

PROBLEM 3 Yanis Tazi

Q1

I)

1. Adagrad : it adapts the learning rate to every parameter with small updates corresponding to low learning rate for high frequency features and large updates corresponding to high learning rates for low frequency features . This is why , it has been mostly used to deal with sparse data.

$$W_{t+1,i} = W_{t,i} - \frac{\eta}{\sqrt{G_{t,ii} + \epsilon}} g_{t,i}.$$

Considering G_t as the diagonal matrix with the sum squares of past gradients with respect to all parameters W , we can have a vectorized implementation:

$$W_{t+1} = W_t - \frac{\eta}{\sqrt{G_t + \epsilon}} g_t$$

where the $W_{t,i}$ is the parameter i at time step t , η is the learning rate, ϵ is a constant smoothing term to make sure we do not divide by zero, $g_{t,i} = \nabla_W J(W_{t,i})$ is the partial derivative of the loss with respect to W_i at step t and $G_{t,ii}$ is the sum of the squares of the gradients with respect to W_i up to step t

2. RMSProp : it allows us to deal with the aggressive diminishing learning rates caused by Adagrad.

$W_{t+1} = W_t - \frac{\eta}{\sqrt{E(g^2)_t + \epsilon}} g_t$, with $E(g^2)_t = 0.9E(g^2)_{t-1} + 0.1g_t^2$, where $E(g^2)_t$ is the running average .

3. Adadelta : it is an extension of Adagrad attempting to deal with the aggressive diminishing learning rates caused by Adagrad. The idea is to use the sum of gradients recursively with a decay average formula.

$W_{t+1} = W_t - \frac{\eta}{\sqrt{E(g^2)_t + \epsilon}} g_t$, with $E(g^2)_t = \gamma E(g^2)_{t-1} + (1 - \gamma)g_t^2$, where $E(g^2)_t$ is the running average and γ is the fraction given to the running average.

4. Adam : As the previous methods, Adam also computes a learning rate for each of the features. In complement to the running average previously described, it also stores keeps an exponentially decaying average of past gradients in the same way as momentum in order to find flat minima.

$W_{t+1} = W_t - \frac{\eta}{\sqrt{\hat{v}_t + \epsilon}} \hat{m}_t$, where $\hat{m}_t = \frac{m_t}{1 - \beta_1^t}$ and $\hat{v}_t = \frac{v_t}{1 - \beta_2^t}$.

$m_t = \beta_1 m_{t-1} + (1 - \beta_1)g_t$ and $v_t = \beta_2 v_{t-1} + (1 - \beta_2)g_t^2$, that can be seen as the decaying averages of past gradients and squared past gradients i.e estimating mean and variance unscaled of the gradients.

To sum up, it can be viewed as a combination of both RMSProp and momentum.

5. Nadam :

$W_{t+1} = W_t - \frac{\eta}{\sqrt{\hat{v}_t + \epsilon}} (\beta_1 \hat{m}_t \frac{(1 - \beta_1)g_t}{1 - \beta_1^t})$

The idea here is to combine Adam with Nesterov accelerated gradient to have a more accurate step towards the direction of the gradient.

II)

Hyperparameters :**Adagrad:** η, ϵ **RMSprop:** η, ϵ **Adadelta:** η, ϵ, γ **Adam:** $\eta, \beta_1, \beta_2, \epsilon$ **Nadam :** $\eta, \beta_1, \beta_2, \epsilon$ **III)**

Adadelta removes the use of the learning rate parameter completely by replacing it with thth

In summary, RMSprop is an extension of Adagrad that deals with its radically diminishing learning rates. It is identical to Adadelta, except that Adadelta uses the RMS of parameter updates in the numerator update rule. Adam, finally, adds bias-correction and momentum to RMSprop

IV)

Nadam (nesterov-accelerated adaptive moment estimation) is simply the combination of Adam with Nesterov accelerated gradient.

Adam however can be viewed as RMSProp and Nesterov momentum

Q2

```
In [3]: import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from sklearn.preprocessing import StandardScaler
from tensorflow.keras.models import Sequential
from tensorflow.keras import models, layers
import tensorflow.keras as keras
from tensorflow.keras.layers import BatchNormalization, LayerNormalizati
on
import tensorflow as tf
from tensorflow.keras.layers import Dropout
import numpy as np
import matplotlib.pyplot as plt
if tf.test.gpu_device_name():
    print('Default GPU Device: {}'.format(tf.test.gpu_device_name()))
else:
    print("Please install GPU version of TF")
from matplotlib import pyplot
from tensorflow.keras.datasets import cifar10
from numpy import save
from numpy import savetxt
from numpy import loadtxt
from time import time
```

/Users/taziy/anaconda3/lib/python3.7/site-packages/tensorboard/compat/tensorflow_stub/dtypes.py:541: FutureWarning: Passing (type, 1) or 'ltype' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,)) / '(1,)type'.

```
_np_qint8 = np.dtype [("qint8", np.int8, 1)]
```

/Users/taziy/anaconda3/lib/python3.7/site-packages/tensorboard/compat/tensorflow_stub/dtypes.py:542: FutureWarning: Passing (type, 1) or 'ltype' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,)) / '(1,)type'.

```
_np_quint8 = np.dtype [("quint8", np.uint8, 1)]
```

/Users/taziy/anaconda3/lib/python3.7/site-packages/tensorboard/compat/tensorflow_stub/dtypes.py:543: FutureWarning: Passing (type, 1) or 'ltype' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,)) / '(1,)type'.

```
_np_qint16 = np.dtype [("qint16", np.int16, 1)]
```

/Users/taziy/anaconda3/lib/python3.7/site-packages/tensorboard/compat/tensorflow_stub/dtypes.py:544: FutureWarning: Passing (type, 1) or 'ltype' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,)) / '(1,)type'.

```
_np_quint16 = np.dtype [("quint16", np.uint16, 1)]
```

/Users/taziy/anaconda3/lib/python3.7/site-packages/tensorboard/compat/tensorflow_stub/dtypes.py:545: FutureWarning: Passing (type, 1) or 'ltype' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,)) / '(1,)type'.

```
_np_qint32 = np.dtype [("qint32", np.int32, 1)]
```

/Users/taziy/anaconda3/lib/python3.7/site-packages/tensorboard/compat/tensorflow_stub/dtypes.py:550: FutureWarning: Passing (type, 1) or 'ltype' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,)) / '(1,)type'.

```
np_resource = np.dtype [("resource", np.ubyte, 1)]
```

Please install GPU version of TF

```
In [2]: # load dataset

(x_train, y_train), (x_test, y_test) = cifar10.load_data()

# Set numeric type to float32 from uint8
x_train = x_train.astype('float32')
x_test = x_test.astype('float32')

# Normalize value to [0, 1]
x_train /= 255
x_test /= 255

# Transform labels to one-hot encoding
y_train = tf.keras.utils.to_categorical(y_train, 10)
y_test = tf.keras.utils.to_categorical(y_test, 10)

# Reshape the dataset into 1D array
dim_data = np.prod(x_train.shape[1:])

x_train = x_train.reshape(x_train.shape[0], dim_data)
x_test = x_test.reshape(x_test.shape[0], dim_data)
```

```
In [ ]:
```

```
In [3]: def create_model():
        tf.random.set_seed(17)

        #Model with 2 hidden layers and l2 regularization, relu activation

        model = Sequential()
        model.add(Dense(1000, input_shape=(dim_data,), activation='relu', kernel_regularizer=keras.regularizers.l2()))
        model.add(Dense(1000, activation='relu', kernel_regularizer=keras.regularizers.l2()))
        model.add(Dense(10, activation='softmax', kernel_regularizer=keras.regularizers.l2()))
        return model
```

```
In [4]: hist = []
training_time_q2 = []
val_q2 = []
for opt in ['Adagrad', 'RMSProp', 'Adadelta', 'Adam', 'Nadam']:
    model = create_model()
    model.compile(loss=keras.losses.categorical_crossentropy, optimizer=
opt, metrics=['accuracy'])
    start = time()
    hist.append(model.fit(x=x_train,y=y_train, epochs=200, batch_size=12
8, verbose=1))
    training_time_q2.append(time()-start)
    val_q2.append(model.evaluate(x_test,y_test))
```

```
Epoch 1/200
391/391 [=====] - 3s 8ms/step - loss: 12.8399
- accuracy: 0.3116
Epoch 2/200
391/391 [=====] - 3s 7ms/step - loss: 6.7911 -
accuracy: 0.3751
Epoch 3/200
391/391 [=====] - 3s 8ms/step - loss: 5.1031 -
accuracy: 0.3948
Epoch 4/200
391/391 [=====] - 3s 8ms/step - loss: 4.2582 -
accuracy: 0.4073
Epoch 5/200
391/391 [=====] - 3s 7ms/step - loss: 3.7417 -
accuracy: 0.4117
Epoch 6/200
391/391 [=====] - 3s 7ms/step - loss: 3.3898 -
accuracy: 0.4179
Epoch 7/200
391/391 [=====] - 3s 7ms/step - loss: 3.1366 -
accuracy: 0.4227
Epoch 8/200
391/391 [=====] - 3s 7ms/step - loss: 2.9424 -
accuracy: 0.4251
Epoch 9/200
391/391 [=====] - 3s 7ms/step - loss: 2.7913 -
accuracy: 0.4299
Epoch 10/200
391/391 [=====] - 3s 7ms/step - loss: 2.6701 -
accuracy: 0.4315
Epoch 11/200
391/391 [=====] - 3s 7ms/step - loss: 2.5719 -
accuracy: 0.4356
Epoch 12/200
391/391 [=====] - 3s 7ms/step - loss: 2.4899 -
accuracy: 0.4372
Epoch 13/200
391/391 [=====] - 3s 7ms/step - loss: 2.4209 -
accuracy: 0.4397
Epoch 14/200
391/391 [=====] - 3s 7ms/step - loss: 2.3621 -
accuracy: 0.4404
Epoch 15/200
391/391 [=====] - 3s 7ms/step - loss: 2.3124 -
accuracy: 0.4422
Epoch 16/200
391/391 [=====] - 3s 7ms/step - loss: 2.2683 -
accuracy: 0.4438
Epoch 17/200
391/391 [=====] - 3s 7ms/step - loss: 2.2305 -
accuracy: 0.4454
Epoch 18/200
391/391 [=====] - 3s 7ms/step - loss: 2.1985 -
accuracy: 0.4483
Epoch 19/200
391/391 [=====] - 3s 7ms/step - loss: 2.1688 -
accuracy: 0.4469
```

```
Epoch 20/200
391/391 [=====] - 3s 7ms/step - loss: 2.1431 -
accuracy: 0.4485
Epoch 21/200
391/391 [=====] - 3s 7ms/step - loss: 2.1190 -
accuracy: 0.4503
Epoch 22/200
391/391 [=====] - 3s 7ms/step - loss: 2.0984 -
accuracy: 0.4508
Epoch 23/200
391/391 [=====] - 3s 7ms/step - loss: 2.0802 -
accuracy: 0.4539
Epoch 24/200
391/391 [=====] - 3s 7ms/step - loss: 2.0649 -
accuracy: 0.4530
Epoch 25/200
391/391 [=====] - 3s 7ms/step - loss: 2.0487 -
accuracy: 0.4536
Epoch 26/200
391/391 [=====] - 3s 7ms/step - loss: 2.0343 -
accuracy: 0.4563
Epoch 27/200
391/391 [=====] - 3s 7ms/step - loss: 2.0222 -
accuracy: 0.4554
Epoch 28/200
391/391 [=====] - 3s 7ms/step - loss: 2.0108 -
accuracy: 0.4560
Epoch 29/200
391/391 [=====] - 3s 7ms/step - loss: 2.0004 -
accuracy: 0.4562
Epoch 30/200
391/391 [=====] - 3s 7ms/step - loss: 1.9914 -
accuracy: 0.4574
Epoch 31/200
391/391 [=====] - 3s 7ms/step - loss: 1.9821 -
accuracy: 0.4596
Epoch 32/200
391/391 [=====] - 3s 7ms/step - loss: 1.9743 -
accuracy: 0.4582
Epoch 33/200
391/391 [=====] - 3s 7ms/step - loss: 1.9659 -
accuracy: 0.4593
Epoch 34/200
391/391 [=====] - 3s 7ms/step - loss: 1.9592 -
accuracy: 0.4602
Epoch 35/200
391/391 [=====] - 3s 7ms/step - loss: 1.9530 -
accuracy: 0.4606
Epoch 36/200
391/391 [=====] - 3s 7ms/step - loss: 1.9471 -
accuracy: 0.4631
Epoch 37/200
391/391 [=====] - 3s 7ms/step - loss: 1.9413 -
accuracy: 0.4605
Epoch 38/200
391/391 [=====] - 3s 7ms/step - loss: 1.9360 -
accuracy: 0.4608
```



```
Epoch 39/200
391/391 [=====] - 3s 7ms/step - loss: 1.9315 -
accuracy: 0.4617
Epoch 40/200
391/391 [=====] - 3s 7ms/step - loss: 1.9265 -
accuracy: 0.4645
Epoch 41/200
391/391 [=====] - 3s 7ms/step - loss: 1.9225 -
accuracy: 0.4646
Epoch 42/200
391/391 [=====] - 3s 8ms/step - loss: 1.9186 -
accuracy: 0.4629
Epoch 43/200
391/391 [=====] - 3s 7ms/step - loss: 1.9144 -
accuracy: 0.4635
Epoch 44/200
391/391 [=====] - 3s 7ms/step - loss: 1.9110 -
accuracy: 0.4640
Epoch 45/200
391/391 [=====] - 3s 7ms/step - loss: 1.9081 -
accuracy: 0.4647
Epoch 46/200
391/391 [=====] - 3s 7ms/step - loss: 1.9049 -
accuracy: 0.4640
Epoch 47/200
391/391 [=====] - 3s 7ms/step - loss: 1.9008 -
accuracy: 0.4654
Epoch 48/200
391/391 [=====] - 3s 7ms/step - loss: 1.8988 -
accuracy: 0.4665
Epoch 49/200
391/391 [=====] - 3s 7ms/step - loss: 1.8959 -
accuracy: 0.4653
Epoch 50/200
391/391 [=====] - 3s 7ms/step - loss: 1.8934 -
accuracy: 0.4658
Epoch 51/200
391/391 [=====] - 3s 7ms/step - loss: 1.8903 -
accuracy: 0.4674
Epoch 52/200
391/391 [=====] - 3s 7ms/step - loss: 1.8882 -
accuracy: 0.4671
Epoch 53/200
391/391 [=====] - 3s 7ms/step - loss: 1.8862 -
accuracy: 0.4663
Epoch 54/200
391/391 [=====] - 3s 7ms/step - loss: 1.8840 -
accuracy: 0.4667
Epoch 55/200
391/391 [=====] - 3s 7ms/step - loss: 1.8822 -
accuracy: 0.4679
Epoch 56/200
391/391 [=====] - 3s 7ms/step - loss: 1.8800 -
accuracy: 0.4684
Epoch 57/200
391/391 [=====] - 3s 7ms/step - loss: 1.8782 -
accuracy: 0.4678
```

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Epoch 58/200
391/391 [=====] - 3s 7ms/step - loss: 1.8762 -
accuracy: 0.4690
Epoch 59/200
391/391 [=====] - 3s 7ms/step - loss: 1.8752 -
accuracy: 0.4689
Epoch 60/200
391/391 [=====] - 3s 8ms/step - loss: 1.8730 -
accuracy: 0.4685
Epoch 61/200
391/391 [=====] - 3s 7ms/step - loss: 1.8719 -
accuracy: 0.4693
Epoch 62/200
391/391 [=====] - 3s 7ms/step - loss: 1.8701 -
accuracy: 0.4695
Epoch 63/200
391/391 [=====] - 3s 7ms/step - loss: 1.8692 -
accuracy: 0.4699
Epoch 64/200
391/391 [=====] - 3s 7ms/step - loss: 1.8677 -
accuracy: 0.4689
Epoch 65/200
391/391 [=====] - 3s 7ms/step - loss: 1.8658 -
accuracy: 0.4696
Epoch 66/200
391/391 [=====] - 3s 7ms/step - loss: 1.8653 -
accuracy: 0.4703
Epoch 67/200
391/391 [=====] - 3s 7ms/step - loss: 1.8639 -
accuracy: 0.4714
Epoch 68/200
391/391 [=====] - 3s 7ms/step - loss: 1.8628 -
accuracy: 0.4709
Epoch 69/200
391/391 [=====] - 3s 7ms/step - loss: 1.8618 -
accuracy: 0.4715
Epoch 70/200
391/391 [=====] - 3s 7ms/step - loss: 1.8607 -
accuracy: 0.4707
Epoch 71/200
391/391 [=====] - 3s 7ms/step - loss: 1.8596 -
accuracy: 0.4713
Epoch 72/200
391/391 [=====] - 3s 7ms/step - loss: 1.8585 -
accuracy: 0.4713
Epoch 73/200
391/391 [=====] - 3s 7ms/step - loss: 1.8578 -
accuracy: 0.4701
Epoch 74/200
391/391 [=====] - 3s 7ms/step - loss: 1.8565 -
accuracy: 0.4730
Epoch 75/200
391/391 [=====] - 3s 8ms/step - loss: 1.8559 -
accuracy: 0.4718
Epoch 76/200
391/391 [=====] - 3s 8ms/step - loss: 1.8548 -
accuracy: 0.4720
```

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Epoch 77/200
391/391 [=====] - 3s 8ms/step - loss: 1.8541 -
accuracy: 0.4718
Epoch 78/200
391/391 [=====] - 3s 8ms/step - loss: 1.8534 -
accuracy: 0.4717
Epoch 79/200
391/391 [=====] - 3s 8ms/step - loss: 1.8524 -
accuracy: 0.4730
Epoch 80/200
391/391 [=====] - 3s 7ms/step - loss: 1.8519 -
accuracy: 0.4727
Epoch 81/200
391/391 [=====] - 3s 7ms/step - loss: 1.8513 -
accuracy: 0.4738
Epoch 82/200
391/391 [=====] - 3s 7ms/step - loss: 1.8503 -
accuracy: 0.4737
Epoch 83/200
391/391 [=====] - 3s 7ms/step - loss: 1.8496 -
accuracy: 0.4755
Epoch 84/200
391/391 [=====] - 3s 7ms/step - loss: 1.8488 -
accuracy: 0.4721
Epoch 85/200
391/391 [=====] - 3s 7ms/step - loss: 1.8481 -
accuracy: 0.4740
Epoch 86/200
391/391 [=====] - 3s 8ms/step - loss: 1.8473 -
accuracy: 0.4742
Epoch 87/200
391/391 [=====] - 3s 7ms/step - loss: 1.8468 -
accuracy: 0.4732
Epoch 88/200
391/391 [=====] - 3s 7ms/step - loss: 1.8460 -
accuracy: 0.4746
Epoch 89/200
391/391 [=====] - 3s 7ms/step - loss: 1.8454 -
accuracy: 0.4740
Epoch 90/200
391/391 [=====] - 3s 7ms/step - loss: 1.8445 -
accuracy: 0.4736
Epoch 91/200
391/391 [=====] - 3s 7ms/step - loss: 1.8446 -
accuracy: 0.4732
Epoch 92/200
391/391 [=====] - 3s 7ms/step - loss: 1.8440 -
accuracy: 0.4738
Epoch 93/200
391/391 [=====] - 3s 7ms/step - loss: 1.8433 -
accuracy: 0.4734
Epoch 94/200
391/391 [=====] - 3s 7ms/step - loss: 1.8430 -
accuracy: 0.4750
Epoch 95/200
391/391 [=====] - 3s 8ms/step - loss: 1.8426 -
accuracy: 0.4750
```

```
Epoch 96/200
391/391 [=====] - 3s 7ms/step - loss: 1.8417 -
accuracy: 0.4750
Epoch 97/200
391/391 [=====] - 3s 8ms/step - loss: 1.8415 -
accuracy: 0.4755
Epoch 98/200
391/391 [=====] - 3s 7ms/step - loss: 1.8405 -
accuracy: 0.4748
Epoch 99/200
391/391 [=====] - 3s 8ms/step - loss: 1.8404 -
accuracy: 0.4752
Epoch 100/200
391/391 [=====] - 3s 7ms/step - loss: 1.8401 -
accuracy: 0.4749
Epoch 101/200
391/391 [=====] - 3s 7ms/step - loss: 1.8396 -
accuracy: 0.4767
Epoch 102/200
391/391 [=====] - 3s 7ms/step - loss: 1.8390 -
accuracy: 0.4746
Epoch 103/200
391/391 [=====] - 3s 7ms/step - loss: 1.8383 -
accuracy: 0.4761
Epoch 104/200
391/391 [=====] - 3s 7ms/step - loss: 1.8383 -
accuracy: 0.4768
Epoch 105/200
391/391 [=====] - 3s 7ms/step - loss: 1.8377 -
accuracy: 0.4765
Epoch 106/200
391/391 [=====] - 3s 7ms/step - loss: 1.8372 -
accuracy: 0.4770
Epoch 107/200
391/391 [=====] - 3s 7ms/step - loss: 1.8372 -
accuracy: 0.4761
Epoch 108/200
391/391 [=====] - 3s 7ms/step - loss: 1.8368 -
accuracy: 0.4762
Epoch 109/200
391/391 [=====] - 3s 8ms/step - loss: 1.8367 -
accuracy: 0.4763
Epoch 110/200
391/391 [=====] - 3s 8ms/step - loss: 1.8357 -
accuracy: 0.4767
Epoch 111/200
391/391 [=====] - 3s 7ms/step - loss: 1.8355 -
accuracy: 0.4759
Epoch 112/200
391/391 [=====] - 3s 7ms/step - loss: 1.8353 -
accuracy: 0.4765
Epoch 113/200
391/391 [=====] - 3s 7ms/step - loss: 1.8347 -
accuracy: 0.4768
Epoch 114/200
391/391 [=====] - 3s 7ms/step - loss: 1.8344 -
accuracy: 0.4770
```

```
Epoch 115/200
391/391 [=====] - 3s 7ms/step - loss: 1.8341 -
accuracy: 0.4758
Epoch 116/200
391/391 [=====] - 3s 7ms/step - loss: 1.8334 -
accuracy: 0.4774
Epoch 117/200
391/391 [=====] - 3s 8ms/step - loss: 1.8339 -
accuracy: 0.4778
Epoch 118/200
391/391 [=====] - 3s 7ms/step - loss: 1.8331 -
accuracy: 0.4769
Epoch 119/200
391/391 [=====] - 3s 8ms/step - loss: 1.8331 -
accuracy: 0.4772
Epoch 120/200
391/391 [=====] - 3s 7ms/step - loss: 1.8329 -
accuracy: 0.4763
Epoch 121/200
391/391 [=====] - 3s 8ms/step - loss: 1.8325 -
accuracy: 0.4767
Epoch 122/200
391/391 [=====] - 3s 7ms/step - loss: 1.8323 -
accuracy: 0.4771
Epoch 123/200
391/391 [=====] - 3s 7ms/step - loss: 1.8320 -
accuracy: 0.4781
Epoch 124/200
391/391 [=====] - 3s 7ms/step - loss: 1.8318 -
accuracy: 0.4782
Epoch 125/200
391/391 [=====] - 3s 7ms/step - loss: 1.8311 -
accuracy: 0.4782
Epoch 126/200
391/391 [=====] - 3s 7ms/step - loss: 1.8314 -
accuracy: 0.4767
Epoch 127/200
391/391 [=====] - 3s 7ms/step - loss: 1.8313 -
accuracy: 0.4786
Epoch 128/200
391/391 [=====] - 3s 7ms/step - loss: 1.8303 -
accuracy: 0.4785
Epoch 129/200
391/391 [=====] - 3s 7ms/step - loss: 1.8303 -
accuracy: 0.4784
Epoch 130/200
391/391 [=====] - 3s 7ms/step - loss: 1.8301 -
accuracy: 0.4787
Epoch 131/200
391/391 [=====] - 3s 7ms/step - loss: 1.8299 -
accuracy: 0.4789
Epoch 132/200
391/391 [=====] - 3s 7ms/step - loss: 1.8297 -
accuracy: 0.4781
Epoch 133/200
391/391 [=====] - 3s 7ms/step - loss: 1.8291 -
accuracy: 0.4794
```

```
Epoch 134/200
391/391 [=====] - 3s 7ms/step - loss: 1.8292 -
accuracy: 0.4789
Epoch 135/200
391/391 [=====] - 3s 7ms/step - loss: 1.8287 -
accuracy: 0.4798
Epoch 136/200
391/391 [=====] - 3s 7ms/step - loss: 1.8287 -
accuracy: 0.4791
Epoch 137/200
391/391 [=====] - 3s 7ms/step - loss: 1.8284 -
accuracy: 0.4795
Epoch 138/200
391/391 [=====] - 3s 7ms/step - loss: 1.8282 -
accuracy: 0.4790
Epoch 139/200
391/391 [=====] - 3s 7ms/step - loss: 1.8279 -
accuracy: 0.4785
Epoch 140/200
391/391 [=====] - 3s 7ms/step - loss: 1.8279 -
accuracy: 0.4800
Epoch 141/200
391/391 [=====] - 3s 8ms/step - loss: 1.8277 -
accuracy: 0.4795
Epoch 142/200
391/391 [=====] - 3s 7ms/step - loss: 1.8277 -
accuracy: 0.4796
Epoch 143/200
391/391 [=====] - 3s 7ms/step - loss: 1.8275 -
accuracy: 0.4791
Epoch 144/200
391/391 [=====] - 3s 7ms/step - loss: 1.8266 -
accuracy: 0.4794
Epoch 145/200
391/391 [=====] - 3s 7ms/step - loss: 1.8269 -
accuracy: 0.4802
Epoch 146/200
391/391 [=====] - 3s 7ms/step - loss: 1.8264 -
accuracy: 0.4799
Epoch 147/200
391/391 [=====] - 3s 7ms/step - loss: 1.8263 -
accuracy: 0.4801
Epoch 148/200
391/391 [=====] - 3s 7ms/step - loss: 1.8267 -
accuracy: 0.4799
Epoch 149/200
391/391 [=====] - 3s 7ms/step - loss: 1.8265 -
accuracy: 0.4797
Epoch 150/200
391/391 [=====] - 3s 7ms/step - loss: 1.8259 -
accuracy: 0.4800
Epoch 151/200
391/391 [=====] - 3s 7ms/step - loss: 1.8259 -
accuracy: 0.4786
Epoch 152/200
391/391 [=====] - 3s 7ms/step - loss: 1.8254 -
accuracy: 0.4806
```

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Epoch 153/200
391/391 [=====] - 3s 7ms/step - loss: 1.8253 -
accuracy: 0.4797
Epoch 154/200
391/391 [=====] - 3s 7ms/step - loss: 1.8256 -
accuracy: 0.4808
Epoch 155/200
391/391 [=====] - 3s 7ms/step - loss: 1.8249 -
accuracy: 0.4806
Epoch 156/200
391/391 [=====] - 3s 7ms/step - loss: 1.8248 -
accuracy: 0.4803
Epoch 157/200
391/391 [=====] - 3s 7ms/step - loss: 1.8247 -
accuracy: 0.4798
Epoch 158/200
391/391 [=====] - 3s 7ms/step - loss: 1.8249 -
accuracy: 0.4804
Epoch 159/200
391/391 [=====] - 3s 7ms/step - loss: 1.8244 -
accuracy: 0.4793
Epoch 160/200
391/391 [=====] - 3s 7ms/step - loss: 1.8243 -
accuracy: 0.4808
Epoch 161/200
391/391 [=====] - 3s 8ms/step - loss: 1.8242 -
accuracy: 0.4814
Epoch 162/200
391/391 [=====] - 3s 7ms/step - loss: 1.8243 -
accuracy: 0.4817
Epoch 163/200
391/391 [=====] - 3s 7ms/step - loss: 1.8240 -
accuracy: 0.4807
Epoch 164/200
391/391 [=====] - 3s 7ms/step - loss: 1.8236 -
accuracy: 0.4806
Epoch 165/200
391/391 [=====] - 3s 7ms/step - loss: 1.8240 -
accuracy: 0.4807
Epoch 166/200
391/391 [=====] - 3s 7ms/step - loss: 1.8236 -
accuracy: 0.4810
Epoch 167/200
391/391 [=====] - 3s 7ms/step - loss: 1.8233 -
accuracy: 0.4817
Epoch 168/200
391/391 [=====] - 3s 7ms/step - loss: 1.8229 -
accuracy: 0.4810
Epoch 169/200
391/391 [=====] - 3s 7ms/step - loss: 1.8232 -
accuracy: 0.4818
Epoch 170/200
391/391 [=====] - 3s 8ms/step - loss: 1.8232 -
accuracy: 0.4806
Epoch 171/200
391/391 [=====] - 3s 7ms/step - loss: 1.8230 -
accuracy: 0.4813
```

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Epoch 172/200
391/391 [=====] - 3s 8ms/step - loss: 1.8225 -
accuracy: 0.4818
Epoch 173/200
391/391 [=====] - 3s 7ms/step - loss: 1.8224 -
accuracy: 0.4819
Epoch 174/200
391/391 [=====] - 3s 7ms/step - loss: 1.8226 -
accuracy: 0.4820
Epoch 175/200
391/391 [=====] - 3s 7ms/step - loss: 1.8219 -
accuracy: 0.4808
Epoch 176/200
391/391 [=====] - 3s 7ms/step - loss: 1.8223 -
accuracy: 0.4809
Epoch 177/200
391/391 [=====] - 3s 7ms/step - loss: 1.8223 -
accuracy: 0.4815
Epoch 178/200
391/391 [=====] - 3s 7ms/step - loss: 1.8219 -
accuracy: 0.4814
Epoch 179/200
391/391 [=====] - 3s 7ms/step - loss: 1.8216 -
accuracy: 0.4819
Epoch 180/200
391/391 [=====] - 3s 7ms/step - loss: 1.8219 -
accuracy: 0.4819
Epoch 181/200
391/391 [=====] - 3s 7ms/step - loss: 1.8212 -
accuracy: 0.4806
Epoch 182/200
391/391 [=====] - 3s 8ms/step - loss: 1.8217 -
accuracy: 0.4817
Epoch 183/200
391/391 [=====] - 3s 8ms/step - loss: 1.8219 -
accuracy: 0.4815
Epoch 184/200
391/391 [=====] - 3s 8ms/step - loss: 1.8214 -
accuracy: 0.4818
Epoch 185/200
391/391 [=====] - 3s 8ms/step - loss: 1.8214 -
accuracy: 0.4815
Epoch 186/200
391/391 [=====] - 3s 7ms/step - loss: 1.8212 -
accuracy: 0.4809
Epoch 187/200
391/391 [=====] - 3s 7ms/step - loss: 1.8212 -
accuracy: 0.4828
Epoch 188/200
391/391 [=====] - 3s 7ms/step - loss: 1.8207 -
accuracy: 0.4809
Epoch 189/200
391/391 [=====] - 3s 7ms/step - loss: 1.8207 -
accuracy: 0.4820
Epoch 190/200
391/391 [=====] - 3s 7ms/step - loss: 1.8211 -
accuracy: 0.4817
```


Epoch 191/200
391/391 [=====] - 3s 7ms/step - loss: 1.8204 -
accuracy: 0.4833
Epoch 192/200
391/391 [=====] - 3s 8ms/step - loss: 1.8207 -
accuracy: 0.4823
Epoch 193/200
391/391 [=====] - 3s 7ms/step - loss: 1.8203 -
accuracy: 0.4836
Epoch 194/200
391/391 [=====] - 3s 7ms/step - loss: 1.8204 -
accuracy: 0.4826
Epoch 195/200
391/391 [=====] - 3s 7ms/step - loss: 1.8201 -
accuracy: 0.4830
Epoch 196/200
391/391 [=====] - 3s 8ms/step - loss: 1.8200 -
accuracy: 0.4830
Epoch 197/200
391/391 [=====] - 3s 7ms/step - loss: 1.8200 -
accuracy: 0.4825
Epoch 198/200
391/391 [=====] - 3s 7ms/step - loss: 1.8199 -
accuracy: 0.4817
Epoch 199/200
391/391 [=====] - 3s 7ms/step - loss: 1.8200 -
accuracy: 0.4825
Epoch 200/200
391/391 [=====] - 3s 7ms/step - loss: 1.8196 -
accuracy: 0.4821
313/313 [=====] - 1s 4ms/step - loss: 1.8397 -
accuracy: 0.4731
Epoch 1/200
391/391 [=====] - 4s 9ms/step - loss: 3.9202 -
accuracy: 0.2110
Epoch 2/200
391/391 [=====] - 4s 9ms/step - loss: 2.1472 -
accuracy: 0.2705
Epoch 3/200
391/391 [=====] - 4s 9ms/step - loss: 2.1110 -
accuracy: 0.2854
Epoch 4/200
391/391 [=====] - 4s 9ms/step - loss: 2.0856 -
accuracy: 0.2991
Epoch 5/200
391/391 [=====] - 4s 9ms/step - loss: 2.0606 -
accuracy: 0.3053
Epoch 6/200
391/391 [=====] - 4s 9ms/step - loss: 2.0348 -
accuracy: 0.3184
Epoch 7/200
391/391 [=====] - 4s 9ms/step - loss: 2.0209 -
accuracy: 0.3224
Epoch 8/200
391/391 [=====] - 4s 9ms/step - loss: 2.0113 -
accuracy: 0.3277
Epoch 9/200

```
391/391 [=====] - 4s 9ms/step - loss: 2.0058 -  
accuracy: 0.3304  
Epoch 10/200  
391/391 [=====] - 4s 9ms/step - loss: 2.0015 -  
accuracy: 0.3338  
Epoch 11/200  
391/391 [=====] - 4s 10ms/step - loss: 2.0035  
- accuracy: 0.3328  
Epoch 12/200  
391/391 [=====] - 4s 9ms/step - loss: 2.0003 -  
accuracy: 0.3358  
Epoch 13/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9981 -  
accuracy: 0.3380  
Epoch 14/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9994 -  
accuracy: 0.3388  
Epoch 15/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9990 -  
accuracy: 0.3373  
Epoch 16/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9956 -  
accuracy: 0.3396  
Epoch 17/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9957 -  
accuracy: 0.3390  
Epoch 18/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9958 -  
accuracy: 0.3363  
Epoch 19/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9945 -  
accuracy: 0.3389  
Epoch 20/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9900 -  
accuracy: 0.3385  
Epoch 21/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9909 -  
accuracy: 0.3398  
Epoch 22/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9888 -  
accuracy: 0.3427  
Epoch 23/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9892 -  
accuracy: 0.3442  
Epoch 24/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9929 -  
accuracy: 0.3408  
Epoch 25/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9876 -  
accuracy: 0.3418  
Epoch 26/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9889 -  
accuracy: 0.3448  
Epoch 27/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9896 -  
accuracy: 0.3423  
Epoch 28/200
```

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391/391 [=====] - 4s 9ms/step - loss: 1.9892 -  
accuracy: 0.3448  
Epoch 29/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9886 -  
accuracy: 0.3441  
Epoch 30/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9888 -  
accuracy: 0.3415  
Epoch 31/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9845 -  
accuracy: 0.3424  
Epoch 32/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9865 -  
accuracy: 0.3441  
Epoch 33/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9858 -  
accuracy: 0.3446  
Epoch 34/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9860 -  
accuracy: 0.3426  
Epoch 35/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9871 -  
accuracy: 0.3441  
Epoch 36/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9861 -  
accuracy: 0.3448  
Epoch 37/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9865 -  
accuracy: 0.3440  
Epoch 38/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9852 -  
accuracy: 0.3463  
Epoch 39/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9861 -  
accuracy: 0.3465  
Epoch 40/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9851 -  
accuracy: 0.3437  
Epoch 41/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9855 -  
accuracy: 0.3439  
Epoch 42/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9875 -  
accuracy: 0.3438  
Epoch 43/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9862 -  
accuracy: 0.3420  
Epoch 44/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9843 -  
accuracy: 0.3450  
Epoch 45/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9854 -  
accuracy: 0.3429  
Epoch 46/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9856 -  
accuracy: 0.3428  
Epoch 47/200
```

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391/391 [=====] - 4s 9ms/step - loss: 1.9844 -  
accuracy: 0.3458  
Epoch 48/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9840 -  
accuracy: 0.3463  
Epoch 49/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9854 -  
accuracy: 0.3437  
Epoch 50/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9861 -  
accuracy: 0.3440  
Epoch 51/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9845 -  
accuracy: 0.3467  
Epoch 52/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9854 -  
accuracy: 0.3454  
Epoch 53/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9866 -  
accuracy: 0.3447  
Epoch 54/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9841 -  
accuracy: 0.3438  
Epoch 55/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9858 -  
accuracy: 0.3456  
Epoch 56/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9836 -  
accuracy: 0.3453  
Epoch 57/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9859 -  
accuracy: 0.3424  
Epoch 58/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9843 -  
accuracy: 0.3432  
Epoch 59/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9842 -  
accuracy: 0.3442  
Epoch 60/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9842 -  
accuracy: 0.3454  
Epoch 61/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9826 -  
accuracy: 0.3482  
Epoch 62/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9847 -  
accuracy: 0.3442  
Epoch 63/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9836 -  
accuracy: 0.3472  
Epoch 64/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9848 -  
accuracy: 0.3455  
Epoch 65/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9832 -  
accuracy: 0.3452  
Epoch 66/200
```

```
391/391 [=====] - 3s 9ms/step - loss: 1.9843 -  
accuracy: 0.3435  
Epoch 67/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9810 -  
accuracy: 0.3462  
Epoch 68/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9831 -  
accuracy: 0.3465  
Epoch 69/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9831 -  
accuracy: 0.3473  
Epoch 70/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9833 -  
accuracy: 0.3456  
Epoch 71/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9859 -  
accuracy: 0.3459  
Epoch 72/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9810 -  
accuracy: 0.3455  
Epoch 73/200  
391/391 [=====] - 4s 10ms/step - loss: 1.9855  
- accuracy: 0.3459  
Epoch 74/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9806 -  
accuracy: 0.3486  
Epoch 75/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9846 -  
accuracy: 0.3448  
Epoch 76/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9855 -  
accuracy: 0.3479  
Epoch 77/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9853 -  
accuracy: 0.3458  
Epoch 78/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9833 -  
accuracy: 0.3462  
Epoch 79/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9842 -  
accuracy: 0.3456  
Epoch 80/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9836 -  
accuracy: 0.3456  
Epoch 81/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9832 -  
accuracy: 0.3478  
Epoch 82/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9812 -  
accuracy: 0.3466  
Epoch 83/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9838 -  
accuracy: 0.3471  
Epoch 84/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9829 -  
accuracy: 0.3483  
Epoch 85/200
```

```
391/391 [=====] - 4s 9ms/step - loss: 1.9813 -  
accuracy: 0.3469  
Epoch 86/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9830 -  
accuracy: 0.3451  
Epoch 87/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9837 -  
accuracy: 0.3485  
Epoch 88/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9805 -  
accuracy: 0.3490  
Epoch 89/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9806 -  
accuracy: 0.3503  
Epoch 90/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9818 -  
accuracy: 0.3474  
Epoch 91/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9830 -  
accuracy: 0.3468  
Epoch 92/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9811 -  
accuracy: 0.3474  
Epoch 93/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9818 -  
accuracy: 0.3479  
Epoch 94/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9812 -  
accuracy: 0.3513  
Epoch 95/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9816 -  
accuracy: 0.3495  
Epoch 96/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9821 -  
accuracy: 0.3458  
Epoch 97/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9800 -  
accuracy: 0.3500  
Epoch 98/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9811 -  
accuracy: 0.3477  
Epoch 99/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9821 -  
accuracy: 0.3463  
Epoch 100/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9828 -  
accuracy: 0.3473  
Epoch 101/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9827 -  
accuracy: 0.3486  
Epoch 102/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9808 -  
accuracy: 0.3485  
Epoch 103/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9809 -  
accuracy: 0.3490  
Epoch 104/200
```

```
391/391 [=====] - 3s 9ms/step - loss: 1.9806 -  
accuracy: 0.3484  
Epoch 105/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9823 -  
accuracy: 0.3485  
Epoch 106/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9791 -  
accuracy: 0.3480  
Epoch 107/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9823 -  
accuracy: 0.3492  
Epoch 108/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9823 -  
accuracy: 0.3490  
Epoch 109/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9803 -  
accuracy: 0.3509  
Epoch 110/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9796 -  
accuracy: 0.3504  
Epoch 111/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9790 -  
accuracy: 0.3489  
Epoch 112/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9785 -  
accuracy: 0.3493  
Epoch 113/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9793 -  
accuracy: 0.3480  
Epoch 114/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9766 -  
accuracy: 0.3503  
Epoch 115/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9801 -  
accuracy: 0.3498  
Epoch 116/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9787 -  
accuracy: 0.3498  
Epoch 117/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9789 -  
accuracy: 0.3481  
Epoch 118/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9770 -  
accuracy: 0.3515  
Epoch 119/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9808 -  
accuracy: 0.3472  
Epoch 120/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9770 -  
accuracy: 0.3507  
Epoch 121/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9765 -  
accuracy: 0.3507  
Epoch 122/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9770 -  
accuracy: 0.3514  
Epoch 123/200
```

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391/391 [=====] - 3s 9ms/step - loss: 1.9787 -  
accuracy: 0.3487  
Epoch 124/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9792 -  
accuracy: 0.3491  
Epoch 125/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9776 -  
accuracy: 0.3511  
Epoch 126/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9786 -  
accuracy: 0.3494  
Epoch 127/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9788 -  
accuracy: 0.3510  
Epoch 128/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9784 -  
accuracy: 0.3503  
Epoch 129/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9769 -  
accuracy: 0.3494  
Epoch 130/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9768 -  
accuracy: 0.3521  
Epoch 131/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9746 -  
accuracy: 0.3508  
Epoch 132/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9770 -  
accuracy: 0.3481  
Epoch 133/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9762 -  
accuracy: 0.3507  
Epoch 134/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9777 -  
accuracy: 0.3482  
Epoch 135/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9773 -  
accuracy: 0.3509  
Epoch 136/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9762 -  
accuracy: 0.3487  
Epoch 137/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9756 -  
accuracy: 0.3509  
Epoch 138/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9770 -  
accuracy: 0.3495  
Epoch 139/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9749 -  
accuracy: 0.3493  
Epoch 140/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9781 -  
accuracy: 0.3500  
Epoch 141/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9787 -  
accuracy: 0.3501  
Epoch 142/200
```



```
391/391 [=====] - 3s 9ms/step - loss: 1.9748 -  
accuracy: 0.3516  
Epoch 143/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9770 -  
accuracy: 0.3509  
Epoch 144/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9743 -  
accuracy: 0.3518  
Epoch 145/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9758 -  
accuracy: 0.3506  
Epoch 146/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9757 -  
accuracy: 0.3510  
Epoch 147/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9745 -  
accuracy: 0.3523  
Epoch 148/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9760 -  
accuracy: 0.3517  
Epoch 149/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9778 -  
accuracy: 0.3497  
Epoch 150/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9759 -  
accuracy: 0.3501  
Epoch 151/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9749 -  
accuracy: 0.3529  
Epoch 152/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9745 -  
accuracy: 0.3516  
Epoch 153/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9742 -  
accuracy: 0.3512  
Epoch 154/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9747 -  
accuracy: 0.3524  
Epoch 155/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9749 -  
accuracy: 0.3539  
Epoch 156/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9751 -  
accuracy: 0.3518  
Epoch 157/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9751 -  
accuracy: 0.3508  
Epoch 158/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9756 -  
accuracy: 0.3507  
Epoch 159/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9763 -  
accuracy: 0.3511  
Epoch 160/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9738 -  
accuracy: 0.3517  
Epoch 161/200
```

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391/391 [=====] - 4s 9ms/step - loss: 1.9759 -  
accuracy: 0.3504  
Epoch 162/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9750 -  
accuracy: 0.3520  
Epoch 163/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9739 -  
accuracy: 0.3508  
Epoch 164/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9735 -  
accuracy: 0.3529  
Epoch 165/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9750 -  
accuracy: 0.3514  
Epoch 166/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9728 -  
accuracy: 0.3512  
Epoch 167/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9758 -  
accuracy: 0.3524  
Epoch 168/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9725 -  
accuracy: 0.3507  
Epoch 169/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9745 -  
accuracy: 0.3532  
Epoch 170/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9726 -  
accuracy: 0.3529  
Epoch 171/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9751 -  
accuracy: 0.3525  
Epoch 172/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9729 -  
accuracy: 0.3519  
Epoch 173/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9735 -  
accuracy: 0.3541  
Epoch 174/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9741 -  
accuracy: 0.3522  
Epoch 175/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9718 -  
accuracy: 0.3527  
Epoch 176/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9731 -  
accuracy: 0.3541  
Epoch 177/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9738 -  
accuracy: 0.3527  
Epoch 178/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9730 -  
accuracy: 0.3537  
Epoch 179/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9738 -  
accuracy: 0.3530  
Epoch 180/200
```

```
391/391 [=====] - 3s 9ms/step - loss: 1.9730 -  
accuracy: 0.3528  
Epoch 181/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9729 -  
accuracy: 0.3511  
Epoch 182/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9753 -  
accuracy: 0.3509  
Epoch 183/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9756 -  
accuracy: 0.3521  
Epoch 184/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9741 -  
accuracy: 0.3530  
Epoch 185/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9744 -  
accuracy: 0.3517  
Epoch 186/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9731 -  
accuracy: 0.3540  
Epoch 187/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9738 -  
accuracy: 0.3536  
Epoch 188/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9745 -  
accuracy: 0.3544  
Epoch 189/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9740 -  
accuracy: 0.3511  
Epoch 190/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9738 -  
accuracy: 0.3514  
Epoch 191/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9721 -  
accuracy: 0.3522  
Epoch 192/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9737 -  
accuracy: 0.3532  
Epoch 193/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9748 -  
accuracy: 0.3517  
Epoch 194/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9731 -  
accuracy: 0.3530  
Epoch 195/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9724 -  
accuracy: 0.3541  
Epoch 196/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9735 -  
accuracy: 0.3524  
Epoch 197/200  
391/391 [=====] - 4s 9ms/step - loss: 1.9723 -  
accuracy: 0.3532  
Epoch 198/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9736 -  
accuracy: 0.3538  
Epoch 199/200
```

```
391/391 [=====] - 3s 9ms/step - loss: 1.9759 -  
accuracy: 0.3515  
Epoch 200/200  
391/391 [=====] - 3s 9ms/step - loss: 1.9723 -  
accuracy: 0.3515  
313/313 [=====] - 1s 4ms/step - loss: 2.0016 -  
accuracy: 0.3338  
Epoch 1/200  
391/391 [=====] - 3s 8ms/step - loss: 27.4059  
- accuracy: 0.1593  
Epoch 2/200  
391/391 [=====] - 3s 8ms/step - loss: 26.9983  
- accuracy: 0.2429  
Epoch 3/200  
391/391 [=====] - 3s 8ms/step - loss: 26.6341  
- accuracy: 0.2771  
Epoch 4/200  
391/391 [=====] - 3s 8ms/step - loss: 26.2931  
- accuracy: 0.2984  
Epoch 5/200  
391/391 [=====] - 3s 8ms/step - loss: 25.9677  
- accuracy: 0.3104  
Epoch 6/200  
391/391 [=====] - 3s 8ms/step - loss: 25.6535  
- accuracy: 0.3200  
Epoch 7/200  
391/391 [=====] - 3s 8ms/step - loss: 25.3482  
- accuracy: 0.3290  
Epoch 8/200  
391/391 [=====] - 3s 8ms/step - loss: 25.0513  
- accuracy: 0.3359  
Epoch 9/200  
391/391 [=====] - 3s 8ms/step - loss: 24.7616  
- accuracy: 0.3409  
Epoch 10/200  
391/391 [=====] - 3s 8ms/step - loss: 24.4787  
- accuracy: 0.3460  
Epoch 11/200  
391/391 [=====] - 3s 8ms/step - loss: 24.2013  
- accuracy: 0.3495  
Epoch 12/200  
391/391 [=====] - 3s 8ms/step - loss: 23.9289  
- accuracy: 0.3533  
Epoch 13/200  
391/391 [=====] - 3s 8ms/step - loss: 23.6621  
- accuracy: 0.3554  
Epoch 14/200  
391/391 [=====] - 3s 8ms/step - loss: 23.4001  
- accuracy: 0.3591  
Epoch 15/200  
391/391 [=====] - 3s 8ms/step - loss: 23.1422  
- accuracy: 0.3618  
Epoch 16/200  
391/391 [=====] - 3s 8ms/step - loss: 22.8879  
- accuracy: 0.3638  
Epoch 17/200  
391/391 [=====] - 3s 8ms/step - loss: 22.6377
```

```
- accuracy: 0.3651
Epoch 18/200
391/391 [=====] - 3s 8ms/step - loss: 22.3912
- accuracy: 0.3692
Epoch 19/200
391/391 [=====] - 3s 8ms/step - loss: 22.1492
- accuracy: 0.3708
Epoch 20/200
391/391 [=====] - 3s 8ms/step - loss: 21.9111
- accuracy: 0.3724
Epoch 21/200
391/391 [=====] - 3s 8ms/step - loss: 21.6757
- accuracy: 0.3747
Epoch 22/200
391/391 [=====] - 3s 8ms/step - loss: 21.4434
- accuracy: 0.3766
Epoch 23/200
391/391 [=====] - 3s 8ms/step - loss: 21.2145
- accuracy: 0.3778
Epoch 24/200
391/391 [=====] - 3s 8ms/step - loss: 20.9891
- accuracy: 0.3795
Epoch 25/200
391/391 [=====] - 3s 8ms/step - loss: 20.7673
- accuracy: 0.3792
Epoch 26/200
391/391 [=====] - 3s 8ms/step - loss: 20.5483
- accuracy: 0.3817
Epoch 27/200
391/391 [=====] - 3s 8ms/step - loss: 20.3323
- accuracy: 0.3825
Epoch 28/200
391/391 [=====] - 3s 8ms/step - loss: 20.1186
- accuracy: 0.3847
Epoch 29/200
391/391 [=====] - 3s 8ms/step - loss: 19.9072
- accuracy: 0.3854
Epoch 30/200
391/391 [=====] - 3s 8ms/step - loss: 19.6996
- accuracy: 0.3870
Epoch 31/200
391/391 [=====] - 3s 8ms/step - loss: 19.4947
- accuracy: 0.3881
Epoch 32/200
391/391 [=====] - 3s 8ms/step - loss: 19.2921
- accuracy: 0.3888
Epoch 33/200
391/391 [=====] - 3s 8ms/step - loss: 19.0916
- accuracy: 0.3894
Epoch 34/200
391/391 [=====] - 3s 8ms/step - loss: 18.8935
- accuracy: 0.3907
Epoch 35/200
391/391 [=====] - 3s 8ms/step - loss: 18.6985
- accuracy: 0.3916
Epoch 36/200
391/391 [=====] - 3s 8ms/step - loss: 18.5061
```

```
- accuracy: 0.3930
Epoch 37/200
391/391 [=====] - 3s 8ms/step - loss: 18.3157
- accuracy: 0.3929
Epoch 38/200
391/391 [=====] - 3s 8ms/step - loss: 18.1281
- accuracy: 0.3938
Epoch 39/200
391/391 [=====] - 3s 8ms/step - loss: 17.9426
- accuracy: 0.3944
Epoch 40/200
391/391 [=====] - 3s 8ms/step - loss: 17.7594
- accuracy: 0.3963
Epoch 41/200
391/391 [=====] - 3s 8ms/step - loss: 17.5784
- accuracy: 0.3969
Epoch 42/200
391/391 [=====] - 3s 8ms/step - loss: 17.4002
- accuracy: 0.3983
Epoch 43/200
391/391 [=====] - 3s 8ms/step - loss: 17.2244
- accuracy: 0.3986
Epoch 44/200
391/391 [=====] - 3s 8ms/step - loss: 17.0509
- accuracy: 0.4001
Epoch 45/200
391/391 [=====] - 3s 8ms/step - loss: 16.8791
- accuracy: 0.3994
Epoch 46/200
391/391 [=====] - 3s 8ms/step - loss: 16.7090
- accuracy: 0.4011
Epoch 47/200
391/391 [=====] - 3s 8ms/step - loss: 16.5412
- accuracy: 0.4002
Epoch 48/200
391/391 [=====] - 3s 8ms/step - loss: 16.3753
- accuracy: 0.4025
Epoch 49/200
391/391 [=====] - 3s 8ms/step - loss: 16.2115
- accuracy: 0.4024
Epoch 50/200
391/391 [=====] - 3s 8ms/step - loss: 16.0499
- accuracy: 0.4033
Epoch 51/200
391/391 [=====] - 3s 8ms/step - loss: 15.8903
- accuracy: 0.4038
Epoch 52/200
391/391 [=====] - 3s 8ms/step - loss: 15.7321
- accuracy: 0.4047
Epoch 53/200
391/391 [=====] - 3s 8ms/step - loss: 15.5759
- accuracy: 0.4048
Epoch 54/200
391/391 [=====] - 3s 8ms/step - loss: 15.4217
- accuracy: 0.4063
Epoch 55/200
391/391 [=====] - 3s 8ms/step - loss: 15.2694
```

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- accuracy: 0.4061
Epoch 56/200
391/391 [=====] - 3s 8ms/step - loss: 15.1188
- accuracy: 0.4066
Epoch 57/200
391/391 [=====] - 3s 8ms/step - loss: 14.9704
- accuracy: 0.4079
Epoch 58/200
391/391 [=====] - 3s 8ms/step - loss: 14.8235
- accuracy: 0.4081
Epoch 59/200
391/391 [=====] - 3s 8ms/step - loss: 14.6784
- accuracy: 0.4076
Epoch 60/200
391/391 [=====] - 3s 8ms/step - loss: 14.5351
- accuracy: 0.4085
Epoch 61/200
391/391 [=====] - 3s 8ms/step - loss: 14.3933
- accuracy: 0.4100
Epoch 62/200
391/391 [=====] - 3s 8ms/step - loss: 14.2529
- accuracy: 0.4103
Epoch 63/200
391/391 [=====] - 3s 8ms/step - loss: 14.1146
- accuracy: 0.4099
Epoch 64/200
391/391 [=====] - 3s 8ms/step - loss: 13.9783
- accuracy: 0.4112
Epoch 65/200
391/391 [=====] - 3s 8ms/step - loss: 13.8434
- accuracy: 0.4116
Epoch 66/200
391/391 [=====] - 3s 8ms/step - loss: 13.7096
- accuracy: 0.4123
Epoch 67/200
391/391 [=====] - 3s 8ms/step - loss: 13.5775
- accuracy: 0.4122
Epoch 68/200
391/391 [=====] - 3s 8ms/step - loss: 13.4475
- accuracy: 0.4130
Epoch 69/200
391/391 [=====] - 3s 8ms/step - loss: 13.3182
- accuracy: 0.4144
Epoch 70/200
391/391 [=====] - 3s 8ms/step - loss: 13.1905
- accuracy: 0.4139
Epoch 71/200
391/391 [=====] - 3s 8ms/step - loss: 13.0645
- accuracy: 0.4147
Epoch 72/200
391/391 [=====] - 3s 8ms/step - loss: 12.9400
- accuracy: 0.4144
Epoch 73/200
391/391 [=====] - 3s 8ms/step - loss: 12.8171
- accuracy: 0.4153
Epoch 74/200
391/391 [=====] - 3s 8ms/step - loss: 12.6953
```

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- accuracy: 0.4162
Epoch 75/200
391/391 [=====] - 3s 8ms/step - loss: 12.5752
- accuracy: 0.4161
Epoch 76/200
391/391 [=====] - 3s 8ms/step - loss: 12.4565
- accuracy: 0.4165
Epoch 77/200
391/391 [=====] - 3s 8ms/step - loss: 12.3390
- accuracy: 0.4167
Epoch 78/200
391/391 [=====] - 3s 8ms/step - loss: 12.2232
- accuracy: 0.4167
Epoch 79/200
391/391 [=====] - 3s 8ms/step - loss: 12.1091
- accuracy: 0.4178
Epoch 80/200
391/391 [=====] - 3s 8ms/step - loss: 11.9955
- accuracy: 0.4169
Epoch 81/200
391/391 [=====] - 3s 8ms/step - loss: 11.8838
- accuracy: 0.4183
Epoch 82/200
391/391 [=====] - 3s 8ms/step - loss: 11.7737
- accuracy: 0.4189
Epoch 83/200
391/391 [=====] - 3s 8ms/step - loss: 11.6643
- accuracy: 0.4183
Epoch 84/200
391/391 [=====] - 3s 8ms/step - loss: 11.5563
- accuracy: 0.4191
Epoch 85/200
391/391 [=====] - 3s 8ms/step - loss: 11.4496
- accuracy: 0.4195
Epoch 86/200
391/391 [=====] - 3s 8ms/step - loss: 11.3435
- accuracy: 0.4198
Epoch 87/200
391/391 [=====] - 3s 8ms/step - loss: 11.2387
- accuracy: 0.4203
Epoch 88/200
391/391 [=====] - 3s 8ms/step - loss: 11.1352
- accuracy: 0.4198
Epoch 89/200
391/391 [=====] - 3s 8ms/step - loss: 11.0328
- accuracy: 0.4207
Epoch 90/200
391/391 [=====] - 3s 8ms/step - loss: 10.9318
- accuracy: 0.4202
Epoch 91/200
391/391 [=====] - 3s 8ms/step - loss: 10.8320
- accuracy: 0.4212
Epoch 92/200
391/391 [=====] - 3s 8ms/step - loss: 10.7331
- accuracy: 0.4214
Epoch 93/200
391/391 [=====] - 3s 8ms/step - loss: 10.6359
```



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- accuracy: 0.4217
Epoch 94/200
391/391 [=====] - 3s 8ms/step - loss: 10.5395
- accuracy: 0.4214
Epoch 95/200
391/391 [=====] - 3s 8ms/step - loss: 10.4449
- accuracy: 0.4229
Epoch 96/200
391/391 [=====] - 3s 8ms/step - loss: 10.3506
- accuracy: 0.4223
Epoch 97/200
391/391 [=====] - 3s 8ms/step - loss: 10.2576
- accuracy: 0.4227
Epoch 98/200
391/391 [=====] - 3s 8ms/step - loss: 10.1655
- accuracy: 0.4230
Epoch 99/200
391/391 [=====] - 3s 8ms/step - loss: 10.0744
- accuracy: 0.4230
Epoch 100/200
391/391 [=====] - 3s 8ms/step - loss: 9.9843 -
accuracy: 0.4229
Epoch 101/200
391/391 [=====] - 3s 8ms/step - loss: 9.8957 -
accuracy: 0.4248
Epoch 102/200
391/391 [=====] - 3s 8ms/step - loss: 9.8077 -
accuracy: 0.4245
Epoch 103/200
391/391 [=====] - 3s 8ms/step - loss: 9.7206 -
accuracy: 0.4246
Epoch 104/200
391/391 [=====] - 3s 8ms/step - loss: 9.6347 -
accuracy: 0.4247
Epoch 105/200
391/391 [=====] - 3s 8ms/step - loss: 9.5495 -
accuracy: 0.4251
Epoch 106/200
391/391 [=====] - 3s 8ms/step - loss: 9.4653 -
accuracy: 0.4255
Epoch 107/200
391/391 [=====] - 3s 8ms/step - loss: 9.3825 -
accuracy: 0.4246
Epoch 108/200
391/391 [=====] - 3s 8ms/step - loss: 9.3005 -
accuracy: 0.4252
Epoch 109/200
391/391 [=====] - 3s 8ms/step - loss: 9.2195 -
accuracy: 0.4265
Epoch 110/200
391/391 [=====] - 3s 8ms/step - loss: 9.1394 -
accuracy: 0.4268
Epoch 111/200
391/391 [=====] - 3s 8ms/step - loss: 9.0598 -
accuracy: 0.4265
Epoch 112/200
391/391 [=====] - 3s 8ms/step - loss: 8.9814 -
```

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accuracy: 0.4263
Epoch 113/200
391/391 [=====] - 3s 8ms/step - loss: 8.9041 -
accuracy: 0.4266
Epoch 114/200
391/391 [=====] - 3s 8ms/step - loss: 8.8274 -
accuracy: 0.4267
Epoch 115/200
391/391 [=====] - 3s 8ms/step - loss: 8.7516 -
accuracy: 0.4270
Epoch 116/200
391/391 [=====] - 3s 8ms/step - loss: 8.6765 -
accuracy: 0.4272
Epoch 117/200
391/391 [=====] - 3s 8ms/step - loss: 8.6027 -
accuracy: 0.4283
Epoch 118/200
391/391 [=====] - 3s 8ms/step - loss: 8.5294 -
accuracy: 0.4269
Epoch 119/200
391/391 [=====] - 3s 8ms/step - loss: 8.4570 -
accuracy: 0.4282
Epoch 120/200
391/391 [=====] - 3s 8ms/step - loss: 8.3856 -
accuracy: 0.4280
Epoch 121/200
391/391 [=====] - 3s 8ms/step - loss: 8.3147 -
accuracy: 0.4296
Epoch 122/200
391/391 [=====] - 3s 8ms/step - loss: 8.2448 -
accuracy: 0.4293
Epoch 123/200
391/391 [=====] - 3s 8ms/step - loss: 8.1755 -
accuracy: 0.4294
Epoch 124/200
391/391 [=====] - 3s 8ms/step - loss: 8.1068 -
accuracy: 0.4291
Epoch 125/200
391/391 [=====] - 3s 8ms/step - loss: 8.0390 -
accuracy: 0.4291
Epoch 126/200
391/391 [=====] - 3s 8ms/step - loss: 7.9724 -
accuracy: 0.4294
Epoch 127/200
391/391 [=====] - 3s 8ms/step - loss: 7.9066 -
accuracy: 0.4303
Epoch 128/200
391/391 [=====] - 3s 8ms/step - loss: 7.8413 -
accuracy: 0.4308
Epoch 129/200
391/391 [=====] - 3s 8ms/step - loss: 7.7769 -
accuracy: 0.4302
Epoch 130/200
391/391 [=====] - 3s 8ms/step - loss: 7.7133 -
accuracy: 0.4310
Epoch 131/200
391/391 [=====] - 3s 8ms/step - loss: 7.6503 -
```

```
accuracy: 0.4311
Epoch 132/200
391/391 [=====] - 3s 8ms/step - loss: 7.5878 -
accuracy: 0.4303
Epoch 133/200
391/391 [=====] - 3s 8ms/step - loss: 7.5262 -
accuracy: 0.4317
Epoch 134/200
391/391 [=====] - 3s 8ms/step - loss: 7.4650 -
accuracy: 0.4315
Epoch 135/200
391/391 [=====] - 3s 8ms/step - loss: 7.4046 -
accuracy: 0.4316
Epoch 136/200
391/391 [=====] - 3s 8ms/step - loss: 7.3450 -
accuracy: 0.4316
Epoch 137/200
391/391 [=====] - 3s 8ms/step - loss: 7.2858 -
accuracy: 0.4318
Epoch 138/200
391/391 [=====] - 3s 8ms/step - loss: 7.2272 -
accuracy: 0.4319
Epoch 139/200
391/391 [=====] - 3s 8ms/step - loss: 7.1695 -
accuracy: 0.4315
Epoch 140/200
391/391 [=====] - 3s 8ms/step - loss: 7.1128 -
accuracy: 0.4321
Epoch 141/200
391/391 [=====] - 3s 8ms/step - loss: 7.0567 -
accuracy: 0.4328
Epoch 142/200
391/391 [=====] - 3s 8ms/step - loss: 7.0011 -
accuracy: 0.4324
Epoch 143/200
391/391 [=====] - 3s 8ms/step - loss: 6.9463 -
accuracy: 0.4325
Epoch 144/200
391/391 [=====] - 3s 8ms/step - loss: 6.8917 -
accuracy: 0.4330
Epoch 145/200
391/391 [=====] - 3s 8ms/step - loss: 6.8376 -
accuracy: 0.4324
Epoch 146/200
391/391 [=====] - 3s 8ms/step - loss: 6.7844 -
accuracy: 0.4332
Epoch 147/200
391/391 [=====] - 3s 8ms/step - loss: 6.7317 -
accuracy: 0.4329
Epoch 148/200
391/391 [=====] - 3s 8ms/step - loss: 6.6797 -
accuracy: 0.4334
Epoch 149/200
391/391 [=====] - 3s 8ms/step - loss: 6.6284 -
accuracy: 0.4344
Epoch 150/200
391/391 [=====] - 3s 8ms/step - loss: 6.5773 -
```

```
accuracy: 0.4351
Epoch 151/200
391/391 [=====] - 3s 8ms/step - loss: 6.5270 -
accuracy: 0.4336
Epoch 152/200
391/391 [=====] - 3s 8ms/step - loss: 6.4771 -
accuracy: 0.4350
Epoch 153/200
391/391 [=====] - 3s 8ms/step - loss: 6.4280 -
accuracy: 0.4344
Epoch 154/200
391/391 [=====] - 3s 8ms/step - loss: 6.3795 -
accuracy: 0.4346
Epoch 155/200
391/391 [=====] - 3s 8ms/step - loss: 6.3312 -
accuracy: 0.4354
Epoch 156/200
391/391 [=====] - 3s 8ms/step - loss: 6.2834 -
accuracy: 0.4350
Epoch 157/200
391/391 [=====] - 3s 8ms/step - loss: 6.2364 -
accuracy: 0.4352
Epoch 158/200
391/391 [=====] - 3s 8ms/step - loss: 6.1901 -
accuracy: 0.4359
Epoch 159/200
391/391 [=====] - 3s 8ms/step - loss: 6.1440 -
accuracy: 0.4346
Epoch 160/200
391/391 [=====] - 3s 8ms/step - loss: 6.0985 -
accuracy: 0.4355
Epoch 161/200
391/391 [=====] - 3s 8ms/step - loss: 6.0536 -
accuracy: 0.4357
Epoch 162/200
391/391 [=====] - 3s 8ms/step - loss: 6.0093 -
accuracy: 0.4358
Epoch 163/200
391/391 [=====] - 3s 8ms/step - loss: 5.9654 -
accuracy: 0.4362
Epoch 164/200
391/391 [=====] - 3s 8ms/step - loss: 5.9221 -
accuracy: 0.4360
Epoch 165/200
391/391 [=====] - 3s 8ms/step - loss: 5.8793 -
accuracy: 0.4363
Epoch 166/200
391/391 [=====] - 3s 8ms/step - loss: 5.8368 -
accuracy: 0.4356
Epoch 167/200
391/391 [=====] - 3s 8ms/step - loss: 5.7946 -
accuracy: 0.4369
Epoch 168/200
391/391 [=====] - 3s 8ms/step - loss: 5.7527 -
accuracy: 0.4374
Epoch 169/200
391/391 [=====] - 3s 8ms/step - loss: 5.7115 -
```

```
accuracy: 0.4371
Epoch 170/200
391/391 [=====] - 3s 8ms/step - loss: 5.6708 -
accuracy: 0.4372
Epoch 171/200
391/391 [=====] - 3s 8ms/step - loss: 5.6305 -
accuracy: 0.4369
Epoch 172/200
391/391 [=====] - 3s 8ms/step - loss: 5.5907 -
accuracy: 0.4368
Epoch 173/200
391/391 [=====] - 3s 8ms/step - loss: 5.5515 -
accuracy: 0.4380
Epoch 174/200
391/391 [=====] - 3s 8ms/step - loss: 5.5125 -
accuracy: 0.4386
Epoch 175/200
391/391 [=====] - 3s 8ms/step - loss: 5.4738 -
accuracy: 0.4380
Epoch 176/200
391/391 [=====] - 3s 8ms/step - loss: 5.4359 -
accuracy: 0.4385
Epoch 177/200
391/391 [=====] - 3s 8ms/step - loss: 5.3984 -
accuracy: 0.4376
Epoch 178/200
391/391 [=====] - 3s 8ms/step - loss: 5.3612 -
accuracy: 0.4378
Epoch 179/200
391/391 [=====] - 3s 8ms/step - loss: 5.3246 -
accuracy: 0.4382
Epoch 180/200
391/391 [=====] - 3s 8ms/step - loss: 5.2882 -
accuracy: 0.4383
Epoch 181/200
391/391 [=====] - 3s 8ms/step - loss: 5.2523 -
accuracy: 0.4391
Epoch 182/200
391/391 [=====] - 3s 8ms/step - loss: 5.2168 -
accuracy: 0.4375
Epoch 183/200
391/391 [=====] - 3s 8ms/step - loss: 5.1817 -
accuracy: 0.4400
Epoch 184/200
391/391 [=====] - 3s 8ms/step - loss: 5.1469 -
accuracy: 0.4384
Epoch 185/200
391/391 [=====] - 3s 8ms/step - loss: 5.1122 -
accuracy: 0.4394
Epoch 186/200
391/391 [=====] - 3s 8ms/step - loss: 5.0781 -
accuracy: 0.4383
Epoch 187/200
391/391 [=====] - 3s 8ms/step - loss: 5.0444 -
accuracy: 0.4392
Epoch 188/200
391/391 [=====] - 3s 8ms/step - loss: 5.0111 -
```

```
accuracy: 0.4397
Epoch 189/200
391/391 [=====] - 3s 8ms/step - loss: 4.9780 -
accuracy: 0.4401
Epoch 190/200
391/391 [=====] - 3s 8ms/step - loss: 4.9456 -
accuracy: 0.4390
Epoch 191/200
391/391 [=====] - 3s 8ms/step - loss: 4.9133 -
accuracy: 0.4400
Epoch 192/200
391/391 [=====] - 3s 8ms/step - loss: 4.8814 -
accuracy: 0.4402
Epoch 193/200
391/391 [=====] - 3s 8ms/step - loss: 4.8499 -
accuracy: 0.4404
Epoch 194/200
391/391 [=====] - 3s 8ms/step - loss: 4.8187 -
accuracy: 0.4397
Epoch 195/200
391/391 [=====] - 3s 8ms/step - loss: 4.7878 -
accuracy: 0.4413
Epoch 196/200
391/391 [=====] - 3s 8ms/step - loss: 4.7573 -
accuracy: 0.4407
Epoch 197/200
391/391 [=====] - 3s 8ms/step - loss: 4.7273 -
accuracy: 0.4405
Epoch 198/200
391/391 [=====] - 3s 8ms/step - loss: 4.6976 -
accuracy: 0.4417
Epoch 199/200
391/391 [=====] - 3s 8ms/step - loss: 4.6681 -
accuracy: 0.4404
Epoch 200/200
391/391 [=====] - 3s 8ms/step - loss: 4.6387 -
accuracy: 0.4409
313/313 [=====] - 1s 4ms/step - loss: 4.6324 -
accuracy: 0.4371
Epoch 1/200
391/391 [=====] - 3s 8ms/step - loss: 4.6372 -
accuracy: 0.2995
Epoch 2/200
391/391 [=====] - 3s 7ms/step - loss: 2.0743 -
accuracy: 0.3398
Epoch 3/200
391/391 [=====] - 3s 7ms/step - loss: 1.9776 -
accuracy: 0.3523
Epoch 4/200
391/391 [=====] - 3s 7ms/step - loss: 1.9585 -
accuracy: 0.3559
Epoch 5/200
391/391 [=====] - 3s 7ms/step - loss: 1.9425 -
accuracy: 0.3618
Epoch 6/200
391/391 [=====] - 3s 7ms/step - loss: 1.9384 -
accuracy: 0.3613
```

```
Epoch 7/200
391/391 [=====] - 3s 7ms/step - loss: 1.9292 -
accuracy: 0.3686
Epoch 8/200
391/391 [=====] - 3s 7ms/step - loss: 1.9233 -
accuracy: 0.3687
Epoch 9/200
391/391 [=====] - 3s 7ms/step - loss: 1.9198 -
accuracy: 0.3701
Epoch 10/200
391/391 [=====] - 3s 7ms/step - loss: 1.9273 -
accuracy: 0.3678
Epoch 11/200
391/391 [=====] - 3s 7ms/step - loss: 1.9160 -
accuracy: 0.3715
Epoch 12/200
391/391 [=====] - 3s 7ms/step - loss: 1.9184 -
accuracy: 0.3736
Epoch 13/200
391/391 [=====] - 3s 7ms/step - loss: 1.9190 -
accuracy: 0.3713
Epoch 14/200
391/391 [=====] - 3s 7ms/step - loss: 1.9220 -
accuracy: 0.3722
Epoch 15/200
391/391 [=====] - 3s 7ms/step - loss: 1.9183 -
accuracy: 0.3716
Epoch 16/200
391/391 [=====] - 3s 7ms/step - loss: 1.9095 -
accuracy: 0.3784
Epoch 17/200
391/391 [=====] - 3s 7ms/step - loss: 1.9147 -
accuracy: 0.3767
Epoch 18/200
391/391 [=====] - 3s 7ms/step - loss: 1.9152 -
accuracy: 0.3754
Epoch 19/200
391/391 [=====] - 3s 7ms/step - loss: 1.9119 -
accuracy: 0.3796
Epoch 20/200
391/391 [=====] - 3s 7ms/step - loss: 1.9073 -
accuracy: 0.3810
Epoch 21/200
391/391 [=====] - 3s 7ms/step - loss: 1.9010 -
accuracy: 0.3841
Epoch 22/200
391/391 [=====] - 3s 7ms/step - loss: 1.9074 -
accuracy: 0.3802
Epoch 23/200
391/391 [=====] - 3s 7ms/step - loss: 1.9048 -
accuracy: 0.3815
Epoch 24/200
391/391 [=====] - 3s 7ms/step - loss: 1.9084 -
accuracy: 0.3784
Epoch 25/200
391/391 [=====] - 3s 7ms/step - loss: 1.9055 -
accuracy: 0.3823
```

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Epoch 26/200
391/391 [=====] - 3s 7ms/step - loss: 1.9012 -
accuracy: 0.3846
Epoch 27/200
391/391 [=====] - 3s 7ms/step - loss: 1.9064 -
accuracy: 0.3818
Epoch 28/200
391/391 [=====] - 3s 7ms/step - loss: 1.9018 -
accuracy: 0.3834
Epoch 29/200
391/391 [=====] - 3s 7ms/step - loss: 1.9046 -
accuracy: 0.3820
Epoch 30/200
391/391 [=====] - 3s 7ms/step - loss: 1.9078 -
accuracy: 0.3784
Epoch 31/200
391/391 [=====] - 3s 7ms/step - loss: 1.9082 -
accuracy: 0.3816
Epoch 32/200
391/391 [=====] - 3s 7ms/step - loss: 1.9043 -
accuracy: 0.3798
Epoch 33/200
391/391 [=====] - 3s 7ms/step - loss: 1.9000 -
accuracy: 0.3828
Epoch 34/200
391/391 [=====] - 3s 7ms/step - loss: 1.9055 -
accuracy: 0.3800
Epoch 35/200
391/391 [=====] - 3s 7ms/step - loss: 1.9090 -
accuracy: 0.3802
Epoch 36/200
391/391 [=====] - 3s 7ms/step - loss: 1.8991 -
accuracy: 0.3832
Epoch 37/200
391/391 [=====] - 3s 7ms/step - loss: 1.9067 -
accuracy: 0.3775
Epoch 38/200
391/391 [=====] - 3s 7ms/step - loss: 1.9026 -
accuracy: 0.3826
Epoch 39/200
391/391 [=====] - 3s 7ms/step - loss: 1.8986 -
accuracy: 0.3828
Epoch 40/200
391/391 [=====] - 3s 7ms/step - loss: 1.9070 -
accuracy: 0.3766
Epoch 41/200
391/391 [=====] - 3s 7ms/step - loss: 1.9074 -
accuracy: 0.3784
Epoch 42/200
391/391 [=====] - 3s 7ms/step - loss: 1.9075 -
accuracy: 0.3780
Epoch 43/200
391/391 [=====] - 3s 7ms/step - loss: 1.9041 -
accuracy: 0.3778
Epoch 44/200
391/391 [=====] - 3s 7ms/step - loss: 1.9049 -
accuracy: 0.3786
```



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Epoch 45/200
391/391 [=====] - 3s 7ms/step - loss: 1.9077 -
accuracy: 0.3778
Epoch 46/200
391/391 [=====] - 3s 7ms/step - loss: 1.9031 -
accuracy: 0.3789
Epoch 47/200
391/391 [=====] - 3s 7ms/step - loss: 1.8982 -
accuracy: 0.3830
Epoch 48/200
391/391 [=====] - 3s 7ms/step - loss: 1.9099 -
accuracy: 0.3765
Epoch 49/200
391/391 [=====] - 3s 7ms/step - loss: 1.9058 -
accuracy: 0.3776
Epoch 50/200
391/391 [=====] - 3s 7ms/step - loss: 1.9016 -
accuracy: 0.3815
Epoch 51/200
391/391 [=====] - 3s 7ms/step - loss: 1.9015 -
accuracy: 0.3815
Epoch 52/200
391/391 [=====] - 3s 7ms/step - loss: 1.9004 -
accuracy: 0.3834
Epoch 53/200
391/391 [=====] - 3s 7ms/step - loss: 1.8968 -
accuracy: 0.3842
Epoch 54/200
391/391 [=====] - 3s 7ms/step - loss: 1.9018 -
accuracy: 0.3815
Epoch 55/200
391/391 [=====] - 3s 7ms/step - loss: 1.8957 -
accuracy: 0.3862
Epoch 56/200
391/391 [=====] - 3s 7ms/step - loss: 1.8976 -
accuracy: 0.3835
Epoch 57/200
391/391 [=====] - 3s 7ms/step - loss: 1.9026 -
accuracy: 0.3800
Epoch 58/200
391/391 [=====] - 3s 7ms/step - loss: 1.8993 -
accuracy: 0.3819
Epoch 59/200
391/391 [=====] - 3s 7ms/step - loss: 1.8976 -
accuracy: 0.3838
Epoch 60/200
391/391 [=====] - 3s 7ms/step - loss: 1.8993 -
accuracy: 0.3837
Epoch 61/200
391/391 [=====] - 3s 7ms/step - loss: 1.9015 -
accuracy: 0.3821
Epoch 62/200
391/391 [=====] - 3s 7ms/step - loss: 1.8967 -
accuracy: 0.3834
Epoch 63/200
391/391 [=====] - 3s 7ms/step - loss: 1.9090 -
accuracy: 0.3797
```

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Epoch 64/200
391/391 [=====] - 3s 7ms/step - loss: 1.8998 -
accuracy: 0.3836
Epoch 65/200
391/391 [=====] - 3s 7ms/step - loss: 1.8954 -
accuracy: 0.3856
Epoch 66/200
391/391 [=====] - 3s 8ms/step - loss: 1.8998 -
accuracy: 0.3808
Epoch 67/200
391/391 [=====] - 3s 8ms/step - loss: 1.9014 -
accuracy: 0.3821
Epoch 68/200
391/391 [=====] - 3s 8ms/step - loss: 1.8984 -
accuracy: 0.3835
Epoch 69/200
391/391 [=====] - 3s 7ms/step - loss: 1.8983 -
accuracy: 0.3819
Epoch 70/200
391/391 [=====] - 3s 7ms/step - loss: 1.9044 -
accuracy: 0.3815
Epoch 71/200
391/391 [=====] - 3s 7ms/step - loss: 1.8996 -
accuracy: 0.3806
Epoch 72/200
391/391 [=====] - 3s 7ms/step - loss: 1.9028 -
accuracy: 0.3823
Epoch 73/200
391/391 [=====] - 3s 7ms/step - loss: 1.8985 -
accuracy: 0.3847
Epoch 74/200
391/391 [=====] - 3s 7ms/step - loss: 1.8997 -
accuracy: 0.3826
Epoch 75/200
391/391 [=====] - 3s 7ms/step - loss: 1.9025 -
accuracy: 0.3820
Epoch 76/200
391/391 [=====] - 3s 7ms/step - loss: 1.8996 -
accuracy: 0.3821
Epoch 77/200
391/391 [=====] - 3s 7ms/step - loss: 1.9024 -
accuracy: 0.3822
Epoch 78/200
391/391 [=====] - 3s 7ms/step - loss: 1.8969 -
accuracy: 0.3856
Epoch 79/200
391/391 [=====] - 3s 7ms/step - loss: 1.9020 -
accuracy: 0.3827
Epoch 80/200
391/391 [=====] - 3s 7ms/step - loss: 1.9032 -
accuracy: 0.3822
Epoch 81/200
391/391 [=====] - 3s 7ms/step - loss: 1.8958 -
accuracy: 0.3859
Epoch 82/200
391/391 [=====] - 3s 7ms/step - loss: 1.9019 -
accuracy: 0.3826
```

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Epoch 83/200
391/391 [=====] - 3s 7ms/step - loss: 1.9014 -
accuracy: 0.3849
Epoch 84/200
391/391 [=====] - 3s 7ms/step - loss: 1.8984 -
accuracy: 0.3828
Epoch 85/200
391/391 [=====] - 3s 7ms/step - loss: 1.8977 -
accuracy: 0.3850
Epoch 86/200
391/391 [=====] - 3s 7ms/step - loss: 1.8952 -
accuracy: 0.3858
Epoch 87/200
391/391 [=====] - 3s 7ms/step - loss: 1.8990 -
accuracy: 0.3838
Epoch 88/200
391/391 [=====] - 3s 7ms/step - loss: 1.9005 -
accuracy: 0.3826
Epoch 89/200
391/391 [=====] - 3s 8ms/step - loss: 1.9069 -
accuracy: 0.3809
Epoch 90/200
391/391 [=====] - 3s 7ms/step - loss: 1.8937 -
accuracy: 0.3866
Epoch 91/200
391/391 [=====] - 3s 7ms/step - loss: 1.8966 -
accuracy: 0.3858
Epoch 92/200
391/391 [=====] - 3s 7ms/step - loss: 1.8998 -
accuracy: 0.3826
Epoch 93/200
391/391 [=====] - 3s 7ms/step - loss: 1.8960 -
accuracy: 0.3854
Epoch 94/200
391/391 [=====] - 3s 7ms/step - loss: 1.8997 -
accuracy: 0.3844
Epoch 95/200
391/391 [=====] - 3s 7ms/step - loss: 1.9000 -
accuracy: 0.3847
Epoch 96/200
391/391 [=====] - 3s 7ms/step - loss: 1.9035 -
accuracy: 0.3810
Epoch 97/200
391/391 [=====] - 3s 7ms/step - loss: 1.8942 -
accuracy: 0.3835
Epoch 98/200
391/391 [=====] - 3s 7ms/step - loss: 1.8982 -
accuracy: 0.3872
Epoch 99/200
391/391 [=====] - 3s 7ms/step - loss: 1.8975 -
accuracy: 0.3837
Epoch 100/200
391/391 [=====] - 3s 7ms/step - loss: 1.8985 -
accuracy: 0.3865
Epoch 101/200
391/391 [=====] - 3s 7ms/step - loss: 1.9014 -
accuracy: 0.3853
```

```
Epoch 102/200
391/391 [=====] - 3s 7ms/step - loss: 1.8950 -
accuracy: 0.3852
Epoch 103/200
391/391 [=====] - 3s 7ms/step - loss: 1.8971 -
accuracy: 0.3862
Epoch 104/200
391/391 [=====] - 3s 7ms/step - loss: 1.9012 -
accuracy: 0.3842
Epoch 105/200
391/391 [=====] - 3s 7ms/step - loss: 1.9015 -
accuracy: 0.3829
Epoch 106/200
391/391 [=====] - 3s 7ms/step - loss: 1.9020 -
accuracy: 0.3842
Epoch 107/200
391/391 [=====] - 3s 7ms/step - loss: 1.9016 -
accuracy: 0.3833
Epoch 108/200
391/391 [=====] - 3s 7ms/step - loss: 1.8945 -
accuracy: 0.3863
Epoch 109/200
391/391 [=====] - 3s 7ms/step - loss: 1.8996 -
accuracy: 0.3838
Epoch 110/200
391/391 [=====] - 3s 7ms/step - loss: 1.8983 -
accuracy: 0.3828
Epoch 111/200
391/391 [=====] - 3s 7ms/step - loss: 1.9009 -
accuracy: 0.3822
Epoch 112/200
391/391 [=====] - 3s 7ms/step - loss: 1.8928 -
accuracy: 0.3889
Epoch 113/200
391/391 [=====] - 3s 7ms/step - loss: 1.9013 -
accuracy: 0.3842
Epoch 114/200
391/391 [=====] - 3s 7ms/step - loss: 1.9011 -
accuracy: 0.3826
Epoch 115/200
391/391 [=====] - 3s 7ms/step - loss: 1.8979 -
accuracy: 0.3843
Epoch 116/200
391/391 [=====] - 3s 7ms/step - loss: 1.9008 -
accuracy: 0.3845
Epoch 117/200
391/391 [=====] - 3s 7ms/step - loss: 1.8972 -
accuracy: 0.3837
Epoch 118/200
391/391 [=====] - 3s 7ms/step - loss: 1.8990 -
accuracy: 0.3854
Epoch 119/200
391/391 [=====] - 3s 7ms/step - loss: 1.8946 -
accuracy: 0.3866
Epoch 120/200
391/391 [=====] - 3s 7ms/step - loss: 1.8951 -
accuracy: 0.3880
```

```
Epoch 121/200
391/391 [=====] - 3s 7ms/step - loss: 1.9070 -
accuracy: 0.3831
Epoch 122/200
391/391 [=====] - 3s 7ms/step - loss: 1.8986 -
accuracy: 0.3856
Epoch 123/200
391/391 [=====] - 3s 7ms/step - loss: 1.8988 -
accuracy: 0.3838
Epoch 124/200
391/391 [=====] - 3s 7ms/step - loss: 1.9002 -
accuracy: 0.3852
Epoch 125/200
391/391 [=====] - 3s 7ms/step - loss: 1.9000 -
accuracy: 0.3832
Epoch 126/200
391/391 [=====] - 3s 7ms/step - loss: 1.8989 -
accuracy: 0.3837
Epoch 127/200
391/391 [=====] - 3s 7ms/step - loss: 1.8923 -
accuracy: 0.3867
Epoch 128/200
391/391 [=====] - 3s 7ms/step - loss: 1.8973 -
accuracy: 0.3855
Epoch 129/200
391/391 [=====] - 3s 7ms/step - loss: 1.9009 -
accuracy: 0.3835
Epoch 130/200
391/391 [=====] - 3s 7ms/step - loss: 1.8934 -
accuracy: 0.3861
Epoch 131/200
391/391 [=====] - 3s 7ms/step - loss: 1.9038 -
accuracy: 0.3826
Epoch 132/200
391/391 [=====] - 3s 7ms/step - loss: 1.9037 -
accuracy: 0.3832
Epoch 133/200
391/391 [=====] - 3s 7ms/step - loss: 1.9004 -
accuracy: 0.3850
Epoch 134/200
391/391 [=====] - 3s 7ms/step - loss: 1.8964 -
accuracy: 0.3882
Epoch 135/200
391/391 [=====] - 3s 7ms/step - loss: 1.8995 -
accuracy: 0.3841
Epoch 136/200
391/391 [=====] - 3s 7ms/step - loss: 1.8927 -
accuracy: 0.3863
Epoch 137/200
391/391 [=====] - 3s 7ms/step - loss: 1.8976 -
accuracy: 0.3846
Epoch 138/200
391/391 [=====] - 3s 7ms/step - loss: 1.8959 -
accuracy: 0.3866
Epoch 139/200
391/391 [=====] - 3s 7ms/step - loss: 1.9006 -
accuracy: 0.3848
```

```
Epoch 140/200
391/391 [=====] - 3s 7ms/step - loss: 1.8970 -
accuracy: 0.3876
Epoch 141/200
391/391 [=====] - 3s 7ms/step - loss: 1.8984 -
accuracy: 0.3839
Epoch 142/200
391/391 [=====] - 3s 7ms/step - loss: 1.8948 -
accuracy: 0.3873
Epoch 143/200
391/391 [=====] - 3s 7ms/step - loss: 1.8993 -
accuracy: 0.3864
Epoch 144/200
391/391 [=====] - 3s 7ms/step - loss: 1.8941 -
accuracy: 0.3859
Epoch 145/200
391/391 [=====] - 3s 7ms/step - loss: 1.8978 -
accuracy: 0.3859
Epoch 146/200
391/391 [=====] - 3s 7ms/step - loss: 1.9019 -
accuracy: 0.3871
Epoch 147/200
391/391 [=====] - 3s 7ms/step - loss: 1.9000 -
accuracy: 0.3840
Epoch 148/200
391/391 [=====] - 3s 7ms/step - loss: 1.8968 -
accuracy: 0.3854
Epoch 149/200
391/391 [=====] - 3s 7ms/step - loss: 1.9055 -
accuracy: 0.3833
Epoch 150/200
391/391 [=====] - 3s 7ms/step - loss: 1.8963 -
accuracy: 0.3859
Epoch 151/200
391/391 [=====] - 3s 7ms/step - loss: 1.8975 -
accuracy: 0.3871
Epoch 152/200
391/391 [=====] - 3s 7ms/step - loss: 1.8975 -
accuracy: 0.3867
Epoch 153/200
391/391 [=====] - 3s 7ms/step - loss: 1.9048 -
accuracy: 0.3834
Epoch 154/200
391/391 [=====] - 3s 7ms/step - loss: 1.9004 -
accuracy: 0.3833
Epoch 155/200
391/391 [=====] - 3s 7ms/step - loss: 1.9029 -
accuracy: 0.3832
Epoch 156/200
391/391 [=====] - 3s 7ms/step - loss: 1.8979 -
accuracy: 0.3867
Epoch 157/200
391/391 [=====] - 3s 7ms/step - loss: 1.8969 -
accuracy: 0.3867
Epoch 158/200
391/391 [=====] - 3s 7ms/step - loss: 1.9023 -
accuracy: 0.3860
```

```
Epoch 159/200
391/391 [=====] - 3s 7ms/step - loss: 1.8947 -
accuracy: 0.3866
Epoch 160/200
391/391 [=====] - 3s 7ms/step - loss: 1.8998 -
accuracy: 0.3848
Epoch 161/200
391/391 [=====] - 3s 7ms/step - loss: 1.8975 -
accuracy: 0.3858
Epoch 162/200
391/391 [=====] - 3s 7ms/step - loss: 1.9000 -
accuracy: 0.3828
Epoch 163/200
391/391 [=====] - 3s 7ms/step - loss: 1.8969 -
accuracy: 0.3851
Epoch 164/200
391/391 [=====] - 3s 7ms/step - loss: 1.8989 -
accuracy: 0.3853
Epoch 165/200
391/391 [=====] - 3s 7ms/step - loss: 1.8958 -
accuracy: 0.3867
Epoch 166/200
391/391 [=====] - 3s 7ms/step - loss: 1.9000 -
accuracy: 0.3838
Epoch 167/200
391/391 [=====] - 3s 7ms/step - loss: 1.8926 -
accuracy: 0.3898
Epoch 168/200
391/391 [=====] - 3s 7ms/step - loss: 1.8986 -
accuracy: 0.3843
Epoch 169/200
391/391 [=====] - 3s 7ms/step - loss: 1.8995 -
accuracy: 0.3850
Epoch 170/200
391/391 [=====] - 3s 7ms/step - loss: 1.8981 -
accuracy: 0.3871
Epoch 171/200
391/391 [=====] - 3s 7ms/step - loss: 1.9016 -
accuracy: 0.3848
Epoch 172/200
391/391 [=====] - 3s 7ms/step - loss: 1.8980 -
accuracy: 0.3856
Epoch 173/200
391/391 [=====] - 3s 7ms/step - loss: 1.8923 -
accuracy: 0.3894
Epoch 174/200
391/391 [=====] - 3s 7ms/step - loss: 1.8966 -
accuracy: 0.3849
Epoch 175/200
391/391 [=====] - 3s 7ms/step - loss: 1.8992 -
accuracy: 0.3849
Epoch 176/200
391/391 [=====] - 3s 8ms/step - loss: 1.8949 -
accuracy: 0.3893
Epoch 177/200
391/391 [=====] - 3s 8ms/step - loss: 1.8976 -
accuracy: 0.3861
```

```
Epoch 178/200
391/391 [=====] - 3s 8ms/step - loss: 1.8980 -
accuracy: 0.3874
Epoch 179/200
391/391 [=====] - 3s 7ms/step - loss: 1.9038 -
accuracy: 0.3837
Epoch 180/200
391/391 [=====] - 3s 7ms/step - loss: 1.8956 -
accuracy: 0.3872
Epoch 181/200
391/391 [=====] - 3s 7ms/step - loss: 1.8931 -
accuracy: 0.3880
Epoch 182/200
391/391 [=====] - 3s 7ms/step - loss: 1.8976 -
accuracy: 0.3851
Epoch 183/200
391/391 [=====] - 3s 7ms/step - loss: 1.9000 -
accuracy: 0.3850
Epoch 184/200
391/391 [=====] - 3s 7ms/step - loss: 1.8963 -
accuracy: 0.3858
Epoch 185/200
391/391 [=====] - 3s 7ms/step - loss: 1.8943 -
accuracy: 0.3895
Epoch 186/200
391/391 [=====] - 3s 7ms/step - loss: 1.8952 -
accuracy: 0.3871
Epoch 187/200
391/391 [=====] - 3s 7ms/step - loss: 1.8988 -
accuracy: 0.3868
Epoch 188/200
391/391 [=====] - ETA: 0s - loss: 1.8998 - acc
uracy: 0.38 - 3s 7ms/step - loss: 1.8998 - accuracy: 0.3866
Epoch 189/200
391/391 [=====] - 3s 7ms/step - loss: 1.8935 -
accuracy: 0.3891
Epoch 190/200
391/391 [=====] - 3s 7ms/step - loss: 1.9009 -
accuracy: 0.3834
Epoch 191/200
391/391 [=====] - 3s 7ms/step - loss: 1.8968 -
accuracy: 0.3868
Epoch 192/200
391/391 [=====] - 3s 7ms/step - loss: 1.8980 -
accuracy: 0.3851
Epoch 193/200
391/391 [=====] - 3s 7ms/step - loss: 1.8929 -
accuracy: 0.3867
Epoch 194/200
391/391 [=====] - 3s 7ms/step - loss: 1.8972 -
accuracy: 0.3872
Epoch 195/200
391/391 [=====] - 3s 7ms/step - loss: 1.8978 -
accuracy: 0.3853
Epoch 196/200
391/391 [=====] - 3s 7ms/step - loss: 1.8982 -
accuracy: 0.3858
```



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Epoch 197/200
391/391 [=====] - 3s 7ms/step - loss: 1.8978 -
accuracy: 0.3827
Epoch 198/200
391/391 [=====] - 3s 8ms/step - loss: 1.8936 -
accuracy: 0.3878
Epoch 199/200
391/391 [=====] - 3s 7ms/step - loss: 1.8933 -
accuracy: 0.3906
Epoch 200/200
391/391 [=====] - 3s 7ms/step - loss: 1.8990 -
accuracy: 0.3849
313/313 [=====] - 1s 4ms/step - loss: 1.9108 -
accuracy: 0.3809
Epoch 1/200
391/391 [=====] - 5s 12ms/step - loss: 4.8922
- accuracy: 0.2646
Epoch 2/200
391/391 [=====] - 5s 12ms/step - loss: 2.0926
- accuracy: 0.3205
Epoch 3/200
391/391 [=====] - 5s 12ms/step - loss: 2.0104
- accuracy: 0.3364
Epoch 4/200
391/391 [=====] - 5s 12ms/step - loss: 1.9831
- accuracy: 0.3483
Epoch 5/200
391/391 [=====] - 5s 12ms/step - loss: 1.9683
- accuracy: 0.3484
Epoch 6/200
391/391 [=====] - 5s 12ms/step - loss: 1.9551
- accuracy: 0.3553
Epoch 7/200
391/391 [=====] - 5s 12ms/step - loss: 1.9518
- accuracy: 0.3579
Epoch 8/200
391/391 [=====] - 5s 12ms/step - loss: 1.9422
- accuracy: 0.3623
Epoch 9/200
391/391 [=====] - 5s 12ms/step - loss: 1.9380
- accuracy: 0.3637
Epoch 10/200
391/391 [=====] - 5s 12ms/step - loss: 1.9310
- accuracy: 0.3667
Epoch 11/200
391/391 [=====] - 5s 12ms/step - loss: 1.9326
- accuracy: 0.3680
Epoch 12/200
391/391 [=====] - 5s 12ms/step - loss: 1.9278
- accuracy: 0.3703
Epoch 13/200
391/391 [=====] - 5s 12ms/step - loss: 1.9241
- accuracy: 0.3730
Epoch 14/200
391/391 [=====] - 5s 12ms/step - loss: 1.9197
- accuracy: 0.3722
Epoch 15/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 1.9154
- accuracy: 0.3733
Epoch 16/200
391/391 [=====] - 5s 12ms/step - loss: 1.9096
- accuracy: 0.3752
Epoch 17/200
391/391 [=====] - 5s 12ms/step - loss: 1.9076
- accuracy: 0.3756
Epoch 18/200
391/391 [=====] - 5s 12ms/step - loss: 1.9069
- accuracy: 0.3753
Epoch 19/200
391/391 [=====] - 5s 12ms/step - loss: 1.9058
- accuracy: 0.3788
Epoch 20/200
391/391 [=====] - 5s 12ms/step - loss: 1.9019
- accuracy: 0.3788
Epoch 21/200
391/391 [=====] - 5s 12ms/step - loss: 1.9002
- accuracy: 0.3789
Epoch 22/200
391/391 [=====] - 5s 12ms/step - loss: 1.8989
- accuracy: 0.3811
Epoch 23/200
391/391 [=====] - 5s 12ms/step - loss: 1.8989
- accuracy: 0.3790
Epoch 24/200
391/391 [=====] - 5s 12ms/step - loss: 1.9000
- accuracy: 0.3821
Epoch 25/200
391/391 [=====] - 5s 12ms/step - loss: 1.8965
- accuracy: 0.3833
Epoch 26/200
391/391 [=====] - 5s 12ms/step - loss: 1.8933
- accuracy: 0.3841
Epoch 27/200
391/391 [=====] - 5s 12ms/step - loss: 1.8950
- accuracy: 0.3825
Epoch 28/200
391/391 [=====] - 5s 12ms/step - loss: 1.8934
- accuracy: 0.3839
Epoch 29/200
391/391 [=====] - 5s 12ms/step - loss: 1.8927
- accuracy: 0.3844
Epoch 30/200
391/391 [=====] - 5s 12ms/step - loss: 1.8927
- accuracy: 0.3827
Epoch 31/200
391/391 [=====] - 5s 12ms/step - loss: 1.8928
- accuracy: 0.3829
Epoch 32/200
391/391 [=====] - 5s 12ms/step - loss: 1.8925
- accuracy: 0.3858
Epoch 33/200
391/391 [=====] - 5s 12ms/step - loss: 1.8905
- accuracy: 0.3853
Epoch 34/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 1.8923
- accuracy: 0.3848
Epoch 35/200
391/391 [=====] - 5s 12ms/step - loss: 1.8909
- accuracy: 0.3855
Epoch 36/200
391/391 [=====] - 5s 12ms/step - loss: 1.8909
- accuracy: 0.3875
Epoch 37/200
391/391 [=====] - 5s 12ms/step - loss: 1.8905
- accuracy: 0.3859
Epoch 38/200
391/391 [=====] - 5s 12ms/step - loss: 1.8898
- accuracy: 0.3867
Epoch 39/200
391/391 [=====] - 5s 12ms/step - loss: 1.8902
- accuracy: 0.3853
Epoch 40/200
391/391 [=====] - 5s 12ms/step - loss: 1.8891
- accuracy: 0.3878
Epoch 41/200
391/391 [=====] - 5s 12ms/step - loss: 1.8893
- accuracy: 0.3848
Epoch 42/200
391/391 [=====] - 5s 12ms/step - loss: 1.8900
- accuracy: 0.3843
Epoch 43/200
391/391 [=====] - 5s 12ms/step - loss: 1.8873
- accuracy: 0.3859
Epoch 44/200
391/391 [=====] - 5s 12ms/step - loss: 1.8881
- accuracy: 0.3895
Epoch 45/200
391/391 [=====] - 5s 12ms/step - loss: 1.8902
- accuracy: 0.3842
Epoch 46/200
391/391 [=====] - 5s 12ms/step - loss: 1.8881
- accuracy: 0.3863
Epoch 47/200
391/391 [=====] - 5s 12ms/step - loss: 1.8860
- accuracy: 0.3872
Epoch 48/200
391/391 [=====] - 5s 12ms/step - loss: 1.8879
- accuracy: 0.3874
Epoch 49/200
391/391 [=====] - 5s 12ms/step - loss: 1.8880
- accuracy: 0.3856
Epoch 50/200
391/391 [=====] - 5s 12ms/step - loss: 1.8883
- accuracy: 0.3871
Epoch 51/200
391/391 [=====] - 5s 12ms/step - loss: 1.8852
- accuracy: 0.3873
Epoch 52/200
391/391 [=====] - 5s 12ms/step - loss: 1.8861
- accuracy: 0.3879
Epoch 53/200
```

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391/391 [=====] - 5s 12ms/step - loss: 1.8877
- accuracy: 0.3861
Epoch 54/200
391/391 [=====] - 5s 12ms/step - loss: 1.8867
- accuracy: 0.3865
Epoch 55/200
391/391 [=====] - 5s 12ms/step - loss: 1.8866
- accuracy: 0.3871
Epoch 56/200
391/391 [=====] - 5s 12ms/step - loss: 1.8855
- accuracy: 0.3862
Epoch 57/200
391/391 [=====] - 5s 12ms/step - loss: 1.8868
- accuracy: 0.3881
Epoch 58/200
391/391 [=====] - 5s 12ms/step - loss: 1.8867
- accuracy: 0.3868
Epoch 59/200
391/391 [=====] - 5s 12ms/step - loss: 1.8872
- accuracy: 0.3882
Epoch 60/200
391/391 [=====] - 5s 12ms/step - loss: 1.8852
- accuracy: 0.3885
Epoch 61/200
391/391 [=====] - 5s 12ms/step - loss: 1.8859
- accuracy: 0.3869
Epoch 62/200
391/391 [=====] - 5s 12ms/step - loss: 1.8861
- accuracy: 0.3863
Epoch 63/200
391/391 [=====] - 5s 12ms/step - loss: 1.8882
- accuracy: 0.3872
Epoch 64/200
391/391 [=====] - 5s 12ms/step - loss: 1.8864
- accuracy: 0.3894
Epoch 65/200
391/391 [=====] - 5s 12ms/step - loss: 1.8840
- accuracy: 0.3889
Epoch 66/200
391/391 [=====] - 5s 12ms/step - loss: 1.8860
- accuracy: 0.3878
Epoch 67/200
391/391 [=====] - 5s 12ms/step - loss: 1.8848
- accuracy: 0.3889
Epoch 68/200
391/391 [=====] - 5s 12ms/step - loss: 1.8850
- accuracy: 0.3873
Epoch 69/200
391/391 [=====] - 4s 12ms/step - loss: 1.8854
- accuracy: 0.3891
Epoch 70/200
391/391 [=====] - 5s 12ms/step - loss: 1.8864
- accuracy: 0.3880
Epoch 71/200
391/391 [=====] - 5s 12ms/step - loss: 1.8855
- accuracy: 0.3875
Epoch 72/200
```

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391/391 [=====] - 5s 12ms/step - loss: 1.8849
- accuracy: 0.3899
Epoch 73/200
391/391 [=====] - 5s 12ms/step - loss: 1.8863
- accuracy: 0.3876
Epoch 74/200
391/391 [=====] - 5s 12ms/step - loss: 1.8859
- accuracy: 0.3890
Epoch 75/200
391/391 [=====] - 5s 12ms/step - loss: 1.8854
- accuracy: 0.3889
Epoch 76/200
391/391 [=====] - 5s 12ms/step - loss: 1.8855
- accuracy: 0.3871
Epoch 77/200
391/391 [=====] - 5s 12ms/step - loss: 1.8841
- accuracy: 0.3881
Epoch 78/200
391/391 [=====] - 5s 12ms/step - loss: 1.8849
- accuracy: 0.3905
Epoch 79/200
391/391 [=====] - 5s 12ms/step - loss: 1.8854
- accuracy: 0.3875
Epoch 80/200
391/391 [=====] - 5s 12ms/step - loss: 1.8860
- accuracy: 0.3878
Epoch 81/200
391/391 [=====] - 5s 12ms/step - loss: 1.8864
- accuracy: 0.3881
Epoch 82/200
391/391 [=====] - 5s 12ms/step - loss: 1.8846
- accuracy: 0.3887
Epoch 83/200
391/391 [=====] - 5s 12ms/step - loss: 1.8853
- accuracy: 0.3906
Epoch 84/200
391/391 [=====] - 5s 12ms/step - loss: 1.8852
- accuracy: 0.3857
Epoch 85/200
391/391 [=====] - 5s 12ms/step - loss: 1.8841
- accuracy: 0.3894
Epoch 86/200
391/391 [=====] - 5s 12ms/step - loss: 1.8844
- accuracy: 0.3888
Epoch 87/200
391/391 [=====] - 5s 12ms/step - loss: 1.8844
- accuracy: 0.3898
Epoch 88/200
391/391 [=====] - 5s 12ms/step - loss: 1.8839
- accuracy: 0.3878
Epoch 89/200
391/391 [=====] - 5s 12ms/step - loss: 1.8848
- accuracy: 0.3890
Epoch 90/200
391/391 [=====] - 5s 12ms/step - loss: 1.8841
- accuracy: 0.3880
Epoch 91/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 1.8849
- accuracy: 0.3904
Epoch 92/200
391/391 [=====] - 5s 12ms/step - loss: 1.8854
- accuracy: 0.3882
Epoch 93/200
391/391 [=====] - 5s 12ms/step - loss: 1.8845
- accuracy: 0.3891
Epoch 94/200
391/391 [=====] - 5s 12ms/step - loss: 1.8869
- accuracy: 0.3875
Epoch 95/200
391/391 [=====] - 5s 12ms/step - loss: 1.8849
- accuracy: 0.3893
Epoch 96/200
391/391 [=====] - 5s 12ms/step - loss: 1.8843
- accuracy: 0.3878
Epoch 97/200
391/391 [=====] - 5s 12ms/step - loss: 1.8840
- accuracy: 0.3912
Epoch 98/200
391/391 [=====] - 5s 12ms/step - loss: 1.8826
- accuracy: 0.3892
Epoch 99/200
391/391 [=====] - 5s 12ms/step - loss: 1.8850
- accuracy: 0.3892
Epoch 100/200
391/391 [=====] - 5s 12ms/step - loss: 1.8837
- accuracy: 0.3902
Epoch 101/200
391/391 [=====] - 5s 12ms/step - loss: 1.8839
- accuracy: 0.3892
Epoch 102/200
391/391 [=====] - 5s 12ms/step - loss: 1.8834
- accuracy: 0.3883
Epoch 103/200
391/391 [=====] - 5s 12ms/step - loss: 1.8839
- accuracy: 0.3905
Epoch 104/200
391/391 [=====] - 5s 12ms/step - loss: 1.8838
- accuracy: 0.3901
Epoch 105/200
391/391 [=====] - 5s 13ms/step - loss: 1.8834
- accuracy: 0.3884
Epoch 106/200
391/391 [=====] - 5s 14ms/step - loss: 1.8843
- accuracy: 0.3896
Epoch 107/200
391/391 [=====] - 5s 12ms/step - loss: 1.8847
- accuracy: 0.3916
Epoch 108/200
391/391 [=====] - 5s 12ms/step - loss: 1.8839
- accuracy: 0.3891
Epoch 109/200
391/391 [=====] - 5s 12ms/step - loss: 1.8848
- accuracy: 0.3879
Epoch 110/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 1.8827
- accuracy: 0.3891
Epoch 111/200
391/391 [=====] - 5s 12ms/step - loss: 1.8833
- accuracy: 0.3886
Epoch 112/200
391/391 [=====] - 5s 12ms/step - loss: 1.8842
- accuracy: 0.3894
Epoch 113/200
391/391 [=====] - 5s 12ms/step - loss: 1.8833
- accuracy: 0.3869
Epoch 114/200
391/391 [=====] - 5s 12ms/step - loss: 1.8822
- accuracy: 0.3891
Epoch 115/200
391/391 [=====] - 5s 12ms/step - loss: 1.8839
- accuracy: 0.3896
Epoch 116/200
391/391 [=====] - 5s 12ms/step - loss: 1.8823
- accuracy: 0.3902
Epoch 117/200
391/391 [=====] - 5s 12ms/step - loss: 1.8851
- accuracy: 0.3895
Epoch 118/200
391/391 [=====] - 5s 12ms/step - loss: 1.8840
- accuracy: 0.3894
Epoch 119/200
391/391 [=====] - 5s 12ms/step - loss: 1.8840
- accuracy: 0.3877
Epoch 120/200
391/391 [=====] - 5s 12ms/step - loss: 1.8836
- accuracy: 0.3894
Epoch 121/200
391/391 [=====] - 5s 12ms/step - loss: 1.8839
- accuracy: 0.3900
Epoch 122/200
391/391 [=====] - 5s 12ms/step - loss: 1.8832
- accuracy: 0.3879
Epoch 123/200
391/391 [=====] - 5s 12ms/step - loss: 1.8834
- accuracy: 0.3886
Epoch 124/200
391/391 [=====] - 5s 12ms/step - loss: 1.8853
- accuracy: 0.3892
Epoch 125/200
391/391 [=====] - 5s 12ms/step - loss: 1.8832
- accuracy: 0.3885
Epoch 126/200
391/391 [=====] - 5s 12ms/step - loss: 1.8844
- accuracy: 0.3899
Epoch 127/200
391/391 [=====] - 5s 12ms/step - loss: 1.8833
- accuracy: 0.3901
Epoch 128/200
391/391 [=====] - 5s 12ms/step - loss: 1.8813
- accuracy: 0.3910
Epoch 129/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 1.8824
- accuracy: 0.3894
Epoch 130/200
391/391 [=====] - 5s 12ms/step - loss: 1.8830
- accuracy: 0.3903
Epoch 131/200
391/391 [=====] - 5s 12ms/step - loss: 1.8832
- accuracy: 0.3887
Epoch 132/200
391/391 [=====] - 5s 12ms/step - loss: 1.8835
- accuracy: 0.3890
Epoch 133/200
391/391 [=====] - 5s 12ms/step - loss: 1.8833
- accuracy: 0.3916
Epoch 134/200
391/391 [=====] - 5s 12ms/step - loss: 1.8826
- accuracy: 0.3889
Epoch 135/200
391/391 [=====] - 5s 12ms/step - loss: 1.8819
- accuracy: 0.3902
Epoch 136/200
391/391 [=====] - 5s 12ms/step - loss: 1.8819
- accuracy: 0.3902
Epoch 137/200
391/391 [=====] - 5s 12ms/step - loss: 1.8819
- accuracy: 0.3893
Epoch 138/200
391/391 [=====] - 5s 12ms/step - loss: 1.8821
- accuracy: 0.3926
Epoch 139/200
391/391 [=====] - 5s 12ms/step - loss: 1.8831
- accuracy: 0.3902
Epoch 140/200
391/391 [=====] - 5s 12ms/step - loss: 1.8836
- accuracy: 0.3887
Epoch 141/200
391/391 [=====] - 5s 12ms/step - loss: 1.8838
- accuracy: 0.3882
Epoch 142/200
391/391 [=====] - 5s 12ms/step - loss: 1.8826
- accuracy: 0.3898
Epoch 143/200
391/391 [=====] - 5s 12ms/step - loss: 1.8827
- accuracy: 0.3899
Epoch 144/200
391/391 [=====] - 5s 12ms/step - loss: 1.8812
- accuracy: 0.3923
Epoch 145/200
391/391 [=====] - 5s 12ms/step - loss: 1.8821
- accuracy: 0.3907
Epoch 146/200
391/391 [=====] - 5s 12ms/step - loss: 1.8827
- accuracy: 0.3902
Epoch 147/200
391/391 [=====] - 5s 12ms/step - loss: 1.8830
- accuracy: 0.3897
Epoch 148/200
```



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391/391 [=====] - 5s 12ms/step - loss: 1.8832
- accuracy: 0.3917
Epoch 149/200
391/391 [=====] - 5s 12ms/step - loss: 1.8844
- accuracy: 0.3883
Epoch 150/200
391/391 [=====] - 5s 12ms/step - loss: 1.8811
- accuracy: 0.3901
Epoch 151/200
391/391 [=====] - 5s 12ms/step - loss: 1.8829
- accuracy: 0.3898
Epoch 152/200
391/391 [=====] - 5s 12ms/step - loss: 1.8825
- accuracy: 0.3903
Epoch 153/200
391/391 [=====] - 5s 12ms/step - loss: 1.8812
- accuracy: 0.3916
Epoch 154/200
391/391 [=====] - 5s 12ms/step - loss: 1.8840
- accuracy: 0.3895
Epoch 155/200
391/391 [=====] - 5s 12ms/step - loss: 1.8824
- accuracy: 0.3898
Epoch 156/200
391/391 [=====] - 5s 12ms/step - loss: 1.8822
- accuracy: 0.3906
Epoch 157/200
391/391 [=====] - 5s 12ms/step - loss: 1.8808
- accuracy: 0.3901
Epoch 158/200
391/391 [=====] - 5s 12ms/step - loss: 1.8851
- accuracy: 0.3890
Epoch 159/200
391/391 [=====] - 5s 12ms/step - loss: 1.8830
- accuracy: 0.3914
Epoch 160/200
391/391 [=====] - 5s 12ms/step - loss: 1.8824
- accuracy: 0.3905
Epoch 161/200
391/391 [=====] - 5s 12ms/step - loss: 1.8832
- accuracy: 0.3911
Epoch 162/200
391/391 [=====] - 5s 12ms/step - loss: 1.8842
- accuracy: 0.3883
Epoch 163/200
391/391 [=====] - 5s 12ms/step - loss: 1.8832
- accuracy: 0.3885
Epoch 164/200
391/391 [=====] - 5s 12ms/step - loss: 1.8811
- accuracy: 0.3886
Epoch 165/200
391/391 [=====] - 5s 12ms/step - loss: 1.8830
- accuracy: 0.3906
Epoch 166/200
391/391 [=====] - 5s 12ms/step - loss: 1.8827
- accuracy: 0.3896
Epoch 167/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 1.8820
- accuracy: 0.3911
Epoch 168/200
391/391 [=====] - 5s 12ms/step - loss: 1.8820
- accuracy: 0.3880
Epoch 169/200
391/391 [=====] - 5s 14ms/step - loss: 1.8830
- accuracy: 0.3917
Epoch 170/200
391/391 [=====] - 5s 14ms/step - loss: 1.8832
- accuracy: 0.3889
Epoch 171/200
391/391 [=====] - 5s 12ms/step - loss: 1.8833
- accuracy: 0.3893
Epoch 172/200
391/391 [=====] - 5s 12ms/step - loss: 1.8825
- accuracy: 0.3891
Epoch 173/200
391/391 [=====] - 5s 12ms/step - loss: 1.8807
- accuracy: 0.3912
Epoch 174/200
391/391 [=====] - 5s 12ms/step - loss: 1.8825
- accuracy: 0.3894
Epoch 175/200
391/391 [=====] - 5s 12ms/step - loss: 1.8815
- accuracy: 0.3919
Epoch 176/200
391/391 [=====] - 5s 12ms/step - loss: 1.8822
- accuracy: 0.3925
Epoch 177/200
391/391 [=====] - 5s 13ms/step - loss: 1.8836
- accuracy: 0.3898
Epoch 178/200
391/391 [=====] - 5s 12ms/step - loss: 1.8817
- accuracy: 0.3912
Epoch 179/200
391/391 [=====] - 5s 12ms/step - loss: 1.8815
- accuracy: 0.3911
Epoch 180/200
391/391 [=====] - 5s 12ms/step - loss: 1.8827
- accuracy: 0.3911
Epoch 181/200
391/391 [=====] - 5s 12ms/step - loss: 1.8805
- accuracy: 0.3908
Epoch 182/200
391/391 [=====] - 5s 12ms/step - loss: 1.8837
- accuracy: 0.3899
Epoch 183/200
391/391 [=====] - 5s 12ms/step - loss: 1.8836
- accuracy: 0.3918
Epoch 184/200
391/391 [=====] - 5s 12ms/step - loss: 1.8828
- accuracy: 0.3886
Epoch 185/200
391/391 [=====] - 5s 13ms/step - loss: 1.8828
- accuracy: 0.3911
Epoch 186/200
```

```

391/391 [=====] - 5s 13ms/step - loss: 1.8816
- accuracy: 0.3935
Epoch 187/200
391/391 [=====] - 5s 12ms/step - loss: 1.8830
- accuracy: 0.3901
Epoch 188/200
391/391 [=====] - 5s 12ms/step - loss: 1.8819
- accuracy: 0.3901
Epoch 189/200
391/391 [=====] - 5s 12ms/step - loss: 1.8816
- accuracy: 0.3909
Epoch 190/200
391/391 [=====] - 5s 12ms/step - loss: 1.8824
- accuracy: 0.3899
Epoch 191/200
391/391 [=====] - 5s 12ms/step - loss: 1.8824
- accuracy: 0.3909
Epoch 192/200
391/391 [=====] - 5s 12ms/step - loss: 1.8828
- accuracy: 0.3904
Epoch 193/200
391/391 [=====] - 5s 12ms/step - loss: 1.8819
- accuracy: 0.3897
Epoch 194/200
391/391 [=====] - 5s 12ms/step - loss: 1.8820
- accuracy: 0.3910
Epoch 195/200
391/391 [=====] - 5s 12ms/step - loss: 1.8819
- accuracy: 0.3915
Epoch 196/200
391/391 [=====] - 5s 12ms/step - loss: 1.8826
- accuracy: 0.3922
Epoch 197/200
391/391 [=====] - 5s 12ms/step - loss: 1.8825
- accuracy: 0.3915
Epoch 198/200
391/391 [=====] - 5s 12ms/step - loss: 1.8820
- accuracy: 0.3911
Epoch 199/200
391/391 [=====] - 5s 12ms/step - loss: 1.8818
- accuracy: 0.3911
Epoch 200/200
391/391 [=====] - 5s 12ms/step - loss: 1.8815
- accuracy: 0.3924
313/313 [=====] - 1s 4ms/step - loss: 1.9018 -
accuracy: 0.3806

```

```
In [5]: training_time_q2
```

```
Out[5]: [579.5734162330627,
703.8594861030579,
603.6786489486694,
566.6453628540039,
935.6838295459747]
```

```
In [6]: training_loss = []
        training_accuracy = []

        for i in range(5):
            training_loss.append(hist[i].history['loss'])
            training_accuracy.append(hist[i].history['accuracy'])
```

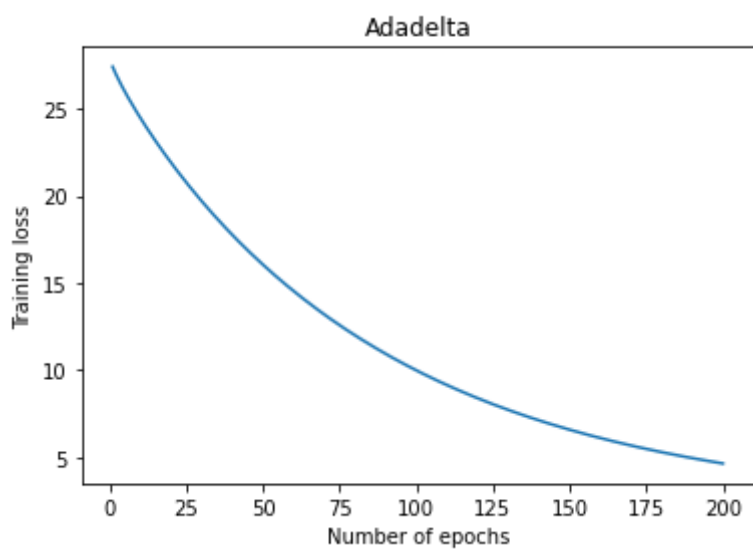
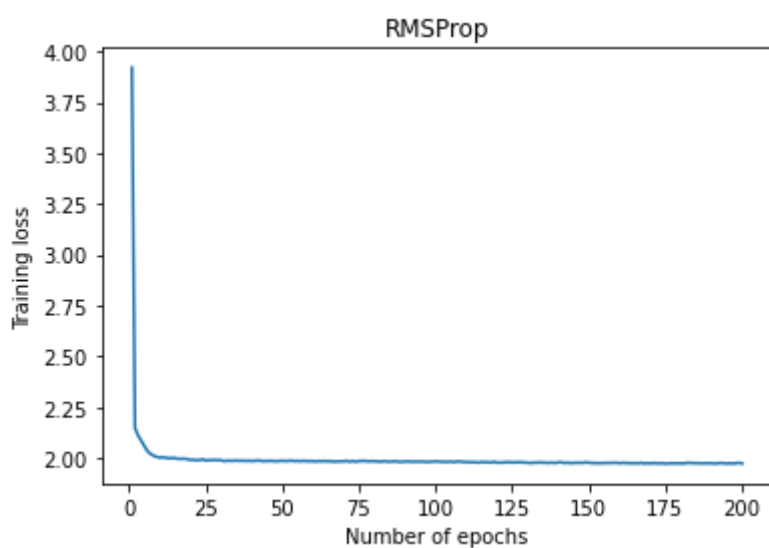
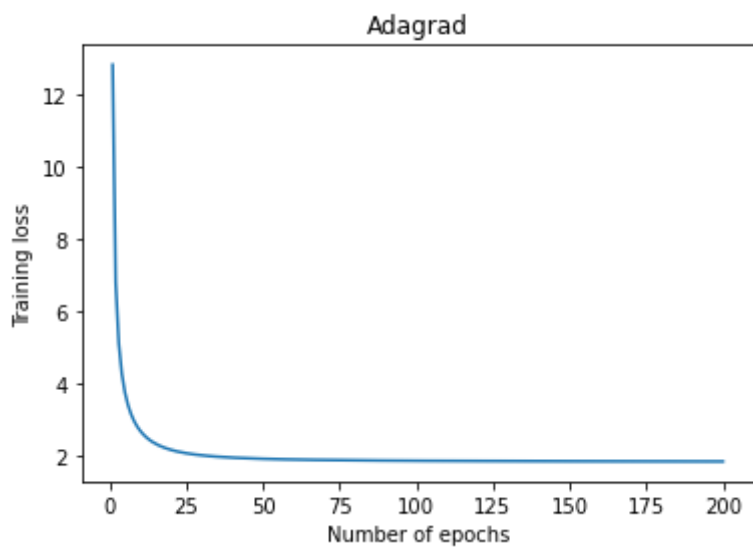
```
In [7]: savetxt('training_loss.csv', training_loss, delimiter=',')
        savetxt('val_q2.csv', val_q2, delimiter=',')
        #data = loadtxt('training_loss.csv', delimiter=',')
```

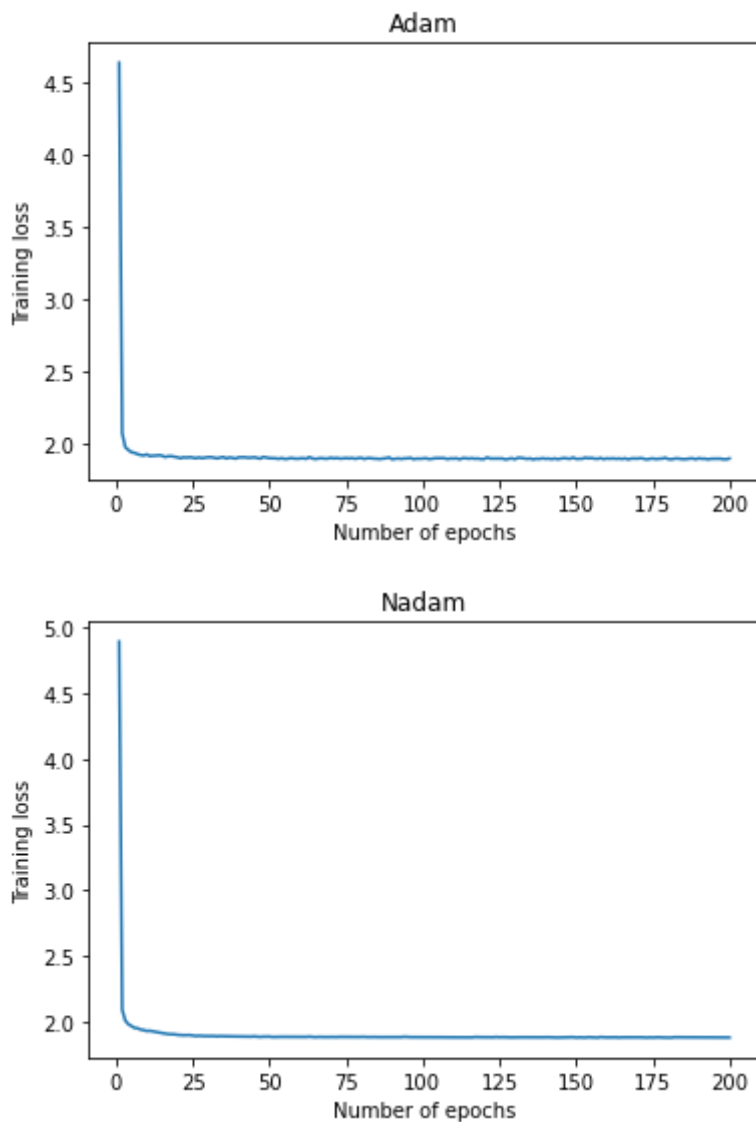
```
In [12]: training_loss = loadtxt('training_loss.csv', delimiter=',')
```

```
In [15]: training_loss[1]
```

```
Out[15]: array([3.92019343, 2.14718223, 2.11101246, 2.08563709, 2.06057215,
 2.03478193, 2.02088022, 2.0112958 , 2.00576448, 2.0015204 ,
 2.0035007 , 2.00031781, 1.9981488 , 1.99942529, 1.99898052,
 1.99563861, 1.99571621, 1.99584568, 1.994488 , 1.99001324,
 1.99094856, 1.98883784, 1.98922646, 1.99290919, 1.98763525,
 1.98886395, 1.98959482, 1.9892112 , 1.98862004, 1.98878145,
 1.98451591, 1.98651803, 1.98583925, 1.98602831, 1.98708129,
 1.98608506, 1.98654234, 1.98524439, 1.98610687, 1.98510468,
 1.98552239, 1.98747277, 1.98624623, 1.98427689, 1.98537779,
 1.98556316, 1.98442948, 1.98399329, 1.98543346, 1.98610353,
 1.9845016 , 1.98544824, 1.98660064, 1.98412895, 1.9858247 ,
 1.98357081, 1.9858638 , 1.98425591, 1.98424768, 1.98416543,
 1.98257411, 1.98465753, 1.98364925, 1.98477435, 1.98319042,
 1.98427498, 1.98096621, 1.983091 , 1.98314691, 1.98326707,
 1.98586214, 1.98102283, 1.98547423, 1.98063052, 1.98463178,
 1.98548126, 1.98525858, 1.98334205, 1.98420846, 1.98360324,
 1.98322046, 1.98120785, 1.98384786, 1.98290074, 1.98131073,
 1.98303485, 1.98373318, 1.9805094 , 1.98064995, 1.9818387 ,
 1.98298204, 1.98113322, 1.98182142, 1.98116469, 1.98159182,
 1.98214746, 1.98002541, 1.98114026, 1.98214173, 1.98276079,
 1.98267376, 1.98075044, 1.98089683, 1.98059094, 1.98231232,
 1.97913814, 1.98231494, 1.98226511, 1.98026717, 1.97959268,
 1.97900534, 1.97854495, 1.97925591, 1.97659349, 1.98007035,
 1.97872925, 1.97890532, 1.97702777, 1.98080325, 1.97703719,
 1.97653604, 1.97700512, 1.97866762, 1.97916973, 1.97762287,
 1.9785887 , 1.97880173, 1.97842395, 1.97689557, 1.97676849,
 1.97462189, 1.97704971, 1.97619092, 1.97771323, 1.97725654,
 1.97615612, 1.97555256, 1.97699797, 1.9748956 , 1.97807062,
 1.97867215, 1.97482312, 1.97699666, 1.97425938, 1.97580433,
 1.97570574, 1.97454035, 1.97598374, 1.97784197, 1.97594416,
 1.97491896, 1.97447515, 1.97416151, 1.97474861, 1.97492075,
 1.97513103, 1.97511184, 1.97563064, 1.97627389, 1.97379589,
 1.97587359, 1.97498846, 1.97392666, 1.97348583, 1.97499013,
 1.97279048, 1.97581506, 1.9725337 , 1.97451115, 1.97258675,
 1.97507966, 1.97287297, 1.97345591, 1.97410285, 1.97178125,
 1.97308624, 1.9737798 , 1.97300363, 1.97377729, 1.97298515,
 1.97285688, 1.9753226 , 1.97561121, 1.97405028, 1.97444093,
 1.9731487 , 1.9737823 , 1.97450113, 1.97399175, 1.97378302,
 1.97207797, 1.97372127, 1.97482872, 1.97314668, 1.97244966,
 1.9735117 , 1.97226262, 1.97362483, 1.97589028, 1.97233188])
```

```
In [32]: training_loss = loadtxt('training_loss.csv', delimiter=',')
title=["Adagrad", "RMSProp", "Adadelata", "Adam", "Nadam"]
for i in range(5) :
    plt.plot(range(1,201),training_loss[i])
    plt.title (title[i])
    plt.xlabel("Number of epochs")
    plt.ylabel("Training loss")
    plt.show()
```





Lowest training loss at 200 epochs : Adagrad

```
In [35]: print("Training loss for each method :", "\n")
for i in range(5):
    print(title[i], training_loss[i][199])
```

Training loss for each method :

```
Adagrad 1.8195613622665405
RMSProp 1.9723318815231323
Adadelta 4.638694763183594
Adam 1.8989620208740234
Nadam 1.8815386295318604
```

Q3)


```
In [3]: def create_model_dropout():
        tf.random.set_seed(17)

        #Model with 2 hidden layers and l2 regularization, relu activation and dropout

        model = Sequential()
        model.add(Dropout(0.2, input_shape=(dim_data,)))
        model.add(Dense(1000, activation='relu', kernel_regularizer=keras.regularizers.l2()))
        model.add(Dropout(0.5))
        model.add(Dense(1000, activation='relu', kernel_regularizer=keras.regularizers.l2()))
        model.add(Dropout(0.5))
        model.add(Dense(10, activation='softmax', kernel_regularizer=keras.regularizers.l2()))
        return model
```

```
In [4]: hist = []
training_time_q3 = []
val_q3 = []
for opt in ['Adagrad', 'RMSProp', 'Adadelta', 'Adam', 'Nadam']:
    model = create_model_dropout()
    model.compile(loss=keras.losses.categorical_crossentropy, optimizer=
opt, metrics=['accuracy'])
    start = time()
    hist.append(model.fit(x=x_train,y=y_train, epochs=200, batch_size=12
8,verbose=1))
    training_time_q3.append(time()-start)
    val_q3.append(model.evaluate(x_test,y_test))
```

```
Epoch 1/200
391/391 [=====] - 3s 8ms/step - loss: 14.7377
- accuracy: 0.2381
Epoch 2/200
391/391 [=====] - 3s 7ms/step - loss: 8.1977 -
accuracy: 0.3045
Epoch 3/200
391/391 [=====] - 3s 8ms/step - loss: 6.0756 -
accuracy: 0.3277
Epoch 4/200
391/391 [=====] - 3s 8ms/step - loss: 4.9703 -
accuracy: 0.3420
Epoch 5/200
391/391 [=====] - 3s 7ms/step - loss: 4.2902 -
accuracy: 0.3523
Epoch 6/200
391/391 [=====] - 3s 7ms/step - loss: 3.8295 -
accuracy: 0.3602
Epoch 7/200
391/391 [=====] - 3s 8ms/step - loss: 3.4939 -
accuracy: 0.3669
Epoch 8/200
391/391 [=====] - 3s 8ms/step - loss: 3.2433 -
accuracy: 0.3719
Epoch 9/200
391/391 [=====] - 3s 7ms/step - loss: 3.0473 -
accuracy: 0.3768
Epoch 10/200
391/391 [=====] - 3s 7ms/step - loss: 2.8892 -
accuracy: 0.3804
Epoch 11/200
391/391 [=====] - 3s 8ms/step - loss: 2.7643 -
accuracy: 0.3826
Epoch 12/200
391/391 [=====] - 3s 7ms/step - loss: 2.6613 -
accuracy: 0.3863
Epoch 13/200
391/391 [=====] - 3s 7ms/step - loss: 2.5721 -
accuracy: 0.3890
Epoch 14/200
391/391 [=====] - 3s 7ms/step - loss: 2.4988 -
accuracy: 0.3901
Epoch 15/200
391/391 [=====] - 3s 7ms/step - loss: 2.4351 -
accuracy: 0.3906
Epoch 16/200
391/391 [=====] - 3s 7ms/step - loss: 2.3819 -
accuracy: 0.3928
Epoch 17/200
391/391 [=====] - 3s 8ms/step - loss: 2.3313 -
accuracy: 0.3955
Epoch 18/200
391/391 [=====] - 3s 7ms/step - loss: 2.2923 -
accuracy: 0.3955
Epoch 19/200
391/391 [=====] - 3s 8ms/step - loss: 2.2575 -
accuracy: 0.3983
```

```
Epoch 20/200
391/391 [=====] - 3s 7ms/step - loss: 2.2253 -
accuracy: 0.3985
Epoch 21/200
391/391 [=====] - 3s 8ms/step - loss: 2.1959 -
accuracy: 0.3994
Epoch 22/200
391/391 [=====] - 3s 7ms/step - loss: 2.1731 -
accuracy: 0.4037
Epoch 23/200
391/391 [=====] - 3s 8ms/step - loss: 2.1487 -
accuracy: 0.4030
Epoch 24/200
391/391 [=====] - 3s 7ms/step - loss: 2.1301 -
accuracy: 0.4043
Epoch 25/200
391/391 [=====] - 3s 8ms/step - loss: 2.1141 -
accuracy: 0.4042
Epoch 26/200
391/391 [=====] - 3s 7ms/step - loss: 2.0936 -
accuracy: 0.4061
Epoch 27/200
391/391 [=====] - 3s 8ms/step - loss: 2.0783 -
accuracy: 0.4078
Epoch 28/200
391/391 [=====] - 3s 7ms/step - loss: 2.0680 -
accuracy: 0.4084
Epoch 29/200
391/391 [=====] - 3s 7ms/step - loss: 2.0545 -
accuracy: 0.4055
Epoch 30/200
391/391 [=====] - 3s 7ms/step - loss: 2.0454 -
accuracy: 0.4064
Epoch 31/200
391/391 [=====] - 3s 7ms/step - loss: 2.0345 -
accuracy: 0.4090
Epoch 32/200
391/391 [=====] - 3s 7ms/step - loss: 2.0252 -
accuracy: 0.4105
Epoch 33/200
391/391 [=====] - 3s 8ms/step - loss: 2.0158 -
accuracy: 0.4118
Epoch 34/200
391/391 [=====] - 3s 8ms/step - loss: 2.0082 -
accuracy: 0.4094
Epoch 35/200
391/391 [=====] - 3s 8ms/step - loss: 2.0025 -
accuracy: 0.4120
Epoch 36/200
391/391 [=====] - 3s 7ms/step - loss: 1.9961 -
accuracy: 0.4124
Epoch 37/200
391/391 [=====] - 3s 8ms/step - loss: 1.9899 -
accuracy: 0.4096
Epoch 38/200
391/391 [=====] - 3s 7ms/step - loss: 1.9842 -
accuracy: 0.4112
```

```
Epoch 39/200
391/391 [=====] - 3s 7ms/step - loss: 1.9799 -
accuracy: 0.4134
Epoch 40/200
391/391 [=====] - 3s 7ms/step - loss: 1.9748 -
accuracy: 0.4151
Epoch 41/200
391/391 [=====] - 3s 7ms/step - loss: 1.9679 -
accuracy: 0.4163
Epoch 42/200
391/391 [=====] - 3s 8ms/step - loss: 1.9642 -
accuracy: 0.4149
Epoch 43/200
391/391 [=====] - 4s 9ms/step - loss: 1.9603 -
accuracy: 0.4182
Epoch 44/200
391/391 [=====] - 4s 10ms/step - loss: 1.9574
- accuracy: 0.4146
Epoch 45/200
391/391 [=====] - 3s 8ms/step - loss: 1.9541 -
accuracy: 0.4148
Epoch 46/200
391/391 [=====] - 3s 8ms/step - loss: 1.9491 -
accuracy: 0.4146
Epoch 47/200
391/391 [=====] - 3s 8ms/step - loss: 1.9494 -
accuracy: 0.4169
Epoch 48/200
391/391 [=====] - 3s 8ms/step - loss: 1.9447 -
accuracy: 0.4177
Epoch 49/200
391/391 [=====] - 3s 7ms/step - loss: 1.9426 -
accuracy: 0.4157
Epoch 50/200
391/391 [=====] - 3s 8ms/step - loss: 1.9398 -
accuracy: 0.4162
Epoch 51/200
391/391 [=====] - 3s 8ms/step - loss: 1.9355 -
accuracy: 0.4163
Epoch 52/200
391/391 [=====] - 3s 8ms/step - loss: 1.9345 -
accuracy: 0.4170
Epoch 53/200
391/391 [=====] - 3s 8ms/step - loss: 1.9332 -
accuracy: 0.4177
Epoch 54/200
391/391 [=====] - 3s 8ms/step - loss: 1.9295 -
accuracy: 0.4192
Epoch 55/200
391/391 [=====] - 3s 8ms/step - loss: 1.9300 -
accuracy: 0.4169
Epoch 56/200
391/391 [=====] - 3s 8ms/step - loss: 1.9268 -
accuracy: 0.4186
Epoch 57/200
391/391 [=====] - 3s 8ms/step - loss: 1.9257 -
accuracy: 0.4179
```

```
Epoch 58/200
391/391 [=====] - 3s 8ms/step - loss: 1.9223 -
accuracy: 0.4214
Epoch 59/200
391/391 [=====] - 3s 8ms/step - loss: 1.9230 -
accuracy: 0.4200
Epoch 60/200
391/391 [=====] - 3s 8ms/step - loss: 1.9214 -
accuracy: 0.4205
Epoch 61/200
391/391 [=====] - 3s 8ms/step - loss: 1.9189 -
accuracy: 0.4198
Epoch 62/200
391/391 [=====] - 3s 8ms/step - loss: 1.9172 -
accuracy: 0.4187
Epoch 63/200
391/391 [=====] - 3s 8ms/step - loss: 1.9145 -
accuracy: 0.4187
Epoch 64/200
391/391 [=====] - 3s 8ms/step - loss: 1.9144 -
accuracy: 0.4204
Epoch 65/200
391/391 [=====] - 3s 8ms/step - loss: 1.9146 -
accuracy: 0.4196
Epoch 66/200
391/391 [=====] - 3s 8ms/step - loss: 1.9128 -
accuracy: 0.4188
Epoch 67/200
391/391 [=====] - 3s 8ms/step - loss: 1.9128 -
accuracy: 0.4196
Epoch 68/200
391/391 [=====] - 3s 8ms/step - loss: 1.9114 -
accuracy: 0.4199
Epoch 69/200
391/391 [=====] - 3s 7ms/step - loss: 1.9115 -
accuracy: 0.4204
Epoch 70/200
391/391 [=====] - 3s 8ms/step - loss: 1.9096 -
accuracy: 0.4203
Epoch 71/200
391/391 [=====] - 3s 7ms/step - loss: 1.9075 -
accuracy: 0.4208
Epoch 72/200
391/391 [=====] - 3s 8ms/step - loss: 1.9061 -
accuracy: 0.4207
Epoch 73/200
391/391 [=====] - 3s 7ms/step - loss: 1.9079 -
accuracy: 0.4196
Epoch 74/200
391/391 [=====] - 3s 8ms/step - loss: 1.9059 -
accuracy: 0.4215
Epoch 75/200
391/391 [=====] - 3s 7ms/step - loss: 1.9063 -
accuracy: 0.4222
Epoch 76/200
391/391 [=====] - 3s 8ms/step - loss: 1.9037 -
accuracy: 0.4230
```

```
Epoch 77/200
391/391 [=====] - 3s 8ms/step - loss: 1.9051 -
accuracy: 0.4205
Epoch 78/200
391/391 [=====] - 3s 8ms/step - loss: 1.9012 -
accuracy: 0.4211
Epoch 79/200
391/391 [=====] - 3s 7ms/step - loss: 1.9025 -
accuracy: 0.4227
Epoch 80/200
391/391 [=====] - 3s 7ms/step - loss: 1.9016 -
accuracy: 0.4235
Epoch 81/200
391/391 [=====] - 3s 7ms/step - loss: 1.9006 -
accuracy: 0.4225
Epoch 82/200
391/391 [=====] - 3s 7ms/step - loss: 1.9005 -
accuracy: 0.4222
Epoch 83/200
391/391 [=====] - 3s 7ms/step - loss: 1.9013 -
accuracy: 0.4222
Epoch 84/200
391/391 [=====] - 3s 7ms/step - loss: 1.8999 -
accuracy: 0.4238
Epoch 85/200
391/391 [=====] - 3s 8ms/step - loss: 1.8979 -
accuracy: 0.4231
Epoch 86/200
391/391 [=====] - 3s 7ms/step - loss: 1.8965 -
accuracy: 0.4227
Epoch 87/200
391/391 [=====] - 3s 8ms/step - loss: 1.8988 -
accuracy: 0.4241
Epoch 88/200
391/391 [=====] - 3s 8ms/step - loss: 1.8966 -
accuracy: 0.4232
Epoch 89/200
391/391 [=====] - 3s 8ms/step - loss: 1.8991 -
accuracy: 0.4216
Epoch 90/200
391/391 [=====] - 3s 7ms/step - loss: 1.8975 -
accuracy: 0.4195
Epoch 91/200
391/391 [=====] - 3s 7ms/step - loss: 1.8973 -
accuracy: 0.4237
Epoch 92/200
391/391 [=====] - 3s 8ms/step - loss: 1.8967 -
accuracy: 0.4220
Epoch 93/200
391/391 [=====] - 3s 7ms/step - loss: 1.8961 -
accuracy: 0.4239
Epoch 94/200
391/391 [=====] - 3s 8ms/step - loss: 1.8951 -
accuracy: 0.4252
Epoch 95/200
391/391 [=====] - 3s 7ms/step - loss: 1.8968 -
accuracy: 0.4228
```

```
Epoch 96/200
391/391 [=====] - 3s 8ms/step - loss: 1.8936 -
accuracy: 0.4234
Epoch 97/200
391/391 [=====] - 3s 7ms/step - loss: 1.8943 -
accuracy: 0.4239
Epoch 98/200
391/391 [=====] - 3s 8ms/step - loss: 1.8925 -
accuracy: 0.4258
Epoch 99/200
391/391 [=====] - 3s 7ms/step - loss: 1.8930 -
accuracy: 0.4213
Epoch 100/200
391/391 [=====] - 3s 8ms/step - loss: 1.8941 -
accuracy: 0.4217
Epoch 101/200
391/391 [=====] - 3s 7ms/step - loss: 1.8914 -
accuracy: 0.4244
Epoch 102/200
391/391 [=====] - 3s 8ms/step - loss: 1.8914 -
accuracy: 0.4242
Epoch 103/200
391/391 [=====] - 3s 7ms/step - loss: 1.8897 -
accuracy: 0.4271
Epoch 104/200
391/391 [=====] - 3s 8ms/step - loss: 1.8925 -
accuracy: 0.4238
Epoch 105/200
391/391 [=====] - 3s 8ms/step - loss: 1.8915 -
accuracy: 0.4233
Epoch 106/200
391/391 [=====] - 3s 7ms/step - loss: 1.8905 -
accuracy: 0.4256
Epoch 107/200
391/391 [=====] - 3s 8ms/step - loss: 1.8902 -
accuracy: 0.4252
Epoch 108/200
391/391 [=====] - 3s 7ms/step - loss: 1.8901 -
accuracy: 0.4241
Epoch 109/200
391/391 [=====] - 3s 8ms/step - loss: 1.8900 -
accuracy: 0.4239
Epoch 110/200
391/391 [=====] - 3s 7ms/step - loss: 1.8880 -
accuracy: 0.4249
Epoch 111/200
391/391 [=====] - 3s 8ms/step - loss: 1.8896 -
accuracy: 0.4224
Epoch 112/200
391/391 [=====] - 3s 7ms/step - loss: 1.8904 -
accuracy: 0.4227
Epoch 113/200
391/391 [=====] - 3s 8ms/step - loss: 1.8901 -
accuracy: 0.4259
Epoch 114/200
391/391 [=====] - 3s 7ms/step - loss: 1.8887 -
accuracy: 0.4244
```



```
Epoch 115/200
391/391 [=====] - 3s 8ms/step - loss: 1.8892 -
accuracy: 0.4248
Epoch 116/200
391/391 [=====] - 3s 8ms/step - loss: 1.8912 -
accuracy: 0.4266
Epoch 117/200
391/391 [=====] - 3s 8ms/step - loss: 1.8892 -
accuracy: 0.4230
Epoch 118/200
391/391 [=====] - 3s 7ms/step - loss: 1.8882 -
accuracy: 0.4240
Epoch 119/200
391/391 [=====] - 3s 8ms/step - loss: 1.8888 -
accuracy: 0.4250
Epoch 120/200
391/391 [=====] - 3s 7ms/step - loss: 1.8875 -
accuracy: 0.4244
Epoch 121/200
391/391 [=====] - 3s 7ms/step - loss: 1.8867 -
accuracy: 0.4263
Epoch 122/200
391/391 [=====] - 3s 8ms/step - loss: 1.8888 -
accuracy: 0.4244
Epoch 123/200
391/391 [=====] - 3s 7ms/step - loss: 1.8869 -
accuracy: 0.4263
Epoch 124/200
391/391 [=====] - 3s 8ms/step - loss: 1.8885 -
accuracy: 0.4240
Epoch 125/200
391/391 [=====] - 3s 7ms/step - loss: 1.8871 -
accuracy: 0.4266
Epoch 126/200
391/391 [=====] - 3s 8ms/step - loss: 1.8837 -
accuracy: 0.4269
Epoch 127/200
391/391 [=====] - 3s 7ms/step - loss: 1.8865 -
accuracy: 0.4248
Epoch 128/200
391/391 [=====] - 3s 8ms/step - loss: 1.8849 -
accuracy: 0.4234
Epoch 129/200
391/391 [=====] - 3s 7ms/step - loss: 1.8852 -
accuracy: 0.4277
Epoch 130/200
391/391 [=====] - 3s 8ms/step - loss: 1.8864 -
accuracy: 0.4254
Epoch 131/200
391/391 [=====] - 3s 7ms/step - loss: 1.8858 -
accuracy: 0.4251
Epoch 132/200
391/391 [=====] - 3s 8ms/step - loss: 1.8852 -
accuracy: 0.4274
Epoch 133/200
391/391 [=====] - 3s 7ms/step - loss: 1.8837 -
accuracy: 0.4276
```

```
Epoch 134/200
391/391 [=====] - 3s 7ms/step - loss: 1.8849 -
accuracy: 0.4261
Epoch 135/200
391/391 [=====] - 3s 7ms/step - loss: 1.8864 -
accuracy: 0.4240
Epoch 136/200
391/391 [=====] - 3s 8ms/step - loss: 1.8837 -
accuracy: 0.4271
Epoch 137/200
391/391 [=====] - 3s 8ms/step - loss: 1.8853 -
accuracy: 0.4268
Epoch 138/200
391/391 [=====] - 3s 8ms/step - loss: 1.8856 -
accuracy: 0.4257
Epoch 139/200
391/391 [=====] - 3s 8ms/step - loss: 1.8827 -
accuracy: 0.4253
Epoch 140/200
391/391 [=====] - 3s 7ms/step - loss: 1.8841 -
accuracy: 0.4269
Epoch 141/200
391/391 [=====] - 3s 7ms/step - loss: 1.8839 -
accuracy: 0.4280
Epoch 142/200
391/391 [=====] - 3s 7ms/step - loss: 1.8829 -
accuracy: 0.4249
Epoch 143/200
391/391 [=====] - 3s 8ms/step - loss: 1.8846 -
accuracy: 0.4260
Epoch 144/200
391/391 [=====] - 3s 7ms/step - loss: 1.8848 -
accuracy: 0.4257
Epoch 145/200
391/391 [=====] - 3s 8ms/step - loss: 1.8831 -
accuracy: 0.4260
Epoch 146/200
391/391 [=====] - 3s 7ms/step - loss: 1.8842 -
accuracy: 0.4243
Epoch 147/200
391/391 [=====] - 3s 8ms/step - loss: 1.8811 -
accuracy: 0.4289
Epoch 148/200
391/391 [=====] - 3s 7ms/step - loss: 1.8820 -
accuracy: 0.4262
Epoch 149/200
391/391 [=====] - 3s 8ms/step - loss: 1.8818 -
accuracy: 0.4261
Epoch 150/200
391/391 [=====] - 3s 8ms/step - loss: 1.8817 -
accuracy: 0.4258
Epoch 151/200
391/391 [=====] - 3s 8ms/step - loss: 1.8833 -
accuracy: 0.4255
Epoch 152/200
391/391 [=====] - 3s 7ms/step - loss: 1.8828 -
accuracy: 0.4271
```

```
Epoch 153/200
391/391 [=====] - 3s 8ms/step - loss: 1.8818 -
accuracy: 0.4263
Epoch 154/200
391/391 [=====] - 3s 7ms/step - loss: 1.8818 -
accuracy: 0.4278
Epoch 155/200
391/391 [=====] - 3s 7ms/step - loss: 1.8802 -
accuracy: 0.4273
Epoch 156/200
391/391 [=====] - 3s 8ms/step - loss: 1.8817 -
accuracy: 0.4266
Epoch 157/200
391/391 [=====] - 3s 8ms/step - loss: 1.8821 -
accuracy: 0.4262
Epoch 158/200
391/391 [=====] - 3s 8ms/step - loss: 1.8817 -
accuracy: 0.4272
Epoch 159/200
391/391 [=====] - 3s 8ms/step - loss: 1.8807 -
accuracy: 0.4258
Epoch 160/200
391/391 [=====] - 3s 8ms/step - loss: 1.8824 -
accuracy: 0.4268
Epoch 161/200
391/391 [=====] - 3s 8ms/step - loss: 1.8821 -
accuracy: 0.4241
Epoch 162/200
391/391 [=====] - 3s 8ms/step - loss: 1.8815 -
accuracy: 0.4255
Epoch 163/200
391/391 [=====] - 3s 7ms/step - loss: 1.8826 -
accuracy: 0.4252
Epoch 164/200
391/391 [=====] - 3s 8ms/step - loss: 1.8806 -
accuracy: 0.4267
Epoch 165/200
391/391 [=====] - 3s 7ms/step - loss: 1.8811 -
accuracy: 0.4275
Epoch 166/200
391/391 [=====] - 3s 8ms/step - loss: 1.8799 -
accuracy: 0.4265
Epoch 167/200
391/391 [=====] - 3s 7ms/step - loss: 1.8811 -
accuracy: 0.4275
Epoch 168/200
391/391 [=====] - 3s 7ms/step - loss: 1.8799 -
accuracy: 0.4273
Epoch 169/200
391/391 [=====] - 3s 8ms/step - loss: 1.8803 -
accuracy: 0.4254
Epoch 170/200
391/391 [=====] - 3s 8ms/step - loss: 1.8807 -
accuracy: 0.4272
Epoch 171/200
391/391 [=====] - 3s 7ms/step - loss: 1.8804 -
accuracy: 0.4272
```

```
Epoch 172/200
391/391 [=====] - 3s 8ms/step - loss: 1.8789 -
accuracy: 0.4287
Epoch 173/200
391/391 [=====] - 3s 8ms/step - loss: 1.8811 -
accuracy: 0.4274
Epoch 174/200
391/391 [=====] - 3s 8ms/step - loss: 1.8810 -
accuracy: 0.4268
Epoch 175/200
391/391 [=====] - 3s 7ms/step - loss: 1.8795 -
accuracy: 0.4309
Epoch 176/200
391/391 [=====] - 3s 8ms/step - loss: 1.8783 -
accuracy: 0.4292
Epoch 177/200
391/391 [=====] - 3s 8ms/step - loss: 1.8804 -
accuracy: 0.4266
Epoch 178/200
391/391 [=====] - 3s 7ms/step - loss: 1.8808 -
accuracy: 0.4257
Epoch 179/200
391/391 [=====] - 3s 7ms/step - loss: 1.8802 -
accuracy: 0.4267
Epoch 180/200
391/391 [=====] - 3s 8ms/step - loss: 1.8807 -
accuracy: 0.4260
Epoch 181/200
391/391 [=====] - 3s 8ms/step - loss: 1.8795 -
accuracy: 0.4302
Epoch 182/200
391/391 [=====] - 3s 7ms/step - loss: 1.8805 -
accuracy: 0.4280
Epoch 183/200
391/391 [=====] - 3s 8ms/step - loss: 1.8798 -
accuracy: 0.4312
Epoch 184/200
391/391 [=====] - 3s 7ms/step - loss: 1.8787 -
accuracy: 0.4255
Epoch 185/200
391/391 [=====] - 3s 8ms/step - loss: 1.8798 -
accuracy: 0.4250
Epoch 186/200
391/391 [=====] - 3s 7ms/step - loss: 1.8783 -
accuracy: 0.4267
Epoch 187/200
391/391 [=====] - 3s 7ms/step - loss: 1.8772 -
accuracy: 0.4317
Epoch 188/200
391/391 [=====] - 3s 8ms/step - loss: 1.8804 -
accuracy: 0.4246
Epoch 189/200
391/391 [=====] - 3s 7ms/step - loss: 1.8791 -
accuracy: 0.4273
Epoch 190/200
391/391 [=====] - 3s 8ms/step - loss: 1.8780 -
accuracy: 0.4302
```

Epoch 191/200
391/391 [=====] - 3s 8ms/step - loss: 1.8773 -
accuracy: 0.4269
Epoch 192/200
391/391 [=====] - 3s 7ms/step - loss: 1.8806 -
accuracy: 0.4261
Epoch 193/200
391/391 [=====] - 3s 7ms/step - loss: 1.8787 -
accuracy: 0.4275
Epoch 194/200
391/391 [=====] - 3s 8ms/step - loss: 1.8781 -
accuracy: 0.4278
Epoch 195/200
391/391 [=====] - 3s 7ms/step - loss: 1.8777 -
accuracy: 0.4279
Epoch 196/200
391/391 [=====] - 3s 8ms/step - loss: 1.8794 -
accuracy: 0.4287
Epoch 197/200
391/391 [=====] - 3s 8ms/step - loss: 1.8792 -
accuracy: 0.4278
Epoch 198/200
391/391 [=====] - 3s 8ms/step - loss: 1.8778 -
accuracy: 0.4288
Epoch 199/200
391/391 [=====] - 3s 7ms/step - loss: 1.8809 -
accuracy: 0.4277
Epoch 200/200
391/391 [=====] - 3s 8ms/step - loss: 1.8797 -
accuracy: 0.4282
313/313 [=====] - 1s 4ms/step - loss: 1.8448 -
accuracy: 0.4482
Epoch 1/200
391/391 [=====] - 4s 9ms/step - loss: 4.3107 -
accuracy: 0.1723
Epoch 2/200
391/391 [=====] - 4s 9ms/step - loss: 2.2674 -
accuracy: 0.1992
Epoch 3/200
391/391 [=====] - 4s 9ms/step - loss: 2.2432 -
accuracy: 0.2064
Epoch 4/200
391/391 [=====] - 4s 9ms/step - loss: 2.2276 -
accuracy: 0.2120
Epoch 5/200
391/391 [=====] - 4s 9ms/step - loss: 2.2145 -
accuracy: 0.2131
Epoch 6/200
391/391 [=====] - 4s 9ms/step - loss: 2.2011 -
accuracy: 0.2197
Epoch 7/200
391/391 [=====] - 4s 9ms/step - loss: 2.1888 -
accuracy: 0.2219
Epoch 8/200
391/391 [=====] - 4s 9ms/step - loss: 2.1785 -
accuracy: 0.2260
Epoch 9/200

```
391/391 [=====] - 4s 9ms/step - loss: 2.1779 -  
accuracy: 0.2268  
Epoch 10/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1710 -  
accuracy: 0.2263  
Epoch 11/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1732 -  
accuracy: 0.2303  
Epoch 12/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1713 -  
accuracy: 0.2274  
Epoch 13/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1733 -  
accuracy: 0.2274  
Epoch 14/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1714 -  
accuracy: 0.2251  
Epoch 15/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1685 -  
accuracy: 0.2276  
Epoch 16/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1674 -  
accuracy: 0.2290  
Epoch 17/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1684 -  
accuracy: 0.2286  
Epoch 18/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1671 -  
accuracy: 0.2299  
Epoch 19/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1692 -  
accuracy: 0.2289  
Epoch 20/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1660 -  
accuracy: 0.2328  
Epoch 21/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1662 -  
accuracy: 0.2319  
Epoch 22/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1646 -  
accuracy: 0.2343  
Epoch 23/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1667 -  
accuracy: 0.2324  
Epoch 24/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1701 -  
accuracy: 0.2287  
Epoch 25/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1662 -  
accuracy: 0.2343  
Epoch 26/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1624 -  
accuracy: 0.2333  
Epoch 27/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1647 -  
accuracy: 0.2338  
Epoch 28/200
```

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391/391 [=====] - 4s 9ms/step - loss: 2.1628 -  
accuracy: 0.2318  
Epoch 29/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1632 -  
accuracy: 0.2340  
Epoch 30/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1599 -  
accuracy: 0.2361  
Epoch 31/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1665 -  
accuracy: 0.2297  
Epoch 32/200  
391/391 [=====] - 4s 10ms/step - loss: 2.1646  
- accuracy: 0.2332  
Epoch 33/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1610 -  
accuracy: 0.2351  
Epoch 34/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1615 -  
accuracy: 0.2372  
Epoch 35/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1624 -  
accuracy: 0.2353  
Epoch 36/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1658 -  
accuracy: 0.2372  
Epoch 37/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1611 -  
accuracy: 0.2352  
Epoch 38/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1621 -  
accuracy: 0.2361  
Epoch 39/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1668 -  
accuracy: 0.2355  
Epoch 40/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1630 -  
accuracy: 0.2358  
Epoch 41/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1621 -  
accuracy: 0.2394  
Epoch 42/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1598 -  
accuracy: 0.2337  
Epoch 43/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1602 -  
accuracy: 0.2366  
Epoch 44/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1618 -  
accuracy: 0.2341  
Epoch 45/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1658 -  
accuracy: 0.2360  
Epoch 46/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1586 -  
accuracy: 0.2380  
Epoch 47/200
```

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391/391 [=====] - 4s 9ms/step - loss: 2.1617 -  
accuracy: 0.2389  
Epoch 48/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1589 -  
accuracy: 0.2376  
Epoch 49/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1604 -  
accuracy: 0.2373  
Epoch 50/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1641 -  
accuracy: 0.2360  
Epoch 51/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1594 -  
accuracy: 0.2369  
Epoch 52/200  
391/391 [=====] - 4s 10ms/step - loss: 2.1641  
- accuracy: 0.2349  
Epoch 53/200  
391/391 [=====] - 4s 10ms/step - loss: 2.1657  
- accuracy: 0.2332  
Epoch 54/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1622 -  
accuracy: 0.2338  
Epoch 55/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1636 -  
accuracy: 0.2366  
Epoch 56/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1643 -  
accuracy: 0.2382  
Epoch 57/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1606 -  
accuracy: 0.2403  
Epoch 58/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1646 -  
accuracy: 0.2345  
Epoch 59/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1576 -  
accuracy: 0.2401  
Epoch 60/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1607 -  
accuracy: 0.2393  
Epoch 61/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1597 -  
accuracy: 0.2377  
Epoch 62/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1614 -  
accuracy: 0.2342  
Epoch 63/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1602 -  
accuracy: 0.2381  
Epoch 64/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1608 -  
accuracy: 0.2385  
Epoch 65/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1606 -  
accuracy: 0.2395  
Epoch 66/200
```



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391/391 [=====] - 4s 9ms/step - loss: 2.1632 -  
accuracy: 0.2360  
Epoch 67/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1611 -  
accuracy: 0.2367  
Epoch 68/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1616 -  
accuracy: 0.2397  
Epoch 69/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1631 -  
accuracy: 0.2387  
Epoch 70/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1638 -  
accuracy: 0.2376  
Epoch 71/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1628 -  
accuracy: 0.2368  
Epoch 72/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1600 -  
accuracy: 0.2409  
Epoch 73/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1631 -  
accuracy: 0.2399  
Epoch 74/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1609 -  
accuracy: 0.2403  
Epoch 75/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1614 -  
accuracy: 0.2420  
Epoch 76/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1624 -  
accuracy: 0.2405  
Epoch 77/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1595 -  
accuracy: 0.2384  
Epoch 78/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1598 -  
accuracy: 0.2377  
Epoch 79/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1608 -  
accuracy: 0.2389  
Epoch 80/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1650 -  
accuracy: 0.2362  
Epoch 81/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1619 -  
accuracy: 0.2367  
Epoch 82/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1566 -  
accuracy: 0.2392  
Epoch 83/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1610 -  
accuracy: 0.2401  
Epoch 84/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1605 -  
accuracy: 0.2395  
Epoch 85/200
```

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391/391 [=====] - 4s 9ms/step - loss: 2.1605 -  
accuracy: 0.2392  
Epoch 86/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1612 -  
accuracy: 0.2394  
Epoch 87/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1569 -  
accuracy: 0.2419  
Epoch 88/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1598 -  
accuracy: 0.2412  
Epoch 89/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1604 -  
accuracy: 0.2408  
Epoch 90/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1585 -  
accuracy: 0.2403  
Epoch 91/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1589 -  
accuracy: 0.2446  
Epoch 92/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1579 -  
accuracy: 0.2421  
Epoch 93/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1615 -  
accuracy: 0.2416  
Epoch 94/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1633 -  
accuracy: 0.2391  
Epoch 95/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1629 -  
accuracy: 0.2398  
Epoch 96/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1578 -  
accuracy: 0.2397  
Epoch 97/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1614 -  
accuracy: 0.2393  
Epoch 98/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1599 -  
accuracy: 0.2389  
Epoch 99/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1599 -  
accuracy: 0.2377  
Epoch 100/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1605 -  
accuracy: 0.2350  
Epoch 101/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1574 -  
accuracy: 0.2395  
Epoch 102/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1572 -  
accuracy: 0.2388  
Epoch 103/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1579 -  
accuracy: 0.2406  
Epoch 104/200
```

```
391/391 [=====] - 4s 9ms/step - loss: 2.1581 -  
accuracy: 0.2385  
Epoch 105/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1607 -  
accuracy: 0.2386  
Epoch 106/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1582 -  
accuracy: 0.2404  
Epoch 107/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1586 -  
accuracy: 0.2397  
Epoch 108/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1598 -  
accuracy: 0.2370  
Epoch 109/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1610 -  
accuracy: 0.2396  
Epoch 110/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1600 -  
accuracy: 0.2378  
Epoch 111/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1611 -  
accuracy: 0.2386  
Epoch 112/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1563 -  
accuracy: 0.2404  
Epoch 113/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1576 -  
accuracy: 0.2391  
Epoch 114/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1556 -  
accuracy: 0.2410  
Epoch 115/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1574 -  
accuracy: 0.2419  
Epoch 116/200  
391/391 [=====] - 4s 10ms/step - loss: 2.1621  
- accuracy: 0.2419  
Epoch 117/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1575 -  
accuracy: 0.2386  
Epoch 118/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1596 -  
accuracy: 0.2400  
Epoch 119/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1613 -  
accuracy: 0.2384  
Epoch 120/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1574 -  
accuracy: 0.2398  
Epoch 121/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1565 -  
accuracy: 0.2417  
Epoch 122/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1585 -  
accuracy: 0.2392  
Epoch 123/200
```

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391/391 [=====] - 4s 9ms/step - loss: 2.1579 -  
accuracy: 0.2392  
Epoch 124/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1606 -  
accuracy: 0.2422  
Epoch 125/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1601 -  
accuracy: 0.2409  
Epoch 126/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1596 -  
accuracy: 0.2380  
Epoch 127/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1606 -  
accuracy: 0.2402  
Epoch 128/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1591 -  
accuracy: 0.2430  
Epoch 129/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1577 -  
accuracy: 0.2373  
Epoch 130/200  
391/391 [=====] - 4s 10ms/step - loss: 2.1589  
- accuracy: 0.2396  
Epoch 131/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1560 -  
accuracy: 0.2397  
Epoch 132/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1583 -  
accuracy: 0.2399  
Epoch 133/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1543 -  
accuracy: 0.2415  
Epoch 134/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1573 -  
accuracy: 0.2392  
Epoch 135/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1625 -  
accuracy: 0.2397  
Epoch 136/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1585 -  
accuracy: 0.2395  
Epoch 137/200  
391/391 [=====] - 4s 10ms/step - loss: 2.1583  
- accuracy: 0.2390  
Epoch 138/200  
391/391 [=====] - 4s 10ms/step - loss: 2.1593  
- accuracy: 0.2385  
Epoch 139/200  
391/391 [=====] - 4s 10ms/step - loss: 2.1585  
- accuracy: 0.2407  
Epoch 140/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1577 -  
accuracy: 0.2403  
Epoch 141/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1617 -  
accuracy: 0.2398  
Epoch 142/200
```

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391/391 [=====] - 4s 9ms/step - loss: 2.1583 -  
accuracy: 0.2397  
Epoch 143/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1553 -  
accuracy: 0.2419  
Epoch 144/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1595 -  
accuracy: 0.2400  
Epoch 145/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1575 -  
accuracy: 0.2397  
Epoch 146/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1563 -  
accuracy: 0.2432  
Epoch 147/200  
391/391 [=====] - 4s 10ms/step - loss: 2.1567  
- accuracy: 0.2433  
Epoch 148/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1620 -  
accuracy: 0.2381  
Epoch 149/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1633 -  
accuracy: 0.2390  
Epoch 150/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1575 -  
accuracy: 0.2403  
Epoch 151/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1577 -  
accuracy: 0.2397  
Epoch 152/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1597 -  
accuracy: 0.2414  
Epoch 153/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1604 -  
accuracy: 0.2399  
Epoch 154/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1590 -  
accuracy: 0.2412  
Epoch 155/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1585 -  
accuracy: 0.2416  
Epoch 156/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1579 -  
accuracy: 0.2419  
Epoch 157/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1614 -  
accuracy: 0.2398  
Epoch 158/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1578 -  
accuracy: 0.2402  
Epoch 159/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1585 -  
accuracy: 0.2411  
Epoch 160/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1578 -  
accuracy: 0.2375  
Epoch 161/200
```

```
391/391 [=====] - 4s 9ms/step - loss: 2.1594 -  
accuracy: 0.2419  
Epoch 162/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1560 -  
accuracy: 0.2418  
Epoch 163/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1576 -  
accuracy: 0.2419  
Epoch 164/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1610 -  
accuracy: 0.2399  
Epoch 165/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1589 -  
accuracy: 0.2383  
Epoch 166/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1603 -  
accuracy: 0.2412  
Epoch 167/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1564 -  
accuracy: 0.2427  
Epoch 168/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1577 -  
accuracy: 0.2379  
Epoch 169/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1591 -  
accuracy: 0.2399  
Epoch 170/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1580 -  
accuracy: 0.2427  
Epoch 171/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1592 -  
accuracy: 0.2375  
Epoch 172/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1583 -  
accuracy: 0.2396  
Epoch 173/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1596 -  
accuracy: 0.2378  
Epoch 174/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1579 -  
accuracy: 0.2397  
Epoch 175/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1560 -  
accuracy: 0.2439  
Epoch 176/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1597 -  
accuracy: 0.2379  
Epoch 177/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1620 -  
accuracy: 0.2397  
Epoch 178/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1585 -  
accuracy: 0.2403  
Epoch 179/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1588 -  
accuracy: 0.2405  
Epoch 180/200
```

```
391/391 [=====] - 4s 9ms/step - loss: 2.1593 -  
accuracy: 0.2374  
Epoch 181/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1544 -  
accuracy: 0.2397  
Epoch 182/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1583 -  
accuracy: 0.2405  
Epoch 183/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1634 -  
accuracy: 0.2402  
Epoch 184/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1592 -  
accuracy: 0.2369  
Epoch 185/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1619 -  
accuracy: 0.2394  
Epoch 186/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1597 -  
accuracy: 0.2367  
Epoch 187/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1591 -  
accuracy: 0.2395  
Epoch 188/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1582 -  
accuracy: 0.2382  
Epoch 189/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1581 -  
accuracy: 0.2412  
Epoch 190/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1601 -  
accuracy: 0.2408  
Epoch 191/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1590 -  
accuracy: 0.2412  
Epoch 192/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1595 -  
accuracy: 0.2402  
Epoch 193/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1610 -  
accuracy: 0.2415  
Epoch 194/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1600 -  
accuracy: 0.2410  
Epoch 195/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1568 -  
accuracy: 0.2382  
Epoch 196/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1578 -  
accuracy: 0.2386  
Epoch 197/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1571 -  
accuracy: 0.2400  
Epoch 198/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1587 -  
accuracy: 0.2392  
Epoch 199/200
```

```
391/391 [=====] - 4s 9ms/step - loss: 2.1570 -  
accuracy: 0.2388  
Epoch 200/200  
391/391 [=====] - 4s 9ms/step - loss: 2.1567 -  
accuracy: 0.2418  
313/313 [=====] - 1s 5ms/step - loss: 2.0730 -  
accuracy: 0.2869  
Epoch 1/200  
391/391 [=====] - 3s 8ms/step - loss: 27.7722  
- accuracy: 0.1030  
Epoch 2/200  
391/391 [=====] - 3s 8ms/step - loss: 27.4389  
- accuracy: 0.1134  
Epoch 3/200  
391/391 [=====] - 3s 8ms/step - loss: 27.1566  
- accuracy: 0.1219  
Epoch 4/200  
391/391 [=====] - 3s 8ms/step - loss: 26.8902  
- accuracy: 0.1326  
Epoch 5/200  
391/391 [=====] - 3s 8ms/step - loss: 26.6362  
- accuracy: 0.1415  
Epoch 6/200  
391/391 [=====] - 3s 8ms/step - loss: 26.3803  
- accuracy: 0.1516  
Epoch 7/200  
391/391 [=====] - 3s 8ms/step - loss: 26.1381  
- accuracy: 0.1590  
Epoch 8/200  
391/391 [=====] - 3s 8ms/step - loss: 25.8923  
- accuracy: 0.1692  
Epoch 9/200  
391/391 [=====] - 3s 8ms/step - loss: 25.6510  
- accuracy: 0.1729  
Epoch 10/200  
391/391 [=====] - 3s 8ms/step - loss: 25.4098  
- accuracy: 0.1794  
Epoch 11/200  
391/391 [=====] - 3s 8ms/step - loss: 25.1752  
- accuracy: 0.1852  
Epoch 12/200  
391/391 [=====] - 3s 8ms/step - loss: 24.9402  
- accuracy: 0.1909  
Epoch 13/200  
391/391 [=====] - 3s 8ms/step - loss: 24.7061  
- accuracy: 0.1953  
Epoch 14/200  
391/391 [=====] - 3s 8ms/step - loss: 24.4745  
- accuracy: 0.1976  
Epoch 15/200  
391/391 [=====] - 3s 9ms/step - loss: 24.2456  
- accuracy: 0.2031  
Epoch 16/200  
391/391 [=====] - 3s 9ms/step - loss: 24.0208  
- accuracy: 0.2055  
Epoch 17/200  
391/391 [=====] - 3s 8ms/step - loss: 23.7905
```



```
- accuracy: 0.2128
Epoch 18/200
391/391 [=====] - 3s 9ms/step - loss: 23.5692
- accuracy: 0.2149
Epoch 19/200
391/391 [=====] - 3s 8ms/step - loss: 23.3470
- accuracy: 0.2208
Epoch 20/200
391/391 [=====] - 3s 8ms/step - loss: 23.1280
- accuracy: 0.2222
Epoch 21/200
391/391 [=====] - 3s 8ms/step - loss: 22.9137
- accuracy: 0.2236
Epoch 22/200
391/391 [=====] - 3s 8ms/step - loss: 22.6999
- accuracy: 0.2260
Epoch 23/200
391/391 [=====] - 3s 8ms/step - loss: 22.4874
- accuracy: 0.2297
Epoch 24/200
391/391 [=====] - 3s 8ms/step - loss: 22.2760
- accuracy: 0.2321
Epoch 25/200
391/391 [=====] - 3s 8ms/step - loss: 22.0700
- accuracy: 0.2352
Epoch 26/200
391/391 [=====] - 3s 8ms/step - loss: 21.8609
- accuracy: 0.2367
Epoch 27/200
391/391 [=====] - 3s 8ms/step - loss: 21.6556
- accuracy: 0.2405
Epoch 28/200
391/391 [=====] - 3s 8ms/step - loss: 21.4614
- accuracy: 0.2418
Epoch 29/200
391/391 [=====] - 3s 8ms/step - loss: 21.2576
- accuracy: 0.2437
Epoch 30/200
391/391 [=====] - 3s 8ms/step - loss: 21.0667
- accuracy: 0.2450
Epoch 31/200
391/391 [=====] - 3s 8ms/step - loss: 20.8680
- accuracy: 0.2492
Epoch 32/200
391/391 [=====] - 3s 8ms/step - loss: 20.6782
- accuracy: 0.2481
Epoch 33/200
391/391 [=====] - 3s 8ms/step - loss: 20.4854
- accuracy: 0.2512
Epoch 34/200
391/391 [=====] - 3s 8ms/step - loss: 20.2966
- accuracy: 0.2536
Epoch 35/200
391/391 [=====] - 3s 8ms/step - loss: 20.1080
- accuracy: 0.2572
Epoch 36/200
391/391 [=====] - 3s 8ms/step - loss: 19.9262
```

```
- accuracy: 0.2579
Epoch 37/200
391/391 [=====] - 3s 8ms/step - loss: 19.7408
- accuracy: 0.2584
Epoch 38/200
391/391 [=====] - 3s 8ms/step - loss: 19.5646
- accuracy: 0.2600
Epoch 39/200
391/391 [=====] - 3s 8ms/step - loss: 19.3811
- accuracy: 0.2624
Epoch 40/200
391/391 [=====] - 3s 8ms/step - loss: 19.2090
- accuracy: 0.2624
Epoch 41/200
391/391 [=====] - 3s 8ms/step - loss: 19.0316
- accuracy: 0.2664
Epoch 42/200
391/391 [=====] - 3s 8ms/step - loss: 18.8567
- accuracy: 0.2689
Epoch 43/200
391/391 [=====] - 3s 8ms/step - loss: 18.6869
- accuracy: 0.2724
Epoch 44/200
391/391 [=====] - 3s 8ms/step - loss: 18.5170
- accuracy: 0.2701
Epoch 45/200
391/391 [=====] - 3s 8ms/step - loss: 18.3513
- accuracy: 0.2732
Epoch 46/200
391/391 [=====] - 3s 8ms/step - loss: 18.1835
- accuracy: 0.2724
Epoch 47/200
391/391 [=====] - 3s 8ms/step - loss: 18.0206
- accuracy: 0.2734
Epoch 48/200
391/391 [=====] - 3s 8ms/step - loss: 17.8603
- accuracy: 0.2756
Epoch 49/200
391/391 [=====] - 3s 8ms/step - loss: 17.7003
- accuracy: 0.2787
Epoch 50/200
391/391 [=====] - 3s 8ms/step - loss: 17.5420
- accuracy: 0.2798
Epoch 51/200
391/391 [=====] - 3s 8ms/step - loss: 17.3836
- accuracy: 0.2790
Epoch 52/200
391/391 [=====] - 3s 8ms/step - loss: 17.2268
- accuracy: 0.2825
Epoch 53/200
391/391 [=====] - 3s 8ms/step - loss: 17.0755
- accuracy: 0.2811
Epoch 54/200
391/391 [=====] - 3s 8ms/step - loss: 16.9240
- accuracy: 0.2844
Epoch 55/200
391/391 [=====] - 3s 8ms/step - loss: 16.7688
```

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- accuracy: 0.2870
Epoch 56/200
391/391 [=====] - 3s 8ms/step - loss: 16.6224
- accuracy: 0.2853
Epoch 57/200
391/391 [=====] - 3s 8ms/step - loss: 16.4740
- accuracy: 0.2899
Epoch 58/200
391/391 [=====] - 3s 8ms/step - loss: 16.3301
- accuracy: 0.2880
Epoch 59/200
391/391 [=====] - 3s 8ms/step - loss: 16.1862
- accuracy: 0.2898
Epoch 60/200
391/391 [=====] - 3s 8ms/step - loss: 16.0464
- accuracy: 0.2893
Epoch 61/200
391/391 [=====] - 3s 8ms/step - loss: 15.9025
- accuracy: 0.2920
Epoch 62/200
391/391 [=====] - 3s 8ms/step - loss: 15.7637
- accuracy: 0.2934
Epoch 63/200
391/391 [=====] - 3s 8ms/step - loss: 15.6242
- accuracy: 0.2933
Epoch 64/200
391/391 [=====] - 3s 8ms/step - loss: 15.4900
- accuracy: 0.2936
Epoch 65/200
391/391 [=====] - 3s 8ms/step - loss: 15.3540
- accuracy: 0.2983
Epoch 66/200
391/391 [=====] - 3s 8ms/step - loss: 15.2176
- accuracy: 0.2991
Epoch 67/200
391/391 [=====] - 3s 8ms/step - loss: 15.0860
- accuracy: 0.2996
Epoch 68/200
391/391 [=====] - 3s 8ms/step - loss: 14.9596
- accuracy: 0.2985
Epoch 69/200
391/391 [=====] - 3s 8ms/step - loss: 14.8263
- accuracy: 0.3033
Epoch 70/200
391/391 [=====] - 3s 8ms/step - loss: 14.6996
- accuracy: 0.3005
Epoch 71/200
391/391 [=====] - 3s 8ms/step - loss: 14.5710
- accuracy: 0.3036
Epoch 72/200
391/391 [=====] - 3s 8ms/step - loss: 14.4464
- accuracy: 0.3040
Epoch 73/200
391/391 [=====] - 3s 8ms/step - loss: 14.3237
- accuracy: 0.3037
Epoch 74/200
391/391 [=====] - 3s 8ms/step - loss: 14.1990
```

```
- accuracy: 0.3057
Epoch 75/200
391/391 [=====] - 3s 8ms/step - loss: 14.0784
- accuracy: 0.3060
Epoch 76/200
391/391 [=====] - 3s 8ms/step - loss: 13.9538
- accuracy: 0.3059
Epoch 77/200
391/391 [=====] - 3s 8ms/step - loss: 13.8375
- accuracy: 0.3068
Epoch 78/200
391/391 [=====] - 3s 8ms/step - loss: 13.7183
- accuracy: 0.3093
Epoch 79/200
391/391 [=====] - 3s 8ms/step - loss: 13.5990
- accuracy: 0.3127
Epoch 80/200
391/391 [=====] - 3s 8ms/step - loss: 13.4857
- accuracy: 0.3103
Epoch 81/200
391/391 [=====] - 3s 8ms/step - loss: 13.3721
- accuracy: 0.3118
Epoch 82/200
391/391 [=====] - 3s 8ms/step - loss: 13.2603
- accuracy: 0.3112
Epoch 83/200
391/391 [=====] - 3s 8ms/step - loss: 13.1505
- accuracy: 0.3073
Epoch 84/200
391/391 [=====] - 3s 8ms/step - loss: 13.0375
- accuracy: 0.3115
Epoch 85/200
391/391 [=====] - 3s 8ms/step - loss: 12.9277
- accuracy: 0.3120
Epoch 86/200
391/391 [=====] - 3s 8ms/step - loss: 12.8171
- accuracy: 0.3138
Epoch 87/200
391/391 [=====] - 3s 8ms/step - loss: 12.7122
- accuracy: 0.3121
Epoch 88/200
391/391 [=====] - 3s 8ms/step - loss: 12.6051
- accuracy: 0.3160
Epoch 89/200
391/391 [=====] - 3s 8ms/step - loss: 12.5004
- accuracy: 0.3172
Epoch 90/200
391/391 [=====] - 3s 8ms/step - loss: 12.3960
- accuracy: 0.3179
Epoch 91/200
391/391 [=====] - 3s 8ms/step - loss: 12.2934
- accuracy: 0.3162
Epoch 92/200
391/391 [=====] - 3s 8ms/step - loss: 12.1896
- accuracy: 0.3213
Epoch 93/200
391/391 [=====] - 3s 8ms/step - loss: 12.0899
```

```
- accuracy: 0.3185
Epoch 94/200
391/391 [=====] - 3s 8ms/step - loss: 11.9898
- accuracy: 0.3197
Epoch 95/200
391/391 [=====] - 3s 8ms/step - loss: 11.8926
- accuracy: 0.3184
Epoch 96/200
391/391 [=====] - 3s 8ms/step - loss: 11.7923
- accuracy: 0.3209
Epoch 97/200
391/391 [=====] - 3s 8ms/step - loss: 11.6943
- accuracy: 0.3207
Epoch 98/200
391/391 [=====] - 3s 8ms/step - loss: 11.6007
- accuracy: 0.3207
Epoch 99/200
391/391 [=====] - 3s 8ms/step - loss: 11.5056
- accuracy: 0.3226
Epoch 100/200
391/391 [=====] - 3s 8ms/step - loss: 11.4094
- accuracy: 0.3248
Epoch 101/200
391/391 [=====] - 3s 8ms/step - loss: 11.3145
- accuracy: 0.3260
Epoch 102/200
391/391 [=====] - 3s 8ms/step - loss: 11.2245
- accuracy: 0.3248
Epoch 103/200
391/391 [=====] - 3s 8ms/step - loss: 11.1322
- accuracy: 0.3239
Epoch 104/200
391/391 [=====] - 3s 8ms/step - loss: 11.0417
- accuracy: 0.3284
Epoch 105/200
391/391 [=====] - 3s 8ms/step - loss: 10.9539
- accuracy: 0.3273
Epoch 106/200
391/391 [=====] - 3s 8ms/step - loss: 10.8639
- accuracy: 0.3259
Epoch 107/200
391/391 [=====] - 3s 8ms/step - loss: 10.7761
- accuracy: 0.3282
Epoch 108/200
391/391 [=====] - 3s 8ms/step - loss: 10.6924
- accuracy: 0.3268
Epoch 109/200
391/391 [=====] - 3s 8ms/step - loss: 10.6063
- accuracy: 0.3292
Epoch 110/200
391/391 [=====] - 3s 8ms/step - loss: 10.5220
- accuracy: 0.3270
Epoch 111/200
391/391 [=====] - 3s 8ms/step - loss: 10.4346
- accuracy: 0.3297
Epoch 112/200
391/391 [=====] - 3s 8ms/step - loss: 10.3511
```

```
- accuracy: 0.3313
Epoch 113/200
391/391 [=====] - 3s 8ms/step - loss: 10.2718
- accuracy: 0.3286
Epoch 114/200
391/391 [=====] - 3s 8ms/step - loss: 10.1893
- accuracy: 0.3311
Epoch 115/200
391/391 [=====] - 3s 8ms/step - loss: 10.1078
- accuracy: 0.3321
Epoch 116/200
391/391 [=====] - 3s 8ms/step - loss: 10.0284
- accuracy: 0.3345
Epoch 117/200
391/391 [=====] - 3s 8ms/step - loss: 9.9523 -
accuracy: 0.3317
Epoch 118/200
391/391 [=====] - 3s 8ms/step - loss: 9.8721 -
accuracy: 0.3358
Epoch 119/200
391/391 [=====] - 3s 8ms/step - loss: 9.7932 -
accuracy: 0.3353
Epoch 120/200
391/391 [=====] - 3s 8ms/step - loss: 9.7159 -
accuracy: 0.3354
Epoch 121/200
391/391 [=====] - 3s 8ms/step - loss: 9.6408 -
accuracy: 0.3356
Epoch 122/200
391/391 [=====] - 3s 8ms/step - loss: 9.5686 -
accuracy: 0.3344
Epoch 123/200
391/391 [=====] - 3s 8ms/step - loss: 9.4920 -
accuracy: 0.3366
Epoch 124/200
391/391 [=====] - 3s 8ms/step - loss: 9.4193 -
accuracy: 0.3370
Epoch 125/200
391/391 [=====] - 3s 8ms/step - loss: 9.3473 -
accuracy: 0.3362
Epoch 126/200
391/391 [=====] - 3s 8ms/step - loss: 9.2695 -
accuracy: 0.3392
Epoch 127/200
391/391 [=====] - 3s 8ms/step - loss: 9.2029 -
accuracy: 0.3363
Epoch 128/200
391/391 [=====] - 3s 8ms/step - loss: 9.1314 -
accuracy: 0.3370
Epoch 129/200
391/391 [=====] - 3s 8ms/step - loss: 9.0605 -
accuracy: 0.3413
Epoch 130/200
391/391 [=====] - 3s 8ms/step - loss: 8.9922 -
accuracy: 0.3393
Epoch 131/200
391/391 [=====] - 3s 8ms/step - loss: 8.9221 -
```

```
accuracy: 0.3397
Epoch 132/200
391/391 [=====] - 3s 8ms/step - loss: 8.8540 -
accuracy: 0.3406
Epoch 133/200
391/391 [=====] - 3s 8ms/step - loss: 8.7869 -
accuracy: 0.3412
Epoch 134/200
391/391 [=====] - 3s 8ms/step - loss: 8.7203 -
accuracy: 0.3408
Epoch 135/200
391/391 [=====] - 3s 8ms/step - loss: 8.6566 -
accuracy: 0.3382
Epoch 136/200
391/391 [=====] - 3s 8ms/step - loss: 8.5901 -
accuracy: 0.3395
Epoch 137/200
391/391 [=====] - 3s 8ms/step - loss: 8.5247 -
accuracy: 0.3431
Epoch 138/200
391/391 [=====] - 3s 8ms/step - loss: 8.4631 -
accuracy: 0.3436
Epoch 139/200
391/391 [=====] - 3s 8ms/step - loss: 8.3958 -
accuracy: 0.3443
Epoch 140/200
391/391 [=====] - 3s 8ms/step - loss: 8.3318 -
accuracy: 0.3420
Epoch 141/200
391/391 [=====] - 3s 8ms/step - loss: 8.2729 -
accuracy: 0.3435
Epoch 142/200
391/391 [=====] - 3s 8ms/step - loss: 8.2086 -
accuracy: 0.3448
Epoch 143/200
391/391 [=====] - 3s 8ms/step - loss: 8.1476 -
accuracy: 0.3458
Epoch 144/200
391/391 [=====] - 3s 8ms/step - loss: 8.0884 -
accuracy: 0.3485
Epoch 145/200
391/391 [=====] - 3s 8ms/step - loss: 8.0292 -
accuracy: 0.3481
Epoch 146/200
391/391 [=====] - 3s 8ms/step - loss: 7.9702 -
accuracy: 0.3461
Epoch 147/200
391/391 [=====] - 3s 8ms/step - loss: 7.9108 -
accuracy: 0.3472
Epoch 148/200
391/391 [=====] - 3s 8ms/step - loss: 7.8502 -
accuracy: 0.3483
Epoch 149/200
391/391 [=====] - 3s 8ms/step - loss: 7.7955 -
accuracy: 0.3459
Epoch 150/200
391/391 [=====] - 3s 8ms/step - loss: 7.7375 -
```

```
accuracy: 0.3479
Epoch 151/200
391/391 [=====] - 3s 8ms/step - loss: 7.6828 -
accuracy: 0.3489
Epoch 152/200
391/391 [=====] - 3s 8ms/step - loss: 7.6279 -
accuracy: 0.3492
Epoch 153/200
391/391 [=====] - 3s 8ms/step - loss: 7.5727 -
accuracy: 0.3499
Epoch 154/200
391/391 [=====] - 3s 8ms/step - loss: 7.5174 -
accuracy: 0.3499
Epoch 155/200
391/391 [=====] - 3s 8ms/step - loss: 7.4614 -
accuracy: 0.3507
Epoch 156/200
391/391 [=====] - 3s 8ms/step - loss: 7.4085 -
accuracy: 0.3505
Epoch 157/200
391/391 [=====] - 3s 8ms/step - loss: 7.3583 -
accuracy: 0.3513
Epoch 158/200
391/391 [=====] - 3s 8ms/step - loss: 7.3067 -
accuracy: 0.3503
Epoch 159/200
391/391 [=====] - 3s 8ms/step - loss: 7.2526 -
accuracy: 0.3514
Epoch 160/200
391/391 [=====] - 3s 8ms/step - loss: 7.1997 -
accuracy: 0.3543
Epoch 161/200
391/391 [=====] - 3s 8ms/step - loss: 7.1527 -
accuracy: 0.3492
Epoch 162/200
391/391 [=====] - 3s 8ms/step - loss: 7.0986 -
accuracy: 0.3506
Epoch 163/200
391/391 [=====] - 3s 8ms/step - loss: 7.0511 -
accuracy: 0.3506
Epoch 164/200
391/391 [=====] - 3s 8ms/step - loss: 7.0019 -
accuracy: 0.3541
Epoch 165/200
391/391 [=====] - 3s 8ms/step - loss: 6.9523 -
accuracy: 0.3540
Epoch 166/200
391/391 [=====] - 3s 8ms/step - loss: 6.9044 -
accuracy: 0.3529
Epoch 167/200
391/391 [=====] - 3s 8ms/step - loss: 6.8549 -
accuracy: 0.3525
Epoch 168/200
391/391 [=====] - 3s 8ms/step - loss: 6.8068 -
accuracy: 0.3597
Epoch 169/200
391/391 [=====] - 3s 8ms/step - loss: 6.7610 -
```



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accuracy: 0.3553
Epoch 170/200
391/391 [=====] - 3s 8ms/step - loss: 6.7152 -
accuracy: 0.3560
Epoch 171/200
391/391 [=====] - 3s 8ms/step - loss: 6.6681 -
accuracy: 0.3548
Epoch 172/200
391/391 [=====] - 3s 8ms/step - loss: 6.6207 -
accuracy: 0.3593
Epoch 173/200
391/391 [=====] - 3s 8ms/step - loss: 6.5769 -
accuracy: 0.3578
Epoch 174/200
391/391 [=====] - 3s 8ms/step - loss: 6.5330 -
accuracy: 0.3579
Epoch 175/200
391/391 [=====] - 3s 8ms/step - loss: 6.4894 -
accuracy: 0.3548
Epoch 176/200
391/391 [=====] - 3s 8ms/step - loss: 6.4431 -
accuracy: 0.3584
Epoch 177/200
391/391 [=====] - 3s 8ms/step - loss: 6.4017 -
accuracy: 0.3582
Epoch 178/200
391/391 [=====] - 3s 8ms/step - loss: 6.3588 -
accuracy: 0.3577
Epoch 179/200
391/391 [=====] - 3s 8ms/step - loss: 6.3157 -
accuracy: 0.3591
Epoch 180/200
391/391 [=====] - 3s 8ms/step - loss: 6.2739 -
accuracy: 0.3591
Epoch 181/200
391/391 [=====] - 3s 8ms/step - loss: 6.2328 -
accuracy: 0.3604
Epoch 182/200
391/391 [=====] - 3s 8ms/step - loss: 6.1900 -
accuracy: 0.3602
Epoch 183/200
391/391 [=====] - 3s 8ms/step - loss: 6.1485 -
accuracy: 0.3601
Epoch 184/200
391/391 [=====] - 3s 8ms/step - loss: 6.1073 -
accuracy: 0.3612
Epoch 185/200
391/391 [=====] - 3s 8ms/step - loss: 6.0661 -
accuracy: 0.3608
Epoch 186/200
391/391 [=====] - 3s 8ms/step - loss: 6.0280 -
accuracy: 0.3605
Epoch 187/200
391/391 [=====] - 3s 8ms/step - loss: 5.9860 -
accuracy: 0.3629
Epoch 188/200
391/391 [=====] - 3s 8ms/step - loss: 5.9515 -
```

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accuracy: 0.3628
Epoch 189/200
391/391 [=====] - 3s 8ms/step - loss: 5.9111 -
accuracy: 0.3612
Epoch 190/200
391/391 [=====] - 3s 8ms/step - loss: 5.8714 -
accuracy: 0.3624
Epoch 191/200
391/391 [=====] - 3s 8ms/step - loss: 5.8329 -
accuracy: 0.3656
Epoch 192/200
391/391 [=====] - 3s 8ms/step - loss: 5.8005 -
accuracy: 0.3614
Epoch 193/200
391/391 [=====] - 3s 8ms/step - loss: 5.7614 -
accuracy: 0.3634
Epoch 194/200
391/391 [=====] - 3s 8ms/step - loss: 5.7238 -
accuracy: 0.3632
Epoch 195/200
391/391 [=====] - 3s 8ms/step - loss: 5.6856 -
accuracy: 0.3658
Epoch 196/200
391/391 [=====] - 3s 8ms/step - loss: 5.6520 -
accuracy: 0.3647
Epoch 197/200
391/391 [=====] - 3s 8ms/step - loss: 5.6162 -
accuracy: 0.3659
Epoch 198/200
391/391 [=====] - 3s 8ms/step - loss: 5.5794 -
accuracy: 0.3654
Epoch 199/200
391/391 [=====] - 3s 8ms/step - loss: 5.5447 -
accuracy: 0.3662
Epoch 200/200
391/391 [=====] - 3s 8ms/step - loss: 5.5114 -
accuracy: 0.3677
313/313 [=====] - 1s 4ms/step - loss: 5.4216 -
accuracy: 0.3998
Epoch 1/200
391/391 [=====] - 3s 8ms/step - loss: 4.9079 -
accuracy: 0.2223
Epoch 2/200
391/391 [=====] - 3s 7ms/step - loss: 2.2026 -
accuracy: 0.2524
Epoch 3/200
391/391 [=====] - 3s 8ms/step - loss: 2.1372 -
accuracy: 0.2495
Epoch 4/200
391/391 [=====] - 3s 8ms/step - loss: 2.1380 -
accuracy: 0.2455
Epoch 5/200
391/391 [=====] - 3s 8ms/step - loss: 2.1271 -
accuracy: 0.2442
Epoch 6/200
391/391 [=====] - 3s 8ms/step - loss: 2.1395 -
accuracy: 0.2381
```

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Epoch 7/200
391/391 [=====] - 3s 7ms/step - loss: 2.1297 -
accuracy: 0.2416
Epoch 8/200
391/391 [=====] - 3s 8ms/step - loss: 2.1353 -
accuracy: 0.2335
Epoch 9/200
391/391 [=====] - 3s 7ms/step - loss: 2.1324 -
accuracy: 0.2331
Epoch 10/200
391/391 [=====] - 3s 8ms/step - loss: 2.1366 -
accuracy: 0.2331
Epoch 11/200
391/391 [=====] - 3s 8ms/step - loss: 2.1431 -
accuracy: 0.2276
Epoch 12/200
391/391 [=====] - 3s 7ms/step - loss: 2.1408 -
accuracy: 0.2269
Epoch 13/200
391/391 [=====] - 3s 7ms/step - loss: 2.1448 -
accuracy: 0.2246
Epoch 14/200
391/391 [=====] - 3s 8ms/step - loss: 2.1373 -
accuracy: 0.2249
Epoch 15/200
391/391 [=====] - 3s 7ms/step - loss: 2.1353 -
accuracy: 0.2247
Epoch 16/200
391/391 [=====] - 3s 7ms/step - loss: 2.1360 -
accuracy: 0.2232
Epoch 17/200
391/391 [=====] - 3s 8ms/step - loss: 2.1367 -
accuracy: 0.2231
Epoch 18/200
391/391 [=====] - 3s 8ms/step - loss: 2.1326 -
accuracy: 0.2297
Epoch 19/200
391/391 [=====] - 3s 7ms/step - loss: 2.1318 -
accuracy: 0.2236
Epoch 20/200
391/391 [=====] - 3s 8ms/step - loss: 2.1406 -
accuracy: 0.2237
Epoch 21/200
391/391 [=====] - 3s 8ms/step - loss: 2.1491 -
accuracy: 0.2131
Epoch 22/200
391/391 [=====] - 3s 8ms/step - loss: 2.1387 -
accuracy: 0.2200
Epoch 23/200
391/391 [=====] - 3s 8ms/step - loss: 2.1377 -
accuracy: 0.2171
Epoch 24/200
391/391 [=====] - 3s 8ms/step - loss: 2.1422 -
accuracy: 0.2158
Epoch 25/200
391/391 [=====] - 3s 8ms/step - loss: 2.1407 -
accuracy: 0.2196
```

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Epoch 26/200
391/391 [=====] - 3s 7ms/step - loss: 2.1457 -
accuracy: 0.2142
Epoch 27/200
391/391 [=====] - 3s 8ms/step - loss: 2.1405 -
accuracy: 0.2166
Epoch 28/200
391/391 [=====] - 3s 7ms/step - loss: 2.1392 -
accuracy: 0.2194
Epoch 29/200
391/391 [=====] - 3s 7ms/step - loss: 2.1458 -
accuracy: 0.2121
Epoch 30/200
391/391 [=====] - 3s 7ms/step - loss: 2.1479 -
accuracy: 0.2126
Epoch 31/200
391/391 [=====] - 3s 8ms/step - loss: 2.1463 -
accuracy: 0.2133
Epoch 32/200
391/391 [=====] - 3s 7ms/step - loss: 2.1474 -
accuracy: 0.2110
Epoch 33/200
391/391 [=====] - 3s 8ms/step - loss: 2.1417 -
accuracy: 0.2181
Epoch 34/200
391/391 [=====] - 3s 8ms/step - loss: 2.1425 -
accuracy: 0.2184
Epoch 35/200
391/391 [=====] - 3s 8ms/step - loss: 2.1431 -
accuracy: 0.2155
Epoch 36/200
391/391 [=====] - 3s 7ms/step - loss: 2.1433 -
accuracy: 0.2145
Epoch 37/200
391/391 [=====] - 3s 8ms/step - loss: 2.1436 -
accuracy: 0.2124
Epoch 38/200
391/391 [=====] - 3s 7ms/step - loss: 2.1392 -
accuracy: 0.2181
Epoch 39/200
391/391 [=====] - 3s 7ms/step - loss: 2.1465 -
accuracy: 0.2160
Epoch 40/200
391/391 [=====] - 3s 7ms/step - loss: 2.1417 -
accuracy: 0.2188
Epoch 41/200
391/391 [=====] - 3s 8ms/step - loss: 2.1491 -
accuracy: 0.2162
Epoch 42/200
391/391 [=====] - 3s 7ms/step - loss: 2.1569 -
accuracy: 0.2078
Epoch 43/200
391/391 [=====] - 3s 7ms/step - loss: 2.1487 -
accuracy: 0.2115
Epoch 44/200
391/391 [=====] - 3s 8ms/step - loss: 2.1448 -
accuracy: 0.2169
```

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Epoch 45/200
391/391 [=====] - 3s 8ms/step - loss: 2.1400 -
accuracy: 0.2201
Epoch 46/200
391/391 [=====] - 3s 7ms/step - loss: 2.1377 -
accuracy: 0.2209
Epoch 47/200
391/391 [=====] - 3s 7ms/step - loss: 2.1443 -
accuracy: 0.2175
Epoch 48/200
391/391 [=====] - 3s 7ms/step - loss: 2.1441 -
accuracy: 0.2209
Epoch 49/200
391/391 [=====] - 3s 8ms/step - loss: 2.1397 -
accuracy: 0.2214
Epoch 50/200
391/391 [=====] - 3s 7ms/step - loss: 2.1435 -
accuracy: 0.2174
Epoch 51/200
391/391 [=====] - 3s 7ms/step - loss: 2.1426 -
accuracy: 0.2185
Epoch 52/200
391/391 [=====] - 3s 8ms/step - loss: 2.1404 -
accuracy: 0.2225
Epoch 53/200
391/391 [=====] - 3s 7ms/step - loss: 2.1412 -
accuracy: 0.2199
Epoch 54/200
391/391 [=====] - 3s 8ms/step - loss: 2.1402 -
accuracy: 0.2222
Epoch 55/200
391/391 [=====] - 3s 7ms/step - loss: 2.1392 -
accuracy: 0.2216
Epoch 56/200
391/391 [=====] - 3s 8ms/step - loss: 2.1400 -
accuracy: 0.2193
Epoch 57/200
391/391 [=====] - 3s 7ms/step - loss: 2.1465 -
accuracy: 0.2142
Epoch 58/200
391/391 [=====] - 3s 8ms/step - loss: 2.1427 -
accuracy: 0.2205
Epoch 59/200
391/391 [=====] - 3s 7ms/step - loss: 2.1422 -
accuracy: 0.2162
Epoch 60/200
391/391 [=====] - 3s 7ms/step - loss: 2.1409 -
accuracy: 0.2200
Epoch 61/200
391/391 [=====] - 3s 8ms/step - loss: 2.1390 -
accuracy: 0.2204
Epoch 62/200
391/391 [=====] - 3s 7ms/step - loss: 2.1464 -
accuracy: 0.2177
Epoch 63/200
391/391 [=====] - 3s 8ms/step - loss: 2.1416 -
accuracy: 0.2201
```

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Epoch 64/200
391/391 [=====] - 3s 7ms/step - loss: 2.1412 -
accuracy: 0.2200
Epoch 65/200
391/391 [=====] - 3s 8ms/step - loss: 2.1367 -
accuracy: 0.2207
Epoch 66/200
391/391 [=====] - 3s 7ms/step - loss: 2.1375 -
accuracy: 0.2197
Epoch 67/200
391/391 [=====] - 3s 7ms/step - loss: 2.1392 -
accuracy: 0.2192
Epoch 68/200
391/391 [=====] - 3s 7ms/step - loss: 2.1398 -
accuracy: 0.2206
Epoch 69/200
391/391 [=====] - 3s 7ms/step - loss: 2.1443 -
accuracy: 0.2187
Epoch 70/200
391/391 [=====] - 3s 7ms/step - loss: 2.1429 -
accuracy: 0.2177
Epoch 71/200
391/391 [=====] - 3s 7ms/step - loss: 2.1412 -
accuracy: 0.2185
Epoch 72/200
391/391 [=====] - 3s 7ms/step - loss: 2.1426 -
accuracy: 0.2177
Epoch 73/200
391/391 [=====] - 3s 7ms/step - loss: 2.1418 -
accuracy: 0.2204
Epoch 74/200
391/391 [=====] - 3s 7ms/step - loss: 2.1372 -
accuracy: 0.2203
Epoch 75/200
391/391 [=====] - 3s 8ms/step - loss: 2.1395 -
accuracy: 0.2202
Epoch 76/200
391/391 [=====] - 3s 8ms/step - loss: 2.1361 -
accuracy: 0.2211
Epoch 77/200
391/391 [=====] - 3s 7ms/step - loss: 2.1410 -
accuracy: 0.2187
Epoch 78/200
391/391 [=====] - 3s 8ms/step - loss: 2.1394 -
accuracy: 0.2216
Epoch 79/200
391/391 [=====] - 3s 7ms/step - loss: 2.1408 -
accuracy: 0.2214
Epoch 80/200
391/391 [=====] - 3s 7ms/step - loss: 2.1400 -
accuracy: 0.2200
Epoch 81/200
391/391 [=====] - 3s 7ms/step - loss: 2.1482 -
accuracy: 0.2153
Epoch 82/200
391/391 [=====] - 3s 8ms/step - loss: 2.1466 -
accuracy: 0.2157
```

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Epoch 83/200
391/391 [=====] - 3s 7ms/step - loss: 2.1448 -
accuracy: 0.2168
Epoch 84/200
391/391 [=====] - 3s 8ms/step - loss: 2.1415 -
accuracy: 0.2188
Epoch 85/200
391/391 [=====] - 3s 8ms/step - loss: 2.1361 -
accuracy: 0.2215
Epoch 86/200
391/391 [=====] - 3s 7ms/step - loss: 2.1343 -
accuracy: 0.2258
Epoch 87/200
391/391 [=====] - 3s 7ms/step - loss: 2.1454 -
accuracy: 0.2208
Epoch 88/200
391/391 [=====] - 3s 7ms/step - loss: 2.1447 -
accuracy: 0.2154
Epoch 89/200
391/391 [=====] - 3s 8ms/step - loss: 2.1400 -
accuracy: 0.2206
Epoch 90/200
391/391 [=====] - 3s 7ms/step - loss: 2.1430 -
accuracy: 0.2189
Epoch 91/200
391/391 [=====] - 3s 7ms/step - loss: 2.1405 -
accuracy: 0.2189
Epoch 92/200
391/391 [=====] - 3s 8ms/step - loss: 2.1423 -
accuracy: 0.2196
Epoch 93/200
391/391 [=====] - 3s 8ms/step - loss: 2.1400 -
accuracy: 0.2222
Epoch 94/200
391/391 [=====] - 3s 8ms/step - loss: 2.1406 -
accuracy: 0.2225
Epoch 95/200
391/391 [=====] - 3s 8ms/step - loss: 2.1430 -
accuracy: 0.2195
Epoch 96/200
391/391 [=====] - 3s 8ms/step - loss: 2.1400 -
accuracy: 0.2205
Epoch 97/200
391/391 [=====] - 3s 8ms/step - loss: 2.1403 -
accuracy: 0.2171
Epoch 98/200
391/391 [=====] - 3s 7ms/step - loss: 2.1528 -
accuracy: 0.2118
Epoch 99/200
391/391 [=====] - 3s 8ms/step - loss: 2.1464 -
accuracy: 0.2153
Epoch 100/200
391/391 [=====] - 3s 7ms/step - loss: 2.1485 -
accuracy: 0.2135
Epoch 101/200
391/391 [=====] - 3s 7ms/step - loss: 2.1466 -
accuracy: 0.2144
```

```
Epoch 102/200
391/391 [=====] - 3s 7ms/step - loss: 2.1503 -
accuracy: 0.2131
Epoch 103/200
391/391 [=====] - 3s 7ms/step - loss: 2.1466 -
accuracy: 0.2144
Epoch 104/200
391/391 [=====] - 3s 8ms/step - loss: 2.1491 -
accuracy: 0.2107
Epoch 105/200
391/391 [=====] - 3s 7ms/step - loss: 2.1477 -
accuracy: 0.2106
Epoch 106/200
391/391 [=====] - 3s 8ms/step - loss: 2.1483 -
accuracy: 0.2161
Epoch 107/200
391/391 [=====] - 3s 7ms/step - loss: 2.1479 -
accuracy: 0.2110
Epoch 108/200
391/391 [=====] - 3s 7ms/step - loss: 2.1497 -
accuracy: 0.2072
Epoch 109/200
391/391 [=====] - 3s 8ms/step - loss: 2.1599 -
accuracy: 0.1983
Epoch 110/200
391/391 [=====] - 3s 8ms/step - loss: 2.1544 -
accuracy: 0.2002
Epoch 111/200
391/391 [=====] - 3s 7ms/step - loss: 2.1546 -
accuracy: 0.2012
Epoch 112/200
391/391 [=====] - 3s 7ms/step - loss: 2.1523 -
accuracy: 0.2030
Epoch 113/200
391/391 [=====] - 3s 8ms/step - loss: 2.1540 -
accuracy: 0.2022
Epoch 114/200
391/391 [=====] - 3s 7ms/step - loss: 2.1527 -
accuracy: 0.2030
Epoch 115/200
391/391 [=====] - 3s 8ms/step - loss: 2.1543 -
accuracy: 0.2039
Epoch 116/200
391/391 [=====] - 3s 8ms/step - loss: 2.1549 -
accuracy: 0.2041
Epoch 117/200
391/391 [=====] - 3s 8ms/step - loss: 2.1545 -
accuracy: 0.2008
Epoch 118/200
391/391 [=====] - 3s 7ms/step - loss: 2.1558 -
accuracy: 0.2016
Epoch 119/200
391/391 [=====] - 3s 7ms/step - loss: 2.1528 -
accuracy: 0.2035
Epoch 120/200
391/391 [=====] - 3s 8ms/step - loss: 2.1585 -
accuracy: 0.2028
```



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Epoch 121/200
391/391 [=====] - 3s 7ms/step - loss: 2.1533 -
accuracy: 0.2023
Epoch 122/200
391/391 [=====] - 3s 7ms/step - loss: 2.1495 -
accuracy: 0.2045
Epoch 123/200
391/391 [=====] - 3s 8ms/step - loss: 2.1495 -
accuracy: 0.2052
Epoch 124/200
391/391 [=====] - 3s 8ms/step - loss: 2.1526 -
accuracy: 0.2054
Epoch 125/200
391/391 [=====] - 3s 7ms/step - loss: 2.1530 -
accuracy: 0.2046
Epoch 126/200
391/391 [=====] - 3s 8ms/step - loss: 2.1635 -
accuracy: 0.1986
Epoch 127/200
391/391 [=====] - 3s 8ms/step - loss: 2.1519 -
accuracy: 0.2055
Epoch 128/200
391/391 [=====] - 3s 8ms/step - loss: 2.1606 -
accuracy: 0.2014
Epoch 129/200
391/391 [=====] - 3s 8ms/step - loss: 2.1565 -
accuracy: 0.2003
Epoch 130/200
391/391 [=====] - 3s 8ms/step - loss: 2.1566 -
accuracy: 0.1993
Epoch 131/200
391/391 [=====] - 3s 7ms/step - loss: 2.1537 -
accuracy: 0.2015
Epoch 132/200
391/391 [=====] - 3s 7ms/step - loss: 2.1528 -
accuracy: 0.2044
Epoch 133/200
391/391 [=====] - 3s 8ms/step - loss: 2.1517 -
accuracy: 0.2056
Epoch 134/200
391/391 [=====] - 3s 8ms/step - loss: 2.1510 -
accuracy: 0.2040
Epoch 135/200
391/391 [=====] - 3s 8ms/step - loss: 2.1503 -
accuracy: 0.2069
Epoch 136/200
391/391 [=====] - 3s 8ms/step - loss: 2.1536 -
accuracy: 0.2042
Epoch 137/200
391/391 [=====] - 3s 8ms/step - loss: 2.1525 -
accuracy: 0.2059
Epoch 138/200
391/391 [=====] - 3s 8ms/step - loss: 2.1556 -
accuracy: 0.2038
Epoch 139/200
391/391 [=====] - 3s 7ms/step - loss: 2.1556 -
accuracy: 0.2044
```

```
Epoch 140/200
391/391 [=====] - 3s 8ms/step - loss: 2.1544 -
accuracy: 0.2029
Epoch 141/200
391/391 [=====] - 3s 7ms/step - loss: 2.1557 -
accuracy: 0.2026
Epoch 142/200
391/391 [=====] - 3s 7ms/step - loss: 2.1560 -
accuracy: 0.2021
Epoch 143/200
391/391 [=====] - 3s 8ms/step - loss: 2.1528 -
accuracy: 0.2056
Epoch 144/200
391/391 [=====] - 3s 8ms/step - loss: 2.1571 -
accuracy: 0.2014
Epoch 145/200
391/391 [=====] - 3s 8ms/step - loss: 2.1565 -
accuracy: 0.2016
Epoch 146/200
391/391 [=====] - 3s 8ms/step - loss: 2.1549 -
accuracy: 0.2031
Epoch 147/200
391/391 [=====] - 3s 8ms/step - loss: 2.1512 -
accuracy: 0.2033
Epoch 148/200
391/391 [=====] - 3s 7ms/step - loss: 2.1548 -
accuracy: 0.2012
Epoch 149/200
391/391 [=====] - 3s 7ms/step - loss: 2.1528 -
accuracy: 0.2020
Epoch 150/200
391/391 [=====] - 3s 8ms/step - loss: 2.1579 -
accuracy: 0.2025
Epoch 151/200
391/391 [=====] - 3s 8ms/step - loss: 2.1542 -
accuracy: 0.2056
Epoch 152/200
391/391 [=====] - 3s 7ms/step - loss: 2.1506 -
accuracy: 0.2038
Epoch 153/200
391/391 [=====] - 3s 7ms/step - loss: 2.1537 -
accuracy: 0.2030
Epoch 154/200
391/391 [=====] - 3s 8ms/step - loss: 2.1551 -
accuracy: 0.2023
Epoch 155/200
391/391 [=====] - 3s 8ms/step - loss: 2.1514 -
accuracy: 0.2021
Epoch 156/200
391/391 [=====] - 3s 8ms/step - loss: 2.1528 -
accuracy: 0.2034
Epoch 157/200
391/391 [=====] - 3s 8ms/step - loss: 2.1563 -
accuracy: 0.2042
Epoch 158/200
391/391 [=====] - 3s 7ms/step - loss: 2.1539 -
accuracy: 0.2047
```

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Epoch 159/200
391/391 [=====] - 3s 8ms/step - loss: 2.1527 -
accuracy: 0.2016
Epoch 160/200
391/391 [=====] - 3s 7ms/step - loss: 2.1542 -
accuracy: 0.2004
Epoch 161/200
391/391 [=====] - 3s 8ms/step - loss: 2.1547 -
accuracy: 0.2063
Epoch 162/200
391/391 [=====] - 3s 7ms/step - loss: 2.1525 -
accuracy: 0.2047
Epoch 163/200
391/391 [=====] - 3s 7ms/step - loss: 2.1532 -
accuracy: 0.2024
Epoch 164/200
391/391 [=====] - 3s 8ms/step - loss: 2.1504 -
accuracy: 0.2057
Epoch 165/200
391/391 [=====] - 3s 8ms/step - loss: 2.1570 -
accuracy: 0.2020
Epoch 166/200
391/391 [=====] - 3s 8ms/step - loss: 2.1593 -
accuracy: 0.2004
Epoch 167/200
391/391 [=====] - 3s 8ms/step - loss: 2.1598 -
accuracy: 0.2014
Epoch 168/200
391/391 [=====] - 3s 8ms/step - loss: 2.1518 -
accuracy: 0.2033
Epoch 169/200
391/391 [=====] - 3s 7ms/step - loss: 2.1504 -
accuracy: 0.2048
Epoch 170/200
391/391 [=====] - 3s 7ms/step - loss: 2.1564 -
accuracy: 0.2034
Epoch 171/200
391/391 [=====] - 3s 8ms/step - loss: 2.1579 -
accuracy: 0.2016
Epoch 172/200
391/391 [=====] - 3s 8ms/step - loss: 2.1569 -
accuracy: 0.2029
Epoch 173/200
391/391 [=====] - 3s 7ms/step - loss: 2.1528 -
accuracy: 0.2042
Epoch 174/200
391/391 [=====] - 3s 8ms/step - loss: 2.1535 -
accuracy: 0.2041
Epoch 175/200
391/391 [=====] - 3s 7ms/step - loss: 2.1561 -
accuracy: 0.2021
Epoch 176/200
391/391 [=====] - 3s 8ms/step - loss: 2.1560 -
accuracy: 0.2035
Epoch 177/200
391/391 [=====] - 3s 7ms/step - loss: 2.1530 -
accuracy: 0.2007
```

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Epoch 178/200
391/391 [=====] - 3s 8ms/step - loss: 2.1503 -
accuracy: 0.2044
Epoch 179/200
391/391 [=====] - 3s 7ms/step - loss: 2.1563 -
accuracy: 0.2049
Epoch 180/200
391/391 [=====] - 3s 7ms/step - loss: 2.1508 -
accuracy: 0.2032
Epoch 181/200
391/391 [=====] - 3s 7ms/step - loss: 2.1535 -
accuracy: 0.2048
Epoch 182/200
391/391 [=====] - 3s 7ms/step - loss: 2.1515 -
accuracy: 0.2043
Epoch 183/200
391/391 [=====] - 3s 7ms/step - loss: 2.1535 -
accuracy: 0.2022
Epoch 184/200
391/391 [=====] - 3s 7ms/step - loss: 2.1526 -
accuracy: 0.2059
Epoch 185/200
391/391 [=====] - 3s 8ms/step - loss: 2.1498 -
accuracy: 0.2045
Epoch 186/200
391/391 [=====] - 3s 7ms/step - loss: 2.1543 -
accuracy: 0.2049
Epoch 187/200
391/391 [=====] - 3s 7ms/step - loss: 2.1549 -
accuracy: 0.2062
Epoch 188/200
391/391 [=====] - 3s 7ms/step - loss: 2.1511 -
accuracy: 0.2073
Epoch 189/200
391/391 [=====] - 3s 7ms/step - loss: 2.1499 -
accuracy: 0.2043
Epoch 190/200
391/391 [=====] - 3s 7ms/step - loss: 2.1560 -
accuracy: 0.2025
Epoch 191/200
391/391 [=====] - 3s 8ms/step - loss: 2.1544 -
accuracy: 0.2020
Epoch 192/200
391/391 [=====] - 3s 7ms/step - loss: 2.1508 -
accuracy: 0.2086
Epoch 193/200
391/391 [=====] - 3s 7ms/step - loss: 2.1545 -
accuracy: 0.2043
Epoch 194/200
391/391 [=====] - 3s 7ms/step - loss: 2.1513 -
accuracy: 0.2009
Epoch 195/200
391/391 [=====] - 3s 7ms/step - loss: 2.1547 -
accuracy: 0.2026
Epoch 196/200
391/391 [=====] - 3s 7ms/step - loss: 2.1514 -
accuracy: 0.2040
```

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Epoch 197/200
391/391 [=====] - 3s 7ms/step - loss: 2.1515 -
accuracy: 0.2032
Epoch 198/200
391/391 [=====] - 3s 8ms/step - loss: 2.1557 -
accuracy: 0.2033
Epoch 199/200
391/391 [=====] - 3s 8ms/step - loss: 2.1557 -
accuracy: 0.2037
Epoch 200/200
391/391 [=====] - 3s 7ms/step - loss: 2.1544 -
accuracy: 0.2032
313/313 [=====] - 1s 4ms/step - loss: 2.0946 -
accuracy: 0.2479
Epoch 1/200
391/391 [=====] - 5s 12ms/step - loss: 5.0515
- accuracy: 0.2120
Epoch 2/200
391/391 [=====] - 5s 12ms/step - loss: 2.1732
- accuracy: 0.2532
Epoch 3/200
391/391 [=====] - 5s 12ms/step - loss: 2.1315
- accuracy: 0.2566
Epoch 4/200
391/391 [=====] - 5s 12ms/step - loss: 2.1213
- accuracy: 0.2654
Epoch 5/200
391/391 [=====] - 5s 12ms/step - loss: 2.1204
- accuracy: 0.2641
Epoch 6/200
391/391 [=====] - 5s 12ms/step - loss: 2.1141
- accuracy: 0.2666
Epoch 7/200
391/391 [=====] - 5s 12ms/step - loss: 2.1093
- accuracy: 0.2683
Epoch 8/200
391/391 [=====] - 5s 12ms/step - loss: 2.1111
- accuracy: 0.2653
Epoch 9/200
391/391 [=====] - 5s 12ms/step - loss: 2.1059
- accuracy: 0.2676
Epoch 10/200
391/391 [=====] - 5s 12ms/step - loss: 2.1001
- accuracy: 0.2686
Epoch 11/200
391/391 [=====] - 5s 12ms/step - loss: 2.1016
- accuracy: 0.2712
Epoch 12/200
391/391 [=====] - 5s 12ms/step - loss: 2.1002
- accuracy: 0.2713
Epoch 13/200
391/391 [=====] - 5s 12ms/step - loss: 2.0967
- accuracy: 0.2719
Epoch 14/200
391/391 [=====] - 5s 12ms/step - loss: 2.0997
- accuracy: 0.2730
Epoch 15/200
```

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391/391 [=====] - 5s 12ms/step - loss: 2.0934
- accuracy: 0.2717
Epoch 16/200
391/391 [=====] - 5s 12ms/step - loss: 2.0943
- accuracy: 0.2730
Epoch 17/200
391/391 [=====] - 5s 12ms/step - loss: 2.0913
- accuracy: 0.2733
Epoch 18/200
391/391 [=====] - 5s 12ms/step - loss: 2.0927
- accuracy: 0.2733
Epoch 19/200
391/391 [=====] - 5s 12ms/step - loss: 2.0879
- accuracy: 0.2747
Epoch 20/200
391/391 [=====] - 5s 12ms/step - loss: 2.0898
- accuracy: 0.2755
Epoch 21/200
391/391 [=====] - 5s 12ms/step - loss: 2.0907
- accuracy: 0.2734
Epoch 22/200
391/391 [=====] - 5s 12ms/step - loss: 2.0880
- accuracy: 0.2726
Epoch 23/200
391/391 [=====] - 5s 12ms/step - loss: 2.0886
- accuracy: 0.2751
Epoch 24/200
391/391 [=====] - 5s 12ms/step - loss: 2.0888
- accuracy: 0.2758
Epoch 25/200
391/391 [=====] - 5s 12ms/step - loss: 2.0908
- accuracy: 0.2712
Epoch 26/200
391/391 [=====] - 5s 12ms/step - loss: 2.0855
- accuracy: 0.2750
Epoch 27/200
391/391 [=====] - 5s 12ms/step - loss: 2.0860
- accuracy: 0.2734
Epoch 28/200
391/391 [=====] - 5s 12ms/step - loss: 2.0887
- accuracy: 0.2763
Epoch 29/200
391/391 [=====] - 5s 12ms/step - loss: 2.0854
- accuracy: 0.2774
Epoch 30/200
391/391 [=====] - 5s 12ms/step - loss: 2.0913
- accuracy: 0.2764
Epoch 31/200
391/391 [=====] - 5s 12ms/step - loss: 2.0880
- accuracy: 0.2720
Epoch 32/200
391/391 [=====] - 5s 12ms/step - loss: 2.0887
- accuracy: 0.2745
Epoch 33/200
391/391 [=====] - 5s 12ms/step - loss: 2.0893
- accuracy: 0.2752
Epoch 34/200
```

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391/391 [=====] - 5s 12ms/step - loss: 2.0860
- accuracy: 0.2757
Epoch 35/200
391/391 [=====] - 5s 12ms/step - loss: 2.0905
- accuracy: 0.2702
Epoch 36/200
391/391 [=====] - 5s 12ms/step - loss: 2.0884
- accuracy: 0.2735
Epoch 37/200
391/391 [=====] - 5s 12ms/step - loss: 2.0932
- accuracy: 0.2704
Epoch 38/200
391/391 [=====] - 5s 12ms/step - loss: 2.0874
- accuracy: 0.2704
Epoch 39/200
391/391 [=====] - 5s 12ms/step - loss: 2.0905
- accuracy: 0.2732
Epoch 40/200
391/391 [=====] - 5s 12ms/step - loss: 2.0874
- accuracy: 0.2724
Epoch 41/200
391/391 [=====] - 5s 12ms/step - loss: 2.0929
- accuracy: 0.2730
Epoch 42/200
391/391 [=====] - 5s 12ms/step - loss: 2.0850
- accuracy: 0.2738
Epoch 43/200
391/391 [=====] - 5s 12ms/step - loss: 2.0901
- accuracy: 0.2725
Epoch 44/200
391/391 [=====] - 5s 12ms/step - loss: 2.0897
- accuracy: 0.2724
Epoch 45/200
391/391 [=====] - 5s 12ms/step - loss: 2.0958
- accuracy: 0.2642
Epoch 46/200
391/391 [=====] - 5s 12ms/step - loss: 2.0914
- accuracy: 0.2650
Epoch 47/200
391/391 [=====] - 5s 12ms/step - loss: 2.0922
- accuracy: 0.2665
Epoch 48/200
391/391 [=====] - 5s 12ms/step - loss: 2.0915
- accuracy: 0.2661
Epoch 49/200
391/391 [=====] - 5s 12ms/step - loss: 2.0908
- accuracy: 0.2698
Epoch 50/200
391/391 [=====] - 5s 12ms/step - loss: 2.0951
- accuracy: 0.2677
Epoch 51/200
391/391 [=====] - 5s 12ms/step - loss: 2.0925
- accuracy: 0.2687
Epoch 52/200
391/391 [=====] - 5s 12ms/step - loss: 2.0917
- accuracy: 0.2690
Epoch 53/200
```

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391/391 [=====] - 5s 12ms/step - loss: 2.0909
- accuracy: 0.2662
Epoch 54/200
391/391 [=====] - 5s 12ms/step - loss: 2.0941
- accuracy: 0.2702
Epoch 55/200
391/391 [=====] - 5s 12ms/step - loss: 2.0949
- accuracy: 0.2623
Epoch 56/200
391/391 [=====] - 5s 12ms/step - loss: 2.0930
- accuracy: 0.2637
Epoch 57/200
391/391 [=====] - 5s 12ms/step - loss: 2.0948
- accuracy: 0.2639
Epoch 58/200
391/391 [=====] - 5s 12ms/step - loss: 2.0961
- accuracy: 0.2601
Epoch 59/200
391/391 [=====] - 5s 12ms/step - loss: 2.0927
- accuracy: 0.2614
Epoch 60/200
391/391 [=====] - 5s 12ms/step - loss: 2.0967
- accuracy: 0.2627
Epoch 61/200
391/391 [=====] - 5s 12ms/step - loss: 2.0974
- accuracy: 0.2629
Epoch 62/200
391/391 [=====] - 5s 12ms/step - loss: 2.0940
- accuracy: 0.2613
Epoch 63/200
391/391 [=====] - 5s 12ms/step - loss: 2.0981
- accuracy: 0.2605
Epoch 64/200
391/391 [=====] - 5s 12ms/step - loss: 2.0939
- accuracy: 0.2628
Epoch 65/200
391/391 [=====] - 5s 12ms/step - loss: 2.0961
- accuracy: 0.2642
Epoch 66/200
391/391 [=====] - 5s 12ms/step - loss: 2.0962
- accuracy: 0.2616
Epoch 67/200
391/391 [=====] - 5s 12ms/step - loss: 2.0962
- accuracy: 0.2624
Epoch 68/200
391/391 [=====] - 5s 12ms/step - loss: 2.0960
- accuracy: 0.2636
Epoch 69/200
391/391 [=====] - 5s 12ms/step - loss: 2.0978
- accuracy: 0.2591
Epoch 70/200
391/391 [=====] - 5s 12ms/step - loss: 2.0970
- accuracy: 0.2612
Epoch 71/200
391/391 [=====] - 5s 12ms/step - loss: 2.0954
- accuracy: 0.2653
Epoch 72/200
```



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391/391 [=====] - 5s 12ms/step - loss: 2.0946
- accuracy: 0.2657
Epoch 73/200
391/391 [=====] - 5s 12ms/step - loss: 2.0998
- accuracy: 0.2592
Epoch 74/200
391/391 [=====] - 5s 12ms/step - loss: 2.0998
- accuracy: 0.2626
Epoch 75/200
391/391 [=====] - 5s 12ms/step - loss: 2.0987
- accuracy: 0.2607
Epoch 76/200
391/391 [=====] - 5s 12ms/step - loss: 2.0957
- accuracy: 0.2630
Epoch 77/200
391/391 [=====] - 5s 12ms/step - loss: 2.0956
- accuracy: 0.2626
Epoch 78/200
391/391 [=====] - 5s 12ms/step - loss: 2.0965
- accuracy: 0.2603
Epoch 79/200
391/391 [=====] - 5s 12ms/step - loss: 2.0937
- accuracy: 0.2646
Epoch 80/200
391/391 [=====] - 5s 12ms/step - loss: 2.0950
- accuracy: 0.2631
Epoch 81/200
391/391 [=====] - 5s 12ms/step - loss: 2.0965
- accuracy: 0.2653
Epoch 82/200
391/391 [=====] - 5s 12ms/step - loss: 2.0974
- accuracy: 0.2615
Epoch 83/200
391/391 [=====] - 5s 12ms/step - loss: 2.0993
- accuracy: 0.2628
Epoch 84/200
391/391 [=====] - 5s 12ms/step - loss: 2.0951
- accuracy: 0.2631
Epoch 85/200
391/391 [=====] - 5s 12ms/step - loss: 2.0989
- accuracy: 0.2629
Epoch 86/200
391/391 [=====] - 5s 12ms/step - loss: 2.0951
- accuracy: 0.2624
Epoch 87/200
391/391 [=====] - 5s 13ms/step - loss: 2.0954
- accuracy: 0.2632
Epoch 88/200
391/391 [=====] - 5s 12ms/step - loss: 2.0966
- accuracy: 0.2636
Epoch 89/200
391/391 [=====] - 5s 12ms/step - loss: 2.0990
- accuracy: 0.2613
Epoch 90/200
391/391 [=====] - 5s 12ms/step - loss: 2.0994
- accuracy: 0.2602
Epoch 91/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 2.0955
- accuracy: 0.2663
Epoch 92/200
391/391 [=====] - 5s 12ms/step - loss: 2.0937
- accuracy: 0.2640
Epoch 93/200
391/391 [=====] - 5s 12ms/step - loss: 2.0967
- accuracy: 0.2632
Epoch 94/200
391/391 [=====] - 5s 12ms/step - loss: 2.1013
- accuracy: 0.2628
Epoch 95/200
391/391 [=====] - 5s 12ms/step - loss: 2.1016
- accuracy: 0.2599
Epoch 96/200
391/391 [=====] - 5s 12ms/step - loss: 2.0985
- accuracy: 0.2579
Epoch 97/200
391/391 [=====] - 5s 12ms/step - loss: 2.0969
- accuracy: 0.2607
Epoch 98/200
391/391 [=====] - 5s 12ms/step - loss: 2.0967
- accuracy: 0.2639
Epoch 99/200
391/391 [=====] - 5s 12ms/step - loss: 2.1006
- accuracy: 0.2589
Epoch 100/200
391/391 [=====] - 5s 12ms/step - loss: 2.1015
- accuracy: 0.2603
Epoch 101/200
391/391 [=====] - 5s 12ms/step - loss: 2.0967
- accuracy: 0.2618
Epoch 102/200
391/391 [=====] - 5s 12ms/step - loss: 2.0964
- accuracy: 0.2624
Epoch 103/200
391/391 [=====] - 5s 12ms/step - loss: 2.0955
- accuracy: 0.2631
Epoch 104/200
391/391 [=====] - 5s 12ms/step - loss: 2.0978
- accuracy: 0.2624
Epoch 105/200
391/391 [=====] - 5s 12ms/step - loss: 2.0990
- accuracy: 0.2622
Epoch 106/200
391/391 [=====] - 5s 12ms/step - loss: 2.0975
- accuracy: 0.2593
Epoch 107/200
391/391 [=====] - 5s 12ms/step - loss: 2.0984
- accuracy: 0.2619
Epoch 108/200
391/391 [=====] - 5s 12ms/step - loss: 2.0970
- accuracy: 0.2625
Epoch 109/200
391/391 [=====] - 5s 12ms/step - loss: 2.0993
- accuracy: 0.2595
Epoch 110/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 2.0977
- accuracy: 0.2587
Epoch 111/200
391/391 [=====] - 5s 12ms/step - loss: 2.0975
- accuracy: 0.2604
Epoch 112/200
391/391 [=====] - 5s 12ms/step - loss: 2.0981
- accuracy: 0.2604
Epoch 113/200
391/391 [=====] - 5s 12ms/step - loss: 2.0963
- accuracy: 0.2638
Epoch 114/200
391/391 [=====] - 5s 12ms/step - loss: 2.0957
- accuracy: 0.2661
Epoch 115/200
391/391 [=====] - 5s 12ms/step - loss: 2.1031
- accuracy: 0.2567
Epoch 116/200
391/391 [=====] - 5s 12ms/step - loss: 2.1049
- accuracy: 0.2585
Epoch 117/200
391/391 [=====] - 5s 12ms/step - loss: 2.1009
- accuracy: 0.2580
Epoch 118/200
391/391 [=====] - 5s 12ms/step - loss: 2.1032
- accuracy: 0.2553
Epoch 119/200
391/391 [=====] - 5s 12ms/step - loss: 2.0997
- accuracy: 0.2560
Epoch 120/200
391/391 [=====] - 5s 12ms/step - loss: 2.1021
- accuracy: 0.2562
Epoch 121/200
391/391 [=====] - 5s 12ms/step - loss: 2.1043
- accuracy: 0.2552
Epoch 122/200
391/391 [=====] - 5s 12ms/step - loss: 2.1001
- accuracy: 0.2564
Epoch 123/200
391/391 [=====] - 5s 12ms/step - loss: 2.1012
- accuracy: 0.2580
Epoch 124/200
391/391 [=====] - 5s 12ms/step - loss: 2.1059
- accuracy: 0.2545
Epoch 125/200
391/391 [=====] - 5s 12ms/step - loss: 2.1031
- accuracy: 0.2558
Epoch 126/200
391/391 [=====] - 5s 12ms/step - loss: 2.0992
- accuracy: 0.2547
Epoch 127/200
391/391 [=====] - 5s 12ms/step - loss: 2.1033
- accuracy: 0.2559
Epoch 128/200
391/391 [=====] - 5s 12ms/step - loss: 2.1039
- accuracy: 0.2542
Epoch 129/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 2.1019
- accuracy: 0.2558
Epoch 130/200
391/391 [=====] - 5s 12ms/step - loss: 2.1013
- accuracy: 0.2566
Epoch 131/200
391/391 [=====] - 5s 12ms/step - loss: 2.1008
- accuracy: 0.2585
Epoch 132/200
391/391 [=====] - 5s 12ms/step - loss: 2.1007
- accuracy: 0.2556
Epoch 133/200
391/391 [=====] - 5s 12ms/step - loss: 2.1016
- accuracy: 0.2565
Epoch 134/200
391/391 [=====] - 5s 12ms/step - loss: 2.1000
- accuracy: 0.2592
Epoch 135/200
391/391 [=====] - 5s 12ms/step - loss: 2.1075
- accuracy: 0.2548
Epoch 136/200
391/391 [=====] - 5s 12ms/step - loss: 2.1030
- accuracy: 0.2541
Epoch 137/200
391/391 [=====] - 5s 12ms/step - loss: 2.1085
- accuracy: 0.2545
Epoch 138/200
391/391 [=====] - 5s 12ms/step - loss: 2.1038
- accuracy: 0.2543
Epoch 139/200
391/391 [=====] - 5s 12ms/step - loss: 2.1029
- accuracy: 0.2539
Epoch 140/200
391/391 [=====] - 5s 12ms/step - loss: 2.1055
- accuracy: 0.2545
Epoch 141/200
391/391 [=====] - 5s 12ms/step - loss: 2.1053
- accuracy: 0.2528
Epoch 142/200
391/391 [=====] - 5s 12ms/step - loss: 2.1055
- accuracy: 0.2529
Epoch 143/200
391/391 [=====] - 5s 12ms/step - loss: 2.1047
- accuracy: 0.2553
Epoch 144/200
391/391 [=====] - 5s 12ms/step - loss: 2.1039
- accuracy: 0.2517
Epoch 145/200
391/391 [=====] - 5s 12ms/step - loss: 2.1037
- accuracy: 0.2565
Epoch 146/200
391/391 [=====] - 5s 12ms/step - loss: 2.1040
- accuracy: 0.2552
Epoch 147/200
391/391 [=====] - 5s 12ms/step - loss: 2.1030
- accuracy: 0.2536
Epoch 148/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 2.1038
- accuracy: 0.2538
Epoch 149/200
391/391 [=====] - 5s 12ms/step - loss: 2.1041
- accuracy: 0.2549
Epoch 150/200
391/391 [=====] - 5s 12ms/step - loss: 2.1044
- accuracy: 0.2508
Epoch 151/200
391/391 [=====] - 5s 12ms/step - loss: 2.1068
- accuracy: 0.2520
Epoch 152/200
391/391 [=====] - 5s 12ms/step - loss: 2.1056
- accuracy: 0.2543
Epoch 153/200
391/391 [=====] - 5s 12ms/step - loss: 2.1065
- accuracy: 0.2532
Epoch 154/200
391/391 [=====] - 5s 12ms/step - loss: 2.1085
- accuracy: 0.2512
Epoch 155/200
391/391 [=====] - 5s 12ms/step - loss: 2.1008
- accuracy: 0.2545
Epoch 156/200
391/391 [=====] - 5s 12ms/step - loss: 2.1059
- accuracy: 0.2527
Epoch 157/200
391/391 [=====] - 5s 12ms/step - loss: 2.1098
- accuracy: 0.2500
Epoch 158/200
391/391 [=====] - 5s 12ms/step - loss: 2.1030
- accuracy: 0.2526
Epoch 159/200
391/391 [=====] - 5s 12ms/step - loss: 2.1076
- accuracy: 0.2509
Epoch 160/200
391/391 [=====] - 5s 12ms/step - loss: 2.1051
- accuracy: 0.2541
Epoch 161/200
391/391 [=====] - 5s 12ms/step - loss: 2.1015
- accuracy: 0.2537
Epoch 162/200
391/391 [=====] - 5s 12ms/step - loss: 2.1043
- accuracy: 0.2548
Epoch 163/200
391/391 [=====] - 5s 12ms/step - loss: 2.1026
- accuracy: 0.2531
Epoch 164/200
391/391 [=====] - 5s 12ms/step - loss: 2.1039
- accuracy: 0.2530
Epoch 165/200
391/391 [=====] - 5s 12ms/step - loss: 2.1042
- accuracy: 0.2517
Epoch 166/200
391/391 [=====] - 5s 12ms/step - loss: 2.1036
- accuracy: 0.2538
Epoch 167/200
```

```
391/391 [=====] - 5s 12ms/step - loss: 2.1051
- accuracy: 0.2496
Epoch 168/200
391/391 [=====] - 5s 12ms/step - loss: 2.1112
- accuracy: 0.2472
Epoch 169/200
391/391 [=====] - 5s 12ms/step - loss: 2.1070
- accuracy: 0.2494
Epoch 170/200
391/391 [=====] - 5s 12ms/step - loss: 2.1096
- accuracy: 0.2501
Epoch 171/200
391/391 [=====] - 5s 12ms/step - loss: 2.1105
- accuracy: 0.2469
Epoch 172/200
391/391 [=====] - 5s 12ms/step - loss: 2.1090
- accuracy: 0.2455
Epoch 173/200
391/391 [=====] - 5s 12ms/step - loss: 2.1086
- accuracy: 0.2494
Epoch 174/200
391/391 [=====] - 5s 12ms/step - loss: 2.1109
- accuracy: 0.2485
Epoch 175/200
391/391 [=====] - 5s 12ms/step - loss: 2.1057
- accuracy: 0.2499
Epoch 176/200
391/391 [=====] - 5s 12ms/step - loss: 2.1087
- accuracy: 0.2482
Epoch 177/200
391/391 [=====] - 5s 12ms/step - loss: 2.1078
- accuracy: 0.2468
Epoch 178/200
391/391 [=====] - 5s 12ms/step - loss: 2.1065
- accuracy: 0.2492
Epoch 179/200
391/391 [=====] - 5s 12ms/step - loss: 2.1073
- accuracy: 0.2506
Epoch 180/200
391/391 [=====] - 5s 12ms/step - loss: 2.1083
- accuracy: 0.2493
Epoch 181/200
391/391 [=====] - 5s 12ms/step - loss: 2.1092
- accuracy: 0.2502
Epoch 182/200
391/391 [=====] - 5s 12ms/step - loss: 2.1050
- accuracy: 0.2508
Epoch 183/200
391/391 [=====] - 5s 12ms/step - loss: 2.1076
- accuracy: 0.2494
Epoch 184/200
391/391 [=====] - 5s 12ms/step - loss: 2.1086
- accuracy: 0.2483
Epoch 185/200
391/391 [=====] - 5s 12ms/step - loss: 2.1115
- accuracy: 0.2475
Epoch 186/200
```

```

391/391 [=====] - 5s 12ms/step - loss: 2.1098
- accuracy: 0.2463
Epoch 187/200
391/391 [=====] - 5s 12ms/step - loss: 2.1079
- accuracy: 0.2493
Epoch 188/200
391/391 [=====] - 5s 12ms/step - loss: 2.1080
- accuracy: 0.2477
Epoch 189/200
391/391 [=====] - 5s 12ms/step - loss: 2.1074
- accuracy: 0.2513
Epoch 190/200
391/391 [=====] - 5s 12ms/step - loss: 2.1079
- accuracy: 0.2470
Epoch 191/200
391/391 [=====] - 5s 12ms/step - loss: 2.1082
- accuracy: 0.2462
Epoch 192/200
391/391 [=====] - 5s 12ms/step - loss: 2.1093
- accuracy: 0.2484
Epoch 193/200
391/391 [=====] - 5s 12ms/step - loss: 2.1086
- accuracy: 0.2487
Epoch 194/200
391/391 [=====] - 5s 12ms/step - loss: 2.1116
- accuracy: 0.2471
Epoch 195/200
391/391 [=====] - 5s 12ms/step - loss: 2.1088
- accuracy: 0.2502
Epoch 196/200
391/391 [=====] - 5s 12ms/step - loss: 2.1116
- accuracy: 0.2463
Epoch 197/200
391/391 [=====] - 5s 12ms/step - loss: 2.1115
- accuracy: 0.2489
Epoch 198/200
391/391 [=====] - 5s 12ms/step - loss: 2.1110
- accuracy: 0.2478
Epoch 199/200
391/391 [=====] - 5s 12ms/step - loss: 2.1108
- accuracy: 0.2460
Epoch 200/200
391/391 [=====] - 5s 12ms/step - loss: 2.1063
- accuracy: 0.2514
313/313 [=====] - 1s 4ms/step - loss: 2.0592 -
accuracy: 0.2850

```

```

In [6]: training_loss_q3 = []
training_accuracy_q3 = []

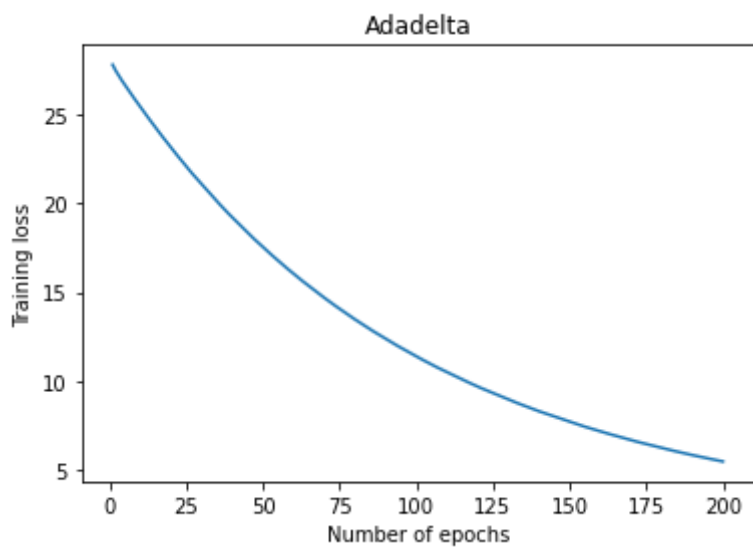
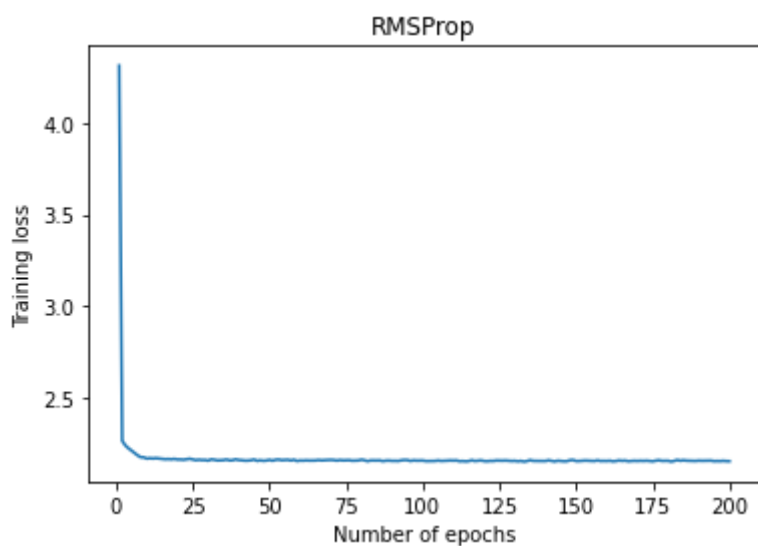
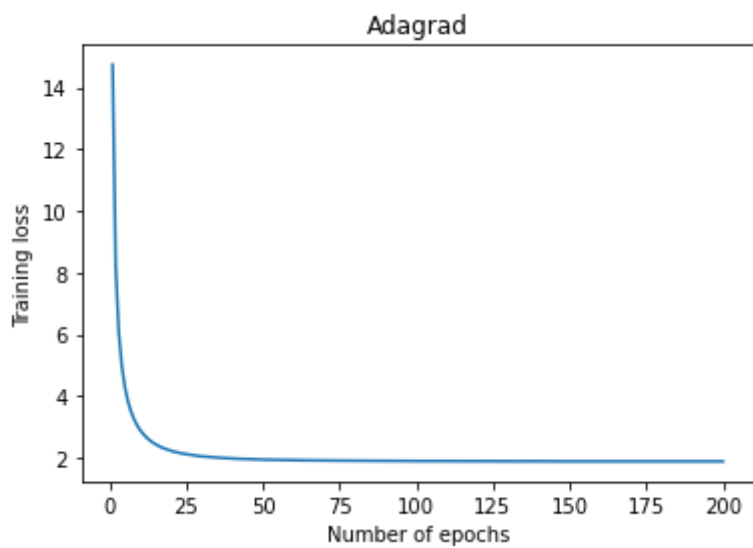
for i in range(5):
    training_loss_q3.append(hist[i].history['loss'])
    training_accuracy_q3.append(hist[i].history['accuracy'])

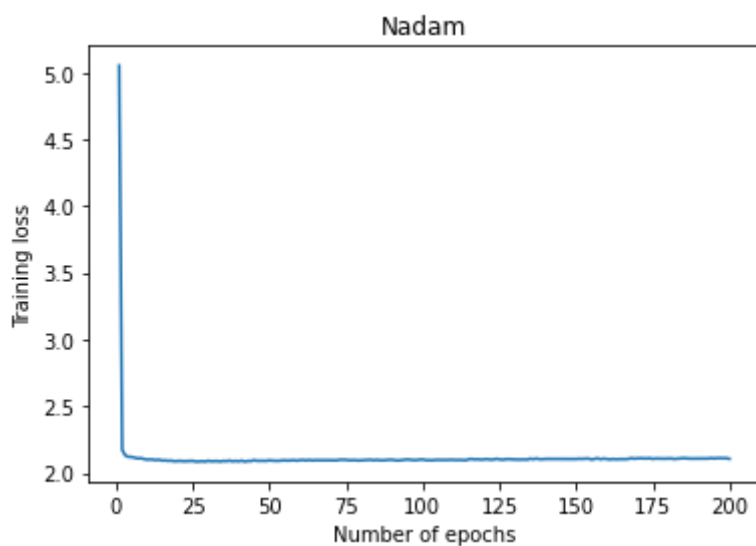
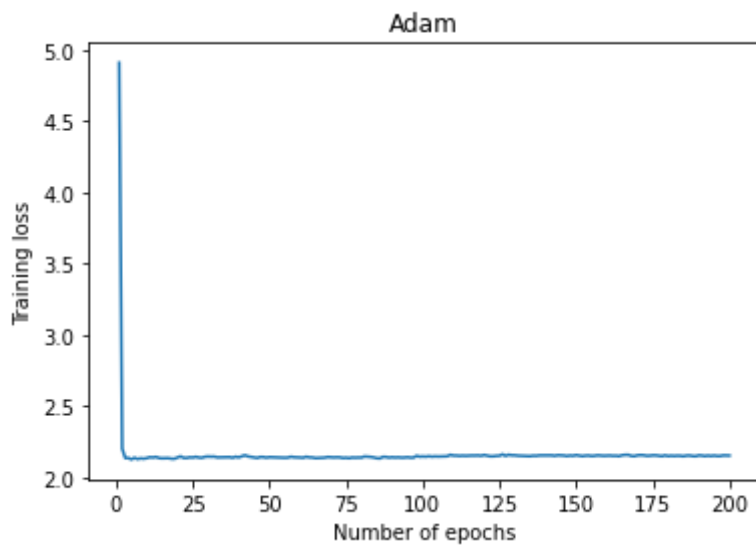
```

```
In [7]: savetxt('training_loss_q3.csv', training_loss_q3, delimiter=',')  
savetxt('val_q3.csv', val_q3, delimiter=',')
```



```
In [36]: training_loss_q3 = loadtxt('training_loss_q3.csv', delimiter=',')
title=["Adagrad", "RMSProp", "Adadelta", "Adam", "Nadam"]
for i in range(5) :
    plt.plot(range(1,201),training_loss_q3[i])
    plt.title (title[i])
    plt.xlabel("Number of epochs")
    plt.ylabel("Training loss")
    plt.show()
```





Lowest training loss at 200 epochs is again Adagrad when we perform dropout . Interestingly, it seems that the dropout slightly decreased the performance in the training. We will see in q4 if this is because it prevents overfitting when we will evaluate on the test accuracy.

```
In [37]: print("Training loss for each method :", "\n")
for i in range(5):
    print(title[i], training_loss_q3[i][199])
```

Training loss for each method :

```
Adagrad 1.8797223567962646
RMSProp 2.1566853523254395
Adadelta 5.511438846588135
Adam 2.1543853282928467
Nadam 2.106313943862915
```

Comparison of the training times :

Training time with dropout for Adagrad, RMSProp, Adadelata, Adam, Nadam (in order) :

```
In [5]: training_time_q3
```

```
Out[5]: [595.7203233242035,  
        727.5254926681519,  
        626.3900682926178,  
        590.7172820568085,  
        943.4767484664917]
```

Training time without dropout for Adagrad, RMSProp, Adadelata, Adam, Nadam (in order) :

```
In [5]: training_time_q2
```

```
Out[5]: [579.5734162330627,  
        703.8594861030579,  
        603.6786489486694,  
        566.6453628540039,  
        935.6838295459747]
```

It is consistent with what has been shown in the litterature : Indeed, dropout increases training time !

Q4)

```
In [40]: val_q2 = loadtxt('val_q2.csv', delimiter=',')  
        val_q3 = loadtxt('val_q3.csv', delimiter=',')
```

```
In [47]: print("Test accuracy of trained models for all the five methods:", "\n")
for i in range(5):
    print(title[i], "          without dropout : ", val_q2[i][1], "
    //// with dropout : ", val_q3[i][1])
```

Test accuracy of trained models for all the five methods:

```
Adagrad          without dropout :  0.4731000065803528      //// with
droupout :  0.448199987411499
RMSProp          without dropout :  0.33379998803138733    //// wit
h droupout :  0.28690001368522644
Adadelata        without dropout :  0.43709999322891235    //// wi
th droupout :  0.39980000257492065
Adam              without dropout :  0.38089999556541443    //// with d
roupout :  0.24789999425411224
Nadam             without dropout :  0.3806000053882599    //// with d
roupout :  0.2849999964237213
```

In []: