection of the **training hyperparameters**, for example:

- learning rate
- learning rate decay schedule
- batch size
- optimizer-specific hyperparameters (for example, the `Adam` optimizer we have been using has `beta_1`, `beta_2`, and `epsilon` hyperparameters)

and this challenge is further complicated by the fact that all of these training hyperparameters interact with one another.

(Note: **training hyperparameters** are distinct from **model hyperparameters**, like the number of hidden units or layers.)

Sometimes, the choice of training hyperparameters affects whether or not the model will find an acceptable set of weights at all - i.e. whether the optimizer converges.

It's more often the case, though, that **for a given model**, we can arrive at a set of weights that have similar performance in many different ways, i.e. with different combinations of optimizer

hyperparameters. However, the *training cost** in both **time** and **energy** will be very much affected.

In this section, we will explore these further.

Repeat your model preparation and fitting code, but try four learning rates as shown in the vector `rates`. In each iteration of the loop:

- use `K.clear_session()` to free up memory from models that are no longer in scope. (Note that this does not affect models that are still "in scope"!)
- construct the network
- select the optimizer. Use the Adam optimizer with the learning rate specific to this iteration
- train the model for 20 epochs (make sure you are training a *new* model in each iteration, and not *continuing* the training of a model created already outside the loop)
- save the history of training and validation accuracy and loss for this model

[ ]:
```
rates = [0.1, 0.01,0.001,0.0001]

# To store the history of each model
histories = {}

for lr in rates:
    # Clearing the Keras session to free up memory
    K.clear_session()

    # Construct the network
    model = Sequential()
    model.add(Dense(nh, input_shape=(n_feat,), activation='sigmoid'))
    model.add(Dense(n_class, activation='softmax'))

    # Select the optimizer with the current learning rate
    opt = Adam(learning_rate=lr)

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

    # Train the model
    history = model.fit(Xtr_scale, ytr, epochs=20, batch_size=128,␣
 ↪validation_data=(Xts_scale, yts))

    # Save the history
    histories[lr] = history
```

```
Epoch 1/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2567 -
accuracy: 0.9425 - val_loss: 0.3769 - val_accuracy: 0.8926
Epoch 2/20
518/518 [==============================] - 2s 3ms/step - loss: 0.1979 -
```

```
accuracy: 0.9584 - val_loss: 0.5243 - val_accuracy: 0.9241
Epoch 3/20
518/518 [==============================] - 2s 3ms/step - loss: 0.1728 -
accuracy: 0.9681 - val_loss: 0.3242 - val_accuracy: 0.9518
Epoch 4/20
518/518 [==============================] - 2s 3ms/step - loss: 0.1949 -
accuracy: 0.9685 - val_loss: 0.5207 - val_accuracy: 0.9308
Epoch 5/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2412 -
accuracy: 0.9676 - val_loss: 0.5134 - val_accuracy: 0.9346
Epoch 6/20
518/518 [==============================] - 2s 5ms/step - loss: 0.1990 -
accuracy: 0.9714 - val_loss: 0.3563 - val_accuracy: 0.9584
Epoch 7/20
518/518 [==============================] - 3s 6ms/step - loss: 0.2185 -
accuracy: 0.9744 - val_loss: 0.5013 - val_accuracy: 0.9527
Epoch 8/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2098 -
accuracy: 0.9745 - val_loss: 0.5085 - val_accuracy: 0.9471
Epoch 9/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2060 -
accuracy: 0.9766 - val_loss: 0.4111 - val_accuracy: 0.9622
Epoch 10/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2043 -
accuracy: 0.9767 - val_loss: 0.2967 - val_accuracy: 0.9686
Epoch 11/20
518/518 [==============================] - 2s 3ms/step - loss: 0.3001 -
accuracy: 0.9658 - val_loss: 1.4059 - val_accuracy: 0.8706
Epoch 12/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2220 -
accuracy: 0.9790 - val_loss: 0.3682 - val_accuracy: 0.9462
Epoch 13/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2028 -
accuracy: 0.9792 - val_loss: 0.3779 - val_accuracy: 0.9691
Epoch 14/20
518/518 [==============================] - 3s 5ms/step - loss: 0.2198 -
accuracy: 0.9792 - val_loss: 0.5151 - val_accuracy: 0.9610
Epoch 15/20
518/518 [==============================] - 2s 5ms/step - loss: 0.1836 -
accuracy: 0.9815 - val_loss: 0.3946 - val_accuracy: 0.9703
Epoch 16/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2235 -
accuracy: 0.9790 - val_loss: 0.4796 - val_accuracy: 0.9643
Epoch 17/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2155 -
accuracy: 0.9795 - val_loss: 0.6288 - val_accuracy: 0.9575
Epoch 18/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2484 -
```

```
accuracy: 0.9787 - val_loss: 0.8349 - val_accuracy: 0.9063
Epoch 19/20
518/518 [==============================] - 2s 3ms/step - loss: 0.2776 -
accuracy: 0.9773 - val_loss: 0.5436 - val_accuracy: 0.9668
Epoch 20/20
518/518 [==============================] - 2s 3ms/step - loss: 0.1995 -
accuracy: 0.9830 - val_loss: 0.6679 - val_accuracy: 0.9604
Epoch 1/20
518/518 [==============================] - 3s 5ms/step - loss: 0.1164 -
accuracy: 0.9638 - val_loss: 0.0582 - val_accuracy: 0.9803
Epoch 2/20
518/518 [==============================] - 2s 5ms/step - loss: 0.0286 -
accuracy: 0.9905 - val_loss: 0.0298 - val_accuracy: 0.9912
Epoch 3/20
518/518 [==============================] - 2s 4ms/step - loss: 0.0221 -
accuracy: 0.9928 - val_loss: 0.0308 - val_accuracy: 0.9914
Epoch 4/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0150 -
accuracy: 0.9952 - val_loss: 0.0398 - val_accuracy: 0.9851
Epoch 5/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0152 -
accuracy: 0.9952 - val_loss: 0.0237 - val_accuracy: 0.9916
Epoch 6/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0155 -
accuracy: 0.9946 - val_loss: 0.0289 - val_accuracy: 0.9893
Epoch 7/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0116 -
accuracy: 0.9961 - val_loss: 0.1106 - val_accuracy: 0.9716
Epoch 8/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0113 -
accuracy: 0.9966 - val_loss: 0.0323 - val_accuracy: 0.9902
Epoch 9/20
518/518 [==============================] - 2s 5ms/step - loss: 0.0075 -
accuracy: 0.9976 - val_loss: 0.0328 - val_accuracy: 0.9890
Epoch 10/20
518/518 [==============================] - 2s 5ms/step - loss: 0.0099 -
accuracy: 0.9969 - val_loss: 0.0344 - val_accuracy: 0.9894
Epoch 11/20
518/518 [==============================] - 2s 4ms/step - loss: 0.0094 -
accuracy: 0.9969 - val_loss: 0.0536 - val_accuracy: 0.9837
Epoch 12/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0103 -
accuracy: 0.9969 - val_loss: 0.0279 - val_accuracy: 0.9911
Epoch 13/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0108 -
accuracy: 0.9967 - val_loss: 0.0554 - val_accuracy: 0.9832
Epoch 14/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0105 -
```

```
accuracy: 0.9968 - val_loss: 0.0319 - val_accuracy: 0.9901
Epoch 15/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0070 -
accuracy: 0.9978 - val_loss: 0.0646 - val_accuracy: 0.9823
Epoch 16/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0071 -
accuracy: 0.9977 - val_loss: 0.0348 - val_accuracy: 0.9911
Epoch 17/20
518/518 [==============================] - 2s 4ms/step - loss: 0.0116 -
accuracy: 0.9969 - val_loss: 0.0912 - val_accuracy: 0.9805
Epoch 18/20
518/518 [==============================] - 2s 5ms/step - loss: 0.0059 -
accuracy: 0.9983 - val_loss: 0.0634 - val_accuracy: 0.9853
Epoch 19/20
518/518 [==============================] - 2s 4ms/step - loss: 0.0074 -
accuracy: 0.9978 - val_loss: 0.0602 - val_accuracy: 0.9856
Epoch 20/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0072 -
accuracy: 0.9978 - val_loss: 0.0801 - val_accuracy: 0.9813
Epoch 1/20
518/518 [==============================] - 2s 4ms/step - loss: 0.4094 -
accuracy: 0.8859 - val_loss: 0.2210 - val_accuracy: 0.9399
Epoch 2/20
518/518 [==============================] - 2s 3ms/step - loss: 0.1232 -
accuracy: 0.9703 - val_loss: 0.1353 - val_accuracy: 0.9564
Epoch 3/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0733 -
accuracy: 0.9825 - val_loss: 0.0736 - val_accuracy: 0.9822
Epoch 4/20
518/518 [==============================] - 2s 5ms/step - loss: 0.0514 -
accuracy: 0.9876 - val_loss: 0.0584 - val_accuracy: 0.9868
Epoch 5/20
518/518 [==============================] - 2s 5ms/step - loss: 0.0397 -
accuracy: 0.9900 - val_loss: 0.0466 - val_accuracy: 0.9871
Epoch 6/20
518/518 [==============================] - 2s 4ms/step - loss: 0.0317 -
accuracy: 0.9919 - val_loss: 0.0462 - val_accuracy: 0.9875
Epoch 7/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0258 -
accuracy: 0.9933 - val_loss: 0.0351 - val_accuracy: 0.9911
Epoch 8/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0214 -
accuracy: 0.9945 - val_loss: 0.0307 - val_accuracy: 0.9917
Epoch 9/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0184 -
accuracy: 0.9953 - val_loss: 0.0272 - val_accuracy: 0.9924
Epoch 10/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0163 -
```

```
accuracy: 0.9958 - val_loss: 0.0253 - val_accuracy: 0.9916
Epoch 11/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0140 -
accuracy: 0.9965 - val_loss: 0.0272 - val_accuracy: 0.9912
Epoch 12/20
518/518 [==============================] - 3s 5ms/step - loss: 0.0123 -
accuracy: 0.9968 - val_loss: 0.0285 - val_accuracy: 0.9904
Epoch 13/20
518/518 [==============================] - 3s 5ms/step - loss: 0.0113 -
accuracy: 0.9973 - val_loss: 0.0277 - val_accuracy: 0.9908
Epoch 14/20
518/518 [==============================] - 2s 4ms/step - loss: 0.0103 -
accuracy: 0.9973 - val_loss: 0.0209 - val_accuracy: 0.9934
Epoch 15/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0093 -
accuracy: 0.9976 - val_loss: 0.0220 - val_accuracy: 0.9917
Epoch 16/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0081 -
accuracy: 0.9980 - val_loss: 0.0239 - val_accuracy: 0.9922
Epoch 17/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0075 -
accuracy: 0.9982 - val_loss: 0.0190 - val_accuracy: 0.9935
Epoch 18/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0072 -
accuracy: 0.9982 - val_loss: 0.0188 - val_accuracy: 0.9932
Epoch 19/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0064 -
accuracy: 0.9984 - val_loss: 0.0334 - val_accuracy: 0.9880
Epoch 20/20
518/518 [==============================] - 3s 5ms/step - loss: 0.0061 -
accuracy: 0.9983 - val_loss: 0.0253 - val_accuracy: 0.9907
Epoch 1/20
518/518 [==============================] - 2s 4ms/step - loss: 1.1999 -
accuracy: 0.6365 - val_loss: 0.9263 - val_accuracy: 0.6681
Epoch 2/20
518/518 [==============================] - 2s 4ms/step - loss: 0.6244 -
accuracy: 0.8166 - val_loss: 0.6524 - val_accuracy: 0.7737
Epoch 3/20
518/518 [==============================] - 2s 4ms/step - loss: 0.4391 -
accuracy: 0.8918 - val_loss: 0.5036 - val_accuracy: 0.8478
Epoch 4/20
518/518 [==============================] - 2s 4ms/step - loss: 0.3424 -
accuracy: 0.9226 - val_loss: 0.4083 - val_accuracy: 0.8843
Epoch 5/20
518/518 [==============================] - 2s 4ms/step - loss: 0.2813 -
accuracy: 0.9372 - val_loss: 0.3465 - val_accuracy: 0.9002
Epoch 6/20
518/518 [==============================] - 3s 5ms/step - loss: 0.2377 -
```

```
accuracy: 0.9474 - val_loss: 0.3081 - val_accuracy: 0.9092
Epoch 7/20
518/518 [==============================] - 2s 4ms/step - loss: 0.2044 -
accuracy: 0.9545 - val_loss: 0.2500 - val_accuracy: 0.9335
Epoch 8/20
518/518 [==============================] - 2s 4ms/step - loss: 0.1780 -
accuracy: 0.9598 - val_loss: 0.2232 - val_accuracy: 0.9389
Epoch 9/20
518/518 [==============================] - 2s 4ms/step - loss: 0.1563 -
accuracy: 0.9641 - val_loss: 0.1956 - val_accuracy: 0.9452
Epoch 10/20
518/518 [==============================] - 2s 3ms/step - loss: 0.1384 -
accuracy: 0.9677 - val_loss: 0.1676 - val_accuracy: 0.9550
Epoch 11/20
518/518 [==============================] - 2s 4ms/step - loss: 0.1233 -
accuracy: 0.9711 - val_loss: 0.1528 - val_accuracy: 0.9571
Epoch 12/20
518/518 [==============================] - 2s 4ms/step - loss: 0.1107 -
accuracy: 0.9744 - val_loss: 0.1369 - val_accuracy: 0.9616
Epoch 13/20
518/518 [==============================] - 2s 5ms/step - loss: 0.1000 -
accuracy: 0.9769 - val_loss: 0.1280 - val_accuracy: 0.9627
Epoch 14/20
518/518 [==============================] - 3s 5ms/step - loss: 0.0909 -
accuracy: 0.9789 - val_loss: 0.1159 - val_accuracy: 0.9662
Epoch 15/20
518/518 [==============================] - 2s 4ms/step - loss: 0.0832 -
accuracy: 0.9809 - val_loss: 0.1026 - val_accuracy: 0.9732
Epoch 16/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0765 -
accuracy: 0.9821 - val_loss: 0.0912 - val_accuracy: 0.9774
Epoch 17/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0707 -
accuracy: 0.9838 - val_loss: 0.0885 - val_accuracy: 0.9774
Epoch 18/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0656 -
accuracy: 0.9850 - val_loss: 0.0834 - val_accuracy: 0.9787
Epoch 19/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0613 -
accuracy: 0.9857 - val_loss: 0.0780 - val_accuracy: 0.9795
Epoch 20/20
518/518 [==============================] - 2s 3ms/step - loss: 0.0574 -
accuracy: 0.9867 - val_loss: 0.0738 - val_accuracy: 0.9817
```

Plot the training loss vs. the epoch number for all of the learning rates on one graph (use `semilogy` again). You should see that the lower learning rates are more stable, but converge slower, while with a learning rate that is too high, the gradient descent may fail to move towards weights that decrease the loss function.

Make sure to label each axis, and each series.

Comment on the results. Given that all other optimizer hyperparameters are fixed, what is the effect of varying learning rate on the training process?

A learning rate that is too high can lead to instability and prevent the model from converging to a good solution. A learning rate that is too low can lead to slow convergence, requiring more epochs and hence more computational resources and time. An appropriately chosen learning rate provides a balance between the speed of convergence and the stability of the training process.

[ ]:
```
# TODO - plot showing the training process for different learning rates
plt.figure(figsize=(12, 8))

for lr, history in histories.items():
    plt.semilogy(history.epoch, history.history['loss'], label=f'LR = {lr}')

plt.title('Training Loss vs. Epoch Number for Different Learning Rates')
plt.xlabel('Epoch')
plt.ylabel('Training Loss (log scale)')
plt.legend()
plt.grid(True)
plt.show()
```

In the previous example, we trained each model for a fixed number of epochs. Now, we'll explore

what happens when we vary the training hyperparameters, but train each model to the same validation **accuracy target**. We will consider:

- how much *time* it takes to achieve that accuracy target ("time to accuracy")
- how much *energy* it takes to achieve that accuracy target ("energy to accuracy")
- and the *test accuracy* for the model, given that it is trained to the specified validation accuracy target

Energy consumption To do this, first we will need some way to measure the energy used to train the model. We will use Zeus, a Python package developed by researchers at the University of Michigan, to measure the GPU energy consumption.

Note: if you are running this experiment in a CPU-only runtime, you should skip this section on energy comsumption. Continue with the " `TrainToAccuracy` callback" section.

First, install the package:

[ ]:
```
!pip install zeus-ml
```

```
Requirement already satisfied: zeus-ml in /usr/local/lib/python3.10/dist-
packages (0.8.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages
(from zeus-ml) (1.23.5)
Requirement already satisfied: pandas in /usr/local/lib/python3.10/dist-packages
(from zeus-ml) (1.5.3)
Requirement already satisfied: scikit-learn in /usr/local/lib/python3.10/dist-
packages (from zeus-ml) (1.2.2)
Requirement already satisfied: nvidia-ml-py in /usr/local/lib/python3.10/dist-
packages (from zeus-ml) (12.535.133)
Requirement already satisfied: pydantic<2 in /usr/local/lib/python3.10/dist-
packages (from zeus-ml) (1.10.13)
Requirement already satisfied: rich in /usr/local/lib/python3.10/dist-packages
(from zeus-ml) (13.7.0)
Requirement already satisfied: tyro in /usr/local/lib/python3.10/dist-packages
(from zeus-ml) (0.5.17)
Requirement already satisfied: fastapi[all]==0.87.0 in
/usr/local/lib/python3.10/dist-packages (from zeus-ml) (0.87.0)
Requirement already satisfied: httpx in /usr/local/lib/python3.10/dist-packages
(from zeus-ml) (0.25.1)
Requirement already satisfied: aiofiles==22.1.0 in
/usr/local/lib/python3.10/dist-packages (from zeus-ml) (22.1.0)
Requirement already satisfied: lowtime in /usr/local/lib/python3.10/dist-
packages (from zeus-ml) (0.1.0)
Requirement already satisfied: starlette==0.21.0 in
/usr/local/lib/python3.10/dist-packages (from fastapi[all]==0.87.0->zeus-ml)
(0.21.0)
Requirement already satisfied: email-validator>=1.1.1 in
/usr/local/lib/python3.10/dist-packages (from fastapi[all]==0.87.0->zeus-ml)
(2.1.0.post1)
```

```
Requirement already satisfied: itsdangerous>=1.1.0 in
/usr/local/lib/python3.10/dist-packages (from fastapi[all]==0.87.0->zeus-ml)
(2.1.2)
Requirement already satisfied: jinja2>=2.11.2 in /usr/local/lib/python3.10/dist-
packages (from fastapi[all]==0.87.0->zeus-ml) (3.1.2)
Requirement already satisfied: orjson>=3.2.1 in /usr/local/lib/python3.10/dist-
packages (from fastapi[all]==0.87.0->zeus-ml) (3.9.10)
Requirement already satisfied: python-multipart>=0.0.5 in
/usr/local/lib/python3.10/dist-packages (from fastapi[all]==0.87.0->zeus-ml)
(0.0.6)
Requirement already satisfied: pyyaml>=5.3.1 in /usr/local/lib/python3.10/dist-
packages (from fastapi[all]==0.87.0->zeus-ml) (6.0.1)
Requirement already satisfied:
ujson!=4.0.2,!=4.1.0,!=4.2.0,!=4.3.0,!=5.0.0,!=5.1.0,>=4.0.1 in
/usr/local/lib/python3.10/dist-packages (from fastapi[all]==0.87.0->zeus-ml)
(5.8.0)
Requirement already satisfied: uvicorn[standard]>=0.12.0 in
/usr/local/lib/python3.10/dist-packages (from fastapi[all]==0.87.0->zeus-ml)
(0.24.0.post1)
Requirement already satisfied: anyio<5,>=3.4.0 in
/usr/local/lib/python3.10/dist-packages (from
starlette==0.21.0->fastapi[all]==0.87.0->zeus-ml) (3.7.1)
Requirement already satisfied: certifi in /usr/local/lib/python3.10/dist-
packages (from httpx->zeus-ml) (2023.7.22)
Requirement already satisfied: httpcore in /usr/local/lib/python3.10/dist-
packages (from httpx->zeus-ml) (1.0.2)
Requirement already satisfied: idna in /usr/local/lib/python3.10/dist-packages
(from httpx->zeus-ml) (3.4)
Requirement already satisfied: sniffio in /usr/local/lib/python3.10/dist-
packages (from httpx->zeus-ml) (1.3.0)
Requirement already satisfied: typing-extensions>=4.2.0 in
/usr/local/lib/python3.10/dist-packages (from pydantic<2->zeus-ml) (4.5.0)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-
packages (from lowtime->zeus-ml) (3.7.1)
Requirement already satisfied: attrs in /usr/local/lib/python3.10/dist-packages
(from lowtime->zeus-ml) (23.1.0)
Requirement already satisfied: networkx in /usr/local/lib/python3.10/dist-
packages (from lowtime->zeus-ml) (3.2.1)
Requirement already satisfied: python-dateutil>=2.8.1 in
/usr/local/lib/python3.10/dist-packages (from pandas->zeus-ml) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-
packages (from pandas->zeus-ml) (2023.3.post1)
Requirement already satisfied: markdown-it-py>=2.2.0 in
/usr/local/lib/python3.10/dist-packages (from rich->zeus-ml) (3.0.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in
/usr/local/lib/python3.10/dist-packages (from rich->zeus-ml) (2.16.1)
Requirement already satisfied: scipy>=1.3.2 in /usr/local/lib/python3.10/dist-
packages (from scikit-learn->zeus-ml) (1.11.3)
```

```
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.10/dist-
packages (from scikit-learn->zeus-ml) (1.3.2)
Requirement already satisfied: threadpoolctl>=2.0.0 in
/usr/local/lib/python3.10/dist-packages (from scikit-learn->zeus-ml) (3.2.0)
Requirement already satisfied: docstring-parser>=0.14.1 in
/usr/local/lib/python3.10/dist-packages (from tyro->zeus-ml) (0.15)
Requirement already satisfied: shtab>=1.5.6 in /usr/local/lib/python3.10/dist-
packages (from tyro->zeus-ml) (1.6.4)
Requirement already satisfied: exceptiongroup in /usr/local/lib/python3.10/dist-
packages (from anyio<5,>=3.4.0->starlette==0.21.0->fastapi[all]==0.87.0->zeus-
ml) (1.1.3)
Requirement already satisfied: dnspython>=2.0.0 in
/usr/local/lib/python3.10/dist-packages (from email-
validator>=1.1.1->fastapi[all]==0.87.0->zeus-ml) (2.4.2)
Requirement already satisfied: MarkupSafe>=2.0 in
/usr/local/lib/python3.10/dist-packages (from
jinja2>=2.11.2->fastapi[all]==0.87.0->zeus-ml) (2.1.3)
Requirement already satisfied: mdurl~=0.1 in /usr/local/lib/python3.10/dist-
packages (from markdown-it-py>=2.2.0->rich->zeus-ml) (0.1.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-
packages (from python-dateutil>=2.8.1->pandas->zeus-ml) (1.16.0)
Requirement already satisfied: click>=7.0 in /usr/local/lib/python3.10/dist-
packages (from uvicorn[standard]>=0.12.0->fastapi[all]==0.87.0->zeus-ml) (8.1.7)
Requirement already satisfied: h11>=0.8 in /usr/local/lib/python3.10/dist-
packages (from uvicorn[standard]>=0.12.0->fastapi[all]==0.87.0->zeus-ml)
(0.14.0)
Requirement already satisfied: httptools>=0.5.0 in
/usr/local/lib/python3.10/dist-packages (from
uvicorn[standard]>=0.12.0->fastapi[all]==0.87.0->zeus-ml) (0.6.1)
Requirement already satisfied: python-dotenv>=0.13 in
/usr/local/lib/python3.10/dist-packages (from
uvicorn[standard]>=0.12.0->fastapi[all]==0.87.0->zeus-ml) (1.0.0)
Requirement already satisfied: uvloop!=0.15.0,!=0.15.1,>=0.14.0 in
/usr/local/lib/python3.10/dist-packages (from
uvicorn[standard]>=0.12.0->fastapi[all]==0.87.0->zeus-ml) (0.19.0)
Requirement already satisfied: watchfiles>=0.13 in
/usr/local/lib/python3.10/dist-packages (from
uvicorn[standard]>=0.12.0->fastapi[all]==0.87.0->zeus-ml) (0.21.0)
Requirement already satisfied: websockets>=10.4 in
/usr/local/lib/python3.10/dist-packages (from
uvicorn[standard]>=0.12.0->fastapi[all]==0.87.0->zeus-ml) (12.0)
Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->lowtime->zeus-ml)
(1.2.0)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-
packages (from matplotlib->lowtime->zeus-ml) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->lowtime->zeus-ml)
```

```
(4.44.3)
Requirement already satisfied: kiwisolver>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->lowtime->zeus-ml)
(1.4.5)
Requirement already satisfied: packaging>=20.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->lowtime->zeus-ml)
(23.2)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-
packages (from matplotlib->lowtime->zeus-ml) (9.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->lowtime->zeus-ml)
(3.1.1)
```

Then, import it, and tell it to monitor your GPU:

[ ]:
```
# from zeus.monitor import ZeusMonitor

# monitor = ZeusMonitor(gpu_indices=[0])
```

```
---------------------------------------------------------------------------
OSError                                   Traceback (most recent call last)
/usr/local/lib/python3.10/dist-packages/pynvml.py in _LoadNvmlLibrary()
   1974                         # assume linux
-> 1975                         nvmlLib = CDLL("libnvidia-ml.so.1")
   1976                 except OSError as ose:

/usr/lib/python3.10/ctypes/__init__.py in __init__(self, name, mode, handle,␣
 ↪use_errno, use_last_error, winmode)
    373         if handle is None:
--> 374             self._handle = _dlopen(self._name, mode)
    375         else:

OSError: libnvidia-ml.so.1: cannot open shared object file: No such file or␣
 ↪directory

During handling of the above exception, another exception occurred:

NVMLError_LibraryNotFound                 Traceback (most recent call last)
<ipython-input-88-60ea6d9d49fc> in <cell line: 3>()
      1 from zeus.monitor import ZeusMonitor
      2
----> 3 monitor = ZeusMonitor(gpu_indices=[0])

/usr/local/lib/python3.10/dist-packages/zeus/monitor/energy.py in __init__(self␣
 ↪gpu_indices, approx_instant_energy, log_file)
    130
    131         # Initialize NVML.
--> 132         pynvml.nvmlInit()
```

```
    133         atexit.register(pynvml.nvmlShutdown)
    134 

/usr/local/lib/python3.10/dist-packages/pynvml.py in nvmlInit()
   1945 
   1946 def nvmlInit():
-> 1947     nvmlInitWithFlags(0)
   1948     return None
   1949 

/usr/local/lib/python3.10/dist-packages/pynvml.py in nvmlInitWithFlags(flags)
   1928 ## C function wrappers ##
   1929 def nvmlInitWithFlags(flags):
-> 1930     _LoadNvmlLibrary()
   1931 
   1932     #

/usr/local/lib/python3.10/dist-packages/pynvml.py in _LoadNvmlLibrary()
   1975                         nvmlLib = CDLL("libnvidia-ml.so.1")
   1976                 except OSError as ose:
-> 1977                     _nvmlCheckReturn(NVML_ERROR_LIBRARY_NOT_FOUND)
   1978                 if (nvmlLib == None):
   1979                     _nvmlCheckReturn(NVML_ERROR_LIBRARY_NOT_FOUND)

/usr/local/lib/python3.10/dist-packages/pynvml.py in _nvmlCheckReturn(ret)
    897 def _nvmlCheckReturn(ret):
    898     if (ret != NVML_SUCCESS):
--> 899         raise NVMLError(ret)
    900     return ret
    901 

NVMLError_LibraryNotFound: NVML Shared Library Not Found
```

When you want to measure GPU energy usage, you will:

- start a "monitoring window"
- do your GPU-intensive computation (e.g. call `model.fit`)
- stop the "monitoring window"

and then you can get the time and total energy used by the GPU in the monitoring window.

Try it now - this will just continue fitting whatever `model` is currently in scope from previous cells:

[ ]:
```
# monitor.begin_window("test")
# model.fit(Xtr_scale, ytr, epochs=5)
# measurement = monitor.end_window("test")
# print("Measured time (s)  :" , measurement.time)
# print("Measured energy (J):" , measurement.total_energy)
```

`TrainToAccuracy` callback Next, we need a way to train a model until we achieve our desired validation accuracy. We will write a callback function following these specifications:

- It will be called `TrainToAccuracy` and will accept two arguments: a `threshold` and a `patience` value.
- If the model's validation accuracy is higher than the `threshold` for `patience` epochs in a row, stop training.
- In the `on_epoch_end` function, which will be called at the end of every epoch during training, you should get the current validation accuracy using `currect_acc = logs.get("val_accuracy")`. Then, set `self.model.stop_training = True` if the condition above is met.
- The default values of `threshold` and `patience` are given below, but other values may be passed as arguments at runtime.

Then, when you call `model.fit()`, you will add the `TrainToAccuracy` callback as in

`callbacks=[TrainToAccuracy(threshold=0.98, patience=5)]`

[ ]:
```
# TODO - write a callback function
class TrainToAccuracy(callbacks.Callback):
    def __init__(self, threshold=0.9, patience=3):
        super(TrainToAccuracy, self).__init__()
        self.threshold = threshold  # The desired accuracy threshold
        self.patience = patience  # How many epochs to wait once hitting the␣
 ↪threshold
        self.wait = 0  # Counter for the number of epochs where threshold is met

    def on_epoch_end(self, epoch, logs=None):
        current_acc = logs.get("val_accuracy")
        if current_acc and current_acc > self.threshold:
            self.wait += 1
        else:
            self.wait = 0

        if self.wait >= self.patience:
            self.model.stop_training = True
            print(f"\nReached {self.threshold*100}% accuracy, so stopping␣
 ↪training after {epoch+1} epochs!")
```

Try it! run the following cell to test your `TrainToAccuracy` callback. (This will just continue fitting whatever `model` is currently in scope.)

[ ]:
```
model.fit(Xtr_scale, ytr, epochs=100, validation_split = 0.2,␣
 ↪callbacks=[TrainToAccuracy(threshold=0.95, patience=5)])
```

```
Epoch 1/100
1657/1657 [==============================] - 16s 9ms/step - loss: 0.0550 -
accuracy: 0.9867 - val_loss: 0.1702 - val_accuracy: 0.9296
Epoch 2/100
1657/1657 [==============================] - 7s 4ms/step - loss: 0.0487 -
```

```
accuracy: 0.9880 - val_loss: 0.1928 - val_accuracy: 0.9191
Epoch 3/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0445 -
accuracy: 0.9888 - val_loss: 0.1304 - val_accuracy: 0.9425
Epoch 4/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0410 -
accuracy: 0.9898 - val_loss: 0.1926 - val_accuracy: 0.9195
Epoch 5/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0381 -
accuracy: 0.9905 - val_loss: 0.1679 - val_accuracy: 0.9287
Epoch 6/100
1657/1657 [==============================] - 4s 3ms/step - loss: 0.0356 -
accuracy: 0.9911 - val_loss: 0.1792 - val_accuracy: 0.9252
Epoch 7/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0333 -
accuracy: 0.9913 - val_loss: 0.1701 - val_accuracy: 0.9276
Epoch 8/100
1657/1657 [==============================] - 4s 3ms/step - loss: 0.0313 -
accuracy: 0.9920 - val_loss: 0.1839 - val_accuracy: 0.9233
Epoch 9/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0294 -
accuracy: 0.9923 - val_loss: 0.1951 - val_accuracy: 0.9186
Epoch 10/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0278 -
accuracy: 0.9928 - val_loss: 0.1706 - val_accuracy: 0.9276
Epoch 11/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0264 -
accuracy: 0.9932 - val_loss: 0.2053 - val_accuracy: 0.9158
Epoch 12/100
1657/1657 [==============================] - 6s 3ms/step - loss: 0.0251 -
accuracy: 0.9937 - val_loss: 0.1168 - val_accuracy: 0.9473
Epoch 13/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0239 -
accuracy: 0.9940 - val_loss: 0.1356 - val_accuracy: 0.9408
Epoch 14/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0226 -
accuracy: 0.9942 - val_loss: 0.1297 - val_accuracy: 0.9425
Epoch 15/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0216 -
accuracy: 0.9944 - val_loss: 0.1201 - val_accuracy: 0.9463
Epoch 16/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0207 -
accuracy: 0.9947 - val_loss: 0.1669 - val_accuracy: 0.9297
Epoch 17/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0197 -
accuracy: 0.9950 - val_loss: 0.1401 - val_accuracy: 0.9401
Epoch 18/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0190 -
```

```
accuracy: 0.9951 - val_loss: 0.1498 - val_accuracy: 0.9367
Epoch 19/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0181 -
accuracy: 0.9956 - val_loss: 0.0919 - val_accuracy: 0.9572
Epoch 20/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0175 -
accuracy: 0.9957 - val_loss: 0.1618 - val_accuracy: 0.9323
Epoch 21/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0168 -
accuracy: 0.9959 - val_loss: 0.1041 - val_accuracy: 0.9525
Epoch 22/100
1657/1657 [==============================] - 7s 4ms/step - loss: 0.0162 -
accuracy: 0.9961 - val_loss: 0.1094 - val_accuracy: 0.9510
Epoch 23/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0157 -
accuracy: 0.9960 - val_loss: 0.1393 - val_accuracy: 0.9408
Epoch 24/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0151 -
accuracy: 0.9962 - val_loss: 0.1120 - val_accuracy: 0.9503
Epoch 25/100
1657/1657 [==============================] - 6s 4ms/step - loss: 0.0146 -
accuracy: 0.9966 - val_loss: 0.1476 - val_accuracy: 0.9384
Epoch 26/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0141 -
accuracy: 0.9966 - val_loss: 0.1334 - val_accuracy: 0.9429
Epoch 27/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0137 -
accuracy: 0.9968 - val_loss: 0.1103 - val_accuracy: 0.9512
Epoch 28/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0133 -
accuracy: 0.9968 - val_loss: 0.0551 - val_accuracy: 0.9772
Epoch 29/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0128 -
accuracy: 0.9969 - val_loss: 0.1407 - val_accuracy: 0.9405
Epoch 30/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0124 -
accuracy: 0.9972 - val_loss: 0.1070 - val_accuracy: 0.9524
Epoch 31/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0121 -
accuracy: 0.9972 - val_loss: 0.1254 - val_accuracy: 0.9460
Epoch 32/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0118 -
accuracy: 0.9973 - val_loss: 0.0908 - val_accuracy: 0.9592
Epoch 33/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0115 -
accuracy: 0.9974 - val_loss: 0.0815 - val_accuracy: 0.9634
Epoch 34/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0112 -
```

```
accuracy: 0.9975 - val_loss: 0.1041 - val_accuracy: 0.9539
Epoch 35/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0108 -
accuracy: 0.9975 - val_loss: 0.0498 - val_accuracy: 0.9806
Epoch 36/100
1657/1657 [==============================] - 4s 3ms/step - loss: 0.0105 -
accuracy: 0.9976 - val_loss: 0.1244 - val_accuracy: 0.9472
Epoch 37/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0103 -
accuracy: 0.9975 - val_loss: 0.0966 - val_accuracy: 0.9571
Epoch 38/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0100 -
accuracy: 0.9978 - val_loss: 0.1200 - val_accuracy: 0.9485
Epoch 39/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0098 -
accuracy: 0.9979 - val_loss: 0.0730 - val_accuracy: 0.9681
Epoch 40/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0095 -
accuracy: 0.9979 - val_loss: 0.0797 - val_accuracy: 0.9652
Epoch 41/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0093 -
accuracy: 0.9978 - val_loss: 0.1219 - val_accuracy: 0.9481
Epoch 42/100
1657/1657 [==============================] - 6s 3ms/step - loss: 0.0091 -
accuracy: 0.9978 - val_loss: 0.0537 - val_accuracy: 0.9789
Epoch 43/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0089 -
accuracy: 0.9980 - val_loss: 0.0518 - val_accuracy: 0.9799
Epoch 44/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0087 -
accuracy: 0.9981 - val_loss: 0.0684 - val_accuracy: 0.9715
Epoch 45/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0084 -
accuracy: 0.9980 - val_loss: 0.1244 - val_accuracy: 0.9478
Epoch 46/100
1657/1657 [==============================] - 4s 3ms/step - loss: 0.0083 -
accuracy: 0.9982 - val_loss: 0.0389 - val_accuracy: 0.9850
Epoch 47/100
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0081 -
accuracy: 0.9982 - val_loss: 0.0671 - val_accuracy: 0.9723
Epoch 48/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0080 -
accuracy: 0.9982 - val_loss: 0.0938 - val_accuracy: 0.9589
Epoch 49/100
1657/1657 [==============================] - 5s 3ms/step - loss: 0.0078 -
accuracy: 0.9982 - val_loss: 0.0340 - val_accuracy: 0.9876
Epoch 50/100
1635/1657 [============================>.] - ETA: 0s - loss: 0.0077 - accuracy:
```

```
0.9983
Reached 95.0% accuracy, so stopping training after 50 epochs!
1657/1657 [==============================] - 4s 2ms/step - loss: 0.0076 -
accuracy: 0.9983 - val_loss: 0.0646 - val_accuracy: 0.9735
```

[ ]:
```
<keras.src.callbacks.History at 0x7e7b984141f0>
```

Your model shouldn't *really* train for 100 epochs - it should stop training as soon as 95% validation accuracy is achieved for 5 epochs in a row! (Your "test" is not graded, you may change the `threshold` and `patience` values in this "test" call to `model.fit` in order to check your work.)

Note that since we are now using the validation set performance to *decide* when to stop training the model, we are no longer "allowed" to pass the test set as `validation_data`. The test set must never be used to make decisions during the model training process - only for evaluation of the final model. Instead, we specify that 20% of the training data should be held out as a validation set, and that is the validation accuracy that is used to determine when to stop training.

1.4.1 See how TTA/ETA varies with learning rate, batch size

Now, you will repeat your model preparation and fitting code - with your new `TrainToAccuracy` callback - but in a loop. First, you will iterate over different learning rates.

In each iteration of each loop, you will prepare a model (with the appropriate training hyperparameters) and train it until:

- either it has achieved **0.95 accuracy for 3 epoches in a row** on a 20% validation subset of the training data,
- or, it has trained for 500 epochs

whichever comes FIRST.

For each model, you will record:

- the training hyperparameters (learning rate, batch size)
- the number of epochs of training needed to achieve the target validation accuracy
- the accuracy on the *test* data (not the validation data!). After fitting the model, use `model.evaluate` and pass the scaled *test* data to get the test loss and test accuracy
- **GPU runtime**: the GPU energy and time to train the model to the desired validation accuracy, as computed by a `zeus-ml` measurement window that starts just before `model.fit` and ends just after `model.fit`.
- **CPU runtime**: the time to train the model to the desired validation accuracy, as computed by the difference in `time.time()` just before `model.fit` and just after `model.fit`.

[ ]:
```
# TODO - iterate over learning rates and get TTA/ETA

# default learning rate and batch size -
lr = 0.001
batch_size = 128

metrics_vs_lr = []
```

```
# Iterating over different learning rates
for lr in [0.1, 0.01, 0.001, 0.0001]:

    # Clearing the Keras session to free up memory
    K.clear_session()

    # Construct the model
    model = Sequential()
    model.add(Dense(nh, input_shape=(n_feat,), activation='sigmoid'))
    model.add(Dense(n_class, activation='softmax'))  # Assuming ytr.shape[1] is␣
 ↪the number of classes

    # Compile the model with the current learning rate
    model.compile(optimizer=Adam(learning_rate=lr),␣
 ↪loss='sparse_categorical_crossentropy', metrics=['accuracy'])

    # Start measurement

    start_time = time.time()

    # Fit the model
    history=model.fit(Xtr_scale, ytr, epochs=500, batch_size=batch_size,␣
 ↪validation_split=0.2, callbacks=[TrainToAccuracy(threshold=0.95,␣
 ↪patience=3)])

    # End measurement

    total_time = time.time() - start_time

    # Evaluate the model on test data
    test_loss, test_accuracy = model.evaluate(Xts_scale, yts)

    # Save metrics
    model_metrics = {
        'batch_size': 128,
        'learning_rate': lr,
        'epochs': len(history.history['accuracy']),
        'test_accuracy': test_accuracy,
        'train_time': total_time
    }

    metrics_vs_lr.append(model_metrics)
```

```
Epoch 1/500
415/415 [==============================] - 2s 4ms/step - loss: 0.3073 -
accuracy: 0.9402 - val_loss: 3.2467 - val_accuracy: 0.6085
Epoch 2/500
```

```
415/415 [==============================] - 2s 5ms/step - loss: 0.1696 -
accuracy: 0.9596 - val_loss: 4.1954 - val_accuracy: 0.5968
Epoch 3/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2148 -
accuracy: 0.9586 - val_loss: 3.9436 - val_accuracy: 0.6713
Epoch 4/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1958 -
accuracy: 0.9631 - val_loss: 0.8144 - val_accuracy: 0.8318
Epoch 5/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1694 -
accuracy: 0.9692 - val_loss: 4.2975 - val_accuracy: 0.7910
Epoch 6/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1922 -
accuracy: 0.9695 - val_loss: 3.3472 - val_accuracy: 0.8182
Epoch 7/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1735 -
accuracy: 0.9739 - val_loss: 1.9958 - val_accuracy: 0.7867
Epoch 8/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2209 -
accuracy: 0.9710 - val_loss: 3.8308 - val_accuracy: 0.8175
Epoch 9/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1904 -
accuracy: 0.9741 - val_loss: 5.5421 - val_accuracy: 0.7780
Epoch 10/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2852 -
accuracy: 0.9692 - val_loss: 3.7287 - val_accuracy: 0.8021
Epoch 11/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2205 -
accuracy: 0.9745 - val_loss: 1.4357 - val_accuracy: 0.8795
Epoch 12/500
415/415 [==============================] - 3s 8ms/step - loss: 0.1987 -
accuracy: 0.9766 - val_loss: 3.1192 - val_accuracy: 0.8168
Epoch 13/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2433 -
accuracy: 0.9752 - val_loss: 11.0378 - val_accuracy: 0.6953
Epoch 14/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2201 -
accuracy: 0.9767 - val_loss: 1.4511 - val_accuracy: 0.8894
Epoch 15/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2204 -
accuracy: 0.9774 - val_loss: 0.5629 - val_accuracy: 0.9276
Epoch 16/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1923 -
accuracy: 0.9806 - val_loss: 6.0190 - val_accuracy: 0.7420
Epoch 17/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1897 -
accuracy: 0.9806 - val_loss: 6.2665 - val_accuracy: 0.7336
Epoch 18/500
```

```
415/415 [==============================] - 1s 3ms/step - loss: 0.2234 -
accuracy: 0.9788 - val_loss: 7.6843 - val_accuracy: 0.7790
Epoch 19/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2009 -
accuracy: 0.9801 - val_loss: 4.2760 - val_accuracy: 0.8391
Epoch 20/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2746 -
accuracy: 0.9798 - val_loss: 15.2158 - val_accuracy: 0.7321
Epoch 21/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1857 -
accuracy: 0.9830 - val_loss: 3.7369 - val_accuracy: 0.8383
Epoch 22/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1923 -
accuracy: 0.9816 - val_loss: 10.7123 - val_accuracy: 0.7220
Epoch 23/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2657 -
accuracy: 0.9769 - val_loss: 4.6697 - val_accuracy: 0.7997
Epoch 24/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2361 -
accuracy: 0.9791 - val_loss: 4.6360 - val_accuracy: 0.7990
Epoch 25/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2341 -
accuracy: 0.9785 - val_loss: 8.2288 - val_accuracy: 0.7927
Epoch 26/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2368 -
accuracy: 0.9794 - val_loss: 4.1043 - val_accuracy: 0.7983
Epoch 27/500
415/415 [==============================] - 1s 3ms/step - loss: 0.3216 -
accuracy: 0.9761 - val_loss: 9.7681 - val_accuracy: 0.7100
Epoch 28/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2269 -
accuracy: 0.9805 - val_loss: 12.2591 - val_accuracy: 0.6975
Epoch 29/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2141 -
accuracy: 0.9814 - val_loss: 4.2385 - val_accuracy: 0.8343
Epoch 30/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2134 -
accuracy: 0.9817 - val_loss: 10.6890 - val_accuracy: 0.7677
Epoch 31/500
415/415 [==============================] - 2s 4ms/step - loss: 0.2209 -
accuracy: 0.9813 - val_loss: 26.5517 - val_accuracy: 0.5494
Epoch 32/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2494 -
accuracy: 0.9805 - val_loss: 0.6021 - val_accuracy: 0.9452
Epoch 33/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2063 -
accuracy: 0.9836 - val_loss: 12.5571 - val_accuracy: 0.6475
Epoch 34/500
```

```
415/415 [==============================] - 1s 3ms/step - loss: 0.2006 -
accuracy: 0.9843 - val_loss: 4.8136 - val_accuracy: 0.8018
Epoch 35/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2085 -
accuracy: 0.9839 - val_loss: 5.8591 - val_accuracy: 0.8167
Epoch 36/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2359 -
accuracy: 0.9822 - val_loss: 1.6577 - val_accuracy: 0.9118
Epoch 37/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2360 -
accuracy: 0.9819 - val_loss: 9.3314 - val_accuracy: 0.7103
Epoch 38/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1886 -
accuracy: 0.9839 - val_loss: 1.1704 - val_accuracy: 0.9268
Epoch 39/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2239 -
accuracy: 0.9836 - val_loss: 14.2832 - val_accuracy: 0.7106
Epoch 40/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2150 -
accuracy: 0.9839 - val_loss: 8.3255 - val_accuracy: 0.7808
Epoch 41/500
415/415 [==============================] - 2s 4ms/step - loss: 0.2130 -
accuracy: 0.9836 - val_loss: 3.9330 - val_accuracy: 0.8165
Epoch 42/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1920 -
accuracy: 0.9856 - val_loss: 2.4340 - val_accuracy: 0.9059
Epoch 43/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2424 -
accuracy: 0.9827 - val_loss: 7.6486 - val_accuracy: 0.7907
Epoch 44/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2222 -
accuracy: 0.9834 - val_loss: 0.8443 - val_accuracy: 0.9392
Epoch 45/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2379 -
accuracy: 0.9831 - val_loss: 9.0617 - val_accuracy: 0.8065
Epoch 46/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2030 -
accuracy: 0.9858 - val_loss: 3.3561 - val_accuracy: 0.8727
Epoch 47/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2381 -
accuracy: 0.9834 - val_loss: 2.5170 - val_accuracy: 0.8615
Epoch 48/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1915 -
accuracy: 0.9864 - val_loss: 6.1133 - val_accuracy: 0.7904
Epoch 49/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2112 -
accuracy: 0.9851 - val_loss: 4.3070 - val_accuracy: 0.8384
Epoch 50/500
```

```
415/415 [==============================] - 1s 4ms/step - loss: 0.2052 -
accuracy: 0.9838 - val_loss: 1.9985 - val_accuracy: 0.9005
Epoch 51/500
415/415 [==============================] - 2s 4ms/step - loss: 0.2247 -
accuracy: 0.9840 - val_loss: 2.3085 - val_accuracy: 0.9185
Epoch 52/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1947 -
accuracy: 0.9862 - val_loss: 1.0075 - val_accuracy: 0.9451
Epoch 53/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2265 -
accuracy: 0.9846 - val_loss: 1.4323 - val_accuracy: 0.9167
Epoch 54/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2233 -
accuracy: 0.9845 - val_loss: 5.3324 - val_accuracy: 0.7983
Epoch 55/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2081 -
accuracy: 0.9852 - val_loss: 8.8167 - val_accuracy: 0.7720
Epoch 56/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2035 -
accuracy: 0.9855 - val_loss: 11.2707 - val_accuracy: 0.7150
Epoch 57/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1861 -
accuracy: 0.9857 - val_loss: 0.2009 - val_accuracy: 0.9826
Epoch 58/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1947 -
accuracy: 0.9865 - val_loss: 1.5339 - val_accuracy: 0.9357
Epoch 59/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2107 -
accuracy: 0.9855 - val_loss: 5.1632 - val_accuracy: 0.8540
Epoch 60/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1930 -
accuracy: 0.9853 - val_loss: 1.7039 - val_accuracy: 0.9279
Epoch 61/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2215 -
accuracy: 0.9857 - val_loss: 2.9749 - val_accuracy: 0.9076
Epoch 62/500
415/415 [==============================] - 3s 7ms/step - loss: 0.2064 -
accuracy: 0.9873 - val_loss: 3.6549 - val_accuracy: 0.8724
Epoch 63/500
415/415 [==============================] - 2s 4ms/step - loss: 0.2075 -
accuracy: 0.9862 - val_loss: 12.2574 - val_accuracy: 0.7620
Epoch 64/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1982 -
accuracy: 0.9875 - val_loss: 1.8784 - val_accuracy: 0.8923
Epoch 65/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2098 -
accuracy: 0.9872 - val_loss: 2.9018 - val_accuracy: 0.8671
Epoch 66/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.2030 -
accuracy: 0.9867 - val_loss: 5.0572 - val_accuracy: 0.8337
Epoch 67/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2197 -
accuracy: 0.9855 - val_loss: 5.5604 - val_accuracy: 0.8481
Epoch 68/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2140 -
accuracy: 0.9864 - val_loss: 3.1022 - val_accuracy: 0.9118
Epoch 69/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2075 -
accuracy: 0.9877 - val_loss: 1.1791 - val_accuracy: 0.9242
Epoch 70/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1722 -
accuracy: 0.9884 - val_loss: 1.1685 - val_accuracy: 0.9275
Epoch 71/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1708 -
accuracy: 0.9887 - val_loss: 5.5208 - val_accuracy: 0.8401
Epoch 72/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1922 -
accuracy: 0.9886 - val_loss: 1.9376 - val_accuracy: 0.9248
Epoch 73/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1587 -
accuracy: 0.9889 - val_loss: 1.2592 - val_accuracy: 0.9368
Epoch 74/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1632 -
accuracy: 0.9898 - val_loss: 2.4077 - val_accuracy: 0.9055
Epoch 75/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1792 -
accuracy: 0.9893 - val_loss: 4.3088 - val_accuracy: 0.8573
Epoch 76/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1771 -
accuracy: 0.9878 - val_loss: 2.8328 - val_accuracy: 0.8574
Epoch 77/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2327 -
accuracy: 0.9851 - val_loss: 7.7691 - val_accuracy: 0.8125
Epoch 78/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1844 -
accuracy: 0.9880 - val_loss: 6.5893 - val_accuracy: 0.8402
Epoch 79/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2089 -
accuracy: 0.9863 - val_loss: 1.1900 - val_accuracy: 0.8983
Epoch 80/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2062 -
accuracy: 0.9869 - val_loss: 6.7724 - val_accuracy: 0.8124
Epoch 81/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1828 -
accuracy: 0.9883 - val_loss: 4.3656 - val_accuracy: 0.8423
Epoch 82/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.1834 -
accuracy: 0.9882 - val_loss: 3.8845 - val_accuracy: 0.8578
Epoch 83/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1662 -
accuracy: 0.9899 - val_loss: 3.3408 - val_accuracy: 0.8851
Epoch 84/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1776 -
accuracy: 0.9885 - val_loss: 11.1939 - val_accuracy: 0.7398
Epoch 85/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2082 -
accuracy: 0.9879 - val_loss: 5.9165 - val_accuracy: 0.8620
Epoch 86/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2007 -
accuracy: 0.9885 - val_loss: 19.5572 - val_accuracy: 0.6712
Epoch 87/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1907 -
accuracy: 0.9886 - val_loss: 5.3776 - val_accuracy: 0.8217
Epoch 88/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2399 -
accuracy: 0.9869 - val_loss: 15.0415 - val_accuracy: 0.7318
Epoch 89/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2091 -
accuracy: 0.9883 - val_loss: 0.6002 - val_accuracy: 0.9780
Epoch 90/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1760 -
accuracy: 0.9891 - val_loss: 7.3360 - val_accuracy: 0.8051
Epoch 91/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1723 -
accuracy: 0.9892 - val_loss: 4.9337 - val_accuracy: 0.8809
Epoch 92/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1672 -
accuracy: 0.9897 - val_loss: 0.7933 - val_accuracy: 0.9479
Epoch 93/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1779 -
accuracy: 0.9896 - val_loss: 1.8531 - val_accuracy: 0.9192
Epoch 94/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1453 -
accuracy: 0.9902 - val_loss: 9.0259 - val_accuracy: 0.7707
Epoch 95/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1896 -
accuracy: 0.9889 - val_loss: 4.4112 - val_accuracy: 0.8572
Epoch 96/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1789 -
accuracy: 0.9885 - val_loss: 1.1363 - val_accuracy: 0.9289
Epoch 97/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1788 -
accuracy: 0.9883 - val_loss: 3.6511 - val_accuracy: 0.8873
Epoch 98/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.1750 -
accuracy: 0.9892 - val_loss: 3.2492 - val_accuracy: 0.8840
Epoch 99/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1832 -
accuracy: 0.9892 - val_loss: 1.8906 - val_accuracy: 0.9038
Epoch 100/500
415/415 [==============================] - 2s 4ms/step - loss: 0.2054 -
accuracy: 0.9884 - val_loss: 10.9911 - val_accuracy: 0.7538
Epoch 101/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2540 -
accuracy: 0.9862 - val_loss: 6.4705 - val_accuracy: 0.8346
Epoch 102/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2104 -
accuracy: 0.9862 - val_loss: 12.1949 - val_accuracy: 0.7774
Epoch 103/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1945 -
accuracy: 0.9882 - val_loss: 2.8618 - val_accuracy: 0.9094
Epoch 104/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2059 -
accuracy: 0.9876 - val_loss: 8.0034 - val_accuracy: 0.8223
Epoch 105/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2253 -
accuracy: 0.9869 - val_loss: 3.3407 - val_accuracy: 0.8937
Epoch 106/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1835 -
accuracy: 0.9884 - val_loss: 5.6132 - val_accuracy: 0.8583
Epoch 107/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2258 -
accuracy: 0.9881 - val_loss: 2.7633 - val_accuracy: 0.9209
Epoch 108/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2143 -
accuracy: 0.9878 - val_loss: 22.1648 - val_accuracy: 0.6632
Epoch 109/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2090 -
accuracy: 0.9882 - val_loss: 6.5594 - val_accuracy: 0.8561
Epoch 110/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1770 -
accuracy: 0.9884 - val_loss: 4.1497 - val_accuracy: 0.8672
Epoch 111/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1953 -
accuracy: 0.9887 - val_loss: 3.6714 - val_accuracy: 0.9002
Epoch 112/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1791 -
accuracy: 0.9897 - val_loss: 6.4418 - val_accuracy: 0.8518
Epoch 113/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1963 -
accuracy: 0.9886 - val_loss: 4.6170 - val_accuracy: 0.8657
Epoch 114/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.1954 -
accuracy: 0.9890 - val_loss: 5.4884 - val_accuracy: 0.8790
Epoch 115/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1704 -
accuracy: 0.9906 - val_loss: 7.0848 - val_accuracy: 0.8483
Epoch 116/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1709 -
accuracy: 0.9901 - val_loss: 6.7977 - val_accuracy: 0.8389
Epoch 117/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1586 -
accuracy: 0.9900 - val_loss: 5.1674 - val_accuracy: 0.8673
Epoch 118/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2398 -
accuracy: 0.9888 - val_loss: 4.0424 - val_accuracy: 0.9048
Epoch 119/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1789 -
accuracy: 0.9901 - val_loss: 7.5890 - val_accuracy: 0.8152
Epoch 120/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1715 -
accuracy: 0.9900 - val_loss: 2.6684 - val_accuracy: 0.9257
Epoch 121/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1774 -
accuracy: 0.9888 - val_loss: 29.1510 - val_accuracy: 0.7115
Epoch 122/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1747 -
accuracy: 0.9905 - val_loss: 3.0763 - val_accuracy: 0.8808
Epoch 123/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1660 -
accuracy: 0.9905 - val_loss: 14.3864 - val_accuracy: 0.7567
Epoch 124/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1449 -
accuracy: 0.9910 - val_loss: 1.3544 - val_accuracy: 0.9457
Epoch 125/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1575 -
accuracy: 0.9899 - val_loss: 6.9028 - val_accuracy: 0.8254
Epoch 126/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2222 -
accuracy: 0.9884 - val_loss: 3.6659 - val_accuracy: 0.8549
Epoch 127/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1851 -
accuracy: 0.9892 - val_loss: 5.3392 - val_accuracy: 0.8669
Epoch 128/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1989 -
accuracy: 0.9891 - val_loss: 5.7221 - val_accuracy: 0.8512
Epoch 129/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1762 -
accuracy: 0.9889 - val_loss: 8.9194 - val_accuracy: 0.8193
Epoch 130/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.1884 -
accuracy: 0.9884 - val_loss: 16.8527 - val_accuracy: 0.7337
Epoch 131/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1876 -
accuracy: 0.9899 - val_loss: 11.0227 - val_accuracy: 0.7608
Epoch 132/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1822 -
accuracy: 0.9893 - val_loss: 8.4460 - val_accuracy: 0.8242
Epoch 133/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1697 -
accuracy: 0.9905 - val_loss: 9.6956 - val_accuracy: 0.8119
Epoch 134/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1930 -
accuracy: 0.9890 - val_loss: 3.6393 - val_accuracy: 0.8962
Epoch 135/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1672 -
accuracy: 0.9909 - val_loss: 10.8604 - val_accuracy: 0.8152
Epoch 136/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1700 -
accuracy: 0.9902 - val_loss: 9.3503 - val_accuracy: 0.8159
Epoch 137/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1603 -
accuracy: 0.9899 - val_loss: 15.5632 - val_accuracy: 0.7274
Epoch 138/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2046 -
accuracy: 0.9893 - val_loss: 11.4932 - val_accuracy: 0.7700
Epoch 139/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2007 -
accuracy: 0.9894 - val_loss: 0.9390 - val_accuracy: 0.9499
Epoch 140/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1512 -
accuracy: 0.9908 - val_loss: 12.2290 - val_accuracy: 0.7583
Epoch 141/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1599 -
accuracy: 0.9899 - val_loss: 8.6410 - val_accuracy: 0.8014
Epoch 142/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2039 -
accuracy: 0.9887 - val_loss: 8.8804 - val_accuracy: 0.8212
Epoch 143/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1684 -
accuracy: 0.9905 - val_loss: 24.8284 - val_accuracy: 0.6797
Epoch 144/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1339 -
accuracy: 0.9925 - val_loss: 8.2606 - val_accuracy: 0.8290
Epoch 145/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1626 -
accuracy: 0.9911 - val_loss: 11.8490 - val_accuracy: 0.7952
Epoch 146/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.1652 -
accuracy: 0.9911 - val_loss: 4.2893 - val_accuracy: 0.9118
Epoch 147/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1764 -
accuracy: 0.9908 - val_loss: 2.0948 - val_accuracy: 0.9370
Epoch 148/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1767 -
accuracy: 0.9916 - val_loss: 5.0765 - val_accuracy: 0.8802
Epoch 149/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1482 -
accuracy: 0.9923 - val_loss: 4.2190 - val_accuracy: 0.8927
Epoch 150/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1724 -
accuracy: 0.9908 - val_loss: 9.2313 - val_accuracy: 0.8214
Epoch 151/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1731 -
accuracy: 0.9907 - val_loss: 8.4767 - val_accuracy: 0.8298
Epoch 152/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1476 -
accuracy: 0.9919 - val_loss: 8.7373 - val_accuracy: 0.8146
Epoch 153/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1779 -
accuracy: 0.9914 - val_loss: 7.1979 - val_accuracy: 0.8370
Epoch 154/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1874 -
accuracy: 0.9895 - val_loss: 19.9382 - val_accuracy: 0.7854
Epoch 155/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1952 -
accuracy: 0.9895 - val_loss: 9.7621 - val_accuracy: 0.8126
Epoch 156/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1852 -
accuracy: 0.9908 - val_loss: 15.8241 - val_accuracy: 0.7671
Epoch 157/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1878 -
accuracy: 0.9899 - val_loss: 5.8254 - val_accuracy: 0.8391
Epoch 158/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2195 -
accuracy: 0.9894 - val_loss: 15.1312 - val_accuracy: 0.7715
Epoch 159/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1812 -
accuracy: 0.9908 - val_loss: 10.1318 - val_accuracy: 0.8219
Epoch 160/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1683 -
accuracy: 0.9913 - val_loss: 11.6359 - val_accuracy: 0.8005
Epoch 161/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1584 -
accuracy: 0.9901 - val_loss: 9.4096 - val_accuracy: 0.8626
Epoch 162/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.1633 -
accuracy: 0.9908 - val_loss: 13.3851 - val_accuracy: 0.7912
Epoch 163/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1877 -
accuracy: 0.9885 - val_loss: 12.3235 - val_accuracy: 0.7817
Epoch 164/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1664 -
accuracy: 0.9906 - val_loss: 9.7465 - val_accuracy: 0.8285
Epoch 165/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1618 -
accuracy: 0.9910 - val_loss: 15.8057 - val_accuracy: 0.7841
Epoch 166/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1752 -
accuracy: 0.9916 - val_loss: 12.2921 - val_accuracy: 0.8506
Epoch 167/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1706 -
accuracy: 0.9918 - val_loss: 6.8908 - val_accuracy: 0.8922
Epoch 168/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1565 -
accuracy: 0.9915 - val_loss: 36.9350 - val_accuracy: 0.6078
Epoch 169/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1507 -
accuracy: 0.9914 - val_loss: 16.9252 - val_accuracy: 0.7525
Epoch 170/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1633 -
accuracy: 0.9914 - val_loss: 13.3553 - val_accuracy: 0.8432
Epoch 171/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1847 -
accuracy: 0.9900 - val_loss: 9.2657 - val_accuracy: 0.8422
Epoch 172/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1674 -
accuracy: 0.9916 - val_loss: 4.3731 - val_accuracy: 0.9112
Epoch 173/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1700 -
accuracy: 0.9901 - val_loss: 19.6030 - val_accuracy: 0.7320
Epoch 174/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1474 -
accuracy: 0.9927 - val_loss: 13.3788 - val_accuracy: 0.8036
Epoch 175/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1274 -
accuracy: 0.9928 - val_loss: 16.7991 - val_accuracy: 0.7727
Epoch 176/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1882 -
accuracy: 0.9912 - val_loss: 9.6033 - val_accuracy: 0.8404
Epoch 177/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1566 -
accuracy: 0.9921 - val_loss: 27.8604 - val_accuracy: 0.7202
Epoch 178/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.1900 -
accuracy: 0.9920 - val_loss: 40.3722 - val_accuracy: 0.6802
Epoch 179/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1849 -
accuracy: 0.9913 - val_loss: 14.0783 - val_accuracy: 0.7808
Epoch 180/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2075 -
accuracy: 0.9899 - val_loss: 12.2724 - val_accuracy: 0.8092
Epoch 181/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1662 -
accuracy: 0.9911 - val_loss: 9.3652 - val_accuracy: 0.8493
Epoch 182/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1917 -
accuracy: 0.9902 - val_loss: 23.7678 - val_accuracy: 0.7886
Epoch 183/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1262 -
accuracy: 0.9927 - val_loss: 13.3835 - val_accuracy: 0.7980
Epoch 184/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1933 -
accuracy: 0.9892 - val_loss: 5.4113 - val_accuracy: 0.9067
Epoch 185/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1787 -
accuracy: 0.9902 - val_loss: 22.3476 - val_accuracy: 0.6992
Epoch 186/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1814 -
accuracy: 0.9902 - val_loss: 3.6180 - val_accuracy: 0.9177
Epoch 187/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1918 -
accuracy: 0.9902 - val_loss: 4.7313 - val_accuracy: 0.8722
Epoch 188/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1586 -
accuracy: 0.9914 - val_loss: 3.8159 - val_accuracy: 0.9087
Epoch 189/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1716 -
accuracy: 0.9907 - val_loss: 6.1263 - val_accuracy: 0.9009
Epoch 190/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1750 -
accuracy: 0.9916 - val_loss: 5.2821 - val_accuracy: 0.9037
Epoch 191/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1688 -
accuracy: 0.9906 - val_loss: 6.3432 - val_accuracy: 0.8569
Epoch 192/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1573 -
accuracy: 0.9919 - val_loss: 7.4849 - val_accuracy: 0.8854
Epoch 193/500
415/415 [==============================] - 1s 3ms/step - loss: 0.2045 -
accuracy: 0.9908 - val_loss: 13.3847 - val_accuracy: 0.7943
Epoch 194/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.2043 -
accuracy: 0.9894 - val_loss: 4.1153 - val_accuracy: 0.9100
Epoch 195/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1643 -
accuracy: 0.9910 - val_loss: 12.1462 - val_accuracy: 0.7983
Epoch 196/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1595 -
accuracy: 0.9902 - val_loss: 10.2500 - val_accuracy: 0.8202
Epoch 197/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1635 -
accuracy: 0.9906 - val_loss: 21.7848 - val_accuracy: 0.7573
Epoch 198/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1442 -
accuracy: 0.9917 - val_loss: 11.9934 - val_accuracy: 0.8011
Epoch 199/500
415/415 [==============================] - 2s 4ms/step - loss: 0.2513 -
accuracy: 0.9880 - val_loss: 15.1974 - val_accuracy: 0.7891
Epoch 200/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1733 -
accuracy: 0.9905 - val_loss: 13.1583 - val_accuracy: 0.8049
Epoch 201/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1891 -
accuracy: 0.9903 - val_loss: 10.5701 - val_accuracy: 0.8417
Epoch 202/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1735 -
accuracy: 0.9906 - val_loss: 16.3714 - val_accuracy: 0.8042
Epoch 203/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1685 -
accuracy: 0.9911 - val_loss: 14.0749 - val_accuracy: 0.8103
Epoch 204/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1676 -
accuracy: 0.9914 - val_loss: 12.0486 - val_accuracy: 0.7350
Epoch 205/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1674 -
accuracy: 0.9920 - val_loss: 6.2892 - val_accuracy: 0.9008
Epoch 206/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1648 -
accuracy: 0.9909 - val_loss: 16.7274 - val_accuracy: 0.7432
Epoch 207/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1540 -
accuracy: 0.9924 - val_loss: 11.3766 - val_accuracy: 0.8002
Epoch 208/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1511 -
accuracy: 0.9925 - val_loss: 13.2725 - val_accuracy: 0.7777
Epoch 209/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1624 -
accuracy: 0.9921 - val_loss: 2.4885 - val_accuracy: 0.8805
Epoch 210/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.1727 -
accuracy: 0.9914 - val_loss: 3.4091 - val_accuracy: 0.8371
Epoch 211/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1802 -
accuracy: 0.9900 - val_loss: 7.3952 - val_accuracy: 0.8215
Epoch 212/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1656 -
accuracy: 0.9909 - val_loss: 11.4636 - val_accuracy: 0.7989
Epoch 213/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1631 -
accuracy: 0.9918 - val_loss: 5.4561 - val_accuracy: 0.8516
Epoch 214/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1514 -
accuracy: 0.9917 - val_loss: 11.5493 - val_accuracy: 0.7793
Epoch 215/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1538 -
accuracy: 0.9921 - val_loss: 16.0676 - val_accuracy: 0.7369
Epoch 216/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1863 -
accuracy: 0.9909 - val_loss: 15.6458 - val_accuracy: 0.7651
Epoch 217/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1892 -
accuracy: 0.9913 - val_loss: 14.2717 - val_accuracy: 0.7642
Epoch 218/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2050 -
accuracy: 0.9920 - val_loss: 8.6136 - val_accuracy: 0.8659
Epoch 219/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1623 -
accuracy: 0.9922 - val_loss: 25.8635 - val_accuracy: 0.6749
Epoch 220/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1481 -
accuracy: 0.9926 - val_loss: 18.6476 - val_accuracy: 0.7368
Epoch 221/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1599 -
accuracy: 0.9911 - val_loss: 9.8484 - val_accuracy: 0.8137
Epoch 222/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1467 -
accuracy: 0.9922 - val_loss: 5.8781 - val_accuracy: 0.8549
Epoch 223/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1364 -
accuracy: 0.9925 - val_loss: 10.5086 - val_accuracy: 0.8112
Epoch 224/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1584 -
accuracy: 0.9922 - val_loss: 4.5195 - val_accuracy: 0.8910
Epoch 225/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1535 -
accuracy: 0.9918 - val_loss: 5.0390 - val_accuracy: 0.8519
Epoch 226/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.1256 -
accuracy: 0.9934 - val_loss: 6.9911 - val_accuracy: 0.8306
Epoch 227/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1492 -
accuracy: 0.9922 - val_loss: 7.9464 - val_accuracy: 0.7891
Epoch 228/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1399 -
accuracy: 0.9929 - val_loss: 6.4169 - val_accuracy: 0.8504
Epoch 229/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1359 -
accuracy: 0.9935 - val_loss: 3.1950 - val_accuracy: 0.9010
Epoch 230/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1330 -
accuracy: 0.9930 - val_loss: 25.8106 - val_accuracy: 0.6854
Epoch 231/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1510 -
accuracy: 0.9936 - val_loss: 4.2507 - val_accuracy: 0.8699
Epoch 232/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1514 -
accuracy: 0.9923 - val_loss: 22.2228 - val_accuracy: 0.7337
Epoch 233/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1607 -
accuracy: 0.9926 - val_loss: 5.6307 - val_accuracy: 0.8572
Epoch 234/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1949 -
accuracy: 0.9915 - val_loss: 5.8908 - val_accuracy: 0.8402
Epoch 235/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1548 -
accuracy: 0.9935 - val_loss: 9.8043 - val_accuracy: 0.7931
Epoch 236/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1776 -
accuracy: 0.9908 - val_loss: 3.6852 - val_accuracy: 0.9236
Epoch 237/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1615 -
accuracy: 0.9926 - val_loss: 6.6536 - val_accuracy: 0.8773
Epoch 238/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1604 -
accuracy: 0.9923 - val_loss: 7.1142 - val_accuracy: 0.8554
Epoch 239/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1742 -
accuracy: 0.9910 - val_loss: 1.2561 - val_accuracy: 0.9651
Epoch 240/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1810 -
accuracy: 0.9910 - val_loss: 3.1098 - val_accuracy: 0.9257
Epoch 241/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1513 -
accuracy: 0.9923 - val_loss: 13.0776 - val_accuracy: 0.8181
Epoch 242/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.1410 -
accuracy: 0.9928 - val_loss: 2.0618 - val_accuracy: 0.9242
Epoch 243/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1326 -
accuracy: 0.9926 - val_loss: 2.6360 - val_accuracy: 0.9078
Epoch 244/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1353 -
accuracy: 0.9935 - val_loss: 1.5998 - val_accuracy: 0.9513
Epoch 245/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1425 -
accuracy: 0.9924 - val_loss: 7.1867 - val_accuracy: 0.8397
Epoch 246/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1488 -
accuracy: 0.9925 - val_loss: 3.2065 - val_accuracy: 0.9234
Epoch 247/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1267 -
accuracy: 0.9933 - val_loss: 22.7217 - val_accuracy: 0.7038
Epoch 248/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1218 -
accuracy: 0.9934 - val_loss: 4.3628 - val_accuracy: 0.8881
Epoch 249/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1490 -
accuracy: 0.9930 - val_loss: 2.2769 - val_accuracy: 0.9082
Epoch 250/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1397 -
accuracy: 0.9927 - val_loss: 1.3612 - val_accuracy: 0.9627
Epoch 251/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1398 -
accuracy: 0.9930 - val_loss: 12.6992 - val_accuracy: 0.7958
Epoch 252/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1371 -
accuracy: 0.9931 - val_loss: 7.8603 - val_accuracy: 0.8668
Epoch 253/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1539 -
accuracy: 0.9916 - val_loss: 8.6816 - val_accuracy: 0.8171
Epoch 254/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1569 -
accuracy: 0.9924 - val_loss: 8.8531 - val_accuracy: 0.8378
Epoch 255/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1814 -
accuracy: 0.9927 - val_loss: 31.8923 - val_accuracy: 0.6679
Epoch 256/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1388 -
accuracy: 0.9936 - val_loss: 8.4215 - val_accuracy: 0.8366
Epoch 257/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1687 -
accuracy: 0.9938 - val_loss: 7.2909 - val_accuracy: 0.8589
Epoch 258/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.1688 -
accuracy: 0.9918 - val_loss: 11.6048 - val_accuracy: 0.7794
Epoch 259/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1463 -
accuracy: 0.9932 - val_loss: 14.0681 - val_accuracy: 0.7796
Epoch 260/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1587 -
accuracy: 0.9927 - val_loss: 24.2379 - val_accuracy: 0.6613
Epoch 261/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1494 -
accuracy: 0.9928 - val_loss: 2.7386 - val_accuracy: 0.9300
Epoch 262/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1749 -
accuracy: 0.9915 - val_loss: 8.8469 - val_accuracy: 0.8676
Epoch 263/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1256 -
accuracy: 0.9935 - val_loss: 8.6938 - val_accuracy: 0.8509
Epoch 264/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1246 -
accuracy: 0.9934 - val_loss: 20.7612 - val_accuracy: 0.7799
Epoch 265/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1215 -
accuracy: 0.9941 - val_loss: 8.2798 - val_accuracy: 0.8595
Epoch 266/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1766 -
accuracy: 0.9897 - val_loss: 8.4247 - val_accuracy: 0.7955
Epoch 267/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1658 -
accuracy: 0.9926 - val_loss: 11.9515 - val_accuracy: 0.7837
Epoch 268/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1395 -
accuracy: 0.9925 - val_loss: 0.7510 - val_accuracy: 0.9571
Epoch 269/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1480 -
accuracy: 0.9934 - val_loss: 6.4321 - val_accuracy: 0.8821
Epoch 270/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1485 -
accuracy: 0.9937 - val_loss: 6.0205 - val_accuracy: 0.8922
Epoch 271/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1230 -
accuracy: 0.9940 - val_loss: 16.7813 - val_accuracy: 0.7651
Epoch 272/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1830 -
accuracy: 0.9922 - val_loss: 9.7582 - val_accuracy: 0.8358
Epoch 273/500
415/415 [==============================] - 2s 4ms/step - loss: 0.2078 -
accuracy: 0.9908 - val_loss: 2.6778 - val_accuracy: 0.9355
Epoch 274/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.1422 -
accuracy: 0.9935 - val_loss: 18.2831 - val_accuracy: 0.7575
Epoch 275/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1474 -
accuracy: 0.9926 - val_loss: 19.3361 - val_accuracy: 0.8159
Epoch 276/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1248 -
accuracy: 0.9947 - val_loss: 9.7124 - val_accuracy: 0.8575
Epoch 277/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1449 -
accuracy: 0.9934 - val_loss: 9.5798 - val_accuracy: 0.8558
Epoch 278/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1884 -
accuracy: 0.9912 - val_loss: 6.9362 - val_accuracy: 0.8336
Epoch 279/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2060 -
accuracy: 0.9911 - val_loss: 28.8175 - val_accuracy: 0.6470
Epoch 280/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2273 -
accuracy: 0.9897 - val_loss: 5.9161 - val_accuracy: 0.9032
Epoch 281/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1556 -
accuracy: 0.9924 - val_loss: 5.2839 - val_accuracy: 0.9303
Epoch 282/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1488 -
accuracy: 0.9928 - val_loss: 25.7421 - val_accuracy: 0.7026
Epoch 283/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1729 -
accuracy: 0.9925 - val_loss: 12.0032 - val_accuracy: 0.8533
Epoch 284/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1833 -
accuracy: 0.9908 - val_loss: 8.4564 - val_accuracy: 0.8556
Epoch 285/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1540 -
accuracy: 0.9927 - val_loss: 9.3750 - val_accuracy: 0.8389
Epoch 286/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1665 -
accuracy: 0.9925 - val_loss: 4.1258 - val_accuracy: 0.8732
Epoch 287/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1255 -
accuracy: 0.9933 - val_loss: 7.3134 - val_accuracy: 0.8639
Epoch 288/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1194 -
accuracy: 0.9944 - val_loss: 10.5751 - val_accuracy: 0.8211
Epoch 289/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1305 -
accuracy: 0.9940 - val_loss: 3.7115 - val_accuracy: 0.8998
Epoch 290/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.1315 -
accuracy: 0.9941 - val_loss: 11.3572 - val_accuracy: 0.8620
Epoch 291/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1322 -
accuracy: 0.9936 - val_loss: 11.8059 - val_accuracy: 0.8172
Epoch 292/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1278 -
accuracy: 0.9946 - val_loss: 25.8602 - val_accuracy: 0.7408
Epoch 293/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1755 -
accuracy: 0.9920 - val_loss: 13.7975 - val_accuracy: 0.7699
Epoch 294/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1447 -
accuracy: 0.9937 - val_loss: 4.0378 - val_accuracy: 0.8866
Epoch 295/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1189 -
accuracy: 0.9940 - val_loss: 2.1810 - val_accuracy: 0.9300
Epoch 296/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1430 -
accuracy: 0.9922 - val_loss: 14.0811 - val_accuracy: 0.8245
Epoch 297/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1604 -
accuracy: 0.9917 - val_loss: 25.3812 - val_accuracy: 0.7411
Epoch 298/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1403 -
accuracy: 0.9931 - val_loss: 17.3892 - val_accuracy: 0.7904
Epoch 299/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1272 -
accuracy: 0.9946 - val_loss: 9.7194 - val_accuracy: 0.8420
Epoch 300/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1450 -
accuracy: 0.9936 - val_loss: 6.3475 - val_accuracy: 0.8489
Epoch 301/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1129 -
accuracy: 0.9943 - val_loss: 2.3178 - val_accuracy: 0.9212
Epoch 302/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1290 -
accuracy: 0.9938 - val_loss: 0.2477 - val_accuracy: 0.9915
Epoch 303/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1058 -
accuracy: 0.9948 - val_loss: 4.2753 - val_accuracy: 0.8996
Epoch 304/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1109 -
accuracy: 0.9944 - val_loss: 6.2406 - val_accuracy: 0.8522
Epoch 305/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1869 -
accuracy: 0.9919 - val_loss: 30.5131 - val_accuracy: 0.6865
Epoch 306/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.1640 -
accuracy: 0.9931 - val_loss: 8.7003 - val_accuracy: 0.8611
Epoch 307/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1489 -
accuracy: 0.9940 - val_loss: 2.6801 - val_accuracy: 0.9177
Epoch 308/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1179 -
accuracy: 0.9945 - val_loss: 14.6718 - val_accuracy: 0.7832
Epoch 309/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1754 -
accuracy: 0.9934 - val_loss: 3.1104 - val_accuracy: 0.9230
Epoch 310/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1593 -
accuracy: 0.9931 - val_loss: 21.2880 - val_accuracy: 0.7405
Epoch 311/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1478 -
accuracy: 0.9944 - val_loss: 5.3273 - val_accuracy: 0.8885
Epoch 312/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1317 -
accuracy: 0.9942 - val_loss: 3.0841 - val_accuracy: 0.9279
Epoch 313/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1281 -
accuracy: 0.9943 - val_loss: 4.6373 - val_accuracy: 0.9054
Epoch 314/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1172 -
accuracy: 0.9948 - val_loss: 3.5844 - val_accuracy: 0.9127
Epoch 315/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1146 -
accuracy: 0.9948 - val_loss: 3.5769 - val_accuracy: 0.9020
Epoch 316/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1306 -
accuracy: 0.9932 - val_loss: 3.2527 - val_accuracy: 0.9212
Epoch 317/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1364 -
accuracy: 0.9936 - val_loss: 15.1204 - val_accuracy: 0.7967
Epoch 318/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0995 -
accuracy: 0.9946 - val_loss: 9.7738 - val_accuracy: 0.8320
Epoch 319/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1433 -
accuracy: 0.9933 - val_loss: 1.6320 - val_accuracy: 0.9501
Epoch 320/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1115 -
accuracy: 0.9947 - val_loss: 10.7638 - val_accuracy: 0.8331
Epoch 321/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1543 -
accuracy: 0.9935 - val_loss: 13.8076 - val_accuracy: 0.8007
Epoch 322/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.2185 -
accuracy: 0.9918 - val_loss: 2.7058 - val_accuracy: 0.9386
Epoch 323/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1592 -
accuracy: 0.9931 - val_loss: 4.0830 - val_accuracy: 0.9245
Epoch 324/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1449 -
accuracy: 0.9937 - val_loss: 6.6779 - val_accuracy: 0.8748
Epoch 325/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1304 -
accuracy: 0.9944 - val_loss: 2.0865 - val_accuracy: 0.9330
Epoch 326/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1043 -
accuracy: 0.9956 - val_loss: 5.5313 - val_accuracy: 0.8926
Epoch 327/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1100 -
accuracy: 0.9948 - val_loss: 8.5673 - val_accuracy: 0.8646
Epoch 328/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1463 -
accuracy: 0.9944 - val_loss: 10.8097 - val_accuracy: 0.8508
Epoch 329/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1569 -
accuracy: 0.9933 - val_loss: 9.9676 - val_accuracy: 0.8516
Epoch 330/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1962 -
accuracy: 0.9929 - val_loss: 2.4890 - val_accuracy: 0.9523
Epoch 331/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1858 -
accuracy: 0.9920 - val_loss: 14.3239 - val_accuracy: 0.8468
Epoch 332/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1400 -
accuracy: 0.9937 - val_loss: 4.2262 - val_accuracy: 0.9036
Epoch 333/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1549 -
accuracy: 0.9932 - val_loss: 4.5968 - val_accuracy: 0.8990
Epoch 334/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1367 -
accuracy: 0.9937 - val_loss: 4.2280 - val_accuracy: 0.8985
Epoch 335/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1572 -
accuracy: 0.9938 - val_loss: 2.3555 - val_accuracy: 0.9395
Epoch 336/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1524 -
accuracy: 0.9929 - val_loss: 20.5937 - val_accuracy: 0.7635
Epoch 337/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1944 -
accuracy: 0.9922 - val_loss: 12.9256 - val_accuracy: 0.8230
Epoch 338/500
```

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415/415 [==============================] - 2s 5ms/step - loss: 0.1797 -
accuracy: 0.9925 - val_loss: 5.6744 - val_accuracy: 0.8525
Epoch 339/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1588 -
accuracy: 0.9927 - val_loss: 4.7805 - val_accuracy: 0.8616
Epoch 340/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1267 -
accuracy: 0.9938 - val_loss: 14.2574 - val_accuracy: 0.7815
Epoch 341/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1749 -
accuracy: 0.9926 - val_loss: 19.6157 - val_accuracy: 0.7731
Epoch 342/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1711 -
accuracy: 0.9931 - val_loss: 16.3127 - val_accuracy: 0.7735
Epoch 343/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1568 -
accuracy: 0.9931 - val_loss: 7.6022 - val_accuracy: 0.8657
Epoch 344/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1857 -
accuracy: 0.9935 - val_loss: 20.2789 - val_accuracy: 0.7689
Epoch 345/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1480 -
accuracy: 0.9940 - val_loss: 11.6103 - val_accuracy: 0.8329
Epoch 346/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1985 -
accuracy: 0.9934 - val_loss: 36.8927 - val_accuracy: 0.6938
Epoch 347/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1390 -
accuracy: 0.9947 - val_loss: 11.0473 - val_accuracy: 0.8552
Epoch 348/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1565 -
accuracy: 0.9940 - val_loss: 10.3863 - val_accuracy: 0.8464
Epoch 349/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1071 -
accuracy: 0.9953 - val_loss: 13.0312 - val_accuracy: 0.8225
Epoch 350/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1653 -
accuracy: 0.9924 - val_loss: 1.0584 - val_accuracy: 0.9755
Epoch 351/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1337 -
accuracy: 0.9935 - val_loss: 3.5423 - val_accuracy: 0.9271
Epoch 352/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1637 -
accuracy: 0.9919 - val_loss: 2.7680 - val_accuracy: 0.9299
Epoch 353/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1517 -
accuracy: 0.9926 - val_loss: 54.2278 - val_accuracy: 0.6150
Epoch 354/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.1485 -
accuracy: 0.9939 - val_loss: 2.2060 - val_accuracy: 0.9224
Epoch 355/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1429 -
accuracy: 0.9939 - val_loss: 9.0602 - val_accuracy: 0.8666
Epoch 356/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1366 -
accuracy: 0.9936 - val_loss: 3.5740 - val_accuracy: 0.9096
Epoch 357/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1314 -
accuracy: 0.9937 - val_loss: 21.1519 - val_accuracy: 0.8075
Epoch 358/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1579 -
accuracy: 0.9933 - val_loss: 3.4251 - val_accuracy: 0.9132
Epoch 359/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1198 -
accuracy: 0.9946 - val_loss: 6.7883 - val_accuracy: 0.8595
Epoch 360/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1201 -
accuracy: 0.9946 - val_loss: 6.8237 - val_accuracy: 0.8725
Epoch 361/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1638 -
accuracy: 0.9931 - val_loss: 10.1053 - val_accuracy: 0.8147
Epoch 362/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1187 -
accuracy: 0.9941 - val_loss: 5.3066 - val_accuracy: 0.8886
Epoch 363/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1186 -
accuracy: 0.9947 - val_loss: 29.1146 - val_accuracy: 0.6889
Epoch 364/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1364 -
accuracy: 0.9948 - val_loss: 13.0027 - val_accuracy: 0.8162
Epoch 365/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1576 -
accuracy: 0.9943 - val_loss: 5.0239 - val_accuracy: 0.9035
Epoch 366/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1321 -
accuracy: 0.9942 - val_loss: 5.4552 - val_accuracy: 0.8911
Epoch 367/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1652 -
accuracy: 0.9935 - val_loss: 3.2169 - val_accuracy: 0.9213
Epoch 368/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1985 -
accuracy: 0.9928 - val_loss: 6.8631 - val_accuracy: 0.8825
Epoch 369/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1499 -
accuracy: 0.9939 - val_loss: 3.2981 - val_accuracy: 0.9260
Epoch 370/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.1255 -
accuracy: 0.9947 - val_loss: 2.6215 - val_accuracy: 0.9351
Epoch 371/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1064 -
accuracy: 0.9952 - val_loss: 6.6866 - val_accuracy: 0.8696
Epoch 372/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1074 -
accuracy: 0.9951 - val_loss: 3.2827 - val_accuracy: 0.9274
Epoch 373/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1344 -
accuracy: 0.9931 - val_loss: 7.7418 - val_accuracy: 0.8537
Epoch 374/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1157 -
accuracy: 0.9947 - val_loss: 4.6639 - val_accuracy: 0.8948
Epoch 375/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1000 -
accuracy: 0.9952 - val_loss: 12.5524 - val_accuracy: 0.8223
Epoch 376/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0912 -
accuracy: 0.9951 - val_loss: 5.4613 - val_accuracy: 0.8938
Epoch 377/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0856 -
accuracy: 0.9961 - val_loss: 6.1673 - val_accuracy: 0.8884
Epoch 378/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1170 -
accuracy: 0.9953 - val_loss: 9.1994 - val_accuracy: 0.8725
Epoch 379/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1116 -
accuracy: 0.9954 - val_loss: 7.3699 - val_accuracy: 0.8460
Epoch 380/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1695 -
accuracy: 0.9927 - val_loss: 7.5328 - val_accuracy: 0.8619
Epoch 381/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1439 -
accuracy: 0.9938 - val_loss: 15.5545 - val_accuracy: 0.7887
Epoch 382/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1226 -
accuracy: 0.9950 - val_loss: 3.3063 - val_accuracy: 0.9328
Epoch 383/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1144 -
accuracy: 0.9954 - val_loss: 24.0770 - val_accuracy: 0.7384
Epoch 384/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1200 -
accuracy: 0.9950 - val_loss: 7.3673 - val_accuracy: 0.8437
Epoch 385/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1025 -
accuracy: 0.9957 - val_loss: 7.0966 - val_accuracy: 0.8469
Epoch 386/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.1065 -
accuracy: 0.9943 - val_loss: 5.4937 - val_accuracy: 0.8695
Epoch 387/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0997 -
accuracy: 0.9952 - val_loss: 10.3469 - val_accuracy: 0.8549
Epoch 388/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1360 -
accuracy: 0.9938 - val_loss: 3.5362 - val_accuracy: 0.9149
Epoch 389/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1172 -
accuracy: 0.9951 - val_loss: 10.2302 - val_accuracy: 0.8547
Epoch 390/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1404 -
accuracy: 0.9951 - val_loss: 13.0859 - val_accuracy: 0.8642
Epoch 391/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1472 -
accuracy: 0.9948 - val_loss: 10.9826 - val_accuracy: 0.8289
Epoch 392/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1440 -
accuracy: 0.9951 - val_loss: 5.4069 - val_accuracy: 0.8931
Epoch 393/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1250 -
accuracy: 0.9951 - val_loss: 9.6088 - val_accuracy: 0.8592
Epoch 394/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1375 -
accuracy: 0.9947 - val_loss: 8.5676 - val_accuracy: 0.8398
Epoch 395/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1120 -
accuracy: 0.9958 - val_loss: 11.1012 - val_accuracy: 0.8245
Epoch 396/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1026 -
accuracy: 0.9959 - val_loss: 7.0754 - val_accuracy: 0.8715
Epoch 397/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1131 -
accuracy: 0.9956 - val_loss: 2.8762 - val_accuracy: 0.9271
Epoch 398/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1563 -
accuracy: 0.9938 - val_loss: 5.5621 - val_accuracy: 0.8835
Epoch 399/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1455 -
accuracy: 0.9939 - val_loss: 5.7685 - val_accuracy: 0.8826
Epoch 400/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1113 -
accuracy: 0.9954 - val_loss: 14.5091 - val_accuracy: 0.7922
Epoch 401/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1037 -
accuracy: 0.9962 - val_loss: 8.7181 - val_accuracy: 0.8266
Epoch 402/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.1436 -
accuracy: 0.9936 - val_loss: 23.4023 - val_accuracy: 0.6979
Epoch 403/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1326 -
accuracy: 0.9941 - val_loss: 1.6563 - val_accuracy: 0.9189
Epoch 404/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1084 -
accuracy: 0.9950 - val_loss: 17.6885 - val_accuracy: 0.8214
Epoch 405/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1018 -
accuracy: 0.9947 - val_loss: 5.3220 - val_accuracy: 0.8763
Epoch 406/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1156 -
accuracy: 0.9943 - val_loss: 5.9846 - val_accuracy: 0.8772
Epoch 407/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1102 -
accuracy: 0.9949 - val_loss: 2.5916 - val_accuracy: 0.9416
Epoch 408/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1170 -
accuracy: 0.9946 - val_loss: 2.3394 - val_accuracy: 0.9472
Epoch 409/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1544 -
accuracy: 0.9927 - val_loss: 10.7612 - val_accuracy: 0.8398
Epoch 410/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1594 -
accuracy: 0.9921 - val_loss: 3.5032 - val_accuracy: 0.9113
Epoch 411/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1702 -
accuracy: 0.9926 - val_loss: 3.7203 - val_accuracy: 0.9345
Epoch 412/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1444 -
accuracy: 0.9939 - val_loss: 2.4038 - val_accuracy: 0.9252
Epoch 413/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1465 -
accuracy: 0.9937 - val_loss: 5.4107 - val_accuracy: 0.9012
Epoch 414/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1454 -
accuracy: 0.9937 - val_loss: 3.0725 - val_accuracy: 0.9206
Epoch 415/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1749 -
accuracy: 0.9925 - val_loss: 2.0619 - val_accuracy: 0.9426
Epoch 416/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1355 -
accuracy: 0.9947 - val_loss: 4.9549 - val_accuracy: 0.9048
Epoch 417/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1759 -
accuracy: 0.9924 - val_loss: 6.7216 - val_accuracy: 0.8937
Epoch 418/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.1319 -
accuracy: 0.9939 - val_loss: 2.8134 - val_accuracy: 0.9504
Epoch 419/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1490 -
accuracy: 0.9934 - val_loss: 25.4194 - val_accuracy: 0.7746
Epoch 420/500
415/415 [==============================] - 2s 4ms/step - loss: 0.2096 -
accuracy: 0.9917 - val_loss: 8.5594 - val_accuracy: 0.8723
Epoch 421/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2075 -
accuracy: 0.9919 - val_loss: 3.3141 - val_accuracy: 0.9326
Epoch 422/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1599 -
accuracy: 0.9918 - val_loss: 2.3330 - val_accuracy: 0.9395
Epoch 423/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1421 -
accuracy: 0.9927 - val_loss: 5.9771 - val_accuracy: 0.8865
Epoch 424/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1258 -
accuracy: 0.9938 - val_loss: 4.1436 - val_accuracy: 0.8995
Epoch 425/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1916 -
accuracy: 0.9913 - val_loss: 8.4384 - val_accuracy: 0.8867
Epoch 426/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1559 -
accuracy: 0.9935 - val_loss: 22.8038 - val_accuracy: 0.7592
Epoch 427/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1420 -
accuracy: 0.9941 - val_loss: 5.2396 - val_accuracy: 0.8934
Epoch 428/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1317 -
accuracy: 0.9943 - val_loss: 3.3320 - val_accuracy: 0.9269
Epoch 429/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1415 -
accuracy: 0.9938 - val_loss: 6.9626 - val_accuracy: 0.8826
Epoch 430/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1080 -
accuracy: 0.9950 - val_loss: 9.7163 - val_accuracy: 0.8629
Epoch 431/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1008 -
accuracy: 0.9958 - val_loss: 10.0618 - val_accuracy: 0.8680
Epoch 432/500
415/415 [==============================] - 1s 3ms/step - loss: 0.0988 -
accuracy: 0.9958 - val_loss: 2.9003 - val_accuracy: 0.9329
Epoch 433/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1169 -
accuracy: 0.9946 - val_loss: 8.0243 - val_accuracy: 0.8725
Epoch 434/500
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415/415 [==============================] - 1s 3ms/step - loss: 0.1491 -
accuracy: 0.9941 - val_loss: 7.2765 - val_accuracy: 0.8849
Epoch 435/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1408 -
accuracy: 0.9941 - val_loss: 2.4428 - val_accuracy: 0.9426
Epoch 436/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1355 -
accuracy: 0.9946 - val_loss: 8.5145 - val_accuracy: 0.8860
Epoch 437/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1258 -
accuracy: 0.9948 - val_loss: 4.1748 - val_accuracy: 0.8981
Epoch 438/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1188 -
accuracy: 0.9950 - val_loss: 6.4137 - val_accuracy: 0.8838
Epoch 439/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1209 -
accuracy: 0.9949 - val_loss: 5.0197 - val_accuracy: 0.8918
Epoch 440/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1011 -
accuracy: 0.9954 - val_loss: 2.7711 - val_accuracy: 0.9266
Epoch 441/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0956 -
accuracy: 0.9959 - val_loss: 6.5659 - val_accuracy: 0.9029
Epoch 442/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1017 -
accuracy: 0.9956 - val_loss: 12.5427 - val_accuracy: 0.8337
Epoch 443/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1144 -
accuracy: 0.9952 - val_loss: 2.7219 - val_accuracy: 0.9266
Epoch 444/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1506 -
accuracy: 0.9941 - val_loss: 8.6083 - val_accuracy: 0.8492
Epoch 445/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1248 -
accuracy: 0.9954 - val_loss: 6.1720 - val_accuracy: 0.8709
Epoch 446/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1285 -
accuracy: 0.9941 - val_loss: 6.6982 - val_accuracy: 0.8615
Epoch 447/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1276 -
accuracy: 0.9942 - val_loss: 5.3728 - val_accuracy: 0.8971
Epoch 448/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1392 -
accuracy: 0.9940 - val_loss: 8.3763 - val_accuracy: 0.8595
Epoch 449/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1680 -
accuracy: 0.9938 - val_loss: 6.6312 - val_accuracy: 0.8562
Epoch 450/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.1343 -
accuracy: 0.9948 - val_loss: 8.6107 - val_accuracy: 0.8414
Epoch 451/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1304 -
accuracy: 0.9942 - val_loss: 2.6153 - val_accuracy: 0.9286
Epoch 452/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1745 -
accuracy: 0.9920 - val_loss: 10.1476 - val_accuracy: 0.8479
Epoch 453/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1555 -
accuracy: 0.9933 - val_loss: 11.5024 - val_accuracy: 0.8325
Epoch 454/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1416 -
accuracy: 0.9948 - val_loss: 3.1008 - val_accuracy: 0.9111
Epoch 455/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1151 -
accuracy: 0.9948 - val_loss: 8.0876 - val_accuracy: 0.8633
Epoch 456/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1510 -
accuracy: 0.9949 - val_loss: 3.2257 - val_accuracy: 0.9271
Epoch 457/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1305 -
accuracy: 0.9951 - val_loss: 9.8919 - val_accuracy: 0.8491
Epoch 458/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1429 -
accuracy: 0.9950 - val_loss: 7.0423 - val_accuracy: 0.8638
Epoch 459/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1179 -
accuracy: 0.9949 - val_loss: 7.7206 - val_accuracy: 0.8621
Epoch 460/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1233 -
accuracy: 0.9943 - val_loss: 8.5066 - val_accuracy: 0.8762
Epoch 461/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1226 -
accuracy: 0.9954 - val_loss: 22.9548 - val_accuracy: 0.7502
Epoch 462/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1012 -
accuracy: 0.9955 - val_loss: 1.6033 - val_accuracy: 0.9642
Epoch 463/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1102 -
accuracy: 0.9957 - val_loss: 21.7563 - val_accuracy: 0.7476
Epoch 464/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1212 -
accuracy: 0.9950 - val_loss: 18.3217 - val_accuracy: 0.7857
Epoch 465/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1228 -
accuracy: 0.9941 - val_loss: 19.6201 - val_accuracy: 0.7823
Epoch 466/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.1232 -
accuracy: 0.9953 - val_loss: 22.1660 - val_accuracy: 0.7355
Epoch 467/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1016 -
accuracy: 0.9959 - val_loss: 24.0012 - val_accuracy: 0.7278
Epoch 468/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1329 -
accuracy: 0.9954 - val_loss: 9.3674 - val_accuracy: 0.8066
Epoch 469/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1140 -
accuracy: 0.9951 - val_loss: 13.0927 - val_accuracy: 0.8632
Epoch 470/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1251 -
accuracy: 0.9950 - val_loss: 5.7843 - val_accuracy: 0.8944
Epoch 471/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1445 -
accuracy: 0.9942 - val_loss: 11.1649 - val_accuracy: 0.8266
Epoch 472/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1440 -
accuracy: 0.9943 - val_loss: 10.8199 - val_accuracy: 0.8312
Epoch 473/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1215 -
accuracy: 0.9957 - val_loss: 6.7285 - val_accuracy: 0.9168
Epoch 474/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1282 -
accuracy: 0.9951 - val_loss: 8.0676 - val_accuracy: 0.8891
Epoch 475/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1300 -
accuracy: 0.9948 - val_loss: 20.6997 - val_accuracy: 0.7755
Epoch 476/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0948 -
accuracy: 0.9961 - val_loss: 28.1609 - val_accuracy: 0.7408
Epoch 477/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1111 -
accuracy: 0.9959 - val_loss: 5.7653 - val_accuracy: 0.8933
Epoch 478/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1229 -
accuracy: 0.9953 - val_loss: 10.5741 - val_accuracy: 0.8469
Epoch 479/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1515 -
accuracy: 0.9944 - val_loss: 8.7892 - val_accuracy: 0.8759
Epoch 480/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1742 -
accuracy: 0.9925 - val_loss: 1.0804 - val_accuracy: 0.9478
Epoch 481/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1783 -
accuracy: 0.9931 - val_loss: 9.0450 - val_accuracy: 0.9020
Epoch 482/500
```

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415/415 [==============================] - 1s 3ms/step - loss: 0.1621 -
accuracy: 0.9925 - val_loss: 12.8173 - val_accuracy: 0.8353
Epoch 483/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1066 -
accuracy: 0.9956 - val_loss: 11.6506 - val_accuracy: 0.8633
Epoch 484/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1122 -
accuracy: 0.9956 - val_loss: 8.2757 - val_accuracy: 0.8848
Epoch 485/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1077 -
accuracy: 0.9962 - val_loss: 3.1687 - val_accuracy: 0.9512
Epoch 486/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1083 -
accuracy: 0.9960 - val_loss: 11.8215 - val_accuracy: 0.8473
Epoch 487/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0754 -
accuracy: 0.9969 - val_loss: 12.1359 - val_accuracy: 0.8522
Epoch 488/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1720 -
accuracy: 0.9932 - val_loss: 17.8679 - val_accuracy: 0.8186
Epoch 489/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1542 -
accuracy: 0.9936 - val_loss: 21.3871 - val_accuracy: 0.7900
Epoch 490/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1446 -
accuracy: 0.9938 - val_loss: 7.3996 - val_accuracy: 0.8764
Epoch 491/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1305 -
accuracy: 0.9945 - val_loss: 1.5543 - val_accuracy: 0.9753
Epoch 492/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1197 -
accuracy: 0.9948 - val_loss: 1.5791 - val_accuracy: 0.9658
Epoch 493/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0917 -
accuracy: 0.9952 - val_loss: 3.9477 - val_accuracy: 0.9374
Epoch 494/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1326 -
accuracy: 0.9945 - val_loss: 7.7353 - val_accuracy: 0.8654
Epoch 495/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1733 -
accuracy: 0.9938 - val_loss: 21.4549 - val_accuracy: 0.7549
Epoch 496/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1540 -
accuracy: 0.9945 - val_loss: 15.2823 - val_accuracy: 0.7792
Epoch 497/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1362 -
accuracy: 0.9941 - val_loss: 6.3477 - val_accuracy: 0.8845
Epoch 498/500
```

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415/415 [==============================] - 2s 5ms/step - loss: 0.1619 -
accuracy: 0.9937 - val_loss: 8.5239 - val_accuracy: 0.8448
Epoch 499/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1133 -
accuracy: 0.9957 - val_loss: 12.4378 - val_accuracy: 0.8070
Epoch 500/500
415/415 [==============================] - 1s 3ms/step - loss: 0.0885 -
accuracy: 0.9967 - val_loss: 17.1401 - val_accuracy: 0.7941
466/466 [==============================] - 1s 2ms/step - loss: 13.2710 -
accuracy: 0.8284
Epoch 1/500
415/415 [==============================] - 3s 4ms/step - loss: 0.1378 -
accuracy: 0.9582 - val_loss: 0.3666 - val_accuracy: 0.8734
Epoch 2/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0337 -
accuracy: 0.9898 - val_loss: 0.5404 - val_accuracy: 0.8529
Epoch 3/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0228 -
accuracy: 0.9929 - val_loss: 0.5383 - val_accuracy: 0.8472
Epoch 4/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0206 -
accuracy: 0.9933 - val_loss: 0.2078 - val_accuracy: 0.9355
Epoch 5/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0172 -
accuracy: 0.9946 - val_loss: 0.3628 - val_accuracy: 0.8996
Epoch 6/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0118 -
accuracy: 0.9963 - val_loss: 0.0683 - val_accuracy: 0.9684
Epoch 7/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0129 -
accuracy: 0.9958 - val_loss: 0.2306 - val_accuracy: 0.9395
Epoch 8/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0121 -
accuracy: 0.9961 - val_loss: 0.0642 - val_accuracy: 0.9795
Epoch 9/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0138 -
accuracy: 0.9955 - val_loss: 0.2391 - val_accuracy: 0.9163
Epoch 10/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0127 -
accuracy: 0.9959 - val_loss: 0.1124 - val_accuracy: 0.9616
Epoch 11/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0097 -
accuracy: 0.9971 - val_loss: 0.7965 - val_accuracy: 0.8330
Epoch 12/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0088 -
accuracy: 0.9974 - val_loss: 0.1811 - val_accuracy: 0.9401
Epoch 13/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0100 -
```

```
accuracy: 0.9970 - val_loss: 0.4254 - val_accuracy: 0.9149
Epoch 14/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0085 -
accuracy: 0.9975 - val_loss: 0.6442 - val_accuracy: 0.8466
Epoch 15/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0068 -
accuracy: 0.9977 - val_loss: 0.6487 - val_accuracy: 0.9011
Epoch 16/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0102 -
accuracy: 0.9971 - val_loss: 1.3049 - val_accuracy: 0.8320
Epoch 17/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0080 -
accuracy: 0.9979 - val_loss: 0.2037 - val_accuracy: 0.9505
Epoch 18/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0052 -
accuracy: 0.9984 - val_loss: 0.1762 - val_accuracy: 0.9527
Epoch 19/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0088 -
accuracy: 0.9973 - val_loss: 0.8383 - val_accuracy: 0.8786
Epoch 20/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0076 -
accuracy: 0.9978 - val_loss: 0.2652 - val_accuracy: 0.9442
Epoch 21/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0082 -
accuracy: 0.9974 - val_loss: 0.5332 - val_accuracy: 0.8940
Epoch 22/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0069 -
accuracy: 0.9979 - val_loss: 0.3448 - val_accuracy: 0.9213
Epoch 23/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0065 -
accuracy: 0.9978 - val_loss: 0.1039 - val_accuracy: 0.9672
Epoch 24/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0050 -
accuracy: 0.9985 - val_loss: 0.1576 - val_accuracy: 0.9638
Epoch 25/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0078 -
accuracy: 0.9979 - val_loss: 0.2683 - val_accuracy: 0.9361
Epoch 26/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0085 -
accuracy: 0.9975 - val_loss: 0.6254 - val_accuracy: 0.9197
Epoch 27/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0096 -
accuracy: 0.9973 - val_loss: 0.2181 - val_accuracy: 0.9444
Epoch 28/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0037 -
accuracy: 0.9988 - val_loss: 0.0849 - val_accuracy: 0.9720
Epoch 29/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0059 -
```

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accuracy: 0.9984 - val_loss: 0.3738 - val_accuracy: 0.9398
Epoch 30/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0074 -
accuracy: 0.9978 - val_loss: 0.1399 - val_accuracy: 0.9674
Epoch 31/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0042 -
accuracy: 0.9987 - val_loss: 0.7506 - val_accuracy: 0.9149
Epoch 32/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0058 -
accuracy: 0.9985 - val_loss: 0.0171 - val_accuracy: 0.9943
Epoch 33/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0071 -
accuracy: 0.9980 - val_loss: 1.2575 - val_accuracy: 0.8514
Epoch 34/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0069 -
accuracy: 0.9982 - val_loss: 0.0957 - val_accuracy: 0.9753
Epoch 35/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0038 -
accuracy: 0.9989 - val_loss: 0.1018 - val_accuracy: 0.9743
Epoch 36/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0048 -
accuracy: 0.9987 - val_loss: 0.6003 - val_accuracy: 0.9103
Epoch 37/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0074 -
accuracy: 0.9982 - val_loss: 0.5374 - val_accuracy: 0.9135
Epoch 38/500
415/415 [==============================] - 1s 3ms/step - loss: 0.0046 -
accuracy: 0.9988 - val_loss: 0.5073 - val_accuracy: 0.9333
Epoch 39/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0051 -
accuracy: 0.9988 - val_loss: 0.2366 - val_accuracy: 0.9469
Epoch 40/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0062 -
accuracy: 0.9984 - val_loss: 0.1504 - val_accuracy: 0.9654
Epoch 41/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0069 -
accuracy: 0.9981 - val_loss: 0.0962 - val_accuracy: 0.9680
Epoch 42/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0030 -
accuracy: 0.9992 - val_loss: 0.9154 - val_accuracy: 0.8623
Epoch 43/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0045 -
accuracy: 0.9987 - val_loss: 0.3481 - val_accuracy: 0.9322
Epoch 44/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0074 -
accuracy: 0.9980 - val_loss: 0.1356 - val_accuracy: 0.9627
Epoch 45/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0035 -
```

```
accuracy: 0.9991 - val_loss: 0.2975 - val_accuracy: 0.9429
Epoch 46/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0039 -
accuracy: 0.9988 - val_loss: 1.6681 - val_accuracy: 0.7869
Epoch 47/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0061 -
accuracy: 0.9983 - val_loss: 0.1092 - val_accuracy: 0.9670
Epoch 48/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0077 -
accuracy: 0.9981 - val_loss: 0.0482 - val_accuracy: 0.9862
Epoch 49/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0037 -
accuracy: 0.9989 - val_loss: 0.2379 - val_accuracy: 0.9572
Epoch 50/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0045 -
accuracy: 0.9987 - val_loss: 0.0712 - val_accuracy: 0.9836
Epoch 51/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0044 -
accuracy: 0.9989 - val_loss: 0.8115 - val_accuracy: 0.8829
Epoch 52/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0052 -
accuracy: 0.9988 - val_loss: 0.0300 - val_accuracy: 0.9895
Epoch 53/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0050 -
accuracy: 0.9986 - val_loss: 0.0615 - val_accuracy: 0.9856
Epoch 54/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0039 -
accuracy: 0.9989 - val_loss: 0.1579 - val_accuracy: 0.9617
Epoch 55/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0050 -
accuracy: 0.9989 - val_loss: 0.0536 - val_accuracy: 0.9867
Epoch 56/500
406/415 [============================>.] - ETA: 0s - loss: 0.0051 - accuracy:
0.9987
Reached 95.0% accuracy, so stopping training after 56 epochs!
415/415 [==============================] - 2s 5ms/step - loss: 0.0054 -
accuracy: 0.9986 - val_loss: 0.2531 - val_accuracy: 0.9536
466/466 [==============================] - 1s 2ms/step - loss: 0.1898 -
accuracy: 0.9620
Epoch 1/500
415/415 [==============================] - 2s 4ms/step - loss: 0.4315 -
accuracy: 0.8853 - val_loss: 1.0625 - val_accuracy: 0.6291
Epoch 2/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1370 -
accuracy: 0.9680 - val_loss: 0.7919 - val_accuracy: 0.7229
Epoch 3/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0845 -
accuracy: 0.9808 - val_loss: 0.5850 - val_accuracy: 0.7749
```

```
Epoch 4/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0610 -
accuracy: 0.9852 - val_loss: 0.4639 - val_accuracy: 0.8125
Epoch 5/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0479 -
accuracy: 0.9882 - val_loss: 0.5844 - val_accuracy: 0.7929
Epoch 6/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0388 -
accuracy: 0.9900 - val_loss: 0.6420 - val_accuracy: 0.7851
Epoch 7/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0322 -
accuracy: 0.9918 - val_loss: 0.3069 - val_accuracy: 0.8763
Epoch 8/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0274 -
accuracy: 0.9931 - val_loss: 0.5358 - val_accuracy: 0.8205
Epoch 9/500
415/415 [==============================] - 1s 3ms/step - loss: 0.0236 -
accuracy: 0.9939 - val_loss: 0.4669 - val_accuracy: 0.8393
Epoch 10/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0206 -
accuracy: 0.9949 - val_loss: 0.4235 - val_accuracy: 0.8527
Epoch 11/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0183 -
accuracy: 0.9954 - val_loss: 0.2317 - val_accuracy: 0.9091
Epoch 12/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0166 -
accuracy: 0.9958 - val_loss: 0.2143 - val_accuracy: 0.9158
Epoch 13/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0144 -
accuracy: 0.9966 - val_loss: 0.3200 - val_accuracy: 0.8872
Epoch 14/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0134 -
accuracy: 0.9967 - val_loss: 0.3120 - val_accuracy: 0.8943
Epoch 15/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0122 -
accuracy: 0.9972 - val_loss: 0.2448 - val_accuracy: 0.9118
Epoch 16/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0110 -
accuracy: 0.9973 - val_loss: 0.4054 - val_accuracy: 0.8748
Epoch 17/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0104 -
accuracy: 0.9973 - val_loss: 0.2962 - val_accuracy: 0.8986
Epoch 18/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0094 -
accuracy: 0.9977 - val_loss: 0.1661 - val_accuracy: 0.9362
Epoch 19/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0087 -
accuracy: 0.9980 - val_loss: 0.0920 - val_accuracy: 0.9672
```

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Epoch 20/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0078 -
accuracy: 0.9982 - val_loss: 0.2860 - val_accuracy: 0.9063
Epoch 21/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0077 -
accuracy: 0.9980 - val_loss: 0.1067 - val_accuracy: 0.9635
Epoch 22/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0068 -
accuracy: 0.9984 - val_loss: 0.2894 - val_accuracy: 0.9040
Epoch 23/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0066 -
accuracy: 0.9983 - val_loss: 0.2281 - val_accuracy: 0.9240
Epoch 24/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0061 -
accuracy: 0.9986 - val_loss: 0.2040 - val_accuracy: 0.9278
Epoch 25/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0055 -
accuracy: 0.9987 - val_loss: 0.0857 - val_accuracy: 0.9734
Epoch 26/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0052 -
accuracy: 0.9987 - val_loss: 0.1048 - val_accuracy: 0.9648
Epoch 27/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0049 -
accuracy: 0.9988 - val_loss: 0.1977 - val_accuracy: 0.9326
Epoch 28/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0049 -
accuracy: 0.9988 - val_loss: 0.1300 - val_accuracy: 0.9566
Epoch 29/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0042 -
accuracy: 0.9990 - val_loss: 0.1081 - val_accuracy: 0.9694
Epoch 30/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0043 -
accuracy: 0.9988 - val_loss: 0.1104 - val_accuracy: 0.9667
Epoch 31/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0039 -
accuracy: 0.9990 - val_loss: 0.1215 - val_accuracy: 0.9627
Epoch 32/500
407/415 [============================>.] - ETA: 0s - loss: 0.0038 - accuracy:
0.9991
Reached 95.0% accuracy, so stopping training after 32 epochs!
415/415 [==============================] - 2s 5ms/step - loss: 0.0039 -
accuracy: 0.9990 - val_loss: 0.1287 - val_accuracy: 0.9614
466/466 [==============================] - 1s 2ms/step - loss: 0.0401 -
accuracy: 0.9843
Epoch 1/500
415/415 [==============================] - 2s 4ms/step - loss: 1.3460 -
accuracy: 0.5836 - val_loss: 2.4013 - val_accuracy: 0.1076
Epoch 2/500
```

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415/415 [==============================] - 1s 4ms/step - loss: 0.7144 -
accuracy: 0.7860 - val_loss: 1.9556 - val_accuracy: 0.3073
Epoch 3/500
415/415 [==============================] - 1s 4ms/step - loss: 0.5105 -
accuracy: 0.8717 - val_loss: 1.6147 - val_accuracy: 0.4362
Epoch 4/500
415/415 [==============================] - 2s 4ms/step - loss: 0.4010 -
accuracy: 0.9104 - val_loss: 1.3946 - val_accuracy: 0.5032
Epoch 5/500
415/415 [==============================] - 2s 4ms/step - loss: 0.3317 -
accuracy: 0.9293 - val_loss: 1.2655 - val_accuracy: 0.5478
Epoch 6/500
415/415 [==============================] - 1s 4ms/step - loss: 0.2826 -
accuracy: 0.9403 - val_loss: 1.1369 - val_accuracy: 0.5865
Epoch 7/500
415/415 [==============================] - 2s 4ms/step - loss: 0.2453 -
accuracy: 0.9482 - val_loss: 1.0673 - val_accuracy: 0.6101
Epoch 8/500
415/415 [==============================] - 2s 5ms/step - loss: 0.2158 -
accuracy: 0.9540 - val_loss: 1.0389 - val_accuracy: 0.6240
Epoch 9/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1915 -
accuracy: 0.9588 - val_loss: 0.9216 - val_accuracy: 0.6611
Epoch 10/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1710 -
accuracy: 0.9624 - val_loss: 0.8785 - val_accuracy: 0.6780
Epoch 11/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1537 -
accuracy: 0.9655 - val_loss: 0.8951 - val_accuracy: 0.6765
Epoch 12/500
415/415 [==============================] - 1s 3ms/step - loss: 0.1390 -
accuracy: 0.9691 - val_loss: 0.7791 - val_accuracy: 0.7125
Epoch 13/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1263 -
accuracy: 0.9715 - val_loss: 0.7762 - val_accuracy: 0.7151
Epoch 14/500
415/415 [==============================] - 2s 4ms/step - loss: 0.1153 -
accuracy: 0.9739 - val_loss: 0.7871 - val_accuracy: 0.7168
Epoch 15/500
415/415 [==============================] - 1s 4ms/step - loss: 0.1058 -
accuracy: 0.9761 - val_loss: 0.7330 - val_accuracy: 0.7340
Epoch 16/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0975 -
accuracy: 0.9784 - val_loss: 0.7568 - val_accuracy: 0.7312
Epoch 17/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0903 -
accuracy: 0.9797 - val_loss: 0.7068 - val_accuracy: 0.7454
Epoch 18/500
```

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415/415 [==============================] - 2s 5ms/step - loss: 0.0838 -
accuracy: 0.9814 - val_loss: 0.6463 - val_accuracy: 0.7602
Epoch 19/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0783 -
accuracy: 0.9823 - val_loss: 0.5744 - val_accuracy: 0.7788
Epoch 20/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0732 -
accuracy: 0.9834 - val_loss: 0.6123 - val_accuracy: 0.7716
Epoch 21/500
415/415 [==============================] - 1s 3ms/step - loss: 0.0690 -
accuracy: 0.9839 - val_loss: 0.6281 - val_accuracy: 0.7688
Epoch 22/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0651 -
accuracy: 0.9849 - val_loss: 0.6325 - val_accuracy: 0.7692
Epoch 23/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0616 -
accuracy: 0.9855 - val_loss: 0.6571 - val_accuracy: 0.7650
Epoch 24/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0585 -
accuracy: 0.9860 - val_loss: 0.5862 - val_accuracy: 0.7820
Epoch 25/500
415/415 [==============================] - 1s 3ms/step - loss: 0.0557 -
accuracy: 0.9866 - val_loss: 0.5225 - val_accuracy: 0.7976
Epoch 26/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0531 -
accuracy: 0.9874 - val_loss: 0.5499 - val_accuracy: 0.7929
Epoch 27/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0508 -
accuracy: 0.9878 - val_loss: 0.5655 - val_accuracy: 0.7912
Epoch 28/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0486 -
accuracy: 0.9882 - val_loss: 0.5496 - val_accuracy: 0.7961
Epoch 29/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0467 -
accuracy: 0.9885 - val_loss: 0.4812 - val_accuracy: 0.8122
Epoch 30/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0448 -
accuracy: 0.9893 - val_loss: 0.4619 - val_accuracy: 0.8183
Epoch 31/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0430 -
accuracy: 0.9893 - val_loss: 0.4795 - val_accuracy: 0.8140
Epoch 32/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0415 -
accuracy: 0.9899 - val_loss: 0.4257 - val_accuracy: 0.8306
Epoch 33/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0401 -
accuracy: 0.9901 - val_loss: 0.4513 - val_accuracy: 0.8238
Epoch 34/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.0387 -
accuracy: 0.9905 - val_loss: 0.4327 - val_accuracy: 0.8306
Epoch 35/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0374 -
accuracy: 0.9906 - val_loss: 0.4845 - val_accuracy: 0.8173
Epoch 36/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0362 -
accuracy: 0.9911 - val_loss: 0.4395 - val_accuracy: 0.8311
Epoch 37/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0351 -
accuracy: 0.9913 - val_loss: 0.4110 - val_accuracy: 0.8380
Epoch 38/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0340 -
accuracy: 0.9916 - val_loss: 0.4289 - val_accuracy: 0.8349
Epoch 39/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0329 -
accuracy: 0.9918 - val_loss: 0.3866 - val_accuracy: 0.8445
Epoch 40/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0319 -
accuracy: 0.9919 - val_loss: 0.3711 - val_accuracy: 0.8497
Epoch 41/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0310 -
accuracy: 0.9922 - val_loss: 0.3466 - val_accuracy: 0.8562
Epoch 42/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0301 -
accuracy: 0.9923 - val_loss: 0.3233 - val_accuracy: 0.8648
Epoch 43/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0293 -
accuracy: 0.9925 - val_loss: 0.3324 - val_accuracy: 0.8632
Epoch 44/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0284 -
accuracy: 0.9929 - val_loss: 0.3714 - val_accuracy: 0.8526
Epoch 45/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0278 -
accuracy: 0.9929 - val_loss: 0.2844 - val_accuracy: 0.8777
Epoch 46/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0270 -
accuracy: 0.9932 - val_loss: 0.3125 - val_accuracy: 0.8700
Epoch 47/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0263 -
accuracy: 0.9935 - val_loss: 0.3970 - val_accuracy: 0.8472
Epoch 48/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0256 -
accuracy: 0.9934 - val_loss: 0.3556 - val_accuracy: 0.8590
Epoch 49/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0250 -
accuracy: 0.9935 - val_loss: 0.3255 - val_accuracy: 0.8677
Epoch 50/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.0243 -
accuracy: 0.9939 - val_loss: 0.3132 - val_accuracy: 0.8714
Epoch 51/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0237 -
accuracy: 0.9940 - val_loss: 0.3071 - val_accuracy: 0.8728
Epoch 52/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0234 -
accuracy: 0.9942 - val_loss: 0.3515 - val_accuracy: 0.8630
Epoch 53/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0227 -
accuracy: 0.9943 - val_loss: 0.2689 - val_accuracy: 0.8863
Epoch 54/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0222 -
accuracy: 0.9946 - val_loss: 0.3425 - val_accuracy: 0.8660
Epoch 55/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0217 -
accuracy: 0.9946 - val_loss: 0.3130 - val_accuracy: 0.8733
Epoch 56/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0212 -
accuracy: 0.9950 - val_loss: 0.2969 - val_accuracy: 0.8786
Epoch 57/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0208 -
accuracy: 0.9950 - val_loss: 0.2669 - val_accuracy: 0.8883
Epoch 58/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0204 -
accuracy: 0.9951 - val_loss: 0.2338 - val_accuracy: 0.8992
Epoch 59/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0199 -
accuracy: 0.9954 - val_loss: 0.2856 - val_accuracy: 0.8837
Epoch 60/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0195 -
accuracy: 0.9953 - val_loss: 0.2514 - val_accuracy: 0.8939
Epoch 61/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0191 -
accuracy: 0.9956 - val_loss: 0.2658 - val_accuracy: 0.8889
Epoch 62/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0187 -
accuracy: 0.9956 - val_loss: 0.2706 - val_accuracy: 0.8878
Epoch 63/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0183 -
accuracy: 0.9958 - val_loss: 0.2798 - val_accuracy: 0.8863
Epoch 64/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0179 -
accuracy: 0.9958 - val_loss: 0.1835 - val_accuracy: 0.9183
Epoch 65/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0176 -
accuracy: 0.9958 - val_loss: 0.2724 - val_accuracy: 0.8892
Epoch 66/500
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415/415 [==============================] - 1s 4ms/step - loss: 0.0173 -
accuracy: 0.9960 - val_loss: 0.2747 - val_accuracy: 0.8889
Epoch 67/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0170 -
accuracy: 0.9959 - val_loss: 0.2575 - val_accuracy: 0.8943
Epoch 68/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0166 -
accuracy: 0.9962 - val_loss: 0.3092 - val_accuracy: 0.8805
Epoch 69/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0164 -
accuracy: 0.9963 - val_loss: 0.1882 - val_accuracy: 0.9175
Epoch 70/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0161 -
accuracy: 0.9963 - val_loss: 0.2029 - val_accuracy: 0.9127
Epoch 71/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0157 -
accuracy: 0.9964 - val_loss: 0.2660 - val_accuracy: 0.8927
Epoch 72/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0155 -
accuracy: 0.9965 - val_loss: 0.1749 - val_accuracy: 0.9234
Epoch 73/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0153 -
accuracy: 0.9965 - val_loss: 0.2238 - val_accuracy: 0.9061
Epoch 74/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0150 -
accuracy: 0.9967 - val_loss: 0.2449 - val_accuracy: 0.8998
Epoch 75/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0147 -
accuracy: 0.9966 - val_loss: 0.2032 - val_accuracy: 0.9138
Epoch 76/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0145 -
accuracy: 0.9966 - val_loss: 0.2222 - val_accuracy: 0.9074
Epoch 77/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0143 -
accuracy: 0.9966 - val_loss: 0.2415 - val_accuracy: 0.9019
Epoch 78/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0140 -
accuracy: 0.9968 - val_loss: 0.1757 - val_accuracy: 0.9245
Epoch 79/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0138 -
accuracy: 0.9968 - val_loss: 0.2361 - val_accuracy: 0.9037
Epoch 80/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0136 -
accuracy: 0.9969 - val_loss: 0.1918 - val_accuracy: 0.9193
Epoch 81/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0134 -
accuracy: 0.9970 - val_loss: 0.2431 - val_accuracy: 0.9019
Epoch 82/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.0132 -
accuracy: 0.9971 - val_loss: 0.2472 - val_accuracy: 0.9005
Epoch 83/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0130 -
accuracy: 0.9971 - val_loss: 0.1944 - val_accuracy: 0.9188
Epoch 84/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0128 -
accuracy: 0.9970 - val_loss: 0.2122 - val_accuracy: 0.9128
Epoch 85/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0126 -
accuracy: 0.9972 - val_loss: 0.1706 - val_accuracy: 0.9271
Epoch 86/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0125 -
accuracy: 0.9971 - val_loss: 0.2397 - val_accuracy: 0.9043
Epoch 87/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0123 -
accuracy: 0.9972 - val_loss: 0.2088 - val_accuracy: 0.9144
Epoch 88/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0121 -
accuracy: 0.9973 - val_loss: 0.1745 - val_accuracy: 0.9261
Epoch 89/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0119 -
accuracy: 0.9975 - val_loss: 0.2301 - val_accuracy: 0.9077
Epoch 90/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0118 -
accuracy: 0.9974 - val_loss: 0.1593 - val_accuracy: 0.9316
Epoch 91/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0116 -
accuracy: 0.9974 - val_loss: 0.1857 - val_accuracy: 0.9229
Epoch 92/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0115 -
accuracy: 0.9974 - val_loss: 0.1714 - val_accuracy: 0.9275
Epoch 93/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0113 -
accuracy: 0.9975 - val_loss: 0.1739 - val_accuracy: 0.9268
Epoch 94/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0112 -
accuracy: 0.9975 - val_loss: 0.1819 - val_accuracy: 0.9245
Epoch 95/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0110 -
accuracy: 0.9976 - val_loss: 0.1555 - val_accuracy: 0.9334
Epoch 96/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0109 -
accuracy: 0.9975 - val_loss: 0.1262 - val_accuracy: 0.9420
Epoch 97/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0108 -
accuracy: 0.9975 - val_loss: 0.1917 - val_accuracy: 0.9220
Epoch 98/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.0106 -
accuracy: 0.9976 - val_loss: 0.1758 - val_accuracy: 0.9270
Epoch 99/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0104 -
accuracy: 0.9976 - val_loss: 0.1880 - val_accuracy: 0.9233
Epoch 100/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0103 -
accuracy: 0.9977 - val_loss: 0.1509 - val_accuracy: 0.9353
Epoch 101/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0102 -
accuracy: 0.9978 - val_loss: 0.1740 - val_accuracy: 0.9275
Epoch 102/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0101 -
accuracy: 0.9978 - val_loss: 0.1633 - val_accuracy: 0.9314
Epoch 103/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0099 -
accuracy: 0.9977 - val_loss: 0.1686 - val_accuracy: 0.9299
Epoch 104/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0098 -
accuracy: 0.9978 - val_loss: 0.1185 - val_accuracy: 0.9455
Epoch 105/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0097 -
accuracy: 0.9978 - val_loss: 0.1845 - val_accuracy: 0.9248
Epoch 106/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0096 -
accuracy: 0.9978 - val_loss: 0.1564 - val_accuracy: 0.9340
Epoch 107/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0095 -
accuracy: 0.9978 - val_loss: 0.1403 - val_accuracy: 0.9397
Epoch 108/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0093 -
accuracy: 0.9978 - val_loss: 0.1427 - val_accuracy: 0.9389
Epoch 109/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0092 -
accuracy: 0.9979 - val_loss: 0.1452 - val_accuracy: 0.9381
Epoch 110/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0091 -
accuracy: 0.9979 - val_loss: 0.1242 - val_accuracy: 0.9442
Epoch 111/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0090 -
accuracy: 0.9980 - val_loss: 0.2041 - val_accuracy: 0.9202
Epoch 112/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0089 -
accuracy: 0.9980 - val_loss: 0.1129 - val_accuracy: 0.9488
Epoch 113/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0088 -
accuracy: 0.9979 - val_loss: 0.2007 - val_accuracy: 0.9205
Epoch 114/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.0087 -
accuracy: 0.9981 - val_loss: 0.1334 - val_accuracy: 0.9415
Epoch 115/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0086 -
accuracy: 0.9981 - val_loss: 0.1344 - val_accuracy: 0.9413
Epoch 116/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0085 -
accuracy: 0.9981 - val_loss: 0.1465 - val_accuracy: 0.9384
Epoch 117/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0084 -
accuracy: 0.9982 - val_loss: 0.1362 - val_accuracy: 0.9410
Epoch 118/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0083 -
accuracy: 0.9981 - val_loss: 0.1537 - val_accuracy: 0.9357
Epoch 119/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0083 -
accuracy: 0.9983 - val_loss: 0.1283 - val_accuracy: 0.9433
Epoch 120/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0081 -
accuracy: 0.9982 - val_loss: 0.1747 - val_accuracy: 0.9288
Epoch 121/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0080 -
accuracy: 0.9983 - val_loss: 0.1836 - val_accuracy: 0.9262
Epoch 122/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0080 -
accuracy: 0.9983 - val_loss: 0.1482 - val_accuracy: 0.9381
Epoch 123/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0079 -
accuracy: 0.9983 - val_loss: 0.1483 - val_accuracy: 0.9380
Epoch 124/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0078 -
accuracy: 0.9983 - val_loss: 0.1483 - val_accuracy: 0.9380
Epoch 125/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0077 -
accuracy: 0.9985 - val_loss: 0.1342 - val_accuracy: 0.9421
Epoch 126/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0076 -
accuracy: 0.9984 - val_loss: 0.1155 - val_accuracy: 0.9488
Epoch 127/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0075 -
accuracy: 0.9985 - val_loss: 0.1554 - val_accuracy: 0.9357
Epoch 128/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0075 -
accuracy: 0.9984 - val_loss: 0.1407 - val_accuracy: 0.9405
Epoch 129/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0074 -
accuracy: 0.9985 - val_loss: 0.1663 - val_accuracy: 0.9326
Epoch 130/500
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415/415 [==============================] - 2s 5ms/step - loss: 0.0073 -
accuracy: 0.9985 - val_loss: 0.1535 - val_accuracy: 0.9366
Epoch 131/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0073 -
accuracy: 0.9985 - val_loss: 0.1202 - val_accuracy: 0.9477
Epoch 132/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0071 -
accuracy: 0.9986 - val_loss: 0.1413 - val_accuracy: 0.9405
Epoch 133/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0071 -
accuracy: 0.9985 - val_loss: 0.1208 - val_accuracy: 0.9475
Epoch 134/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0070 -
accuracy: 0.9986 - val_loss: 0.1352 - val_accuracy: 0.9426
Epoch 135/500
415/415 [==============================] - 1s 4ms/step - loss: 0.0069 -
accuracy: 0.9986 - val_loss: 0.1405 - val_accuracy: 0.9408
Epoch 136/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0069 -
accuracy: 0.9985 - val_loss: 0.1212 - val_accuracy: 0.9475
Epoch 137/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0068 -
accuracy: 0.9986 - val_loss: 0.1185 - val_accuracy: 0.9482
Epoch 138/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0067 -
accuracy: 0.9987 - val_loss: 0.1137 - val_accuracy: 0.9502
Epoch 139/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0067 -
accuracy: 0.9987 - val_loss: 0.1038 - val_accuracy: 0.9542
Epoch 140/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0066 -
accuracy: 0.9986 - val_loss: 0.1126 - val_accuracy: 0.9507
Epoch 141/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0065 -
accuracy: 0.9986 - val_loss: 0.1330 - val_accuracy: 0.9438
Epoch 142/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0064 -
accuracy: 0.9986 - val_loss: 0.1159 - val_accuracy: 0.9496
Epoch 143/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0064 -
accuracy: 0.9987 - val_loss: 0.0842 - val_accuracy: 0.9645
Epoch 144/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0063 -
accuracy: 0.9986 - val_loss: 0.1176 - val_accuracy: 0.9490
Epoch 145/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0063 -
accuracy: 0.9987 - val_loss: 0.0926 - val_accuracy: 0.9608
Epoch 146/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.0062 -
accuracy: 0.9987 - val_loss: 0.1081 - val_accuracy: 0.9531
Epoch 147/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0061 -
accuracy: 0.9987 - val_loss: 0.1093 - val_accuracy: 0.9528
Epoch 148/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0061 -
accuracy: 0.9988 - val_loss: 0.1419 - val_accuracy: 0.9402
Epoch 149/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0061 -
accuracy: 0.9987 - val_loss: 0.1201 - val_accuracy: 0.9482
Epoch 150/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0060 -
accuracy: 0.9987 - val_loss: 0.1167 - val_accuracy: 0.9499
Epoch 151/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0060 -
accuracy: 0.9987 - val_loss: 0.1018 - val_accuracy: 0.9563
Epoch 152/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0059 -
accuracy: 0.9987 - val_loss: 0.1236 - val_accuracy: 0.9471
Epoch 153/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0058 -
accuracy: 0.9987 - val_loss: 0.1167 - val_accuracy: 0.9500
Epoch 154/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0059 -
accuracy: 0.9989 - val_loss: 0.1451 - val_accuracy: 0.9392
Epoch 155/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0057 -
accuracy: 0.9988 - val_loss: 0.1594 - val_accuracy: 0.9359
Epoch 156/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0056 -
accuracy: 0.9988 - val_loss: 0.1282 - val_accuracy: 0.9454
Epoch 157/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0056 -
accuracy: 0.9988 - val_loss: 0.1374 - val_accuracy: 0.9420
Epoch 158/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0056 -
accuracy: 0.9988 - val_loss: 0.1419 - val_accuracy: 0.9408
Epoch 159/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0055 -
accuracy: 0.9988 - val_loss: 0.1502 - val_accuracy: 0.9380
Epoch 160/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0055 -
accuracy: 0.9988 - val_loss: 0.1185 - val_accuracy: 0.9492
Epoch 161/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0054 -
accuracy: 0.9989 - val_loss: 0.1004 - val_accuracy: 0.9577
Epoch 162/500
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415/415 [==============================] - 2s 4ms/step - loss: 0.0054 -
accuracy: 0.9988 - val_loss: 0.1117 - val_accuracy: 0.9521
Epoch 163/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0053 -
accuracy: 0.9988 - val_loss: 0.1039 - val_accuracy: 0.9559
Epoch 164/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0053 -
accuracy: 0.9989 - val_loss: 0.1013 - val_accuracy: 0.9572
Epoch 165/500
413/415 [============================>.] - ETA: 0s - loss: 0.0052 - accuracy:
0.9989
Reached 95.0% accuracy, so stopping training after 165 epochs!
415/415 [==============================] - 2s 4ms/step - loss: 0.0052 -
accuracy: 0.9989 - val_loss: 0.1056 - val_accuracy: 0.9553
466/466 [==============================] - 1s 2ms/step - loss: 0.0774 -
accuracy: 0.9662
```

[ ]:
```
metrics_vs_lr
```

[ ]:
```
[{'batch_size': 128,
  'learning_rate': 0.1,
  'epochs': 500,
  'test_accuracy': 0.8284353017807007,
  'train_time': 810.7042713165283},
 {'batch_size': 128,
  'learning_rate': 0.01,
  'epochs': 56,
  'test_accuracy': 0.9619565010070801,
  'train_time': 97.63764548301697},
 {'batch_size': 128,
  'learning_rate': 0.001,
  'epochs': 32,
  'test_accuracy': 0.9842995405197144,
  'train_time': 56.27615761756897},
 {'batch_size': 128,
  'learning_rate': 0.0001,
  'epochs': 165,
  'test_accuracy': 0.966183602809906,
  'train_time': 287.21042466163635}]
```

Next, you will visualize the results.

GPU runtime instructions: Create a figure with four subplots. In each subplot, create a bar plot with learning rate on the horizontal axis and (1) Time to accuracy, (2) Energy to accuracy, (3) Test accuracy, (4) Epochs, on the vertical axis on each subplot, respectively. Use an appropriate vertical range for each subplot. Label all axes.

CPU runtime instructions: Create a figure with three subplots. In each subplot, create a bar plot with learning rate on the horizontal axis and (1) Time to accuracy, (2) Test accuracy, (3)

Epochs, on the vertical axis on each subplot, respectively. Use an appropriate vertical range for each subplot. Label all axes.

[ ]:
```
# TODO - visualize effect of varying learning rate, when training to a target␣
 ↪accuracy
# Extracting the data for plotting
learning_rates = [m['learning_rate'] for m in metrics_vs_lr]
time_to_accuracy = [m['train_time'] for m in metrics_vs_lr]
test_accuracies = [m['test_accuracy'] for m in metrics_vs_lr]
epochs = [m['epochs'] for m in metrics_vs_lr]
fig, axes = plt.subplots(3, 1, figsize=(10, 15))

# Converting learning rates to strings for better display on the x-axis
learning_rate_labels = [str(lr) for lr in learning_rates]

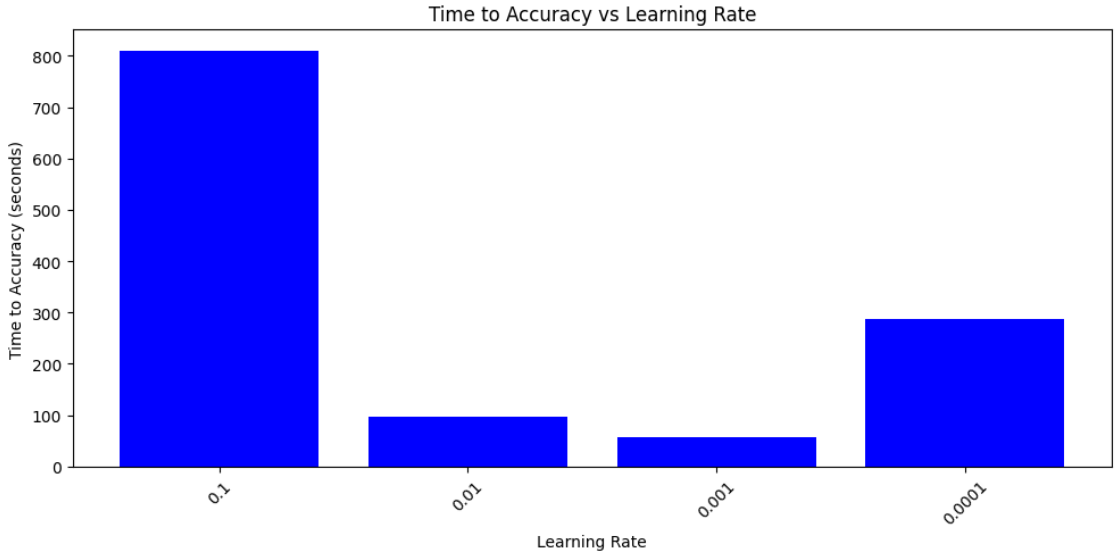
# Subplot 1: Time to Accuracy
axes[0].bar(learning_rate_labels, time_to_accuracy, color='blue')
axes[0].set_title('Time to Accuracy vs Learning Rate')
axes[0].set_xlabel('Learning Rate')
axes[0].set_ylabel('Time to Accuracy (seconds)')

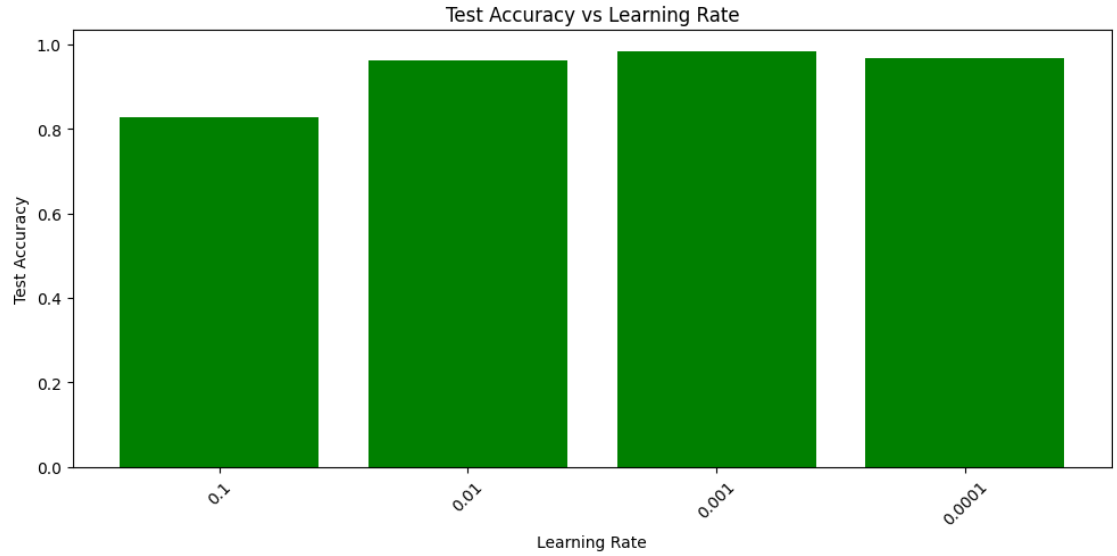
# Subplot 2: Test Accuracy
axes[1].bar(learning_rate_labels, test_accuracies, color='green')
axes[1].set_title('Test Accuracy vs Learning Rate')
axes[1].set_xlabel('Learning Rate')
axes[1].set_ylabel('Test Accuracy')

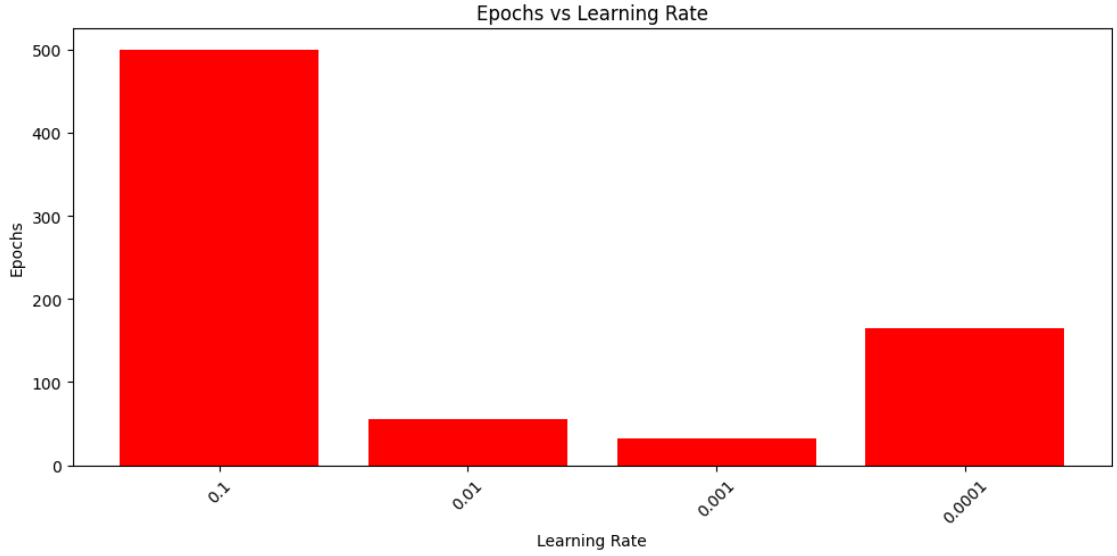
# Subplot 3: Epochs
axes[2].bar(learning_rate_labels, epochs, color='red')
axes[2].set_title('Epochs vs Learning Rate')
axes[2].set_xlabel('Learning Rate')
axes[2].set_ylabel('Epochs')

# Adjusting x-axis and y-axis for better readability
for ax in axes:
    ax.tick_params(axis='x', labelrotation=45)  # Rotate x-axis labels for␣
 ↪clarity

plt.tight_layout()
plt.show()
```


Time to Accuracy vs Learning Rate
Time to Accuracy (seconds)
0
100
200
300
400
500
600
700
800
0.1
0.01
0.001
0.0001
Learning Rate


Test Accuracy vs Learning Rate
Test Accuracy
0.0
0.2
0.4
0.6
0.8
1.0
0.1
0.01
0.001
0.0001
Learning Rate


Epochs vs Learning Rate
Epochs
0
100
200
300
400
500
0.1
0.01
0.001
0.0001
Learning Rate

Comment on the results: Given that the model is trained to a target validation accuracy, what is the effect of the learning rate on the training process?

Note: because of the stochastic nature of neural network training AND in the compute resource, these measurements can be very "noisy". Look for overall trends, but don't be concerned with small differences from one experiment to the next, or with occasional "outlier" results. Also note that if the number of epochs is 500, this is an indication that the target validation accuracy was *not* reached in 500 epochs!

Training Time:

A higher learning rate can lead to faster convergence, meaning the model may reach the target validation accuracy in fewer epochs. However, if the learning rate is too high, it might cause the model to overshoot the minimum of the loss function or even diverge, leading to increased training time or failure to converge.

A lower learning rate ensures more gradual and potentially more stable convergence. However, it may require more epochs to reach the target accuracy, resulting in longer training times. Too low a learning rate can lead to excessively slow convergence, also increasing training time.

Energy Consumption (GPU Runtime):

When using GPUs, the energy consumption is also an important consideration. A higher learning rate might reduce the number of epochs needed to train, potentially lowering total energy consumption. However, this is contingent on the model converging properly.

A lower learning rate, while potentially more stable, could increase the number of epochs needed and thus the overall energy consumption.

Finding the Balance:

The key is to find a balanced learning rate that allows for efficient convergence without overshooting or getting stuck in local minima.

Adaptive learning rate methods (like Adam, RMSprop, etc.) can dynamically adjust the learning rate during training, potentially offering a more efficient path to convergence.

Now, you will repeat, with a loop over different batch sizes -

[ ]:
```
# TODO - iterate over batch size and get TTA/ETA

# default learning rate and batch size -
lr = 0.001

metrics_vs_bs = []
for batch_size in [64, 128, 256, 512, 1024, 2048]:

    # Clearing the Keras session to free up memory
    K.clear_session()
```

```
    # Construct the model
    model = Sequential()
    model.add(Dense(nh, input_shape=(n_feat,), activation='sigmoid'))
    model.add(Dense(n_class, activation='softmax'))  # Assuming ytr.shape[1] is␣
↪the number of classes

    # Compile the model with the current learning rate
    model.compile(optimizer=Adam(learning_rate=lr),␣
↪loss='sparse_categorical_crossentropy', metrics=['accuracy'])

    # Start measurement

    start_time = time.time()

    # Fit the model
    history=model.fit(Xtr_scale, ytr, epochs=500, batch_size=batch_size,␣
↪validation_split=0.2, callbacks=[TrainToAccuracy(threshold=0.95,␣
↪patience=3)])

    # End measurement

    total_time = time.time() - start_time

    # Evaluate the model on test data
    test_loss, test_accuracy = model.evaluate(Xts_scale, yts)

    # Save metrics
    model_metrics = {
        'batch_size': batch_size,
        'epochs': len(history.history['accuracy']),
        'test_accuracy': test_accuracy,
        'train_time': total_time
    }

    metrics_vs_bs.append(model_metrics)
```

```
Epoch 1/500
829/829 [==============================] - 3s 3ms/step - loss: 0.3238 -
accuracy: 0.9148 - val_loss: 0.6761 - val_accuracy: 0.7482
Epoch 2/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0890 -
accuracy: 0.9788 - val_loss: 0.5353 - val_accuracy: 0.7962
Epoch 3/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0538 -
accuracy: 0.9865 - val_loss: 0.4687 - val_accuracy: 0.8245
Epoch 4/500
829/829 [==============================] - 4s 4ms/step - loss: 0.0385 -
```

```
accuracy: 0.9901 - val_loss: 0.5493 - val_accuracy: 0.8112
Epoch 5/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0296 -
accuracy: 0.9922 - val_loss: 0.2845 - val_accuracy: 0.8881
Epoch 6/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0236 -
accuracy: 0.9940 - val_loss: 0.4613 - val_accuracy: 0.8429
Epoch 7/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0189 -
accuracy: 0.9952 - val_loss: 0.3507 - val_accuracy: 0.8754
Epoch 8/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0160 -
accuracy: 0.9957 - val_loss: 0.2894 - val_accuracy: 0.8968
Epoch 9/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0142 -
accuracy: 0.9963 - val_loss: 0.1748 - val_accuracy: 0.9306
Epoch 10/500
829/829 [==============================] - 4s 4ms/step - loss: 0.0122 -
accuracy: 0.9969 - val_loss: 0.2082 - val_accuracy: 0.9216
Epoch 11/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0107 -
accuracy: 0.9972 - val_loss: 0.1638 - val_accuracy: 0.9355
Epoch 12/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0100 -
accuracy: 0.9973 - val_loss: 0.3381 - val_accuracy: 0.8918
Epoch 13/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0088 -
accuracy: 0.9976 - val_loss: 0.2928 - val_accuracy: 0.9059
Epoch 14/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0080 -
accuracy: 0.9978 - val_loss: 0.3088 - val_accuracy: 0.9000
Epoch 15/500
829/829 [==============================] - 4s 4ms/step - loss: 0.0075 -
accuracy: 0.9979 - val_loss: 0.2624 - val_accuracy: 0.9130
Epoch 16/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0069 -
accuracy: 0.9981 - val_loss: 0.1654 - val_accuracy: 0.9377
Epoch 17/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0061 -
accuracy: 0.9984 - val_loss: 0.2062 - val_accuracy: 0.9264
Epoch 18/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0057 -
accuracy: 0.9985 - val_loss: 0.1941 - val_accuracy: 0.9289
Epoch 19/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0052 -
accuracy: 0.9986 - val_loss: 0.2150 - val_accuracy: 0.9208
Epoch 20/500
829/829 [==============================] - 4s 4ms/step - loss: 0.0050 -
```

```
accuracy: 0.9985 - val_loss: 0.2289 - val_accuracy: 0.9189
Epoch 21/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0048 -
accuracy: 0.9986 - val_loss: 0.2188 - val_accuracy: 0.9217
Epoch 22/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0043 -
accuracy: 0.9989 - val_loss: 0.1976 - val_accuracy: 0.9293
Epoch 23/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0040 -
accuracy: 0.9988 - val_loss: 0.1904 - val_accuracy: 0.9329
Epoch 24/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0037 -
accuracy: 0.9990 - val_loss: 0.4206 - val_accuracy: 0.8832
Epoch 25/500
829/829 [==============================] - 4s 4ms/step - loss: 0.0035 -
accuracy: 0.9991 - val_loss: 0.2751 - val_accuracy: 0.9127
Epoch 26/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0034 -
accuracy: 0.9991 - val_loss: 0.2268 - val_accuracy: 0.9251
Epoch 27/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0033 -
accuracy: 0.9991 - val_loss: 0.2144 - val_accuracy: 0.9349
Epoch 28/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0028 -
accuracy: 0.9992 - val_loss: 0.5406 - val_accuracy: 0.8629
Epoch 29/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0032 -
accuracy: 0.9991 - val_loss: 0.1678 - val_accuracy: 0.9442
Epoch 30/500
829/829 [==============================] - 5s 6ms/step - loss: 0.0026 -
accuracy: 0.9993 - val_loss: 0.2387 - val_accuracy: 0.9206
Epoch 31/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0024 -
accuracy: 0.9993 - val_loss: 0.1985 - val_accuracy: 0.9409
Epoch 32/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0031 -
accuracy: 0.9991 - val_loss: 0.2370 - val_accuracy: 0.9245
Epoch 33/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0023 -
accuracy: 0.9993 - val_loss: 0.2938 - val_accuracy: 0.9125
Epoch 34/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0027 -
accuracy: 0.9992 - val_loss: 0.2725 - val_accuracy: 0.9220
Epoch 35/500
829/829 [==============================] - 4s 5ms/step - loss: 0.0020 -
accuracy: 0.9995 - val_loss: 0.3253 - val_accuracy: 0.9099
Epoch 36/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0025 -
```

```
accuracy: 0.9992 - val_loss: 0.3037 - val_accuracy: 0.9111
Epoch 37/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0021 -
accuracy: 0.9994 - val_loss: 0.3451 - val_accuracy: 0.9027
Epoch 38/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0019 -
accuracy: 0.9994 - val_loss: 0.3230 - val_accuracy: 0.9105
Epoch 39/500
829/829 [==============================] - 4s 5ms/step - loss: 0.0020 -
accuracy: 0.9995 - val_loss: 0.2941 - val_accuracy: 0.9184
Epoch 40/500
829/829 [==============================] - 4s 5ms/step - loss: 0.0017 -
accuracy: 0.9995 - val_loss: 0.3051 - val_accuracy: 0.9198
Epoch 41/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0018 -
accuracy: 0.9994 - val_loss: 0.2610 - val_accuracy: 0.9288
Epoch 42/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0015 -
accuracy: 0.9995 - val_loss: 0.3185 - val_accuracy: 0.9157
Epoch 43/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0015 -
accuracy: 0.9996 - val_loss: 0.2797 - val_accuracy: 0.9234
Epoch 44/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0015 -
accuracy: 0.9996 - val_loss: 0.2812 - val_accuracy: 0.9306
Epoch 45/500
829/829 [==============================] - 4s 5ms/step - loss: 0.0019 -
accuracy: 0.9996 - val_loss: 0.2854 - val_accuracy: 0.9313
Epoch 46/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0019 -
accuracy: 0.9996 - val_loss: 0.3327 - val_accuracy: 0.9173
Epoch 47/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0011 -
accuracy: 0.9997 - val_loss: 0.3664 - val_accuracy: 0.9071
Epoch 48/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0011 -
accuracy: 0.9997 - val_loss: 0.3106 - val_accuracy: 0.9219
Epoch 49/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0016 -
accuracy: 0.9995 - val_loss: 0.4088 - val_accuracy: 0.9120
Epoch 50/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0012 -
accuracy: 0.9997 - val_loss: 0.3833 - val_accuracy: 0.9154
Epoch 51/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0011 -
accuracy: 0.9997 - val_loss: 0.3508 - val_accuracy: 0.9226
Epoch 52/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0013 -
```

```
accuracy: 0.9997 - val_loss: 0.3348 - val_accuracy: 0.9235
Epoch 53/500
829/829 [==============================] - 3s 3ms/step - loss: 9.6407e-04 -
accuracy: 0.9997 - val_loss: 0.4158 - val_accuracy: 0.9119
Epoch 54/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0010 -
accuracy: 0.9998 - val_loss: 0.5197 - val_accuracy: 0.8911
Epoch 55/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0014 -
accuracy: 0.9996 - val_loss: 0.4398 - val_accuracy: 0.9107
Epoch 56/500
829/829 [==============================] - 4s 4ms/step - loss: 9.1613e-04 -
accuracy: 0.9997 - val_loss: 0.3863 - val_accuracy: 0.9213
Epoch 57/500
829/829 [==============================] - 3s 3ms/step - loss: 9.1344e-04 -
accuracy: 0.9997 - val_loss: 0.3260 - val_accuracy: 0.9259
Epoch 58/500
829/829 [==============================] - 3s 4ms/step - loss: 8.7816e-04 -
accuracy: 0.9998 - val_loss: 0.6682 - val_accuracy: 0.8652
Epoch 59/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0012 -
accuracy: 0.9997 - val_loss: 0.3991 - val_accuracy: 0.9242
Epoch 60/500
829/829 [==============================] - 3s 4ms/step - loss: 0.0010 -
accuracy: 0.9997 - val_loss: 0.4961 - val_accuracy: 0.9053
Epoch 61/500
829/829 [==============================] - 3s 4ms/step - loss: 9.9745e-04 -
accuracy: 0.9998 - val_loss: 0.3931 - val_accuracy: 0.9298
Epoch 62/500
829/829 [==============================] - 3s 4ms/step - loss: 7.2996e-04 -
accuracy: 0.9998 - val_loss: 0.8174 - val_accuracy: 0.8508
Epoch 63/500
829/829 [==============================] - 2s 3ms/step - loss: 6.8636e-04 -
accuracy: 0.9998 - val_loss: 0.4220 - val_accuracy: 0.9193
Epoch 64/500
829/829 [==============================] - 2s 3ms/step - loss: 9.6854e-04 -
accuracy: 0.9997 - val_loss: 0.3645 - val_accuracy: 0.9248
Epoch 65/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0013 -
accuracy: 0.9996 - val_loss: 0.5638 - val_accuracy: 0.8875
Epoch 66/500
829/829 [==============================] - 4s 4ms/step - loss: 5.3608e-04 -
accuracy: 0.9998 - val_loss: 0.3871 - val_accuracy: 0.9307
Epoch 67/500
829/829 [==============================] - 3s 4ms/step - loss: 7.6397e-04 -
accuracy: 0.9998 - val_loss: 0.4503 - val_accuracy: 0.9187
Epoch 68/500
829/829 [==============================] - 3s 3ms/step - loss: 8.2837e-04 -
```

```
accuracy: 0.9997 - val_loss: 0.7815 - val_accuracy: 0.8580
Epoch 69/500
829/829 [==============================] - 3s 3ms/step - loss: 8.1346e-04 -
accuracy: 0.9998 - val_loss: 0.4885 - val_accuracy: 0.9222
Epoch 70/500
829/829 [==============================] - 2s 3ms/step - loss: 3.7271e-04 -
accuracy: 0.9999 - val_loss: 0.5225 - val_accuracy: 0.9168
Epoch 71/500
829/829 [==============================] - 3s 4ms/step - loss: 8.7641e-04 -
accuracy: 0.9998 - val_loss: 0.5994 - val_accuracy: 0.8969
Epoch 72/500
829/829 [==============================] - 4s 4ms/step - loss: 6.4300e-04 -
accuracy: 0.9998 - val_loss: 0.5764 - val_accuracy: 0.9050
Epoch 73/500
829/829 [==============================] - 2s 3ms/step - loss: 6.5820e-04 -
accuracy: 0.9999 - val_loss: 0.4789 - val_accuracy: 0.9237
Epoch 74/500
829/829 [==============================] - 3s 3ms/step - loss: 4.8292e-04 -
accuracy: 0.9998 - val_loss: 0.7306 - val_accuracy: 0.8815
Epoch 75/500
829/829 [==============================] - 2s 3ms/step - loss: 6.6961e-04 -
accuracy: 0.9998 - val_loss: 0.5584 - val_accuracy: 0.9163
Epoch 76/500
829/829 [==============================] - 3s 3ms/step - loss: 6.0984e-04 -
accuracy: 0.9999 - val_loss: 0.5604 - val_accuracy: 0.9109
Epoch 77/500
829/829 [==============================] - 4s 4ms/step - loss: 6.1798e-04 -
accuracy: 0.9998 - val_loss: 0.5535 - val_accuracy: 0.9044
Epoch 78/500
829/829 [==============================] - 3s 3ms/step - loss: 8.2269e-04 -
accuracy: 0.9998 - val_loss: 0.6679 - val_accuracy: 0.8889
Epoch 79/500
829/829 [==============================] - 2s 3ms/step - loss: 4.2310e-04 -
accuracy: 0.9999 - val_loss: 0.6272 - val_accuracy: 0.9040
Epoch 80/500
829/829 [==============================] - 3s 3ms/step - loss: 7.6017e-04 -
accuracy: 0.9998 - val_loss: 0.5174 - val_accuracy: 0.9253
Epoch 81/500
829/829 [==============================] - 3s 4ms/step - loss: 5.1708e-04 -
accuracy: 0.9999 - val_loss: 0.6027 - val_accuracy: 0.9155
Epoch 82/500
829/829 [==============================] - 4s 4ms/step - loss: 6.5557e-04 -
accuracy: 0.9998 - val_loss: 0.6594 - val_accuracy: 0.8997
Epoch 83/500
829/829 [==============================] - 3s 3ms/step - loss: 4.8634e-04 -
accuracy: 0.9998 - val_loss: 0.4650 - val_accuracy: 0.9266
Epoch 84/500
829/829 [==============================] - 3s 3ms/step - loss: 9.4282e-04 -
```

```
accuracy: 0.9998 - val_loss: 0.4879 - val_accuracy: 0.9127
Epoch 85/500
829/829 [==============================] - 3s 3ms/step - loss: 4.3391e-04 -
accuracy: 0.9999 - val_loss: 0.4033 - val_accuracy: 0.9337
Epoch 86/500
829/829 [==============================] - 3s 3ms/step - loss: 6.0685e-04 -
accuracy: 0.9999 - val_loss: 0.4347 - val_accuracy: 0.9297
Epoch 87/500
829/829 [==============================] - 4s 4ms/step - loss: 4.3185e-04 -
accuracy: 0.9999 - val_loss: 0.6305 - val_accuracy: 0.8922
Epoch 88/500
829/829 [==============================] - 3s 4ms/step - loss: 6.5537e-04 -
accuracy: 0.9998 - val_loss: 0.4331 - val_accuracy: 0.9280
Epoch 89/500
829/829 [==============================] - 3s 3ms/step - loss: 3.3579e-04 -
accuracy: 0.9999 - val_loss: 0.3950 - val_accuracy: 0.9379
Epoch 90/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0015 -
accuracy: 0.9997 - val_loss: 0.5224 - val_accuracy: 0.9229
Epoch 91/500
829/829 [==============================] - 3s 3ms/step - loss: 5.1339e-04 -
accuracy: 0.9998 - val_loss: 0.5011 - val_accuracy: 0.9235
Epoch 92/500
829/829 [==============================] - 3s 4ms/step - loss: 3.8819e-04 -
accuracy: 0.9998 - val_loss: 0.7463 - val_accuracy: 0.8885
Epoch 93/500
829/829 [==============================] - 4s 4ms/step - loss: 5.4247e-04 -
accuracy: 0.9999 - val_loss: 0.4840 - val_accuracy: 0.9285
Epoch 94/500
829/829 [==============================] - 2s 3ms/step - loss: 4.0713e-04 -
accuracy: 0.9999 - val_loss: 0.5214 - val_accuracy: 0.9288
Epoch 95/500
829/829 [==============================] - 3s 3ms/step - loss: 5.4033e-04 -
accuracy: 0.9999 - val_loss: 0.7857 - val_accuracy: 0.8723
Epoch 96/500
829/829 [==============================] - 3s 3ms/step - loss: 6.8115e-04 -
accuracy: 0.9998 - val_loss: 0.5217 - val_accuracy: 0.9257
Epoch 97/500
829/829 [==============================] - 3s 4ms/step - loss: 4.0862e-04 -
accuracy: 0.9999 - val_loss: 0.5129 - val_accuracy: 0.9244
Epoch 98/500
829/829 [==============================] - 4s 4ms/step - loss: 1.7768e-04 -
accuracy: 0.9999 - val_loss: 0.5741 - val_accuracy: 0.9146
Epoch 99/500
829/829 [==============================] - 3s 3ms/step - loss: 3.2950e-04 -
accuracy: 0.9998 - val_loss: 0.6020 - val_accuracy: 0.9175
Epoch 100/500
829/829 [==============================] - 3s 3ms/step - loss: 7.3878e-04 -
```

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accuracy: 0.9998 - val_loss: 0.5881 - val_accuracy: 0.9114
Epoch 101/500
829/829 [==============================] - 2s 3ms/step - loss: 4.4263e-04 -
accuracy: 0.9999 - val_loss: 0.6191 - val_accuracy: 0.9128
Epoch 102/500
829/829 [==============================] - 3s 4ms/step - loss: 6.6702e-04 -
accuracy: 0.9998 - val_loss: 0.5678 - val_accuracy: 0.9234
Epoch 103/500
829/829 [==============================] - 4s 4ms/step - loss: 8.0061e-04 -
accuracy: 0.9998 - val_loss: 0.4919 - val_accuracy: 0.9275
Epoch 104/500
829/829 [==============================] - 3s 4ms/step - loss: 3.3628e-04 -
accuracy: 0.9999 - val_loss: 0.4588 - val_accuracy: 0.9255
Epoch 105/500
829/829 [==============================] - 3s 3ms/step - loss: 5.2066e-04 -
accuracy: 0.9998 - val_loss: 0.6122 - val_accuracy: 0.9139
Epoch 106/500
829/829 [==============================] - 3s 3ms/step - loss: 2.4530e-04 -
accuracy: 0.9999 - val_loss: 0.5559 - val_accuracy: 0.9222
Epoch 107/500
829/829 [==============================] - 3s 3ms/step - loss: 5.0385e-04 -
accuracy: 0.9998 - val_loss: 0.5227 - val_accuracy: 0.9228
Epoch 108/500
829/829 [==============================] - 4s 4ms/step - loss: 3.4724e-04 -
accuracy: 0.9999 - val_loss: 0.5265 - val_accuracy: 0.9284
Epoch 109/500
829/829 [==============================] - 3s 4ms/step - loss: 4.1308e-04 -
accuracy: 0.9999 - val_loss: 0.4718 - val_accuracy: 0.9344
Epoch 110/500
829/829 [==============================] - 3s 3ms/step - loss: 2.3252e-04 -
accuracy: 0.9999 - val_loss: 0.6015 - val_accuracy: 0.9094
Epoch 111/500
829/829 [==============================] - 3s 3ms/step - loss: 4.6685e-04 -
accuracy: 0.9999 - val_loss: 0.4224 - val_accuracy: 0.9386
Epoch 112/500
829/829 [==============================] - 3s 3ms/step - loss: 2.0721e-04 -
accuracy: 1.0000 - val_loss: 0.4703 - val_accuracy: 0.9286
Epoch 113/500
829/829 [==============================] - 4s 4ms/step - loss: 0.0011 -
accuracy: 0.9998 - val_loss: 0.4370 - val_accuracy: 0.9374
Epoch 114/500
829/829 [==============================] - 3s 4ms/step - loss: 3.6803e-04 -
accuracy: 0.9999 - val_loss: 0.4403 - val_accuracy: 0.9402
Epoch 115/500
829/829 [==============================] - 3s 3ms/step - loss: 1.3928e-04 -
accuracy: 1.0000 - val_loss: 0.5839 - val_accuracy: 0.9071
Epoch 116/500
829/829 [==============================] - 3s 3ms/step - loss: 7.1655e-04 -
```

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accuracy: 0.9998 - val_loss: 0.4247 - val_accuracy: 0.9366
Epoch 117/500
829/829 [==============================] - 2s 3ms/step - loss: 1.3246e-04 -
accuracy: 1.0000 - val_loss: 0.4433 - val_accuracy: 0.9334
Epoch 118/500
829/829 [==============================] - 4s 4ms/step - loss: 2.9565e-04 -
accuracy: 1.0000 - val_loss: 0.4725 - val_accuracy: 0.9294
Epoch 119/500
829/829 [==============================] - 3s 4ms/step - loss: 1.8659e-04 -
accuracy: 0.9999 - val_loss: 0.4251 - val_accuracy: 0.9285
Epoch 120/500
829/829 [==============================] - 2s 3ms/step - loss: 8.7120e-05 -
accuracy: 1.0000 - val_loss: 0.4992 - val_accuracy: 0.9256
Epoch 121/500
829/829 [==============================] - 2s 3ms/step - loss: 0.0011 -
accuracy: 0.9997 - val_loss: 0.4880 - val_accuracy: 0.9243
Epoch 122/500
829/829 [==============================] - 3s 3ms/step - loss: 3.4492e-04 -
accuracy: 0.9999 - val_loss: 0.4932 - val_accuracy: 0.9179
Epoch 123/500
829/829 [==============================] - 3s 4ms/step - loss: 1.3504e-04 -
accuracy: 1.0000 - val_loss: 0.4234 - val_accuracy: 0.9304
Epoch 124/500
829/829 [==============================] - 4s 4ms/step - loss: 1.5932e-04 -
accuracy: 1.0000 - val_loss: 0.4952 - val_accuracy: 0.9195
Epoch 125/500
829/829 [==============================] - 3s 3ms/step - loss: 6.0789e-04 -
accuracy: 0.9999 - val_loss: 0.3539 - val_accuracy: 0.9385
Epoch 126/500
829/829 [==============================] - 2s 3ms/step - loss: 7.3482e-05 -
accuracy: 1.0000 - val_loss: 0.4182 - val_accuracy: 0.9338
Epoch 127/500
829/829 [==============================] - 2s 3ms/step - loss: 4.6839e-04 -
accuracy: 0.9998 - val_loss: 0.5436 - val_accuracy: 0.9162
Epoch 128/500
829/829 [==============================] - 3s 3ms/step - loss: 3.3761e-04 -
accuracy: 0.9999 - val_loss: 0.4397 - val_accuracy: 0.9371
Epoch 129/500
829/829 [==============================] - 4s 5ms/step - loss: 4.2440e-04 -
accuracy: 0.9999 - val_loss: 0.4813 - val_accuracy: 0.9272
Epoch 130/500
829/829 [==============================] - 3s 4ms/step - loss: 2.9194e-04 -
accuracy: 0.9999 - val_loss: 0.5051 - val_accuracy: 0.9256
Epoch 131/500
829/829 [==============================] - 2s 3ms/step - loss: 5.8629e-04 -
accuracy: 0.9998 - val_loss: 0.5831 - val_accuracy: 0.9132
Epoch 132/500
829/829 [==============================] - 2s 3ms/step - loss: 9.8401e-05 -
```

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accuracy: 1.0000 - val_loss: 0.5404 - val_accuracy: 0.9183
Epoch 133/500
829/829 [==============================] - 2s 3ms/step - loss: 2.1068e-04 -
accuracy: 0.9999 - val_loss: 0.4174 - val_accuracy: 0.9429
Epoch 134/500
829/829 [==============================] - 3s 4ms/step - loss: 3.6103e-04 -
accuracy: 0.9999 - val_loss: 0.5207 - val_accuracy: 0.9235
Epoch 135/500
829/829 [==============================] - 4s 4ms/step - loss: 2.2558e-04 -
accuracy: 0.9999 - val_loss: 0.5116 - val_accuracy: 0.9275
Epoch 136/500
829/829 [==============================] - 3s 3ms/step - loss: 1.5228e-04 -
accuracy: 1.0000 - val_loss: 0.5348 - val_accuracy: 0.9225
Epoch 137/500
829/829 [==============================] - 3s 3ms/step - loss: 1.2113e-04 -
accuracy: 1.0000 - val_loss: 0.6163 - val_accuracy: 0.9122
Epoch 138/500
829/829 [==============================] - 3s 3ms/step - loss: 2.7594e-04 -
accuracy: 1.0000 - val_loss: 0.6118 - val_accuracy: 0.9146
Epoch 139/500
829/829 [==============================] - 3s 4ms/step - loss: 9.1589e-04 -
accuracy: 0.9997 - val_loss: 0.7166 - val_accuracy: 0.9063
Epoch 140/500
829/829 [==============================] - 4s 4ms/step - loss: 4.6609e-04 -
accuracy: 0.9999 - val_loss: 0.7663 - val_accuracy: 0.9016
Epoch 141/500
829/829 [==============================] - 3s 3ms/step - loss: 8.8571e-05 -
accuracy: 1.0000 - val_loss: 0.6436 - val_accuracy: 0.9242
Epoch 142/500
829/829 [==============================] - 3s 3ms/step - loss: 2.2407e-04 -
accuracy: 0.9999 - val_loss: 0.6588 - val_accuracy: 0.9166
Epoch 143/500
829/829 [==============================] - 3s 3ms/step - loss: 3.5881e-04 -
accuracy: 0.9999 - val_loss: 0.5849 - val_accuracy: 0.9264
Epoch 144/500
829/829 [==============================] - 3s 4ms/step - loss: 5.4991e-04 -
accuracy: 0.9999 - val_loss: 0.6328 - val_accuracy: 0.9144
Epoch 145/500
829/829 [==============================] - 4s 4ms/step - loss: 4.6677e-05 -
accuracy: 1.0000 - val_loss: 0.5742 - val_accuracy: 0.9230
Epoch 146/500
829/829 [==============================] - 2s 3ms/step - loss: 1.0217e-04 -
accuracy: 1.0000 - val_loss: 0.6571 - val_accuracy: 0.9115
Epoch 147/500
829/829 [==============================] - 2s 3ms/step - loss: 2.7376e-04 -
accuracy: 0.9999 - val_loss: 0.6309 - val_accuracy: 0.9131
Epoch 148/500
829/829 [==============================] - 2s 3ms/step - loss: 3.3126e-04 -
```

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accuracy: 0.9999 - val_loss: 0.6316 - val_accuracy: 0.9064
Epoch 149/500
829/829 [==============================] - 3s 3ms/step - loss: 4.7786e-04 -
accuracy: 0.9998 - val_loss: 0.6280 - val_accuracy: 0.9208
Epoch 150/500
829/829 [==============================] - 4s 4ms/step - loss: 3.2077e-04 -
accuracy: 0.9999 - val_loss: 0.6632 - val_accuracy: 0.9147
Epoch 151/500
829/829 [==============================] - 3s 4ms/step - loss: 6.7115e-05 -
accuracy: 1.0000 - val_loss: 0.7144 - val_accuracy: 0.9065
Epoch 152/500
829/829 [==============================] - 3s 3ms/step - loss: 8.1849e-05 -
accuracy: 1.0000 - val_loss: 0.6796 - val_accuracy: 0.9104
Epoch 153/500
829/829 [==============================] - 3s 3ms/step - loss: 3.2672e-04 -
accuracy: 0.9999 - val_loss: 0.6457 - val_accuracy: 0.9075
Epoch 154/500
829/829 [==============================] - 3s 3ms/step - loss: 2.2855e-04 -
accuracy: 0.9999 - val_loss: 0.7060 - val_accuracy: 0.9017
Epoch 155/500
829/829 [==============================] - 4s 5ms/step - loss: 4.7084e-04 -
accuracy: 0.9999 - val_loss: 0.6776 - val_accuracy: 0.9038
Epoch 156/500
829/829 [==============================] - 3s 4ms/step - loss: 7.6521e-04 -
accuracy: 0.9998 - val_loss: 0.4384 - val_accuracy: 0.9385
Epoch 157/500
829/829 [==============================] - 3s 3ms/step - loss: 5.7962e-05 -
accuracy: 1.0000 - val_loss: 0.5116 - val_accuracy: 0.9313
Epoch 158/500
829/829 [==============================] - 3s 3ms/step - loss: 1.8678e-04 -
accuracy: 0.9999 - val_loss: 0.5523 - val_accuracy: 0.9277
Epoch 159/500
829/829 [==============================] - 3s 3ms/step - loss: 3.2136e-05 -
accuracy: 1.0000 - val_loss: 0.6093 - val_accuracy: 0.9159
Epoch 160/500
829/829 [==============================] - 4s 4ms/step - loss: 3.7707e-04 -
accuracy: 0.9999 - val_loss: 0.6035 - val_accuracy: 0.9134
Epoch 161/500
829/829 [==============================] - 4s 4ms/step - loss: 6.4661e-05 -
accuracy: 1.0000 - val_loss: 0.5793 - val_accuracy: 0.9238
Epoch 162/500
829/829 [==============================] - 3s 3ms/step - loss: 7.8020e-04 -
accuracy: 0.9999 - val_loss: 0.6723 - val_accuracy: 0.9130
Epoch 163/500
829/829 [==============================] - 3s 3ms/step - loss: 1.4628e-04 -
accuracy: 1.0000 - val_loss: 0.5524 - val_accuracy: 0.9342
Epoch 164/500
829/829 [==============================] - 2s 3ms/step - loss: 1.5713e-04 -
```

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accuracy: 1.0000 - val_loss: 0.6282 - val_accuracy: 0.9192
Epoch 165/500
829/829 [==============================] - 3s 4ms/step - loss: 4.3738e-05 -
accuracy: 1.0000 - val_loss: 0.6472 - val_accuracy: 0.9121
Epoch 166/500
829/829 [==============================] - 4s 4ms/step - loss: 3.8594e-05 -
accuracy: 1.0000 - val_loss: 0.5711 - val_accuracy: 0.9245
Epoch 167/500
829/829 [==============================] - 3s 4ms/step - loss: 9.6318e-04 -
accuracy: 0.9997 - val_loss: 0.7913 - val_accuracy: 0.8953
Epoch 168/500
829/829 [==============================] - 3s 3ms/step - loss: 5.6281e-04 -
accuracy: 0.9999 - val_loss: 0.5456 - val_accuracy: 0.9294
Epoch 169/500
829/829 [==============================] - 3s 3ms/step - loss: 2.0411e-04 -
accuracy: 0.9999 - val_loss: 0.5654 - val_accuracy: 0.9255
Epoch 170/500
829/829 [==============================] - 3s 3ms/step - loss: 8.7226e-05 -
accuracy: 1.0000 - val_loss: 0.5750 - val_accuracy: 0.9272
Epoch 171/500
829/829 [==============================] - 3s 4ms/step - loss: 2.6290e-05 -
accuracy: 1.0000 - val_loss: 0.6303 - val_accuracy: 0.9204
Epoch 172/500
829/829 [==============================] - 3s 4ms/step - loss: 1.7041e-04 -
accuracy: 0.9999 - val_loss: 0.6062 - val_accuracy: 0.9137
Epoch 173/500
829/829 [==============================] - 3s 3ms/step - loss: 3.2270e-04 -
accuracy: 0.9999 - val_loss: 0.5258 - val_accuracy: 0.9270
Epoch 174/500
829/829 [==============================] - 2s 3ms/step - loss: 1.3758e-04 -
accuracy: 1.0000 - val_loss: 0.8316 - val_accuracy: 0.8854
Epoch 175/500
829/829 [==============================] - 3s 3ms/step - loss: 4.3791e-04 -
accuracy: 0.9999 - val_loss: 0.5903 - val_accuracy: 0.9297
Epoch 176/500
829/829 [==============================] - 4s 5ms/step - loss: 3.9951e-05 -
accuracy: 1.0000 - val_loss: 0.5688 - val_accuracy: 0.9278
Epoch 177/500
829/829 [==============================] - 3s 4ms/step - loss: 2.2928e-04 -
accuracy: 0.9999 - val_loss: 0.4788 - val_accuracy: 0.9299
Epoch 178/500
829/829 [==============================] - 3s 3ms/step - loss: 5.5226e-05 -
accuracy: 1.0000 - val_loss: 0.5621 - val_accuracy: 0.9195
Epoch 179/500
829/829 [==============================] - 3s 3ms/step - loss: 7.4765e-04 -
accuracy: 0.9997 - val_loss: 0.6036 - val_accuracy: 0.9226
Epoch 180/500
829/829 [==============================] - 3s 3ms/step - loss: 3.1612e-04 -
```

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accuracy: 0.9999 - val_loss: 0.6449 - val_accuracy: 0.9242
Epoch 181/500
829/829 [==============================] - 3s 4ms/step - loss: 2.6613e-05 -
accuracy: 1.0000 - val_loss: 0.6969 - val_accuracy: 0.9142
Epoch 182/500
829/829 [==============================] - 4s 4ms/step - loss: 2.0141e-04 -
accuracy: 1.0000 - val_loss: 0.7652 - val_accuracy: 0.9057
Epoch 183/500
829/829 [==============================] - 3s 3ms/step - loss: 3.6432e-04 -
accuracy: 0.9999 - val_loss: 0.7627 - val_accuracy: 0.9070
Epoch 184/500
829/829 [==============================] - 3s 3ms/step - loss: 2.0377e-05 -
accuracy: 1.0000 - val_loss: 0.7613 - val_accuracy: 0.9066
Epoch 185/500
829/829 [==============================] - 3s 3ms/step - loss: 4.7928e-04 -
accuracy: 0.9999 - val_loss: 0.8797 - val_accuracy: 0.8832
Epoch 186/500
829/829 [==============================] - 3s 4ms/step - loss: 4.9178e-05 -
accuracy: 1.0000 - val_loss: 0.6532 - val_accuracy: 0.9165
Epoch 187/500
829/829 [==============================] - 4s 5ms/step - loss: 1.0847e-04 -
accuracy: 1.0000 - val_loss: 0.5595 - val_accuracy: 0.9186
Epoch 188/500
829/829 [==============================] - 3s 3ms/step - loss: 1.6535e-05 -
accuracy: 1.0000 - val_loss: 0.6217 - val_accuracy: 0.9085
Epoch 189/500
829/829 [==============================] - 3s 3ms/step - loss: 3.1974e-04 -
accuracy: 0.9999 - val_loss: 0.5590 - val_accuracy: 0.9152
Epoch 190/500
829/829 [==============================] - 3s 3ms/step - loss: 2.1096e-04 -
accuracy: 0.9999 - val_loss: 0.5117 - val_accuracy: 0.9178
Epoch 191/500
829/829 [==============================] - 3s 3ms/step - loss: 8.8178e-04 -
accuracy: 0.9997 - val_loss: 0.4181 - val_accuracy: 0.9320
Epoch 192/500
829/829 [==============================] - 4s 4ms/step - loss: 2.5165e-05 -
accuracy: 1.0000 - val_loss: 0.5074 - val_accuracy: 0.9196
Epoch 193/500
829/829 [==============================] - 3s 4ms/step - loss: 2.7413e-05 -
accuracy: 1.0000 - val_loss: 0.5457 - val_accuracy: 0.9140
Epoch 194/500
829/829 [==============================] - 3s 3ms/step - loss: 2.5203e-05 -
accuracy: 1.0000 - val_loss: 0.5132 - val_accuracy: 0.9180
Epoch 195/500
829/829 [==============================] - 3s 3ms/step - loss: 2.3794e-04 -
accuracy: 0.9999 - val_loss: 0.5103 - val_accuracy: 0.9180
Epoch 196/500
829/829 [==============================] - 3s 3ms/step - loss: 2.5711e-04 -
```

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accuracy: 0.9999 - val_loss: 0.5802 - val_accuracy: 0.9171
Epoch 197/500
829/829 [==============================] - 4s 4ms/step - loss: 1.3039e-05 -
accuracy: 1.0000 - val_loss: 0.5595 - val_accuracy: 0.9212
Epoch 198/500
829/829 [==============================] - 4s 4ms/step - loss: 1.1760e-04 -
accuracy: 0.9999 - val_loss: 0.4439 - val_accuracy: 0.9313
Epoch 199/500
829/829 [==============================] - 2s 3ms/step - loss: 5.4009e-04 -
accuracy: 0.9998 - val_loss: 0.4813 - val_accuracy: 0.9258
Epoch 200/500
829/829 [==============================] - 3s 3ms/step - loss: 4.5624e-05 -
accuracy: 1.0000 - val_loss: 1.5275 - val_accuracy: 0.8303
Epoch 201/500
829/829 [==============================] - 3s 3ms/step - loss: 3.9412e-04 -
accuracy: 1.0000 - val_loss: 0.5426 - val_accuracy: 0.9242
Epoch 202/500
829/829 [==============================] - 3s 4ms/step - loss: 1.6443e-05 -
accuracy: 1.0000 - val_loss: 0.5363 - val_accuracy: 0.9262
Epoch 203/500
829/829 [==============================] - 4s 5ms/step - loss: 1.1092e-04 -
accuracy: 0.9999 - val_loss: 0.5888 - val_accuracy: 0.9196
Epoch 204/500
829/829 [==============================] - 3s 3ms/step - loss: 1.6519e-04 -
accuracy: 0.9999 - val_loss: 0.5816 - val_accuracy: 0.9232
Epoch 205/500
829/829 [==============================] - 3s 3ms/step - loss: 1.1716e-05 -
accuracy: 1.0000 - val_loss: 0.6168 - val_accuracy: 0.9167
Epoch 206/500
829/829 [==============================] - 3s 3ms/step - loss: 5.2160e-04 -
accuracy: 0.9998 - val_loss: 0.4571 - val_accuracy: 0.9326
Epoch 207/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0010 -
accuracy: 0.9998 - val_loss: 0.5198 - val_accuracy: 0.9267
Epoch 208/500
829/829 [==============================] - 4s 4ms/step - loss: 8.6484e-05 -
accuracy: 1.0000 - val_loss: 0.5215 - val_accuracy: 0.9303
Epoch 209/500
829/829 [==============================] - 3s 4ms/step - loss: 1.9300e-05 -
accuracy: 1.0000 - val_loss: 0.5237 - val_accuracy: 0.9306
Epoch 210/500
829/829 [==============================] - 3s 3ms/step - loss: 4.2846e-04 -
accuracy: 0.9999 - val_loss: 0.5464 - val_accuracy: 0.9226
Epoch 211/500
829/829 [==============================] - 3s 3ms/step - loss: 5.6735e-05 -
accuracy: 1.0000 - val_loss: 0.5643 - val_accuracy: 0.9236
Epoch 212/500
829/829 [==============================] - 3s 3ms/step - loss: 1.4812e-05 -
```

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accuracy: 1.0000 - val_loss: 0.5668 - val_accuracy: 0.9226
Epoch 213/500
829/829 [==============================] - 4s 4ms/step - loss: 3.7633e-04 -
accuracy: 0.9999 - val_loss: 0.5217 - val_accuracy: 0.9215
Epoch 214/500
829/829 [==============================] - 3s 4ms/step - loss: 2.8437e-04 -
accuracy: 0.9999 - val_loss: 0.4655 - val_accuracy: 0.9321
Epoch 215/500
829/829 [==============================] - 3s 3ms/step - loss: 2.0343e-05 -
accuracy: 1.0000 - val_loss: 0.4712 - val_accuracy: 0.9343
Epoch 216/500
829/829 [==============================] - 3s 3ms/step - loss: 9.1793e-05 -
accuracy: 1.0000 - val_loss: 0.5319 - val_accuracy: 0.9275
Epoch 217/500
829/829 [==============================] - 3s 3ms/step - loss: 1.2016e-05 -
accuracy: 1.0000 - val_loss: 0.5589 - val_accuracy: 0.9190
Epoch 218/500
829/829 [==============================] - 4s 4ms/step - loss: 4.3964e-04 -
accuracy: 0.9999 - val_loss: 0.5601 - val_accuracy: 0.9208
Epoch 219/500
829/829 [==============================] - 4s 4ms/step - loss: 9.5357e-06 -
accuracy: 1.0000 - val_loss: 0.5427 - val_accuracy: 0.9232
Epoch 220/500
829/829 [==============================] - 3s 3ms/step - loss: 2.0971e-05 -
accuracy: 1.0000 - val_loss: 0.6797 - val_accuracy: 0.9032
Epoch 221/500
829/829 [==============================] - 3s 3ms/step - loss: 5.9880e-05 -
accuracy: 1.0000 - val_loss: 0.5310 - val_accuracy: 0.9257
Epoch 222/500
829/829 [==============================] - 3s 3ms/step - loss: 2.2374e-04 -
accuracy: 1.0000 - val_loss: 0.5022 - val_accuracy: 0.9263
Epoch 223/500
829/829 [==============================] - 3s 4ms/step - loss: 3.4200e-04 -
accuracy: 0.9999 - val_loss: 0.5900 - val_accuracy: 0.9190
Epoch 224/500
829/829 [==============================] - 4s 4ms/step - loss: 1.1684e-05 -
accuracy: 1.0000 - val_loss: 0.6253 - val_accuracy: 0.9123
Epoch 225/500
829/829 [==============================] - 3s 3ms/step - loss: 9.1255e-06 -
accuracy: 1.0000 - val_loss: 0.5895 - val_accuracy: 0.9156
Epoch 226/500
829/829 [==============================] - 3s 3ms/step - loss: 7.0753e-04 -
accuracy: 0.9998 - val_loss: 0.6924 - val_accuracy: 0.9086
Epoch 227/500
829/829 [==============================] - 3s 3ms/step - loss: 1.6178e-05 -
accuracy: 1.0000 - val_loss: 0.6752 - val_accuracy: 0.9112
Epoch 228/500
829/829 [==============================] - 3s 4ms/step - loss: 2.0971e-04 -
```

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accuracy: 0.9999 - val_loss: 0.5558 - val_accuracy: 0.9229
Epoch 229/500
829/829 [==============================] - 4s 4ms/step - loss: 1.1459e-04 -
accuracy: 0.9999 - val_loss: 0.5614 - val_accuracy: 0.9224
Epoch 230/500
829/829 [==============================] - 3s 3ms/step - loss: 2.0762e-05 -
accuracy: 1.0000 - val_loss: 0.5407 - val_accuracy: 0.9277
Epoch 231/500
829/829 [==============================] - 3s 3ms/step - loss: 9.1002e-04 -
accuracy: 0.9997 - val_loss: 0.6895 - val_accuracy: 0.9126
Epoch 232/500
829/829 [==============================] - 3s 3ms/step - loss: 4.4042e-05 -
accuracy: 1.0000 - val_loss: 0.6957 - val_accuracy: 0.9168
Epoch 233/500
829/829 [==============================] - 3s 4ms/step - loss: 1.3840e-05 -
accuracy: 1.0000 - val_loss: 0.6722 - val_accuracy: 0.9199
Epoch 234/500
829/829 [==============================] - 4s 4ms/step - loss: 3.0097e-04 -
accuracy: 0.9999 - val_loss: 0.6534 - val_accuracy: 0.9214
Epoch 235/500
829/829 [==============================] - 3s 4ms/step - loss: 2.2561e-05 -
accuracy: 1.0000 - val_loss: 0.6435 - val_accuracy: 0.9217
Epoch 236/500
829/829 [==============================] - 3s 3ms/step - loss: 2.8333e-04 -
accuracy: 0.9999 - val_loss: 0.6044 - val_accuracy: 0.9270
Epoch 237/500
829/829 [==============================] - 2s 3ms/step - loss: 2.0394e-04 -
accuracy: 0.9999 - val_loss: 0.7030 - val_accuracy: 0.9220
Epoch 238/500
829/829 [==============================] - 3s 3ms/step - loss: 8.9351e-06 -
accuracy: 1.0000 - val_loss: 0.7504 - val_accuracy: 0.9149
Epoch 239/500
829/829 [==============================] - 4s 4ms/step - loss: 9.5816e-06 -
accuracy: 1.0000 - val_loss: 0.8046 - val_accuracy: 0.9057
Epoch 240/500
829/829 [==============================] - 4s 4ms/step - loss: 7.2760e-05 -
accuracy: 1.0000 - val_loss: 0.7186 - val_accuracy: 0.9169
Epoch 241/500
829/829 [==============================] - 3s 3ms/step - loss: 7.3019e-06 -
accuracy: 1.0000 - val_loss: 0.7069 - val_accuracy: 0.9184
Epoch 242/500
829/829 [==============================] - 3s 3ms/step - loss: 6.9205e-04 -
accuracy: 0.9998 - val_loss: 0.8348 - val_accuracy: 0.9130
Epoch 243/500
829/829 [==============================] - 3s 3ms/step - loss: 3.5193e-04 -
accuracy: 0.9999 - val_loss: 0.7253 - val_accuracy: 0.9149
Epoch 244/500
829/829 [==============================] - 4s 4ms/step - loss: 2.3067e-05 -
```

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accuracy: 1.0000 - val_loss: 0.6520 - val_accuracy: 0.9240
Epoch 245/500
829/829 [==============================] - 4s 4ms/step - loss: 9.1357e-06 -
accuracy: 1.0000 - val_loss: 0.7382 - val_accuracy: 0.9093
Epoch 246/500
829/829 [==============================] - 3s 4ms/step - loss: 7.5481e-06 -
accuracy: 1.0000 - val_loss: 0.7460 - val_accuracy: 0.9079
Epoch 247/500
829/829 [==============================] - 3s 3ms/step - loss: 4.6018e-04 -
accuracy: 1.0000 - val_loss: 0.7516 - val_accuracy: 0.9005
Epoch 248/500
829/829 [==============================] - 3s 4ms/step - loss: 1.9144e-05 -
accuracy: 1.0000 - val_loss: 0.6129 - val_accuracy: 0.9216
Epoch 249/500
829/829 [==============================] - 4s 4ms/step - loss: 6.2051e-04 -
accuracy: 0.9999 - val_loss: 0.6651 - val_accuracy: 0.9154
Epoch 250/500
829/829 [==============================] - 4s 5ms/step - loss: 2.7247e-05 -
accuracy: 1.0000 - val_loss: 0.5764 - val_accuracy: 0.9290
Epoch 251/500
829/829 [==============================] - 3s 3ms/step - loss: 6.1062e-06 -
accuracy: 1.0000 - val_loss: 0.6352 - val_accuracy: 0.9195
Epoch 252/500
829/829 [==============================] - 3s 3ms/step - loss: 8.3905e-06 -
accuracy: 1.0000 - val_loss: 0.6345 - val_accuracy: 0.9198
Epoch 253/500
829/829 [==============================] - 3s 4ms/step - loss: 2.5895e-04 -
accuracy: 0.9999 - val_loss: 0.7155 - val_accuracy: 0.9100
Epoch 254/500
829/829 [==============================] - 3s 4ms/step - loss: 8.0144e-06 -
accuracy: 1.0000 - val_loss: 0.6967 - val_accuracy: 0.9115
Epoch 255/500
829/829 [==============================] - 4s 5ms/step - loss: 3.0070e-05 -
accuracy: 1.0000 - val_loss: 0.7367 - val_accuracy: 0.9035
Epoch 256/500
829/829 [==============================] - 3s 3ms/step - loss: 2.9622e-04 -
accuracy: 0.9999 - val_loss: 0.6836 - val_accuracy: 0.9069
Epoch 257/500
829/829 [==============================] - 3s 3ms/step - loss: 2.8829e-04 -
accuracy: 0.9999 - val_loss: 0.6528 - val_accuracy: 0.9110
Epoch 258/500
829/829 [==============================] - 3s 3ms/step - loss: 8.8292e-06 -
accuracy: 1.0000 - val_loss: 0.6449 - val_accuracy: 0.9105
Epoch 259/500
829/829 [==============================] - 3s 3ms/step - loss: 8.7427e-06 -
accuracy: 1.0000 - val_loss: 0.6923 - val_accuracy: 0.9045
Epoch 260/500
829/829 [==============================] - 4s 5ms/step - loss: 6.7993e-06 -
```

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accuracy: 1.0000 - val_loss: 0.6232 - val_accuracy: 0.9163
Epoch 261/500
829/829 [==============================] - 3s 4ms/step - loss: 4.5100e-04 -
accuracy: 0.9999 - val_loss: 0.6714 - val_accuracy: 0.9031
Epoch 262/500
829/829 [==============================] - 3s 3ms/step - loss: 4.3145e-06 -
accuracy: 1.0000 - val_loss: 0.6456 - val_accuracy: 0.9063
Epoch 263/500
829/829 [==============================] - 3s 3ms/step - loss: 4.4575e-05 -
accuracy: 1.0000 - val_loss: 0.6365 - val_accuracy: 0.9067
Epoch 264/500
829/829 [==============================] - 3s 3ms/step - loss: 6.0572e-05 -
accuracy: 1.0000 - val_loss: 0.5561 - val_accuracy: 0.9161
Epoch 265/500
829/829 [==============================] - 4s 5ms/step - loss: 6.1691e-04 -
accuracy: 0.9998 - val_loss: 0.5835 - val_accuracy: 0.9110
Epoch 266/500
829/829 [==============================] - 4s 4ms/step - loss: 1.0164e-04 -
accuracy: 1.0000 - val_loss: 0.5793 - val_accuracy: 0.9114
Epoch 267/500
829/829 [==============================] - 3s 4ms/step - loss: 5.5171e-06 -
accuracy: 1.0000 - val_loss: 0.5646 - val_accuracy: 0.9149
Epoch 268/500
829/829 [==============================] - 3s 4ms/step - loss: 4.4045e-06 -
accuracy: 1.0000 - val_loss: 0.5560 - val_accuracy: 0.9165
Epoch 269/500
829/829 [==============================] - 3s 3ms/step - loss: 9.3260e-06 -
accuracy: 1.0000 - val_loss: 0.5716 - val_accuracy: 0.9143
Epoch 270/500
829/829 [==============================] - 4s 4ms/step - loss: 1.4286e-04 -
accuracy: 1.0000 - val_loss: 0.6087 - val_accuracy: 0.9065
Epoch 271/500
829/829 [==============================] - 3s 4ms/step - loss: 1.7525e-05 -
accuracy: 1.0000 - val_loss: 0.5344 - val_accuracy: 0.9199
Epoch 272/500
829/829 [==============================] - 3s 3ms/step - loss: 3.2270e-06 -
accuracy: 1.0000 - val_loss: 0.5575 - val_accuracy: 0.9175
Epoch 273/500
829/829 [==============================] - 3s 3ms/step - loss: 1.6293e-05 -
accuracy: 1.0000 - val_loss: 0.5339 - val_accuracy: 0.9199
Epoch 274/500
829/829 [==============================] - 3s 3ms/step - loss: 5.0645e-06 -
accuracy: 1.0000 - val_loss: 0.6072 - val_accuracy: 0.9091
Epoch 275/500
829/829 [==============================] - 3s 4ms/step - loss: 3.3793e-04 -
accuracy: 0.9999 - val_loss: 0.5796 - val_accuracy: 0.9076
Epoch 276/500
829/829 [==============================] - 4s 5ms/step - loss: 2.3191e-04 -
```

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accuracy: 0.9999 - val_loss: 0.5816 - val_accuracy: 0.9079
Epoch 277/500
829/829 [==============================] - 3s 3ms/step - loss: 6.0227e-06 -
accuracy: 1.0000 - val_loss: 0.5365 - val_accuracy: 0.9152
Epoch 278/500
829/829 [==============================] - 3s 3ms/step - loss: 4.6928e-06 -
accuracy: 1.0000 - val_loss: 0.5380 - val_accuracy: 0.9153
Epoch 279/500
829/829 [==============================] - 3s 4ms/step - loss: 3.7212e-06 -
accuracy: 1.0000 - val_loss: 0.5701 - val_accuracy: 0.9115
Epoch 280/500
829/829 [==============================] - 3s 4ms/step - loss: 4.9803e-06 -
accuracy: 1.0000 - val_loss: 0.5820 - val_accuracy: 0.9105
Epoch 281/500
829/829 [==============================] - 4s 5ms/step - loss: 4.3673e-06 -
accuracy: 1.0000 - val_loss: 0.6052 - val_accuracy: 0.9079
Epoch 282/500
829/829 [==============================] - 3s 4ms/step - loss: 7.8171e-04 -
accuracy: 0.9998 - val_loss: 0.6618 - val_accuracy: 0.9112
Epoch 283/500
829/829 [==============================] - 3s 3ms/step - loss: 3.7508e-04 -
accuracy: 0.9998 - val_loss: 0.6143 - val_accuracy: 0.9188
Epoch 284/500
829/829 [==============================] - 3s 3ms/step - loss: 3.8769e-05 -
accuracy: 1.0000 - val_loss: 0.6279 - val_accuracy: 0.9192
Epoch 285/500
829/829 [==============================] - 3s 3ms/step - loss: 4.8829e-06 -
accuracy: 1.0000 - val_loss: 0.6213 - val_accuracy: 0.9196
Epoch 286/500
829/829 [==============================] - 4s 4ms/step - loss: 4.4992e-06 -
accuracy: 1.0000 - val_loss: 0.6227 - val_accuracy: 0.9193
Epoch 287/500
829/829 [==============================] - 4s 4ms/step - loss: 3.8309e-06 -
accuracy: 1.0000 - val_loss: 0.6365 - val_accuracy: 0.9171
Epoch 288/500
829/829 [==============================] - 3s 4ms/step - loss: 4.2410e-06 -
accuracy: 1.0000 - val_loss: 0.6374 - val_accuracy: 0.9152
Epoch 289/500
829/829 [==============================] - 3s 3ms/step - loss: 1.5125e-04 -
accuracy: 0.9999 - val_loss: 0.5960 - val_accuracy: 0.9261
Epoch 290/500
829/829 [==============================] - 3s 3ms/step - loss: 8.8598e-06 -
accuracy: 1.0000 - val_loss: 0.6598 - val_accuracy: 0.9145
Epoch 291/500
829/829 [==============================] - 3s 4ms/step - loss: 7.2546e-06 -
accuracy: 1.0000 - val_loss: 0.8044 - val_accuracy: 0.8965
Epoch 292/500
829/829 [==============================] - 4s 5ms/step - loss: 1.1388e-04 -
```

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accuracy: 1.0000 - val_loss: 0.5920 - val_accuracy: 0.9217
Epoch 293/500
829/829 [==============================] - 3s 4ms/step - loss: 4.3209e-05 -
accuracy: 1.0000 - val_loss: 0.6570 - val_accuracy: 0.9156
Epoch 294/500
829/829 [==============================] - 3s 3ms/step - loss: 1.3572e-04 -
accuracy: 0.9999 - val_loss: 0.6416 - val_accuracy: 0.9189
Epoch 295/500
829/829 [==============================] - 3s 4ms/step - loss: 6.3153e-06 -
accuracy: 1.0000 - val_loss: 0.6400 - val_accuracy: 0.9171
Epoch 296/500
829/829 [==============================] - 3s 4ms/step - loss: 3.4902e-06 -
accuracy: 1.0000 - val_loss: 0.6472 - val_accuracy: 0.9166
Epoch 297/500
829/829 [==============================] - 4s 5ms/step - loss: 2.7510e-06 -
accuracy: 1.0000 - val_loss: 0.6750 - val_accuracy: 0.9122
Epoch 298/500
829/829 [==============================] - 3s 4ms/step - loss: 1.0431e-05 -
accuracy: 1.0000 - val_loss: 0.6763 - val_accuracy: 0.9108
Epoch 299/500
829/829 [==============================] - 3s 3ms/step - loss: 6.2306e-04 -
accuracy: 0.9998 - val_loss: 0.9585 - val_accuracy: 0.8882
Epoch 300/500
829/829 [==============================] - 3s 4ms/step - loss: 9.9770e-06 -
accuracy: 1.0000 - val_loss: 0.9461 - val_accuracy: 0.8860
Epoch 301/500
829/829 [==============================] - 3s 4ms/step - loss: 2.7871e-04 -
accuracy: 1.0000 - val_loss: 0.9683 - val_accuracy: 0.8872
Epoch 302/500
829/829 [==============================] - 4s 4ms/step - loss: 4.4438e-06 -
accuracy: 1.0000 - val_loss: 0.8448 - val_accuracy: 0.9059
Epoch 303/500
829/829 [==============================] - 3s 3ms/step - loss: 2.9976e-06 -
accuracy: 1.0000 - val_loss: 0.9142 - val_accuracy: 0.8931
Epoch 304/500
829/829 [==============================] - 3s 4ms/step - loss: 2.4767e-06 -
accuracy: 1.0000 - val_loss: 0.8499 - val_accuracy: 0.9023
Epoch 305/500
829/829 [==============================] - 3s 4ms/step - loss: 7.5721e-04 -
accuracy: 0.9998 - val_loss: 0.9168 - val_accuracy: 0.9024
Epoch 306/500
829/829 [==============================] - 3s 4ms/step - loss: 4.3273e-04 -
accuracy: 0.9998 - val_loss: 0.9351 - val_accuracy: 0.8989
Epoch 307/500
829/829 [==============================] - 4s 4ms/step - loss: 5.3217e-06 -
accuracy: 1.0000 - val_loss: 0.9497 - val_accuracy: 0.8959
Epoch 308/500
829/829 [==============================] - 3s 4ms/step - loss: 4.6018e-06 -
```

```
accuracy: 1.0000 - val_loss: 0.9394 - val_accuracy: 0.8961
Epoch 309/500
829/829 [==============================] - 3s 3ms/step - loss: 3.1662e-06 -
accuracy: 1.0000 - val_loss: 0.9421 - val_accuracy: 0.8948
Epoch 310/500
829/829 [==============================] - 3s 3ms/step - loss: 2.9910e-06 -
accuracy: 1.0000 - val_loss: 0.9040 - val_accuracy: 0.8977
Epoch 311/500
829/829 [==============================] - 3s 3ms/step - loss: 3.2504e-06 -
accuracy: 1.0000 - val_loss: 0.8969 - val_accuracy: 0.8989
Epoch 312/500
829/829 [==============================] - 3s 4ms/step - loss: 3.4356e-06 -
accuracy: 1.0000 - val_loss: 0.9248 - val_accuracy: 0.8943
Epoch 313/500
829/829 [==============================] - 4s 4ms/step - loss: 8.9869e-04 -
accuracy: 0.9998 - val_loss: 1.4220 - val_accuracy: 0.8259
Epoch 314/500
829/829 [==============================] - 3s 3ms/step - loss: 1.6062e-04 -
accuracy: 1.0000 - val_loss: 0.7296 - val_accuracy: 0.9084
Epoch 315/500
829/829 [==============================] - 3s 3ms/step - loss: 3.4535e-06 -
accuracy: 1.0000 - val_loss: 0.7506 - val_accuracy: 0.9062
Epoch 316/500
829/829 [==============================] - 3s 4ms/step - loss: 3.4962e-06 -
accuracy: 1.0000 - val_loss: 0.7124 - val_accuracy: 0.9118
Epoch 317/500
829/829 [==============================] - 3s 4ms/step - loss: 3.3710e-06 -
accuracy: 1.0000 - val_loss: 0.7443 - val_accuracy: 0.9076
Epoch 318/500
829/829 [==============================] - 4s 5ms/step - loss: 3.2417e-06 -
accuracy: 1.0000 - val_loss: 0.7285 - val_accuracy: 0.9083
Epoch 319/500
829/829 [==============================] - 3s 3ms/step - loss: 3.6107e-06 -
accuracy: 1.0000 - val_loss: 0.7107 - val_accuracy: 0.9095
Epoch 320/500
829/829 [==============================] - 3s 3ms/step - loss: 1.8474e-04 -
accuracy: 0.9999 - val_loss: 0.7948 - val_accuracy: 0.9091
Epoch 321/500
829/829 [==============================] - 3s 4ms/step - loss: 2.1460e-05 -
accuracy: 1.0000 - val_loss: 0.8106 - val_accuracy: 0.9118
Epoch 322/500
829/829 [==============================] - 3s 4ms/step - loss: 3.2323e-06 -
accuracy: 1.0000 - val_loss: 0.8748 - val_accuracy: 0.9005
Epoch 323/500
829/829 [==============================] - 4s 4ms/step - loss: 2.6924e-06 -
accuracy: 1.0000 - val_loss: 0.8441 - val_accuracy: 0.9048
Epoch 324/500
829/829 [==============================] - 3s 4ms/step - loss: 2.7428e-06 -
```

```
accuracy: 1.0000 - val_loss: 0.8422 - val_accuracy: 0.9057
Epoch 325/500
829/829 [==============================] - 3s 3ms/step - loss: 0.0012 -
accuracy: 0.9997 - val_loss: 0.7234 - val_accuracy: 0.9094
Epoch 326/500
829/829 [==============================] - 3s 3ms/step - loss: 4.3000e-05 -
accuracy: 1.0000 - val_loss: 0.6750 - val_accuracy: 0.9152
Epoch 327/500
829/829 [==============================] - 3s 4ms/step - loss: 1.0049e-04 -
accuracy: 1.0000 - val_loss: 0.6501 - val_accuracy: 0.9179
Epoch 328/500
829/829 [==============================] - 4s 5ms/step - loss: 3.9885e-06 -
accuracy: 1.0000 - val_loss: 0.6422 - val_accuracy: 0.9189
Epoch 329/500
829/829 [==============================] - 3s 4ms/step - loss: 3.2969e-06 -
accuracy: 1.0000 - val_loss: 0.6484 - val_accuracy: 0.9177
Epoch 330/500
829/829 [==============================] - 3s 3ms/step - loss: 2.2897e-06 -
accuracy: 1.0000 - val_loss: 0.6555 - val_accuracy: 0.9165
Epoch 331/500
829/829 [==============================] - 3s 4ms/step - loss: 2.3119e-06 -
accuracy: 1.0000 - val_loss: 0.6573 - val_accuracy: 0.9165
Epoch 332/500
829/829 [==============================] - 3s 4ms/step - loss: 4.5450e-04 -
accuracy: 0.9999 - val_loss: 0.7006 - val_accuracy: 0.9026
Epoch 333/500
829/829 [==============================] - 3s 4ms/step - loss: 4.6127e-05 -
accuracy: 1.0000 - val_loss: 0.6252 - val_accuracy: 0.9195
Epoch 334/500
829/829 [==============================] - 4s 5ms/step - loss: 4.5737e-06 -
accuracy: 1.0000 - val_loss: 0.6578 - val_accuracy: 0.9175
Epoch 335/500
829/829 [==============================] - 3s 3ms/step - loss: 3.0690e-06 -
accuracy: 1.0000 - val_loss: 0.6715 - val_accuracy: 0.9179
Epoch 336/500
829/829 [==============================] - 3s 3ms/step - loss: 2.6448e-06 -
accuracy: 1.0000 - val_loss: 0.7149 - val_accuracy: 0.9145
Epoch 337/500
829/829 [==============================] - 3s 4ms/step - loss: 2.0916e-06 -
accuracy: 1.0000 - val_loss: 0.7877 - val_accuracy: 0.9049
Epoch 338/500
829/829 [==============================] - 3s 4ms/step - loss: 2.2921e-06 -
accuracy: 1.0000 - val_loss: 0.7810 - val_accuracy: 0.9050
Epoch 339/500
829/829 [==============================] - 4s 5ms/step - loss: 6.1007e-04 -
accuracy: 0.9999 - val_loss: 0.8427 - val_accuracy: 0.8987
Epoch 340/500
829/829 [==============================] - 3s 4ms/step - loss: 1.7592e-05 -
```

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accuracy: 1.0000 - val_loss: 1.0020 - val_accuracy: 0.8941
Epoch 341/500
829/829 [==============================] - 3s 4ms/step - loss: 2.7019e-06 -
accuracy: 1.0000 - val_loss: 0.9781 - val_accuracy: 0.8944
Epoch 342/500
829/829 [==============================] - 3s 4ms/step - loss: 2.4508e-06 -
accuracy: 1.0000 - val_loss: 0.9411 - val_accuracy: 0.8992
Epoch 343/500
829/829 [==============================] - 3s 4ms/step - loss: 1.9713e-06 -
accuracy: 1.0000 - val_loss: 0.9285 - val_accuracy: 0.8996
Epoch 344/500
829/829 [==============================] - 4s 4ms/step - loss: 1.5655e-06 -
accuracy: 1.0000 - val_loss: 0.9163 - val_accuracy: 0.8988
Epoch 345/500
829/829 [==============================] - 3s 3ms/step - loss: 1.4593e-06 -
accuracy: 1.0000 - val_loss: 0.8778 - val_accuracy: 0.9023
Epoch 346/500
829/829 [==============================] - 3s 3ms/step - loss: 1.3804e-06 -
accuracy: 1.0000 - val_loss: 0.8474 - val_accuracy: 0.9060
Epoch 347/500
829/829 [==============================] - 3s 3ms/step - loss: 1.4837e-06 -
accuracy: 1.0000 - val_loss: 0.8548 - val_accuracy: 0.9049
Epoch 348/500
829/829 [==============================] - 3s 4ms/step - loss: 7.2430e-04 -
accuracy: 0.9998 - val_loss: 1.6049 - val_accuracy: 0.8323
Epoch 349/500
829/829 [==============================] - 4s 5ms/step - loss: 3.7981e-04 -
accuracy: 0.9999 - val_loss: 0.8823 - val_accuracy: 0.9098
Epoch 350/500
829/829 [==============================] - 4s 4ms/step - loss: 4.0970e-06 -
accuracy: 1.0000 - val_loss: 0.9223 - val_accuracy: 0.9068
Epoch 351/500
829/829 [==============================] - 3s 3ms/step - loss: 3.2600e-06 -
accuracy: 1.0000 - val_loss: 0.9281 - val_accuracy: 0.9070
Epoch 352/500
829/829 [==============================] - 3s 4ms/step - loss: 2.9651e-06 -
accuracy: 1.0000 - val_loss: 0.9417 - val_accuracy: 0.9063
Epoch 353/500
829/829 [==============================] - 3s 3ms/step - loss: 2.6374e-06 -
accuracy: 1.0000 - val_loss: 0.9606 - val_accuracy: 0.9048
Epoch 354/500
829/829 [==============================] - 4s 5ms/step - loss: 2.3992e-06 -
accuracy: 1.0000 - val_loss: 0.9599 - val_accuracy: 0.9059
Epoch 355/500
829/829 [==============================] - 4s 4ms/step - loss: 1.7160e-06 -
accuracy: 1.0000 - val_loss: 0.9754 - val_accuracy: 0.9041
Epoch 356/500
829/829 [==============================] - 3s 4ms/step - loss: 1.8649e-06 -
```

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accuracy: 1.0000 - val_loss: 0.9649 - val_accuracy: 0.9063
Epoch 357/500
829/829 [==============================] - 3s 4ms/step - loss: 1.8013e-05 -
accuracy: 1.0000 - val_loss: 1.0366 - val_accuracy: 0.9002
Epoch 358/500
829/829 [==============================] - 3s 4ms/step - loss: 1.4697e-04 -
accuracy: 0.9999 - val_loss: 1.1681 - val_accuracy: 0.8816
Epoch 359/500
829/829 [==============================] - 4s 4ms/step - loss: 1.4455e-04 -
accuracy: 0.9999 - val_loss: 0.9280 - val_accuracy: 0.9023
Epoch 360/500
829/829 [==============================] - 4s 4ms/step - loss: 2.3051e-06 -
accuracy: 1.0000 - val_loss: 0.9240 - val_accuracy: 0.9026
Epoch 361/500
829/829 [==============================] - 3s 4ms/step - loss: 1.8837e-06 -
accuracy: 1.0000 - val_loss: 0.9060 - val_accuracy: 0.9028
Epoch 362/500
829/829 [==============================] - 3s 3ms/step - loss: 1.8085e-06 -
accuracy: 1.0000 - val_loss: 0.9099 - val_accuracy: 0.9029
Epoch 363/500
829/829 [==============================] - 3s 3ms/step - loss: 1.5766e-06 -
accuracy: 1.0000 - val_loss: 0.8702 - val_accuracy: 0.9070
Epoch 364/500
829/829 [==============================] - 3s 4ms/step - loss: 1.6088e-06 -
accuracy: 1.0000 - val_loss: 0.9018 - val_accuracy: 0.9029
Epoch 365/500
829/829 [==============================] - 4s 4ms/step - loss: 0.0013 -
accuracy: 0.9997 - val_loss: 0.9492 - val_accuracy: 0.9004
Epoch 366/500
829/829 [==============================] - 3s 4ms/step - loss: 5.3673e-05 -
accuracy: 1.0000 - val_loss: 0.9089 - val_accuracy: 0.9028
Epoch 367/500
829/829 [==============================] - 3s 4ms/step - loss: 3.7859e-06 -
accuracy: 1.0000 - val_loss: 0.9038 - val_accuracy: 0.9032
Epoch 368/500
829/829 [==============================] - 3s 4ms/step - loss: 3.0536e-06 -
accuracy: 1.0000 - val_loss: 0.9075 - val_accuracy: 0.9026
Epoch 369/500
829/829 [==============================] - 3s 4ms/step - loss: 2.6479e-06 -
accuracy: 1.0000 - val_loss: 0.9078 - val_accuracy: 0.9029
Epoch 370/500
829/829 [==============================] - 4s 4ms/step - loss: 2.4006e-06 -
accuracy: 1.0000 - val_loss: 0.9184 - val_accuracy: 0.9019
Epoch 371/500
829/829 [==============================] - 3s 4ms/step - loss: 1.9156e-06 -
accuracy: 1.0000 - val_loss: 0.9161 - val_accuracy: 0.9018
Epoch 372/500
829/829 [==============================] - 3s 4ms/step - loss: 2.4375e-06 -
```

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accuracy: 1.0000 - val_loss: 0.9273 - val_accuracy: 0.9003
Epoch 373/500
829/829 [==============================] - 3s 3ms/step - loss: 2.3407e-04 -
accuracy: 0.9999 - val_loss: 0.8852 - val_accuracy: 0.8986
Epoch 374/500
829/829 [==============================] - 3s 3ms/step - loss: 7.4974e-06 -
accuracy: 1.0000 - val_loss: 0.9526 - val_accuracy: 0.8932
Epoch 375/500
829/829 [==============================] - 4s 4ms/step - loss: 1.7227e-06 -
accuracy: 1.0000 - val_loss: 0.9005 - val_accuracy: 0.9005
Epoch 376/500
829/829 [==============================] - 4s 4ms/step - loss: 5.0774e-04 -
accuracy: 0.9999 - val_loss: 0.7452 - val_accuracy: 0.9048
Epoch 377/500
829/829 [==============================] - 3s 4ms/step - loss: 2.9753e-04 -
accuracy: 0.9999 - val_loss: 0.9344 - val_accuracy: 0.8887
Epoch 378/500
829/829 [==============================] - 3s 3ms/step - loss: 7.2086e-06 -
accuracy: 1.0000 - val_loss: 0.8080 - val_accuracy: 0.9047
Epoch 379/500
829/829 [==============================] - 3s 3ms/step - loss: 2.5609e-06 -
accuracy: 1.0000 - val_loss: 0.7927 - val_accuracy: 0.9064
Epoch 380/500
829/829 [==============================] - 4s 4ms/step - loss: 1.9868e-06 -
accuracy: 1.0000 - val_loss: 0.7854 - val_accuracy: 0.9068
Epoch 381/500
829/829 [==============================] - 4s 4ms/step - loss: 1.7611e-06 -
accuracy: 1.0000 - val_loss: 0.7779 - val_accuracy: 0.9076
Epoch 382/500
829/829 [==============================] - 3s 3ms/step - loss: 1.5016e-06 -
accuracy: 1.0000 - val_loss: 0.7785 - val_accuracy: 0.9074
Epoch 383/500
829/829 [==============================] - 3s 4ms/step - loss: 1.4024e-06 -
accuracy: 1.0000 - val_loss: 0.7555 - val_accuracy: 0.9115
Epoch 384/500
829/829 [==============================] - 3s 3ms/step - loss: 1.2670e-06 -
accuracy: 1.0000 - val_loss: 0.7779 - val_accuracy: 0.9079
Epoch 385/500
829/829 [==============================] - 3s 4ms/step - loss: 1.3431e-04 -
accuracy: 1.0000 - val_loss: 0.7547 - val_accuracy: 0.9133
Epoch 386/500
829/829 [==============================] - 4s 4ms/step - loss: 3.6470e-06 -
accuracy: 1.0000 - val_loss: 0.7901 - val_accuracy: 0.9075
Epoch 387/500
829/829 [==============================] - 3s 3ms/step - loss: 1.6034e-06 -
accuracy: 1.0000 - val_loss: 0.7756 - val_accuracy: 0.9096
Epoch 388/500
829/829 [==============================] - 3s 3ms/step - loss: 3.1621e-04 -
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accuracy: 1.0000 - val_loss: 0.9301 - val_accuracy: 0.8978
Epoch 389/500
829/829 [==============================] - 3s 3ms/step - loss: 6.7802e-04 -
accuracy: 0.9998 - val_loss: 0.8741 - val_accuracy: 0.9100
Epoch 390/500
829/829 [==============================] - 3s 4ms/step - loss: 5.6749e-04 -
accuracy: 0.9998 - val_loss: 0.9035 - val_accuracy: 0.9085
Epoch 391/500
829/829 [==============================] - 4s 5ms/step - loss: 2.1988e-05 -
accuracy: 1.0000 - val_loss: 0.8892 - val_accuracy: 0.9103
Epoch 392/500
829/829 [==============================] - 4s 4ms/step - loss: 2.7988e-06 -
accuracy: 1.0000 - val_loss: 0.8950 - val_accuracy: 0.9100
Epoch 393/500
829/829 [==============================] - 3s 4ms/step - loss: 2.2076e-06 -
accuracy: 1.0000 - val_loss: 0.9048 - val_accuracy: 0.9102
Epoch 394/500
829/829 [==============================] - 3s 4ms/step - loss: 2.0720e-06 -
accuracy: 1.0000 - val_loss: 0.9164 - val_accuracy: 0.9093
Epoch 395/500
829/829 [==============================] - 3s 4ms/step - loss: 2.9966e-06 -
accuracy: 1.0000 - val_loss: 0.9401 - val_accuracy: 0.9065
Epoch 396/500
829/829 [==============================] - 4s 5ms/step - loss: 2.5571e-04 -
accuracy: 0.9999 - val_loss: 0.9996 - val_accuracy: 0.9047
Epoch 397/500
829/829 [==============================] - 3s 4ms/step - loss: 3.5143e-06 -
accuracy: 1.0000 - val_loss: 1.0415 - val_accuracy: 0.9011
Epoch 398/500
829/829 [==============================] - 3s 3ms/step - loss: 1.9205e-06 -
accuracy: 1.0000 - val_loss: 1.0287 - val_accuracy: 0.9051
Epoch 399/500
829/829 [==============================] - 3s 3ms/step - loss: 1.3231e-06 -
accuracy: 1.0000 - val_loss: 1.1202 - val_accuracy: 0.8929
Epoch 400/500
829/829 [==============================] - 3s 4ms/step - loss: 1.1810e-06 -
accuracy: 1.0000 - val_loss: 1.0904 - val_accuracy: 0.8956
Epoch 401/500
829/829 [==============================] - 4s 4ms/step - loss: 1.0640e-06 -
accuracy: 1.0000 - val_loss: 1.0799 - val_accuracy: 0.8974
Epoch 402/500
829/829 [==============================] - 4s 5ms/step - loss: 0.0011 -
accuracy: 0.9996 - val_loss: 0.9531 - val_accuracy: 0.9137
Epoch 403/500
829/829 [==============================] - 3s 3ms/step - loss: 1.6919e-04 -
accuracy: 0.9999 - val_loss: 0.9903 - val_accuracy: 0.9052
Epoch 404/500
829/829 [==============================] - 3s 3ms/step - loss: 1.0181e-05 -
```

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accuracy: 1.0000 - val_loss: 0.9992 - val_accuracy: 0.9051
Epoch 405/500
829/829 [==============================] - 3s 3ms/step - loss: 2.1930e-06 -
accuracy: 1.0000 - val_loss: 1.0059 - val_accuracy: 0.9048
Epoch 406/500
829/829 [==============================] - 3s 4ms/step - loss: 2.0192e-06 -
accuracy: 1.0000 - val_loss: 1.0198 - val_accuracy: 0.9038
Epoch 407/500
829/829 [==============================] - 4s 4ms/step - loss: 1.7858e-06 -
accuracy: 1.0000 - val_loss: 1.0329 - val_accuracy: 0.9027
Epoch 408/500
829/829 [==============================] - 3s 3ms/step - loss: 1.5979e-06 -
accuracy: 1.0000 - val_loss: 1.0482 - val_accuracy: 0.9018
Epoch 409/500
829/829 [==============================] - 3s 4ms/step - loss: 1.5870e-06 -
accuracy: 1.0000 - val_loss: 1.0644 - val_accuracy: 0.9002
Epoch 410/500
829/829 [==============================] - 3s 4ms/step - loss: 1.1422e-06 -
accuracy: 1.0000 - val_loss: 1.0846 - val_accuracy: 0.8974
Epoch 411/500
829/829 [==============================] - 3s 4ms/step - loss: 1.2793e-06 -
accuracy: 1.0000 - val_loss: 1.0688 - val_accuracy: 0.9008
Epoch 412/500
829/829 [==============================] - 4s 5ms/step - loss: 3.3242e-04 -
accuracy: 0.9999 - val_loss: 1.0532 - val_accuracy: 0.9018
Epoch 413/500
829/829 [==============================] - 3s 4ms/step - loss: 5.4407e-05 -
accuracy: 1.0000 - val_loss: 1.1628 - val_accuracy: 0.8935
Epoch 414/500
829/829 [==============================] - 3s 3ms/step - loss: 6.4406e-06 -
accuracy: 1.0000 - val_loss: 1.1806 - val_accuracy: 0.8911
Epoch 415/500
829/829 [==============================] - 3s 4ms/step - loss: 1.1770e-06 -
accuracy: 1.0000 - val_loss: 1.1683 - val_accuracy: 0.8929
Epoch 416/500
829/829 [==============================] - 3s 3ms/step - loss: 1.1794e-06 -
accuracy: 1.0000 - val_loss: 1.2037 - val_accuracy: 0.8895
Epoch 417/500
829/829 [==============================] - 4s 5ms/step - loss: 1.0417e-06 -
accuracy: 1.0000 - val_loss: 1.1876 - val_accuracy: 0.8906
Epoch 418/500
829/829 [==============================] - 4s 5ms/step - loss: 9.6884e-07 -
accuracy: 1.0000 - val_loss: 1.1918 - val_accuracy: 0.8888
Epoch 419/500
829/829 [==============================] - 3s 4ms/step - loss: 1.4053e-06 -
accuracy: 1.0000 - val_loss: 1.1386 - val_accuracy: 0.8932
Epoch 420/500
829/829 [==============================] - 3s 4ms/step - loss: 1.1358e-06 -
```

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accuracy: 1.0000 - val_loss: 1.1679 - val_accuracy: 0.8888
Epoch 421/500
829/829 [==============================] - 3s 4ms/step - loss: 1.6892e-06 -
accuracy: 1.0000 - val_loss: 1.1712 - val_accuracy: 0.8872
Epoch 422/500
829/829 [==============================] - 4s 4ms/step - loss: 0.0016 -
accuracy: 0.9997 - val_loss: 0.9298 - val_accuracy: 0.8974
Epoch 423/500
829/829 [==============================] - 4s 4ms/step - loss: 1.0070e-04 -
accuracy: 1.0000 - val_loss: 1.0116 - val_accuracy: 0.8996
Epoch 424/500
829/829 [==============================] - 3s 4ms/step - loss: 3.5228e-06 -
accuracy: 1.0000 - val_loss: 0.9913 - val_accuracy: 0.9008
Epoch 425/500
829/829 [==============================] - 3s 4ms/step - loss: 2.2693e-06 -
accuracy: 1.0000 - val_loss: 1.0055 - val_accuracy: 0.8995
Epoch 426/500
829/829 [==============================] - 3s 4ms/step - loss: 1.7842e-06 -
accuracy: 1.0000 - val_loss: 1.0474 - val_accuracy: 0.8952
Epoch 427/500
829/829 [==============================] - 4s 4ms/step - loss: 1.7117e-06 -
accuracy: 1.0000 - val_loss: 0.9419 - val_accuracy: 0.9051
Epoch 428/500
829/829 [==============================] - 4s 4ms/step - loss: 4.8396e-04 -
accuracy: 0.9999 - val_loss: 1.1810 - val_accuracy: 0.8749
Epoch 429/500
829/829 [==============================] - 3s 4ms/step - loss: 2.6884e-04 -
accuracy: 1.0000 - val_loss: 0.8798 - val_accuracy: 0.9075
Epoch 430/500
829/829 [==============================] - 3s 3ms/step - loss: 1.4828e-06 -
accuracy: 1.0000 - val_loss: 0.8576 - val_accuracy: 0.9104
Epoch 431/500
829/829 [==============================] - 3s 3ms/step - loss: 1.1172e-06 -
accuracy: 1.0000 - val_loss: 0.8532 - val_accuracy: 0.9099
Epoch 432/500
829/829 [==============================] - 3s 4ms/step - loss: 9.4784e-07 -
accuracy: 1.0000 - val_loss: 0.8488 - val_accuracy: 0.9101
Epoch 433/500
829/829 [==============================] - 4s 5ms/step - loss: 8.0048e-07 -
accuracy: 1.0000 - val_loss: 0.8375 - val_accuracy: 0.9102
Epoch 434/500
829/829 [==============================] - 3s 4ms/step - loss: 7.4610e-07 -
accuracy: 1.0000 - val_loss: 0.8377 - val_accuracy: 0.9103
Epoch 435/500
829/829 [==============================] - 3s 4ms/step - loss: 8.0966e-07 -
accuracy: 1.0000 - val_loss: 0.8457 - val_accuracy: 0.9085
Epoch 436/500
829/829 [==============================] - 3s 3ms/step - loss: 7.9145e-05 -
```

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accuracy: 1.0000 - val_loss: 0.8169 - val_accuracy: 0.9066
Epoch 437/500
829/829 [==============================] - 3s 4ms/step - loss: 3.6746e-04 -
accuracy: 0.9999 - val_loss: 0.8500 - val_accuracy: 0.9084
Epoch 438/500
829/829 [==============================] - 4s 5ms/step - loss: 1.3239e-06 -
accuracy: 1.0000 - val_loss: 0.8477 - val_accuracy: 0.9081
Epoch 439/500
829/829 [==============================] - 3s 4ms/step - loss: 1.0669e-06 -
accuracy: 1.0000 - val_loss: 0.8614 - val_accuracy: 0.9072
Epoch 440/500
829/829 [==============================] - 3s 4ms/step - loss: 8.8626e-07 -
accuracy: 1.0000 - val_loss: 0.8733 - val_accuracy: 0.9051
Epoch 441/500
829/829 [==============================] - 3s 4ms/step - loss: 8.5468e-07 -
accuracy: 1.0000 - val_loss: 0.8786 - val_accuracy: 0.9068
Epoch 442/500
829/829 [==============================] - 3s 4ms/step - loss: 6.7054e-07 -
accuracy: 1.0000 - val_loss: 0.9014 - val_accuracy: 0.9026
Epoch 443/500
829/829 [==============================] - 4s 4ms/step - loss: 6.0343e-07 -
accuracy: 1.0000 - val_loss: 0.8835 - val_accuracy: 0.9050
Epoch 444/500
829/829 [==============================] - 4s 4ms/step - loss: 6.6991e-07 -
accuracy: 1.0000 - val_loss: 0.9496 - val_accuracy: 0.8979
Epoch 445/500
829/829 [==============================] - 3s 4ms/step - loss: 1.7790e-04 -
accuracy: 1.0000 - val_loss: 0.8793 - val_accuracy: 0.9091
Epoch 446/500
829/829 [==============================] - 3s 3ms/step - loss: 6.2275e-04 -
accuracy: 0.9998 - val_loss: 0.9054 - val_accuracy: 0.9042
Epoch 447/500
829/829 [==============================] - 3s 3ms/step - loss: 2.2489e-05 -
accuracy: 1.0000 - val_loss: 0.9182 - val_accuracy: 0.9029
Epoch 448/500
829/829 [==============================] - 4s 4ms/step - loss: 2.8820e-06 -
accuracy: 1.0000 - val_loss: 0.9690 - val_accuracy: 0.8981
Epoch 449/500
829/829 [==============================] - 4s 4ms/step - loss: 2.2450e-06 -
accuracy: 1.0000 - val_loss: 0.9753 - val_accuracy: 0.8986
Epoch 450/500
829/829 [==============================] - 3s 4ms/step - loss: 1.7121e-06 -
accuracy: 1.0000 - val_loss: 0.9829 - val_accuracy: 0.8979
Epoch 451/500
829/829 [==============================] - 3s 4ms/step - loss: 1.3102e-06 -
accuracy: 1.0000 - val_loss: 0.9962 - val_accuracy: 0.8967
Epoch 452/500
829/829 [==============================] - 3s 4ms/step - loss: 1.0435e-06 -
```

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accuracy: 1.0000 - val_loss: 0.9692 - val_accuracy: 0.9001
Epoch 453/500
829/829 [==============================] - 3s 4ms/step - loss: 8.9514e-07 -
accuracy: 1.0000 - val_loss: 0.9596 - val_accuracy: 0.9015
Epoch 454/500
829/829 [==============================] - 4s 5ms/step - loss: 8.6118e-07 -
accuracy: 1.0000 - val_loss: 0.9773 - val_accuracy: 0.9002
Epoch 455/500
829/829 [==============================] - 3s 4ms/step - loss: 6.5939e-07 -
accuracy: 1.0000 - val_loss: 1.0095 - val_accuracy: 0.8949
Epoch 456/500
829/829 [==============================] - 3s 3ms/step - loss: 3.9703e-04 -
accuracy: 0.9999 - val_loss: 1.0309 - val_accuracy: 0.8897
Epoch 457/500
829/829 [==============================] - 3s 3ms/step - loss: 3.7814e-06 -
accuracy: 1.0000 - val_loss: 0.9865 - val_accuracy: 0.8964
Epoch 458/500
829/829 [==============================] - 3s 4ms/step - loss: 1.2897e-06 -
accuracy: 1.0000 - val_loss: 0.9844 - val_accuracy: 0.8979
Epoch 459/500
829/829 [==============================] - 4s 5ms/step - loss: 7.2051e-07 -
accuracy: 1.0000 - val_loss: 1.0269 - val_accuracy: 0.8932
Epoch 460/500
829/829 [==============================] - 3s 4ms/step - loss: 6.3125e-07 -
accuracy: 1.0000 - val_loss: 1.0398 - val_accuracy: 0.8927
Epoch 461/500
829/829 [==============================] - 3s 4ms/step - loss: 5.3192e-07 -
accuracy: 1.0000 - val_loss: 0.9863 - val_accuracy: 0.8991
Epoch 462/500
829/829 [==============================] - 3s 3ms/step - loss: 3.2455e-04 -
accuracy: 0.9999 - val_loss: 0.9011 - val_accuracy: 0.9057
Epoch 463/500
829/829 [==============================] - 3s 4ms/step - loss: 3.9572e-04 -
accuracy: 0.9999 - val_loss: 1.1523 - val_accuracy: 0.8942
Epoch 464/500
829/829 [==============================] - 4s 5ms/step - loss: 1.5415e-06 -
accuracy: 1.0000 - val_loss: 1.1524 - val_accuracy: 0.8936
Epoch 465/500
829/829 [==============================] - 3s 4ms/step - loss: 1.2020e-06 -
accuracy: 1.0000 - val_loss: 1.1380 - val_accuracy: 0.8949
Epoch 466/500
829/829 [==============================] - 3s 4ms/step - loss: 9.8802e-07 -
accuracy: 1.0000 - val_loss: 1.1438 - val_accuracy: 0.8943
Epoch 467/500
829/829 [==============================] - 3s 4ms/step - loss: 8.0408e-07 -
accuracy: 1.0000 - val_loss: 1.1374 - val_accuracy: 0.8960
Epoch 468/500
829/829 [==============================] - 3s 4ms/step - loss: 7.7497e-07 -
```

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accuracy: 1.0000 - val_loss: 1.1315 - val_accuracy: 0.8962
Epoch 469/500
829/829 [==============================] - 4s 5ms/step - loss: 6.6726e-07 -
accuracy: 1.0000 - val_loss: 1.1324 - val_accuracy: 0.8946
Epoch 470/500
829/829 [==============================] - 4s 5ms/step - loss: 6.1027e-07 -
accuracy: 1.0000 - val_loss: 1.0956 - val_accuracy: 0.8953
Epoch 471/500
829/829 [==============================] - 3s 4ms/step - loss: 9.3552e-07 -
accuracy: 1.0000 - val_loss: 1.0934 - val_accuracy: 0.8964
Epoch 472/500
829/829 [==============================] - 3s 4ms/step - loss: 4.2333e-07 -
accuracy: 1.0000 - val_loss: 1.0788 - val_accuracy: 0.8986
Epoch 473/500
829/829 [==============================] - 3s 4ms/step - loss: 5.0002e-04 -
accuracy: 0.9999 - val_loss: 3.1365 - val_accuracy: 0.7390
Epoch 474/500
829/829 [==============================] - 4s 4ms/step - loss: 6.0933e-04 -
accuracy: 0.9998 - val_loss: 1.1930 - val_accuracy: 0.8768
Epoch 475/500
829/829 [==============================] - 4s 4ms/step - loss: 3.1867e-05 -
accuracy: 1.0000 - val_loss: 1.0241 - val_accuracy: 0.9005
Epoch 476/500
829/829 [==============================] - 3s 4ms/step - loss: 7.7192e-06 -
accuracy: 1.0000 - val_loss: 1.1450 - val_accuracy: 0.8959
Epoch 477/500
829/829 [==============================] - 3s 4ms/step - loss: 1.5304e-06 -
accuracy: 1.0000 - val_loss: 1.0731 - val_accuracy: 0.8968
Epoch 478/500
829/829 [==============================] - 3s 4ms/step - loss: 1.0823e-06 -
accuracy: 1.0000 - val_loss: 1.0620 - val_accuracy: 0.8972
Epoch 479/500
829/829 [==============================] - 3s 4ms/step - loss: 9.5654e-07 -
accuracy: 1.0000 - val_loss: 1.0552 - val_accuracy: 0.8984
Epoch 480/500
829/829 [==============================] - 4s 5ms/step - loss: 8.6985e-07 -
accuracy: 1.0000 - val_loss: 1.0549 - val_accuracy: 0.8974
Epoch 481/500
829/829 [==============================] - 3s 4ms/step - loss: 7.2144e-07 -
accuracy: 1.0000 - val_loss: 1.0397 - val_accuracy: 0.8992
Epoch 482/500
829/829 [==============================] - 3s 3ms/step - loss: 8.6752e-07 -
accuracy: 1.0000 - val_loss: 1.0229 - val_accuracy: 0.8994
Epoch 483/500
829/829 [==============================] - 3s 3ms/step - loss: 4.7406e-07 -
accuracy: 1.0000 - val_loss: 0.9960 - val_accuracy: 0.9015
Epoch 484/500
829/829 [==============================] - 3s 4ms/step - loss: 3.4767e-05 -
```

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accuracy: 1.0000 - val_loss: 0.9580 - val_accuracy: 0.9025
Epoch 485/500
829/829 [==============================] - 4s 5ms/step - loss: 5.4323e-04 -
accuracy: 0.9998 - val_loss: 0.9436 - val_accuracy: 0.8894
Epoch 486/500
829/829 [==============================] - 3s 4ms/step - loss: 5.8844e-06 -
accuracy: 1.0000 - val_loss: 0.8696 - val_accuracy: 0.8961
Epoch 487/500
829/829 [==============================] - 3s 4ms/step - loss: 2.6000e-06 -
accuracy: 1.0000 - val_loss: 0.8216 - val_accuracy: 0.9021
Epoch 488/500
829/829 [==============================] - 3s 3ms/step - loss: 1.6964e-06 -
accuracy: 1.0000 - val_loss: 0.9402 - val_accuracy: 0.8899
Epoch 489/500
829/829 [==============================] - 3s 4ms/step - loss: 1.2709e-06 -
accuracy: 1.0000 - val_loss: 0.8725 - val_accuracy: 0.8974
Epoch 490/500
829/829 [==============================] - 4s 5ms/step - loss: 1.1022e-06 -
accuracy: 1.0000 - val_loss: 0.8541 - val_accuracy: 0.9007
Epoch 491/500
829/829 [==============================] - 4s 5ms/step - loss: 1.0486e-06 -
accuracy: 1.0000 - val_loss: 0.8900 - val_accuracy: 0.8972
Epoch 492/500
829/829 [==============================] - 3s 3ms/step - loss: 3.5804e-04 -
accuracy: 0.9999 - val_loss: 1.1886 - val_accuracy: 0.8643
Epoch 493/500
829/829 [==============================] - 3s 4ms/step - loss: 7.0231e-04 -
accuracy: 0.9999 - val_loss: 0.8910 - val_accuracy: 0.8931
Epoch 494/500
829/829 [==============================] - 3s 4ms/step - loss: 1.1932e-05 -
accuracy: 1.0000 - val_loss: 0.8149 - val_accuracy: 0.9078
Epoch 495/500
829/829 [==============================] - 4s 4ms/step - loss: 6.3732e-06 -
accuracy: 1.0000 - val_loss: 0.8987 - val_accuracy: 0.8986
Epoch 496/500
829/829 [==============================] - 4s 5ms/step - loss: 1.5044e-06 -
accuracy: 1.0000 - val_loss: 0.8973 - val_accuracy: 0.9005
Epoch 497/500
829/829 [==============================] - 3s 4ms/step - loss: 1.5637e-06 -
accuracy: 1.0000 - val_loss: 0.9161 - val_accuracy: 0.8989
Epoch 498/500
829/829 [==============================] - 3s 4ms/step - loss: 1.8929e-04 -
accuracy: 0.9999 - val_loss: 0.7858 - val_accuracy: 0.9109
Epoch 499/500
829/829 [==============================] - 3s 4ms/step - loss: 7.0897e-05 -
accuracy: 1.0000 - val_loss: 0.8874 - val_accuracy: 0.9011
Epoch 500/500
829/829 [==============================] - 3s 4ms/step - loss: 2.5544e-06 -
```

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accuracy: 1.0000 - val_loss: 0.9403 - val_accuracy: 0.8966
466/466 [==============================] - 1s 2ms/step - loss: 0.1532 -
accuracy: 0.9765
Epoch 1/500
415/415 [==============================] - 3s 6ms/step - loss: 0.4560 -
accuracy: 0.8787 - val_loss: 1.1091 - val_accuracy: 0.6177
Epoch 2/500
415/415 [==============================] - 2s 5ms/step - loss: 0.1421 -
accuracy: 0.9675 - val_loss: 0.6459 - val_accuracy: 0.7595
Epoch 3/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0861 -
accuracy: 0.9799 - val_loss: 0.5419 - val_accuracy: 0.7876
Epoch 4/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0617 -
accuracy: 0.9849 - val_loss: 0.6309 - val_accuracy: 0.7785
Epoch 5/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0477 -
accuracy: 0.9881 - val_loss: 0.4023 - val_accuracy: 0.8390
Epoch 6/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0389 -
accuracy: 0.9904 - val_loss: 0.3000 - val_accuracy: 0.8748
Epoch 7/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0323 -
accuracy: 0.9918 - val_loss: 0.4139 - val_accuracy: 0.8475
Epoch 8/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0274 -
accuracy: 0.9929 - val_loss: 0.4178 - val_accuracy: 0.8515
Epoch 9/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0232 -
accuracy: 0.9939 - val_loss: 0.4358 - val_accuracy: 0.8480
Epoch 10/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0207 -
accuracy: 0.9947 - val_loss: 0.2624 - val_accuracy: 0.8974
Epoch 11/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0181 -
accuracy: 0.9952 - val_loss: 0.4642 - val_accuracy: 0.8466
Epoch 12/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0161 -
accuracy: 0.9960 - val_loss: 0.2644 - val_accuracy: 0.9004
Epoch 13/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0146 -
accuracy: 0.9963 - val_loss: 0.1974 - val_accuracy: 0.9205
Epoch 14/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0131 -
accuracy: 0.9968 - val_loss: 0.1727 - val_accuracy: 0.9297
Epoch 15/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0120 -
accuracy: 0.9971 - val_loss: 0.2167 - val_accuracy: 0.9177
```

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Epoch 16/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0110 -
accuracy: 0.9975 - val_loss: 0.2255 - val_accuracy: 0.9163
Epoch 17/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0104 -
accuracy: 0.9974 - val_loss: 0.2042 - val_accuracy: 0.9231
Epoch 18/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0096 -
accuracy: 0.9976 - val_loss: 0.2216 - val_accuracy: 0.9179
Epoch 19/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0085 -
accuracy: 0.9982 - val_loss: 0.3223 - val_accuracy: 0.8958
Epoch 20/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0083 -
accuracy: 0.9980 - val_loss: 0.3245 - val_accuracy: 0.8955
Epoch 21/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0073 -
accuracy: 0.9981 - val_loss: 0.1158 - val_accuracy: 0.9604
Epoch 22/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0071 -
accuracy: 0.9982 - val_loss: 0.2493 - val_accuracy: 0.9125
Epoch 23/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0069 -
accuracy: 0.9982 - val_loss: 0.1938 - val_accuracy: 0.9305
Epoch 24/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0061 -
accuracy: 0.9985 - val_loss: 0.1659 - val_accuracy: 0.9425
Epoch 25/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0074 -
accuracy: 0.9982 - val_loss: 0.1270 - val_accuracy: 0.9548
Epoch 26/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0055 -
accuracy: 0.9987 - val_loss: 0.2452 - val_accuracy: 0.9167
Epoch 27/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0051 -
accuracy: 0.9989 - val_loss: 0.1775 - val_accuracy: 0.9385
Epoch 28/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0048 -
accuracy: 0.9988 - val_loss: 0.1263 - val_accuracy: 0.9617
Epoch 29/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0047 -
accuracy: 0.9988 - val_loss: 0.3139 - val_accuracy: 0.9005
Epoch 30/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0044 -
accuracy: 0.9989 - val_loss: 0.3039 - val_accuracy: 0.9035
Epoch 31/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0040 -
accuracy: 0.9991 - val_loss: 0.1731 - val_accuracy: 0.9457
```

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Epoch 32/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0041 -
accuracy: 0.9991 - val_loss: 0.2964 - val_accuracy: 0.9075
Epoch 33/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0038 -
accuracy: 0.9991 - val_loss: 0.1922 - val_accuracy: 0.9376
Epoch 34/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0038 -
accuracy: 0.9990 - val_loss: 0.2956 - val_accuracy: 0.9081
Epoch 35/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0034 -
accuracy: 0.9992 - val_loss: 0.1842 - val_accuracy: 0.9432
Epoch 36/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0032 -
accuracy: 0.9991 - val_loss: 0.2335 - val_accuracy: 0.9289
Epoch 37/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0032 -
accuracy: 0.9994 - val_loss: 0.2545 - val_accuracy: 0.9183
Epoch 38/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0031 -
accuracy: 0.9993 - val_loss: 0.2325 - val_accuracy: 0.9280
Epoch 39/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0028 -
accuracy: 0.9994 - val_loss: 0.2697 - val_accuracy: 0.9177
Epoch 40/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0028 -
accuracy: 0.9993 - val_loss: 0.2690 - val_accuracy: 0.9164
Epoch 41/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0028 -
accuracy: 0.9994 - val_loss: 0.2283 - val_accuracy: 0.9305
Epoch 42/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0023 -
accuracy: 0.9995 - val_loss: 0.2599 - val_accuracy: 0.9260
Epoch 43/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0024 -
accuracy: 0.9995 - val_loss: 0.2077 - val_accuracy: 0.9454
Epoch 44/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0022 -
accuracy: 0.9995 - val_loss: 0.2452 - val_accuracy: 0.9326
Epoch 45/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0024 -
accuracy: 0.9993 - val_loss: 0.2959 - val_accuracy: 0.9173
Epoch 46/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0021 -
accuracy: 0.9994 - val_loss: 0.2827 - val_accuracy: 0.9192
Epoch 47/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0020 -
accuracy: 0.9994 - val_loss: 0.3098 - val_accuracy: 0.9126
```

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Epoch 48/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0021 -
accuracy: 0.9995 - val_loss: 0.4847 - val_accuracy: 0.8795
Epoch 49/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0019 -
accuracy: 0.9995 - val_loss: 0.2791 - val_accuracy: 0.9229
Epoch 50/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0020 -
accuracy: 0.9994 - val_loss: 0.3000 - val_accuracy: 0.9187
Epoch 51/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0016 -
accuracy: 0.9997 - val_loss: 0.3036 - val_accuracy: 0.9177
Epoch 52/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0017 -
accuracy: 0.9996 - val_loss: 0.2966 - val_accuracy: 0.9272
Epoch 53/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0020 -
accuracy: 0.9994 - val_loss: 0.3056 - val_accuracy: 0.9255
Epoch 54/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0015 -
accuracy: 0.9996 - val_loss: 0.2116 - val_accuracy: 0.9522
Epoch 55/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0014 -
accuracy: 0.9997 - val_loss: 0.3599 - val_accuracy: 0.9101
Epoch 56/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0013 -
accuracy: 0.9997 - val_loss: 0.2416 - val_accuracy: 0.9476
Epoch 57/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0012 -
accuracy: 0.9998 - val_loss: 0.2477 - val_accuracy: 0.9454
Epoch 58/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0014 -
accuracy: 0.9996 - val_loss: 0.3753 - val_accuracy: 0.9074
Epoch 59/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0016 -
accuracy: 0.9995 - val_loss: 0.3190 - val_accuracy: 0.9186
Epoch 60/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0013 -
accuracy: 0.9996 - val_loss: 0.3036 - val_accuracy: 0.9244
Epoch 61/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0010 -
accuracy: 0.9998 - val_loss: 0.2356 - val_accuracy: 0.9451
Epoch 62/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0011 -
accuracy: 0.9997 - val_loss: 0.4283 - val_accuracy: 0.8984
Epoch 63/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0013 -
accuracy: 0.9996 - val_loss: 0.4357 - val_accuracy: 0.8955
```

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Epoch 64/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0011 -
accuracy: 0.9998 - val_loss: 0.3633 - val_accuracy: 0.9106
Epoch 65/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0012 -
accuracy: 0.9997 - val_loss: 0.2625 - val_accuracy: 0.9408
Epoch 66/500
415/415 [==============================] - 2s 4ms/step - loss: 9.1102e-04 -
accuracy: 0.9998 - val_loss: 0.3455 - val_accuracy: 0.9174
Epoch 67/500
415/415 [==============================] - 2s 5ms/step - loss: 9.9328e-04 -
accuracy: 0.9998 - val_loss: 0.3460 - val_accuracy: 0.9179
Epoch 68/500
415/415 [==============================] - 2s 5ms/step - loss: 9.3920e-04 -
accuracy: 0.9998 - val_loss: 0.3105 - val_accuracy: 0.9318
Epoch 69/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0011 -
accuracy: 0.9997 - val_loss: 0.3556 - val_accuracy: 0.9168
Epoch 70/500
415/415 [==============================] - 2s 4ms/step - loss: 8.1431e-04 -
accuracy: 0.9998 - val_loss: 0.3803 - val_accuracy: 0.9101
Epoch 71/500
415/415 [==============================] - 2s 4ms/step - loss: 9.9016e-04 -
accuracy: 0.9998 - val_loss: 0.2766 - val_accuracy: 0.9337
Epoch 72/500
415/415 [==============================] - 2s 4ms/step - loss: 7.5174e-04 -
accuracy: 0.9999 - val_loss: 0.2904 - val_accuracy: 0.9287
Epoch 73/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0012 -
accuracy: 0.9997 - val_loss: 0.2695 - val_accuracy: 0.9405
Epoch 74/500
415/415 [==============================] - 2s 4ms/step - loss: 8.1113e-04 -
accuracy: 0.9998 - val_loss: 0.3207 - val_accuracy: 0.9264
Epoch 75/500
415/415 [==============================] - 2s 4ms/step - loss: 7.6981e-04 -
accuracy: 0.9998 - val_loss: 0.3684 - val_accuracy: 0.9168
Epoch 76/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0010 -
accuracy: 0.9998 - val_loss: 0.3073 - val_accuracy: 0.9442
Epoch 77/500
415/415 [==============================] - 2s 5ms/step - loss: 6.0239e-04 -
accuracy: 0.9998 - val_loss: 0.3497 - val_accuracy: 0.9251
Epoch 78/500
415/415 [==============================] - 2s 5ms/step - loss: 8.6863e-04 -
accuracy: 0.9997 - val_loss: 0.3479 - val_accuracy: 0.9253
Epoch 79/500
415/415 [==============================] - 2s 5ms/step - loss: 5.6089e-04 -
accuracy: 0.9999 - val_loss: 0.4387 - val_accuracy: 0.9049
```

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Epoch 80/500
415/415 [==============================] - 2s 4ms/step - loss: 7.0809e-04 -
accuracy: 0.9999 - val_loss: 0.2232 - val_accuracy: 0.9508
Epoch 81/500
415/415 [==============================] - 2s 4ms/step - loss: 8.8337e-04 -
accuracy: 0.9998 - val_loss: 0.2559 - val_accuracy: 0.9476
Epoch 82/500
415/415 [==============================] - 2s 4ms/step - loss: 7.3297e-04 -
accuracy: 0.9998 - val_loss: 0.2535 - val_accuracy: 0.9454
Epoch 83/500
415/415 [==============================] - 2s 4ms/step - loss: 5.1850e-04 -
accuracy: 0.9999 - val_loss: 0.2939 - val_accuracy: 0.9370
Epoch 84/500
415/415 [==============================] - 2s 4ms/step - loss: 9.0998e-04 -
accuracy: 0.9996 - val_loss: 0.5429 - val_accuracy: 0.8864
Epoch 85/500
415/415 [==============================] - 2s 4ms/step - loss: 8.5116e-04 -
accuracy: 0.9997 - val_loss: 0.3355 - val_accuracy: 0.9264
Epoch 86/500
415/415 [==============================] - 2s 5ms/step - loss: 8.4516e-04 -
accuracy: 0.9998 - val_loss: 0.2405 - val_accuracy: 0.9508
Epoch 87/500
415/415 [==============================] - 2s 5ms/step - loss: 4.4031e-04 -
accuracy: 0.9999 - val_loss: 0.4160 - val_accuracy: 0.9074
Epoch 88/500
415/415 [==============================] - 2s 5ms/step - loss: 5.3656e-04 -
accuracy: 0.9998 - val_loss: 0.3024 - val_accuracy: 0.9360
Epoch 89/500
415/415 [==============================] - 2s 5ms/step - loss: 4.6575e-04 -
accuracy: 0.9999 - val_loss: 0.3158 - val_accuracy: 0.9365
Epoch 90/500
415/415 [==============================] - 2s 4ms/step - loss: 3.7560e-04 -
accuracy: 0.9999 - val_loss: 0.4278 - val_accuracy: 0.9079
Epoch 91/500
415/415 [==============================] - 2s 4ms/step - loss: 6.5656e-04 -
accuracy: 0.9998 - val_loss: 0.9143 - val_accuracy: 0.8377
Epoch 92/500
415/415 [==============================] - 2s 4ms/step - loss: 0.0011 -
accuracy: 0.9998 - val_loss: 0.3129 - val_accuracy: 0.9371
Epoch 93/500
415/415 [==============================] - 2s 4ms/step - loss: 6.8068e-04 -
accuracy: 0.9998 - val_loss: 0.2451 - val_accuracy: 0.9472
Epoch 94/500
415/415 [==============================] - 2s 4ms/step - loss: 3.1270e-04 -
accuracy: 1.0000 - val_loss: 0.2617 - val_accuracy: 0.9455
Epoch 95/500
415/415 [==============================] - 2s 4ms/step - loss: 4.0516e-04 -
accuracy: 0.9999 - val_loss: 0.2954 - val_accuracy: 0.9340
```

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Epoch 96/500
415/415 [==============================] - 2s 5ms/step - loss: 3.7195e-04 -
accuracy: 0.9999 - val_loss: 0.3121 - val_accuracy: 0.9302
Epoch 97/500
415/415 [==============================] - 2s 5ms/step - loss: 3.9063e-04 -
accuracy: 0.9999 - val_loss: 0.3295 - val_accuracy: 0.9269
Epoch 98/500
415/415 [==============================] - 2s 5ms/step - loss: 4.6048e-04 -
accuracy: 0.9999 - val_loss: 0.2641 - val_accuracy: 0.9475
Epoch 99/500
415/415 [==============================] - 2s 4ms/step - loss: 5.2494e-04 -
accuracy: 0.9998 - val_loss: 0.2680 - val_accuracy: 0.9442
Epoch 100/500
415/415 [==============================] - 2s 4ms/step - loss: 4.9012e-04 -
accuracy: 0.9998 - val_loss: 0.2467 - val_accuracy: 0.9474
Epoch 101/500
415/415 [==============================] - 2s 4ms/step - loss: 6.4738e-04 -
accuracy: 0.9998 - val_loss: 0.3298 - val_accuracy: 0.9321
Epoch 102/500
415/415 [==============================] - 2s 4ms/step - loss: 2.9028e-04 -
accuracy: 0.9999 - val_loss: 0.3185 - val_accuracy: 0.9350
Epoch 103/500
415/415 [==============================] - 2s 4ms/step - loss: 2.5259e-04 -
accuracy: 1.0000 - val_loss: 0.3135 - val_accuracy: 0.9362
Epoch 104/500
415/415 [==============================] - 2s 4ms/step - loss: 4.3077e-04 -
accuracy: 0.9998 - val_loss: 0.2822 - val_accuracy: 0.9416
Epoch 105/500
415/415 [==============================] - 2s 5ms/step - loss: 3.6927e-04 -
accuracy: 0.9999 - val_loss: 0.2727 - val_accuracy: 0.9469
Epoch 106/500
415/415 [==============================] - 2s 5ms/step - loss: 3.2662e-04 -
accuracy: 0.9999 - val_loss: 0.3368 - val_accuracy: 0.9272
Epoch 107/500
415/415 [==============================] - 2s 5ms/step - loss: 4.0356e-04 -
accuracy: 0.9998 - val_loss: 0.5167 - val_accuracy: 0.8940
Epoch 108/500
415/415 [==============================] - 2s 5ms/step - loss: 0.0011 -
accuracy: 0.9997 - val_loss: 0.3137 - val_accuracy: 0.9308
Epoch 109/500
415/415 [==============================] - 2s 4ms/step - loss: 9.3054e-04 -
accuracy: 0.9997 - val_loss: 0.3008 - val_accuracy: 0.9402
Epoch 110/500
415/415 [==============================] - 2s 4ms/step - loss: 2.6993e-04 -
accuracy: 0.9999 - val_loss: 0.2863 - val_accuracy: 0.9436
Epoch 111/500
415/415 [==============================] - 2s 4ms/step - loss: 5.4697e-04 -
accuracy: 0.9998 - val_loss: 0.3358 - val_accuracy: 0.9299
```

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Epoch 112/500
415/415 [==============================] - 2s 4ms/step - loss: 4.2983e-04 -
accuracy: 0.9998 - val_loss: 0.2706 - val_accuracy: 0.9426
Epoch 113/500
415/415 [==============================] - 2s 4ms/step - loss: 2.8554e-04 -
accuracy: 0.9999 - val_loss: 0.3635 - val_accuracy: 0.9239
Epoch 114/500
415/415 [==============================] - 2s 4ms/step - loss: 4.6540e-04 -
accuracy: 0.9999 - val_loss: 0.5627 - val_accuracy: 0.8915
Epoch 115/500
415/415 [==============================] - 2s 5ms/step - loss: 3.7554e-04 -
accuracy: 0.9999 - val_loss: 0.3012 - val_accuracy: 0.9372
Epoch 116/500
415/415 [==============================] - 2s 5ms/step - loss: 1.9918e-04 -
accuracy: 0.9999 - val_loss: 0.4246 - val_accuracy: 0.9115
Epoch 117/500
415/415 [==============================] - 2s 5ms/step - loss: 2.4657e-04 -
accuracy: 0.9999 - val_loss: 0.3649 - val_accuracy: 0.9274
Epoch 118/500
415/415 [==============================] - 2s 4ms/step - loss: 2.6381e-04 -
accuracy: 0.9999 - val_loss: 0.2813 - val_accuracy: 0.9496
Epoch 119/500
415/415 [==============================] - 2s 4ms/step - loss: 4.1569e-04 -
accuracy: 0.9998 - val_loss: 0.4342 - val_accuracy: 0.9129
Epoch 120/500
415/415 [==============================] - 2s 4ms/step - loss: 2.7221e-04 -
accuracy: 1.0000 - val_loss: 0.3695 - val_accuracy: 0.9283
Epoch 121/500
415/415 [==============================] - 2s 4ms/step - loss: 2.4481e-04 -
accuracy: 1.0000 - val_loss: 0.2929 - val_accuracy: 0.9412
Epoch 122/500
415/415 [==============================] - 2s 4ms/step - loss: 5.6163e-04 -
accuracy: 0.9998 - val_loss: 0.2477 - val_accuracy: 0.9459
Epoch 123/500
415/415 [==============================] - 2s 4ms/step - loss: 3.4319e-04 -
accuracy: 0.9999 - val_loss: 0.2448 - val_accuracy: 0.9468
Epoch 124/500
415/415 [==============================] - 2s 5ms/step - loss: 1.5408e-04 -
accuracy: 1.0000 - val_loss: 0.3247 - val_accuracy: 0.9280
Epoch 125/500
415/415 [==============================] - 2s 5ms/step - loss: 7.5338e-04 -
accuracy: 0.9998 - val_loss: 0.3862 - val_accuracy: 0.9232
Epoch 126/500
415/415 [==============================] - 2s 5ms/step - loss: 4.9993e-04 -
accuracy: 0.9998 - val_loss: 0.2813 - val_accuracy: 0.9437
Epoch 127/500
415/415 [==============================] - 2s 5ms/step - loss: 2.4956e-04 -
accuracy: 1.0000 - val_loss: 0.2990 - val_accuracy: 0.9362
```

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Epoch 128/500
415/415 [==============================] - 2s 4ms/step - loss: 1.4686e-04 -
accuracy: 1.0000 - val_loss: 0.4017 - val_accuracy: 0.9143
Epoch 129/500
415/415 [==============================] - 2s 4ms/step - loss: 6.6182e-04 -
accuracy: 0.9998 - val_loss: 0.2344 - val_accuracy: 0.9503
Epoch 130/500
415/415 [==============================] - 2s 4ms/step - loss: 2.1428e-04 -
accuracy: 0.9999 - val_loss: 0.2546 - val_accuracy: 0.9451
Epoch 131/500
415/415 [==============================] - 2s 4ms/step - loss: 4.0277e-04 -
accuracy: 0.9999 - val_loss: 0.2969 - val_accuracy: 0.9359
Epoch 132/500
415/415 [==============================] - 2s 4ms/step - loss: 2.8670e-04 -
accuracy: 0.9999 - val_loss: 0.2734 - val_accuracy: 0.9405
Epoch 133/500
415/415 [==============================] - 2s 4ms/step - loss: 1.0621e-04 -
accuracy: 1.0000 - val_loss: 0.2682 - val_accuracy: 0.9420
Epoch 134/500
415/415 [==============================] - 2s 5ms/step - loss: 3.0298e-04 -
accuracy: 0.9999 - val_loss: 0.2922 - val_accuracy: 0.9368
Epoch 135/500
415/415 [==============================] - 2s 5ms/step - loss: 3.0003e-04 -
accuracy: 0.9999 - val_loss: 0.2661 - val_accuracy: 0.9459
Epoch 136/500
415/415 [==============================] - 2s 5ms/step - loss: 1.2695e-04 -
accuracy: 1.0000 - val_loss: 0.2645 - val_accuracy: 0.9438
Epoch 137/500
415/415 [==============================] - 2s 5ms/step - loss: 5.6417e-04 -
accuracy: 0.9999 - val_loss: 0.3247 - val_accuracy: 0.9338
Epoch 138/500
415/415 [==============================] - 2s 4ms/step - loss: 3.6796e-04 -
accuracy: 0.9999 - val_loss: 0.3414 - val_accuracy: 0.9292
Epoch 139/500
415/415 [==============================] - 2s 4ms/step - loss: 2.2783e-04 -
accuracy: 0.9999 - val_loss: 0.2905 - val_accuracy: 0.9395
Epoch 140/500
415/415 [==============================] - 2s 4ms/step - loss: 2.3306e-04 -
accuracy: 1.0000 - val_loss: 0.3037 - val_accuracy: 0.9366
Epoch 141/500
415/415 [==============================] - 2s 4ms/step - loss: 5.2276e-04 -
accuracy: 0.9998 - val_loss: 0.2977 - val_accuracy: 0.9387
Epoch 142/500
415/415 [==============================] - 2s 4ms/step - loss: 1.9728e-04 -
accuracy: 0.9999 - val_loss: 0.3231 - val_accuracy: 0.9347
Epoch 143/500
415/415 [==============================] - 2s 4ms/step - loss: 2.1421e-04 -
accuracy: 0.9999 - val_loss: 0.2448 - val_accuracy: 0.9558
```

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Epoch 144/500
415/415 [==============================] - 2s 5ms/step - loss: 3.6552e-04 -
accuracy: 0.9999 - val_loss: 0.3296 - val_accuracy: 0.9333
Epoch 145/500
415/415 [==============================] - 2s 5ms/step - loss: 9.8429e-04 -
accuracy: 0.9997 - val_loss: 0.3111 - val_accuracy: 0.9445
Epoch 146/500
415/415 [==============================] - 2s 5ms/step - loss: 1.4122e-04 -
accuracy: 1.0000 - val_loss: 0.3253 - val_accuracy: 0.9377
Epoch 147/500
415/415 [==============================] - 2s 4ms/step - loss: 2.7424e-04 -
accuracy: 0.9999 - val_loss: 0.3017 - val_accuracy: 0.9431
Epoch 148/500
415/415 [==============================] - 2s 4ms/step - loss: 1.0241e-04 -
accuracy: 1.0000 - val_loss: 0.3048 - val_accuracy: 0.9411
Epoch 149/500
415/415 [==============================] - 2s 4ms/step - loss: 1.2048e-04 -
accuracy: 0.9999 - val_loss: 0.3223 - val_accuracy: 0.9346
Epoch 150/500
415/415 [==============================] - 2s 4ms/step - loss: 1.2620e-04 -
accuracy: 1.0000 - val_loss: 0.2598 - val_accuracy: 0.9503
Epoch 151/500
415/415 [==============================] - 2s 4ms/step - loss: 3.7059e-04 -
accuracy: 0.9999 - val_loss: 0.2786 - val_accuracy: 0.9442
Epoch 152/500
415/415 [==============================] - 2s 4ms/step - loss: 4.3093e-04 -
accuracy: 0.9999 - val_loss: 0.2626 - val_accuracy: 0.9469
Epoch 153/500
415/415 [==============================] - 2s 4ms/step - loss: 8.8213e-05 -
accuracy: 1.0000 - val_loss: 0.2940 - val_accuracy: 0.9398
Epoch 154/500
415/415 [==============================] - 2s 5ms/step - loss: 1.7265e-04 -
accuracy: 0.9999 - val_loss: 0.2671 - val_accuracy: 0.9484
Epoch 155/500
415/415 [==============================] - 2s 5ms/step - loss: 1.2473e-04 -
accuracy: 1.0000 - val_loss: 0.2845 - val_accuracy: 0.9436
Epoch 156/500
415/415 [==============================] - 2s 5ms/step - loss: 7.2802e-05 -
accuracy: 1.0000 - val_loss: 0.2428 - val_accuracy: 0.9553
Epoch 157/500
415/415 [==============================] - 2s 5ms/step - loss: 1.4071e-04 -
accuracy: 1.0000 - val_loss: 0.3557 - val_accuracy: 0.9296
Epoch 158/500
415/415 [==============================] - 2s 4ms/step - loss: 7.5926e-04 -
accuracy: 0.9997 - val_loss: 0.2732 - val_accuracy: 0.9486
Epoch 159/500
415/415 [==============================] - 2s 4ms/step - loss: 1.8434e-04 -
accuracy: 0.9999 - val_loss: 0.3872 - val_accuracy: 0.9238
```

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Epoch 160/500
415/415 [==============================] - 2s 4ms/step - loss: 5.9586e-05 -
accuracy: 1.0000 - val_loss: 0.3067 - val_accuracy: 0.9408
Epoch 161/500
415/415 [==============================] - 2s 4ms/step - loss: 7.8140e-05 -
accuracy: 1.0000 - val_loss: 0.2752 - val_accuracy: 0.9506
Epoch 162/500
415/415 [==============================] - 2s 4ms/step - loss: 4.3797e-04 -
accuracy: 0.9998 - val_loss: 0.2488 - val_accuracy: 0.9540
Epoch 163/500
415/415 [==============================] - 2s 5ms/step - loss: 3.7161e-04 -
accuracy: 0.9999 - val_loss: 0.2892 - val_accuracy: 0.9455
Epoch 164/500
415/415 [==============================] - 2s 5ms/step - loss: 9.4568e-05 -
accuracy: 1.0000 - val_loss: 0.2712 - val_accuracy: 0.9493
Epoch 165/500
415/415 [==============================] - 2s 5ms/step - loss: 1.7844e-04 -
accuracy: 0.9999 - val_loss: 0.2043 - val_accuracy: 0.9666
Epoch 166/500
415/415 [==============================] - 2s 5ms/step - loss: 9.6736e-05 -
accuracy: 1.0000 - val_loss: 0.2718 - val_accuracy: 0.9502
Epoch 167/500
415/415 [==============================] - 2s 4ms/step - loss: 5.6236e-05 -
accuracy: 1.0000 - val_loss: 0.2965 - val_accuracy: 0.9439
Epoch 168/500
415/415 [==============================] - 2s 4ms/step - loss: 5.5192e-05 -
accuracy: 1.0000 - val_loss: 0.3199 - val_accuracy: 0.9381
Epoch 169/500
415/415 [==============================] - 2s 4ms/step - loss: 2.1217e-04 -
accuracy: 0.9999 - val_loss: 0.3009 - val_accuracy: 0.9444
Epoch 170/500
415/415 [==============================] - 2s 4ms/step - loss: 2.6528e-04 -
accuracy: 0.9999 - val_loss: 0.3914 - val_accuracy: 0.9214
Epoch 171/500
415/415 [==============================] - 2s 4ms/step - loss: 3.0087e-04 -
accuracy: 0.9999 - val_loss: 0.3392 - val_accuracy: 0.9322
Epoch 172/500
415/415 [==============================] - 2s 4ms/step - loss: 3.9494e-05 -
accuracy: 1.0000 - val_loss: 0.3363 - val_accuracy: 0.9312
Epoch 173/500
415/415 [==============================] - 2s 5ms/step - loss: 4.5322e-05 -
accuracy: 1.0000 - val_loss: 0.2668 - val_accuracy: 0.9471
Epoch 174/500
415/415 [==============================] - 2s 5ms/step - loss: 5.2592e-04 -
accuracy: 0.9999 - val_loss: 0.2045 - val_accuracy: 0.9635
Epoch 175/500
415/415 [==============================] - 2s 5ms/step - loss: 3.1421e-04 -
accuracy: 0.9999 - val_loss: 0.4057 - val_accuracy: 0.9200
```

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Epoch 176/500
415/415 [==============================] - 2s 5ms/step - loss: 2.2762e-04 -
accuracy: 0.9999 - val_loss: 0.2654 - val_accuracy: 0.9464
Epoch 177/500
415/415 [==============================] - 2s 4ms/step - loss: 1.0773e-04 -
accuracy: 1.0000 - val_loss: 0.2085 - val_accuracy: 0.9633
Epoch 178/500
415/415 [==============================] - 2s 4ms/step - loss: 2.5224e-04 -
accuracy: 0.9999 - val_loss: 0.2422 - val_accuracy: 0.9544
Epoch 179/500
415/415 [==============================] - 2s 4ms/step - loss: 1.3421e-04 -
accuracy: 0.9999 - val_loss: 0.2685 - val_accuracy: 0.9465
Epoch 180/500
415/415 [==============================] - 2s 4ms/step - loss: 2.8652e-05 -
accuracy: 1.0000 - val_loss: 0.2889 - val_accuracy: 0.9408
Epoch 181/500
415/415 [==============================] - 2s 4ms/step - loss: 3.2168e-05 -
accuracy: 1.0000 - val_loss: 0.2549 - val_accuracy: 0.9503
Epoch 182/500
415/415 [==============================] - 2s 5ms/step - loss: 1.6163e-04 -
accuracy: 1.0000 - val_loss: 0.2935 - val_accuracy: 0.9388
Epoch 183/500
415/415 [==============================] - 2s 5ms/step - loss: 3.2032e-05 -
accuracy: 1.0000 - val_loss: 0.2708 - val_accuracy: 0.9454
Epoch 184/500
415/415 [==============================] - 2s 5ms/step - loss: 5.4409e-04 -
accuracy: 0.9999 - val_loss: 0.3495 - val_accuracy: 0.9306
Epoch 185/500
415/415 [==============================] - 2s 5ms/step - loss: 2.8616e-05 -
accuracy: 1.0000 - val_loss: 0.3358 - val_accuracy: 0.9346
Epoch 186/500
415/415 [==============================] - 2s 4ms/step - loss: 2.9958e-04 -
accuracy: 0.9999 - val_loss: 0.3738 - val_accuracy: 0.9273
Epoch 187/500
415/415 [==============================] - 2s 4ms/step - loss: 3.3165e-05 -
accuracy: 1.0000 - val_loss: 0.3510 - val_accuracy: 0.9321
Epoch 188/500
415/415 [==============================] - 2s 4ms/step - loss: 3.7007e-05 -
accuracy: 1.0000 - val_loss: 0.3163 - val_accuracy: 0.9414
Epoch 189/500
415/415 [==============================] - 2s 4ms/step - loss: 4.0211e-04 -
accuracy: 0.9998 - val_loss: 0.3121 - val_accuracy: 0.9500
Epoch 190/500
415/415 [==============================] - 2s 4ms/step - loss: 3.2319e-04 -
accuracy: 0.9999 - val_loss: 0.2854 - val_accuracy: 0.9464
Epoch 191/500
415/415 [==============================] - 2s 4ms/step - loss: 1.6039e-04 -
accuracy: 1.0000 - val_loss: 0.3193 - val_accuracy: 0.9422
```

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Epoch 192/500
415/415 [==============================] - 2s 5ms/step - loss: 3.0298e-05 -
accuracy: 1.0000 - val_loss: 0.3203 - val_accuracy: 0.9408
Epoch 193/500
415/415 [==============================] - 2s 5ms/step - loss: 1.0015e-04 -
accuracy: 0.9999 - val_loss: 1.7999 - val_accuracy: 0.7910
Epoch 194/500
415/415 [==============================] - 3s 6ms/step - loss: 2.2403e-04 -
accuracy: 1.0000 - val_loss: 0.2791 - val_accuracy: 0.9500
Epoch 195/500
415/415 [==============================] - 2s 5ms/step - loss: 2.7564e-04 -
accuracy: 0.9999 - val_loss: 0.2408 - val_accuracy: 0.9595
Epoch 196/500
415/415 [==============================] - 2s 4ms/step - loss: 2.5350e-05 -
accuracy: 1.0000 - val_loss: 0.2672 - val_accuracy: 0.9533
Epoch 197/500
415/415 [==============================] - 2s 4ms/step - loss: 3.2771e-05 -
accuracy: 1.0000 - val_loss: 0.2647 - val_accuracy: 0.9552
Epoch 198/500
407/415 [============================>.] - ETA: 0s - loss: 3.7682e-05 -
accuracy: 1.0000
Reached 95.0% accuracy, so stopping training after 198 epochs!
415/415 [==============================] - 2s 4ms/step - loss: 3.8306e-05 -
accuracy: 1.0000 - val_loss: 0.2703 - val_accuracy: 0.9528
466/466 [==============================] - 1s 2ms/step - loss: 0.0835 -
accuracy: 0.9822
Epoch 1/500
208/208 [==============================] - 2s 6ms/step - loss: 0.6481 -
accuracy: 0.8190 - val_loss: 1.2197 - val_accuracy: 0.5663
Epoch 2/500
208/208 [==============================] - 1s 6ms/step - loss: 0.2297 -
accuracy: 0.9496 - val_loss: 0.9515 - val_accuracy: 0.6550
Epoch 3/500
208/208 [==============================] - 1s 7ms/step - loss: 0.1494 -
accuracy: 0.9658 - val_loss: 0.8395 - val_accuracy: 0.7006
Epoch 4/500
208/208 [==============================] - 1s 7ms/step - loss: 0.1092 -
accuracy: 0.9752 - val_loss: 0.6754 - val_accuracy: 0.7520
Epoch 5/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0857 -
accuracy: 0.9804 - val_loss: 0.7176 - val_accuracy: 0.7427
Epoch 6/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0699 -
accuracy: 0.9840 - val_loss: 0.6348 - val_accuracy: 0.7671
Epoch 7/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0594 -
accuracy: 0.9858 - val_loss: 0.5738 - val_accuracy: 0.7860
Epoch 8/500
```

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208/208 [==============================] - 1s 5ms/step - loss: 0.0514 -
accuracy: 0.9876 - val_loss: 0.5024 - val_accuracy: 0.8069
Epoch 9/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0451 -
accuracy: 0.9891 - val_loss: 0.4491 - val_accuracy: 0.8251
Epoch 10/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0402 -
accuracy: 0.9900 - val_loss: 0.4224 - val_accuracy: 0.8343
Epoch 11/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0358 -
accuracy: 0.9911 - val_loss: 0.5320 - val_accuracy: 0.8104
Epoch 12/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0323 -
accuracy: 0.9920 - val_loss: 0.4480 - val_accuracy: 0.8346
Epoch 13/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0291 -
accuracy: 0.9928 - val_loss: 0.4099 - val_accuracy: 0.8468
Epoch 14/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0265 -
accuracy: 0.9935 - val_loss: 0.3204 - val_accuracy: 0.8718
Epoch 15/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0242 -
accuracy: 0.9943 - val_loss: 0.2712 - val_accuracy: 0.8889
Epoch 16/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0221 -
accuracy: 0.9949 - val_loss: 0.3108 - val_accuracy: 0.8790
Epoch 17/500
208/208 [==============================] - 1s 6ms/step - loss: 0.0204 -
accuracy: 0.9950 - val_loss: 0.3769 - val_accuracy: 0.8618
Epoch 18/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0187 -
accuracy: 0.9956 - val_loss: 0.2238 - val_accuracy: 0.9081
Epoch 19/500
208/208 [==============================] - 1s 6ms/step - loss: 0.0173 -
accuracy: 0.9959 - val_loss: 0.3671 - val_accuracy: 0.8694
Epoch 20/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0160 -
accuracy: 0.9963 - val_loss: 0.1793 - val_accuracy: 0.9254
Epoch 21/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0150 -
accuracy: 0.9965 - val_loss: 0.2835 - val_accuracy: 0.8945
Epoch 22/500
208/208 [==============================] - 1s 6ms/step - loss: 0.0143 -
accuracy: 0.9965 - val_loss: 0.3648 - val_accuracy: 0.8715
Epoch 23/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0132 -
accuracy: 0.9971 - val_loss: 0.1742 - val_accuracy: 0.9280
Epoch 24/500
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208/208 [==============================] - 1s 5ms/step - loss: 0.0126 -
accuracy: 0.9970 - val_loss: 0.1560 - val_accuracy: 0.9337
Epoch 25/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0115 -
accuracy: 0.9975 - val_loss: 0.3392 - val_accuracy: 0.8821
Epoch 26/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0110 -
accuracy: 0.9975 - val_loss: 0.3021 - val_accuracy: 0.8896
Epoch 27/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0105 -
accuracy: 0.9977 - val_loss: 0.2618 - val_accuracy: 0.9051
Epoch 28/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0099 -
accuracy: 0.9977 - val_loss: 0.1130 - val_accuracy: 0.9525
Epoch 29/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0094 -
accuracy: 0.9979 - val_loss: 0.2476 - val_accuracy: 0.9091
Epoch 30/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0087 -
accuracy: 0.9979 - val_loss: 0.1232 - val_accuracy: 0.9486
Epoch 31/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0120 -
accuracy: 0.9966 - val_loss: 0.1542 - val_accuracy: 0.9376
Epoch 32/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0079 -
accuracy: 0.9981 - val_loss: 0.2058 - val_accuracy: 0.9225
Epoch 33/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0076 -
accuracy: 0.9982 - val_loss: 0.1605 - val_accuracy: 0.9348
Epoch 34/500
208/208 [==============================] - 2s 7ms/step - loss: 0.0071 -
accuracy: 0.9986 - val_loss: 0.2069 - val_accuracy: 0.9204
Epoch 35/500
208/208 [==============================] - 1s 6ms/step - loss: 0.0069 -
accuracy: 0.9985 - val_loss: 0.1697 - val_accuracy: 0.9308
Epoch 36/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0065 -
accuracy: 0.9985 - val_loss: 0.1618 - val_accuracy: 0.9335
Epoch 37/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0065 -
accuracy: 0.9985 - val_loss: 0.1393 - val_accuracy: 0.9417
Epoch 38/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0061 -
accuracy: 0.9986 - val_loss: 0.1926 - val_accuracy: 0.9248
Epoch 39/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0056 -
accuracy: 0.9988 - val_loss: 0.2418 - val_accuracy: 0.9115
Epoch 40/500
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208/208 [==============================] - 1s 5ms/step - loss: 0.0057 -
accuracy: 0.9987 - val_loss: 0.1117 - val_accuracy: 0.9546
Epoch 41/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0053 -
accuracy: 0.9987 - val_loss: 0.2512 - val_accuracy: 0.9091
Epoch 42/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0052 -
accuracy: 0.9987 - val_loss: 0.2623 - val_accuracy: 0.9067
Epoch 43/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0050 -
accuracy: 0.9988 - val_loss: 0.1569 - val_accuracy: 0.9366
Epoch 44/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0048 -
accuracy: 0.9988 - val_loss: 0.1628 - val_accuracy: 0.9345
Epoch 45/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0045 -
accuracy: 0.9990 - val_loss: 0.2034 - val_accuracy: 0.9237
Epoch 46/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0045 -
accuracy: 0.9990 - val_loss: 0.1926 - val_accuracy: 0.9261
Epoch 47/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0042 -
accuracy: 0.9991 - val_loss: 0.2043 - val_accuracy: 0.9233
Epoch 48/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0041 -
accuracy: 0.9990 - val_loss: 0.2020 - val_accuracy: 0.9242
Epoch 49/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0040 -
accuracy: 0.9991 - val_loss: 0.2357 - val_accuracy: 0.9165
Epoch 50/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0038 -
accuracy: 0.9991 - val_loss: 0.2122 - val_accuracy: 0.9224
Epoch 51/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0036 -
accuracy: 0.9992 - val_loss: 0.2121 - val_accuracy: 0.9223
Epoch 52/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0036 -
accuracy: 0.9993 - val_loss: 0.2073 - val_accuracy: 0.9237
Epoch 53/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0034 -
accuracy: 0.9993 - val_loss: 0.1214 - val_accuracy: 0.9537
Epoch 54/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0033 -
accuracy: 0.9992 - val_loss: 0.2289 - val_accuracy: 0.9190
Epoch 55/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0034 -
accuracy: 0.9991 - val_loss: 0.1137 - val_accuracy: 0.9571
Epoch 56/500
```

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208/208 [==============================] - 1s 5ms/step - loss: 0.0030 -
accuracy: 0.9993 - val_loss: 0.1347 - val_accuracy: 0.9497
Epoch 57/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0031 -
accuracy: 0.9994 - val_loss: 0.1542 - val_accuracy: 0.9412
Epoch 58/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0028 -
accuracy: 0.9994 - val_loss: 0.1755 - val_accuracy: 0.9351
Epoch 59/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0029 -
accuracy: 0.9994 - val_loss: 0.2179 - val_accuracy: 0.9221
Epoch 60/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0027 -
accuracy: 0.9994 - val_loss: 0.1818 - val_accuracy: 0.9335
Epoch 61/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0026 -
accuracy: 0.9994 - val_loss: 0.0783 - val_accuracy: 0.9734
Epoch 62/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0028 -
accuracy: 0.9994 - val_loss: 0.1085 - val_accuracy: 0.9589
Epoch 63/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0024 -
accuracy: 0.9994 - val_loss: 0.1379 - val_accuracy: 0.9499
Epoch 64/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0023 -
accuracy: 0.9995 - val_loss: 0.1196 - val_accuracy: 0.9570
Epoch 65/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0025 -
accuracy: 0.9993 - val_loss: 0.0653 - val_accuracy: 0.9785
Epoch 66/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0022 -
accuracy: 0.9995 - val_loss: 0.1488 - val_accuracy: 0.9463
Epoch 67/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0022 -
accuracy: 0.9995 - val_loss: 0.1934 - val_accuracy: 0.9327
Epoch 68/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0022 -
accuracy: 0.9995 - val_loss: 0.0865 - val_accuracy: 0.9700
Epoch 69/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0024 -
accuracy: 0.9994 - val_loss: 0.1180 - val_accuracy: 0.9566
Epoch 70/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0022 -
accuracy: 0.9995 - val_loss: 0.1715 - val_accuracy: 0.9394
Epoch 71/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0018 -
accuracy: 0.9997 - val_loss: 0.1322 - val_accuracy: 0.9529
Epoch 72/500
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208/208 [==============================] - 1s 5ms/step - loss: 0.0018 -
accuracy: 0.9996 - val_loss: 0.2673 - val_accuracy: 0.9158
Epoch 73/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0016 -
accuracy: 0.9997 - val_loss: 0.1228 - val_accuracy: 0.9555
Epoch 74/500
208/208 [==============================] - 1s 6ms/step - loss: 0.0016 -
accuracy: 0.9998 - val_loss: 0.0798 - val_accuracy: 0.9734
Epoch 75/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0015 -
accuracy: 0.9997 - val_loss: 0.4216 - val_accuracy: 0.8882
Epoch 76/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0027 -
accuracy: 0.9993 - val_loss: 0.1793 - val_accuracy: 0.9383
Epoch 77/500
208/208 [==============================] - 1s 6ms/step - loss: 0.0016 -
accuracy: 0.9997 - val_loss: 0.1200 - val_accuracy: 0.9563
Epoch 78/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0014 -
accuracy: 0.9997 - val_loss: 0.1557 - val_accuracy: 0.9453
Epoch 79/500
208/208 [==============================] - 1s 7ms/step - loss: 0.0013 -
accuracy: 0.9998 - val_loss: 0.0686 - val_accuracy: 0.9775
Epoch 80/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0012 -
accuracy: 0.9998 - val_loss: 0.1392 - val_accuracy: 0.9514
Epoch 81/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0013 -
accuracy: 0.9997 - val_loss: 0.1687 - val_accuracy: 0.9413
Epoch 82/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0013 -
accuracy: 0.9997 - val_loss: 0.0734 - val_accuracy: 0.9754
Epoch 83/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0013 -
accuracy: 0.9998 - val_loss: 0.0571 - val_accuracy: 0.9817
Epoch 84/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0012 -
accuracy: 0.9998 - val_loss: 0.1874 - val_accuracy: 0.9373
Epoch 85/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0011 -
accuracy: 0.9998 - val_loss: 0.0773 - val_accuracy: 0.9737
Epoch 86/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0012 -
accuracy: 0.9997 - val_loss: 0.1063 - val_accuracy: 0.9627
Epoch 87/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0011 -
accuracy: 0.9998 - val_loss: 0.0884 - val_accuracy: 0.9697
Epoch 88/500
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208/208 [==============================] - 1s 5ms/step - loss: 0.0013 -
accuracy: 0.9997 - val_loss: 0.3871 - val_accuracy: 0.8973
Epoch 89/500
208/208 [==============================] - 2s 8ms/step - loss: 0.0012 -
accuracy: 0.9998 - val_loss: 0.1175 - val_accuracy: 0.9573
Epoch 90/500
208/208 [==============================] - 2s 7ms/step - loss: 9.7011e-04 -
accuracy: 0.9998 - val_loss: 0.0903 - val_accuracy: 0.9679
Epoch 91/500
208/208 [==============================] - 1s 7ms/step - loss: 9.3956e-04 -
accuracy: 0.9998 - val_loss: 0.1743 - val_accuracy: 0.9420
Epoch 92/500
208/208 [==============================] - 2s 7ms/step - loss: 9.3987e-04 -
accuracy: 0.9998 - val_loss: 0.0792 - val_accuracy: 0.9738
Epoch 93/500
208/208 [==============================] - 2s 8ms/step - loss: 9.6537e-04 -
accuracy: 0.9998 - val_loss: 0.1354 - val_accuracy: 0.9531
Epoch 94/500
208/208 [==============================] - 1s 5ms/step - loss: 8.3862e-04 -
accuracy: 0.9998 - val_loss: 0.0890 - val_accuracy: 0.9693
Epoch 95/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0010 -
accuracy: 0.9998 - val_loss: 0.2814 - val_accuracy: 0.9198
Epoch 96/500
208/208 [==============================] - 1s 5ms/step - loss: 8.2893e-04 -
accuracy: 0.9998 - val_loss: 0.1526 - val_accuracy: 0.9489
Epoch 97/500
208/208 [==============================] - 1s 5ms/step - loss: 9.5471e-04 -
accuracy: 0.9998 - val_loss: 0.0986 - val_accuracy: 0.9660
Epoch 98/500
208/208 [==============================] - 1s 5ms/step - loss: 7.9420e-04 -
accuracy: 0.9998 - val_loss: 0.0985 - val_accuracy: 0.9660
Epoch 99/500
208/208 [==============================] - 1s 5ms/step - loss: 8.0301e-04 -
accuracy: 0.9999 - val_loss: 0.2303 - val_accuracy: 0.9304
Epoch 100/500
208/208 [==============================] - 1s 5ms/step - loss: 0.0010 -
accuracy: 0.9998 - val_loss: 0.0987 - val_accuracy: 0.9656
Epoch 101/500
208/208 [==============================] - 1s 5ms/step - loss: 8.7484e-04 -
accuracy: 0.9998 - val_loss: 0.0997 - val_accuracy: 0.9654
Epoch 102/500
208/208 [==============================] - 1s 5ms/step - loss: 7.8520e-04 -
accuracy: 0.9998 - val_loss: 0.1398 - val_accuracy: 0.9528
Epoch 103/500
208/208 [==============================] - 2s 7ms/step - loss: 7.9821e-04 -
accuracy: 0.9999 - val_loss: 0.0984 - val_accuracy: 0.9660
Epoch 104/500
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203/208 [============================>.] - ETA: 0s - loss: 6.7806e-04 -
accuracy: 0.9999
Reached 95.0% accuracy, so stopping training after 104 epochs!
208/208 [==============================] - 1s 7ms/step - loss: 6.7110e-04 -
accuracy: 0.9999 - val_loss: 0.0950 - val_accuracy: 0.9678
466/466 [==============================] - 1s 3ms/step - loss: 0.0660 -
accuracy: 0.9793
Epoch 1/500
104/104 [==============================] - 2s 12ms/step - loss: 0.8724 -
accuracy: 0.7440 - val_loss: 1.6767 - val_accuracy: 0.4512
Epoch 2/500
104/104 [==============================] - 1s 11ms/step - loss: 0.3464 -
accuracy: 0.9237 - val_loss: 1.2742 - val_accuracy: 0.5531
Epoch 3/500
104/104 [==============================] - 1s 8ms/step - loss: 0.2321 -
accuracy: 0.9506 - val_loss: 0.9763 - val_accuracy: 0.6415
Epoch 4/500
104/104 [==============================] - 1s 7ms/step - loss: 0.1734 -
accuracy: 0.9624 - val_loss: 0.9380 - val_accuracy: 0.6590
Epoch 5/500
104/104 [==============================] - 1s 8ms/step - loss: 0.1366 -
accuracy: 0.9697 - val_loss: 0.8276 - val_accuracy: 0.6980
Epoch 6/500
104/104 [==============================] - 1s 8ms/step - loss: 0.1118 -
accuracy: 0.9754 - val_loss: 0.8175 - val_accuracy: 0.7046
Epoch 7/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0941 -
accuracy: 0.9793 - val_loss: 0.7637 - val_accuracy: 0.7229
Epoch 8/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0812 -
accuracy: 0.9817 - val_loss: 0.6862 - val_accuracy: 0.7463
Epoch 9/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0715 -
accuracy: 0.9839 - val_loss: 0.6097 - val_accuracy: 0.7703
Epoch 10/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0639 -
accuracy: 0.9853 - val_loss: 0.6853 - val_accuracy: 0.7545
Epoch 11/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0578 -
accuracy: 0.9869 - val_loss: 0.6918 - val_accuracy: 0.7567
Epoch 12/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0527 -
accuracy: 0.9876 - val_loss: 0.4907 - val_accuracy: 0.8047
Epoch 13/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0483 -
accuracy: 0.9886 - val_loss: 0.5399 - val_accuracy: 0.7947
Epoch 14/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0447 -
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accuracy: 0.9894 - val_loss: 0.5074 - val_accuracy: 0.8044
Epoch 15/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0415 -
accuracy: 0.9901 - val_loss: 0.4517 - val_accuracy: 0.8210
Epoch 16/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0386 -
accuracy: 0.9905 - val_loss: 0.5196 - val_accuracy: 0.8049
Epoch 17/500
104/104 [==============================] - 1s 11ms/step - loss: 0.0361 -
accuracy: 0.9911 - val_loss: 0.5096 - val_accuracy: 0.8103
Epoch 18/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0335 -
accuracy: 0.9918 - val_loss: 0.4643 - val_accuracy: 0.8232
Epoch 19/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0314 -
accuracy: 0.9923 - val_loss: 0.4957 - val_accuracy: 0.8174
Epoch 20/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0295 -
accuracy: 0.9927 - val_loss: 0.3964 - val_accuracy: 0.8437
Epoch 21/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0278 -
accuracy: 0.9932 - val_loss: 0.4413 - val_accuracy: 0.8337
Epoch 22/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0263 -
accuracy: 0.9935 - val_loss: 0.4653 - val_accuracy: 0.8300
Epoch 23/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0248 -
accuracy: 0.9940 - val_loss: 0.3599 - val_accuracy: 0.8580
Epoch 24/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0234 -
accuracy: 0.9944 - val_loss: 0.3543 - val_accuracy: 0.8600
Epoch 25/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0222 -
accuracy: 0.9948 - val_loss: 0.4230 - val_accuracy: 0.8435
Epoch 26/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0211 -
accuracy: 0.9948 - val_loss: 0.3818 - val_accuracy: 0.8555
Epoch 27/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0201 -
accuracy: 0.9953 - val_loss: 0.2446 - val_accuracy: 0.8978
Epoch 28/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0192 -
accuracy: 0.9957 - val_loss: 0.3086 - val_accuracy: 0.8782
Epoch 29/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0183 -
accuracy: 0.9958 - val_loss: 0.2626 - val_accuracy: 0.8924
Epoch 30/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0175 -
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accuracy: 0.9957 - val_loss: 0.3591 - val_accuracy: 0.8662
Epoch 31/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0168 -
accuracy: 0.9960 - val_loss: 0.2691 - val_accuracy: 0.8920
Epoch 32/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0162 -
accuracy: 0.9961 - val_loss: 0.4178 - val_accuracy: 0.8534
Epoch 33/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0153 -
accuracy: 0.9965 - val_loss: 0.2676 - val_accuracy: 0.8943
Epoch 34/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0147 -
accuracy: 0.9969 - val_loss: 0.3509 - val_accuracy: 0.8723
Epoch 35/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0141 -
accuracy: 0.9967 - val_loss: 0.2503 - val_accuracy: 0.9007
Epoch 36/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0134 -
accuracy: 0.9972 - val_loss: 0.3395 - val_accuracy: 0.8769
Epoch 37/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0130 -
accuracy: 0.9971 - val_loss: 0.2882 - val_accuracy: 0.8918
Epoch 38/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0125 -
accuracy: 0.9975 - val_loss: 0.3238 - val_accuracy: 0.8833
Epoch 39/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0122 -
accuracy: 0.9973 - val_loss: 0.2085 - val_accuracy: 0.9177
Epoch 40/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0117 -
accuracy: 0.9973 - val_loss: 0.2241 - val_accuracy: 0.9139
Epoch 41/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0110 -
accuracy: 0.9976 - val_loss: 0.2963 - val_accuracy: 0.8932
Epoch 42/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0107 -
accuracy: 0.9977 - val_loss: 0.2252 - val_accuracy: 0.9143
Epoch 43/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0104 -
accuracy: 0.9978 - val_loss: 0.2870 - val_accuracy: 0.8967
Epoch 44/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0099 -
accuracy: 0.9979 - val_loss: 0.3463 - val_accuracy: 0.8823
Epoch 45/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0098 -
accuracy: 0.9977 - val_loss: 0.3132 - val_accuracy: 0.8917
Epoch 46/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0094 -
```

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accuracy: 0.9979 - val_loss: 0.1870 - val_accuracy: 0.9276
Epoch 47/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0089 -
accuracy: 0.9981 - val_loss: 0.1490 - val_accuracy: 0.9391
Epoch 48/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0086 -
accuracy: 0.9982 - val_loss: 0.2115 - val_accuracy: 0.9216
Epoch 49/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0086 -
accuracy: 0.9982 - val_loss: 0.3351 - val_accuracy: 0.8874
Epoch 50/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0080 -
accuracy: 0.9984 - val_loss: 0.1994 - val_accuracy: 0.9254
Epoch 51/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0078 -
accuracy: 0.9983 - val_loss: 0.1363 - val_accuracy: 0.9458
Epoch 52/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0076 -
accuracy: 0.9984 - val_loss: 0.1784 - val_accuracy: 0.9305
Epoch 53/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0073 -
accuracy: 0.9984 - val_loss: 0.1683 - val_accuracy: 0.9342
Epoch 54/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0071 -
accuracy: 0.9985 - val_loss: 0.2172 - val_accuracy: 0.9212
Epoch 55/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0069 -
accuracy: 0.9985 - val_loss: 0.2038 - val_accuracy: 0.9245
Epoch 56/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0067 -
accuracy: 0.9987 - val_loss: 0.2288 - val_accuracy: 0.9181
Epoch 57/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0064 -
accuracy: 0.9986 - val_loss: 0.1708 - val_accuracy: 0.9346
Epoch 58/500
104/104 [==============================] - 1s 11ms/step - loss: 0.0062 -
accuracy: 0.9986 - val_loss: 0.1856 - val_accuracy: 0.9299
Epoch 59/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0061 -
accuracy: 0.9987 - val_loss: 0.1202 - val_accuracy: 0.9544
Epoch 60/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0059 -
accuracy: 0.9988 - val_loss: 0.1510 - val_accuracy: 0.9412
Epoch 61/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0056 -
accuracy: 0.9988 - val_loss: 0.2101 - val_accuracy: 0.9242
Epoch 62/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0054 -
```

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accuracy: 0.9988 - val_loss: 0.1835 - val_accuracy: 0.9310
Epoch 63/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0054 -
accuracy: 0.9988 - val_loss: 0.2259 - val_accuracy: 0.9210
Epoch 64/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0052 -
accuracy: 0.9990 - val_loss: 0.1529 - val_accuracy: 0.9420
Epoch 65/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0051 -
accuracy: 0.9989 - val_loss: 0.2061 - val_accuracy: 0.9253
Epoch 66/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0049 -
accuracy: 0.9990 - val_loss: 0.1612 - val_accuracy: 0.9401
Epoch 67/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0047 -
accuracy: 0.9990 - val_loss: 0.1638 - val_accuracy: 0.9395
Epoch 68/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0047 -
accuracy: 0.9989 - val_loss: 0.1845 - val_accuracy: 0.9322
Epoch 69/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0044 -
accuracy: 0.9992 - val_loss: 0.1781 - val_accuracy: 0.9350
Epoch 70/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0044 -
accuracy: 0.9991 - val_loss: 0.1830 - val_accuracy: 0.9339
Epoch 71/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0041 -
accuracy: 0.9992 - val_loss: 0.2497 - val_accuracy: 0.9161
Epoch 72/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0040 -
accuracy: 0.9992 - val_loss: 0.1380 - val_accuracy: 0.9517
Epoch 73/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0040 -
accuracy: 0.9992 - val_loss: 0.1397 - val_accuracy: 0.9512
Epoch 74/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0039 -
accuracy: 0.9992 - val_loss: 0.1552 - val_accuracy: 0.9442
Epoch 75/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0040 -
accuracy: 0.9991 - val_loss: 0.1709 - val_accuracy: 0.9390
Epoch 76/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0036 -
accuracy: 0.9993 - val_loss: 0.1657 - val_accuracy: 0.9408
Epoch 77/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0035 -
accuracy: 0.9993 - val_loss: 0.1202 - val_accuracy: 0.9591
Epoch 78/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0036 -
```

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accuracy: 0.9993 - val_loss: 0.2481 - val_accuracy: 0.9171
Epoch 79/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0033 -
accuracy: 0.9994 - val_loss: 0.1586 - val_accuracy: 0.9458
Epoch 80/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0033 -
accuracy: 0.9994 - val_loss: 0.1721 - val_accuracy: 0.9405
Epoch 81/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0032 -
accuracy: 0.9994 - val_loss: 0.1661 - val_accuracy: 0.9423
Epoch 82/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0032 -
accuracy: 0.9994 - val_loss: 0.1203 - val_accuracy: 0.9609
Epoch 83/500
104/104 [==============================] - 1s 11ms/step - loss: 0.0030 -
accuracy: 0.9993 - val_loss: 0.1252 - val_accuracy: 0.9592
Epoch 84/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0030 -
accuracy: 0.9994 - val_loss: 0.1696 - val_accuracy: 0.9420
Epoch 85/500
104/104 [==============================] - 1s 11ms/step - loss: 0.0029 -
accuracy: 0.9995 - val_loss: 0.1556 - val_accuracy: 0.9468
Epoch 86/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0027 -
accuracy: 0.9995 - val_loss: 0.1316 - val_accuracy: 0.9574
Epoch 87/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0027 -
accuracy: 0.9994 - val_loss: 0.2281 - val_accuracy: 0.9234
Epoch 88/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0027 -
accuracy: 0.9994 - val_loss: 0.2645 - val_accuracy: 0.9134
Epoch 89/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0025 -
accuracy: 0.9996 - val_loss: 0.1637 - val_accuracy: 0.9458
Epoch 90/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0027 -
accuracy: 0.9993 - val_loss: 0.2697 - val_accuracy: 0.9123
Epoch 91/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0026 -
accuracy: 0.9995 - val_loss: 0.2282 - val_accuracy: 0.9248
Epoch 92/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0023 -
accuracy: 0.9996 - val_loss: 0.2056 - val_accuracy: 0.9313
Epoch 93/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0022 -
accuracy: 0.9996 - val_loss: 0.1779 - val_accuracy: 0.9402
Epoch 94/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0023 -
```

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accuracy: 0.9996 - val_loss: 0.1359 - val_accuracy: 0.9566
Epoch 95/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0021 -
accuracy: 0.9995 - val_loss: 0.1799 - val_accuracy: 0.9408
Epoch 96/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0022 -
accuracy: 0.9996 - val_loss: 0.1677 - val_accuracy: 0.9451
Epoch 97/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0022 -
accuracy: 0.9996 - val_loss: 0.1791 - val_accuracy: 0.9410
Epoch 98/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0019 -
accuracy: 0.9996 - val_loss: 0.1880 - val_accuracy: 0.9375
Epoch 99/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0020 -
accuracy: 0.9996 - val_loss: 0.2818 - val_accuracy: 0.9100
Epoch 100/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0021 -
accuracy: 0.9996 - val_loss: 0.1233 - val_accuracy: 0.9626
Epoch 101/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0019 -
accuracy: 0.9997 - val_loss: 0.2289 - val_accuracy: 0.9245
Epoch 102/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0018 -
accuracy: 0.9997 - val_loss: 0.3206 - val_accuracy: 0.9024
Epoch 103/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0018 -
accuracy: 0.9997 - val_loss: 0.2152 - val_accuracy: 0.9294
Epoch 104/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0019 -
accuracy: 0.9996 - val_loss: 0.2247 - val_accuracy: 0.9258
Epoch 105/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0019 -
accuracy: 0.9996 - val_loss: 0.2533 - val_accuracy: 0.9177
Epoch 106/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0017 -
accuracy: 0.9997 - val_loss: 0.1300 - val_accuracy: 0.9595
Epoch 107/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0017 -
accuracy: 0.9997 - val_loss: 0.1932 - val_accuracy: 0.9359
Epoch 108/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0016 -
accuracy: 0.9996 - val_loss: 0.2263 - val_accuracy: 0.9260
Epoch 109/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0015 -
accuracy: 0.9997 - val_loss: 0.1487 - val_accuracy: 0.9524
Epoch 110/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0015 -
```

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accuracy: 0.9998 - val_loss: 0.1948 - val_accuracy: 0.9356
Epoch 111/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0016 -
accuracy: 0.9996 - val_loss: 0.3693 - val_accuracy: 0.8907
Epoch 112/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0015 -
accuracy: 0.9998 - val_loss: 0.1819 - val_accuracy: 0.9414
Epoch 113/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0016 -
accuracy: 0.9996 - val_loss: 0.1306 - val_accuracy: 0.9595
Epoch 114/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0014 -
accuracy: 0.9998 - val_loss: 0.1800 - val_accuracy: 0.9408
Epoch 115/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0015 -
accuracy: 0.9997 - val_loss: 0.3261 - val_accuracy: 0.9017
Epoch 116/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0014 -
accuracy: 0.9997 - val_loss: 0.1877 - val_accuracy: 0.9390
Epoch 117/500
104/104 [==============================] - 1s 7ms/step - loss: 0.0012 -
accuracy: 0.9998 - val_loss: 0.1775 - val_accuracy: 0.9419
Epoch 118/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0013 -
accuracy: 0.9998 - val_loss: 0.1624 - val_accuracy: 0.9469
Epoch 119/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0015 -
accuracy: 0.9996 - val_loss: 0.1621 - val_accuracy: 0.9469
Epoch 120/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0011 -
accuracy: 0.9998 - val_loss: 0.2753 - val_accuracy: 0.9145
Epoch 121/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0014 -
accuracy: 0.9997 - val_loss: 0.1737 - val_accuracy: 0.9436
Epoch 122/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0012 -
accuracy: 0.9998 - val_loss: 0.1627 - val_accuracy: 0.9479
Epoch 123/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0010 -
accuracy: 0.9999 - val_loss: 0.2004 - val_accuracy: 0.9354
Epoch 124/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0012 -
accuracy: 0.9998 - val_loss: 0.1824 - val_accuracy: 0.9414
Epoch 125/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0012 -
accuracy: 0.9998 - val_loss: 0.1861 - val_accuracy: 0.9396
Epoch 126/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0010 -
```

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accuracy: 0.9998 - val_loss: 0.1866 - val_accuracy: 0.9395
Epoch 127/500
104/104 [==============================] - 1s 10ms/step - loss: 0.0010 -
accuracy: 0.9998 - val_loss: 0.1739 - val_accuracy: 0.9448
Epoch 128/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0010 -
accuracy: 0.9999 - val_loss: 0.1626 - val_accuracy: 0.9492
Epoch 129/500
104/104 [==============================] - 1s 8ms/step - loss: 0.0011 -
accuracy: 0.9998 - val_loss: 0.1837 - val_accuracy: 0.9421
Epoch 130/500
104/104 [==============================] - 1s 8ms/step - loss: 9.9676e-04 -
accuracy: 0.9998 - val_loss: 0.1685 - val_accuracy: 0.9474
Epoch 131/500
104/104 [==============================] - 1s 8ms/step - loss: 9.6460e-04 -
accuracy: 0.9998 - val_loss: 0.1638 - val_accuracy: 0.9499
Epoch 132/500
104/104 [==============================] - 1s 7ms/step - loss: 9.0876e-04 -
accuracy: 0.9999 - val_loss: 0.1682 - val_accuracy: 0.9480
Epoch 133/500
104/104 [==============================] - 1s 7ms/step - loss: 8.5944e-04 -
accuracy: 0.9999 - val_loss: 0.1670 - val_accuracy: 0.9476
Epoch 134/500
104/104 [==============================] - 1s 8ms/step - loss: 8.1932e-04 -
accuracy: 0.9999 - val_loss: 0.2606 - val_accuracy: 0.9192
Epoch 135/500
104/104 [==============================] - 1s 8ms/step - loss: 8.7498e-04 -
accuracy: 0.9999 - val_loss: 0.2366 - val_accuracy: 0.9274
Epoch 136/500
104/104 [==============================] - 1s 7ms/step - loss: 7.8523e-04 -
accuracy: 0.9999 - val_loss: 0.2575 - val_accuracy: 0.9204
Epoch 137/500
104/104 [==============================] - 1s 7ms/step - loss: 8.3196e-04 -
accuracy: 0.9998 - val_loss: 0.2872 - val_accuracy: 0.9122
Epoch 138/500
104/104 [==============================] - 1s 8ms/step - loss: 8.4342e-04 -
accuracy: 0.9999 - val_loss: 0.2263 - val_accuracy: 0.9278
Epoch 139/500
104/104 [==============================] - 1s 8ms/step - loss: 7.7635e-04 -
accuracy: 0.9999 - val_loss: 0.2739 - val_accuracy: 0.9162
Epoch 140/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0010 -
accuracy: 0.9998 - val_loss: 0.1848 - val_accuracy: 0.9404
Epoch 141/500
104/104 [==============================] - 1s 11ms/step - loss: 8.6316e-04 -
accuracy: 0.9998 - val_loss: 0.1986 - val_accuracy: 0.9377
Epoch 142/500
104/104 [==============================] - 1s 10ms/step - loss: 6.5271e-04 -
```

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accuracy: 0.9999 - val_loss: 0.1665 - val_accuracy: 0.9475
Epoch 143/500
104/104 [==============================] - 1s 10ms/step - loss: 7.4417e-04 -
accuracy: 0.9999 - val_loss: 0.2146 - val_accuracy: 0.9339
Epoch 144/500
104/104 [==============================] - 1s 11ms/step - loss: 7.0516e-04 -
accuracy: 0.9999 - val_loss: 0.2515 - val_accuracy: 0.9226
Epoch 145/500
104/104 [==============================] - 1s 9ms/step - loss: 0.0010 -
accuracy: 0.9997 - val_loss: 0.1694 - val_accuracy: 0.9472
Epoch 146/500
104/104 [==============================] - 1s 10ms/step - loss: 6.4582e-04 -
accuracy: 0.9999 - val_loss: 0.1853 - val_accuracy: 0.9433
Epoch 147/500
104/104 [==============================] - 1s 10ms/step - loss: 7.0508e-04 -
accuracy: 0.9998 - val_loss: 0.1939 - val_accuracy: 0.9412
Epoch 148/500
104/104 [==============================] - 1s 9ms/step - loss: 5.9828e-04 -
accuracy: 0.9999 - val_loss: 0.2091 - val_accuracy: 0.9356
Epoch 149/500
104/104 [==============================] - 1s 7ms/step - loss: 6.4434e-04 -
accuracy: 0.9999 - val_loss: 0.2132 - val_accuracy: 0.9337
Epoch 150/500
104/104 [==============================] - 1s 7ms/step - loss: 6.9002e-04 -
accuracy: 0.9999 - val_loss: 0.2264 - val_accuracy: 0.9306
Epoch 151/500
104/104 [==============================] - 1s 7ms/step - loss: 6.5406e-04 -
accuracy: 0.9999 - val_loss: 0.2149 - val_accuracy: 0.9340
Epoch 152/500
104/104 [==============================] - 1s 8ms/step - loss: 5.5988e-04 -
accuracy: 0.9999 - val_loss: 0.1717 - val_accuracy: 0.9483
Epoch 153/500
104/104 [==============================] - 1s 7ms/step - loss: 5.4820e-04 -
accuracy: 0.9999 - val_loss: 0.2479 - val_accuracy: 0.9243
Epoch 154/500
104/104 [==============================] - 1s 7ms/step - loss: 5.9255e-04 -
accuracy: 0.9999 - val_loss: 0.1742 - val_accuracy: 0.9478
Epoch 155/500
104/104 [==============================] - 1s 8ms/step - loss: 6.2285e-04 -
accuracy: 0.9999 - val_loss: 0.1659 - val_accuracy: 0.9506
Epoch 156/500
104/104 [==============================] - 1s 8ms/step - loss: 5.4931e-04 -
accuracy: 0.9999 - val_loss: 0.2062 - val_accuracy: 0.9382
Epoch 157/500
104/104 [==============================] - 1s 8ms/step - loss: 4.9277e-04 -
accuracy: 0.9999 - val_loss: 0.2291 - val_accuracy: 0.9313
Epoch 158/500
104/104 [==============================] - 1s 7ms/step - loss: 8.1879e-04 -
```

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accuracy: 0.9998 - val_loss: 0.1669 - val_accuracy: 0.9512
Epoch 159/500
104/104 [==============================] - 1s 8ms/step - loss: 4.1361e-04 -
accuracy: 1.0000 - val_loss: 0.1980 - val_accuracy: 0.9408
Epoch 160/500
104/104 [==============================] - 1s 8ms/step - loss: 6.1347e-04 -
accuracy: 0.9998 - val_loss: 0.2610 - val_accuracy: 0.9217
Epoch 161/500
104/104 [==============================] - 1s 10ms/step - loss: 6.3212e-04 -
accuracy: 0.9999 - val_loss: 0.2050 - val_accuracy: 0.9395
Epoch 162/500
104/104 [==============================] - 1s 9ms/step - loss: 4.8997e-04 -
accuracy: 0.9999 - val_loss: 0.2136 - val_accuracy: 0.9369
Epoch 163/500
104/104 [==============================] - 1s 11ms/step - loss: 4.2576e-04 -
accuracy: 0.9999 - val_loss: 0.2545 - val_accuracy: 0.9237
Epoch 164/500
104/104 [==============================] - 1s 11ms/step - loss: 5.4638e-04 -
accuracy: 0.9999 - val_loss: 0.1777 - val_accuracy: 0.9472
Epoch 165/500
104/104 [==============================] - 1s 10ms/step - loss: 4.4164e-04 -
accuracy: 0.9999 - val_loss: 0.2442 - val_accuracy: 0.9272
Epoch 166/500
104/104 [==============================] - 1s 11ms/step - loss: 4.7188e-04 -
accuracy: 0.9999 - val_loss: 0.2240 - val_accuracy: 0.9349
Epoch 167/500
104/104 [==============================] - 1s 10ms/step - loss: 4.4517e-04 -
accuracy: 0.9999 - val_loss: 0.1791 - val_accuracy: 0.9488
Epoch 168/500
104/104 [==============================] - 1s 10ms/step - loss: 3.9765e-04 -
accuracy: 0.9999 - val_loss: 0.2538 - val_accuracy: 0.9244
Epoch 169/500
104/104 [==============================] - 1s 8ms/step - loss: 5.0398e-04 -
accuracy: 0.9999 - val_loss: 0.2198 - val_accuracy: 0.9368
Epoch 170/500
104/104 [==============================] - 1s 8ms/step - loss: 4.8017e-04 -
accuracy: 0.9999 - val_loss: 0.2212 - val_accuracy: 0.9371
Epoch 171/500
104/104 [==============================] - 1s 7ms/step - loss: 4.4614e-04 -
accuracy: 0.9999 - val_loss: 0.1912 - val_accuracy: 0.9458
Epoch 172/500
104/104 [==============================] - 1s 8ms/step - loss: 3.8770e-04 -
accuracy: 0.9999 - val_loss: 0.2498 - val_accuracy: 0.9270
Epoch 173/500
104/104 [==============================] - 1s 7ms/step - loss: 4.5073e-04 -
accuracy: 0.9999 - val_loss: 0.2113 - val_accuracy: 0.9385
Epoch 174/500
104/104 [==============================] - 1s 8ms/step - loss: 3.2366e-04 -
```

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accuracy: 1.0000 - val_loss: 0.2269 - val_accuracy: 0.9341
Epoch 175/500
104/104 [==============================] - 1s 8ms/step - loss: 4.4286e-04 -
accuracy: 0.9999 - val_loss: 0.2366 - val_accuracy: 0.9313
Epoch 176/500
104/104 [==============================] - 1s 7ms/step - loss: 4.4923e-04 -
accuracy: 0.9998 - val_loss: 0.1867 - val_accuracy: 0.9447
Epoch 177/500
104/104 [==============================] - 1s 8ms/step - loss: 4.0882e-04 -
accuracy: 0.9999 - val_loss: 0.2256 - val_accuracy: 0.9362
Epoch 178/500
104/104 [==============================] - 1s 8ms/step - loss: 3.7675e-04 -
accuracy: 0.9999 - val_loss: 0.3046 - val_accuracy: 0.9134
Epoch 179/500
104/104 [==============================] - 1s 8ms/step - loss: 8.2694e-04 -
accuracy: 0.9998 - val_loss: 0.2924 - val_accuracy: 0.9166
Epoch 180/500
104/104 [==============================] - 1s 8ms/step - loss: 6.0184e-04 -
accuracy: 0.9998 - val_loss: 0.2001 - val_accuracy: 0.9414
Epoch 181/500
104/104 [==============================] - 1s 8ms/step - loss: 3.8344e-04 -
accuracy: 0.9999 - val_loss: 0.2141 - val_accuracy: 0.9386
Epoch 182/500
104/104 [==============================] - 1s 10ms/step - loss: 2.8356e-04 -
accuracy: 1.0000 - val_loss: 0.2400 - val_accuracy: 0.9309
Epoch 183/500
104/104 [==============================] - 1s 10ms/step - loss: 2.7827e-04 -
accuracy: 1.0000 - val_loss: 0.2218 - val_accuracy: 0.9371
Epoch 184/500
104/104 [==============================] - 1s 10ms/step - loss: 3.4955e-04 -
accuracy: 0.9999 - val_loss: 0.2484 - val_accuracy: 0.9318
Epoch 185/500
104/104 [==============================] - 1s 10ms/step - loss: 3.2071e-04 -
accuracy: 0.9999 - val_loss: 0.2280 - val_accuracy: 0.9382
Epoch 186/500
104/104 [==============================] - 1s 11ms/step - loss: 4.2951e-04 -
accuracy: 0.9999 - val_loss: 0.2585 - val_accuracy: 0.9300
Epoch 187/500
104/104 [==============================] - 1s 11ms/step - loss: 2.6221e-04 -
accuracy: 1.0000 - val_loss: 0.2127 - val_accuracy: 0.9441
Epoch 188/500
104/104 [==============================] - 1s 10ms/step - loss: 3.1061e-04 -
accuracy: 1.0000 - val_loss: 0.2232 - val_accuracy: 0.9392
Epoch 189/500
104/104 [==============================] - 1s 10ms/step - loss: 2.7969e-04 -
accuracy: 1.0000 - val_loss: 0.2331 - val_accuracy: 0.9371
Epoch 190/500
104/104 [==============================] - 1s 8ms/step - loss: 2.3938e-04 -
```

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accuracy: 1.0000 - val_loss: 0.2404 - val_accuracy: 0.9349
Epoch 191/500
104/104 [==============================] - 1s 7ms/step - loss: 2.4693e-04 -
accuracy: 1.0000 - val_loss: 0.3373 - val_accuracy: 0.9078
Epoch 192/500
104/104 [==============================] - 1s 7ms/step - loss: 3.1617e-04 -
accuracy: 0.9999 - val_loss: 0.2019 - val_accuracy: 0.9458
Epoch 193/500
104/104 [==============================] - 1s 7ms/step - loss: 3.0364e-04 -
accuracy: 0.9999 - val_loss: 0.2184 - val_accuracy: 0.9395
Epoch 194/500
104/104 [==============================] - 1s 8ms/step - loss: 3.6507e-04 -
accuracy: 0.9999 - val_loss: 0.2806 - val_accuracy: 0.9213
Epoch 195/500
104/104 [==============================] - 1s 8ms/step - loss: 2.8159e-04 -
accuracy: 1.0000 - val_loss: 0.2219 - val_accuracy: 0.9385
Epoch 196/500
104/104 [==============================] - 1s 8ms/step - loss: 2.2705e-04 -
accuracy: 1.0000 - val_loss: 0.2487 - val_accuracy: 0.9328
Epoch 197/500
104/104 [==============================] - 1s 8ms/step - loss: 2.1149e-04 -
accuracy: 1.0000 - val_loss: 0.2086 - val_accuracy: 0.9443
Epoch 198/500
104/104 [==============================] - 1s 7ms/step - loss: 3.6492e-04 -
accuracy: 0.9999 - val_loss: 0.2348 - val_accuracy: 0.9370
Epoch 199/500
104/104 [==============================] - 1s 7ms/step - loss: 2.8920e-04 -
accuracy: 0.9999 - val_loss: 0.2111 - val_accuracy: 0.9429
Epoch 200/500
104/104 [==============================] - 1s 8ms/step - loss: 2.6472e-04 -
accuracy: 0.9999 - val_loss: 0.2141 - val_accuracy: 0.9410
Epoch 201/500
104/104 [==============================] - 1s 8ms/step - loss: 2.3184e-04 -
accuracy: 0.9999 - val_loss: 0.1948 - val_accuracy: 0.9480
Epoch 202/500
104/104 [==============================] - 1s 10ms/step - loss: 3.8943e-04 -
accuracy: 1.0000 - val_loss: 0.2718 - val_accuracy: 0.9226
Epoch 203/500
104/104 [==============================] - 1s 10ms/step - loss: 3.8782e-04 -
accuracy: 0.9999 - val_loss: 0.1995 - val_accuracy: 0.9460
Epoch 204/500
104/104 [==============================] - 1s 12ms/step - loss: 1.7010e-04 -
accuracy: 1.0000 - val_loss: 0.2400 - val_accuracy: 0.9343
Epoch 205/500
104/104 [==============================] - 1s 10ms/step - loss: 1.7189e-04 -
accuracy: 1.0000 - val_loss: 0.2699 - val_accuracy: 0.9248
Epoch 206/500
104/104 [==============================] - 1s 10ms/step - loss: 1.8170e-04 -
```

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accuracy: 1.0000 - val_loss: 0.2227 - val_accuracy: 0.9398
Epoch 207/500
104/104 [==============================] - 1s 10ms/step - loss: 1.6875e-04 -
accuracy: 1.0000 - val_loss: 0.2688 - val_accuracy: 0.9270
Epoch 208/500
104/104 [==============================] - 1s 11ms/step - loss: 3.5629e-04 -
accuracy: 0.9999 - val_loss: 0.2122 - val_accuracy: 0.9407
Epoch 209/500
104/104 [==============================] - 1s 10ms/step - loss: 3.1769e-04 -
accuracy: 0.9999 - val_loss: 0.1690 - val_accuracy: 0.9542
Epoch 210/500
104/104 [==============================] - 1s 7ms/step - loss: 3.3702e-04 -
accuracy: 0.9999 - val_loss: 0.2017 - val_accuracy: 0.9453
Epoch 211/500
104/104 [==============================] - 1s 8ms/step - loss: 2.7081e-04 -
accuracy: 0.9999 - val_loss: 0.2448 - val_accuracy: 0.9338
Epoch 212/500
104/104 [==============================] - 1s 8ms/step - loss: 1.5688e-04 -
accuracy: 1.0000 - val_loss: 0.2296 - val_accuracy: 0.9376
Epoch 213/500
104/104 [==============================] - 1s 8ms/step - loss: 1.7267e-04 -
accuracy: 1.0000 - val_loss: 0.2629 - val_accuracy: 0.9292
Epoch 214/500
104/104 [==============================] - 1s 8ms/step - loss: 1.9498e-04 -
accuracy: 1.0000 - val_loss: 0.2152 - val_accuracy: 0.9445
Epoch 215/500
104/104 [==============================] - 1s 7ms/step - loss: 2.5432e-04 -
accuracy: 0.9999 - val_loss: 0.5005 - val_accuracy: 0.8797
Epoch 216/500
104/104 [==============================] - 1s 7ms/step - loss: 3.0157e-04 -
accuracy: 0.9999 - val_loss: 0.2118 - val_accuracy: 0.9458
Epoch 217/500
104/104 [==============================] - 1s 8ms/step - loss: 3.3074e-04 -
accuracy: 0.9999 - val_loss: 0.2483 - val_accuracy: 0.9358
Epoch 218/500
104/104 [==============================] - 1s 7ms/step - loss: 1.9209e-04 -
accuracy: 1.0000 - val_loss: 0.3451 - val_accuracy: 0.9094
Epoch 219/500
104/104 [==============================] - 1s 8ms/step - loss: 2.0308e-04 -
accuracy: 0.9999 - val_loss: 0.3574 - val_accuracy: 0.9068
Epoch 220/500
104/104 [==============================] - 1s 7ms/step - loss: 1.5317e-04 -
accuracy: 1.0000 - val_loss: 0.2674 - val_accuracy: 0.9312
Epoch 221/500
104/104 [==============================] - 1s 8ms/step - loss: 3.7219e-04 -
accuracy: 0.9999 - val_loss: 0.2491 - val_accuracy: 0.9351
Epoch 222/500
104/104 [==============================] - 1s 9ms/step - loss: 2.1908e-04 -
```

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accuracy: 1.0000 - val_loss: 0.2591 - val_accuracy: 0.9328
Epoch 223/500
104/104 [==============================] - 1s 10ms/step - loss: 1.7316e-04 -
accuracy: 1.0000 - val_loss: 0.2782 - val_accuracy: 0.9292
Epoch 224/500
104/104 [==============================] - 1s 9ms/step - loss: 1.8986e-04 -
accuracy: 1.0000 - val_loss: 0.3380 - val_accuracy: 0.9125
Epoch 225/500
104/104 [==============================] - 1s 10ms/step - loss: 1.9091e-04 -
accuracy: 0.9999 - val_loss: 0.2956 - val_accuracy: 0.9232
Epoch 226/500
104/104 [==============================] - 1s 10ms/step - loss: 3.5477e-04 -
accuracy: 0.9999 - val_loss: 0.1965 - val_accuracy: 0.9457
Epoch 227/500
104/104 [==============================] - 1s 9ms/step - loss: 1.6102e-04 -
accuracy: 1.0000 - val_loss: 0.2305 - val_accuracy: 0.9388
Epoch 228/500
104/104 [==============================] - 1s 10ms/step - loss: 1.5352e-04 -
accuracy: 1.0000 - val_loss: 0.2973 - val_accuracy: 0.9201
Epoch 229/500
104/104 [==============================] - 1s 10ms/step - loss: 1.6635e-04 -
accuracy: 1.0000 - val_loss: 0.2159 - val_accuracy: 0.9432
Epoch 230/500
104/104 [==============================] - 1s 11ms/step - loss: 1.4133e-04 -
accuracy: 1.0000 - val_loss: 0.2537 - val_accuracy: 0.9325
Epoch 231/500
104/104 [==============================] - 1s 8ms/step - loss: 1.3011e-04 -
accuracy: 1.0000 - val_loss: 0.2641 - val_accuracy: 0.9318
Epoch 232/500
104/104 [==============================] - 1s 8ms/step - loss: 1.7830e-04 -
accuracy: 0.9999 - val_loss: 0.2703 - val_accuracy: 0.9304
Epoch 233/500
104/104 [==============================] - 1s 7ms/step - loss: 1.5532e-04 -
accuracy: 1.0000 - val_loss: 0.2277 - val_accuracy: 0.9408
Epoch 234/500
104/104 [==============================] - 1s 7ms/step - loss: 1.4372e-04 -
accuracy: 1.0000 - val_loss: 0.2844 - val_accuracy: 0.9280
Epoch 235/500
104/104 [==============================] - 1s 8ms/step - loss: 1.4595e-04 -
accuracy: 1.0000 - val_loss: 0.2637 - val_accuracy: 0.9343
Epoch 236/500
104/104 [==============================] - 1s 8ms/step - loss: 2.2415e-04 -
accuracy: 1.0000 - val_loss: 0.2755 - val_accuracy: 0.9323
Epoch 237/500
104/104 [==============================] - 1s 7ms/step - loss: 9.2017e-05 -
accuracy: 1.0000 - val_loss: 0.3074 - val_accuracy: 0.9223
Epoch 238/500
104/104 [==============================] - 1s 8ms/step - loss: 9.5434e-05 -
```

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accuracy: 1.0000 - val_loss: 0.3301 - val_accuracy: 0.9162
Epoch 239/500
104/104 [==============================] - 1s 7ms/step - loss: 1.8367e-04 -
accuracy: 0.9999 - val_loss: 0.2730 - val_accuracy: 0.9333
Epoch 240/500
104/104 [==============================] - 1s 8ms/step - loss: 1.1823e-04 -
accuracy: 1.0000 - val_loss: 0.2931 - val_accuracy: 0.9291
Epoch 241/500
104/104 [==============================] - 1s 7ms/step - loss: 1.1428e-04 -
accuracy: 1.0000 - val_loss: 0.2679 - val_accuracy: 0.9353
Epoch 242/500
104/104 [==============================] - 1s 7ms/step - loss: 1.4255e-04 -
accuracy: 1.0000 - val_loss: 0.4160 - val_accuracy: 0.8989
Epoch 243/500
104/104 [==============================] - 1s 8ms/step - loss: 2.4592e-04 -
accuracy: 0.9999 - val_loss: 0.3128 - val_accuracy: 0.9205
Epoch 244/500
104/104 [==============================] - 1s 11ms/step - loss: 1.1872e-04 -
accuracy: 1.0000 - val_loss: 0.2915 - val_accuracy: 0.9275
Epoch 245/500
104/104 [==============================] - 1s 13ms/step - loss: 1.7660e-04 -
accuracy: 0.9999 - val_loss: 0.2981 - val_accuracy: 0.9266
Epoch 246/500
104/104 [==============================] - 1s 11ms/step - loss: 8.7988e-05 -
accuracy: 1.0000 - val_loss: 0.2896 - val_accuracy: 0.9299
Epoch 247/500
104/104 [==============================] - 1s 10ms/step - loss: 9.0841e-05 -
accuracy: 1.0000 - val_loss: 0.2738 - val_accuracy: 0.9336
Epoch 248/500
104/104 [==============================] - 1s 10ms/step - loss: 1.3446e-04 -
accuracy: 1.0000 - val_loss: 0.3453 - val_accuracy: 0.9171
Epoch 249/500
104/104 [==============================] - 1s 11ms/step - loss: 4.9225e-04 -
accuracy: 0.9998 - val_loss: 0.2907 - val_accuracy: 0.9269
Epoch 250/500
104/104 [==============================] - 1s 10ms/step - loss: 9.6681e-05 -
accuracy: 1.0000 - val_loss: 0.2622 - val_accuracy: 0.9342
Epoch 251/500
104/104 [==============================] - 1s 9ms/step - loss: 1.1310e-04 -
accuracy: 1.0000 - val_loss: 0.2325 - val_accuracy: 0.9426
Epoch 252/500
104/104 [==============================] - 1s 8ms/step - loss: 9.7114e-05 -
accuracy: 1.0000 - val_loss: 0.2997 - val_accuracy: 0.9282
Epoch 253/500
104/104 [==============================] - 1s 9ms/step - loss: 9.6015e-05 -
accuracy: 1.0000 - val_loss: 0.2950 - val_accuracy: 0.9292
Epoch 254/500
104/104 [==============================] - 1s 7ms/step - loss: 8.9200e-05 -
```

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accuracy: 1.0000 - val_loss: 0.3148 - val_accuracy: 0.9238
Epoch 255/500
104/104 [==============================] - 1s 8ms/step - loss: 1.5240e-04 -
accuracy: 1.0000 - val_loss: 0.2410 - val_accuracy: 0.9423
Epoch 256/500
104/104 [==============================] - 1s 8ms/step - loss: 2.2759e-04 -
accuracy: 0.9999 - val_loss: 0.2915 - val_accuracy: 0.9278
Epoch 257/500
104/104 [==============================] - 1s 8ms/step - loss: 9.0355e-05 -
accuracy: 1.0000 - val_loss: 0.2396 - val_accuracy: 0.9411
Epoch 258/500
104/104 [==============================] - 1s 8ms/step - loss: 2.6663e-04 -
accuracy: 0.9999 - val_loss: 0.2343 - val_accuracy: 0.9432
Epoch 259/500
104/104 [==============================] - 1s 8ms/step - loss: 2.6604e-04 -
accuracy: 0.9999 - val_loss: 0.2974 - val_accuracy: 0.9289
Epoch 260/500
104/104 [==============================] - 1s 8ms/step - loss: 1.5601e-04 -
accuracy: 0.9999 - val_loss: 0.2757 - val_accuracy: 0.9327
Epoch 261/500
104/104 [==============================] - 1s 8ms/step - loss: 6.5103e-05 -
accuracy: 1.0000 - val_loss: 0.2968 - val_accuracy: 0.9273
Epoch 262/500
104/104 [==============================] - 1s 7ms/step - loss: 6.9422e-05 -
accuracy: 1.0000 - val_loss: 0.3054 - val_accuracy: 0.9264
Epoch 263/500
104/104 [==============================] - 1s 9ms/step - loss: 1.0726e-04 -
accuracy: 1.0000 - val_loss: 0.3439 - val_accuracy: 0.9164
Epoch 264/500
104/104 [==============================] - 1s 11ms/step - loss: 1.0266e-04 -
accuracy: 1.0000 - val_loss: 0.3749 - val_accuracy: 0.9083
Epoch 265/500
104/104 [==============================] - 1s 10ms/step - loss: 8.2840e-05 -
accuracy: 1.0000 - val_loss: 0.3253 - val_accuracy: 0.9224
Epoch 266/500
104/104 [==============================] - 1s 10ms/step - loss: 1.7463e-04 -
accuracy: 1.0000 - val_loss: 0.5367 - val_accuracy: 0.8805
Epoch 267/500
104/104 [==============================] - 1s 11ms/step - loss: 1.9432e-04 -
accuracy: 0.9999 - val_loss: 0.2827 - val_accuracy: 0.9333
Epoch 268/500
104/104 [==============================] - 1s 11ms/step - loss: 9.3342e-05 -
accuracy: 1.0000 - val_loss: 0.2893 - val_accuracy: 0.9317
Epoch 269/500
104/104 [==============================] - 1s 12ms/step - loss: 6.0576e-05 -
accuracy: 1.0000 - val_loss: 0.3267 - val_accuracy: 0.9226
Epoch 270/500
104/104 [==============================] - 1s 11ms/step - loss: 1.1252e-04 -
```

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accuracy: 1.0000 - val_loss: 0.4044 - val_accuracy: 0.9057
Epoch 271/500
104/104 [==============================] - 1s 9ms/step - loss: 1.2406e-04 -
accuracy: 1.0000 - val_loss: 0.2903 - val_accuracy: 0.9327
Epoch 272/500
104/104 [==============================] - 1s 8ms/step - loss: 1.5470e-04 -
accuracy: 0.9999 - val_loss: 0.3367 - val_accuracy: 0.9223
Epoch 273/500
104/104 [==============================] - 1s 8ms/step - loss: 4.7630e-05 -
accuracy: 1.0000 - val_loss: 0.3536 - val_accuracy: 0.9183
Epoch 274/500
104/104 [==============================] - 1s 8ms/step - loss: 6.7015e-05 -
accuracy: 1.0000 - val_loss: 0.3071 - val_accuracy: 0.9291
Epoch 275/500
104/104 [==============================] - 1s 7ms/step - loss: 5.9198e-05 -
accuracy: 1.0000 - val_loss: 0.3314 - val_accuracy: 0.9229
Epoch 276/500
104/104 [==============================] - 1s 8ms/step - loss: 5.3751e-05 -
accuracy: 1.0000 - val_loss: 0.3292 - val_accuracy: 0.9251
Epoch 277/500
104/104 [==============================] - 1s 9ms/step - loss: 6.3570e-05 -
accuracy: 1.0000 - val_loss: 0.3720 - val_accuracy: 0.9146
Epoch 278/500
104/104 [==============================] - 1s 9ms/step - loss: 9.6142e-05 -
accuracy: 1.0000 - val_loss: 0.3824 - val_accuracy: 0.9109
Epoch 279/500
104/104 [==============================] - 1s 9ms/step - loss: 5.0305e-05 -
accuracy: 1.0000 - val_loss: 0.3465 - val_accuracy: 0.9203
Epoch 280/500
104/104 [==============================] - 1s 9ms/step - loss: 1.1875e-04 -
accuracy: 1.0000 - val_loss: 0.3424 - val_accuracy: 0.9263
Epoch 281/500
104/104 [==============================] - 1s 8ms/step - loss: 9.3109e-05 -
accuracy: 1.0000 - val_loss: 0.3322 - val_accuracy: 0.9292
Epoch 282/500
104/104 [==============================] - 1s 8ms/step - loss: 5.7331e-05 -
accuracy: 1.0000 - val_loss: 0.3117 - val_accuracy: 0.9312
Epoch 283/500
104/104 [==============================] - 1s 10ms/step - loss: 1.7663e-04 -
accuracy: 1.0000 - val_loss: 0.3900 - val_accuracy: 0.9071
Epoch 284/500
104/104 [==============================] - 1s 10ms/step - loss: 6.1380e-05 -
accuracy: 1.0000 - val_loss: 0.3183 - val_accuracy: 0.9259
Epoch 285/500
104/104 [==============================] - 1s 10ms/step - loss: 7.0417e-05 -
accuracy: 1.0000 - val_loss: 0.3062 - val_accuracy: 0.9303
Epoch 286/500
104/104 [==============================] - 1s 10ms/step - loss: 3.9416e-05 -
```

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accuracy: 1.0000 - val_loss: 0.3130 - val_accuracy: 0.9271
Epoch 287/500
104/104 [==============================] - 1s 10ms/step - loss: 7.2408e-05 -
accuracy: 1.0000 - val_loss: 0.2855 - val_accuracy: 0.9337
Epoch 288/500
104/104 [==============================] - 1s 11ms/step - loss: 2.6495e-04 -
accuracy: 0.9999 - val_loss: 0.3130 - val_accuracy: 0.9259
Epoch 289/500
104/104 [==============================] - 1s 11ms/step - loss: 4.3113e-05 -
accuracy: 1.0000 - val_loss: 0.3308 - val_accuracy: 0.9231
Epoch 290/500
104/104 [==============================] - 1s 11ms/step - loss: 8.0017e-05 -
accuracy: 1.0000 - val_loss: 0.3959 - val_accuracy: 0.9062
Epoch 291/500
104/104 [==============================] - 1s 10ms/step - loss: 7.5749e-05 -
accuracy: 1.0000 - val_loss: 0.3104 - val_accuracy: 0.9264
Epoch 292/500
104/104 [==============================] - 1s 8ms/step - loss: 5.6820e-05 -
accuracy: 1.0000 - val_loss: 0.2918 - val_accuracy: 0.9313
Epoch 293/500
104/104 [==============================] - 1s 9ms/step - loss: 4.1834e-05 -
accuracy: 1.0000 - val_loss: 0.3332 - val_accuracy: 0.9218
Epoch 294/500
104/104 [==============================] - 1s 7ms/step - loss: 8.9044e-05 -
accuracy: 1.0000 - val_loss: 0.3023 - val_accuracy: 0.9295
Epoch 295/500
104/104 [==============================] - 1s 8ms/step - loss: 1.3583e-04 -
accuracy: 0.9999 - val_loss: 0.3270 - val_accuracy: 0.9231
Epoch 296/500
104/104 [==============================] - 1s 7ms/step - loss: 8.6407e-05 -
accuracy: 1.0000 - val_loss: 0.4133 - val_accuracy: 0.9049
Epoch 297/500
104/104 [==============================] - 1s 9ms/step - loss: 3.5488e-04 -
accuracy: 0.9999 - val_loss: 0.3690 - val_accuracy: 0.9150
Epoch 298/500
104/104 [==============================] - 1s 8ms/step - loss: 7.0013e-05 -
accuracy: 1.0000 - val_loss: 0.3260 - val_accuracy: 0.9248
Epoch 299/500
104/104 [==============================] - 1s 9ms/step - loss: 4.0898e-05 -
accuracy: 1.0000 - val_loss: 0.3468 - val_accuracy: 0.9214
Epoch 300/500
104/104 [==============================] - 1s 9ms/step - loss: 7.2553e-05 -
accuracy: 1.0000 - val_loss: 0.3322 - val_accuracy: 0.9247
Epoch 301/500
104/104 [==============================] - 1s 8ms/step - loss: 6.6112e-05 -
accuracy: 1.0000 - val_loss: 0.3044 - val_accuracy: 0.9333
Epoch 302/500
104/104 [==============================] - 1s 7ms/step - loss: 1.1092e-04 -
```

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accuracy: 1.0000 - val_loss: 0.2982 - val_accuracy: 0.9365
Epoch 303/500
104/104 [==============================] - 1s 10ms/step - loss: 1.5104e-04 -
accuracy: 1.0000 - val_loss: 0.3522 - val_accuracy: 0.9208
Epoch 304/500
104/104 [==============================] - 1s 12ms/step - loss: 3.3751e-05 -
accuracy: 1.0000 - val_loss: 0.3530 - val_accuracy: 0.9213
Epoch 305/500
104/104 [==============================] - 1s 12ms/step - loss: 3.8437e-05 -
accuracy: 1.0000 - val_loss: 0.3231 - val_accuracy: 0.9292
Epoch 306/500
104/104 [==============================] - 1s 10ms/step - loss: 4.8549e-05 -
accuracy: 1.0000 - val_loss: 0.3417 - val_accuracy: 0.9238
Epoch 307/500
104/104 [==============================] - 1s 11ms/step - loss: 3.2544e-05 -
accuracy: 1.0000 - val_loss: 0.3721 - val_accuracy: 0.9177
Epoch 308/500
104/104 [==============================] - 1s 10ms/step - loss: 1.3170e-04 -
accuracy: 1.0000 - val_loss: 0.3638 - val_accuracy: 0.9189
Epoch 309/500
104/104 [==============================] - 1s 10ms/step - loss: 4.7171e-05 -
accuracy: 1.0000 - val_loss: 0.3649 - val_accuracy: 0.9179
Epoch 310/500
104/104 [==============================] - 1s 11ms/step - loss: 3.0741e-05 -
accuracy: 1.0000 - val_loss: 0.3521 - val_accuracy: 0.9209
Epoch 311/500
104/104 [==============================] - 1s 8ms/step - loss: 3.2306e-05 -
accuracy: 1.0000 - val_loss: 0.3755 - val_accuracy: 0.9154
Epoch 312/500
104/104 [==============================] - 1s 8ms/step - loss: 6.9808e-05 -
accuracy: 1.0000 - val_loss: 0.4350 - val_accuracy: 0.9011
Epoch 313/500
104/104 [==============================] - 1s 8ms/step - loss: 6.1011e-05 -
accuracy: 1.0000 - val_loss: 0.3405 - val_accuracy: 0.9221
Epoch 314/500
104/104 [==============================] - 1s 9ms/step - loss: 3.1011e-04 -
accuracy: 0.9999 - val_loss: 0.2308 - val_accuracy: 0.9448
Epoch 315/500
104/104 [==============================] - 1s 8ms/step - loss: 1.7176e-04 -
accuracy: 1.0000 - val_loss: 0.2140 - val_accuracy: 0.9501
Epoch 316/500
104/104 [==============================] - 1s 8ms/step - loss: 5.0289e-05 -
accuracy: 1.0000 - val_loss: 0.2916 - val_accuracy: 0.9294
Epoch 317/500
104/104 [==============================] - 1s 8ms/step - loss: 4.3033e-05 -
accuracy: 1.0000 - val_loss: 0.2505 - val_accuracy: 0.9420
Epoch 318/500
104/104 [==============================] - 1s 8ms/step - loss: 5.6743e-05 -
```

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accuracy: 1.0000 - val_loss: 0.2889 - val_accuracy: 0.9325
Epoch 319/500
104/104 [==============================] - 1s 9ms/step - loss: 2.9091e-05 -
accuracy: 1.0000 - val_loss: 0.2861 - val_accuracy: 0.9346
Epoch 320/500
104/104 [==============================] - 1s 9ms/step - loss: 8.5505e-05 -
accuracy: 1.0000 - val_loss: 0.2780 - val_accuracy: 0.9365
Epoch 321/500
104/104 [==============================] - 1s 8ms/step - loss: 6.8982e-05 -
accuracy: 1.0000 - val_loss: 0.2812 - val_accuracy: 0.9355
Epoch 322/500
104/104 [==============================] - 1s 9ms/step - loss: 3.2222e-05 -
accuracy: 1.0000 - val_loss: 0.3122 - val_accuracy: 0.9291
Epoch 323/500
104/104 [==============================] - 1s 11ms/step - loss: 2.7518e-05 -
accuracy: 1.0000 - val_loss: 0.3191 - val_accuracy: 0.9278
Epoch 324/500
104/104 [==============================] - 1s 10ms/step - loss: 2.9012e-05 -
accuracy: 1.0000 - val_loss: 0.3006 - val_accuracy: 0.9340
Epoch 325/500
104/104 [==============================] - 1s 13ms/step - loss: 4.8503e-05 -
accuracy: 1.0000 - val_loss: 0.3227 - val_accuracy: 0.9281
Epoch 326/500
104/104 [==============================] - 1s 12ms/step - loss: 3.2830e-05 -
accuracy: 1.0000 - val_loss: 0.3221 - val_accuracy: 0.9295
Epoch 327/500
104/104 [==============================] - 1s 13ms/step - loss: 3.2256e-05 -
accuracy: 1.0000 - val_loss: 0.3530 - val_accuracy: 0.9224
Epoch 328/500
104/104 [==============================] - 1s 11ms/step - loss: 3.1047e-05 -
accuracy: 1.0000 - val_loss: 0.3237 - val_accuracy: 0.9291
Epoch 329/500
104/104 [==============================] - 1s 10ms/step - loss: 4.6993e-05 -
accuracy: 1.0000 - val_loss: 0.3011 - val_accuracy: 0.9350
Epoch 330/500
104/104 [==============================] - 1s 9ms/step - loss: 2.7707e-05 -
accuracy: 1.0000 - val_loss: 0.3295 - val_accuracy: 0.9266
Epoch 331/500
104/104 [==============================] - 1s 9ms/step - loss: 2.2159e-05 -
accuracy: 1.0000 - val_loss: 0.3551 - val_accuracy: 0.9217
Epoch 332/500
104/104 [==============================] - 1s 8ms/step - loss: 2.2461e-05 -
accuracy: 1.0000 - val_loss: 0.3463 - val_accuracy: 0.9242
Epoch 333/500
104/104 [==============================] - 1s 8ms/step - loss: 2.4688e-05 -
accuracy: 1.0000 - val_loss: 0.3326 - val_accuracy: 0.9266
Epoch 334/500
104/104 [==============================] - 1s 9ms/step - loss: 9.0088e-05 -
```

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accuracy: 1.0000 - val_loss: 0.3459 - val_accuracy: 0.9230
Epoch 335/500
104/104 [==============================] - 1s 8ms/step - loss: 4.9538e-05 -
accuracy: 1.0000 - val_loss: 0.3758 - val_accuracy: 0.9151
Epoch 336/500
104/104 [==============================] - 1s 9ms/step - loss: 9.7907e-05 -
accuracy: 0.9999 - val_loss: 0.3495 - val_accuracy: 0.9235
Epoch 337/500
104/104 [==============================] - 1s 8ms/step - loss: 1.8525e-05 -
accuracy: 1.0000 - val_loss: 0.3470 - val_accuracy: 0.9248
Epoch 338/500
104/104 [==============================] - 1s 8ms/step - loss: 2.7949e-05 -
accuracy: 1.0000 - val_loss: 0.3217 - val_accuracy: 0.9323
Epoch 339/500
104/104 [==============================] - 1s 7ms/step - loss: 2.2026e-05 -
accuracy: 1.0000 - val_loss: 0.3332 - val_accuracy: 0.9268
Epoch 340/500
104/104 [==============================] - 1s 8ms/step - loss: 2.7351e-05 -
accuracy: 1.0000 - val_loss: 0.3544 - val_accuracy: 0.9230
Epoch 341/500
104/104 [==============================] - 1s 9ms/step - loss: 2.2102e-05 -
accuracy: 1.0000 - val_loss: 0.3211 - val_accuracy: 0.9309
Epoch 342/500
104/104 [==============================] - 1s 11ms/step - loss: 2.3352e-05 -
accuracy: 1.0000 - val_loss: 0.3570 - val_accuracy: 0.9233
Epoch 343/500
104/104 [==============================] - 1s 10ms/step - loss: 1.8893e-05 -
accuracy: 1.0000 - val_loss: 0.3407 - val_accuracy: 0.9273
Epoch 344/500
104/104 [==============================] - 1s 11ms/step - loss: 2.3215e-05 -
accuracy: 1.0000 - val_loss: 0.3458 - val_accuracy: 0.9254
Epoch 345/500
104/104 [==============================] - 1s 11ms/step - loss: 1.6310e-05 -
accuracy: 1.0000 - val_loss: 0.3420 - val_accuracy: 0.9266
Epoch 346/500
104/104 [==============================] - 1s 10ms/step - loss: 2.3828e-05 -
accuracy: 1.0000 - val_loss: 0.3459 - val_accuracy: 0.9257
Epoch 347/500
104/104 [==============================] - 1s 10ms/step - loss: 4.0820e-04 -
accuracy: 0.9999 - val_loss: 0.4166 - val_accuracy: 0.9182
Epoch 348/500
104/104 [==============================] - 1s 11ms/step - loss: 2.0235e-04 -
accuracy: 0.9999 - val_loss: 0.4022 - val_accuracy: 0.9206
Epoch 349/500
104/104 [==============================] - 1s 10ms/step - loss: 2.8550e-05 -
accuracy: 1.0000 - val_loss: 0.3933 - val_accuracy: 0.9202
Epoch 350/500
104/104 [==============================] - 1s 8ms/step - loss: 2.3069e-05 -
```

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accuracy: 1.0000 - val_loss: 0.3779 - val_accuracy: 0.9225
Epoch 351/500
104/104 [==============================] - 1s 9ms/step - loss: 2.0999e-05 -
accuracy: 1.0000 - val_loss: 0.3839 - val_accuracy: 0.9205
Epoch 352/500
104/104 [==============================] - 1s 8ms/step - loss: 2.0243e-05 -
accuracy: 1.0000 - val_loss: 0.3410 - val_accuracy: 0.9311
Epoch 353/500
104/104 [==============================] - 1s 8ms/step - loss: 2.5571e-04 -
accuracy: 1.0000 - val_loss: 0.3570 - val_accuracy: 0.9268
Epoch 354/500
104/104 [==============================] - 1s 9ms/step - loss: 1.7679e-05 -
accuracy: 1.0000 - val_loss: 0.3535 - val_accuracy: 0.9267
Epoch 355/500
104/104 [==============================] - 1s 8ms/step - loss: 2.0325e-05 -
accuracy: 1.0000 - val_loss: 0.3707 - val_accuracy: 0.9251
Epoch 356/500
104/104 [==============================] - 1s 7ms/step - loss: 1.8933e-05 -
accuracy: 1.0000 - val_loss: 0.3450 - val_accuracy: 0.9306
Epoch 357/500
104/104 [==============================] - 1s 8ms/step - loss: 2.0931e-05 -
accuracy: 1.0000 - val_loss: 0.3486 - val_accuracy: 0.9306
Epoch 358/500
104/104 [==============================] - 1s 8ms/step - loss: 1.7559e-05 -
accuracy: 1.0000 - val_loss: 0.3636 - val_accuracy: 0.9282
Epoch 359/500
104/104 [==============================] - 1s 8ms/step - loss: 1.6302e-05 -
accuracy: 1.0000 - val_loss: 0.3842 - val_accuracy: 0.9235
Epoch 360/500
104/104 [==============================] - 1s 8ms/step - loss: 1.8132e-05 -
accuracy: 1.0000 - val_loss: 0.3773 - val_accuracy: 0.9256
Epoch 361/500
104/104 [==============================] - 1s 10ms/step - loss: 1.5430e-05 -
accuracy: 1.0000 - val_loss: 0.4053 - val_accuracy: 0.9192
Epoch 362/500
104/104 [==============================] - 1s 12ms/step - loss: 9.0571e-05 -
accuracy: 1.0000 - val_loss: 0.3813 - val_accuracy: 0.9262
Epoch 363/500
104/104 [==============================] - 1s 10ms/step - loss: 3.2072e-05 -
accuracy: 1.0000 - val_loss: 0.3785 - val_accuracy: 0.9248
Epoch 364/500
104/104 [==============================] - 1s 9ms/step - loss: 2.2744e-05 -
accuracy: 1.0000 - val_loss: 0.3771 - val_accuracy: 0.9243
Epoch 365/500
104/104 [==============================] - 1s 11ms/step - loss: 2.0582e-05 -
accuracy: 1.0000 - val_loss: 0.3942 - val_accuracy: 0.9211
Epoch 366/500
104/104 [==============================] - 1s 10ms/step - loss: 1.5664e-05 -
```

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accuracy: 1.0000 - val_loss: 0.3974 - val_accuracy: 0.9206
Epoch 367/500
104/104 [==============================] - 1s 12ms/step - loss: 1.5718e-05 -
accuracy: 1.0000 - val_loss: 0.3683 - val_accuracy: 0.9299
Epoch 368/500
104/104 [==============================] - 1s 10ms/step - loss: 1.6644e-04 -
accuracy: 1.0000 - val_loss: 0.4383 - val_accuracy: 0.9153
Epoch 369/500
104/104 [==============================] - 1s 10ms/step - loss: 1.9635e-05 -
accuracy: 1.0000 - val_loss: 0.4417 - val_accuracy: 0.9140
Epoch 370/500
104/104 [==============================] - 1s 8ms/step - loss: 2.2325e-05 -
accuracy: 1.0000 - val_loss: 0.3908 - val_accuracy: 0.9235
Epoch 371/500
104/104 [==============================] - 1s 8ms/step - loss: 1.7471e-05 -
accuracy: 1.0000 - val_loss: 0.3936 - val_accuracy: 0.9232
Epoch 372/500
104/104 [==============================] - 1s 8ms/step - loss: 1.4273e-05 -
accuracy: 1.0000 - val_loss: 0.3993 - val_accuracy: 0.9211
Epoch 373/500
104/104 [==============================] - 1s 8ms/step - loss: 1.5301e-05 -
accuracy: 1.0000 - val_loss: 0.3751 - val_accuracy: 0.9285
Epoch 374/500
104/104 [==============================] - 1s 8ms/step - loss: 1.3886e-05 -
accuracy: 1.0000 - val_loss: 0.3733 - val_accuracy: 0.9282
Epoch 375/500
104/104 [==============================] - 1s 9ms/step - loss: 1.4637e-05 -
accuracy: 1.0000 - val_loss: 0.3988 - val_accuracy: 0.9232
Epoch 376/500
104/104 [==============================] - 1s 7ms/step - loss: 1.6165e-05 -
accuracy: 1.0000 - val_loss: 0.3692 - val_accuracy: 0.9305
Epoch 377/500
104/104 [==============================] - 1s 8ms/step - loss: 1.5054e-05 -
accuracy: 1.0000 - val_loss: 0.3967 - val_accuracy: 0.9233
Epoch 378/500
104/104 [==============================] - 1s 7ms/step - loss: 1.2299e-05 -
accuracy: 1.0000 - val_loss: 0.3883 - val_accuracy: 0.9264
Epoch 379/500
104/104 [==============================] - 1s 8ms/step - loss: 2.2254e-04 -
accuracy: 0.9999 - val_loss: 0.4263 - val_accuracy: 0.9187
Epoch 380/500
104/104 [==============================] - 1s 8ms/step - loss: 5.7716e-05 -
accuracy: 1.0000 - val_loss: 0.3496 - val_accuracy: 0.9328
Epoch 381/500
104/104 [==============================] - 1s 10ms/step - loss: 1.4741e-05 -
accuracy: 1.0000 - val_loss: 0.3389 - val_accuracy: 0.9339
Epoch 382/500
104/104 [==============================] - 1s 12ms/step - loss: 1.3249e-05 -
```

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accuracy: 1.0000 - val_loss: 0.3546 - val_accuracy: 0.9309
Epoch 383/500
104/104 [==============================] - 1s 10ms/step - loss: 1.4826e-05 -
accuracy: 1.0000 - val_loss: 0.4072 - val_accuracy: 0.9198
Epoch 384/500
104/104 [==============================] - 1s 10ms/step - loss: 1.1733e-05 -
accuracy: 1.0000 - val_loss: 0.3965 - val_accuracy: 0.9224
Epoch 385/500
104/104 [==============================] - 1s 12ms/step - loss: 1.2109e-05 -
accuracy: 1.0000 - val_loss: 0.3961 - val_accuracy: 0.9231
Epoch 386/500
104/104 [==============================] - 1s 10ms/step - loss: 1.2766e-05 -
accuracy: 1.0000 - val_loss: 0.4130 - val_accuracy: 0.9197
Epoch 387/500
104/104 [==============================] - 1s 11ms/step - loss: 1.3982e-05 -
accuracy: 1.0000 - val_loss: 0.3839 - val_accuracy: 0.9258
Epoch 388/500
104/104 [==============================] - 1s 11ms/step - loss: 1.3840e-05 -
accuracy: 1.0000 - val_loss: 0.3608 - val_accuracy: 0.9319
Epoch 389/500
104/104 [==============================] - 1s 9ms/step - loss: 5.3224e-04 -
accuracy: 0.9999 - val_loss: 0.3236 - val_accuracy: 0.9334
Epoch 390/500
104/104 [==============================] - 1s 8ms/step - loss: 2.5262e-04 -
accuracy: 0.9999 - val_loss: 0.3128 - val_accuracy: 0.9388
Epoch 391/500
104/104 [==============================] - 1s 9ms/step - loss: 1.9615e-05 -
accuracy: 1.0000 - val_loss: 0.2998 - val_accuracy: 0.9426
Epoch 392/500
104/104 [==============================] - 1s 8ms/step - loss: 1.4712e-05 -
accuracy: 1.0000 - val_loss: 0.3240 - val_accuracy: 0.9381
Epoch 393/500
104/104 [==============================] - 1s 7ms/step - loss: 1.2970e-05 -
accuracy: 1.0000 - val_loss: 0.3217 - val_accuracy: 0.9388
Epoch 394/500
104/104 [==============================] - 1s 8ms/step - loss: 1.3785e-05 -
accuracy: 1.0000 - val_loss: 0.3263 - val_accuracy: 0.9383
Epoch 395/500
104/104 [==============================] - 1s 8ms/step - loss: 1.4147e-05 -
accuracy: 1.0000 - val_loss: 0.3559 - val_accuracy: 0.9321
Epoch 396/500
104/104 [==============================] - 1s 9ms/step - loss: 1.4050e-05 -
accuracy: 1.0000 - val_loss: 0.3516 - val_accuracy: 0.9335
Epoch 397/500
104/104 [==============================] - 1s 8ms/step - loss: 1.3767e-05 -
accuracy: 1.0000 - val_loss: 0.3479 - val_accuracy: 0.9347
Epoch 398/500
104/104 [==============================] - 1s 7ms/step - loss: 1.2270e-05 -
```

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accuracy: 1.0000 - val_loss: 0.3485 - val_accuracy: 0.9355
Epoch 399/500
104/104 [==============================] - 1s 8ms/step - loss: 1.4466e-05 -
accuracy: 1.0000 - val_loss: 0.3629 - val_accuracy: 0.9326
Epoch 400/500
104/104 [==============================] - 1s 8ms/step - loss: 1.6924e-05 -
accuracy: 1.0000 - val_loss: 0.3700 - val_accuracy: 0.9315
Epoch 401/500
104/104 [==============================] - 1s 10ms/step - loss: 1.3705e-05 -
accuracy: 1.0000 - val_loss: 0.3663 - val_accuracy: 0.9321
Epoch 402/500
104/104 [==============================] - 1s 10ms/step - loss: 1.8831e-05 -
accuracy: 1.0000 - val_loss: 0.3706 - val_accuracy: 0.9315
Epoch 403/500
104/104 [==============================] - 1s 10ms/step - loss: 1.2932e-05 -
accuracy: 1.0000 - val_loss: 0.3810 - val_accuracy: 0.9301
Epoch 404/500
104/104 [==============================] - 1s 10ms/step - loss: 1.3142e-05 -
accuracy: 1.0000 - val_loss: 0.3845 - val_accuracy: 0.9296
Epoch 405/500
104/104 [==============================] - 1s 11ms/step - loss: 1.3651e-05 -
accuracy: 1.0000 - val_loss: 0.3859 - val_accuracy: 0.9300
Epoch 406/500
104/104 [==============================] - 1s 11ms/step - loss: 1.3103e-05 -
accuracy: 1.0000 - val_loss: 0.3920 - val_accuracy: 0.9288
Epoch 407/500
104/104 [==============================] - 1s 11ms/step - loss: 2.0082e-05 -
accuracy: 1.0000 - val_loss: 0.3914 - val_accuracy: 0.9291
Epoch 408/500
104/104 [==============================] - 1s 12ms/step - loss: 1.2230e-05 -
accuracy: 1.0000 - val_loss: 0.4116 - val_accuracy: 0.9245
Epoch 409/500
104/104 [==============================] - 1s 9ms/step - loss: 1.5460e-05 -
accuracy: 1.0000 - val_loss: 0.3950 - val_accuracy: 0.9289
Epoch 410/500
104/104 [==============================] - 1s 8ms/step - loss: 1.0519e-05 -
accuracy: 1.0000 - val_loss: 0.4155 - val_accuracy: 0.9243
Epoch 411/500
104/104 [==============================] - 1s 8ms/step - loss: 1.2634e-05 -
accuracy: 1.0000 - val_loss: 0.4005 - val_accuracy: 0.9285
Epoch 412/500
104/104 [==============================] - 1s 8ms/step - loss: 1.7102e-05 -
accuracy: 1.0000 - val_loss: 0.4266 - val_accuracy: 0.9227
Epoch 413/500
104/104 [==============================] - 1s 7ms/step - loss: 1.4313e-05 -
accuracy: 1.0000 - val_loss: 0.4256 - val_accuracy: 0.9229
Epoch 414/500
104/104 [==============================] - 1s 7ms/step - loss: 1.0709e-05 -
```

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accuracy: 1.0000 - val_loss: 0.4284 - val_accuracy: 0.9225
Epoch 415/500
104/104 [==============================] - 1s 8ms/step - loss: 1.4851e-05 -
accuracy: 1.0000 - val_loss: 0.3904 - val_accuracy: 0.9322
Epoch 416/500
104/104 [==============================] - 1s 8ms/step - loss: 2.9904e-05 -
accuracy: 1.0000 - val_loss: 0.4357 - val_accuracy: 0.9222
Epoch 417/500
104/104 [==============================] - 1s 8ms/step - loss: 2.8122e-04 -
accuracy: 0.9999 - val_loss: 0.4747 - val_accuracy: 0.9173
Epoch 418/500
104/104 [==============================] - 1s 8ms/step - loss: 1.9456e-04 -
accuracy: 0.9999 - val_loss: 0.4384 - val_accuracy: 0.9230
Epoch 419/500
104/104 [==============================] - 1s 8ms/step - loss: 3.1376e-05 -
accuracy: 1.0000 - val_loss: 0.4664 - val_accuracy: 0.9165
Epoch 420/500
104/104 [==============================] - 1s 9ms/step - loss: 7.6662e-05 -
accuracy: 1.0000 - val_loss: 0.4782 - val_accuracy: 0.9144
Epoch 421/500
104/104 [==============================] - 1s 10ms/step - loss: 3.0523e-05 -
accuracy: 1.0000 - val_loss: 0.4839 - val_accuracy: 0.9132
Epoch 422/500
104/104 [==============================] - 1s 12ms/step - loss: 1.7328e-05 -
accuracy: 1.0000 - val_loss: 0.4687 - val_accuracy: 0.9162
Epoch 423/500
104/104 [==============================] - 1s 10ms/step - loss: 1.2424e-05 -
accuracy: 1.0000 - val_loss: 0.4614 - val_accuracy: 0.9177
Epoch 424/500
104/104 [==============================] - 1s 10ms/step - loss: 1.5766e-05 -
accuracy: 1.0000 - val_loss: 0.4555 - val_accuracy: 0.9197
Epoch 425/500
104/104 [==============================] - 1s 12ms/step - loss: 1.0220e-05 -
accuracy: 1.0000 - val_loss: 0.5014 - val_accuracy: 0.9101
Epoch 426/500
104/104 [==============================] - 1s 10ms/step - loss: 1.3201e-05 -
accuracy: 1.0000 - val_loss: 0.4870 - val_accuracy: 0.9125
Epoch 427/500
104/104 [==============================] - 1s 10ms/step - loss: 1.0468e-05 -
accuracy: 1.0000 - val_loss: 0.4870 - val_accuracy: 0.9126
Epoch 428/500
104/104 [==============================] - 1s 10ms/step - loss: 1.1175e-05 -
accuracy: 1.0000 - val_loss: 0.4799 - val_accuracy: 0.9148
Epoch 429/500
104/104 [==============================] - 1s 10ms/step - loss: 9.6446e-06 -
accuracy: 1.0000 - val_loss: 0.4762 - val_accuracy: 0.9154
Epoch 430/500
104/104 [==============================] - 1s 9ms/step - loss: 1.0560e-05 -
```

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accuracy: 1.0000 - val_loss: 0.4497 - val_accuracy: 0.9211
Epoch 431/500
104/104 [==============================] - 1s 8ms/step - loss: 1.0074e-05 -
accuracy: 1.0000 - val_loss: 0.4876 - val_accuracy: 0.9131
Epoch 432/500
104/104 [==============================] - 1s 8ms/step - loss: 1.3113e-05 -
accuracy: 1.0000 - val_loss: 0.4995 - val_accuracy: 0.9100
Epoch 433/500
104/104 [==============================] - 1s 9ms/step - loss: 9.1400e-06 -
accuracy: 1.0000 - val_loss: 0.5318 - val_accuracy: 0.9036
Epoch 434/500
104/104 [==============================] - 1s 8ms/step - loss: 1.3924e-05 -
accuracy: 1.0000 - val_loss: 0.5021 - val_accuracy: 0.9108
Epoch 435/500
104/104 [==============================] - 1s 8ms/step - loss: 2.2195e-04 -
accuracy: 0.9999 - val_loss: 0.8286 - val_accuracy: 0.8620
Epoch 436/500
104/104 [==============================] - 1s 9ms/step - loss: 2.0229e-04 -
accuracy: 1.0000 - val_loss: 0.5494 - val_accuracy: 0.9037
Epoch 437/500
104/104 [==============================] - 1s 8ms/step - loss: 1.7178e-04 -
accuracy: 1.0000 - val_loss: 0.4911 - val_accuracy: 0.9143
Epoch 438/500
104/104 [==============================] - 1s 8ms/step - loss: 1.0340e-05 -
accuracy: 1.0000 - val_loss: 0.4845 - val_accuracy: 0.9159
Epoch 439/500
104/104 [==============================] - 1s 8ms/step - loss: 8.8680e-06 -
accuracy: 1.0000 - val_loss: 0.4817 - val_accuracy: 0.9164
Epoch 440/500
104/104 [==============================] - 1s 8ms/step - loss: 9.6847e-06 -
accuracy: 1.0000 - val_loss: 0.4681 - val_accuracy: 0.9193
Epoch 441/500
104/104 [==============================] - 1s 10ms/step - loss: 8.7454e-06 -
accuracy: 1.0000 - val_loss: 0.4692 - val_accuracy: 0.9192
Epoch 442/500
104/104 [==============================] - 1s 11ms/step - loss: 8.2173e-06 -
accuracy: 1.0000 - val_loss: 0.4694 - val_accuracy: 0.9187
Epoch 443/500
104/104 [==============================] - 1s 11ms/step - loss: 7.9203e-06 -
accuracy: 1.0000 - val_loss: 0.4704 - val_accuracy: 0.9185
Epoch 444/500
104/104 [==============================] - 1s 10ms/step - loss: 8.1643e-06 -
accuracy: 1.0000 - val_loss: 0.4751 - val_accuracy: 0.9175
Epoch 445/500
104/104 [==============================] - 1s 10ms/step - loss: 8.1432e-06 -
accuracy: 1.0000 - val_loss: 0.4670 - val_accuracy: 0.9194
Epoch 446/500
104/104 [==============================] - 1s 11ms/step - loss: 8.9561e-06 -
```

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accuracy: 1.0000 - val_loss: 0.4860 - val_accuracy: 0.9151
Epoch 447/500
104/104 [==============================] - 1s 10ms/step - loss: 8.8334e-06 -
accuracy: 1.0000 - val_loss: 0.4766 - val_accuracy: 0.9173
Epoch 448/500
104/104 [==============================] - 1s 11ms/step - loss: 8.6527e-06 -
accuracy: 1.0000 - val_loss: 0.4471 - val_accuracy: 0.9240
Epoch 449/500
104/104 [==============================] - 1s 10ms/step - loss: 8.1760e-06 -
accuracy: 1.0000 - val_loss: 0.4782 - val_accuracy: 0.9169
Epoch 450/500
104/104 [==============================] - 1s 9ms/step - loss: 7.1926e-06 -
accuracy: 1.0000 - val_loss: 0.4815 - val_accuracy: 0.9159
Epoch 451/500
104/104 [==============================] - 1s 8ms/step - loss: 1.0854e-05 -
accuracy: 1.0000 - val_loss: 0.4649 - val_accuracy: 0.9198
Epoch 452/500
104/104 [==============================] - 1s 9ms/step - loss: 4.8088e-05 -
accuracy: 1.0000 - val_loss: 0.4741 - val_accuracy: 0.9186
Epoch 453/500
104/104 [==============================] - 1s 8ms/step - loss: 1.2171e-05 -
accuracy: 1.0000 - val_loss: 0.4735 - val_accuracy: 0.9182
Epoch 454/500
104/104 [==============================] - 1s 7ms/step - loss: 8.7195e-06 -
accuracy: 1.0000 - val_loss: 0.4600 - val_accuracy: 0.9213
Epoch 455/500
104/104 [==============================] - 1s 8ms/step - loss: 8.0423e-06 -
accuracy: 1.0000 - val_loss: 0.4783 - val_accuracy: 0.9173
Epoch 456/500
104/104 [==============================] - 1s 8ms/step - loss: 1.4415e-05 -
accuracy: 1.0000 - val_loss: 0.4778 - val_accuracy: 0.9174
Epoch 457/500
104/104 [==============================] - 1s 9ms/step - loss: 2.5849e-04 -
accuracy: 0.9999 - val_loss: 0.4694 - val_accuracy: 0.9197
Epoch 458/500
104/104 [==============================] - 1s 8ms/step - loss: 4.8173e-04 -
accuracy: 0.9998 - val_loss: 0.4148 - val_accuracy: 0.9254
Epoch 459/500
104/104 [==============================] - 1s 8ms/step - loss: 2.3470e-05 -
accuracy: 1.0000 - val_loss: 0.4199 - val_accuracy: 0.9253
Epoch 460/500
104/104 [==============================] - 1s 8ms/step - loss: 1.1124e-05 -
accuracy: 1.0000 - val_loss: 0.4546 - val_accuracy: 0.9174
Epoch 461/500
104/104 [==============================] - 1s 8ms/step - loss: 9.1824e-06 -
accuracy: 1.0000 - val_loss: 0.4492 - val_accuracy: 0.9182
Epoch 462/500
104/104 [==============================] - 1s 10ms/step - loss: 8.9237e-06 -
```

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accuracy: 1.0000 - val_loss: 0.4528 - val_accuracy: 0.9180
Epoch 463/500
104/104 [==============================] - 1s 10ms/step - loss: 8.1618e-06 -
accuracy: 1.0000 - val_loss: 0.4380 - val_accuracy: 0.9226
Epoch 464/500
104/104 [==============================] - 1s 10ms/step - loss: 9.1149e-06 -
accuracy: 1.0000 - val_loss: 0.4632 - val_accuracy: 0.9171
Epoch 465/500
104/104 [==============================] - 1s 9ms/step - loss: 7.2333e-06 -
accuracy: 1.0000 - val_loss: 0.4546 - val_accuracy: 0.9189
Epoch 466/500
104/104 [==============================] - 1s 10ms/step - loss: 8.1500e-06 -
accuracy: 1.0000 - val_loss: 0.4594 - val_accuracy: 0.9178
Epoch 467/500
104/104 [==============================] - 1s 11ms/step - loss: 8.2156e-06 -
accuracy: 1.0000 - val_loss: 0.4498 - val_accuracy: 0.9205
Epoch 468/500
104/104 [==============================] - 1s 10ms/step - loss: 7.2297e-06 -
accuracy: 1.0000 - val_loss: 0.4789 - val_accuracy: 0.9144
Epoch 469/500
104/104 [==============================] - 1s 11ms/step - loss: 8.1442e-06 -
accuracy: 1.0000 - val_loss: 0.4932 - val_accuracy: 0.9118
Epoch 470/500
104/104 [==============================] - 1s 10ms/step - loss: 9.1097e-06 -
accuracy: 1.0000 - val_loss: 0.4886 - val_accuracy: 0.9120
Epoch 471/500
104/104 [==============================] - 1s 9ms/step - loss: 6.7551e-06 -
accuracy: 1.0000 - val_loss: 0.4918 - val_accuracy: 0.9116
Epoch 472/500
104/104 [==============================] - 1s 9ms/step - loss: 6.8773e-06 -
accuracy: 1.0000 - val_loss: 0.4644 - val_accuracy: 0.9177
Epoch 473/500
104/104 [==============================] - 1s 7ms/step - loss: 6.3880e-06 -
accuracy: 1.0000 - val_loss: 0.4560 - val_accuracy: 0.9201
Epoch 474/500
104/104 [==============================] - 1s 8ms/step - loss: 6.8415e-06 -
accuracy: 1.0000 - val_loss: 0.4818 - val_accuracy: 0.9148
Epoch 475/500
104/104 [==============================] - 1s 8ms/step - loss: 6.7818e-06 -
accuracy: 1.0000 - val_loss: 0.4876 - val_accuracy: 0.9134
Epoch 476/500
104/104 [==============================] - 1s 8ms/step - loss: 7.0969e-06 -
accuracy: 1.0000 - val_loss: 0.4887 - val_accuracy: 0.9135
Epoch 477/500
104/104 [==============================] - 1s 8ms/step - loss: 6.2503e-06 -
accuracy: 1.0000 - val_loss: 0.4879 - val_accuracy: 0.9143
Epoch 478/500
104/104 [==============================] - 1s 8ms/step - loss: 7.4253e-06 -
```

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accuracy: 1.0000 - val_loss: 0.5016 - val_accuracy: 0.9127
Epoch 479/500
104/104 [==============================] - 1s 9ms/step - loss: 4.3267e-04 -
accuracy: 0.9999 - val_loss: 0.3491 - val_accuracy: 0.9417
Epoch 480/500
104/104 [==============================] - 1s 8ms/step - loss: 1.7561e-05 -
accuracy: 1.0000 - val_loss: 0.3945 - val_accuracy: 0.9324
Epoch 481/500
104/104 [==============================] - 1s 9ms/step - loss: 6.7979e-06 -
accuracy: 1.0000 - val_loss: 0.3991 - val_accuracy: 0.9312
Epoch 482/500
104/104 [==============================] - 1s 10ms/step - loss: 6.9725e-06 -
accuracy: 1.0000 - val_loss: 0.4029 - val_accuracy: 0.9305
Epoch 483/500
104/104 [==============================] - 1s 11ms/step - loss: 6.8880e-06 -
accuracy: 1.0000 - val_loss: 0.4066 - val_accuracy: 0.9302
Epoch 484/500
104/104 [==============================] - 1s 10ms/step - loss: 7.5362e-06 -
accuracy: 1.0000 - val_loss: 0.4102 - val_accuracy: 0.9293
Epoch 485/500
104/104 [==============================] - 1s 10ms/step - loss: 6.2133e-06 -
accuracy: 1.0000 - val_loss: 0.4060 - val_accuracy: 0.9308
Epoch 486/500
104/104 [==============================] - 1s 9ms/step - loss: 6.2239e-06 -
accuracy: 1.0000 - val_loss: 0.4155 - val_accuracy: 0.9290
Epoch 487/500
104/104 [==============================] - 1s 10ms/step - loss: 6.0375e-06 -
accuracy: 1.0000 - val_loss: 0.4201 - val_accuracy: 0.9283
Epoch 488/500
104/104 [==============================] - 1s 12ms/step - loss: 6.1197e-06 -
accuracy: 1.0000 - val_loss: 0.4149 - val_accuracy: 0.9291
Epoch 489/500
104/104 [==============================] - 1s 11ms/step - loss: 5.9694e-06 -
accuracy: 1.0000 - val_loss: 0.4161 - val_accuracy: 0.9290
Epoch 490/500
104/104 [==============================] - 1s 10ms/step - loss: 5.7294e-06 -
accuracy: 1.0000 - val_loss: 0.4229 - val_accuracy: 0.9277
Epoch 491/500
104/104 [==============================] - 1s 9ms/step - loss: 5.8612e-06 -
accuracy: 1.0000 - val_loss: 0.4227 - val_accuracy: 0.9282
Epoch 492/500
104/104 [==============================] - 1s 9ms/step - loss: 5.5075e-06 -
accuracy: 1.0000 - val_loss: 0.4191 - val_accuracy: 0.9291
Epoch 493/500
104/104 [==============================] - 1s 8ms/step - loss: 5.3735e-06 -
accuracy: 1.0000 - val_loss: 0.4285 - val_accuracy: 0.9268
Epoch 494/500
104/104 [==============================] - 1s 8ms/step - loss: 6.0155e-06 -
```

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accuracy: 1.0000 - val_loss: 0.4357 - val_accuracy: 0.9260
Epoch 495/500
104/104 [==============================] - 1s 8ms/step - loss: 6.2851e-06 -
accuracy: 1.0000 - val_loss: 0.4404 - val_accuracy: 0.9254
Epoch 496/500
104/104 [==============================] - 1s 9ms/step - loss: 5.5802e-06 -
accuracy: 1.0000 - val_loss: 0.4347 - val_accuracy: 0.9269
Epoch 497/500
104/104 [==============================] - 1s 8ms/step - loss: 6.8266e-06 -
accuracy: 1.0000 - val_loss: 0.4372 - val_accuracy: 0.9257
Epoch 498/500
104/104 [==============================] - 1s 8ms/step - loss: 4.8273e-06 -
accuracy: 1.0000 - val_loss: 0.4539 - val_accuracy: 0.9228
Epoch 499/500
104/104 [==============================] - 1s 8ms/step - loss: 6.2312e-06 -
accuracy: 1.0000 - val_loss: 0.4470 - val_accuracy: 0.9245
Epoch 500/500
104/104 [==============================] - 1s 8ms/step - loss: 5.3616e-06 -
accuracy: 1.0000 - val_loss: 0.4609 - val_accuracy: 0.9217
466/466 [==============================] - 1s 2ms/step - loss: 0.1318 -
accuracy: 0.9763
Epoch 1/500
52/52 [==============================] - 2s 22ms/step - loss: 1.1432 - accuracy:
0.6458 - val_loss: 2.1512 - val_accuracy: 0.2702
Epoch 2/500
52/52 [==============================] - 1s 17ms/step - loss: 0.5356 - accuracy:
0.8664 - val_loss: 1.4970 - val_accuracy: 0.4843
Epoch 3/500
52/52 [==============================] - 1s 16ms/step - loss: 0.3690 - accuracy:
0.9199 - val_loss: 1.2163 - val_accuracy: 0.5622
Epoch 4/500
52/52 [==============================] - 1s 15ms/step - loss: 0.2874 - accuracy:
0.9382 - val_loss: 1.1158 - val_accuracy: 0.5942
Epoch 5/500
52/52 [==============================] - 1s 17ms/step - loss: 0.2364 - accuracy:
0.9497 - val_loss: 1.0146 - val_accuracy: 0.6269
Epoch 6/500
52/52 [==============================] - 1s 17ms/step - loss: 0.2014 - accuracy:
0.9565 - val_loss: 0.9050 - val_accuracy: 0.6637
Epoch 7/500
52/52 [==============================] - 1s 17ms/step - loss: 0.1743 - accuracy:
0.9624 - val_loss: 0.8716 - val_accuracy: 0.6795
Epoch 8/500
52/52 [==============================] - 1s 16ms/step - loss: 0.1531 - accuracy:
0.9669 - val_loss: 0.8165 - val_accuracy: 0.6986
Epoch 9/500
52/52 [==============================] - 1s 14ms/step - loss: 0.1361 - accuracy:
0.9699 - val_loss: 0.7896 - val_accuracy: 0.7103
```

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Epoch 10/500
52/52 [==============================] - 1s 12ms/step - loss: 0.1220 - accuracy:
0.9731 - val_loss: 0.8160 - val_accuracy: 0.7068
Epoch 11/500
52/52 [==============================] - 1s 12ms/step - loss: 0.1106 - accuracy:
0.9751 - val_loss: 0.7154 - val_accuracy: 0.7362
Epoch 12/500
52/52 [==============================] - 1s 12ms/step - loss: 0.1007 - accuracy:
0.9776 - val_loss: 0.6988 - val_accuracy: 0.7423
Epoch 13/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0924 - accuracy:
0.9793 - val_loss: 0.6463 - val_accuracy: 0.7564
Epoch 14/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0852 - accuracy:
0.9809 - val_loss: 0.6208 - val_accuracy: 0.7648
Epoch 15/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0793 - accuracy:
0.9823 - val_loss: 0.6430 - val_accuracy: 0.7623
Epoch 16/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0738 - accuracy:
0.9834 - val_loss: 0.5817 - val_accuracy: 0.7780
Epoch 17/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0692 - accuracy:
0.9845 - val_loss: 0.5941 - val_accuracy: 0.7767
Epoch 18/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0650 - accuracy:
0.9855 - val_loss: 0.5970 - val_accuracy: 0.7776
Epoch 19/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0613 - accuracy:
0.9861 - val_loss: 0.5224 - val_accuracy: 0.7966
Epoch 20/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0581 - accuracy:
0.9868 - val_loss: 0.5481 - val_accuracy: 0.7908
Epoch 21/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0551 - accuracy:
0.9873 - val_loss: 0.5118 - val_accuracy: 0.8011
Epoch 22/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0522 - accuracy:
0.9880 - val_loss: 0.4824 - val_accuracy: 0.8088
Epoch 23/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0499 - accuracy:
0.9883 - val_loss: 0.5423 - val_accuracy: 0.7967
Epoch 24/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0475 - accuracy:
0.9892 - val_loss: 0.4405 - val_accuracy: 0.8242
Epoch 25/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0455 - accuracy:
0.9894 - val_loss: 0.4727 - val_accuracy: 0.8154
```

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Epoch 26/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0434 - accuracy:
0.9897 - val_loss: 0.4278 - val_accuracy: 0.8296
Epoch 27/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0416 - accuracy:
0.9903 - val_loss: 0.4191 - val_accuracy: 0.8328
Epoch 28/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0400 - accuracy:
0.9904 - val_loss: 0.4445 - val_accuracy: 0.8279
Epoch 29/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0383 - accuracy:
0.9909 - val_loss: 0.4243 - val_accuracy: 0.8331
Epoch 30/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0368 - accuracy:
0.9911 - val_loss: 0.3679 - val_accuracy: 0.8502
Epoch 31/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0353 - accuracy:
0.9915 - val_loss: 0.4392 - val_accuracy: 0.8307
Epoch 32/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0340 - accuracy:
0.9917 - val_loss: 0.3390 - val_accuracy: 0.8615
Epoch 33/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0328 - accuracy:
0.9922 - val_loss: 0.3997 - val_accuracy: 0.8442
Epoch 34/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0316 - accuracy:
0.9929 - val_loss: 0.5097 - val_accuracy: 0.8172
Epoch 35/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0305 - accuracy:
0.9928 - val_loss: 0.4264 - val_accuracy: 0.8383
Epoch 36/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0294 - accuracy:
0.9931 - val_loss: 0.3473 - val_accuracy: 0.8617
Epoch 37/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0283 - accuracy:
0.9934 - val_loss: 0.3695 - val_accuracy: 0.8544
Epoch 38/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0274 - accuracy:
0.9937 - val_loss: 0.3316 - val_accuracy: 0.8663
Epoch 39/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0265 - accuracy:
0.9937 - val_loss: 0.3583 - val_accuracy: 0.8594
Epoch 40/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0256 - accuracy:
0.9939 - val_loss: 0.2917 - val_accuracy: 0.8810
Epoch 41/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0248 - accuracy:
0.9944 - val_loss: 0.3228 - val_accuracy: 0.8712
```

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Epoch 42/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0241 - accuracy:
0.9944 - val_loss: 0.3415 - val_accuracy: 0.8664
Epoch 43/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0232 - accuracy:
0.9947 - val_loss: 0.3722 - val_accuracy: 0.8592
Epoch 44/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0225 - accuracy:
0.9949 - val_loss: 0.3187 - val_accuracy: 0.8752
Epoch 45/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0218 - accuracy:
0.9951 - val_loss: 0.3351 - val_accuracy: 0.8714
Epoch 46/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0212 - accuracy:
0.9951 - val_loss: 0.3248 - val_accuracy: 0.8749
Epoch 47/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0206 - accuracy:
0.9955 - val_loss: 0.3262 - val_accuracy: 0.8755
Epoch 48/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0200 - accuracy:
0.9954 - val_loss: 0.2850 - val_accuracy: 0.8892
Epoch 49/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0194 - accuracy:
0.9957 - val_loss: 0.2962 - val_accuracy: 0.8865
Epoch 50/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0189 - accuracy:
0.9958 - val_loss: 0.3578 - val_accuracy: 0.8696
Epoch 51/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0183 - accuracy:
0.9959 - val_loss: 0.2742 - val_accuracy: 0.8940
Epoch 52/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0179 - accuracy:
0.9962 - val_loss: 0.2626 - val_accuracy: 0.8982
Epoch 53/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0174 - accuracy:
0.9962 - val_loss: 0.2133 - val_accuracy: 0.9137
Epoch 54/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0170 - accuracy:
0.9962 - val_loss: 0.2414 - val_accuracy: 0.9060
Epoch 55/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0163 - accuracy:
0.9963 - val_loss: 0.1928 - val_accuracy: 0.9221
Epoch 56/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0162 - accuracy:
0.9962 - val_loss: 0.2232 - val_accuracy: 0.9124
Epoch 57/500
52/52 [==============================] - 1s 18ms/step - loss: 0.0156 - accuracy:
0.9967 - val_loss: 0.2645 - val_accuracy: 0.8998
```

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Epoch 58/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0152 - accuracy:
0.9967 - val_loss: 0.2505 - val_accuracy: 0.9038
Epoch 59/500
52/52 [==============================] - 1s 18ms/step - loss: 0.0148 - accuracy:
0.9969 - val_loss: 0.2675 - val_accuracy: 0.8995
Epoch 60/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0146 - accuracy:
0.9968 - val_loss: 0.2617 - val_accuracy: 0.9016
Epoch 61/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0141 - accuracy:
0.9970 - val_loss: 0.2917 - val_accuracy: 0.8927
Epoch 62/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0139 - accuracy:
0.9970 - val_loss: 0.2255 - val_accuracy: 0.9126
Epoch 63/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0135 - accuracy:
0.9972 - val_loss: 0.2308 - val_accuracy: 0.9112
Epoch 64/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0132 - accuracy:
0.9972 - val_loss: 0.2673 - val_accuracy: 0.9006
Epoch 65/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0128 - accuracy:
0.9972 - val_loss: 0.2266 - val_accuracy: 0.9137
Epoch 66/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0126 - accuracy:
0.9974 - val_loss: 0.2151 - val_accuracy: 0.9167
Epoch 67/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0122 - accuracy:
0.9975 - val_loss: 0.2778 - val_accuracy: 0.8985
Epoch 68/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0120 - accuracy:
0.9975 - val_loss: 0.1678 - val_accuracy: 0.9328
Epoch 69/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0117 - accuracy:
0.9976 - val_loss: 0.1980 - val_accuracy: 0.9238
Epoch 70/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0115 - accuracy:
0.9977 - val_loss: 0.1640 - val_accuracy: 0.9340
Epoch 71/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0113 - accuracy:
0.9975 - val_loss: 0.1692 - val_accuracy: 0.9323
Epoch 72/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0109 - accuracy:
0.9978 - val_loss: 0.1554 - val_accuracy: 0.9356
Epoch 73/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0107 - accuracy:
0.9978 - val_loss: 0.1949 - val_accuracy: 0.9245
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Epoch 74/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0104 - accuracy:
0.9978 - val_loss: 0.2286 - val_accuracy: 0.9145
Epoch 75/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0102 - accuracy:
0.9979 - val_loss: 0.2124 - val_accuracy: 0.9193
Epoch 76/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0101 - accuracy:
0.9979 - val_loss: 0.2253 - val_accuracy: 0.9156
Epoch 77/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0099 - accuracy:
0.9980 - val_loss: 0.1907 - val_accuracy: 0.9257
Epoch 78/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0096 - accuracy:
0.9981 - val_loss: 0.1984 - val_accuracy: 0.9237
Epoch 79/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0095 - accuracy:
0.9980 - val_loss: 0.2089 - val_accuracy: 0.9198
Epoch 80/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0091 - accuracy:
0.9981 - val_loss: 0.1906 - val_accuracy: 0.9251
Epoch 81/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0090 - accuracy:
0.9982 - val_loss: 0.1826 - val_accuracy: 0.9270
Epoch 82/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0088 - accuracy:
0.9981 - val_loss: 0.2401 - val_accuracy: 0.9110
Epoch 83/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0086 - accuracy:
0.9983 - val_loss: 0.1749 - val_accuracy: 0.9300
Epoch 84/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0084 - accuracy:
0.9982 - val_loss: 0.3478 - val_accuracy: 0.8825
Epoch 85/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0083 - accuracy:
0.9983 - val_loss: 0.2257 - val_accuracy: 0.9158
Epoch 86/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0080 - accuracy:
0.9983 - val_loss: 0.2106 - val_accuracy: 0.9202
Epoch 87/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0080 - accuracy:
0.9984 - val_loss: 0.2283 - val_accuracy: 0.9149
Epoch 88/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0078 - accuracy:
0.9983 - val_loss: 0.2083 - val_accuracy: 0.9198
Epoch 89/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0076 - accuracy:
0.9985 - val_loss: 0.1934 - val_accuracy: 0.9235
```

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Epoch 90/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0078 - accuracy:
0.9983 - val_loss: 0.1691 - val_accuracy: 0.9311
Epoch 91/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0073 - accuracy:
0.9985 - val_loss: 0.1337 - val_accuracy: 0.9452
Epoch 92/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0071 - accuracy:
0.9987 - val_loss: 0.2201 - val_accuracy: 0.9166
Epoch 93/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0073 - accuracy:
0.9985 - val_loss: 0.1834 - val_accuracy: 0.9266
Epoch 94/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0068 - accuracy:
0.9986 - val_loss: 0.1818 - val_accuracy: 0.9271
Epoch 95/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0067 - accuracy:
0.9986 - val_loss: 0.1845 - val_accuracy: 0.9267
Epoch 96/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0067 - accuracy:
0.9986 - val_loss: 0.1422 - val_accuracy: 0.9429
Epoch 97/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0064 - accuracy:
0.9987 - val_loss: 0.1982 - val_accuracy: 0.9226
Epoch 98/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0062 - accuracy:
0.9988 - val_loss: 0.2129 - val_accuracy: 0.9184
Epoch 99/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0062 - accuracy:
0.9987 - val_loss: 0.1712 - val_accuracy: 0.9320
Epoch 100/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0061 - accuracy:
0.9987 - val_loss: 0.1749 - val_accuracy: 0.9303
Epoch 101/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0060 - accuracy:
0.9988 - val_loss: 0.1827 - val_accuracy: 0.9278
Epoch 102/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0060 - accuracy:
0.9987 - val_loss: 0.1778 - val_accuracy: 0.9297
Epoch 103/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0060 - accuracy:
0.9987 - val_loss: 0.2209 - val_accuracy: 0.9167
Epoch 104/500
52/52 [==============================] - 1s 18ms/step - loss: 0.0057 - accuracy:
0.9989 - val_loss: 0.1631 - val_accuracy: 0.9358
Epoch 105/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0056 - accuracy:
0.9989 - val_loss: 0.2099 - val_accuracy: 0.9200
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Epoch 106/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0056 - accuracy:
0.9989 - val_loss: 0.2294 - val_accuracy: 0.9140
Epoch 107/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0057 - accuracy:
0.9988 - val_loss: 0.2060 - val_accuracy: 0.9223
Epoch 108/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0052 - accuracy:
0.9990 - val_loss: 0.1962 - val_accuracy: 0.9251
Epoch 109/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0052 - accuracy:
0.9990 - val_loss: 0.1530 - val_accuracy: 0.9420
Epoch 110/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0050 - accuracy:
0.9990 - val_loss: 0.2731 - val_accuracy: 0.9029
Epoch 111/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0051 - accuracy:
0.9990 - val_loss: 0.2075 - val_accuracy: 0.9213
Epoch 112/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0047 - accuracy:
0.9990 - val_loss: 0.1562 - val_accuracy: 0.9408
Epoch 113/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0049 - accuracy:
0.9990 - val_loss: 0.2282 - val_accuracy: 0.9153
Epoch 114/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0047 - accuracy:
0.9991 - val_loss: 0.1879 - val_accuracy: 0.9286
Epoch 115/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0045 - accuracy:
0.9991 - val_loss: 0.2228 - val_accuracy: 0.9177
Epoch 116/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0045 - accuracy:
0.9991 - val_loss: 0.1693 - val_accuracy: 0.9365
Epoch 117/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0044 - accuracy:
0.9991 - val_loss: 0.2934 - val_accuracy: 0.8998
Epoch 118/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0043 - accuracy:
0.9992 - val_loss: 0.2570 - val_accuracy: 0.9087
Epoch 119/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0044 - accuracy:
0.9991 - val_loss: 0.2190 - val_accuracy: 0.9202
Epoch 120/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0042 - accuracy:
0.9992 - val_loss: 0.2496 - val_accuracy: 0.9110
Epoch 121/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0042 - accuracy:
0.9992 - val_loss: 0.2744 - val_accuracy: 0.9046
```

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Epoch 122/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0041 - accuracy:
0.9991 - val_loss: 0.2472 - val_accuracy: 0.9119
Epoch 123/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0040 - accuracy:
0.9992 - val_loss: 0.2352 - val_accuracy: 0.9163
Epoch 124/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0042 - accuracy:
0.9992 - val_loss: 0.1739 - val_accuracy: 0.9380
Epoch 125/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0038 - accuracy:
0.9992 - val_loss: 0.2240 - val_accuracy: 0.9209
Epoch 126/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0038 - accuracy:
0.9992 - val_loss: 0.2123 - val_accuracy: 0.9245
Epoch 127/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0038 - accuracy:
0.9992 - val_loss: 0.2093 - val_accuracy: 0.9262
Epoch 128/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0036 - accuracy:
0.9993 - val_loss: 0.1411 - val_accuracy: 0.9535
Epoch 129/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0036 - accuracy:
0.9992 - val_loss: 0.1784 - val_accuracy: 0.9377
Epoch 130/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0036 - accuracy:
0.9992 - val_loss: 0.2045 - val_accuracy: 0.9276
Epoch 131/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0035 - accuracy:
0.9994 - val_loss: 0.1820 - val_accuracy: 0.9372
Epoch 132/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0033 - accuracy:
0.9994 - val_loss: 0.1690 - val_accuracy: 0.9433
Epoch 133/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0033 - accuracy:
0.9995 - val_loss: 0.1974 - val_accuracy: 0.9331
Epoch 134/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0033 - accuracy:
0.9993 - val_loss: 0.2907 - val_accuracy: 0.9045
Epoch 135/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0033 - accuracy:
0.9994 - val_loss: 0.1888 - val_accuracy: 0.9362
Epoch 136/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0031 - accuracy:
0.9994 - val_loss: 0.2375 - val_accuracy: 0.9205
Epoch 137/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0030 - accuracy:
0.9995 - val_loss: 0.2019 - val_accuracy: 0.9325
```

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Epoch 138/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0032 - accuracy:
0.9993 - val_loss: 0.1960 - val_accuracy: 0.9353
Epoch 139/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0031 - accuracy:
0.9994 - val_loss: 0.2192 - val_accuracy: 0.9266
Epoch 140/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0030 - accuracy:
0.9993 - val_loss: 0.2864 - val_accuracy: 0.9066
Epoch 141/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0030 - accuracy:
0.9994 - val_loss: 0.2643 - val_accuracy: 0.9136
Epoch 142/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0029 - accuracy:
0.9994 - val_loss: 0.2141 - val_accuracy: 0.9300
Epoch 143/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0028 - accuracy:
0.9995 - val_loss: 0.2621 - val_accuracy: 0.9153
Epoch 144/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0027 - accuracy:
0.9995 - val_loss: 0.2187 - val_accuracy: 0.9295
Epoch 145/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0027 - accuracy:
0.9995 - val_loss: 0.2008 - val_accuracy: 0.9358
Epoch 146/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0026 - accuracy:
0.9996 - val_loss: 0.1985 - val_accuracy: 0.9373
Epoch 147/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0026 - accuracy:
0.9995 - val_loss: 0.2111 - val_accuracy: 0.9341
Epoch 148/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0026 - accuracy:
0.9996 - val_loss: 0.2070 - val_accuracy: 0.9350
Epoch 149/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0026 - accuracy:
0.9995 - val_loss: 0.2605 - val_accuracy: 0.9169
Epoch 150/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0025 - accuracy:
0.9995 - val_loss: 0.2199 - val_accuracy: 0.9308
Epoch 151/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0025 - accuracy:
0.9995 - val_loss: 0.2443 - val_accuracy: 0.9238
Epoch 152/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0024 - accuracy:
0.9996 - val_loss: 0.2083 - val_accuracy: 0.9361
Epoch 153/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0024 - accuracy:
0.9996 - val_loss: 0.2221 - val_accuracy: 0.9319
```

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Epoch 154/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0023 - accuracy:
0.9996 - val_loss: 0.2459 - val_accuracy: 0.9242
Epoch 155/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0024 - accuracy:
0.9995 - val_loss: 0.3133 - val_accuracy: 0.9022
Epoch 156/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0023 - accuracy:
0.9995 - val_loss: 0.2243 - val_accuracy: 0.9320
Epoch 157/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0021 - accuracy:
0.9996 - val_loss: 0.2288 - val_accuracy: 0.9309
Epoch 158/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0022 - accuracy:
0.9996 - val_loss: 0.2108 - val_accuracy: 0.9374
Epoch 159/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0023 - accuracy:
0.9996 - val_loss: 0.2560 - val_accuracy: 0.9216
Epoch 160/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0021 - accuracy:
0.9996 - val_loss: 0.2302 - val_accuracy: 0.9306
Epoch 161/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0020 - accuracy:
0.9996 - val_loss: 0.2311 - val_accuracy: 0.9306
Epoch 162/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0021 - accuracy:
0.9996 - val_loss: 0.2669 - val_accuracy: 0.9187
Epoch 163/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0019 - accuracy:
0.9996 - val_loss: 0.3200 - val_accuracy: 0.9023
Epoch 164/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0022 - accuracy:
0.9996 - val_loss: 0.2763 - val_accuracy: 0.9176
Epoch 165/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0021 - accuracy:
0.9996 - val_loss: 0.2458 - val_accuracy: 0.9271
Epoch 166/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0020 - accuracy:
0.9996 - val_loss: 0.2534 - val_accuracy: 0.9256
Epoch 167/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0018 - accuracy:
0.9997 - val_loss: 0.3278 - val_accuracy: 0.9016
Epoch 168/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0019 - accuracy:
0.9998 - val_loss: 0.2338 - val_accuracy: 0.9317
Epoch 169/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0019 - accuracy:
0.9996 - val_loss: 0.3088 - val_accuracy: 0.9079
```

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Epoch 170/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0017 - accuracy:
0.9998 - val_loss: 0.3177 - val_accuracy: 0.9055
Epoch 171/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0019 - accuracy:
0.9997 - val_loss: 0.2243 - val_accuracy: 0.9349
Epoch 172/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0017 - accuracy:
0.9997 - val_loss: 0.2381 - val_accuracy: 0.9309
Epoch 173/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0017 - accuracy:
0.9997 - val_loss: 0.3232 - val_accuracy: 0.9032
Epoch 174/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0019 - accuracy:
0.9996 - val_loss: 0.2420 - val_accuracy: 0.9285
Epoch 175/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0016 - accuracy:
0.9998 - val_loss: 0.2235 - val_accuracy: 0.9372
Epoch 176/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0017 - accuracy:
0.9995 - val_loss: 0.2221 - val_accuracy: 0.9377
Epoch 177/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0016 - accuracy:
0.9998 - val_loss: 0.3169 - val_accuracy: 0.9075
Epoch 178/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0017 - accuracy:
0.9997 - val_loss: 0.2471 - val_accuracy: 0.9295
Epoch 179/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0015 - accuracy:
0.9998 - val_loss: 0.2470 - val_accuracy: 0.9302
Epoch 180/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0016 - accuracy:
0.9998 - val_loss: 0.2388 - val_accuracy: 0.9341
Epoch 181/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0016 - accuracy:
0.9998 - val_loss: 0.2357 - val_accuracy: 0.9352
Epoch 182/500
52/52 [==============================] - 1s 18ms/step - loss: 0.0014 - accuracy:
0.9998 - val_loss: 0.3162 - val_accuracy: 0.9083
Epoch 183/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0014 - accuracy:
0.9998 - val_loss: 0.2605 - val_accuracy: 0.9257
Epoch 184/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0015 - accuracy:
0.9997 - val_loss: 0.2360 - val_accuracy: 0.9337
Epoch 185/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0015 - accuracy:
0.9997 - val_loss: 0.2711 - val_accuracy: 0.9221
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Epoch 186/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.2259 - val_accuracy: 0.9392
Epoch 187/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0014 - accuracy:
0.9998 - val_loss: 0.3441 - val_accuracy: 0.9011
Epoch 188/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0014 - accuracy:
0.9998 - val_loss: 0.2261 - val_accuracy: 0.9398
Epoch 189/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.2604 - val_accuracy: 0.9275
Epoch 190/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.2685 - val_accuracy: 0.9262
Epoch 191/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.2897 - val_accuracy: 0.9195
Epoch 192/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.2832 - val_accuracy: 0.9227
Epoch 193/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.2929 - val_accuracy: 0.9191
Epoch 194/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.2358 - val_accuracy: 0.9380
Epoch 195/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.3074 - val_accuracy: 0.9144
Epoch 196/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0014 - accuracy:
0.9996 - val_loss: 0.2528 - val_accuracy: 0.9328
Epoch 197/500
52/52 [==============================] - 1s 14ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.3192 - val_accuracy: 0.9124
Epoch 198/500
52/52 [==============================] - 1s 12ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.2907 - val_accuracy: 0.9202
Epoch 199/500
52/52 [==============================] - 1s 13ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.2919 - val_accuracy: 0.9203
Epoch 200/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0011 - accuracy:
0.9999 - val_loss: 0.2866 - val_accuracy: 0.9225
Epoch 201/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.3023 - val_accuracy: 0.9183
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Epoch 202/500
52/52 [==============================] - 1s 15ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.2829 - val_accuracy: 0.9228
Epoch 203/500
52/52 [==============================] - 1s 16ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.2811 - val_accuracy: 0.9254
Epoch 204/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0010 - accuracy:
0.9999 - val_loss: 0.3109 - val_accuracy: 0.9151
Epoch 205/500
52/52 [==============================] - 1s 17ms/step - loss: 9.9014e-04 -
accuracy: 0.9999 - val_loss: 0.2659 - val_accuracy: 0.9302
Epoch 206/500
52/52 [==============================] - 1s 17ms/step - loss: 0.0010 - accuracy:
0.9998 - val_loss: 0.2868 - val_accuracy: 0.9243
Epoch 207/500
52/52 [==============================] - 1s 16ms/step - loss: 9.3441e-04 -
accuracy: 0.9998 - val_loss: 0.2741 - val_accuracy: 0.9284
Epoch 208/500
52/52 [==============================] - 1s 16ms/step - loss: 9.7117e-04 -
accuracy: 0.9999 - val_loss: 0.3488 - val_accuracy: 0.9051
Epoch 209/500
52/52 [==============================] - 1s 15ms/step - loss: 9.3044e-04 -
accuracy: 0.9999 - val_loss: 0.2821 - val_accuracy: 0.9257
Epoch 210/500
52/52 [==============================] - 1s 16ms/step - loss: 9.2175e-04 -
accuracy: 0.9999 - val_loss: 0.2643 - val_accuracy: 0.9322
Epoch 211/500
52/52 [==============================] - 1s 14ms/step - loss: 9.5795e-04 -
accuracy: 0.9999 - val_loss: 0.3111 - val_accuracy: 0.9170
Epoch 212/500
52/52 [==============================] - 1s 14ms/step - loss: 9.0291e-04 -
accuracy: 0.9999 - val_loss: 0.3232 - val_accuracy: 0.9137
Epoch 213/500
52/52 [==============================] - 1s 14ms/step - loss: 9.0557e-04 -
accuracy: 0.9999 - val_loss: 0.2832 - val_accuracy: 0.9254
Epoch 214/500
52/52 [==============================] - 1s 15ms/step - loss: 8.4867e-04 -
accuracy: 0.9999 - val_loss: 0.2930 - val_accuracy: 0.9229
Epoch 215/500
52/52 [==============================] - 1s 15ms/step - loss: 8.3539e-04 -
accuracy: 0.9999 - val_loss: 0.3242 - val_accuracy: 0.9143
Epoch 216/500
52/52 [==============================] - 1s 13ms/step - loss: 8.4888e-04 -
accuracy: 0.9999 - val_loss: 0.3053 - val_accuracy: 0.9191
Epoch 217/500
52/52 [==============================] - 1s 13ms/step - loss: 8.8897e-04 -
accuracy: 0.9999 - val_loss: 0.3340 - val_accuracy: 0.9109
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Epoch 218/500
52/52 [==============================] - 1s 13ms/step - loss: 9.3514e-04 -
accuracy: 0.9998 - val_loss: 0.2508 - val_accuracy: 0.9355
Epoch 219/500
52/52 [==============================] - 1s 13ms/step - loss: 8.0096e-04 -
accuracy: 0.9999 - val_loss: 0.2686 - val_accuracy: 0.9295
Epoch 220/500
52/52 [==============================] - 1s 14ms/step - loss: 8.2092e-04 -
accuracy: 0.9999 - val_loss: 0.3164 - val_accuracy: 0.9160
Epoch 221/500
52/52 [==============================] - 1s 13ms/step - loss: 8.0870e-04 -
accuracy: 0.9999 - val_loss: 0.2857 - val_accuracy: 0.9262
Epoch 222/500
52/52 [==============================] - 1s 13ms/step - loss: 7.5139e-04 -
accuracy: 0.9999 - val_loss: 0.2682 - val_accuracy: 0.9323
Epoch 223/500
52/52 [==============================] - 1s 13ms/step - loss: 7.8742e-04 -
accuracy: 0.9999 - val_loss: 0.3227 - val_accuracy: 0.9168
Epoch 224/500
52/52 [==============================] - 1s 15ms/step - loss: 9.0913e-04 -
accuracy: 0.9998 - val_loss: 0.2662 - val_accuracy: 0.9334
Epoch 225/500
52/52 [==============================] - 1s 15ms/step - loss: 6.9708e-04 -
accuracy: 0.9999 - val_loss: 0.3012 - val_accuracy: 0.9224
Epoch 226/500
52/52 [==============================] - 1s 17ms/step - loss: 7.8798e-04 -
accuracy: 0.9999 - val_loss: 0.3149 - val_accuracy: 0.9178
Epoch 227/500
52/52 [==============================] - 1s 15ms/step - loss: 7.3673e-04 -
accuracy: 0.9999 - val_loss: 0.2990 - val_accuracy: 0.9244
Epoch 228/500
52/52 [==============================] - 1s 16ms/step - loss: 7.7878e-04 -
accuracy: 0.9999 - val_loss: 0.2591 - val_accuracy: 0.9355
Epoch 229/500
52/52 [==============================] - 1s 17ms/step - loss: 6.9209e-04 -
accuracy: 0.9999 - val_loss: 0.2919 - val_accuracy: 0.9250
Epoch 230/500
52/52 [==============================] - 1s 17ms/step - loss: 6.9356e-04 -
accuracy: 0.9999 - val_loss: 0.3620 - val_accuracy: 0.9051
Epoch 231/500
52/52 [==============================] - 1s 17ms/step - loss: 7.6392e-04 -
accuracy: 0.9999 - val_loss: 0.2718 - val_accuracy: 0.9318
Epoch 232/500
52/52 [==============================] - 1s 16ms/step - loss: 6.2985e-04 -
accuracy: 0.9999 - val_loss: 0.3148 - val_accuracy: 0.9177
Epoch 233/500
52/52 [==============================] - 1s 16ms/step - loss: 6.9382e-04 -
accuracy: 0.9999 - val_loss: 0.3422 - val_accuracy: 0.9097
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Epoch 234/500
52/52 [==============================] - 1s 17ms/step - loss: 7.1726e-04 -
accuracy: 0.9999 - val_loss: 0.3153 - val_accuracy: 0.9179
Epoch 235/500
52/52 [==============================] - 1s 15ms/step - loss: 6.5477e-04 -
accuracy: 0.9999 - val_loss: 0.3125 - val_accuracy: 0.9198
Epoch 236/500
52/52 [==============================] - 1s 15ms/step - loss: 7.1468e-04 -
accuracy: 0.9998 - val_loss: 0.2913 - val_accuracy: 0.9274
Epoch 237/500
52/52 [==============================] - 1s 15ms/step - loss: 6.3276e-04 -
accuracy: 0.9999 - val_loss: 0.2750 - val_accuracy: 0.9325
Epoch 238/500
52/52 [==============================] - 1s 15ms/step - loss: 6.1763e-04 -
accuracy: 0.9999 - val_loss: 0.4282 - val_accuracy: 0.8893
Epoch 239/500
52/52 [==============================] - 1s 13ms/step - loss: 6.3559e-04 -
accuracy: 0.9999 - val_loss: 0.2927 - val_accuracy: 0.9260
Epoch 240/500
52/52 [==============================] - 1s 12ms/step - loss: 6.3761e-04 -
accuracy: 0.9999 - val_loss: 0.3207 - val_accuracy: 0.9168
Epoch 241/500
52/52 [==============================] - 1s 13ms/step - loss: 7.0531e-04 -
accuracy: 0.9999 - val_loss: 0.3190 - val_accuracy: 0.9195
Epoch 242/500
52/52 [==============================] - 1s 12ms/step - loss: 6.3882e-04 -
accuracy: 0.9999 - val_loss: 0.4393 - val_accuracy: 0.8860
Epoch 243/500
52/52 [==============================] - 1s 13ms/step - loss: 9.6856e-04 -
accuracy: 0.9998 - val_loss: 0.2431 - val_accuracy: 0.9378
Epoch 244/500
52/52 [==============================] - 1s 13ms/step - loss: 5.4412e-04 -
accuracy: 1.0000 - val_loss: 0.2852 - val_accuracy: 0.9266
Epoch 245/500
52/52 [==============================] - 1s 13ms/step - loss: 5.3821e-04 -
accuracy: 1.0000 - val_loss: 0.2862 - val_accuracy: 0.9269
Epoch 246/500
52/52 [==============================] - 1s 13ms/step - loss: 5.4146e-04 -
accuracy: 0.9999 - val_loss: 0.3026 - val_accuracy: 0.9242
Epoch 247/500
52/52 [==============================] - 1s 13ms/step - loss: 5.3401e-04 -
accuracy: 0.9999 - val_loss: 0.3150 - val_accuracy: 0.9207
Epoch 248/500
52/52 [==============================] - 1s 12ms/step - loss: 5.7162e-04 -
accuracy: 0.9999 - val_loss: 0.3005 - val_accuracy: 0.9257
Epoch 249/500
52/52 [==============================] - 1s 14ms/step - loss: 4.9486e-04 -
accuracy: 0.9999 - val_loss: 0.3097 - val_accuracy: 0.9226
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Epoch 250/500
52/52 [==============================] - 1s 17ms/step - loss: 4.9585e-04 -
accuracy: 0.9999 - val_loss: 0.2944 - val_accuracy: 0.9273
Epoch 251/500
52/52 [==============================] - 1s 16ms/step - loss: 4.6699e-04 -
accuracy: 1.0000 - val_loss: 0.3409 - val_accuracy: 0.9149
Epoch 252/500
52/52 [==============================] - 1s 15ms/step - loss: 5.3068e-04 -
accuracy: 0.9999 - val_loss: 0.3503 - val_accuracy: 0.9118
Epoch 253/500
52/52 [==============================] - 1s 16ms/step - loss: 5.1047e-04 -
accuracy: 0.9999 - val_loss: 0.3369 - val_accuracy: 0.9183
Epoch 254/500
52/52 [==============================] - 1s 14ms/step - loss: 4.7253e-04 -
accuracy: 1.0000 - val_loss: 0.3014 - val_accuracy: 0.9273
Epoch 255/500
52/52 [==============================] - 1s 15ms/step - loss: 4.6900e-04 -
accuracy: 1.0000 - val_loss: 0.3132 - val_accuracy: 0.9257
Epoch 256/500
52/52 [==============================] - 1s 15ms/step - loss: 8.1448e-04 -
accuracy: 0.9998 - val_loss: 0.3520 - val_accuracy: 0.9097
Epoch 257/500
52/52 [==============================] - 1s 17ms/step - loss: 5.2106e-04 -
accuracy: 0.9999 - val_loss: 0.2944 - val_accuracy: 0.9260
Epoch 258/500
52/52 [==============================] - 1s 18ms/step - loss: 4.7514e-04 -
accuracy: 0.9999 - val_loss: 0.3103 - val_accuracy: 0.9222
Epoch 259/500
52/52 [==============================] - 1s 17ms/step - loss: 4.0887e-04 -
accuracy: 1.0000 - val_loss: 0.3323 - val_accuracy: 0.9182
Epoch 260/500
52/52 [==============================] - 1s 15ms/step - loss: 4.1008e-04 -
accuracy: 0.9999 - val_loss: 0.3082 - val_accuracy: 0.9260
Epoch 261/500
52/52 [==============================] - 1s 15ms/step - loss: 4.3681e-04 -
accuracy: 1.0000 - val_loss: 0.3509 - val_accuracy: 0.9143
Epoch 262/500
52/52 [==============================] - 1s 15ms/step - loss: 3.9308e-04 -
accuracy: 1.0000 - val_loss: 0.3008 - val_accuracy: 0.9292
Epoch 263/500
52/52 [==============================] - 1s 13ms/step - loss: 4.2344e-04 -
accuracy: 0.9999 - val_loss: 0.3302 - val_accuracy: 0.9229
Epoch 264/500
52/52 [==============================] - 1s 15ms/step - loss: 4.2273e-04 -
accuracy: 1.0000 - val_loss: 0.3569 - val_accuracy: 0.9160
Epoch 265/500
52/52 [==============================] - 1s 15ms/step - loss: 3.8123e-04 -
accuracy: 0.9999 - val_loss: 0.3172 - val_accuracy: 0.9266
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Epoch 266/500
52/52 [==============================] - 1s 13ms/step - loss: 4.1597e-04 -
accuracy: 0.9999 - val_loss: 0.3486 - val_accuracy: 0.9186
Epoch 267/500
52/52 [==============================] - 1s 12ms/step - loss: 3.7984e-04 -
accuracy: 0.9999 - val_loss: 0.3763 - val_accuracy: 0.9122
Epoch 268/500
52/52 [==============================] - 1s 12ms/step - loss: 3.8024e-04 -
accuracy: 1.0000 - val_loss: 0.3395 - val_accuracy: 0.9218
Epoch 269/500
52/52 [==============================] - 1s 13ms/step - loss: 3.6268e-04 -
accuracy: 1.0000 - val_loss: 0.3672 - val_accuracy: 0.9149
Epoch 270/500
52/52 [==============================] - 1s 13ms/step - loss: 4.0110e-04 -
accuracy: 1.0000 - val_loss: 0.3829 - val_accuracy: 0.9109
Epoch 271/500
52/52 [==============================] - 1s 13ms/step - loss: 4.1146e-04 -
accuracy: 1.0000 - val_loss: 0.3528 - val_accuracy: 0.9178
Epoch 272/500
52/52 [==============================] - 1s 13ms/step - loss: 3.7009e-04 -
accuracy: 1.0000 - val_loss: 0.3623 - val_accuracy: 0.9148
Epoch 273/500
52/52 [==============================] - 1s 12ms/step - loss: 3.8062e-04 -
accuracy: 0.9999 - val_loss: 0.3835 - val_accuracy: 0.9077
Epoch 274/500
52/52 [==============================] - 1s 17ms/step - loss: 3.7092e-04 -
accuracy: 1.0000 - val_loss: 0.3617 - val_accuracy: 0.9149
Epoch 275/500
52/52 [==============================] - 1s 17ms/step - loss: 3.4013e-04 -
accuracy: 0.9999 - val_loss: 0.3415 - val_accuracy: 0.9209
Epoch 276/500
52/52 [==============================] - 1s 17ms/step - loss: 3.4755e-04 -
accuracy: 1.0000 - val_loss: 0.3725 - val_accuracy: 0.9122
Epoch 277/500
52/52 [==============================] - 1s 16ms/step - loss: 3.5327e-04 -
accuracy: 0.9999 - val_loss: 0.3791 - val_accuracy: 0.9097
Epoch 278/500
52/52 [==============================] - 1s 16ms/step - loss: 3.4267e-04 -
accuracy: 1.0000 - val_loss: 0.3873 - val_accuracy: 0.9079
Epoch 279/500
52/52 [==============================] - 1s 18ms/step - loss: 3.1899e-04 -
accuracy: 1.0000 - val_loss: 0.3672 - val_accuracy: 0.9158
Epoch 280/500
52/52 [==============================] - 1s 17ms/step - loss: 2.9879e-04 -
accuracy: 1.0000 - val_loss: 0.3533 - val_accuracy: 0.9176
Epoch 281/500
52/52 [==============================] - 1s 17ms/step - loss: 3.5359e-04 -
accuracy: 0.9999 - val_loss: 0.3514 - val_accuracy: 0.9196
```

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Epoch 282/500
52/52 [==============================] - 1s 17ms/step - loss: 3.1635e-04 -
accuracy: 1.0000 - val_loss: 0.3464 - val_accuracy: 0.9204
Epoch 283/500
52/52 [==============================] - 1s 16ms/step - loss: 2.9222e-04 -
accuracy: 1.0000 - val_loss: 0.4052 - val_accuracy: 0.9036
Epoch 284/500
52/52 [==============================] - 1s 14ms/step - loss: 4.3008e-04 -
accuracy: 0.9999 - val_loss: 0.4342 - val_accuracy: 0.8942
Epoch 285/500
52/52 [==============================] - 1s 13ms/step - loss: 4.1463e-04 -
accuracy: 0.9999 - val_loss: 0.3334 - val_accuracy: 0.9228
Epoch 286/500
52/52 [==============================] - 1s 14ms/step - loss: 2.7513e-04 -
accuracy: 1.0000 - val_loss: 0.3301 - val_accuracy: 0.9235
Epoch 287/500
52/52 [==============================] - 1s 14ms/step - loss: 2.9953e-04 -
accuracy: 0.9999 - val_loss: 0.3590 - val_accuracy: 0.9150
Epoch 288/500
52/52 [==============================] - 1s 14ms/step - loss: 2.8192e-04 -
accuracy: 1.0000 - val_loss: 0.3708 - val_accuracy: 0.9128
Epoch 289/500
52/52 [==============================] - 1s 13ms/step - loss: 2.9889e-04 -
accuracy: 1.0000 - val_loss: 0.3565 - val_accuracy: 0.9177
Epoch 290/500
52/52 [==============================] - 1s 13ms/step - loss: 3.0766e-04 -
accuracy: 1.0000 - val_loss: 0.3187 - val_accuracy: 0.9278
Epoch 291/500
52/52 [==============================] - 1s 12ms/step - loss: 4.7632e-04 -
accuracy: 0.9999 - val_loss: 0.3026 - val_accuracy: 0.9300
Epoch 292/500
52/52 [==============================] - 1s 12ms/step - loss: 3.3209e-04 -
accuracy: 1.0000 - val_loss: 0.3587 - val_accuracy: 0.9160
Epoch 293/500
52/52 [==============================] - 1s 13ms/step - loss: 2.8648e-04 -
accuracy: 1.0000 - val_loss: 0.3592 - val_accuracy: 0.9186
Epoch 294/500
52/52 [==============================] - 1s 13ms/step - loss: 2.6833e-04 -
accuracy: 0.9999 - val_loss: 0.3811 - val_accuracy: 0.9114
Epoch 295/500
52/52 [==============================] - 1s 12ms/step - loss: 2.6525e-04 -
accuracy: 1.0000 - val_loss: 0.3419 - val_accuracy: 0.9222
Epoch 296/500
52/52 [==============================] - 1s 13ms/step - loss: 3.1729e-04 -
accuracy: 0.9999 - val_loss: 0.3302 - val_accuracy: 0.9260
Epoch 297/500
52/52 [==============================] - 1s 13ms/step - loss: 2.8482e-04 -
accuracy: 1.0000 - val_loss: 0.3591 - val_accuracy: 0.9171
```

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Epoch 298/500
52/52 [==============================] - 1s 15ms/step - loss: 2.3745e-04 -
accuracy: 1.0000 - val_loss: 0.3680 - val_accuracy: 0.9164
Epoch 299/500
52/52 [==============================] - 1s 18ms/step - loss: 2.7755e-04 -
accuracy: 1.0000 - val_loss: 0.3357 - val_accuracy: 0.9265
Epoch 300/500
52/52 [==============================] - 1s 17ms/step - loss: 2.2902e-04 -
accuracy: 1.0000 - val_loss: 0.3864 - val_accuracy: 0.9140
Epoch 301/500
52/52 [==============================] - 1s 15ms/step - loss: 2.2559e-04 -
accuracy: 1.0000 - val_loss: 0.3829 - val_accuracy: 0.9125
Epoch 302/500
52/52 [==============================] - 1s 16ms/step - loss: 2.3859e-04 -
accuracy: 1.0000 - val_loss: 0.3956 - val_accuracy: 0.9091
Epoch 303/500
52/52 [==============================] - 1s 17ms/step - loss: 2.4706e-04 -
accuracy: 1.0000 - val_loss: 0.3397 - val_accuracy: 0.9229
Epoch 304/500
52/52 [==============================] - 1s 17ms/step - loss: 2.3957e-04 -
accuracy: 1.0000 - val_loss: 0.4029 - val_accuracy: 0.9077
Epoch 305/500
52/52 [==============================] - 1s 16ms/step - loss: 2.4192e-04 -
accuracy: 1.0000 - val_loss: 0.3698 - val_accuracy: 0.9174
Epoch 306/500
52/52 [==============================] - 1s 16ms/step - loss: 2.1528e-04 -
accuracy: 1.0000 - val_loss: 0.3712 - val_accuracy: 0.9163
Epoch 307/500
52/52 [==============================] - 1s 16ms/step - loss: 2.0879e-04 -
accuracy: 1.0000 - val_loss: 0.3728 - val_accuracy: 0.9160
Epoch 308/500
52/52 [==============================] - 1s 15ms/step - loss: 2.2549e-04 -
accuracy: 0.9999 - val_loss: 0.3812 - val_accuracy: 0.9121
Epoch 309/500
52/52 [==============================] - 1s 14ms/step - loss: 2.4003e-04 -
accuracy: 1.0000 - val_loss: 0.4074 - val_accuracy: 0.9063
Epoch 310/500
52/52 [==============================] - 1s 14ms/step - loss: 2.3521e-04 -
accuracy: 1.0000 - val_loss: 0.3299 - val_accuracy: 0.9292
Epoch 311/500
52/52 [==============================] - 1s 15ms/step - loss: 2.0868e-04 -
accuracy: 1.0000 - val_loss: 0.3380 - val_accuracy: 0.9264
Epoch 312/500
52/52 [==============================] - 1s 14ms/step - loss: 2.1256e-04 -
accuracy: 1.0000 - val_loss: 0.3709 - val_accuracy: 0.9172
Epoch 313/500
52/52 [==============================] - 1s 14ms/step - loss: 2.7684e-04 -
accuracy: 0.9999 - val_loss: 0.3517 - val_accuracy: 0.9226
```

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Epoch 314/500
52/52 [==============================] - 1s 15ms/step - loss: 4.6326e-04 -
accuracy: 0.9999 - val_loss: 0.3514 - val_accuracy: 0.9242
Epoch 315/500
52/52 [==============================] - 1s 13ms/step - loss: 2.6136e-04 -
accuracy: 0.9999 - val_loss: 0.3643 - val_accuracy: 0.9171
Epoch 316/500
52/52 [==============================] - 1s 13ms/step - loss: 2.0116e-04 -
accuracy: 1.0000 - val_loss: 0.4301 - val_accuracy: 0.9013
Epoch 317/500
52/52 [==============================] - 1s 13ms/step - loss: 2.4327e-04 -
accuracy: 1.0000 - val_loss: 0.3658 - val_accuracy: 0.9167
Epoch 318/500
52/52 [==============================] - 1s 13ms/step - loss: 2.3307e-04 -
accuracy: 1.0000 - val_loss: 0.3236 - val_accuracy: 0.9272
Epoch 319/500
52/52 [==============================] - 1s 12ms/step - loss: 2.0873e-04 -
accuracy: 1.0000 - val_loss: 0.3702 - val_accuracy: 0.9168
Epoch 320/500
52/52 [==============================] - 1s 13ms/step - loss: 1.9047e-04 -
accuracy: 1.0000 - val_loss: 0.3442 - val_accuracy: 0.9220
Epoch 321/500
52/52 [==============================] - 1s 13ms/step - loss: 1.7617e-04 -
accuracy: 1.0000 - val_loss: 0.3515 - val_accuracy: 0.9212
Epoch 322/500
52/52 [==============================] - 1s 14ms/step - loss: 2.1200e-04 -
accuracy: 1.0000 - val_loss: 0.3269 - val_accuracy: 0.9293
Epoch 323/500
52/52 [==============================] - 1s 15ms/step - loss: 1.8679e-04 -
accuracy: 1.0000 - val_loss: 0.3484 - val_accuracy: 0.9229
Epoch 324/500
52/52 [==============================] - 1s 17ms/step - loss: 1.8835e-04 -
accuracy: 1.0000 - val_loss: 0.3847 - val_accuracy: 0.9155
Epoch 325/500
52/52 [==============================] - 1s 16ms/step - loss: 1.6976e-04 -
accuracy: 1.0000 - val_loss: 0.3921 - val_accuracy: 0.9146
Epoch 326/500
52/52 [==============================] - 1s 14ms/step - loss: 1.8882e-04 -
accuracy: 1.0000 - val_loss: 0.3514 - val_accuracy: 0.9226
Epoch 327/500
52/52 [==============================] - 1s 15ms/step - loss: 1.6532e-04 -
accuracy: 1.0000 - val_loss: 0.3438 - val_accuracy: 0.9238
Epoch 328/500
52/52 [==============================] - 1s 16ms/step - loss: 1.4587e-04 -
accuracy: 1.0000 - val_loss: 0.3977 - val_accuracy: 0.9097
Epoch 329/500
52/52 [==============================] - 1s 16ms/step - loss: 1.5878e-04 -
accuracy: 1.0000 - val_loss: 0.4060 - val_accuracy: 0.9089
```

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Epoch 330/500
52/52 [==============================] - 1s 16ms/step - loss: 1.8336e-04 -
accuracy: 1.0000 - val_loss: 0.4136 - val_accuracy: 0.9057
Epoch 331/500
52/52 [==============================] - 1s 16ms/step - loss: 1.5867e-04 -
accuracy: 1.0000 - val_loss: 0.3312 - val_accuracy: 0.9286
Epoch 332/500
52/52 [==============================] - 1s 17ms/step - loss: 1.4595e-04 -
accuracy: 1.0000 - val_loss: 0.4039 - val_accuracy: 0.9092
Epoch 333/500
52/52 [==============================] - 1s 16ms/step - loss: 2.5856e-04 -
accuracy: 1.0000 - val_loss: 0.4212 - val_accuracy: 0.9038
Epoch 334/500
52/52 [==============================] - 1s 14ms/step - loss: 1.9791e-04 -
accuracy: 1.0000 - val_loss: 0.3347 - val_accuracy: 0.9258
Epoch 335/500
52/52 [==============================] - 1s 14ms/step - loss: 1.3892e-04 -
accuracy: 1.0000 - val_loss: 0.3637 - val_accuracy: 0.9182
Epoch 336/500
52/52 [==============================] - 1s 15ms/step - loss: 1.9550e-04 -
accuracy: 1.0000 - val_loss: 0.3692 - val_accuracy: 0.9185
Epoch 337/500
52/52 [==============================] - 1s 15ms/step - loss: 1.6555e-04 -
accuracy: 1.0000 - val_loss: 0.3587 - val_accuracy: 0.9222
Epoch 338/500
52/52 [==============================] - 1s 14ms/step - loss: 2.8507e-04 -
accuracy: 0.9999 - val_loss: 0.3812 - val_accuracy: 0.9177
Epoch 339/500
52/52 [==============================] - 1s 15ms/step - loss: 2.2847e-04 -
accuracy: 0.9999 - val_loss: 0.4152 - val_accuracy: 0.9060
Epoch 340/500
52/52 [==============================] - 1s 15ms/step - loss: 1.2658e-04 -
accuracy: 1.0000 - val_loss: 0.3883 - val_accuracy: 0.9117
Epoch 341/500
52/52 [==============================] - 1s 13ms/step - loss: 1.1981e-04 -
accuracy: 1.0000 - val_loss: 0.3937 - val_accuracy: 0.9114
Epoch 342/500
52/52 [==============================] - 1s 13ms/step - loss: 1.1931e-04 -
accuracy: 1.0000 - val_loss: 0.3760 - val_accuracy: 0.9151
Epoch 343/500
52/52 [==============================] - 1s 12ms/step - loss: 1.1304e-04 -
accuracy: 1.0000 - val_loss: 0.3367 - val_accuracy: 0.9246
Epoch 344/500
52/52 [==============================] - 1s 12ms/step - loss: 1.4129e-04 -
accuracy: 1.0000 - val_loss: 0.3380 - val_accuracy: 0.9257
Epoch 345/500
52/52 [==============================] - 1s 12ms/step - loss: 1.3930e-04 -
accuracy: 1.0000 - val_loss: 0.4279 - val_accuracy: 0.9034
```

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Epoch 346/500
52/52 [==============================] - 1s 14ms/step - loss: 1.3116e-04 -
accuracy: 1.0000 - val_loss: 0.3943 - val_accuracy: 0.9091
Epoch 347/500
52/52 [==============================] - 1s 15ms/step - loss: 1.3059e-04 -
accuracy: 1.0000 - val_loss: 0.4081 - val_accuracy: 0.9063
Epoch 348/500
52/52 [==============================] - 1s 16ms/step - loss: 1.4201e-04 -
accuracy: 1.0000 - val_loss: 0.3514 - val_accuracy: 0.9214
Epoch 349/500
52/52 [==============================] - 1s 16ms/step - loss: 1.4741e-04 -
accuracy: 1.0000 - val_loss: 0.3183 - val_accuracy: 0.9324
Epoch 350/500
52/52 [==============================] - 1s 16ms/step - loss: 1.4897e-04 -
accuracy: 1.0000 - val_loss: 0.3947 - val_accuracy: 0.9132
Epoch 351/500
52/52 [==============================] - 1s 17ms/step - loss: 1.1705e-04 -
accuracy: 1.0000 - val_loss: 0.3418 - val_accuracy: 0.9271
Epoch 352/500
52/52 [==============================] - 1s 18ms/step - loss: 1.3815e-04 -
accuracy: 1.0000 - val_loss: 0.3970 - val_accuracy: 0.9130
Epoch 353/500
52/52 [==============================] - 1s 16ms/step - loss: 9.9129e-05 -
accuracy: 1.0000 - val_loss: 0.3568 - val_accuracy: 0.9242
Epoch 354/500
52/52 [==============================] - 1s 16ms/step - loss: 1.0788e-04 -
accuracy: 1.0000 - val_loss: 0.3308 - val_accuracy: 0.9297
Epoch 355/500
52/52 [==============================] - 1s 16ms/step - loss: 1.2667e-04 -
accuracy: 1.0000 - val_loss: 0.4077 - val_accuracy: 0.9099
Epoch 356/500
52/52 [==============================] - 1s 16ms/step - loss: 1.1403e-04 -
accuracy: 1.0000 - val_loss: 0.3718 - val_accuracy: 0.9190
Epoch 357/500
52/52 [==============================] - 1s 15ms/step - loss: 1.0976e-04 -
accuracy: 1.0000 - val_loss: 0.3460 - val_accuracy: 0.9243
Epoch 358/500
52/52 [==============================] - 1s 15ms/step - loss: 1.3913e-04 -
accuracy: 1.0000 - val_loss: 0.3393 - val_accuracy: 0.9270
Epoch 359/500
52/52 [==============================] - 1s 13ms/step - loss: 1.3547e-04 -
accuracy: 1.0000 - val_loss: 0.3186 - val_accuracy: 0.9315
Epoch 360/500
52/52 [==============================] - 1s 13ms/step - loss: 1.7331e-04 -
accuracy: 1.0000 - val_loss: 0.3432 - val_accuracy: 0.9244
Epoch 361/500
52/52 [==============================] - 1s 15ms/step - loss: 1.1642e-04 -
accuracy: 1.0000 - val_loss: 0.3469 - val_accuracy: 0.9238
```

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Epoch 362/500
52/52 [==============================] - 1s 13ms/step - loss: 9.8066e-05 -
accuracy: 1.0000 - val_loss: 0.3390 - val_accuracy: 0.9266
Epoch 363/500
52/52 [==============================] - 1s 13ms/step - loss: 9.0432e-05 -
accuracy: 1.0000 - val_loss: 0.3840 - val_accuracy: 0.9168
Epoch 364/500
52/52 [==============================] - 1s 13ms/step - loss: 9.6265e-05 -
accuracy: 1.0000 - val_loss: 0.4061 - val_accuracy: 0.9099
Epoch 365/500
52/52 [==============================] - 1s 15ms/step - loss: 1.5747e-04 -
accuracy: 1.0000 - val_loss: 0.3706 - val_accuracy: 0.9174
Epoch 366/500
52/52 [==============================] - 1s 13ms/step - loss: 1.2395e-04 -
accuracy: 1.0000 - val_loss: 0.3688 - val_accuracy: 0.9189
Epoch 367/500
52/52 [==============================] - 1s 15ms/step - loss: 8.8369e-05 -
accuracy: 1.0000 - val_loss: 0.3697 - val_accuracy: 0.9202
Epoch 368/500
52/52 [==============================] - 1s 13ms/step - loss: 8.8164e-05 -
accuracy: 1.0000 - val_loss: 0.3728 - val_accuracy: 0.9168
Epoch 369/500
52/52 [==============================] - 1s 13ms/step - loss: 1.3990e-04 -
accuracy: 1.0000 - val_loss: 0.3544 - val_accuracy: 0.9257
Epoch 370/500
52/52 [==============================] - 1s 13ms/step - loss: 7.9572e-05 -
accuracy: 1.0000 - val_loss: 0.3894 - val_accuracy: 0.9155
Epoch 371/500
52/52 [==============================] - 1s 15ms/step - loss: 8.5047e-05 -
accuracy: 1.0000 - val_loss: 0.4248 - val_accuracy: 0.9054
Epoch 372/500
52/52 [==============================] - 1s 15ms/step - loss: 1.2675e-04 -
accuracy: 1.0000 - val_loss: 0.3269 - val_accuracy: 0.9306
Epoch 373/500
52/52 [==============================] - 1s 15ms/step - loss: 1.0995e-04 -
accuracy: 1.0000 - val_loss: 0.3775 - val_accuracy: 0.9183
Epoch 374/500
52/52 [==============================] - 1s 15ms/step - loss: 2.4804e-04 -
accuracy: 0.9999 - val_loss: 0.3562 - val_accuracy: 0.9238
Epoch 375/500
52/52 [==============================] - 1s 17ms/step - loss: 1.2385e-04 -
accuracy: 1.0000 - val_loss: 0.3669 - val_accuracy: 0.9215
Epoch 376/500
52/52 [==============================] - 1s 17ms/step - loss: 8.3675e-05 -
accuracy: 1.0000 - val_loss: 0.3549 - val_accuracy: 0.9232
Epoch 377/500
52/52 [==============================] - 1s 15ms/step - loss: 1.0719e-04 -
accuracy: 1.0000 - val_loss: 0.4086 - val_accuracy: 0.9123
```

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Epoch 378/500
52/52 [==============================] - 1s 14ms/step - loss: 7.0418e-05 -
accuracy: 1.0000 - val_loss: 0.3926 - val_accuracy: 0.9150
Epoch 379/500
52/52 [==============================] - 1s 16ms/step - loss: 9.8021e-05 -
accuracy: 1.0000 - val_loss: 0.3922 - val_accuracy: 0.9163
Epoch 380/500
52/52 [==============================] - 1s 15ms/step - loss: 1.2160e-04 -
accuracy: 1.0000 - val_loss: 0.3368 - val_accuracy: 0.9279
Epoch 381/500
52/52 [==============================] - 1s 16ms/step - loss: 9.4421e-05 -
accuracy: 1.0000 - val_loss: 0.3404 - val_accuracy: 0.9269
Epoch 382/500
52/52 [==============================] - 1s 15ms/step - loss: 7.6258e-05 -
accuracy: 1.0000 - val_loss: 0.3431 - val_accuracy: 0.9261
Epoch 383/500
52/52 [==============================] - 1s 14ms/step - loss: 8.8856e-05 -
accuracy: 1.0000 - val_loss: 0.5417 - val_accuracy: 0.8792
Epoch 384/500
52/52 [==============================] - 1s 15ms/step - loss: 1.4807e-04 -
accuracy: 1.0000 - val_loss: 0.3661 - val_accuracy: 0.9180
Epoch 385/500
52/52 [==============================] - 1s 14ms/step - loss: 8.7457e-05 -
accuracy: 1.0000 - val_loss: 0.3690 - val_accuracy: 0.9184
Epoch 386/500
52/52 [==============================] - 1s 14ms/step - loss: 7.9605e-05 -
accuracy: 1.0000 - val_loss: 0.3413 - val_accuracy: 0.9242
Epoch 387/500
52/52 [==============================] - 1s 15ms/step - loss: 7.1858e-05 -
accuracy: 1.0000 - val_loss: 0.3945 - val_accuracy: 0.9125
Epoch 388/500
52/52 [==============================] - 1s 15ms/step - loss: 6.7942e-05 -
accuracy: 1.0000 - val_loss: 0.3775 - val_accuracy: 0.9177
Epoch 389/500
52/52 [==============================] - 1s 15ms/step - loss: 5.8088e-05 -
accuracy: 1.0000 - val_loss: 0.3438 - val_accuracy: 0.9254
Epoch 390/500
52/52 [==============================] - 1s 14ms/step - loss: 7.6611e-05 -
accuracy: 1.0000 - val_loss: 0.3911 - val_accuracy: 0.9147
Epoch 391/500
52/52 [==============================] - 1s 15ms/step - loss: 2.1530e-04 -
accuracy: 0.9999 - val_loss: 0.2922 - val_accuracy: 0.9376
Epoch 392/500
52/52 [==============================] - 1s 13ms/step - loss: 1.9873e-04 -
accuracy: 1.0000 - val_loss: 0.3556 - val_accuracy: 0.9205
Epoch 393/500
52/52 [==============================] - 1s 13ms/step - loss: 7.1895e-05 -
accuracy: 1.0000 - val_loss: 0.3450 - val_accuracy: 0.9243
```

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Epoch 394/500
52/52 [==============================] - 1s 13ms/step - loss: 7.3231e-05 -
accuracy: 1.0000 - val_loss: 0.3205 - val_accuracy: 0.9296
Epoch 395/500
52/52 [==============================] - 1s 13ms/step - loss: 6.1710e-05 -
accuracy: 1.0000 - val_loss: 0.3531 - val_accuracy: 0.9217
Epoch 396/500
52/52 [==============================] - 1s 15ms/step - loss: 5.7911e-05 -
accuracy: 1.0000 - val_loss: 0.3631 - val_accuracy: 0.9189
Epoch 397/500
52/52 [==============================] - 1s 16ms/step - loss: 5.5155e-05 -
accuracy: 1.0000 - val_loss: 0.3446 - val_accuracy: 0.9241
Epoch 398/500
52/52 [==============================] - 1s 17ms/step - loss: 1.0540e-04 -
accuracy: 1.0000 - val_loss: 0.3750 - val_accuracy: 0.9156
Epoch 399/500
52/52 [==============================] - 1s 16ms/step - loss: 1.1158e-04 -
accuracy: 1.0000 - val_loss: 0.3273 - val_accuracy: 0.9283
Epoch 400/500
52/52 [==============================] - 1s 17ms/step - loss: 5.8251e-05 -
accuracy: 1.0000 - val_loss: 0.3397 - val_accuracy: 0.9254
Epoch 401/500
52/52 [==============================] - 1s 17ms/step - loss: 5.1370e-05 -
accuracy: 1.0000 - val_loss: 0.3664 - val_accuracy: 0.9178
Epoch 402/500
52/52 [==============================] - 1s 16ms/step - loss: 9.5733e-05 -
accuracy: 1.0000 - val_loss: 0.3882 - val_accuracy: 0.9131
Epoch 403/500
52/52 [==============================] - 1s 16ms/step - loss: 6.1361e-05 -
accuracy: 1.0000 - val_loss: 0.3394 - val_accuracy: 0.9258
Epoch 404/500
52/52 [==============================] - 1s 16ms/step - loss: 6.1838e-05 -
accuracy: 1.0000 - val_loss: 0.3300 - val_accuracy: 0.9278
Epoch 405/500
52/52 [==============================] - 1s 17ms/step - loss: 5.4546e-05 -
accuracy: 1.0000 - val_loss: 0.3619 - val_accuracy: 0.9194
Epoch 406/500
52/52 [==============================] - 1s 14ms/step - loss: 5.4215e-05 -
accuracy: 1.0000 - val_loss: 0.3187 - val_accuracy: 0.9306
Epoch 407/500
52/52 [==============================] - 1s 14ms/step - loss: 5.1990e-05 -
accuracy: 1.0000 - val_loss: 0.3523 - val_accuracy: 0.9219
Epoch 408/500
52/52 [==============================] - 1s 14ms/step - loss: 6.1477e-05 -
accuracy: 1.0000 - val_loss: 0.3415 - val_accuracy: 0.9254
Epoch 409/500
52/52 [==============================] - 1s 15ms/step - loss: 5.0257e-05 -
accuracy: 1.0000 - val_loss: 0.3836 - val_accuracy: 0.9134
```

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Epoch 410/500
52/52 [==============================] - 1s 15ms/step - loss: 5.2446e-05 -
accuracy: 1.0000 - val_loss: 0.3261 - val_accuracy: 0.9289
Epoch 411/500
52/52 [==============================] - 1s 15ms/step - loss: 7.3587e-05 -
accuracy: 1.0000 - val_loss: 0.3078 - val_accuracy: 0.9332
Epoch 412/500
52/52 [==============================] - 1s 15ms/step - loss: 7.1749e-05 -
accuracy: 1.0000 - val_loss: 0.3898 - val_accuracy: 0.9126
Epoch 413/500
52/52 [==============================] - 1s 14ms/step - loss: 5.3382e-05 -
accuracy: 1.0000 - val_loss: 0.3486 - val_accuracy: 0.9212
Epoch 414/500
52/52 [==============================] - 1s 15ms/step - loss: 7.3664e-05 -
accuracy: 1.0000 - val_loss: 0.3273 - val_accuracy: 0.9289
Epoch 415/500
52/52 [==============================] - 1s 14ms/step - loss: 9.7107e-05 -
accuracy: 1.0000 - val_loss: 0.3127 - val_accuracy: 0.9333
Epoch 416/500
52/52 [==============================] - 1s 12ms/step - loss: 9.3665e-05 -
accuracy: 1.0000 - val_loss: 0.4852 - val_accuracy: 0.8900
Epoch 417/500
52/52 [==============================] - 1s 12ms/step - loss: 3.6800e-04 -
accuracy: 0.9999 - val_loss: 0.4218 - val_accuracy: 0.9034
Epoch 418/500
52/52 [==============================] - 1s 13ms/step - loss: 7.9896e-05 -
accuracy: 1.0000 - val_loss: 0.3005 - val_accuracy: 0.9319
Epoch 419/500
52/52 [==============================] - 1s 13ms/step - loss: 6.8906e-05 -
accuracy: 1.0000 - val_loss: 0.2839 - val_accuracy: 0.9387
Epoch 420/500
52/52 [==============================] - 1s 14ms/step - loss: 1.2171e-04 -
accuracy: 0.9999 - val_loss: 0.2934 - val_accuracy: 0.9357
Epoch 421/500
52/52 [==============================] - 1s 17ms/step - loss: 4.4431e-05 -
accuracy: 1.0000 - val_loss: 0.3111 - val_accuracy: 0.9306
Epoch 422/500
52/52 [==============================] - 1s 17ms/step - loss: 4.7772e-05 -
accuracy: 1.0000 - val_loss: 0.3019 - val_accuracy: 0.9325
Epoch 423/500
52/52 [==============================] - 1s 16ms/step - loss: 4.0714e-05 -
accuracy: 1.0000 - val_loss: 0.3407 - val_accuracy: 0.9229
Epoch 424/500
52/52 [==============================] - 1s 16ms/step - loss: 6.1126e-05 -
accuracy: 1.0000 - val_loss: 0.3492 - val_accuracy: 0.9210
Epoch 425/500
52/52 [==============================] - 1s 16ms/step - loss: 4.7033e-05 -
accuracy: 1.0000 - val_loss: 0.3194 - val_accuracy: 0.9286
```

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Epoch 426/500
52/52 [==============================] - 1s 16ms/step - loss: 4.3048e-05 -
accuracy: 1.0000 - val_loss: 0.3182 - val_accuracy: 0.9294
Epoch 427/500
52/52 [==============================] - 1s 16ms/step - loss: 5.8508e-05 -
accuracy: 1.0000 - val_loss: 0.3434 - val_accuracy: 0.9231
Epoch 428/500
52/52 [==============================] - 1s 16ms/step - loss: 7.9131e-05 -
accuracy: 1.0000 - val_loss: 0.3192 - val_accuracy: 0.9285
Epoch 429/500
52/52 [==============================] - 1s 15ms/step - loss: 4.0806e-05 -
accuracy: 1.0000 - val_loss: 0.3177 - val_accuracy: 0.9300
Epoch 430/500
52/52 [==============================] - 1s 16ms/step - loss: 3.7676e-05 -
accuracy: 1.0000 - val_loss: 0.3184 - val_accuracy: 0.9295
Epoch 431/500
52/52 [==============================] - 1s 13ms/step - loss: 7.9419e-05 -
accuracy: 1.0000 - val_loss: 0.3354 - val_accuracy: 0.9249
Epoch 432/500
52/52 [==============================] - 1s 14ms/step - loss: 4.3733e-05 -
accuracy: 1.0000 - val_loss: 0.3455 - val_accuracy: 0.9225
Epoch 433/500
52/52 [==============================] - 1s 14ms/step - loss: 4.7854e-05 -
accuracy: 1.0000 - val_loss: 0.3462 - val_accuracy: 0.9224
Epoch 434/500
52/52 [==============================] - 1s 14ms/step - loss: 4.2384e-05 -
accuracy: 1.0000 - val_loss: 0.3469 - val_accuracy: 0.9226
Epoch 435/500
52/52 [==============================] - 1s 14ms/step - loss: 4.0786e-05 -
accuracy: 1.0000 - val_loss: 0.3670 - val_accuracy: 0.9187
Epoch 436/500
52/52 [==============================] - 1s 13ms/step - loss: 4.0883e-05 -
accuracy: 1.0000 - val_loss: 0.3344 - val_accuracy: 0.9264
Epoch 437/500
52/52 [==============================] - 1s 14ms/step - loss: 3.4415e-05 -
accuracy: 1.0000 - val_loss: 0.3545 - val_accuracy: 0.9218
Epoch 438/500
52/52 [==============================] - 1s 14ms/step - loss: 3.8925e-05 -
accuracy: 1.0000 - val_loss: 0.3274 - val_accuracy: 0.9273
Epoch 439/500
52/52 [==============================] - 1s 13ms/step - loss: 4.1429e-05 -
accuracy: 1.0000 - val_loss: 0.3419 - val_accuracy: 0.9234
Epoch 440/500
52/52 [==============================] - 1s 14ms/step - loss: 3.8736e-05 -
accuracy: 1.0000 - val_loss: 0.3467 - val_accuracy: 0.9226
Epoch 441/500
52/52 [==============================] - 1s 14ms/step - loss: 9.0339e-05 -
accuracy: 1.0000 - val_loss: 0.3334 - val_accuracy: 0.9244
```

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Epoch 442/500
52/52 [==============================] - 1s 14ms/step - loss: 2.3705e-04 -
accuracy: 0.9999 - val_loss: 0.3602 - val_accuracy: 0.9199
Epoch 443/500
52/52 [==============================] - 1s 13ms/step - loss: 4.8258e-05 -
accuracy: 1.0000 - val_loss: 0.3371 - val_accuracy: 0.9241
Epoch 444/500
52/52 [==============================] - 1s 15ms/step - loss: 4.1822e-05 -
accuracy: 1.0000 - val_loss: 0.3618 - val_accuracy: 0.9186
Epoch 445/500
52/52 [==============================] - 1s 16ms/step - loss: 3.3183e-05 -
accuracy: 1.0000 - val_loss: 0.3700 - val_accuracy: 0.9159
Epoch 446/500
52/52 [==============================] - 1s 17ms/step - loss: 3.1641e-05 -
accuracy: 1.0000 - val_loss: 0.3516 - val_accuracy: 0.9204
Epoch 447/500
52/52 [==============================] - 1s 16ms/step - loss: 2.9876e-05 -
accuracy: 1.0000 - val_loss: 0.3221 - val_accuracy: 0.9278
Epoch 448/500
52/52 [==============================] - 1s 18ms/step - loss: 4.0967e-05 -
accuracy: 1.0000 - val_loss: 0.3268 - val_accuracy: 0.9268
Epoch 449/500
52/52 [==============================] - 1s 15ms/step - loss: 2.9880e-05 -
accuracy: 1.0000 - val_loss: 0.3212 - val_accuracy: 0.9287
Epoch 450/500
52/52 [==============================] - 1s 16ms/step - loss: 3.1193e-05 -
accuracy: 1.0000 - val_loss: 0.3588 - val_accuracy: 0.9183
Epoch 451/500
52/52 [==============================] - 1s 17ms/step - loss: 3.4917e-05 -
accuracy: 1.0000 - val_loss: 0.4067 - val_accuracy: 0.9071
Epoch 452/500
52/52 [==============================] - 1s 18ms/step - loss: 3.2144e-05 -
accuracy: 1.0000 - val_loss: 0.3374 - val_accuracy: 0.9236
Epoch 453/500
52/52 [==============================] - 1s 15ms/step - loss: 3.4972e-05 -
accuracy: 1.0000 - val_loss: 0.3622 - val_accuracy: 0.9172
Epoch 454/500
52/52 [==============================] - 1s 16ms/step - loss: 5.3165e-05 -
accuracy: 1.0000 - val_loss: 0.3250 - val_accuracy: 0.9254
Epoch 455/500
52/52 [==============================] - 1s 15ms/step - loss: 3.3559e-05 -
accuracy: 1.0000 - val_loss: 0.3424 - val_accuracy: 0.9214
Epoch 456/500
52/52 [==============================] - 1s 15ms/step - loss: 2.9931e-05 -
accuracy: 1.0000 - val_loss: 0.3308 - val_accuracy: 0.9245
Epoch 457/500
52/52 [==============================] - 1s 14ms/step - loss: 3.0357e-05 -
accuracy: 1.0000 - val_loss: 0.3046 - val_accuracy: 0.9300
```

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Epoch 458/500
52/52 [==============================] - 1s 14ms/step - loss: 3.0552e-05 -
accuracy: 1.0000 - val_loss: 0.3398 - val_accuracy: 0.9221
Epoch 459/500
52/52 [==============================] - 1s 15ms/step - loss: 5.6721e-05 -
accuracy: 1.0000 - val_loss: 0.3167 - val_accuracy: 0.9292
Epoch 460/500
52/52 [==============================] - 1s 15ms/step - loss: 2.9429e-05 -
accuracy: 1.0000 - val_loss: 0.3185 - val_accuracy: 0.9276
Epoch 461/500
52/52 [==============================] - 1s 14ms/step - loss: 3.1970e-05 -
accuracy: 1.0000 - val_loss: 0.3328 - val_accuracy: 0.9243
Epoch 462/500
52/52 [==============================] - 1s 15ms/step - loss: 3.1117e-05 -
accuracy: 1.0000 - val_loss: 0.3320 - val_accuracy: 0.9243
Epoch 463/500
52/52 [==============================] - 1s 14ms/step - loss: 2.6617e-05 -
accuracy: 1.0000 - val_loss: 0.3330 - val_accuracy: 0.9240
Epoch 464/500
52/52 [==============================] - 1s 15ms/step - loss: 3.0159e-05 -
accuracy: 1.0000 - val_loss: 0.3112 - val_accuracy: 0.9285
Epoch 465/500
52/52 [==============================] - 1s 14ms/step - loss: 2.7245e-05 -
accuracy: 1.0000 - val_loss: 0.3314 - val_accuracy: 0.9235
Epoch 466/500
52/52 [==============================] - 1s 12ms/step - loss: 4.8705e-05 -
accuracy: 1.0000 - val_loss: 0.3580 - val_accuracy: 0.9183
Epoch 467/500
52/52 [==============================] - 1s 13ms/step - loss: 3.0302e-05 -
accuracy: 1.0000 - val_loss: 0.3081 - val_accuracy: 0.9309
Epoch 468/500
52/52 [==============================] - 1s 13ms/step - loss: 2.9901e-05 -
accuracy: 1.0000 - val_loss: 0.3309 - val_accuracy: 0.9238
Epoch 469/500
52/52 [==============================] - 1s 17ms/step - loss: 3.9804e-05 -
accuracy: 1.0000 - val_loss: 0.3103 - val_accuracy: 0.9283
Epoch 470/500
52/52 [==============================] - 1s 17ms/step - loss: 2.7253e-05 -
accuracy: 1.0000 - val_loss: 0.3117 - val_accuracy: 0.9285
Epoch 471/500
52/52 [==============================] - 1s 17ms/step - loss: 2.5198e-05 -
accuracy: 1.0000 - val_loss: 0.3093 - val_accuracy: 0.9295
Epoch 472/500
52/52 [==============================] - 1s 16ms/step - loss: 2.4322e-05 -
accuracy: 1.0000 - val_loss: 0.3048 - val_accuracy: 0.9297
Epoch 473/500
52/52 [==============================] - 1s 17ms/step - loss: 2.8377e-05 -
accuracy: 1.0000 - val_loss: 0.3437 - val_accuracy: 0.9208
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Epoch 474/500
52/52 [==============================] - 1s 15ms/step - loss: 2.3772e-05 -
accuracy: 1.0000 - val_loss: 0.2926 - val_accuracy: 0.9329
Epoch 475/500
52/52 [==============================] - 1s 18ms/step - loss: 2.4328e-05 -
accuracy: 1.0000 - val_loss: 0.3303 - val_accuracy: 0.9242
Epoch 476/500
52/52 [==============================] - 1s 18ms/step - loss: 2.3223e-05 -
accuracy: 1.0000 - val_loss: 0.3249 - val_accuracy: 0.9249
Epoch 477/500
52/52 [==============================] - 1s 16ms/step - loss: 2.6399e-05 -
accuracy: 1.0000 - val_loss: 0.3171 - val_accuracy: 0.9273
Epoch 478/500
52/52 [==============================] - 1s 17ms/step - loss: 3.3781e-05 -
accuracy: 1.0000 - val_loss: 0.3585 - val_accuracy: 0.9181
Epoch 479/500
52/52 [==============================] - 1s 14ms/step - loss: 4.0246e-05 -
accuracy: 1.0000 - val_loss: 0.3046 - val_accuracy: 0.9297
Epoch 480/500
52/52 [==============================] - 1s 14ms/step - loss: 2.6633e-05 -
accuracy: 1.0000 - val_loss: 0.3470 - val_accuracy: 0.9195
Epoch 481/500
52/52 [==============================] - 1s 14ms/step - loss: 8.8931e-05 -
accuracy: 0.9999 - val_loss: 0.4243 - val_accuracy: 0.9020
Epoch 482/500
52/52 [==============================] - 1s 14ms/step - loss: 7.0003e-05 -
accuracy: 1.0000 - val_loss: 0.3434 - val_accuracy: 0.9211
Epoch 483/500
52/52 [==============================] - 1s 15ms/step - loss: 3.0729e-05 -
accuracy: 1.0000 - val_loss: 0.3177 - val_accuracy: 0.9266
Epoch 484/500
52/52 [==============================] - 1s 15ms/step - loss: 2.2339e-05 -
accuracy: 1.0000 - val_loss: 0.3235 - val_accuracy: 0.9250
Epoch 485/500
52/52 [==============================] - 1s 14ms/step - loss: 2.0414e-05 -
accuracy: 1.0000 - val_loss: 0.3428 - val_accuracy: 0.9199
Epoch 486/500
52/52 [==============================] - 1s 14ms/step - loss: 1.8760e-05 -
accuracy: 1.0000 - val_loss: 0.3085 - val_accuracy: 0.9271
Epoch 487/500
52/52 [==============================] - 1s 15ms/step - loss: 2.2018e-05 -
accuracy: 1.0000 - val_loss: 0.3177 - val_accuracy: 0.9249
Epoch 488/500
52/52 [==============================] - 1s 14ms/step - loss: 1.7874e-05 -
accuracy: 1.0000 - val_loss: 0.3169 - val_accuracy: 0.9251
Epoch 489/500
52/52 [==============================] - 1s 15ms/step - loss: 1.8343e-05 -
accuracy: 1.0000 - val_loss: 0.3042 - val_accuracy: 0.9278
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Epoch 490/500
52/52 [==============================] - 1s 15ms/step - loss: 1.7617e-05 -
accuracy: 1.0000 - val_loss: 0.3063 - val_accuracy: 0.9275
Epoch 491/500
52/52 [==============================] - 1s 13ms/step - loss: 2.9750e-05 -
accuracy: 1.0000 - val_loss: 0.2824 - val_accuracy: 0.9343
Epoch 492/500
52/52 [==============================] - 1s 14ms/step - loss: 4.0073e-05 -
accuracy: 1.0000 - val_loss: 0.2716 - val_accuracy: 0.9362
Epoch 493/500
52/52 [==============================] - 1s 15ms/step - loss: 1.9622e-05 -
accuracy: 1.0000 - val_loss: 0.3032 - val_accuracy: 0.9290
Epoch 494/500
52/52 [==============================] - 1s 16ms/step - loss: 5.6593e-05 -
accuracy: 1.0000 - val_loss: 0.3134 - val_accuracy: 0.9265
Epoch 495/500
52/52 [==============================] - 1s 17ms/step - loss: 8.4370e-05 -
accuracy: 1.0000 - val_loss: 0.3667 - val_accuracy: 0.9148
Epoch 496/500
52/52 [==============================] - 1s 16ms/step - loss: 1.4415e-04 -
accuracy: 1.0000 - val_loss: 0.3179 - val_accuracy: 0.9274
Epoch 497/500
52/52 [==============================] - 1s 17ms/step - loss: 1.9115e-05 -
accuracy: 1.0000 - val_loss: 0.3330 - val_accuracy: 0.9223
Epoch 498/500
52/52 [==============================] - 1s 16ms/step - loss: 1.6077e-05 -
accuracy: 1.0000 - val_loss: 0.3135 - val_accuracy: 0.9275
Epoch 499/500
52/52 [==============================] - 1s 16ms/step - loss: 1.7634e-05 -
accuracy: 1.0000 - val_loss: 0.3131 - val_accuracy: 0.9280
Epoch 500/500
52/52 [==============================] - 1s 17ms/step - loss: 1.8681e-05 -
accuracy: 1.0000 - val_loss: 0.3000 - val_accuracy: 0.9303
466/466 [==============================] - 1s 2ms/step - loss: 0.1313 -
accuracy: 0.9738
Epoch 1/500
26/26 [==============================] - 1s 27ms/step - loss: 1.4224 - accuracy:
0.5616 - val_loss: 3.7070 - val_accuracy: 0.0000e+00
Epoch 2/500
26/26 [==============================] - 1s 23ms/step - loss: 0.7981 - accuracy:
0.7652 - val_loss: 2.3459 - val_accuracy: 0.2428
Epoch 3/500
26/26 [==============================] - 1s 26ms/step - loss: 0.5775 - accuracy:
0.8517 - val_loss: 1.9400 - val_accuracy: 0.3829
Epoch 4/500
26/26 [==============================] - 1s 31ms/step - loss: 0.4557 - accuracy:
0.8986 - val_loss: 1.7012 - val_accuracy: 0.4488
Epoch 5/500
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26/26 [==============================] - 1s 31ms/step - loss: 0.3779 - accuracy:
0.9209 - val_loss: 1.4343 - val_accuracy: 0.5124
Epoch 6/500
26/26 [==============================] - 1s 28ms/step - loss: 0.3240 - accuracy:
0.9334 - val_loss: 1.2791 - val_accuracy: 0.5517
Epoch 7/500
26/26 [==============================] - 1s 27ms/step - loss: 0.2844 - accuracy:
0.9407 - val_loss: 1.2137 - val_accuracy: 0.5671
Epoch 8/500
26/26 [==============================] - 1s 30ms/step - loss: 0.2533 - accuracy:
0.9482 - val_loss: 1.0834 - val_accuracy: 0.6038
Epoch 9/500
26/26 [==============================] - 1s 29ms/step - loss: 0.2287 - accuracy:
0.9525 - val_loss: 1.0858 - val_accuracy: 0.6046
Epoch 10/500
26/26 [==============================] - 1s 28ms/step - loss: 0.2082 - accuracy:
0.9558 - val_loss: 1.0171 - val_accuracy: 0.6236
Epoch 11/500
26/26 [==============================] - 1s 26ms/step - loss: 0.1909 - accuracy:
0.9592 - val_loss: 0.9696 - val_accuracy: 0.6391
Epoch 12/500
26/26 [==============================] - 1s 29ms/step - loss: 0.1761 - accuracy:
0.9618 - val_loss: 0.9282 - val_accuracy: 0.6525
Epoch 13/500
26/26 [==============================] - 1s 27ms/step - loss: 0.1632 - accuracy:
0.9647 - val_loss: 0.8957 - val_accuracy: 0.6652
Epoch 14/500
26/26 [==============================] - 1s 30ms/step - loss: 0.1520 - accuracy:
0.9668 - val_loss: 0.8797 - val_accuracy: 0.6722
Epoch 15/500
26/26 [==============================] - 1s 25ms/step - loss: 0.1419 - accuracy:
0.9687 - val_loss: 0.8678 - val_accuracy: 0.6771
Epoch 16/500
26/26 [==============================] - 1s 23ms/step - loss: 0.1330 - accuracy:
0.9699 - val_loss: 0.8335 - val_accuracy: 0.6883
Epoch 17/500
26/26 [==============================] - 1s 23ms/step - loss: 0.1250 - accuracy:
0.9721 - val_loss: 0.7962 - val_accuracy: 0.6989
Epoch 18/500
26/26 [==============================] - 1s 22ms/step - loss: 0.1179 - accuracy:
0.9739 - val_loss: 0.8059 - val_accuracy: 0.6977
Epoch 19/500
26/26 [==============================] - 1s 26ms/step - loss: 0.1116 - accuracy:
0.9751 - val_loss: 0.7812 - val_accuracy: 0.7075
Epoch 20/500
26/26 [==============================] - 1s 25ms/step - loss: 0.1056 - accuracy:
0.9766 - val_loss: 0.7701 - val_accuracy: 0.7126
Epoch 21/500
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26/26 [==============================] - 1s 26ms/step - loss: 0.1004 - accuracy:
0.9775 - val_loss: 0.7581 - val_accuracy: 0.7189
Epoch 22/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0956 - accuracy:
0.9786 - val_loss: 0.7443 - val_accuracy: 0.7238
Epoch 23/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0911 - accuracy:
0.9799 - val_loss: 0.7385 - val_accuracy: 0.7275
Epoch 24/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0871 - accuracy:
0.9803 - val_loss: 0.7120 - val_accuracy: 0.7348
Epoch 25/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0833 - accuracy:
0.9813 - val_loss: 0.7180 - val_accuracy: 0.7343
Epoch 26/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0799 - accuracy:
0.9821 - val_loss: 0.6907 - val_accuracy: 0.7419
Epoch 27/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0767 - accuracy:
0.9827 - val_loss: 0.6812 - val_accuracy: 0.7453
Epoch 28/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0737 - accuracy:
0.9835 - val_loss: 0.6609 - val_accuracy: 0.7494
Epoch 29/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0710 - accuracy:
0.9844 - val_loss: 0.6574 - val_accuracy: 0.7507
Epoch 30/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0684 - accuracy:
0.9848 - val_loss: 0.6634 - val_accuracy: 0.7508
Epoch 31/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0660 - accuracy:
0.9853 - val_loss: 0.6214 - val_accuracy: 0.7617
Epoch 32/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0638 - accuracy:
0.9858 - val_loss: 0.6354 - val_accuracy: 0.7589
Epoch 33/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0617 - accuracy:
0.9861 - val_loss: 0.6191 - val_accuracy: 0.7645
Epoch 34/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0597 - accuracy:
0.9866 - val_loss: 0.6250 - val_accuracy: 0.7636
Epoch 35/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0577 - accuracy:
0.9872 - val_loss: 0.6029 - val_accuracy: 0.7694
Epoch 36/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0559 - accuracy:
0.9874 - val_loss: 0.5906 - val_accuracy: 0.7718
Epoch 37/500
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26/26 [==============================] - 1s 29ms/step - loss: 0.0544 - accuracy:
0.9874 - val_loss: 0.5760 - val_accuracy: 0.7777
Epoch 38/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0525 - accuracy:
0.9881 - val_loss: 0.5916 - val_accuracy: 0.7733
Epoch 39/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0513 - accuracy:
0.9880 - val_loss: 0.5715 - val_accuracy: 0.7787
Epoch 40/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0496 - accuracy:
0.9885 - val_loss: 0.5659 - val_accuracy: 0.7808
Epoch 41/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0483 - accuracy:
0.9888 - val_loss: 0.5554 - val_accuracy: 0.7842
Epoch 42/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0469 - accuracy:
0.9893 - val_loss: 0.5444 - val_accuracy: 0.7869
Epoch 43/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0457 - accuracy:
0.9895 - val_loss: 0.5500 - val_accuracy: 0.7854
Epoch 44/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0445 - accuracy:
0.9895 - val_loss: 0.5355 - val_accuracy: 0.7909
Epoch 45/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0433 - accuracy:
0.9899 - val_loss: 0.5423 - val_accuracy: 0.7888
Epoch 46/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0422 - accuracy:
0.9900 - val_loss: 0.5106 - val_accuracy: 0.7988
Epoch 47/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0412 - accuracy:
0.9904 - val_loss: 0.5172 - val_accuracy: 0.7977
Epoch 48/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0402 - accuracy:
0.9906 - val_loss: 0.5041 - val_accuracy: 0.8004
Epoch 49/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0392 - accuracy:
0.9909 - val_loss: 0.5134 - val_accuracy: 0.7995
Epoch 50/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0381 - accuracy:
0.9911 - val_loss: 0.5141 - val_accuracy: 0.8000
Epoch 51/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0374 - accuracy:
0.9911 - val_loss: 0.4974 - val_accuracy: 0.8045
Epoch 52/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0364 - accuracy:
0.9913 - val_loss: 0.4774 - val_accuracy: 0.8095
Epoch 53/500
```

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26/26 [==============================] - 1s 24ms/step - loss: 0.0356 - accuracy:
0.9918 - val_loss: 0.4566 - val_accuracy: 0.8156
Epoch 54/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0348 - accuracy:
0.9920 - val_loss: 0.4783 - val_accuracy: 0.8106
Epoch 55/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0340 - accuracy:
0.9919 - val_loss: 0.4528 - val_accuracy: 0.8174
Epoch 56/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0332 - accuracy:
0.9922 - val_loss: 0.4898 - val_accuracy: 0.8098
Epoch 57/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0325 - accuracy:
0.9924 - val_loss: 0.4384 - val_accuracy: 0.8245
Epoch 58/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0318 - accuracy:
0.9927 - val_loss: 0.4661 - val_accuracy: 0.8154
Epoch 59/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0310 - accuracy:
0.9929 - val_loss: 0.4628 - val_accuracy: 0.8173
Epoch 60/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0304 - accuracy:
0.9929 - val_loss: 0.4585 - val_accuracy: 0.8190
Epoch 61/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0298 - accuracy:
0.9932 - val_loss: 0.4490 - val_accuracy: 0.8233
Epoch 62/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0293 - accuracy:
0.9935 - val_loss: 0.4380 - val_accuracy: 0.8267
Epoch 63/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0286 - accuracy:
0.9936 - val_loss: 0.4356 - val_accuracy: 0.8288
Epoch 64/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0280 - accuracy:
0.9936 - val_loss: 0.4275 - val_accuracy: 0.8312
Epoch 65/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0275 - accuracy:
0.9936 - val_loss: 0.4124 - val_accuracy: 0.8351
Epoch 66/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0270 - accuracy:
0.9940 - val_loss: 0.4131 - val_accuracy: 0.8349
Epoch 67/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0264 - accuracy:
0.9941 - val_loss: 0.4286 - val_accuracy: 0.8318
Epoch 68/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0259 - accuracy:
0.9941 - val_loss: 0.4095 - val_accuracy: 0.8367
Epoch 69/500
```

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26/26 [==============================] - 1s 30ms/step - loss: 0.0254 - accuracy:
0.9943 - val_loss: 0.4236 - val_accuracy: 0.8343
Epoch 70/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0249 - accuracy:
0.9944 - val_loss: 0.4107 - val_accuracy: 0.8371
Epoch 71/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0245 - accuracy:
0.9944 - val_loss: 0.4012 - val_accuracy: 0.8402
Epoch 72/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0240 - accuracy:
0.9945 - val_loss: 0.3737 - val_accuracy: 0.8487
Epoch 73/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0236 - accuracy:
0.9947 - val_loss: 0.3870 - val_accuracy: 0.8448
Epoch 74/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0231 - accuracy:
0.9949 - val_loss: 0.3749 - val_accuracy: 0.8488
Epoch 75/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0227 - accuracy:
0.9949 - val_loss: 0.3823 - val_accuracy: 0.8468
Epoch 76/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0225 - accuracy:
0.9950 - val_loss: 0.3639 - val_accuracy: 0.8528
Epoch 77/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0220 - accuracy:
0.9951 - val_loss: 0.3816 - val_accuracy: 0.8479
Epoch 78/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0216 - accuracy:
0.9952 - val_loss: 0.3643 - val_accuracy: 0.8535
Epoch 79/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0212 - accuracy:
0.9953 - val_loss: 0.3553 - val_accuracy: 0.8565
Epoch 80/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0209 - accuracy:
0.9954 - val_loss: 0.3693 - val_accuracy: 0.8525
Epoch 81/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0207 - accuracy:
0.9955 - val_loss: 0.3627 - val_accuracy: 0.8552
Epoch 82/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0202 - accuracy:
0.9957 - val_loss: 0.3540 - val_accuracy: 0.8579
Epoch 83/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0198 - accuracy:
0.9957 - val_loss: 0.3576 - val_accuracy: 0.8574
Epoch 84/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0194 - accuracy:
0.9959 - val_loss: 0.3425 - val_accuracy: 0.8612
Epoch 85/500
```

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26/26 [==============================] - 1s 26ms/step - loss: 0.0192 - accuracy:
0.9960 - val_loss: 0.3466 - val_accuracy: 0.8608
Epoch 86/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0189 - accuracy:
0.9959 - val_loss: 0.3308 - val_accuracy: 0.8664
Epoch 87/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0185 - accuracy:
0.9962 - val_loss: 0.3514 - val_accuracy: 0.8591
Epoch 88/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0183 - accuracy:
0.9961 - val_loss: 0.3236 - val_accuracy: 0.8700
Epoch 89/500
26/26 [==============================] - 1s 31ms/step - loss: 0.0179 - accuracy:
0.9964 - val_loss: 0.3319 - val_accuracy: 0.8669
Epoch 90/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0178 - accuracy:
0.9961 - val_loss: 0.3048 - val_accuracy: 0.8762
Epoch 91/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0176 - accuracy:
0.9963 - val_loss: 0.3607 - val_accuracy: 0.8583
Epoch 92/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0172 - accuracy:
0.9963 - val_loss: 0.3180 - val_accuracy: 0.8730
Epoch 93/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0170 - accuracy:
0.9962 - val_loss: 0.2992 - val_accuracy: 0.8789
Epoch 94/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0166 - accuracy:
0.9965 - val_loss: 0.3044 - val_accuracy: 0.8780
Epoch 95/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0164 - accuracy:
0.9965 - val_loss: 0.3077 - val_accuracy: 0.8773
Epoch 96/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0162 - accuracy:
0.9966 - val_loss: 0.3134 - val_accuracy: 0.8760
Epoch 97/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0159 - accuracy:
0.9967 - val_loss: 0.3125 - val_accuracy: 0.8758
Epoch 98/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0156 - accuracy:
0.9968 - val_loss: 0.3043 - val_accuracy: 0.8789
Epoch 99/500
26/26 [==============================] - 1s 31ms/step - loss: 0.0155 - accuracy:
0.9967 - val_loss: 0.2804 - val_accuracy: 0.8854
Epoch 100/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0152 - accuracy:
0.9970 - val_loss: 0.2970 - val_accuracy: 0.8810
Epoch 101/500
```

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26/26 [==============================] - 1s 26ms/step - loss: 0.0150 - accuracy:
0.9968 - val_loss: 0.3054 - val_accuracy: 0.8792
Epoch 102/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0148 - accuracy:
0.9969 - val_loss: 0.2825 - val_accuracy: 0.8853
Epoch 103/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0147 - accuracy:
0.9968 - val_loss: 0.2747 - val_accuracy: 0.8884
Epoch 104/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0144 - accuracy:
0.9969 - val_loss: 0.2696 - val_accuracy: 0.8906
Epoch 105/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0142 - accuracy:
0.9969 - val_loss: 0.2934 - val_accuracy: 0.8828
Epoch 106/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0140 - accuracy:
0.9970 - val_loss: 0.3073 - val_accuracy: 0.8796
Epoch 107/500
26/26 [==============================] - 1s 21ms/step - loss: 0.0138 - accuracy:
0.9971 - val_loss: 0.2846 - val_accuracy: 0.8857
Epoch 108/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0136 - accuracy:
0.9971 - val_loss: 0.2685 - val_accuracy: 0.8922
Epoch 109/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0134 - accuracy:
0.9972 - val_loss: 0.2613 - val_accuracy: 0.8949
Epoch 110/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0134 - accuracy:
0.9973 - val_loss: 0.2841 - val_accuracy: 0.8872
Epoch 111/500
26/26 [==============================] - 1s 21ms/step - loss: 0.0131 - accuracy:
0.9973 - val_loss: 0.2766 - val_accuracy: 0.8897
Epoch 112/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0128 - accuracy:
0.9972 - val_loss: 0.2665 - val_accuracy: 0.8936
Epoch 113/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0129 - accuracy:
0.9975 - val_loss: 0.2593 - val_accuracy: 0.8960
Epoch 114/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0126 - accuracy:
0.9975 - val_loss: 0.2531 - val_accuracy: 0.8975
Epoch 115/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0124 - accuracy:
0.9974 - val_loss: 0.2938 - val_accuracy: 0.8851
Epoch 116/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0122 - accuracy:
0.9976 - val_loss: 0.2456 - val_accuracy: 0.9002
Epoch 117/500
```

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26/26 [==============================] - 1s 24ms/step - loss: 0.0121 - accuracy:
0.9975 - val_loss: 0.2622 - val_accuracy: 0.8957
Epoch 118/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0119 - accuracy:
0.9976 - val_loss: 0.2828 - val_accuracy: 0.8903
Epoch 119/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0117 - accuracy:
0.9976 - val_loss: 0.2405 - val_accuracy: 0.9026
Epoch 120/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0115 - accuracy:
0.9977 - val_loss: 0.2340 - val_accuracy: 0.9048
Epoch 121/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0114 - accuracy:
0.9976 - val_loss: 0.2474 - val_accuracy: 0.9006
Epoch 122/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0113 - accuracy:
0.9977 - val_loss: 0.2621 - val_accuracy: 0.8965
Epoch 123/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0111 - accuracy:
0.9977 - val_loss: 0.2210 - val_accuracy: 0.9109
Epoch 124/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0111 - accuracy:
0.9978 - val_loss: 0.2802 - val_accuracy: 0.8922
Epoch 125/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0109 - accuracy:
0.9978 - val_loss: 0.2623 - val_accuracy: 0.8970
Epoch 126/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0107 - accuracy:
0.9979 - val_loss: 0.2605 - val_accuracy: 0.8977
Epoch 127/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0106 - accuracy:
0.9979 - val_loss: 0.2255 - val_accuracy: 0.9098
Epoch 128/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0104 - accuracy:
0.9981 - val_loss: 0.2609 - val_accuracy: 0.8977
Epoch 129/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0103 - accuracy:
0.9980 - val_loss: 0.2155 - val_accuracy: 0.9138
Epoch 130/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0102 - accuracy:
0.9980 - val_loss: 0.2433 - val_accuracy: 0.9033
Epoch 131/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0101 - accuracy:
0.9981 - val_loss: 0.2133 - val_accuracy: 0.9149
Epoch 132/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0099 - accuracy:
0.9981 - val_loss: 0.2504 - val_accuracy: 0.9009
Epoch 133/500
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26/26 [==============================] - 1s 24ms/step - loss: 0.0098 - accuracy:
0.9980 - val_loss: 0.2492 - val_accuracy: 0.9009
Epoch 134/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0097 - accuracy:
0.9981 - val_loss: 0.2178 - val_accuracy: 0.9132
Epoch 135/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0096 - accuracy:
0.9980 - val_loss: 0.1995 - val_accuracy: 0.9201
Epoch 136/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0094 - accuracy:
0.9982 - val_loss: 0.2501 - val_accuracy: 0.9015
Epoch 137/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0094 - accuracy:
0.9981 - val_loss: 0.2389 - val_accuracy: 0.9054
Epoch 138/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0093 - accuracy:
0.9982 - val_loss: 0.2146 - val_accuracy: 0.9144
Epoch 139/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0092 - accuracy:
0.9982 - val_loss: 0.2455 - val_accuracy: 0.9037
Epoch 140/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0091 - accuracy:
0.9983 - val_loss: 0.2602 - val_accuracy: 0.8987
Epoch 141/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0089 - accuracy:
0.9983 - val_loss: 0.2008 - val_accuracy: 0.9202
Epoch 142/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0089 - accuracy:
0.9982 - val_loss: 0.2540 - val_accuracy: 0.9012
Epoch 143/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0087 - accuracy:
0.9983 - val_loss: 0.2075 - val_accuracy: 0.9177
Epoch 144/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0086 - accuracy:
0.9982 - val_loss: 0.2113 - val_accuracy: 0.9161
Epoch 145/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0085 - accuracy:
0.9984 - val_loss: 0.2702 - val_accuracy: 0.8971
Epoch 146/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0084 - accuracy:
0.9984 - val_loss: 0.1975 - val_accuracy: 0.9214
Epoch 147/500
26/26 [==============================] - 1s 31ms/step - loss: 0.0083 - accuracy:
0.9984 - val_loss: 0.2018 - val_accuracy: 0.9202
Epoch 148/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0082 - accuracy:
0.9985 - val_loss: 0.2269 - val_accuracy: 0.9117
Epoch 149/500
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26/26 [==============================] - 1s 30ms/step - loss: 0.0081 - accuracy:
0.9984 - val_loss: 0.1782 - val_accuracy: 0.9265
Epoch 150/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0081 - accuracy:
0.9984 - val_loss: 0.2187 - val_accuracy: 0.9143
Epoch 151/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0080 - accuracy:
0.9984 - val_loss: 0.2167 - val_accuracy: 0.9156
Epoch 152/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0078 - accuracy:
0.9985 - val_loss: 0.2430 - val_accuracy: 0.9076
Epoch 153/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0077 - accuracy:
0.9985 - val_loss: 0.1949 - val_accuracy: 0.9227
Epoch 154/500
26/26 [==============================] - 1s 31ms/step - loss: 0.0077 - accuracy:
0.9985 - val_loss: 0.2422 - val_accuracy: 0.9077
Epoch 155/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0075 - accuracy:
0.9985 - val_loss: 0.2156 - val_accuracy: 0.9167
Epoch 156/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0075 - accuracy:
0.9985 - val_loss: 0.1934 - val_accuracy: 0.9233
Epoch 157/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0073 - accuracy:
0.9986 - val_loss: 0.2202 - val_accuracy: 0.9150
Epoch 158/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0073 - accuracy:
0.9986 - val_loss: 0.2436 - val_accuracy: 0.9072
Epoch 159/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0073 - accuracy:
0.9986 - val_loss: 0.1692 - val_accuracy: 0.9298
Epoch 160/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0071 - accuracy:
0.9986 - val_loss: 0.1985 - val_accuracy: 0.9217
Epoch 161/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0070 - accuracy:
0.9986 - val_loss: 0.2039 - val_accuracy: 0.9205
Epoch 162/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0071 - accuracy:
0.9987 - val_loss: 0.1951 - val_accuracy: 0.9225
Epoch 163/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0069 - accuracy:
0.9987 - val_loss: 0.1881 - val_accuracy: 0.9246
Epoch 164/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0068 - accuracy:
0.9987 - val_loss: 0.2088 - val_accuracy: 0.9189
Epoch 165/500
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26/26 [==============================] - 1s 24ms/step - loss: 0.0068 - accuracy:
0.9987 - val_loss: 0.2116 - val_accuracy: 0.9182
Epoch 166/500
26/26 [==============================] - 1s 21ms/step - loss: 0.0067 - accuracy:
0.9987 - val_loss: 0.2245 - val_accuracy: 0.9149
Epoch 167/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0066 - accuracy:
0.9987 - val_loss: 0.2210 - val_accuracy: 0.9161
Epoch 168/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0065 - accuracy:
0.9987 - val_loss: 0.1825 - val_accuracy: 0.9260
Epoch 169/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0064 - accuracy:
0.9987 - val_loss: 0.2340 - val_accuracy: 0.9116
Epoch 170/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0064 - accuracy:
0.9988 - val_loss: 0.2438 - val_accuracy: 0.9083
Epoch 171/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0063 - accuracy:
0.9988 - val_loss: 0.1908 - val_accuracy: 0.9242
Epoch 172/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0062 - accuracy:
0.9988 - val_loss: 0.2031 - val_accuracy: 0.9199
Epoch 173/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0064 - accuracy:
0.9987 - val_loss: 0.2485 - val_accuracy: 0.9071
Epoch 174/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0063 - accuracy:
0.9987 - val_loss: 0.1878 - val_accuracy: 0.9245
Epoch 175/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0062 - accuracy:
0.9987 - val_loss: 0.1748 - val_accuracy: 0.9298
Epoch 176/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0059 - accuracy:
0.9989 - val_loss: 0.2050 - val_accuracy: 0.9199
Epoch 177/500
26/26 [==============================] - 1s 32ms/step - loss: 0.0059 - accuracy:
0.9988 - val_loss: 0.2087 - val_accuracy: 0.9186
Epoch 178/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0059 - accuracy:
0.9988 - val_loss: 0.1953 - val_accuracy: 0.9219
Epoch 179/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0058 - accuracy:
0.9988 - val_loss: 0.2054 - val_accuracy: 0.9202
Epoch 180/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0057 - accuracy:
0.9990 - val_loss: 0.1926 - val_accuracy: 0.9234
Epoch 181/500
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26/26 [==============================] - 1s 27ms/step - loss: 0.0057 - accuracy:
0.9989 - val_loss: 0.1924 - val_accuracy: 0.9233
Epoch 182/500
26/26 [==============================] - 1s 31ms/step - loss: 0.0056 - accuracy:
0.9988 - val_loss: 0.1866 - val_accuracy: 0.9260
Epoch 183/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0054 - accuracy:
0.9989 - val_loss: 0.1958 - val_accuracy: 0.9225
Epoch 184/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0054 - accuracy:
0.9988 - val_loss: 0.1999 - val_accuracy: 0.9211
Epoch 185/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0054 - accuracy:
0.9990 - val_loss: 0.1825 - val_accuracy: 0.9271
Epoch 186/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0053 - accuracy:
0.9991 - val_loss: 0.2048 - val_accuracy: 0.9197
Epoch 187/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0053 - accuracy:
0.9990 - val_loss: 0.1773 - val_accuracy: 0.9295
Epoch 188/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0052 - accuracy:
0.9990 - val_loss: 0.1925 - val_accuracy: 0.9244
Epoch 189/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0052 - accuracy:
0.9989 - val_loss: 0.1798 - val_accuracy: 0.9295
Epoch 190/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0050 - accuracy:
0.9990 - val_loss: 0.2037 - val_accuracy: 0.9205
Epoch 191/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0050 - accuracy:
0.9991 - val_loss: 0.2388 - val_accuracy: 0.9107
Epoch 192/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0050 - accuracy:
0.9990 - val_loss: 0.2325 - val_accuracy: 0.9121
Epoch 193/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0049 - accuracy:
0.9991 - val_loss: 0.1845 - val_accuracy: 0.9280
Epoch 194/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0049 - accuracy:
0.9991 - val_loss: 0.1881 - val_accuracy: 0.9267
Epoch 195/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0049 - accuracy:
0.9991 - val_loss: 0.1904 - val_accuracy: 0.9257
Epoch 196/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0047 - accuracy:
0.9991 - val_loss: 0.1716 - val_accuracy: 0.9330
Epoch 197/500
```

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26/26 [==============================] - 1s 23ms/step - loss: 0.0047 - accuracy:
0.9992 - val_loss: 0.1844 - val_accuracy: 0.9282
Epoch 198/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0046 - accuracy:
0.9992 - val_loss: 0.2183 - val_accuracy: 0.9164
Epoch 199/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0046 - accuracy:
0.9991 - val_loss: 0.2096 - val_accuracy: 0.9192
Epoch 200/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0046 - accuracy:
0.9992 - val_loss: 0.2285 - val_accuracy: 0.9134
Epoch 201/500
26/26 [==============================] - 1s 31ms/step - loss: 0.0045 - accuracy:
0.9991 - val_loss: 0.1960 - val_accuracy: 0.9248
Epoch 202/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0046 - accuracy:
0.9992 - val_loss: 0.1749 - val_accuracy: 0.9325
Epoch 203/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0044 - accuracy:
0.9992 - val_loss: 0.2306 - val_accuracy: 0.9131
Epoch 204/500
26/26 [==============================] - 1s 32ms/step - loss: 0.0043 - accuracy:
0.9992 - val_loss: 0.1721 - val_accuracy: 0.9343
Epoch 205/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0043 - accuracy:
0.9993 - val_loss: 0.1843 - val_accuracy: 0.9296
Epoch 206/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0043 - accuracy:
0.9992 - val_loss: 0.1988 - val_accuracy: 0.9245
Epoch 207/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0042 - accuracy:
0.9992 - val_loss: 0.1646 - val_accuracy: 0.9388
Epoch 208/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0042 - accuracy:
0.9992 - val_loss: 0.2393 - val_accuracy: 0.9106
Epoch 209/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0042 - accuracy:
0.9992 - val_loss: 0.2178 - val_accuracy: 0.9175
Epoch 210/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0041 - accuracy:
0.9992 - val_loss: 0.1918 - val_accuracy: 0.9277
Epoch 211/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0040 - accuracy:
0.9993 - val_loss: 0.2101 - val_accuracy: 0.9211
Epoch 212/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0040 - accuracy:
0.9993 - val_loss: 0.2486 - val_accuracy: 0.9091
Epoch 213/500
```

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26/26 [==============================] - 1s 26ms/step - loss: 0.0041 - accuracy:
0.9992 - val_loss: 0.2099 - val_accuracy: 0.9217
Epoch 214/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0039 - accuracy:
0.9993 - val_loss: 0.1872 - val_accuracy: 0.9303
Epoch 215/500
26/26 [==============================] - 1s 21ms/step - loss: 0.0038 - accuracy:
0.9993 - val_loss: 0.1930 - val_accuracy: 0.9284
Epoch 216/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0039 - accuracy:
0.9993 - val_loss: 0.2179 - val_accuracy: 0.9195
Epoch 217/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0038 - accuracy:
0.9993 - val_loss: 0.1673 - val_accuracy: 0.9398
Epoch 218/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0038 - accuracy:
0.9993 - val_loss: 0.1977 - val_accuracy: 0.9266
Epoch 219/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0037 - accuracy:
0.9993 - val_loss: 0.2210 - val_accuracy: 0.9183
Epoch 220/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0037 - accuracy:
0.9993 - val_loss: 0.1999 - val_accuracy: 0.9265
Epoch 221/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0037 - accuracy:
0.9993 - val_loss: 0.1953 - val_accuracy: 0.9282
Epoch 222/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0035 - accuracy:
0.9994 - val_loss: 0.2256 - val_accuracy: 0.9184
Epoch 223/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0035 - accuracy:
0.9993 - val_loss: 0.2084 - val_accuracy: 0.9249
Epoch 224/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0035 - accuracy:
0.9994 - val_loss: 0.2489 - val_accuracy: 0.9109
Epoch 225/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0035 - accuracy:
0.9993 - val_loss: 0.2376 - val_accuracy: 0.9146
Epoch 226/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0035 - accuracy:
0.9993 - val_loss: 0.1914 - val_accuracy: 0.9326
Epoch 227/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0034 - accuracy:
0.9994 - val_loss: 0.2044 - val_accuracy: 0.9271
Epoch 228/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0034 - accuracy:
0.9994 - val_loss: 0.2325 - val_accuracy: 0.9181
Epoch 229/500
```

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26/26 [==============================] - 1s 28ms/step - loss: 0.0033 - accuracy:
0.9994 - val_loss: 0.2312 - val_accuracy: 0.9186
Epoch 230/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0034 - accuracy:
0.9994 - val_loss: 0.1928 - val_accuracy: 0.9331
Epoch 231/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0033 - accuracy:
0.9995 - val_loss: 0.2660 - val_accuracy: 0.9073
Epoch 232/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0033 - accuracy:
0.9993 - val_loss: 0.2046 - val_accuracy: 0.9279
Epoch 233/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0032 - accuracy:
0.9994 - val_loss: 0.2014 - val_accuracy: 0.9311
Epoch 234/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0032 - accuracy:
0.9994 - val_loss: 0.2068 - val_accuracy: 0.9293
Epoch 235/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0032 - accuracy:
0.9994 - val_loss: 0.2441 - val_accuracy: 0.9155
Epoch 236/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0031 - accuracy:
0.9995 - val_loss: 0.2164 - val_accuracy: 0.9253
Epoch 237/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0031 - accuracy:
0.9995 - val_loss: 0.2187 - val_accuracy: 0.9245
Epoch 238/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0030 - accuracy:
0.9994 - val_loss: 0.2185 - val_accuracy: 0.9260
Epoch 239/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0030 - accuracy:
0.9995 - val_loss: 0.2413 - val_accuracy: 0.9177
Epoch 240/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0030 - accuracy:
0.9995 - val_loss: 0.2450 - val_accuracy: 0.9167
Epoch 241/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0031 - accuracy:
0.9994 - val_loss: 0.2103 - val_accuracy: 0.9297
Epoch 242/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0029 - accuracy:
0.9995 - val_loss: 0.2361 - val_accuracy: 0.9199
Epoch 243/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0029 - accuracy:
0.9994 - val_loss: 0.2134 - val_accuracy: 0.9287
Epoch 244/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0029 - accuracy:
0.9995 - val_loss: 0.2414 - val_accuracy: 0.9183
Epoch 245/500
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26/26 [==============================] - 1s 26ms/step - loss: 0.0029 - accuracy:
0.9996 - val_loss: 0.2172 - val_accuracy: 0.9279
Epoch 246/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0028 - accuracy:
0.9995 - val_loss: 0.2027 - val_accuracy: 0.9349
Epoch 247/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0028 - accuracy:
0.9996 - val_loss: 0.2818 - val_accuracy: 0.9063
Epoch 248/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0027 - accuracy:
0.9996 - val_loss: 0.1980 - val_accuracy: 0.9355
Epoch 249/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0027 - accuracy:
0.9995 - val_loss: 0.2179 - val_accuracy: 0.9278
Epoch 250/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0028 - accuracy:
0.9995 - val_loss: 0.2656 - val_accuracy: 0.9127
Epoch 251/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0027 - accuracy:
0.9995 - val_loss: 0.2423 - val_accuracy: 0.9195
Epoch 252/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0027 - accuracy:
0.9996 - val_loss: 0.2367 - val_accuracy: 0.9227
Epoch 253/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0026 - accuracy:
0.9996 - val_loss: 0.2205 - val_accuracy: 0.9294
Epoch 254/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0026 - accuracy:
0.9996 - val_loss: 0.2304 - val_accuracy: 0.9260
Epoch 255/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0026 - accuracy:
0.9996 - val_loss: 0.2839 - val_accuracy: 0.9089
Epoch 256/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0027 - accuracy:
0.9995 - val_loss: 0.2365 - val_accuracy: 0.9254
Epoch 257/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0025 - accuracy:
0.9996 - val_loss: 0.2209 - val_accuracy: 0.9318
Epoch 258/500
26/26 [==============================] - 1s 31ms/step - loss: 0.0025 - accuracy:
0.9996 - val_loss: 0.2088 - val_accuracy: 0.9360
Epoch 259/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0024 - accuracy:
0.9996 - val_loss: 0.3355 - val_accuracy: 0.8944
Epoch 260/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0024 - accuracy:
0.9996 - val_loss: 0.2124 - val_accuracy: 0.9340
Epoch 261/500
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26/26 [==============================] - 1s 29ms/step - loss: 0.0025 - accuracy:
0.9996 - val_loss: 0.2125 - val_accuracy: 0.9348
Epoch 262/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0024 - accuracy:
0.9995 - val_loss: 0.2073 - val_accuracy: 0.9368
Epoch 263/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0024 - accuracy:
0.9996 - val_loss: 0.2491 - val_accuracy: 0.9210
Epoch 264/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0023 - accuracy:
0.9995 - val_loss: 0.2526 - val_accuracy: 0.9207
Epoch 265/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0023 - accuracy:
0.9996 - val_loss: 0.2634 - val_accuracy: 0.9173
Epoch 266/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0022 - accuracy:
0.9997 - val_loss: 0.2535 - val_accuracy: 0.9220
Epoch 267/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0022 - accuracy:
0.9997 - val_loss: 0.2391 - val_accuracy: 0.9267
Epoch 268/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0023 - accuracy:
0.9995 - val_loss: 0.2583 - val_accuracy: 0.9202
Epoch 269/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0021 - accuracy:
0.9997 - val_loss: 0.2338 - val_accuracy: 0.9299
Epoch 270/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0022 - accuracy:
0.9997 - val_loss: 0.2257 - val_accuracy: 0.9336
Epoch 271/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0022 - accuracy:
0.9996 - val_loss: 0.2385 - val_accuracy: 0.9292
Epoch 272/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0022 - accuracy:
0.9997 - val_loss: 0.2475 - val_accuracy: 0.9262
Epoch 273/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0021 - accuracy:
0.9997 - val_loss: 0.2508 - val_accuracy: 0.9248
Epoch 274/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0021 - accuracy:
0.9996 - val_loss: 0.2697 - val_accuracy: 0.9189
Epoch 275/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0022 - accuracy:
0.9996 - val_loss: 0.2627 - val_accuracy: 0.9219
Epoch 276/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0021 - accuracy:
0.9997 - val_loss: 0.2373 - val_accuracy: 0.9318
Epoch 277/500
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26/26 [==============================] - 1s 22ms/step - loss: 0.0021 - accuracy:
0.9997 - val_loss: 0.2556 - val_accuracy: 0.9247
Epoch 278/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0020 - accuracy:
0.9997 - val_loss: 0.2739 - val_accuracy: 0.9192
Epoch 279/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0020 - accuracy:
0.9997 - val_loss: 0.2611 - val_accuracy: 0.9241
Epoch 280/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0020 - accuracy:
0.9997 - val_loss: 0.2370 - val_accuracy: 0.9332
Epoch 281/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0020 - accuracy:
0.9997 - val_loss: 0.2518 - val_accuracy: 0.9278
Epoch 282/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0020 - accuracy:
0.9996 - val_loss: 0.2582 - val_accuracy: 0.9248
Epoch 283/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0019 - accuracy:
0.9998 - val_loss: 0.2428 - val_accuracy: 0.9309
Epoch 284/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0019 - accuracy:
0.9997 - val_loss: 0.2540 - val_accuracy: 0.9275
Epoch 285/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0019 - accuracy:
0.9997 - val_loss: 0.2490 - val_accuracy: 0.9299
Epoch 286/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0019 - accuracy:
0.9997 - val_loss: 0.2763 - val_accuracy: 0.9195
Epoch 287/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0019 - accuracy:
0.9996 - val_loss: 0.2961 - val_accuracy: 0.9140
Epoch 288/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0018 - accuracy:
0.9997 - val_loss: 0.2607 - val_accuracy: 0.9267
Epoch 289/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0018 - accuracy:
0.9998 - val_loss: 0.2804 - val_accuracy: 0.9194
Epoch 290/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0018 - accuracy:
0.9996 - val_loss: 0.2480 - val_accuracy: 0.9318
Epoch 291/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0018 - accuracy:
0.9998 - val_loss: 0.2601 - val_accuracy: 0.9277
Epoch 292/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0018 - accuracy:
0.9997 - val_loss: 0.2986 - val_accuracy: 0.9140
Epoch 293/500
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26/26 [==============================] - 1s 29ms/step - loss: 0.0018 - accuracy:
0.9997 - val_loss: 0.3207 - val_accuracy: 0.9064
Epoch 294/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0018 - accuracy:
0.9998 - val_loss: 0.2710 - val_accuracy: 0.9248
Epoch 295/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0018 - accuracy:
0.9997 - val_loss: 0.2549 - val_accuracy: 0.9307
Epoch 296/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0017 - accuracy:
0.9998 - val_loss: 0.2589 - val_accuracy: 0.9294
Epoch 297/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0017 - accuracy:
0.9998 - val_loss: 0.2988 - val_accuracy: 0.9152
Epoch 298/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0017 - accuracy:
0.9997 - val_loss: 0.2922 - val_accuracy: 0.9185
Epoch 299/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0016 - accuracy:
0.9997 - val_loss: 0.2819 - val_accuracy: 0.9229
Epoch 300/500
26/26 [==============================] - 1s 21ms/step - loss: 0.0016 - accuracy:
0.9998 - val_loss: 0.2681 - val_accuracy: 0.9278
Epoch 301/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0016 - accuracy:
0.9998 - val_loss: 0.2633 - val_accuracy: 0.9300
Epoch 302/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0016 - accuracy:
0.9997 - val_loss: 0.2651 - val_accuracy: 0.9289
Epoch 303/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0016 - accuracy:
0.9998 - val_loss: 0.2854 - val_accuracy: 0.9224
Epoch 304/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0015 - accuracy:
0.9998 - val_loss: 0.3194 - val_accuracy: 0.9114
Epoch 305/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0015 - accuracy:
0.9998 - val_loss: 0.2906 - val_accuracy: 0.9213
Epoch 306/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0016 - accuracy:
0.9997 - val_loss: 0.2662 - val_accuracy: 0.9311
Epoch 307/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0015 - accuracy:
0.9998 - val_loss: 0.3124 - val_accuracy: 0.9133
Epoch 308/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0015 - accuracy:
0.9998 - val_loss: 0.2570 - val_accuracy: 0.9337
Epoch 309/500
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26/26 [==============================] - 1s 23ms/step - loss: 0.0015 - accuracy:
0.9998 - val_loss: 0.2922 - val_accuracy: 0.9216
Epoch 310/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0015 - accuracy:
0.9997 - val_loss: 0.2771 - val_accuracy: 0.9266
Epoch 311/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0015 - accuracy:
0.9998 - val_loss: 0.2842 - val_accuracy: 0.9244
Epoch 312/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0015 - accuracy:
0.9998 - val_loss: 0.2796 - val_accuracy: 0.9264
Epoch 313/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0014 - accuracy:
0.9998 - val_loss: 0.3010 - val_accuracy: 0.9189
Epoch 314/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0014 - accuracy:
0.9998 - val_loss: 0.2899 - val_accuracy: 0.9242
Epoch 315/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0015 - accuracy:
0.9997 - val_loss: 0.2807 - val_accuracy: 0.9263
Epoch 316/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0014 - accuracy:
0.9998 - val_loss: 0.2949 - val_accuracy: 0.9232
Epoch 317/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.2826 - val_accuracy: 0.9269
Epoch 318/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0014 - accuracy:
0.9998 - val_loss: 0.3511 - val_accuracy: 0.9035
Epoch 319/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0014 - accuracy:
0.9998 - val_loss: 0.3307 - val_accuracy: 0.9112
Epoch 320/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.3268 - val_accuracy: 0.9118
Epoch 321/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0013 - accuracy:
0.9999 - val_loss: 0.2967 - val_accuracy: 0.9226
Epoch 322/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.2707 - val_accuracy: 0.9319
Epoch 323/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.2651 - val_accuracy: 0.9346
Epoch 324/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.2814 - val_accuracy: 0.9282
Epoch 325/500
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26/26 [==============================] - 1s 25ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.3378 - val_accuracy: 0.9109
Epoch 326/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.3223 - val_accuracy: 0.9167
Epoch 327/500
26/26 [==============================] - 1s 24ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.2921 - val_accuracy: 0.9260
Epoch 328/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0012 - accuracy:
0.9999 - val_loss: 0.3437 - val_accuracy: 0.9096
Epoch 329/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0012 - accuracy:
0.9999 - val_loss: 0.3461 - val_accuracy: 0.9097
Epoch 330/500
26/26 [==============================] - 1s 27ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.2932 - val_accuracy: 0.9269
Epoch 331/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.2711 - val_accuracy: 0.9336
Epoch 332/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0012 - accuracy:
0.9998 - val_loss: 0.2884 - val_accuracy: 0.9285
Epoch 333/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0013 - accuracy:
0.9998 - val_loss: 0.3038 - val_accuracy: 0.9248
Epoch 334/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.2951 - val_accuracy: 0.9292
Epoch 335/500
26/26 [==============================] - 1s 23ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.2958 - val_accuracy: 0.9288
Epoch 336/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0011 - accuracy:
0.9999 - val_loss: 0.3506 - val_accuracy: 0.9105
Epoch 337/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0011 - accuracy:
0.9999 - val_loss: 0.3435 - val_accuracy: 0.9133
Epoch 338/500
26/26 [==============================] - 1s 26ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.2817 - val_accuracy: 0.9343
Epoch 339/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0011 - accuracy:
0.9999 - val_loss: 0.3195 - val_accuracy: 0.9210
Epoch 340/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0011 - accuracy:
0.9999 - val_loss: 0.3129 - val_accuracy: 0.9241
Epoch 341/500
```

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26/26 [==============================] - 1s 28ms/step - loss: 0.0010 - accuracy:
0.9999 - val_loss: 0.3356 - val_accuracy: 0.9170
Epoch 342/500
26/26 [==============================] - 1s 31ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.3089 - val_accuracy: 0.9257
Epoch 343/500
26/26 [==============================] - 1s 29ms/step - loss: 0.0011 - accuracy:
0.9999 - val_loss: 0.3466 - val_accuracy: 0.9141
Epoch 344/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0010 - accuracy:
0.9998 - val_loss: 0.3387 - val_accuracy: 0.9163
Epoch 345/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0010 - accuracy:
0.9999 - val_loss: 0.3091 - val_accuracy: 0.9267
Epoch 346/500
26/26 [==============================] - 1s 31ms/step - loss: 9.8923e-04 -
accuracy: 0.9999 - val_loss: 0.3491 - val_accuracy: 0.9140
Epoch 347/500
26/26 [==============================] - 1s 25ms/step - loss: 0.0010 - accuracy:
0.9998 - val_loss: 0.3482 - val_accuracy: 0.9149
Epoch 348/500
26/26 [==============================] - 1s 28ms/step - loss: 9.9106e-04 -
accuracy: 0.9999 - val_loss: 0.3520 - val_accuracy: 0.9147
Epoch 349/500
26/26 [==============================] - 1s 30ms/step - loss: 0.0010 - accuracy:
0.9998 - val_loss: 0.3105 - val_accuracy: 0.9288
Epoch 350/500
26/26 [==============================] - 1s 27ms/step - loss: 9.7879e-04 -
accuracy: 0.9999 - val_loss: 0.3125 - val_accuracy: 0.9277
Epoch 351/500
26/26 [==============================] - 1s 22ms/step - loss: 0.0010 - accuracy:
0.9999 - val_loss: 0.3098 - val_accuracy: 0.9282
Epoch 352/500
26/26 [==============================] - 1s 23ms/step - loss: 9.5284e-04 -
accuracy: 0.9999 - val_loss: 0.3129 - val_accuracy: 0.9285
Epoch 353/500
26/26 [==============================] - 1s 26ms/step - loss: 9.5050e-04 -
accuracy: 0.9998 - val_loss: 0.2994 - val_accuracy: 0.9336
Epoch 354/500
26/26 [==============================] - 1s 28ms/step - loss: 0.0011 - accuracy:
0.9998 - val_loss: 0.3190 - val_accuracy: 0.9267
Epoch 355/500
26/26 [==============================] - 1s 23ms/step - loss: 9.3864e-04 -
accuracy: 0.9999 - val_loss: 0.3257 - val_accuracy: 0.9235
Epoch 356/500
26/26 [==============================] - 1s 23ms/step - loss: 9.3037e-04 -
accuracy: 0.9999 - val_loss: 0.3187 - val_accuracy: 0.9275
Epoch 357/500
```

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26/26 [==============================] - 1s 24ms/step - loss: 8.9846e-04 -
accuracy: 0.9999 - val_loss: 0.3314 - val_accuracy: 0.9232
Epoch 358/500
26/26 [==============================] - 1s 26ms/step - loss: 9.1560e-04 -
accuracy: 0.9999 - val_loss: 0.3206 - val_accuracy: 0.9272
Epoch 359/500
26/26 [==============================] - 1s 23ms/step - loss: 8.8872e-04 -
accuracy: 0.9999 - val_loss: 0.3642 - val_accuracy: 0.9122
Epoch 360/500
26/26 [==============================] - 1s 25ms/step - loss: 9.4165e-04 -
accuracy: 0.9999 - val_loss: 0.3849 - val_accuracy: 0.9074
Epoch 361/500
26/26 [==============================] - 1s 27ms/step - loss: 9.0305e-04 -
accuracy: 0.9999 - val_loss: 0.3954 - val_accuracy: 0.9047
Epoch 362/500
26/26 [==============================] - 1s 22ms/step - loss: 9.0603e-04 -
accuracy: 0.9998 - val_loss: 0.3462 - val_accuracy: 0.9194
Epoch 363/500
26/26 [==============================] - 1s 27ms/step - loss: 8.3521e-04 -
accuracy: 0.9999 - val_loss: 0.3310 - val_accuracy: 0.9257
Epoch 364/500
26/26 [==============================] - 1s 27ms/step - loss: 8.1270e-04 -
accuracy: 0.9999 - val_loss: 0.3126 - val_accuracy: 0.9317
Epoch 365/500
26/26 [==============================] - 1s 26ms/step - loss: 8.8451e-04 -
accuracy: 0.9999 - val_loss: 0.3551 - val_accuracy: 0.9181
Epoch 366/500
26/26 [==============================] - 1s 29ms/step - loss: 8.4265e-04 -
accuracy: 0.9999 - val_loss: 0.3036 - val_accuracy: 0.9352
Epoch 367/500
26/26 [==============================] - 1s 28ms/step - loss: 9.2230e-04 -
accuracy: 0.9998 - val_loss: 0.3422 - val_accuracy: 0.9229
Epoch 368/500
26/26 [==============================] - 1s 31ms/step - loss: 7.9288e-04 -
accuracy: 0.9999 - val_loss: 0.3288 - val_accuracy: 0.9264
Epoch 369/500
26/26 [==============================] - 1s 29ms/step - loss: 7.9925e-04 -
accuracy: 0.9999 - val_loss: 0.3357 - val_accuracy: 0.9254
Epoch 370/500
26/26 [==============================] - 1s 31ms/step - loss: 7.8430e-04 -
accuracy: 0.9999 - val_loss: 0.3520 - val_accuracy: 0.9211
Epoch 371/500
26/26 [==============================] - 1s 27ms/step - loss: 7.9606e-04 -
accuracy: 0.9999 - val_loss: 0.3489 - val_accuracy: 0.9216
Epoch 372/500
26/26 [==============================] - 1s 28ms/step - loss: 7.6596e-04 -
accuracy: 0.9999 - val_loss: 0.3633 - val_accuracy: 0.9175
Epoch 373/500
```

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26/26 [==============================] - 1s 26ms/step - loss: 7.7200e-04 -
accuracy: 1.0000 - val_loss: 0.3612 - val_accuracy: 0.9188
Epoch 374/500
26/26 [==============================] - 1s 27ms/step - loss: 8.0410e-04 -
accuracy: 0.9999 - val_loss: 0.4075 - val_accuracy: 0.9055
Epoch 375/500
26/26 [==============================] - 1s 31ms/step - loss: 8.3228e-04 -
accuracy: 0.9999 - val_loss: 0.3643 - val_accuracy: 0.9189
Epoch 376/500
26/26 [==============================] - 1s 28ms/step - loss: 7.6693e-04 -
accuracy: 0.9999 - val_loss: 0.3731 - val_accuracy: 0.9168
Epoch 377/500
26/26 [==============================] - 1s 26ms/step - loss: 7.5596e-04 -
accuracy: 0.9999 - val_loss: 0.3622 - val_accuracy: 0.9200
Epoch 378/500
26/26 [==============================] - 1s 28ms/step - loss: 7.4087e-04 -
accuracy: 0.9999 - val_loss: 0.3420 - val_accuracy: 0.9273
Epoch 379/500
26/26 [==============================] - 1s 26ms/step - loss: 7.7134e-04 -
accuracy: 0.9999 - val_loss: 0.3511 - val_accuracy: 0.9250
Epoch 380/500
26/26 [==============================] - 1s 22ms/step - loss: 7.6284e-04 -
accuracy: 0.9999 - val_loss: 0.3840 - val_accuracy: 0.9139
Epoch 381/500
26/26 [==============================] - 1s 26ms/step - loss: 7.5163e-04 -
accuracy: 0.9999 - val_loss: 0.3830 - val_accuracy: 0.9157
Epoch 382/500
26/26 [==============================] - 1s 27ms/step - loss: 7.0994e-04 -
accuracy: 0.9999 - val_loss: 0.3826 - val_accuracy: 0.9150
Epoch 383/500
26/26 [==============================] - 1s 26ms/step - loss: 7.4036e-04 -
accuracy: 0.9998 - val_loss: 0.4104 - val_accuracy: 0.9071
Epoch 384/500
26/26 [==============================] - 1s 26ms/step - loss: 8.2438e-04 -
accuracy: 0.9998 - val_loss: 0.4494 - val_accuracy: 0.8962
Epoch 385/500
26/26 [==============================] - 1s 24ms/step - loss: 8.9362e-04 -
accuracy: 0.9999 - val_loss: 0.4518 - val_accuracy: 0.8939
Epoch 386/500
26/26 [==============================] - 1s 23ms/step - loss: 7.8358e-04 -
accuracy: 0.9999 - val_loss: 0.3810 - val_accuracy: 0.9152
Epoch 387/500
26/26 [==============================] - 1s 22ms/step - loss: 6.8648e-04 -
accuracy: 0.9999 - val_loss: 0.3971 - val_accuracy: 0.9100
Epoch 388/500
26/26 [==============================] - 1s 23ms/step - loss: 6.4147e-04 -
accuracy: 1.0000 - val_loss: 0.3588 - val_accuracy: 0.9237
Epoch 389/500
```

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26/26 [==============================] - 1s 22ms/step - loss: 6.4690e-04 -
accuracy: 0.9999 - val_loss: 0.3721 - val_accuracy: 0.9204
Epoch 390/500
26/26 [==============================] - 1s 23ms/step - loss: 6.5942e-04 -
accuracy: 0.9999 - val_loss: 0.3852 - val_accuracy: 0.9162
Epoch 391/500
26/26 [==============================] - 1s 26ms/step - loss: 6.8124e-04 -
accuracy: 0.9999 - val_loss: 0.3992 - val_accuracy: 0.9123
Epoch 392/500
26/26 [==============================] - 1s 26ms/step - loss: 6.3790e-04 -
accuracy: 0.9999 - val_loss: 0.3845 - val_accuracy: 0.9173
Epoch 393/500
26/26 [==============================] - 1s 27ms/step - loss: 6.6193e-04 -
accuracy: 0.9999 - val_loss: 0.3781 - val_accuracy: 0.9198
Epoch 394/500
26/26 [==============================] - 1s 24ms/step - loss: 6.6181e-04 -
accuracy: 0.9999 - val_loss: 0.3608 - val_accuracy: 0.9252
Epoch 395/500
26/26 [==============================] - 1s 26ms/step - loss: 6.5739e-04 -
accuracy: 0.9999 - val_loss: 0.3545 - val_accuracy: 0.9269
Epoch 396/500
26/26 [==============================] - 1s 31ms/step - loss: 6.6125e-04 -
accuracy: 0.9999 - val_loss: 0.3615 - val_accuracy: 0.9258
Epoch 397/500
26/26 [==============================] - 1s 29ms/step - loss: 6.4801e-04 -
accuracy: 0.9999 - val_loss: 0.3666 - val_accuracy: 0.9254
Epoch 398/500
26/26 [==============================] - 1s 28ms/step - loss: 6.1610e-04 -
accuracy: 0.9999 - val_loss: 0.3990 - val_accuracy: 0.9148
Epoch 399/500
26/26 [==============================] - 1s 29ms/step - loss: 6.1177e-04 -
accuracy: 1.0000 - val_loss: 0.3714 - val_accuracy: 0.9236
Epoch 400/500
26/26 [==============================] - 1s 28ms/step - loss: 5.7570e-04 -
accuracy: 1.0000 - val_loss: 0.4024 - val_accuracy: 0.9139
Epoch 401/500
26/26 [==============================] - 1s 26ms/step - loss: 5.9738e-04 -
accuracy: 0.9999 - val_loss: 0.3999 - val_accuracy: 0.9145
Epoch 402/500
26/26 [==============================] - 1s 31ms/step - loss: 5.8464e-04 -
accuracy: 0.9999 - val_loss: 0.3980 - val_accuracy: 0.9156
Epoch 403/500
26/26 [==============================] - 1s 27ms/step - loss: 5.9226e-04 -
accuracy: 0.9999 - val_loss: 0.4599 - val_accuracy: 0.8972
Epoch 404/500
26/26 [==============================] - 1s 27ms/step - loss: 5.8008e-04 -
accuracy: 0.9999 - val_loss: 0.3779 - val_accuracy: 0.9217
Epoch 405/500
```

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26/26 [==============================] - 1s 28ms/step - loss: 5.8792e-04 -
accuracy: 0.9999 - val_loss: 0.4007 - val_accuracy: 0.9145
Epoch 406/500
26/26 [==============================] - 1s 26ms/step - loss: 6.2504e-04 -
accuracy: 0.9999 - val_loss: 0.4495 - val_accuracy: 0.8984
Epoch 407/500
26/26 [==============================] - 1s 27ms/step - loss: 5.9748e-04 -
accuracy: 0.9999 - val_loss: 0.3822 - val_accuracy: 0.9192
Epoch 408/500
26/26 [==============================] - 1s 26ms/step - loss: 5.3561e-04 -
accuracy: 0.9999 - val_loss: 0.3824 - val_accuracy: 0.9195
Epoch 409/500
26/26 [==============================] - 1s 25ms/step - loss: 5.5872e-04 -
accuracy: 0.9999 - val_loss: 0.3598 - val_accuracy: 0.9269
Epoch 410/500
26/26 [==============================] - 1s 26ms/step - loss: 5.3775e-04 -
accuracy: 0.9999 - val_loss: 0.3617 - val_accuracy: 0.9267
Epoch 411/500
26/26 [==============================] - 1s 26ms/step - loss: 5.8476e-04 -
accuracy: 0.9999 - val_loss: 0.3616 - val_accuracy: 0.9276
Epoch 412/500
26/26 [==============================] - 1s 26ms/step - loss: 5.9822e-04 -
accuracy: 0.9999 - val_loss: 0.3808 - val_accuracy: 0.9220
Epoch 413/500
26/26 [==============================] - 1s 23ms/step - loss: 5.2599e-04 -
accuracy: 0.9999 - val_loss: 0.3808 - val_accuracy: 0.9221
Epoch 414/500
26/26 [==============================] - 1s 22ms/step - loss: 5.1788e-04 -
accuracy: 0.9999 - val_loss: 0.3724 - val_accuracy: 0.9260
Epoch 415/500
26/26 [==============================] - 1s 23ms/step - loss: 5.2558e-04 -
accuracy: 1.0000 - val_loss: 0.4085 - val_accuracy: 0.9149
Epoch 416/500
26/26 [==============================] - 1s 26ms/step - loss: 5.1057e-04 -
accuracy: 1.0000 - val_loss: 0.3989 - val_accuracy: 0.9184
Epoch 417/500
26/26 [==============================] - 1s 26ms/step - loss: 4.9626e-04 -
accuracy: 0.9999 - val_loss: 0.3826 - val_accuracy: 0.9233
Epoch 418/500
26/26 [==============================] - 1s 22ms/step - loss: 4.8666e-04 -
accuracy: 1.0000 - val_loss: 0.4212 - val_accuracy: 0.9116
Epoch 419/500
26/26 [==============================] - 1s 25ms/step - loss: 4.7791e-04 -
accuracy: 1.0000 - val_loss: 0.3767 - val_accuracy: 0.9242
Epoch 420/500
26/26 [==============================] - 1s 26ms/step - loss: 5.4367e-04 -
accuracy: 1.0000 - val_loss: 0.3884 - val_accuracy: 0.9217
Epoch 421/500
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26/26 [==============================] - 1s 23ms/step - loss: 5.0172e-04 -
accuracy: 0.9999 - val_loss: 0.3828 - val_accuracy: 0.9234
Epoch 422/500
26/26 [==============================] - 1s 25ms/step - loss: 4.8207e-04 -
accuracy: 1.0000 - val_loss: 0.3844 - val_accuracy: 0.9237
Epoch 423/500
26/26 [==============================] - 1s 31ms/step - loss: 4.8419e-04 -
accuracy: 0.9999 - val_loss: 0.3870 - val_accuracy: 0.9235
Epoch 424/500
26/26 [==============================] - 1s 28ms/step - loss: 4.7697e-04 -
accuracy: 1.0000 - val_loss: 0.4169 - val_accuracy: 0.9149
Epoch 425/500
26/26 [==============================] - 1s 31ms/step - loss: 4.9130e-04 -
accuracy: 1.0000 - val_loss: 0.4387 - val_accuracy: 0.9086
Epoch 426/500
26/26 [==============================] - 1s 29ms/step - loss: 4.5118e-04 -
accuracy: 1.0000 - val_loss: 0.4016 - val_accuracy: 0.9192
Epoch 427/500
26/26 [==============================] - 1s 30ms/step - loss: 4.4365e-04 -
accuracy: 1.0000 - val_loss: 0.4171 - val_accuracy: 0.9152
Epoch 428/500
26/26 [==============================] - 1s 30ms/step - loss: 5.1362e-04 -
accuracy: 0.9999 - val_loss: 0.4474 - val_accuracy: 0.9068
Epoch 429/500
26/26 [==============================] - 1s 27ms/step - loss: 4.5299e-04 -
accuracy: 1.0000 - val_loss: 0.4167 - val_accuracy: 0.9153
Epoch 430/500
26/26 [==============================] - 1s 31ms/step - loss: 4.4100e-04 -
accuracy: 1.0000 - val_loss: 0.4609 - val_accuracy: 0.9026
Epoch 431/500
26/26 [==============================] - 1s 27ms/step - loss: 4.8067e-04 -
accuracy: 0.9999 - val_loss: 0.4015 - val_accuracy: 0.9205
Epoch 432/500
26/26 [==============================] - 1s 26ms/step - loss: 4.6594e-04 -
accuracy: 1.0000 - val_loss: 0.4281 - val_accuracy: 0.9136
Epoch 433/500
26/26 [==============================] - 1s 27ms/step - loss: 4.2372e-04 -
accuracy: 1.0000 - val_loss: 0.4424 - val_accuracy: 0.9085
Epoch 434/500
26/26 [==============================] - 1s 23ms/step - loss: 4.3278e-04 -
accuracy: 1.0000 - val_loss: 0.4422 - val_accuracy: 0.9082
Epoch 435/500
26/26 [==============================] - 1s 25ms/step - loss: 4.4285e-04 -
accuracy: 0.9999 - val_loss: 0.4015 - val_accuracy: 0.9210
Epoch 436/500
26/26 [==============================] - 1s 23ms/step - loss: 4.2873e-04 -
accuracy: 1.0000 - val_loss: 0.4336 - val_accuracy: 0.9114
Epoch 437/500
```

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26/26 [==============================] - 1s 26ms/step - loss: 4.3213e-04 -
accuracy: 0.9999 - val_loss: 0.4042 - val_accuracy: 0.9198
Epoch 438/500
26/26 [==============================] - 1s 25ms/step - loss: 4.1617e-04 -
accuracy: 1.0000 - val_loss: 0.4182 - val_accuracy: 0.9165
Epoch 439/500
26/26 [==============================] - 1s 26ms/step - loss: 4.0621e-04 -
accuracy: 1.0000 - val_loss: 0.4233 - val_accuracy: 0.9154
Epoch 440/500
26/26 [==============================] - 1s 27ms/step - loss: 4.5559e-04 -
accuracy: 1.0000 - val_loss: 0.4217 - val_accuracy: 0.9160
Epoch 441/500
26/26 [==============================] - 1s 22ms/step - loss: 4.1709e-04 -
accuracy: 1.0000 - val_loss: 0.4975 - val_accuracy: 0.8938
Epoch 442/500
26/26 [==============================] - 1s 26ms/step - loss: 4.4099e-04 -
accuracy: 0.9999 - val_loss: 0.4993 - val_accuracy: 0.8923
Epoch 443/500
26/26 [==============================] - 1s 21ms/step - loss: 4.3997e-04 -
accuracy: 0.9999 - val_loss: 0.4413 - val_accuracy: 0.9118
Epoch 444/500
26/26 [==============================] - 1s 26ms/step - loss: 4.3895e-04 -
accuracy: 0.9999 - val_loss: 0.3866 - val_accuracy: 0.9269
Epoch 445/500
26/26 [==============================] - 1s 22ms/step - loss: 4.3361e-04 -
accuracy: 0.9999 - val_loss: 0.4223 - val_accuracy: 0.9163
Epoch 446/500
26/26 [==============================] - 1s 23ms/step - loss: 3.9893e-04 -
accuracy: 1.0000 - val_loss: 0.4478 - val_accuracy: 0.9096
Epoch 447/500
26/26 [==============================] - 1s 23ms/step - loss: 4.0610e-04 -
accuracy: 1.0000 - val_loss: 0.4317 - val_accuracy: 0.9141
Epoch 448/500
26/26 [==============================] - 1s 23ms/step - loss: 3.7683e-04 -
accuracy: 1.0000 - val_loss: 0.4212 - val_accuracy: 0.9174
Epoch 449/500
26/26 [==============================] - 1s 28ms/step - loss: 4.1481e-04 -
accuracy: 1.0000 - val_loss: 0.4388 - val_accuracy: 0.9122
Epoch 450/500
26/26 [==============================] - 1s 29ms/step - loss: 4.3743e-04 -
accuracy: 0.9999 - val_loss: 0.4807 - val_accuracy: 0.9011
Epoch 451/500
26/26 [==============================] - 1s 29ms/step - loss: 4.1166e-04 -
accuracy: 1.0000 - val_loss: 0.4609 - val_accuracy: 0.9067
Epoch 452/500
26/26 [==============================] - 1s 30ms/step - loss: 3.4657e-04 -
accuracy: 1.0000 - val_loss: 0.4634 - val_accuracy: 0.9054
Epoch 453/500
```

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26/26 [==============================] - 1s 24ms/step - loss: 4.2561e-04 -
accuracy: 1.0000 - val_loss: 0.4692 - val_accuracy: 0.9045
Epoch 454/500
26/26 [==============================] - 1s 29ms/step - loss: 3.7347e-04 -
accuracy: 1.0000 - val_loss: 0.4736 - val_accuracy: 0.9036
Epoch 455/500
26/26 [==============================] - 1s 30ms/step - loss: 3.3732e-04 -
accuracy: 1.0000 - val_loss: 0.4532 - val_accuracy: 0.9111
Epoch 456/500
26/26 [==============================] - 1s 29ms/step - loss: 3.6213e-04 -
accuracy: 1.0000 - val_loss: 0.4550 - val_accuracy: 0.9112
Epoch 457/500
26/26 [==============================] - 1s 28ms/step - loss: 4.2329e-04 -
accuracy: 0.9999 - val_loss: 0.4762 - val_accuracy: 0.9042
Epoch 458/500
26/26 [==============================] - 1s 27ms/step - loss: 3.4189e-04 -
accuracy: 1.0000 - val_loss: 0.4595 - val_accuracy: 0.9088
Epoch 459/500
26/26 [==============================] - 1s 28ms/step - loss: 3.2877e-04 -
accuracy: 1.0000 - val_loss: 0.4238 - val_accuracy: 0.9203
Epoch 460/500
26/26 [==============================] - 1s 31ms/step - loss: 3.5614e-04 -
accuracy: 1.0000 - val_loss: 0.4551 - val_accuracy: 0.9118
Epoch 461/500
26/26 [==============================] - 1s 26ms/step - loss: 3.8470e-04 -
accuracy: 0.9999 - val_loss: 0.4669 - val_accuracy: 0.9072
Epoch 462/500
26/26 [==============================] - 1s 23ms/step - loss: 3.0796e-04 -
accuracy: 1.0000 - val_loss: 0.4449 - val_accuracy: 0.9137
Epoch 463/500
26/26 [==============================] - 1s 26ms/step - loss: 3.6363e-04 -
accuracy: 1.0000 - val_loss: 0.4998 - val_accuracy: 0.8974
Epoch 464/500
26/26 [==============================] - 1s 26ms/step - loss: 3.3354e-04 -
accuracy: 1.0000 - val_loss: 0.4516 - val_accuracy: 0.9118
Epoch 465/500
26/26 [==============================] - 1s 23ms/step - loss: 3.1266e-04 -
accuracy: 1.0000 - val_loss: 0.4180 - val_accuracy: 0.9220
Epoch 466/500
26/26 [==============================] - 1s 23ms/step - loss: 3.0487e-04 -
accuracy: 1.0000 - val_loss: 0.4469 - val_accuracy: 0.9140
Epoch 467/500
26/26 [==============================] - 1s 26ms/step - loss: 3.0401e-04 -
accuracy: 1.0000 - val_loss: 0.4460 - val_accuracy: 0.9141
Epoch 468/500
26/26 [==============================] - 1s 22ms/step - loss: 3.0420e-04 -
accuracy: 1.0000 - val_loss: 0.4652 - val_accuracy: 0.9099
Epoch 469/500
```

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26/26 [==============================] - 1s 23ms/step - loss: 3.3494e-04 -
accuracy: 1.0000 - val_loss: 0.4548 - val_accuracy: 0.9126
Epoch 470/500
26/26 [==============================] - 1s 23ms/step - loss: 4.2186e-04 -
accuracy: 0.9999 - val_loss: 0.4752 - val_accuracy: 0.9089
Epoch 471/500
26/26 [==============================] - 1s 26ms/step - loss: 3.2719e-04 -
accuracy: 1.0000 - val_loss: 0.4832 - val_accuracy: 0.9042
Epoch 472/500
26/26 [==============================] - 1s 24ms/step - loss: 2.8326e-04 -
accuracy: 1.0000 - val_loss: 0.4687 - val_accuracy: 0.9100
Epoch 473/500
26/26 [==============================] - 1s 23ms/step - loss: 3.1716e-04 -
accuracy: 1.0000 - val_loss: 0.4739 - val_accuracy: 0.9078
Epoch 474/500
26/26 [==============================] - 1s 25ms/step - loss: 2.8993e-04 -
accuracy: 1.0000 - val_loss: 0.4647 - val_accuracy: 0.9133
Epoch 475/500
26/26 [==============================] - 1s 26ms/step - loss: 2.8493e-04 -
accuracy: 1.0000 - val_loss: 0.4508 - val_accuracy: 0.9147
Epoch 476/500
26/26 [==============================] - 1s 26ms/step - loss: 3.1692e-04 -
accuracy: 0.9999 - val_loss: 0.4623 - val_accuracy: 0.9135
Epoch 477/500
26/26 [==============================] - 1s 29ms/step - loss: 3.3057e-04 -
accuracy: 0.9999 - val_loss: 0.5394 - val_accuracy: 0.8920
Epoch 478/500
26/26 [==============================] - 1s 28ms/step - loss: 3.8997e-04 -
accuracy: 0.9999 - val_loss: 0.4818 - val_accuracy: 0.9081
Epoch 479/500
26/26 [==============================] - 1s 28ms/step - loss: 3.8527e-04 -
accuracy: 0.9999 - val_loss: 0.4529 - val_accuracy: 0.9166
Epoch 480/500
26/26 [==============================] - 1s 28ms/step - loss: 2.8824e-04 -
accuracy: 1.0000 - val_loss: 0.4903 - val_accuracy: 0.9078
Epoch 481/500
26/26 [==============================] - 1s 25ms/step - loss: 3.0268e-04 -
accuracy: 1.0000 - val_loss: 0.4962 - val_accuracy: 0.9071
Epoch 482/500
26/26 [==============================] - 1s 29ms/step - loss: 2.5888e-04 -
accuracy: 1.0000 - val_loss: 0.5060 - val_accuracy: 0.9043
Epoch 483/500
26/26 [==============================] - 1s 27ms/step - loss: 2.9716e-04 -
accuracy: 1.0000 - val_loss: 0.4790 - val_accuracy: 0.9112
Epoch 484/500
26/26 [==============================] - 1s 31ms/step - loss: 3.0501e-04 -
accuracy: 0.9999 - val_loss: 0.4729 - val_accuracy: 0.9125
Epoch 485/500
```

```
26/26 [==============================] - 1s 28ms/step - loss: 2.8034e-04 -
accuracy: 1.0000 - val_loss: 0.5037 - val_accuracy: 0.9049
Epoch 486/500
26/26 [==============================] - 1s 26ms/step - loss: 2.6773e-04 -
accuracy: 1.0000 - val_loss: 0.5332 - val_accuracy: 0.8961
Epoch 487/500
26/26 [==============================] - 1s 28ms/step - loss: 2.7268e-04 -
accuracy: 1.0000 - val_loss: 0.4718 - val_accuracy: 0.9118
Epoch 488/500
26/26 [==============================] - 1s 29ms/step - loss: 2.6476e-04 -
accuracy: 1.0000 - val_loss: 0.4631 - val_accuracy: 0.9147
Epoch 489/500
26/26 [==============================] - 1s 30ms/step - loss: 2.6940e-04 -
accuracy: 1.0000 - val_loss: 0.4703 - val_accuracy: 0.9121
Epoch 490/500
26/26 [==============================] - 1s 24ms/step - loss: 2.6402e-04 -
accuracy: 0.9999 - val_loss: 0.4710 - val_accuracy: 0.9128
Epoch 491/500
26/26 [==============================] - 1s 23ms/step - loss: 3.0526e-04 -
accuracy: 1.0000 - val_loss: 0.4487 - val_accuracy: 0.9213
Epoch 492/500
26/26 [==============================] - 1s 24ms/step - loss: 3.9510e-04 -
accuracy: 0.9999 - val_loss: 0.4633 - val_accuracy: 0.9161
Epoch 493/500
26/26 [==============================] - 1s 26ms/step - loss: 2.5118e-04 -
accuracy: 1.0000 - val_loss: 0.4937 - val_accuracy: 0.9066
Epoch 494/500
26/26 [==============================] - 1s 26ms/step - loss: 2.6853e-04 -
accuracy: 1.0000 - val_loss: 0.4868 - val_accuracy: 0.9093
Epoch 495/500
26/26 [==============================] - 1s 26ms/step - loss: 2.5899e-04 -
accuracy: 1.0000 - val_loss: 0.5182 - val_accuracy: 0.9000
Epoch 496/500
26/26 [==============================] - 1s 27ms/step - loss: 3.5425e-04 -
accuracy: 0.9999 - val_loss: 0.5420 - val_accuracy: 0.8935
Epoch 497/500
26/26 [==============================] - 1s 26ms/step - loss: 2.4311e-04 -
accuracy: 1.0000 - val_loss: 0.4747 - val_accuracy: 0.9094
Epoch 498/500
26/26 [==============================] - 1s 27ms/step - loss: 2.1512e-04 -
accuracy: 1.0000 - val_loss: 0.4508 - val_accuracy: 0.9169
Epoch 499/500
26/26 [==============================] - 1s 23ms/step - loss: 2.7097e-04 -
accuracy: 1.0000 - val_loss: 0.4734 - val_accuracy: 0.9109
Epoch 500/500
26/26 [==============================] - 1s 23ms/step - loss: 2.7393e-04 -
accuracy: 1.0000 - val_loss: 0.4582 - val_accuracy: 0.9158
466/466 [==============================] - 1s 2ms/step - loss: 0.0711 -
```

```
accuracy: 0.9782
```

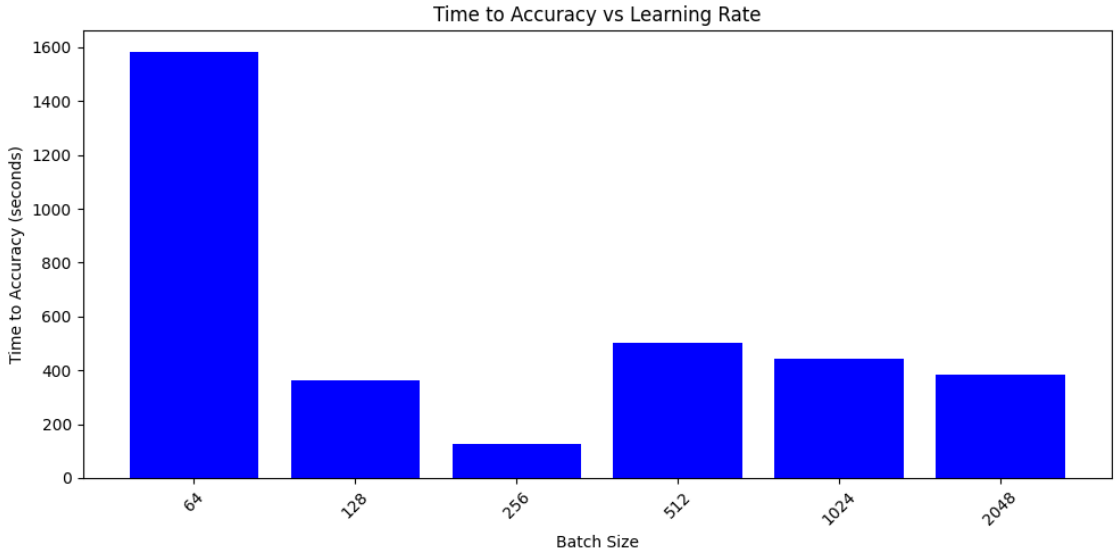
Next, you will visualize the results.

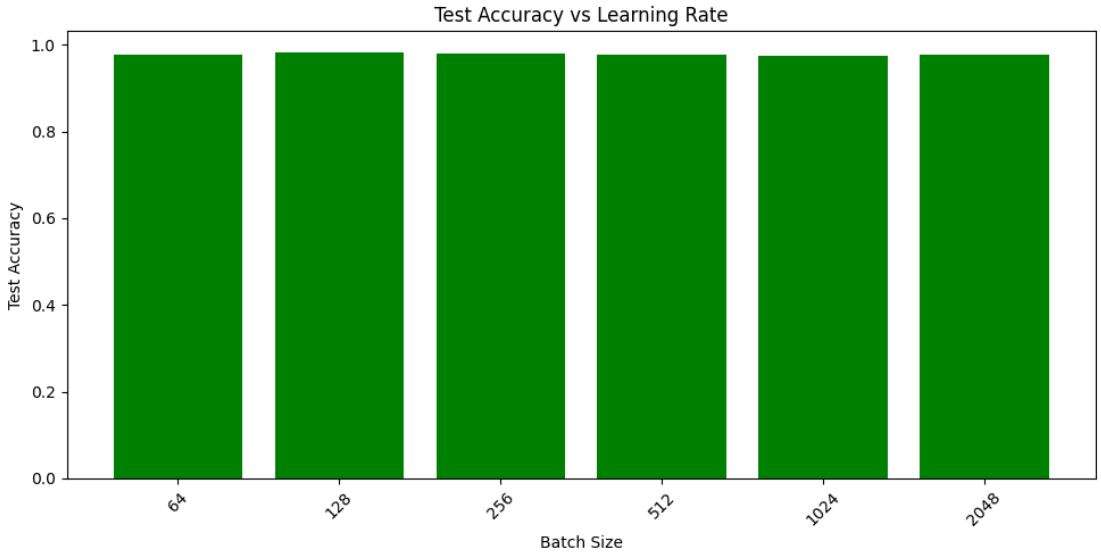
GPU runtime instructions: Create a figure with four subplots. In each subplot, create a bar plot with batch size on the horizontal axis and (1) Time to accuracy, (2) Energy to accuracy, (3) Test accuracy, (4) Epochs, on the vertical axis on each subplot, respectively. Use an appropriate vertical range for each subplot. Label all axes.

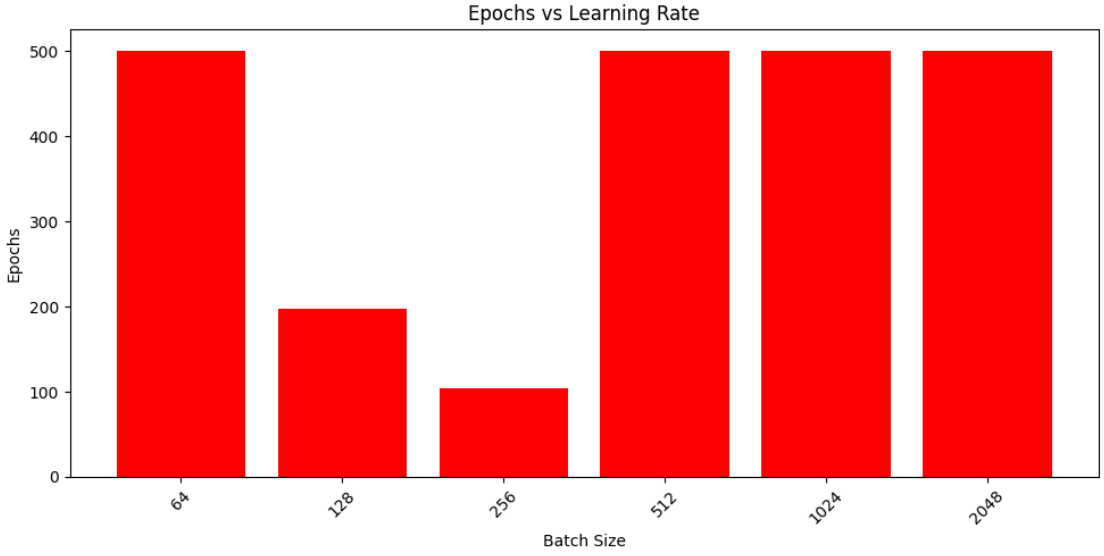
CPU runtime instructions: Create a figure with three subplots. In each subplot, create a bar plot with batch size on the horizontal axis and (1) Time to accuracy, (2) Test accuracy, (3) Epochs, on the vertical axis on each subplot, respectively. Use an appropriate vertical range for each subplot. Label all axes.

[ ]:
```
# TODO - visualize effect of varying batch size, when training to a target␣
 ↪accuracy

batch_size = [m['batch_size'] for m in metrics_vs_bs]
time_to_accuracy = [m['train_time'] for m in metrics_vs_bs]
test_accuracies = [m['test_accuracy'] for m in metrics_vs_bs]
epochs = [m['epochs'] for m in metrics_vs_bs]
fig, axes = plt.subplots(3, 1, figsize=(10, 15))

# Converting learning rates to strings for better display on the x-axis
batch_size_labels = [str(bs) for bs in batch_size]

# Subplot 1: Time to Accuracy
axes[0].bar(batch_size_labels, time_to_accuracy, color='blue')
axes[0].set_title('Time to Accuracy vs Learning Rate')
axes[0].set_xlabel('Batch Size')
axes[0].set_ylabel('Time to Accuracy (seconds)')

# Subplot 2: Test Accuracy
axes[1].bar(batch_size_labels, test_accuracies, color='green')
axes[1].set_title('Test Accuracy vs Learning Rate')
axes[1].set_xlabel('Batch Size')
axes[1].set_ylabel('Test Accuracy')

# Subplot 3: Epochs
axes[2].bar(batch_size_labels, epochs, color='red')
axes[2].set_title('Epochs vs Learning Rate')
axes[2].set_xlabel('Batch Size')
axes[2].set_ylabel('Epochs')

# Adjusting x-axis and y-axis for better readability
for ax in axes:
    ax.tick_params(axis='x', labelrotation=45)  # Rotate x-axis labels for␣
 ↪clarity
```

```
plt.tight_layout()
plt.show()
```


Time to Accuracy vs Learning Rate
Time to Accuracy (seconds)
0
200
400
600
800
1000
1200
1400
1600
64
128
256
512
1024
2048
Batch Size


Test Accuracy vs Learning Rate
Test Accuracy
0.0
0.2
0.4
0.6
0.8
1.0
64
128
256
512
1024
2048
Batch Size


Epochs vs Learning Rate
Epochs
0
100
200
300
400
500
64
128
256
512
1024
2048
Batch Size

Comment on the results: Given that the model is trained to a target validation accuracy, what is the effect of the batch size on the training process?

Note: because of the stochastic nature of neural network training AND in the compute resource, these measurements can be very "noisy". Look for overall trends, but don't be concerned with small differences from one experiment to the next, or with occasional "outlier" results. Also note that if the number of epochs is 500, this is an indication that the target validation accuracy was *not* reached in 500 epochs!

Time to Accuracy: The time required to reach the target validation accuracy appears to be highest for the smallest batch size (64) and decreases as the batch size increases to 256. Beyond this point, the time taken does not decrease significantly with further increases in batch size. This suggests that there is a diminishing return on reducing training time after a certain batch size threshold.

Test Accuracy: The test accuracy remains relatively stable across different batch sizes. This indicates that the batch size does not have a significant effect on the model's generalization to the test data, within the range of batch sizes provided.

Epochs: The number of epochs required to reach the target validation accuracy tends to decrease as the batch size increases. This is likely due to the fact that larger batch sizes provide a more accurate estimate of the gradient, leading to more efficient learning steps.