11-FINAL

December 18, 2018

1 11 - Neural Networks

1.1 Part 1 - XOR

1. Using the XOR dataset below, train (400 epochs) a neural network (NN) using 1, 2, 3, 4, and 5 hidden layers (where each layer has only 2 neurons). For each n layers, store the resulting loss score along with n. Plot the results to find what the optimal number of layers is.
2. Repeat the above with 3-neuron and 4-neuron Hidden layers. How do these results compare to the 2 neuron layers?
3. Using the most optimal configuraion (n-layers, k-neurons per layer), compare how `tanh`, `sigmoid`,`softplus` and `relu` effect the loss after 400 epochs. Try other Activation functions as well (https://keras.io/activations/)
4. Instead of `SGD` try other optimizers and report on the loss score. (https://keras.io/optimizers/)

1.2 Part 2 - BYOD (Bring your own Dataset)

Using your own dataset, experiment and find the best Neural Network configuration. You may use any resource to improve results, just reference it.

While you may use any dataset, I'd prefer you didn't use the diabetes dataset used in the lesson.

https://stackoverflow.com/questions/34673164/how-to-train-and-tune-an-artificial-multilayer-perceptron-neural-network-using-k

https://keras.io/

```
In [1]: !pip install tensorflow keras
```

```
Requirement already satisfied: tensorflow in c:\users\erin\anaconda3\lib\site-packages (1.12.0)
Requirement already satisfied: keras in c:\users\erin\anaconda3\lib\site-packages (2.2.4)
Requirement already satisfied: six>=1.10.0 in c:\users\erin\anaconda3\lib\site-packages (from t
Requirement already satisfied: wheel>=0.26 in c:\users\erin\anaconda3\lib\site-packages (from t
Requirement already satisfied: protobuf>=3.6.1 in c:\users\erin\anaconda3\lib\site-packages (fr
Requirement already satisfied: termcolor>=1.1.0 in c:\users\erin\anaconda3\lib\site-packages (f
Requirement already satisfied: gast>=0.2.0 in c:\users\erin\anaconda3\lib\site-packages (from t
Requirement already satisfied: grpcio>=1.8.6 in c:\users\erin\anaconda3\lib\site-packages (fro
Requirement already satisfied: keras-preprocessing>=1.0.5 in c:\users\erin\anaconda3\lib\site-p
Requirement already satisfied: absl-py>=0.1.6 in c:\users\erin\anaconda3\lib\site-packages (fr
Requirement already satisfied: numpy>=1.13.3 in c:\users\erin\anaconda3\lib\site-packages (fro
```

```
Requirement already satisfied: tensorboard<1.13.0,>=1.12.0 in c:\users\erin\anaconda3\lib\site-
Requirement already satisfied: astor>=0.6.0 in c:\users\erin\anaconda3\lib\site-packages (from
Requirement already satisfied: keras-applications>=1.0.6 in c:\users\erin\anaconda3\lib\site-pa
Requirement already satisfied: scipy>=0.14 in c:\users\erin\anaconda3\lib\site-packages (from k
Requirement already satisfied: pyyaml in c:\users\erin\anaconda3\lib\site-packages (from keras)
Requirement already satisfied: h5py in c:\users\erin\anaconda3\lib\site-packages (from keras)
Requirement already satisfied: setuptools in c:\users\erin\anaconda3\lib\site-packages (from pi
Requirement already satisfied: markdown>=2.6.8 in c:\users\erin\anaconda3\lib\site-packages (fr
Requirement already satisfied: werkzeug>=0.11.10 in c:\users\erin\anaconda3\lib\site-packages

You are using pip version 10.0.1, however version 18.1 is available.
You should consider upgrading via the 'python -m pip install --upgrade pip' command.
```

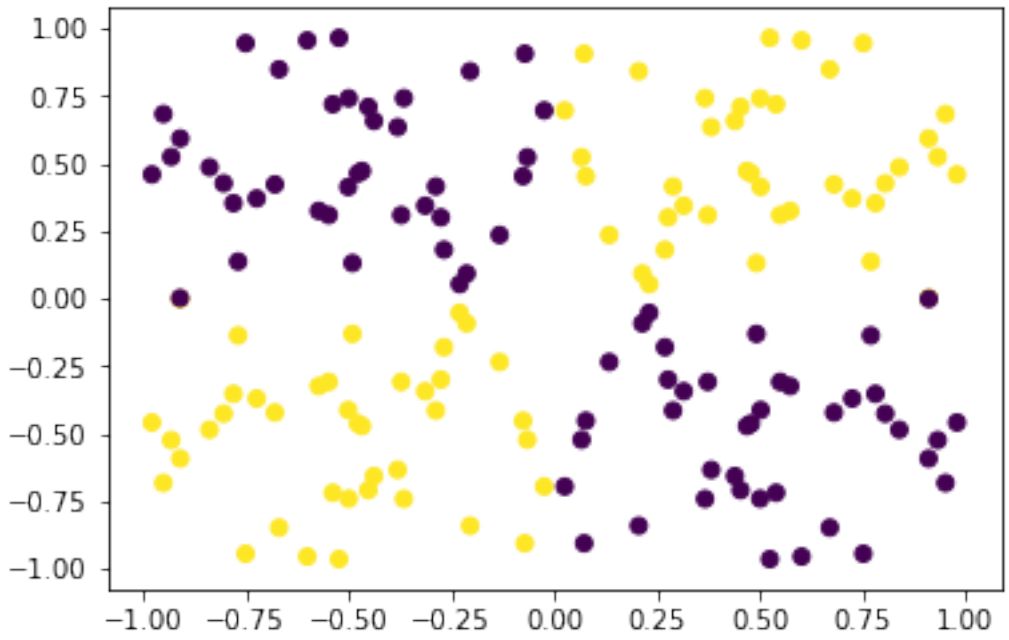
In [44]:
```
from keras.models import Sequential
from keras.layers import Dense
from keras.optimizers import SGD  #Stochastic Gradient Descent

import numpy as np
# fix random seed for reproducibility
np.random.seed(7)

import matplotlib.pyplot as plt
%matplotlib inline
```

In [45]:
```
n = 40
xx = np.random.random((n,1))
yy = np.random.random((n,1))
```

In [46]:
```
X = np.array([np.array([xx,-xx,-xx,xx]),np.array([yy,-yy,yy,-yy])]).reshape(2,4*n).T
y = np.array([np.ones([2*n]),np.zeros([2*n])]).reshape(4*n)
```

In [47]:
```
plt.scatter(*zip(*X), c=y)
```

Out[47]:
```
<matplotlib.collections.PathCollection at 0x1cc43a7a7f0>
```



In [61]:
```
model = Sequential()


        model.add(Dense(2, input_dim=2, activation='tanh'))  #sigmoid, relu
        # model.add(Dense(2, activation='tanh'))
        model.add(Dense(1, activation='sigmoid'))
        # model.add(Dense(1,input_dim=2, activation='sigmoid'))


        sgd = SGD(lr=0.1)
        model.compile(loss='binary_crossentropy', optimizer='sgd')

        model.fit(X, y, batch_size=2, epochs=400) #160/4 = 40 per epoch
        print(model.predict_proba(X).reshape(4*n))

        # evaluate the model
        scores = model.evaluate(X, y)
```

```
Epoch 1/400
160/160 [==============================] - 1s 3ms/step - loss: 0.6953
Epoch 2/400
160/160 [==============================] - 0s 368us/step - loss: 0.6951
Epoch 3/400
160/160 [==============================] - 0s 384us/step - loss: 0.6948
Epoch 4/400
160/160 [==============================] - 0s 399us/step - loss: 0.6947
```

```
Epoch 5/400
160/160 [==============================] - 0s 374us/step - loss: 0.6944
Epoch 6/400
160/160 [==============================] - 0s 387us/step - loss: 0.6942
Epoch 7/400
160/160 [==============================] - 0s 418us/step - loss: 0.6941
Epoch 8/400
160/160 [==============================] - 0s 386us/step - loss: 0.6939
Epoch 9/400
160/160 [==============================] - 0s 387us/step - loss: 0.6940
Epoch 10/400
160/160 [==============================] - 0s 380us/step - loss: 0.6937
Epoch 11/400
160/160 [==============================] - 0s 405us/step - loss: 0.6934
Epoch 12/400
160/160 [==============================] - 0s 362us/step - loss: 0.6934
Epoch 13/400
160/160 [==============================] - 0s 394us/step - loss: 0.6933
Epoch 14/400
160/160 [==============================] - 0s 380us/step - loss: 0.6929
Epoch 15/400
160/160 [==============================] - 0s 399us/step - loss: 0.6927
Epoch 16/400
160/160 [==============================] - 0s 380us/step - loss: 0.6925
Epoch 17/400
160/160 [==============================] - 0s 368us/step - loss: 0.6924
Epoch 18/400
160/160 [==============================] - 0s 374us/step - loss: 0.6922
Epoch 19/400
160/160 [==============================] - 0s 380us/step - loss: 0.6919
Epoch 20/400
160/160 [==============================] - 0s 374us/step - loss: 0.6916
Epoch 21/400
160/160 [==============================] - 0s 374us/step - loss: 0.6911
Epoch 22/400
160/160 [==============================] - 0s 399us/step - loss: 0.6912
Epoch 23/400
160/160 [==============================] - 0s 393us/step - loss: 0.6909
Epoch 24/400
160/160 [==============================] - 0s 380us/step - loss: 0.6905
Epoch 25/400
160/160 [==============================] - 0s 393us/step - loss: 0.6900
Epoch 26/400
160/160 [==============================] - 0s 374us/step - loss: 0.6899
Epoch 27/400
160/160 [==============================] - 0s 374us/step - loss: 0.6895
Epoch 28/400
160/160 [==============================] - 0s 374us/step - loss: 0.6889
```

```
Epoch 29/400
160/160 [==============================] - 0s 380us/step - loss: 0.6887
Epoch 30/400
160/160 [==============================] - 0s 380us/step - loss: 0.6880
Epoch 31/400
160/160 [==============================] - 0s 374us/step - loss: 0.6875
Epoch 32/400
160/160 [==============================] - 0s 386us/step - loss: 0.6870
Epoch 33/400
160/160 [==============================] - 0s 405us/step - loss: 0.6865
Epoch 34/400
160/160 [==============================] - 0s 393us/step - loss: 0.6858
Epoch 35/400
160/160 [==============================] - 0s 393us/step - loss: 0.6852
Epoch 36/400
160/160 [==============================] - 0s 405us/step - loss: 0.6846
Epoch 37/400
160/160 [==============================] - 0s 386us/step - loss: 0.6838
Epoch 38/400
160/160 [==============================] - 0s 393us/step - loss: 0.6829
Epoch 39/400
160/160 [==============================] - 0s 399us/step - loss: 0.6822
Epoch 40/400
160/160 [==============================] - 0s 380us/step - loss: 0.6812
Epoch 41/400
160/160 [==============================] - 0s 362us/step - loss: 0.6803
Epoch 42/400
160/160 [==============================] - 0s 392us/step - loss: 0.6792
Epoch 43/400
160/160 [==============================] - 0s 412us/step - loss: 0.6781
Epoch 44/400
160/160 [==============================] - 0s 418us/step - loss: 0.6768
Epoch 45/400
160/160 [==============================] - 0s 374us/step - loss: 0.6756
Epoch 46/400
160/160 [==============================] - 0s 381us/step - loss: 0.6743
Epoch 47/400
160/160 [==============================] - 0s 363us/step - loss: 0.6729
Epoch 48/400
160/160 [==============================] - 0s 386us/step - loss: 0.6713
Epoch 49/400
160/160 [==============================] - 0s 411us/step - loss: 0.6695
Epoch 50/400
160/160 [==============================] - 0s 362us/step - loss: 0.6679
Epoch 51/400
160/160 [==============================] - 0s 393us/step - loss: 0.6662
Epoch 52/400
160/160 [==============================] - 0s 386us/step - loss: 0.6642
```

```
Epoch 53/400
160/160 [==============================] - 0s 405us/step - loss: 0.6619
Epoch 54/400
160/160 [==============================] - 0s 387us/step - loss: 0.6598
Epoch 55/400
160/160 [==============================] - 0s 399us/step - loss: 0.6574
Epoch 56/400
160/160 [==============================] - 0s 385us/step - loss: 0.6551
Epoch 57/400
160/160 [==============================] - 0s 386us/step - loss: 0.6521
Epoch 58/400
160/160 [==============================] - 0s 375us/step - loss: 0.6495
Epoch 59/400
160/160 [==============================] - 0s 393us/step - loss: 0.6467
Epoch 60/400
160/160 [==============================] - 0s 398us/step - loss: 0.6435
Epoch 61/400
160/160 [==============================] - 0s 393us/step - loss: 0.6405
Epoch 62/400
160/160 [==============================] - 0s 387us/step - loss: 0.6370
Epoch 63/400
160/160 [==============================] - 0s 386us/step - loss: 0.6334
Epoch 64/400
160/160 [==============================] - 0s 380us/step - loss: 0.6298
Epoch 65/400
160/160 [==============================] - 0s 373us/step - loss: 0.6260
Epoch 66/400
160/160 [==============================] - 0s 393us/step - loss: 0.6217
Epoch 67/400
160/160 [==============================] - 0s 374us/step - loss: 0.6180
Epoch 68/400
160/160 [==============================] - 0s 374us/step - loss: 0.6135
Epoch 69/400
160/160 [==============================] - 0s 374us/step - loss: 0.6089
Epoch 70/400
160/160 [==============================] - 0s 368us/step - loss: 0.6046
Epoch 71/400
160/160 [==============================] - 0s 375us/step - loss: 0.5995
Epoch 72/400
160/160 [==============================] - 0s 386us/step - loss: 0.5948
Epoch 73/400
160/160 [==============================] - 0s 381us/step - loss: 0.5897
Epoch 74/400
160/160 [==============================] - 0s 393us/step - loss: 0.5846
Epoch 75/400
160/160 [==============================] - 0s 368us/step - loss: 0.5796
Epoch 76/400
160/160 [==============================] - 0s 355us/step - loss: 0.5742
```

```
Epoch 77/400
160/160 [==============================] - 0s 386us/step - loss: 0.5688
Epoch 78/400
160/160 [==============================] - 0s 380us/step - loss: 0.5634
Epoch 79/400
160/160 [==============================] - 0s 374us/step - loss: 0.5577
Epoch 80/400
160/160 [==============================] - 0s 374us/step - loss: 0.5522
Epoch 81/400
160/160 [==============================] - 0s 393us/step - loss: 0.5467
Epoch 82/400
160/160 [==============================] - 0s 374us/step - loss: 0.5413
Epoch 83/400
160/160 [==============================] - 0s 393us/step - loss: 0.5357
Epoch 84/400
160/160 [==============================] - 0s 380us/step - loss: 0.5299
Epoch 85/400
160/160 [==============================] - 0s 411us/step - loss: 0.5246
Epoch 86/400
160/160 [==============================] - 0s 374us/step - loss: 0.5191
Epoch 87/400
160/160 [==============================] - 0s 386us/step - loss: 0.5135
Epoch 88/400
160/160 [==============================] - 0s 386us/step - loss: 0.5086
Epoch 89/400
160/160 [==============================] - 0s 374us/step - loss: 0.5029
Epoch 90/400
160/160 [==============================] - 0s 393us/step - loss: 0.4978
Epoch 91/400
160/160 [==============================] - 0s 368us/step - loss: 0.4927
Epoch 92/400
160/160 [==============================] - 0s 374us/step - loss: 0.4876
Epoch 93/400
160/160 [==============================] - 0s 380us/step - loss: 0.4826
Epoch 94/400
160/160 [==============================] - 0s 374us/step - loss: 0.4776
Epoch 95/400
160/160 [==============================] - 0s 368us/step - loss: 0.4731
Epoch 96/400
160/160 [==============================] - 0s 393us/step - loss: 0.4684
Epoch 97/400
160/160 [==============================] - 0s 380us/step - loss: 0.4640
Epoch 98/400
160/160 [==============================] - 0s 374us/step - loss: 0.4592
Epoch 99/400
160/160 [==============================] - 0s 380us/step - loss: 0.4549
Epoch 100/400
160/160 [==============================] - 0s 399us/step - loss: 0.4510
```

```
Epoch 101/400
160/160 [==============================] - 0s 393us/step - loss: 0.4466
Epoch 102/400
160/160 [==============================] - 0s 377us/step - loss: 0.4429
Epoch 103/400
160/160 [==============================] - 0s 393us/step - loss: 0.4388
Epoch 104/400
160/160 [==============================] - 0s 405us/step - loss: 0.4350
Epoch 105/400
160/160 [==============================] - 0s 386us/step - loss: 0.4315
Epoch 106/400
160/160 [==============================] - 0s 368us/step - loss: 0.4280
Epoch 107/400
160/160 [==============================] - 0s 368us/step - loss: 0.4243
Epoch 108/400
160/160 [==============================] - 0s 380us/step - loss: 0.4211
Epoch 109/400
160/160 [==============================] - 0s 368us/step - loss: 0.4181
Epoch 110/400
160/160 [==============================] - 0s 386us/step - loss: 0.4148
Epoch 111/400
160/160 [==============================] - 0s 375us/step - loss: 0.4117
Epoch 112/400
160/160 [==============================] - 0s 374us/step - loss: 0.4088
Epoch 113/400
160/160 [==============================] - 0s 362us/step - loss: 0.4063
Epoch 114/400
160/160 [==============================] - 0s 368us/step - loss: 0.4031
Epoch 115/400
160/160 [==============================] - 0s 368us/step - loss: 0.4008
Epoch 116/400
160/160 [==============================] - 0s 374us/step - loss: 0.3979
Epoch 117/400
160/160 [==============================] - 0s 374us/step - loss: 0.3957
Epoch 118/400
160/160 [==============================] - 0s 386us/step - loss: 0.3931
Epoch 119/400
160/160 [==============================] - 0s 374us/step - loss: 0.3910
Epoch 120/400
160/160 [==============================] - 0s 374us/step - loss: 0.3888
Epoch 121/400
160/160 [==============================] - 0s 386us/step - loss: 0.3867
Epoch 122/400
160/160 [==============================] - 0s 375us/step - loss: 0.3845
Epoch 123/400
160/160 [==============================] - 0s 381us/step - loss: 0.3829
Epoch 124/400
160/160 [==============================] - 0s 368us/step - loss: 0.3805
```

```
Epoch 125/400
160/160 [==============================] - 0s 380us/step - loss: 0.3785
Epoch 126/400
160/160 [==============================] - 0s 368us/step - loss: 0.3768
Epoch 127/400
160/160 [==============================] - 0s 374us/step - loss: 0.3747
Epoch 128/400
160/160 [==============================] - 0s 368us/step - loss: 0.3733
Epoch 129/400
160/160 [==============================] - 0s 393us/step - loss: 0.3717
Epoch 130/400
160/160 [==============================] - 0s 374us/step - loss: 0.3700
Epoch 131/400
160/160 [==============================] - 0s 361us/step - loss: 0.3684
Epoch 132/400
160/160 [==============================] - 0s 375us/step - loss: 0.3670
Epoch 133/400
160/160 [==============================] - 0s 374us/step - loss: 0.3656
Epoch 134/400
160/160 [==============================] - 0s 455us/step - loss: 0.3643
Epoch 135/400
160/160 [==============================] - 0s 417us/step - loss: 0.3628
Epoch 136/400
160/160 [==============================] - 0s 381us/step - loss: 0.3615
Epoch 137/400
160/160 [==============================] - 0s 356us/step - loss: 0.3604
Epoch 138/400
160/160 [==============================] - 0s 368us/step - loss: 0.3593
Epoch 139/400
160/160 [==============================] - 0s 386us/step - loss: 0.3577
Epoch 140/400
160/160 [==============================] - 0s 386us/step - loss: 0.3566
Epoch 141/400
160/160 [==============================] - 0s 405us/step - loss: 0.3561
Epoch 142/400
160/160 [==============================] - 0s 399us/step - loss: 0.3549
Epoch 143/400
160/160 [==============================] - 0s 386us/step - loss: 0.3538
Epoch 144/400
160/160 [==============================] - 0s 405us/step - loss: 0.3529
Epoch 145/400
160/160 [==============================] - 0s 380us/step - loss: 0.3516
Epoch 146/400
160/160 [==============================] - 0s 374us/step - loss: 0.3509
Epoch 147/400
160/160 [==============================] - 0s 399us/step - loss: 0.3500
Epoch 148/400
160/160 [==============================] - 0s 380us/step - loss: 0.3494
```

```
Epoch 149/400
160/160 [==============================] - 0s 387us/step - loss: 0.3485
Epoch 150/400
160/160 [==============================] - 0s 380us/step - loss: 0.3475
Epoch 151/400
160/160 [==============================] - 0s 393us/step - loss: 0.3467
Epoch 152/400
160/160 [==============================] - 0s 386us/step - loss: 0.3459
Epoch 153/400
160/160 [==============================] - 0s 362us/step - loss: 0.3453
Epoch 154/400
160/160 [==============================] - 0s 368us/step - loss: 0.3443
Epoch 155/400
160/160 [==============================] - 0s 374us/step - loss: 0.3442
Epoch 156/400
160/160 [==============================] - 0s 381us/step - loss: 0.3434
Epoch 157/400
160/160 [==============================] - 0s 399us/step - loss: 0.3426
Epoch 158/400
160/160 [==============================] - 0s 374us/step - loss: 0.3419
Epoch 159/400
160/160 [==============================] - 0s 386us/step - loss: 0.3414
Epoch 160/400
160/160 [==============================] - 0s 355us/step - loss: 0.3406
Epoch 161/400
160/160 [==============================] - 0s 368us/step - loss: 0.3399
Epoch 162/400
160/160 [==============================] - 0s 399us/step - loss: 0.3396
Epoch 163/400
160/160 [==============================] - 0s 373us/step - loss: 0.3394
Epoch 164/400
160/160 [==============================] - 0s 399us/step - loss: 0.3385
Epoch 165/400
160/160 [==============================] - 0s 399us/step - loss: 0.3385
Epoch 166/400
160/160 [==============================] - 0s 360us/step - loss: 0.3378
Epoch 167/400
160/160 [==============================] - 0s 380us/step - loss: 0.3374
Epoch 168/400
160/160 [==============================] - 0s 380us/step - loss: 0.3366
Epoch 169/400
160/160 [==============================] - 0s 374us/step - loss: 0.3363
Epoch 170/400
160/160 [==============================] - 0s 393us/step - loss: 0.3357
Epoch 171/400
160/160 [==============================] - 0s 380us/step - loss: 0.3351
Epoch 172/400
160/160 [==============================] - 0s 381us/step - loss: 0.3351
```

```
Epoch 173/400
160/160 [==============================] - 0s 424us/step - loss: 0.3348
Epoch 174/400
160/160 [==============================] - 0s 380us/step - loss: 0.3343
Epoch 175/400
160/160 [==============================] - 0s 392us/step - loss: 0.3337
Epoch 176/400
160/160 [==============================] - 0s 387us/step - loss: 0.3335
Epoch 177/400
160/160 [==============================] - 0s 399us/step - loss: 0.3332
Epoch 178/400
160/160 [==============================] - 0s 405us/step - loss: 0.3331
Epoch 179/400
160/160 [==============================] - 0s 386us/step - loss: 0.3324
Epoch 180/400
160/160 [==============================] - 0s 386us/step - loss: 0.3321
Epoch 181/400
160/160 [==============================] - 0s 386us/step - loss: 0.3320
Epoch 182/400
160/160 [==============================] - 0s 355us/step - loss: 0.3316
Epoch 183/400
160/160 [==============================] - 0s 368us/step - loss: 0.3312
Epoch 184/400
160/160 [==============================] - 0s 405us/step - loss: 0.3308
Epoch 185/400
160/160 [==============================] - 0s 393us/step - loss: 0.3308
Epoch 186/400
160/160 [==============================] - 0s 374us/step - loss: 0.3305
Epoch 187/400
160/160 [==============================] - 0s 380us/step - loss: 0.3301
Epoch 188/400
160/160 [==============================] - 0s 424us/step - loss: 0.3300
Epoch 189/400
160/160 [==============================] - 0s 386us/step - loss: 0.3298
Epoch 190/400
160/160 [==============================] - 0s 393us/step - loss: 0.3293
Epoch 191/400
160/160 [==============================] - 0s 399us/step - loss: 0.3295
Epoch 192/400
160/160 [==============================] - 0s 405us/step - loss: 0.3293
Epoch 193/400
160/160 [==============================] - 0s 392us/step - loss: 0.3286
Epoch 194/400
160/160 [==============================] - 0s 393us/step - loss: 0.3284
Epoch 195/400
160/160 [==============================] - 0s 374us/step - loss: 0.3285
Epoch 196/400
160/160 [==============================] - 0s 374us/step - loss: 0.3287
```

```
Epoch 197/400
160/160 [==============================] - 0s 381us/step - loss: 0.3279
Epoch 198/400
160/160 [==============================] - 0s 368us/step - loss: 0.3277
Epoch 199/400
160/160 [==============================] - 0s 368us/step - loss: 0.3275
Epoch 200/400
160/160 [==============================] - 0s 368us/step - loss: 0.3274
Epoch 201/400
160/160 [==============================] - 0s 368us/step - loss: 0.3270
Epoch 202/400
160/160 [==============================] - 0s 393us/step - loss: 0.3271
Epoch 203/400
160/160 [==============================] - 0s 387us/step - loss: 0.3265
Epoch 204/400
160/160 [==============================] - 0s 386us/step - loss: 0.3267
Epoch 205/400
160/160 [==============================] - 0s 374us/step - loss: 0.3265
Epoch 206/400
160/160 [==============================] - 0s 362us/step - loss: 0.3265
Epoch 207/400
160/160 [==============================] - 0s 380us/step - loss: 0.3260
Epoch 208/400
160/160 [==============================] - 0s 399us/step - loss: 0.3263
Epoch 209/400
160/160 [==============================] - 0s 455us/step - loss: 0.3256
Epoch 210/400
160/160 [==============================] - 0s 399us/step - loss: 0.3261
Epoch 211/400
160/160 [==============================] - 0s 362us/step - loss: 0.3258
Epoch 212/400
160/160 [==============================] - 0s 386us/step - loss: 0.3259
Epoch 213/400
160/160 [==============================] - 0s 380us/step - loss: 0.3255
Epoch 214/400
160/160 [==============================] - 0s 386us/step - loss: 0.3256
Epoch 215/400
160/160 [==============================] - 0s 399us/step - loss: 0.3255
Epoch 216/400
160/160 [==============================] - 0s 380us/step - loss: 0.3252
Epoch 217/400
160/160 [==============================] - 0s 405us/step - loss: 0.3249
Epoch 218/400
160/160 [==============================] - 0s 355us/step - loss: 0.3248
Epoch 219/400
160/160 [==============================] - 0s 356us/step - loss: 0.3244
Epoch 220/400
160/160 [==============================] - 0s 361us/step - loss: 0.3246
```

```
Epoch 221/400
160/160 [==============================] - 0s 393us/step - loss: 0.3249
Epoch 222/400
160/160 [==============================] - 0s 393us/step - loss: 0.3244
Epoch 223/400
160/160 [==============================] - 0s 374us/step - loss: 0.3245
Epoch 224/400
160/160 [==============================] - 0s 393us/step - loss: 0.3244
Epoch 225/400
160/160 [==============================] - 0s 405us/step - loss: 0.3242
Epoch 226/400
160/160 [==============================] - 0s 393us/step - loss: 0.3239
Epoch 227/400
160/160 [==============================] - 0s 399us/step - loss: 0.3240
Epoch 228/400
160/160 [==============================] - 0s 393us/step - loss: 0.3235
Epoch 229/400
160/160 [==============================] - 0s 411us/step - loss: 0.3239
Epoch 230/400
160/160 [==============================] - 0s 393us/step - loss: 0.3237
Epoch 231/400
160/160 [==============================] - 0s 386us/step - loss: 0.3237
Epoch 232/400
160/160 [==============================] - 0s 368us/step - loss: 0.3239
Epoch 233/400
160/160 [==============================] - 0s 386us/step - loss: 0.3233
Epoch 234/400
160/160 [==============================] - 0s 374us/step - loss: 0.3235
Epoch 235/400
160/160 [==============================] - 0s 361us/step - loss: 0.3230
Epoch 236/400
160/160 [==============================] - 0s 381us/step - loss: 0.3234
Epoch 237/400
160/160 [==============================] - 0s 374us/step - loss: 0.3234
Epoch 238/400
160/160 [==============================] - 0s 368us/step - loss: 0.3231
Epoch 239/400
160/160 [==============================] - 0s 374us/step - loss: 0.3232
Epoch 240/400
160/160 [==============================] - 0s 368us/step - loss: 0.3234
Epoch 241/400
160/160 [==============================] - 0s 380us/step - loss: 0.3227
Epoch 242/400
160/160 [==============================] - 0s 399us/step - loss: 0.3227
Epoch 243/400
160/160 [==============================] - 0s 375us/step - loss: 0.3228
Epoch 244/400
160/160 [==============================] - 0s 368us/step - loss: 0.3231
```

```
Epoch 245/400
160/160 [==============================] - 0s 362us/step - loss: 0.3230
Epoch 246/400
160/160 [==============================] - 0s 368us/step - loss: 0.3232
Epoch 247/400
160/160 [==============================] - 0s 374us/step - loss: 0.3227
Epoch 248/400
160/160 [==============================] - 0s 393us/step - loss: 0.3230
Epoch 249/400
160/160 [==============================] - 0s 368us/step - loss: 0.3226
Epoch 250/400
160/160 [==============================] - 0s 373us/step - loss: 0.3223
Epoch 251/400
160/160 [==============================] - 0s 387us/step - loss: 0.3224
Epoch 252/400
160/160 [==============================] - 0s 362us/step - loss: 0.3229
Epoch 253/400
160/160 [==============================] - 0s 374us/step - loss: 0.3224
Epoch 254/400
160/160 [==============================] - 0s 368us/step - loss: 0.3225
Epoch 255/400
160/160 [==============================] - 0s 374us/step - loss: 0.3224
Epoch 256/400
160/160 [==============================] - 0s 374us/step - loss: 0.3222
Epoch 257/400
160/160 [==============================] - 0s 343us/step - loss: 0.3223
Epoch 258/400
160/160 [==============================] - 0s 368us/step - loss: 0.3224
Epoch 259/400
160/160 [==============================] - 0s 380us/step - loss: 0.3223
Epoch 260/400
160/160 [==============================] - 0s 374us/step - loss: 0.3223
Epoch 261/400
160/160 [==============================] - 0s 374us/step - loss: 0.3219
Epoch 262/400
160/160 [==============================] - 0s 375us/step - loss: 0.3224
Epoch 263/400
160/160 [==============================] - 0s 386us/step - loss: 0.3223
Epoch 264/400
160/160 [==============================] - 0s 381us/step - loss: 0.3222
Epoch 265/400
160/160 [==============================] - 0s 375us/step - loss: 0.3220
Epoch 266/400
160/160 [==============================] - 0s 380us/step - loss: 0.3217
Epoch 267/400
160/160 [==============================] - 0s 386us/step - loss: 0.3218
Epoch 268/400
160/160 [==============================] - 0s 386us/step - loss: 0.3220
```

```
Epoch 269/400
160/160 [==============================] - 0s 386us/step - loss: 0.3220
Epoch 270/400
160/160 [==============================] - 0s 380us/step - loss: 0.3217
Epoch 271/400
160/160 [==============================] - 0s 362us/step - loss: 0.3217
Epoch 272/400
160/160 [==============================] - 0s 362us/step - loss: 0.3216
Epoch 273/400
160/160 [==============================] - 0s 374us/step - loss: 0.3219
Epoch 274/400
160/160 [==============================] - 0s 394us/step - loss: 0.3212
Epoch 275/400
160/160 [==============================] - 0s 411us/step - loss: 0.3220
Epoch 276/400
160/160 [==============================] - 0s 374us/step - loss: 0.3212
Epoch 277/400
160/160 [==============================] - 0s 399us/step - loss: 0.3213
Epoch 278/400
160/160 [==============================] - 0s 380us/step - loss: 0.3216
Epoch 279/400
160/160 [==============================] - 0s 374us/step - loss: 0.3215
Epoch 280/400
160/160 [==============================] - 0s 380us/step - loss: 0.3218
Epoch 281/400
160/160 [==============================] - 0s 386us/step - loss: 0.3216
Epoch 282/400
160/160 [==============================] - 0s 399us/step - loss: 0.3215
Epoch 283/400
160/160 [==============================] - 0s 393us/step - loss: 0.3215
Epoch 284/400
160/160 [==============================] - 0s 393us/step - loss: 0.3217
Epoch 285/400
160/160 [==============================] - 0s 418us/step - loss: 0.3213
Epoch 286/400
160/160 [==============================] - 0s 405us/step - loss: 0.3210
Epoch 287/400
160/160 [==============================] - 0s 386us/step - loss: 0.3215
Epoch 288/400
160/160 [==============================] - 0s 380us/step - loss: 0.3214
Epoch 289/400
160/160 [==============================] - 0s 380us/step - loss: 0.3214
Epoch 290/400
160/160 [==============================] - 0s 374us/step - loss: 0.3213
Epoch 291/400
160/160 [==============================] - 0s 380us/step - loss: 0.3216
Epoch 292/400
160/160 [==============================] - 0s 368us/step - loss: 0.3214
```

```
Epoch 293/400
160/160 [==============================] - 0s 368us/step - loss: 0.3213
Epoch 294/400
160/160 [==============================] - 0s 362us/step - loss: 0.3212
Epoch 295/400
160/160 [==============================] - 0s 368us/step - loss: 0.3212
Epoch 296/400
160/160 [==============================] - 0s 357us/step - loss: 0.3214
Epoch 297/400
160/160 [==============================] - 0s 366us/step - loss: 0.3212
Epoch 298/400
160/160 [==============================] - 0s 374us/step - loss: 0.3211
Epoch 299/400
160/160 [==============================] - 0s 386us/step - loss: 0.3209
Epoch 300/400
160/160 [==============================] - 0s 374us/step - loss: 0.3212
Epoch 301/400
160/160 [==============================] - 0s 374us/step - loss: 0.3214
Epoch 302/400
160/160 [==============================] - 0s 368us/step - loss: 0.3209
Epoch 303/400
160/160 [==============================] - 0s 368us/step - loss: 0.3212
Epoch 304/400
160/160 [==============================] - 0s 380us/step - loss: 0.3207
Epoch 305/400
160/160 [==============================] - 0s 479us/step - loss: 0.3210
Epoch 306/400
160/160 [==============================] - 0s 436us/step - loss: 0.3208
Epoch 307/400
160/160 [==============================] - 0s 423us/step - loss: 0.3207
Epoch 308/400
160/160 [==============================] - 0s 412us/step - loss: 0.3209
Epoch 309/400
160/160 [==============================] - 0s 411us/step - loss: 0.3211
Epoch 310/400
160/160 [==============================] - 0s 368us/step - loss: 0.3208
Epoch 311/400
160/160 [==============================] - 0s 374us/step - loss: 0.3210
Epoch 312/400
160/160 [==============================] - 0s 362us/step - loss: 0.3212
Epoch 313/400
160/160 [==============================] - 0s 412us/step - loss: 0.3214
Epoch 314/400
160/160 [==============================] - 0s 387us/step - loss: 0.3211
Epoch 315/400
160/160 [==============================] - 0s 368us/step - loss: 0.3211
Epoch 316/400
160/160 [==============================] - 0s 374us/step - loss: 0.3212
```

```
Epoch 317/400
160/160 [==============================] - 0s 374us/step - loss: 0.3211
Epoch 318/400
160/160 [==============================] - 0s 474us/step - loss: 0.3211
Epoch 319/400
160/160 [==============================] - 0s 505us/step - loss: 0.3209
Epoch 320/400
160/160 [==============================] - 0s 430us/step - loss: 0.3207
Epoch 321/400
160/160 [==============================] - 0s 424us/step - loss: 0.3212
Epoch 322/400
160/160 [==============================] - 0s 380us/step - loss: 0.3207
Epoch 323/400
160/160 [==============================] - 0s 430us/step - loss: 0.3207
Epoch 324/400
160/160 [==============================] - 0s 418us/step - loss: 0.3210
Epoch 325/400
160/160 [==============================] - 0s 443us/step - loss: 0.3205
Epoch 326/400
160/160 [==============================] - 0s 442us/step - loss: 0.3210
Epoch 327/400
160/160 [==============================] - 0s 424us/step - loss: 0.3209
Epoch 328/400
160/160 [==============================] - 0s 412us/step - loss: 0.3206
Epoch 329/400
160/160 [==============================] - 0s 418us/step - loss: 0.3207
Epoch 330/400
160/160 [==============================] - 0s 411us/step - loss: 0.3207
Epoch 331/400
160/160 [==============================] - 0s 461us/step - loss: 0.3210
Epoch 332/400
160/160 [==============================] - 0s 430us/step - loss: 0.3208
Epoch 333/400
160/160 [==============================] - 0s 391us/step - loss: 0.3205
Epoch 334/400
160/160 [==============================] - 0s 405us/step - loss: 0.3205
Epoch 335/400
160/160 [==============================] - 0s 399us/step - loss: 0.3207
Epoch 336/400
160/160 [==============================] - 0s 455us/step - loss: 0.3206
Epoch 337/400
160/160 [==============================] - 0s 411us/step - loss: 0.3207
Epoch 338/400
160/160 [==============================] - 0s 381us/step - loss: 0.3206
Epoch 339/400
160/160 [==============================] - 0s 436us/step - loss: 0.3207
Epoch 340/400
160/160 [==============================] - 0s 424us/step - loss: 0.3208
```

```
Epoch 341/400
160/160 [==============================] - 0s 400us/step - loss: 0.3205
Epoch 342/400
160/160 [==============================] - 0s 412us/step - loss: 0.3203
Epoch 343/400
160/160 [==============================] - 0s 430us/step - loss: 0.3207
Epoch 344/400
160/160 [==============================] - 0s 430us/step - loss: 0.3208
Epoch 345/400
160/160 [==============================] - 0s 418us/step - loss: 0.3207
Epoch 346/400
160/160 [==============================] - 0s 449us/step - loss: 0.3207
Epoch 347/400
160/160 [==============================] - 0s 430us/step - loss: 0.3206
Epoch 348/400
160/160 [==============================] - 0s 449us/step - loss: 0.3206
Epoch 349/400
160/160 [==============================] - 0s 411us/step - loss: 0.3208
Epoch 350/400
160/160 [==============================] - 0s 399us/step - loss: 0.3203
Epoch 351/400
160/160 [==============================] - 0s 368us/step - loss: 0.3206
Epoch 352/400
160/160 [==============================] - 0s 430us/step - loss: 0.3203
Epoch 353/400
160/160 [==============================] - 0s 418us/step - loss: 0.3209
Epoch 354/400
160/160 [==============================] - 0s 412us/step - loss: 0.3209
Epoch 355/400
160/160 [==============================] - 0s 405us/step - loss: 0.3205
Epoch 356/400
160/160 [==============================] - 0s 393us/step - loss: 0.3206
Epoch 357/400
160/160 [==============================] - 0s 405us/step - loss: 0.3205
Epoch 358/400
160/160 [==============================] - 0s 393us/step - loss: 0.3206
Epoch 359/400
160/160 [==============================] - 0s 399us/step - loss: 0.3207
Epoch 360/400
160/160 [==============================] - 0s 449us/step - loss: 0.3206
Epoch 361/400
160/160 [==============================] - 0s 380us/step - loss: 0.3207
Epoch 362/400
160/160 [==============================] - 0s 374us/step - loss: 0.3206
Epoch 363/400
160/160 [==============================] - 0s 368us/step - loss: 0.3204
Epoch 364/400
160/160 [==============================] - 0s 355us/step - loss: 0.3200
```

```
Epoch 365/400
160/160 [==============================] - 0s 374us/step - loss: 0.3205
Epoch 366/400
160/160 [==============================] - 0s 399us/step - loss: 0.3207
Epoch 367/400
160/160 [==============================] - 0s 374us/step - loss: 0.3204
Epoch 368/400
160/160 [==============================] - 0s 405us/step - loss: 0.3206
Epoch 369/400
160/160 [==============================] - 0s 361us/step - loss: 0.3206
Epoch 370/400
160/160 [==============================] - 0s 418us/step - loss: 0.3207
Epoch 371/400
160/160 [==============================] - 0s 374us/step - loss: 0.3205
Epoch 372/400
160/160 [==============================] - 0s 380us/step - loss: 0.3202
Epoch 373/400
160/160 [==============================] - 0s 399us/step - loss: 0.3200
Epoch 374/400
160/160 [==============================] - 0s 386us/step - loss: 0.3206
Epoch 375/400
160/160 [==============================] - 0s 374us/step - loss: 0.3206
Epoch 376/400
160/160 [==============================] - 0s 386us/step - loss: 0.3205
Epoch 377/400
160/160 [==============================] - 0s 387us/step - loss: 0.3201
Epoch 378/400
160/160 [==============================] - 0s 399us/step - loss: 0.3204
Epoch 379/400
160/160 [==============================] - 0s 418us/step - loss: 0.3203
Epoch 380/400
160/160 [==============================] - 0s 380us/step - loss: 0.3199
Epoch 381/400
160/160 [==============================] - 0s 393us/step - loss: 0.3205
Epoch 382/400
160/160 [==============================] - 0s 380us/step - loss: 0.3204
Epoch 383/400
160/160 [==============================] - 0s 355us/step - loss: 0.3206
Epoch 384/400
160/160 [==============================] - 0s 362us/step - loss: 0.3207
Epoch 385/400
160/160 [==============================] - 0s 386us/step - loss: 0.3202
Epoch 386/400
160/160 [==============================] - 0s 367us/step - loss: 0.3205
Epoch 387/400
160/160 [==============================] - 0s 368us/step - loss: 0.3208
Epoch 388/400
160/160 [==============================] - 0s 355us/step - loss: 0.3204
```

```
Epoch 389/400
160/160 [==============================] - 0s 393us/step - loss: 0.3203
Epoch 390/400
160/160 [==============================] - 0s 386us/step - loss: 0.3202
Epoch 391/400
160/160 [==============================] - 0s 386us/step - loss: 0.3207
Epoch 392/400
160/160 [==============================] - 0s 374us/step - loss: 0.3203
Epoch 393/400
160/160 [==============================] - 0s 380us/step - loss: 0.3200
Epoch 394/400
160/160 [==============================] - 0s 355us/step - loss: 0.3204
Epoch 395/400
160/160 [==============================] - 0s 374us/step - loss: 0.3198
Epoch 396/400
160/160 [==============================] - 0s 374us/step - loss: 0.3201
Epoch 397/400
160/160 [==============================] - 0s 381us/step - loss: 0.3207
Epoch 398/400
160/160 [==============================] - 0s 368us/step - loss: 0.3203
Epoch 399/400
160/160 [==============================] - 0s 380us/step - loss: 0.3202
Epoch 400/400
160/160 [==============================] - 0s 384us/step - loss: 0.3201
[0.43700853 0.9504791  0.94775605 0.94707376 0.9619245  0.95769393
 0.91426706 0.93233657 0.2721277  0.9570542  0.9479088  0.95635605
 0.9378758  0.5682114  0.7637701  0.9108875  0.11405236 0.9529486
 0.9622016  0.7921738  0.9633189  0.9637903  0.10097442 0.8915526
 0.96276677 0.16665952 0.9626944  0.9640999  0.96296966 0.9220018
 0.9427234  0.62124515 0.730125   0.9220422  0.94897276 0.959649
 0.90983313 0.6934186  0.9080288  0.5335685  0.44112557 0.94955885
 0.94698465 0.9463438  0.96026474 0.95633507 0.91516864 0.93236065
 0.27273512 0.9557366  0.9471321  0.9550847  0.9376281  0.574311
 0.7693572  0.9119632  0.11257565 0.9518818  0.9605193  0.7971503
 0.9615386  0.96196467 0.09953841 0.89344966 0.9610366  0.16545638
 0.9609699  0.96224177 0.9612213  0.92254025 0.9422198  0.62782043
 0.7362254  0.9225791  0.9481327  0.9581593  0.9109499  0.6998413
 0.9092168  0.5393519  0.1794821  0.22420149 0.0782878  0.14132193
 0.38467824 0.06756892 0.04996504 0.8854395  0.05026018 0.08710464
 0.08381514 0.16278209 0.09149937 0.2962439  0.05618897 0.9110194
 0.05363395 0.09384274 0.19376944 0.72558886 0.16606241 0.08611501
 0.0626798  0.07826819 0.11186446 0.05270021 0.2831501  0.07230692
 0.0677797  0.04729939 0.67249376 0.1508096  0.04856512 0.04719591
 0.18458141 0.13876577 0.6379411  0.04784185 0.08119976 0.04765404
 0.17838992 0.22441511 0.07702983 0.14264421 0.38142627 0.06651463
 0.0503534  0.8875398  0.050677   0.08572086 0.08508627 0.16390195
 0.09007869 0.29727486 0.05548707 0.9098986  0.05423609 0.0923947
 0.19445966 0.7316502  0.1647288  0.08738955 0.06359534 0.07947776
```

```
 0.11326466 0.05215686 0.28377393 0.07113729 0.06671345 0.04722119
 0.6788779  0.15209422 0.04884262 0.04721186 0.18349972 0.14008878
 0.6312573  0.04765578 0.08244734 0.04749874]
160/160 [==============================] - 0s 1ms/step
```

```
In [62]: scores = model.evaluate(X, y)
         scores, model.metrics_names
```

```
160/160 [==============================] - 0s 25us/step
```

```
Out[62]: (0.31716773509979246, ['loss'])
```

```
In [ ]: model = Sequential()

        model.add(Dense(3, input_dim=2, activation='tanh'))
        model.add(Dense(2, input_dim=2, activation='tanh'))  #sigmoid, relu
        # model.add(Dense(2, activation='tanh'))
        model.add(Dense(1, activation='sigmoid'))
        # model.add(Dense(1,input_dim=2, activation='sigmoid'))


        sgd = SGD(lr=0.1)
        model.compile(loss='binary_crossentropy', optimizer='sgd')

        model.fit(X, y, batch_size=2, epochs=400) #160/4 = 40 per epoch
        print(model.predict_proba(X).reshape(4*n))

        # evaluate the model
        scores = model.evaluate(X, y)
```

```
In [ ]: model = Sequential()

        model.add(Dense(4, input_dim=2, activation='tanh'))
        model.add(Dense(3, input_dim=2, activation='tanh'))
        model.add(Dense(2, input_dim=2, activation='tanh'))  #sigmoid, relu
        # model.add(Dense(2, activation='tanh'))
        model.add(Dense(1, activation='sigmoid'))
        # model.add(Dense(1,input_dim=2, activation='sigmoid'))


        sgd = SGD(lr=0.1)
        model.compile(loss='binary_crossentropy', optimizer='sgd')

        model.fit(X, y, batch_size=2, epochs=400) #160/4 = 40 per epoch
        print(model.predict_proba(X).reshape(4*n))

        # evaluate the model
        scores = model.evaluate(X, y)
```

```
In [65]: model = Sequential()

         model.add(Dense(5, input_dim=2, activation='tanh'))
         model.add(Dense(4, input_dim=2, activation='tanh'))
         model.add(Dense(3, input_dim=2, activation='tanh'))
         model.add(Dense(2, input_dim=2, activation='tanh'))  #sigmoid, relu
         # model.add(Dense(2, activation='tanh'))
         model.add(Dense(1, activation='sigmoid'))
         # model.add(Dense(1,input_dim=2, activation='sigmoid'))


         sgd = SGD(lr=0.1)
         model.compile(loss='binary_crossentropy', optimizer='sgd')

         model.fit(X, y, batch_size=2, epochs=400) #160/4 = 40 per epoch
         print(model.predict_proba(X).reshape(4*n))

         # evaluate the model
         scores = model.evaluate(X, y)
```

```
Epoch 1/400
160/160 [==============================] - 1s 4ms/step - loss: 0.7143
Epoch 2/400
160/160 [==============================] - 0s 399us/step - loss: 0.7022
Epoch 3/400
160/160 [==============================] - 0s 399us/step - loss: 0.6951
Epoch 4/400
160/160 [==============================] - 0s 437us/step - loss: 0.6894
Epoch 5/400
160/160 [==============================] - 0s 424us/step - loss: 0.6803
Epoch 6/400
160/160 [==============================] - 0s 411us/step - loss: 0.6695
Epoch 7/400
160/160 [==============================] - 0s 430us/step - loss: 0.6566
Epoch 8/400
160/160 [==============================] - 0s 437us/step - loss: 0.6427
Epoch 9/400
160/160 [==============================] - 0s 406us/step - loss: 0.6298
Epoch 10/400
160/160 [==============================] - 0s 411us/step - loss: 0.6188
Epoch 11/400
160/160 [==============================] - 0s 405us/step - loss: 0.6083
Epoch 12/400
160/160 [==============================] - 0s 405us/step - loss: 0.5974
Epoch 13/400
160/160 [==============================] - 0s 430us/step - loss: 0.5896
Epoch 14/400
160/160 [==============================] - 0s 399us/step - loss: 0.5812
```

```
Epoch 15/400
160/160 [==============================] - 0s 412us/step - loss: 0.5722
Epoch 16/400
160/160 [==============================] - 0s 399us/step - loss: 0.5634
Epoch 17/400
160/160 [==============================] - 0s 430us/step - loss: 0.5551
Epoch 18/400
160/160 [==============================] - 0s 455us/step - loss: 0.5419
Epoch 19/400
160/160 [==============================] - 0s 417us/step - loss: 0.5342
Epoch 20/400
160/160 [==============================] - 0s 424us/step - loss: 0.5224
Epoch 21/400
160/160 [==============================] - 0s 430us/step - loss: 0.5098
Epoch 22/400
160/160 [==============================] - 0s 436us/step - loss: 0.4946
Epoch 23/400
160/160 [==============================] - 0s 455us/step - loss: 0.4775
Epoch 24/400
160/160 [==============================] - 0s 436us/step - loss: 0.4627
Epoch 25/400
160/160 [==============================] - 0s 449us/step - loss: 0.4456
Epoch 26/400
160/160 [==============================] - 0s 436us/step - loss: 0.4264
Epoch 27/400
160/160 [==============================] - 0s 424us/step - loss: 0.4127
Epoch 28/400
160/160 [==============================] - 0s 418us/step - loss: 0.3969
Epoch 29/400
160/160 [==============================] - 0s 449us/step - loss: 0.3784
Epoch 30/400
160/160 [==============================] - 0s 430us/step - loss: 0.3650
Epoch 31/400
160/160 [==============================] - 0s 411us/step - loss: 0.3609
Epoch 32/400
160/160 [==============================] - 0s 417us/step - loss: 0.3469
Epoch 33/400
160/160 [==============================] - 0s 393us/step - loss: 0.3373
Epoch 34/400
160/160 [==============================] - 0s 411us/step - loss: 0.3288
Epoch 35/400
160/160 [==============================] - 0s 455us/step - loss: 0.3166
Epoch 36/400
160/160 [==============================] - 0s 443us/step - loss: 0.3108
Epoch 37/400
160/160 [==============================] - 0s 455us/step - loss: 0.3007
Epoch 38/400
160/160 [==============================] - 0s 430us/step - loss: 0.2991
```

```
Epoch 39/400
160/160 [==============================] - 0s 411us/step - loss: 0.2970
Epoch 40/400
160/160 [==============================] - 0s 424us/step - loss: 0.2894
Epoch 41/400
160/160 [==============================] - 0s 436us/step - loss: 0.2702
Epoch 42/400
160/160 [==============================] - 0s 411us/step - loss: 0.2762
Epoch 43/400
160/160 [==============================] - 0s 461us/step - loss: 0.2638
Epoch 44/400
160/160 [==============================] - 0s 443us/step - loss: 0.2582
Epoch 45/400
160/160 [==============================] - 0s 430us/step - loss: 0.2583
Epoch 46/400
160/160 [==============================] - 0s 462us/step - loss: 0.2468
Epoch 47/400
160/160 [==============================] - 0s 430us/step - loss: 0.2486
Epoch 48/400
160/160 [==============================] - 0s 437us/step - loss: 0.2385
Epoch 49/400
160/160 [==============================] - 0s 456us/step - loss: 0.2324
Epoch 50/400
160/160 [==============================] - 0s 436us/step - loss: 0.2279
Epoch 51/400
160/160 [==============================] - 0s 424us/step - loss: 0.2247
Epoch 52/400
160/160 [==============================] - 0s 424us/step - loss: 0.2124
Epoch 53/400
160/160 [==============================] - 0s 436us/step - loss: 0.2080
Epoch 54/400
160/160 [==============================] - 0s 418us/step - loss: 0.2100
Epoch 55/400
160/160 [==============================] - 0s 417us/step - loss: 0.1924
Epoch 56/400
160/160 [==============================] - 0s 411us/step - loss: 0.1939
Epoch 57/400
160/160 [==============================] - 0s 418us/step - loss: 0.1782
Epoch 58/400
160/160 [==============================] - 0s 430us/step - loss: 0.1768
Epoch 59/400
160/160 [==============================] - 0s 436us/step - loss: 0.1726
Epoch 60/400
160/160 [==============================] - 0s 461us/step - loss: 0.1709
Epoch 61/400
160/160 [==============================] - 0s 430us/step - loss: 0.1635
Epoch 62/400
160/160 [==============================] - 0s 406us/step - loss: 0.1606
```

```
Epoch 63/400
160/160 [==============================] - 0s 424us/step - loss: 0.1616
Epoch 64/400
160/160 [==============================] - 0s 405us/step - loss: 0.1524
Epoch 65/400
160/160 [==============================] - 0s 424us/step - loss: 0.1573
Epoch 66/400
160/160 [==============================] - 0s 411us/step - loss: 0.1603
Epoch 67/400
160/160 [==============================] - 0s 418us/step - loss: 0.1437
Epoch 68/400
160/160 [==============================] - 0s 430us/step - loss: 0.1471
Epoch 69/400
160/160 [==============================] - 0s 451us/step - loss: 0.1321
Epoch 70/400
160/160 [==============================] - 0s 443us/step - loss: 0.1344
Epoch 71/400
160/160 [==============================] - 0s 430us/step - loss: 0.1288
Epoch 72/400
160/160 [==============================] - 0s 455us/step - loss: 0.1263
Epoch 73/400
160/160 [==============================] - 0s 399us/step - loss: 0.1149
Epoch 74/400
160/160 [==============================] - 0s 430us/step - loss: 0.1176
Epoch 75/400
160/160 [==============================] - 0s 443us/step - loss: 0.1210
Epoch 76/400
160/160 [==============================] - 0s 443us/step - loss: 0.1391
Epoch 77/400
160/160 [==============================] - 0s 449us/step - loss: 0.1124
Epoch 78/400
160/160 [==============================] - 0s 405us/step - loss: 0.1154
Epoch 79/400
160/160 [==============================] - 0s 424us/step - loss: 0.1096
Epoch 80/400
160/160 [==============================] - 0s 424us/step - loss: 0.0989
Epoch 81/400
160/160 [==============================] - 0s 411us/step - loss: 0.1098
Epoch 82/400
160/160 [==============================] - 0s 412us/step - loss: 0.1047
Epoch 83/400
160/160 [==============================] - 0s 423us/step - loss: 0.1037
Epoch 84/400
160/160 [==============================] - 0s 443us/step - loss: 0.0993
Epoch 85/400
160/160 [==============================] - 0s 442us/step - loss: 0.1232
Epoch 86/400
160/160 [==============================] - 0s 449us/step - loss: 0.1127
```

```
Epoch 87/400
160/160 [==============================] - 0s 437us/step - loss: 0.1007
Epoch 88/400
160/160 [==============================] - 0s 418us/step - loss: 0.1074
Epoch 89/400
160/160 [==============================] - 0s 408us/step - loss: 0.1046
Epoch 90/400
160/160 [==============================] - 0s 430us/step - loss: 0.0884
Epoch 91/400
160/160 [==============================] - 0s 437us/step - loss: 0.1000
Epoch 92/400
160/160 [==============================] - 0s 424us/step - loss: 0.1011
Epoch 93/400
160/160 [==============================] - 0s 405us/step - loss: 0.1091
Epoch 94/400
160/160 [==============================] - 0s 456us/step - loss: 0.0958
Epoch 95/400
160/160 [==============================] - 0s 429us/step - loss: 0.1084
Epoch 96/400
160/160 [==============================] - 0s 424us/step - loss: 0.0999
Epoch 97/400
160/160 [==============================] - 0s 449us/step - loss: 0.0954
Epoch 98/400
160/160 [==============================] - 0s 430us/step - loss: 0.1023
Epoch 99/400
160/160 [==============================] - 0s 424us/step - loss: 0.0934
Epoch 100/400
160/160 [==============================] - 0s 418us/step - loss: 0.0949
Epoch 101/400
160/160 [==============================] - 0s 412us/step - loss: 0.0900
Epoch 102/400
160/160 [==============================] - 0s 424us/step - loss: 0.0861
Epoch 103/400
160/160 [==============================] - 0s 424us/step - loss: 0.0864
Epoch 104/400
160/160 [==============================] - 0s 418us/step - loss: 0.0980
Epoch 105/400
160/160 [==============================] - 0s 418us/step - loss: 0.0917
Epoch 106/400
160/160 [==============================] - 0s 424us/step - loss: 0.0892
Epoch 107/400
160/160 [==============================] - 0s 411us/step - loss: 0.1004
Epoch 108/400
160/160 [==============================] - 0s 437us/step - loss: 0.0800
Epoch 109/400
160/160 [==============================] - 0s 468us/step - loss: 0.0890
Epoch 110/400
160/160 [==============================] - 0s 424us/step - loss: 0.0878
```

```
Epoch 111/400
160/160 [==============================] - 0s 425us/step - loss: 0.0822
Epoch 112/400
160/160 [==============================] - 0s 424us/step - loss: 0.0864
Epoch 113/400
160/160 [==============================] - 0s 418us/step - loss: 0.0911
Epoch 114/400
160/160 [==============================] - 0s 411us/step - loss: 0.0869
Epoch 115/400
160/160 [==============================] - 0s 405us/step - loss: 0.0769
Epoch 116/400
160/160 [==============================] - 0s 393us/step - loss: 0.0760
Epoch 117/400
160/160 [==============================] - 0s 417us/step - loss: 0.0785
Epoch 118/400
160/160 [==============================] - 0s 418us/step - loss: 0.0806
Epoch 119/400
160/160 [==============================] - 0s 430us/step - loss: 0.0599
Epoch 120/400
160/160 [==============================] - 0s 436us/step - loss: 0.0908
Epoch 121/400
160/160 [==============================] - 0s 413us/step - loss: 0.1082
Epoch 122/400
160/160 [==============================] - 0s 411us/step - loss: 0.0772
Epoch 123/400
160/160 [==============================] - 0s 424us/step - loss: 0.0701
Epoch 124/400
160/160 [==============================] - 0s 405us/step - loss: 0.0733
Epoch 125/400
160/160 [==============================] - 0s 424us/step - loss: 0.0542
Epoch 126/400
160/160 [==============================] - 0s 430us/step - loss: 0.0828
Epoch 127/400
160/160 [==============================] - 0s 417us/step - loss: 0.1163
Epoch 128/400
160/160 [==============================] - 0s 436us/step - loss: 0.0976
Epoch 129/400
160/160 [==============================] - 0s 430us/step - loss: 0.0860
Epoch 130/400
160/160 [==============================] - 0s 411us/step - loss: 0.0715
Epoch 131/400
160/160 [==============================] - 0s 424us/step - loss: 0.0914
Epoch 132/400
160/160 [==============================] - 0s 436us/step - loss: 0.0933
Epoch 133/400
160/160 [==============================] - 0s 418us/step - loss: 0.0675
Epoch 134/400
160/160 [==============================] - 0s 418us/step - loss: 0.0631
```

```
Epoch 135/400
160/160 [==============================] - 0s 418us/step - loss: 0.0696
Epoch 136/400
160/160 [==============================] - 0s 424us/step - loss: 0.0726
Epoch 137/400
160/160 [==============================] - 0s 418us/step - loss: 0.0993
Epoch 138/400
160/160 [==============================] - 0s 405us/step - loss: 0.0667
Epoch 139/400
160/160 [==============================] - 0s 430us/step - loss: 0.0768
Epoch 140/400
160/160 [==============================] - 0s 424us/step - loss: 0.0806
Epoch 141/400
160/160 [==============================] - 0s 418us/step - loss: 0.0820
Epoch 142/400
160/160 [==============================] - 0s 418us/step - loss: 0.0795
Epoch 143/400
160/160 [==============================] - 0s 424us/step - loss: 0.0611
Epoch 144/400
160/160 [==============================] - 0s 430us/step - loss: 0.0884
Epoch 145/400
160/160 [==============================] - 0s 418us/step - loss: 0.0757
Epoch 146/400
160/160 [==============================] - 0s 418us/step - loss: 0.0631
Epoch 147/400
160/160 [==============================] - 0s 411us/step - loss: 0.0900
Epoch 148/400
160/160 [==============================] - 0s 399us/step - loss: 0.0741
Epoch 149/400
160/160 [==============================] - 0s 418us/step - loss: 0.1002
Epoch 150/400
160/160 [==============================] - 0s 430us/step - loss: 0.0662
Epoch 151/400
160/160 [==============================] - 0s 405us/step - loss: 0.0670
Epoch 152/400
160/160 [==============================] - 0s 424us/step - loss: 0.0794
Epoch 153/400
160/160 [==============================] - 0s 442us/step - loss: 0.0987
Epoch 154/400
160/160 [==============================] - 0s 405us/step - loss: 0.0810
Epoch 155/400
160/160 [==============================] - 0s 411us/step - loss: 0.0852
Epoch 156/400
160/160 [==============================] - 0s 411us/step - loss: 0.0664
Epoch 157/400
160/160 [==============================] - 0s 399us/step - loss: 0.0720
Epoch 158/400
160/160 [==============================] - 0s 424us/step - loss: 0.0776
```

```
Epoch 159/400
160/160 [==============================] - 0s 411us/step - loss: 0.0672
Epoch 160/400
160/160 [==============================] - 0s 461us/step - loss: 0.0831
Epoch 161/400
160/160 [==============================] - 0s 480us/step - loss: 0.1134
Epoch 162/400
160/160 [==============================] - 0s 438us/step - loss: 0.0592
Epoch 163/400
160/160 [==============================] - 0s 411us/step - loss: 0.0654
Epoch 164/400
160/160 [==============================] - 0s 405us/step - loss: 0.0738
Epoch 165/400
160/160 [==============================] - 0s 443us/step - loss: 0.0614
Epoch 166/400
160/160 [==============================] - 0s 405us/step - loss: 0.0898
Epoch 167/400
160/160 [==============================] - 0s 418us/step - loss: 0.0853
Epoch 168/400
160/160 [==============================] - 0s 430us/step - loss: 0.0738
Epoch 169/400
160/160 [==============================] - 0s 411us/step - loss: 0.0720
Epoch 170/400
160/160 [==============================] - 0s 411us/step - loss: 0.0524
Epoch 171/400
160/160 [==============================] - 0s 418us/step - loss: 0.0859
Epoch 172/400
160/160 [==============================] - 0s 430us/step - loss: 0.0871
Epoch 173/400
160/160 [==============================] - 0s 405us/step - loss: 0.0850
Epoch 174/400
160/160 [==============================] - 0s 399us/step - loss: 0.0625
Epoch 175/400
160/160 [==============================] - 0s 399us/step - loss: 0.0758
Epoch 176/400
160/160 [==============================] - 0s 424us/step - loss: 0.0670
Epoch 177/400
160/160 [==============================] - 0s 424us/step - loss: 0.0623
Epoch 178/400
160/160 [==============================] - 0s 417us/step - loss: 0.0611
Epoch 179/400
160/160 [==============================] - 0s 418us/step - loss: 0.0593
Epoch 180/400
160/160 [==============================] - 0s 430us/step - loss: 0.0481
Epoch 181/400
160/160 [==============================] - 0s 418us/step - loss: 0.0975
Epoch 182/400
160/160 [==============================] - 0s 443us/step - loss: 0.0818
```

```
Epoch 183/400
160/160 [==============================] - 0s 418us/step - loss: 0.0789
Epoch 184/400
160/160 [==============================] - 0s 424us/step - loss: 0.0572
Epoch 185/400
160/160 [==============================] - 0s 449us/step - loss: 0.0815
Epoch 186/400
160/160 [==============================] - 0s 423us/step - loss: 0.0789
Epoch 187/400
160/160 [==============================] - 0s 412us/step - loss: 0.0700
Epoch 188/400
160/160 [==============================] - 0s 430us/step - loss: 0.0641
Epoch 189/400
160/160 [==============================] - 0s 405us/step - loss: 0.0664
Epoch 190/400
160/160 [==============================] - 0s 418us/step - loss: 0.0668
Epoch 191/400
160/160 [==============================] - 0s 411us/step - loss: 0.0832
Epoch 192/400
160/160 [==============================] - 0s 405us/step - loss: 0.0596
Epoch 193/400
160/160 [==============================] - 0s 449us/step - loss: 0.0730
Epoch 194/400
160/160 [==============================] - 0s 418us/step - loss: 0.0778
Epoch 195/400
160/160 [==============================] - 0s 411us/step - loss: 0.0616
Epoch 196/400
160/160 [==============================] - 0s 424us/step - loss: 0.0899
Epoch 197/400
160/160 [==============================] - 0s 486us/step - loss: 0.0796
Epoch 198/400
160/160 [==============================] - 0s 486us/step - loss: 0.0945
Epoch 199/400
160/160 [==============================] - 0s 480us/step - loss: 0.0613
Epoch 200/400
160/160 [==============================] - 0s 436us/step - loss: 0.0793
Epoch 201/400
160/160 [==============================] - 0s 424us/step - loss: 0.0691
Epoch 202/400
160/160 [==============================] - 0s 430us/step - loss: 0.0463
Epoch 203/400
160/160 [==============================] - 0s 393us/step - loss: 0.0627
Epoch 204/400
160/160 [==============================] - 0s 393us/step - loss: 0.0678
Epoch 205/400
160/160 [==============================] - 0s 436us/step - loss: 0.0621
Epoch 206/400
160/160 [==============================] - 0s 411us/step - loss: 0.0592
```

```
Epoch 207/400
160/160 [==============================] - 0s 411us/step - loss: 0.0597
Epoch 208/400
160/160 [==============================] - 0s 399us/step - loss: 0.0551
Epoch 209/400
160/160 [==============================] - 0s 399us/step - loss: 0.0607
Epoch 210/400
160/160 [==============================] - 0s 418us/step - loss: 0.0818
Epoch 211/400
160/160 [==============================] - 0s 411us/step - loss: 0.0608
Epoch 212/400
160/160 [==============================] - 0s 430us/step - loss: 0.0513
Epoch 213/400
160/160 [==============================] - 0s 417us/step - loss: 0.0752
Epoch 214/400
160/160 [==============================] - 0s 393us/step - loss: 0.0607
Epoch 215/400
160/160 [==============================] - 0s 393us/step - loss: 0.0585
Epoch 216/400
160/160 [==============================] - 0s 393us/step - loss: 0.0596
Epoch 217/400
160/160 [==============================] - 0s 380us/step - loss: 0.0682
Epoch 218/400
160/160 [==============================] - 0s 418us/step - loss: 0.0550
Epoch 219/400
160/160 [==============================] - 0s 418us/step - loss: 0.0614
Epoch 220/400
160/160 [==============================] - 0s 400us/step - loss: 0.0705
Epoch 221/400
160/160 [==============================] - 0s 429us/step - loss: 0.0603
Epoch 222/400
160/160 [==============================] - 0s 443us/step - loss: 0.0774
Epoch 223/400
160/160 [==============================] - 0s 443us/step - loss: 0.0613
Epoch 224/400
160/160 [==============================] - 0s 418us/step - loss: 0.0871
Epoch 225/400
160/160 [==============================] - 0s 425us/step - loss: 0.0804
Epoch 226/400
160/160 [==============================] - 0s 417us/step - loss: 0.0709
Epoch 227/400
160/160 [==============================] - 0s 424us/step - loss: 0.0554
Epoch 228/400
160/160 [==============================] - 0s 417us/step - loss: 0.0871
Epoch 229/400
160/160 [==============================] - 0s 399us/step - loss: 0.0829
Epoch 230/400
160/160 [==============================] - 0s 399us/step - loss: 0.0540
```

```
Epoch 231/400
160/160 [==============================] - 0s 411us/step - loss: 0.0576
Epoch 232/400
160/160 [==============================] - 0s 430us/step - loss: 0.0581
Epoch 233/400
160/160 [==============================] - 0s 424us/step - loss: 0.0555
Epoch 234/400
160/160 [==============================] - 0s 393us/step - loss: 0.0495
Epoch 235/400
160/160 [==============================] - 0s 411us/step - loss: 0.0541
Epoch 236/400
160/160 [==============================] - 0s 400us/step - loss: 0.0505
Epoch 237/400
160/160 [==============================] - 0s 411us/step - loss: 0.0729
Epoch 238/400
160/160 [==============================] - 0s 405us/step - loss: 0.0807
Epoch 239/400
160/160 [==============================] - 0s 430us/step - loss: 0.0600
Epoch 240/400
160/160 [==============================] - 0s 405us/step - loss: 0.1040
Epoch 241/400
160/160 [==============================] - 0s 399us/step - loss: 0.0773
Epoch 242/400
160/160 [==============================] - 0s 405us/step - loss: 0.0948
Epoch 243/400
160/160 [==============================] - 0s 418us/step - loss: 0.0637
Epoch 244/400
160/160 [==============================] - 0s 424us/step - loss: 0.0482
Epoch 245/400
160/160 [==============================] - 0s 411us/step - loss: 0.0581
Epoch 246/400
160/160 [==============================] - 0s 417us/step - loss: 0.0718
Epoch 247/400
160/160 [==============================] - 0s 380us/step - loss: 0.0498
Epoch 248/400
160/160 [==============================] - 0s 431us/step - loss: 0.0716
Epoch 249/400
160/160 [==============================] - 0s 423us/step - loss: 0.0669
Epoch 250/400
160/160 [==============================] - 0s 418us/step - loss: 0.0570
Epoch 251/400
160/160 [==============================] - 0s 418us/step - loss: 0.0598
Epoch 252/400
160/160 [==============================] - 0s 405us/step - loss: 0.0536
Epoch 253/400
160/160 [==============================] - 0s 443us/step - loss: 0.0554
Epoch 254/400
160/160 [==============================] - 0s 418us/step - loss: 0.0729
```

```
Epoch 255/400
160/160 [==============================] - 0s 424us/step - loss: 0.0678
Epoch 256/400
160/160 [==============================] - 0s 405us/step - loss: 0.0971
Epoch 257/400
160/160 [==============================] - 0s 405us/step - loss: 0.0655
Epoch 258/400
160/160 [==============================] - 0s 399us/step - loss: 0.0652
Epoch 259/400
160/160 [==============================] - 0s 393us/step - loss: 0.0519
Epoch 260/400
160/160 [==============================] - 0s 424us/step - loss: 0.0805
Epoch 261/400
160/160 [==============================] - 0s 430us/step - loss: 0.0490
Epoch 262/400
160/160 [==============================] - 0s 436us/step - loss: 0.0633
Epoch 263/400
160/160 [==============================] - 0s 424us/step - loss: 0.0665
Epoch 264/400
160/160 [==============================] - 0s 405us/step - loss: 0.0542
Epoch 265/400
160/160 [==============================] - 0s 399us/step - loss: 0.0710
Epoch 266/400
160/160 [==============================] - 0s 449us/step - loss: 0.0650
Epoch 267/400
160/160 [==============================] - 0s 405us/step - loss: 0.0604
Epoch 268/400
160/160 [==============================] - 0s 417us/step - loss: 0.0464
Epoch 269/400
160/160 [==============================] - 0s 387us/step - loss: 0.0499
Epoch 270/400
160/160 [==============================] - 0s 405us/step - loss: 0.0583
Epoch 271/400
160/160 [==============================] - 0s 430us/step - loss: 0.0712
Epoch 272/400
160/160 [==============================] - 0s 405us/step - loss: 0.0530
Epoch 273/400
160/160 [==============================] - 0s 411us/step - loss: 0.0571
Epoch 274/400
160/160 [==============================] - 0s 405us/step - loss: 0.0441
Epoch 275/400
160/160 [==============================] - 0s 418us/step - loss: 0.0644
Epoch 276/400
160/160 [==============================] - 0s 411us/step - loss: 0.0592
Epoch 277/400
160/160 [==============================] - 0s 424us/step - loss: 0.0668
Epoch 278/400
160/160 [==============================] - 0s 405us/step - loss: 0.0518
```

```
Epoch 279/400
160/160 [==============================] - 0s 399us/step - loss: 0.0635
Epoch 280/400
160/160 [==============================] - 0s 424us/step - loss: 0.0515
Epoch 281/400
160/160 [==============================] - 0s 405us/step - loss: 0.0576
Epoch 282/400
160/160 [==============================] - 0s 393us/step - loss: 0.0548
Epoch 283/400
160/160 [==============================] - 0s 411us/step - loss: 0.0489
Epoch 284/400
160/160 [==============================] - 0s 424us/step - loss: 0.0704
Epoch 285/400
160/160 [==============================] - 0s 449us/step - loss: 0.0550
Epoch 286/400
160/160 [==============================] - 0s 455us/step - loss: 0.0690
Epoch 287/400
160/160 [==============================] - 0s 443us/step - loss: 0.0536
Epoch 288/400
160/160 [==============================] - 0s 424us/step - loss: 0.0575
Epoch 289/400
160/160 [==============================] - 0s 411us/step - loss: 0.0495
Epoch 290/400
160/160 [==============================] - 0s 411us/step - loss: 0.0554
Epoch 291/400
160/160 [==============================] - 0s 412us/step - loss: 0.0656
Epoch 292/400
160/160 [==============================] - 0s 411us/step - loss: 0.0611
Epoch 293/400
160/160 [==============================] - 0s 418us/step - loss: 0.0579
Epoch 294/400
160/160 [==============================] - 0s 418us/step - loss: 0.0624
Epoch 295/400
160/160 [==============================] - 0s 418us/step - loss: 0.0617
Epoch 296/400
160/160 [==============================] - 0s 419us/step - loss: 0.0499
Epoch 297/400
160/160 [==============================] - 0s 405us/step - loss: 0.0441
Epoch 298/400
160/160 [==============================] - 0s 411us/step - loss: 0.0543
Epoch 299/400
160/160 [==============================] - 0s 412us/step - loss: 0.0652
Epoch 300/400
160/160 [==============================] - 0s 424us/step - loss: 0.0580
Epoch 301/400
160/160 [==============================] - 0s 424us/step - loss: 0.0653
Epoch 302/400
160/160 [==============================] - 0s 386us/step - loss: 0.0751
```

```
Epoch 303/400
160/160 [==============================] - 0s 411us/step - loss: 0.0544
Epoch 304/400
160/160 [==============================] - 0s 424us/step - loss: 0.0602
Epoch 305/400
160/160 [==============================] - 0s 393us/step - loss: 0.0536
Epoch 306/400
160/160 [==============================] - 0s 405us/step - loss: 0.0593
Epoch 307/400
160/160 [==============================] - 0s 411us/step - loss: 0.0457
Epoch 308/400
160/160 [==============================] - 0s 405us/step - loss: 0.0551
Epoch 309/400
160/160 [==============================] - 0s 417us/step - loss: 0.0639
Epoch 310/400
160/160 [==============================] - 0s 436us/step - loss: 0.0572
Epoch 311/400
160/160 [==============================] - 0s 412us/step - loss: 0.0641
Epoch 312/400
160/160 [==============================] - 0s 411us/step - loss: 0.0725
Epoch 313/400
160/160 [==============================] - 0s 418us/step - loss: 0.0631
Epoch 314/400
160/160 [==============================] - 0s 443us/step - loss: 0.0685
Epoch 315/400
160/160 [==============================] - 0s 399us/step - loss: 0.0871
Epoch 316/400
160/160 [==============================] - 0s 406us/step - loss: 0.0506
Epoch 317/400
160/160 [==============================] - 0s 424us/step - loss: 0.0444
Epoch 318/400
160/160 [==============================] - 0s 412us/step - loss: 0.0440
Epoch 319/400
160/160 [==============================] - 0s 424us/step - loss: 0.0507
Epoch 320/400
160/160 [==============================] - 0s 411us/step - loss: 0.0479
Epoch 321/400
160/160 [==============================] - 0s 418us/step - loss: 0.0405
Epoch 322/400
160/160 [==============================] - 0s 418us/step - loss: 0.0449
Epoch 323/400
160/160 [==============================] - 0s 418us/step - loss: 0.0442
Epoch 324/400
160/160 [==============================] - 0s 424us/step - loss: 0.0507
Epoch 325/400
160/160 [==============================] - 0s 411us/step - loss: 0.0441
Epoch 326/400
160/160 [==============================] - 0s 430us/step - loss: 0.0496
```

```
Epoch 327/400
160/160 [==============================] - 0s 424us/step - loss: 0.0550
Epoch 328/400
160/160 [==============================] - 0s 424us/step - loss: 0.0546
Epoch 329/400
160/160 [==============================] - 0s 418us/step - loss: 0.0521
Epoch 330/400
160/160 [==============================] - 0s 405us/step - loss: 0.0418
Epoch 331/400
160/160 [==============================] - 0s 418us/step - loss: 0.0576
Epoch 332/400
160/160 [==============================] - 0s 393us/step - loss: 0.0459
Epoch 333/400
160/160 [==============================] - 0s 399us/step - loss: 0.0584
Epoch 334/400
160/160 [==============================] - 0s 418us/step - loss: 0.0531
Epoch 335/400
160/160 [==============================] - 0s 411us/step - loss: 0.0465
Epoch 336/400
160/160 [==============================] - 0s 436us/step - loss: 0.0535
Epoch 337/400
160/160 [==============================] - 0s 418us/step - loss: 0.0490
Epoch 338/400
160/160 [==============================] - 0s 411us/step - loss: 0.0673
Epoch 339/400
160/160 [==============================] - 0s 405us/step - loss: 0.0442
Epoch 340/400
160/160 [==============================] - 0s 393us/step - loss: 0.0702
Epoch 341/400
160/160 [==============================] - 0s 424us/step - loss: 0.0658
Epoch 342/400
160/160 [==============================] - 0s 411us/step - loss: 0.0672
Epoch 343/400
160/160 [==============================] - 0s 405us/step - loss: 0.0620
Epoch 344/400
160/160 [==============================] - 0s 405us/step - loss: 0.0445
Epoch 345/400
160/160 [==============================] - 0s 436us/step - loss: 0.0387
Epoch 346/400
160/160 [==============================] - 0s 424us/step - loss: 0.0538
Epoch 347/400
160/160 [==============================] - 0s 411us/step - loss: 0.0406
Epoch 348/400
160/160 [==============================] - 0s 411us/step - loss: 0.0638
Epoch 349/400
160/160 [==============================] - 0s 411us/step - loss: 0.0415
Epoch 350/400
160/160 [==============================] - 0s 418us/step - loss: 0.0448
```

```
Epoch 351/400
160/160 [==============================] - 0s 393us/step - loss: 0.0518
Epoch 352/400
160/160 [==============================] - 0s 413us/step - loss: 0.0567
Epoch 353/400
160/160 [==============================] - 0s 424us/step - loss: 0.0418
Epoch 354/400
160/160 [==============================] - 0s 418us/step - loss: 0.0460
Epoch 355/400
160/160 [==============================] - 0s 411us/step - loss: 0.0467
Epoch 356/400
160/160 [==============================] - 0s 430us/step - loss: 0.0565
Epoch 357/400
160/160 [==============================] - 0s 437us/step - loss: 0.0416
Epoch 358/400
160/160 [==============================] - 0s 424us/step - loss: 0.0674
Epoch 359/400
160/160 [==============================] - 0s 405us/step - loss: 0.0664
Epoch 360/400
160/160 [==============================] - 0s 411us/step - loss: 0.0424
Epoch 361/400
160/160 [==============================] - 0s 424us/step - loss: 0.0493
Epoch 362/400
160/160 [==============================] - 0s 405us/step - loss: 0.0393
Epoch 363/400
160/160 [==============================] - 0s 404us/step - loss: 0.0447
Epoch 364/400
160/160 [==============================] - 0s 420us/step - loss: 0.0425
Epoch 365/400
160/160 [==============================] - 0s 418us/step - loss: 0.0468
Epoch 366/400
160/160 [==============================] - 0s 418us/step - loss: 0.0394
Epoch 367/400
160/160 [==============================] - 0s 418us/step - loss: 0.0515
Epoch 368/400
160/160 [==============================] - 0s 424us/step - loss: 0.0576
Epoch 369/400
160/160 [==============================] - 0s 411us/step - loss: 0.0331
Epoch 370/400
160/160 [==============================] - 0s 411us/step - loss: 0.0563
Epoch 371/400
160/160 [==============================] - 0s 411us/step - loss: 0.0592
Epoch 372/400
160/160 [==============================] - 0s 431us/step - loss: 0.0584
Epoch 373/400
160/160 [==============================] - 0s 430us/step - loss: 0.0549
Epoch 374/400
160/160 [==============================] - 0s 424us/step - loss: 0.0479
```

```
Epoch 375/400
160/160 [==============================] - 0s 418us/step - loss: 0.0508
Epoch 376/400
160/160 [==============================] - 0s 443us/step - loss: 0.0403
Epoch 377/400
160/160 [==============================] - 0s 418us/step - loss: 0.0575
Epoch 378/400
160/160 [==============================] - 0s 424us/step - loss: 0.0520
Epoch 379/400
160/160 [==============================] - 0s 411us/step - loss: 0.0510
Epoch 380/400
160/160 [==============================] - 0s 424us/step - loss: 0.0459
Epoch 381/400
160/160 [==============================] - 0s 411us/step - loss: 0.0556
Epoch 382/400
160/160 [==============================] - 0s 418us/step - loss: 0.0413
Epoch 383/400
160/160 [==============================] - 0s 424us/step - loss: 0.0401
Epoch 384/400
160/160 [==============================] - 0s 406us/step - loss: 0.0429
Epoch 385/400
160/160 [==============================] - 0s 405us/step - loss: 0.0543
Epoch 386/400
160/160 [==============================] - 0s 405us/step - loss: 0.0438
Epoch 387/400
160/160 [==============================] - 0s 424us/step - loss: 0.0466
Epoch 388/400
160/160 [==============================] - 0s 387us/step - loss: 0.0405
Epoch 389/400
160/160 [==============================] - 0s 399us/step - loss: 0.0529
Epoch 390/400
160/160 [==============================] - 0s 386us/step - loss: 0.0534
Epoch 391/400
160/160 [==============================] - 0s 412us/step - loss: 0.0511
Epoch 392/400
160/160 [==============================] - 0s 411us/step - loss: 0.0463
Epoch 393/400
160/160 [==============================] - 0s 411us/step - loss: 0.0530
Epoch 394/400
160/160 [==============================] - 0s 411us/step - loss: 0.0368
Epoch 395/400
160/160 [==============================] - 0s 399us/step - loss: 0.0404
Epoch 396/400
160/160 [==============================] - 0s 399us/step - loss: 0.0499
Epoch 397/400
160/160 [==============================] - 0s 412us/step - loss: 0.0524
Epoch 398/400
160/160 [==============================] - 0s 411us/step - loss: 0.0572
```

```
Epoch 399/400
160/160 [==============================] - 0s 418us/step - loss: 0.0408
Epoch 400/400
160/160 [==============================] - 0s 424us/step - loss: 0.0402
[0.9977621  0.9984823  0.9985049  0.9984964  0.998536   0.99851364
 0.9985083  0.99512035 0.9976689  0.99850285 0.99852055 0.9985247
 0.9984963  0.9973839  0.9984799  0.62098885 0.98655593 0.99849844
 0.99854845 0.9737318  0.99848264 0.998555   0.9473517  0.9984382
 0.9985531  0.9974831  0.998459   0.9985139  0.99851567 0.9985177
 0.99824727 0.9968263  0.99842215 0.99851745 0.99846554 0.99854076
 0.9961964  0.9984463  0.99845684 0.99837554 0.9827639  0.9864058
 0.98640466 0.98641413 0.98643064 0.9864318  0.9864073  0.9816219
 0.98584497 0.9864238  0.98642737 0.9864288  0.98637414 0.98179585
 0.98625165 0.9523837  0.9831699  0.98640984 0.98644185 0.9636785
 0.98643816 0.98645127 0.98023385 0.9863798  0.9864477  0.98432136
 0.9864259  0.98644847 0.98644537 0.9864071  0.9859694  0.9859249
 0.98631406 0.9864088  0.98636174 0.9864385  0.9857545  0.9862687
 0.9863906  0.9861667  0.00967899 0.0074615  0.00626394 0.00737472
 0.00678233 0.0066007  0.00683167 0.00649036 0.00743302 0.00650845
 0.007084   0.00701504 0.00599611 0.01145044 0.00566954 0.94814795
 0.01424533 0.0063293  0.00672517 0.05665235 0.00691447 0.00667591
 0.25331622 0.008044   0.0066969  0.00555593 0.00677148 0.00696681
 0.00684647 0.00651564 0.00528206 0.13009174 0.00669709 0.00657526
 0.00593387 0.0068375  0.0463649  0.00596066 0.00783625 0.00583679
 0.00533448 0.00650962 0.00521315 0.00635181 0.00597041 0.00533419
 0.00580056 0.00532113 0.00660305 0.00526918 0.00602556 0.00606491
 0.00507999 0.00647704 0.00492225 0.59152335 0.01016519 0.00520812
 0.00578611 0.15746535 0.00525166 0.00554002 0.04100036 0.00675535
 0.0056544  0.00452531 0.00518874 0.00531049 0.0053416  0.00552489
 0.00453683 0.02894006 0.00585069 0.00557323 0.00499047 0.00586546
 0.02309502 0.00523572 0.00661276 0.00514797]
160/160 [==============================] - 0s 1ms/step
```

```
In [72]: scores = model.evaluate(X, y)
         scores, model.metrics_names
```

```
160/160 [==============================] - 0s 31us/step
```

```
Out[72]: (0.12049313932657242, ['loss'])
```

```
In [69]: model = Sequential()

         model.add(Dense(5, input_dim=2, activation='sigmoid'))
         model.add(Dense(4, input_dim=2, activation='sigmoid'))
         model.add(Dense(3, input_dim=2, activation='relu'))
         model.add(Dense(2, input_dim=2, activation='relu'))  #sigmoid, relu
         # model.add(Dense(2, activation='tanh'))
```

```
        model.add(Dense(1, activation='sigmoid'))
        # model.add(Dense(1,input_dim=2, activation='sigmoid'))


        sgd = SGD(lr=0.1)
        model.compile(loss='binary_crossentropy', optimizer='sgd')

        model.fit(X, y, batch_size=2, epochs=400) #160/4 = 40 per epoch
        print(model.predict_proba(X).reshape(4*n))

        # evaluate the model
        scores = model.evaluate(X, y)
```

```
Epoch 1/400
160/160 [==============================] - 1s 4ms/step - loss: 0.7144
Epoch 2/400
160/160 [==============================] - 0s 454us/step - loss: 0.6967
Epoch 3/400
160/160 [==============================] - 0s 431us/step - loss: 0.6950
Epoch 4/400
160/160 [==============================] - 0s 405us/step - loss: 0.6939
Epoch 5/400
160/160 [==============================] - 0s 425us/step - loss: 0.6945
Epoch 6/400
160/160 [==============================] - 0s 430us/step - loss: 0.6941
Epoch 7/400
160/160 [==============================] - 0s 405us/step - loss: 0.6945
Epoch 8/400
160/160 [==============================] - 0s 399us/step - loss: 0.6944
Epoch 9/400
160/160 [==============================] - 0s 424us/step - loss: 0.6938
Epoch 10/400
160/160 [==============================] - 0s 430us/step - loss: 0.6944
Epoch 11/400
160/160 [==============================] - 0s 430us/step - loss: 0.6944
Epoch 12/400
160/160 [==============================] - 0s 417us/step - loss: 0.6941
Epoch 13/400
160/160 [==============================] - 0s 418us/step - loss: 0.6944
Epoch 14/400
160/160 [==============================] - 0s 424us/step - loss: 0.6934
Epoch 15/400
160/160 [==============================] - 0s 430us/step - loss: 0.6937
Epoch 16/400
160/160 [==============================] - 0s 430us/step - loss: 0.6944
Epoch 17/400
160/160 [==============================] - 0s 443us/step - loss: 0.6942
Epoch 18/400
```

```
160/160 [==============================] - 0s 437us/step - loss: 0.6942
Epoch 19/400
160/160 [==============================] - 0s 430us/step - loss: 0.6937
Epoch 20/400
160/160 [==============================] - 0s 424us/step - loss: 0.6942
Epoch 21/400
160/160 [==============================] - 0s 411us/step - loss: 0.6934
Epoch 22/400
160/160 [==============================] - 0s 418us/step - loss: 0.6940
Epoch 23/400
160/160 [==============================] - 0s 468us/step - loss: 0.6921
Epoch 24/400
160/160 [==============================] - 0s 467us/step - loss: 0.6942
Epoch 25/400
160/160 [==============================] - 0s 449us/step - loss: 0.6932
Epoch 26/400
160/160 [==============================] - 0s 437us/step - loss: 0.6936
Epoch 27/400
160/160 [==============================] - 0s 461us/step - loss: 0.6928
Epoch 28/400
160/160 [==============================] - 0s 405us/step - loss: 0.6928
Epoch 29/400
160/160 [==============================] - 0s 436us/step - loss: 0.6934
Epoch 30/400
160/160 [==============================] - 0s 430us/step - loss: 0.6937
Epoch 31/400
160/160 [==============================] - 0s 430us/step - loss: 0.6914
Epoch 32/400
160/160 [==============================] - 0s 430us/step - loss: 0.6931
Epoch 33/400
160/160 [==============================] - 0s 436us/step - loss: 0.6932
Epoch 34/400
160/160 [==============================] - 0s 455us/step - loss: 0.6930
Epoch 35/400
160/160 [==============================] - 0s 411us/step - loss: 0.6929
Epoch 36/400
160/160 [==============================] - 0s 418us/step - loss: 0.6925
Epoch 37/400
160/160 [==============================] - 0s 411us/step - loss: 0.6928
Epoch 38/400
160/160 [==============================] - 0s 418us/step - loss: 0.6929
Epoch 39/400
160/160 [==============================] - 0s 424us/step - loss: 0.6931
Epoch 40/400
160/160 [==============================] - 0s 418us/step - loss: 0.6926
Epoch 41/400
160/160 [==============================] - 0s 430us/step - loss: 0.6920
Epoch 42/400
```

```
160/160 [==============================] - 0s 430us/step - loss: 0.6927
Epoch 43/400
160/160 [==============================] - 0s 443us/step - loss: 0.6920
Epoch 44/400
160/160 [==============================] - 0s 449us/step - loss: 0.6914
Epoch 45/400
160/160 [==============================] - 0s 430us/step - loss: 0.6928
Epoch 46/400
160/160 [==============================] - 0s 399us/step - loss: 0.6926
Epoch 47/400
160/160 [==============================] - 0s 399us/step - loss: 0.6922
Epoch 48/400
160/160 [==============================] - 0s 443us/step - loss: 0.6924
Epoch 49/400
160/160 [==============================] - 0s 455us/step - loss: 0.6923
Epoch 50/400
160/160 [==============================] - 0s 461us/step - loss: 0.6913
Epoch 51/400
160/160 [==============================] - 0s 462us/step - loss: 0.6924
Epoch 52/400
160/160 [==============================] - 0s 461us/step - loss: 0.6921
Epoch 53/400
160/160 [==============================] - 0s 455us/step - loss: 0.6916
Epoch 54/400
160/160 [==============================] - 0s 424us/step - loss: 0.6919
Epoch 55/400
160/160 [==============================] - 0s 436us/step - loss: 0.6912
Epoch 56/400
160/160 [==============================] - 0s 436us/step - loss: 0.6917
Epoch 57/400
160/160 [==============================] - 0s 430us/step - loss: 0.6910
Epoch 58/400
160/160 [==============================] - 0s 461us/step - loss: 0.6916
Epoch 59/400
160/160 [==============================] - 0s 429us/step - loss: 0.6906
Epoch 60/400
160/160 [==============================] - 0s 430us/step - loss: 0.6912
Epoch 61/400
160/160 [==============================] - 0s 436us/step - loss: 0.6903
Epoch 62/400
160/160 [==============================] - 0s 436us/step - loss: 0.6902
Epoch 63/400
160/160 [==============================] - 0s 418us/step - loss: 0.6891
Epoch 64/400
160/160 [==============================] - 0s 405us/step - loss: 0.6901
Epoch 65/400
160/160 [==============================] - 0s 424us/step - loss: 0.6890
Epoch 66/400
```

```
160/160 [==============================] - 0s 461us/step - loss: 0.6896
Epoch 67/400
160/160 [==============================] - 0s 461us/step - loss: 0.6902
Epoch 68/400
160/160 [==============================] - 0s 436us/step - loss: 0.6896
Epoch 69/400
160/160 [==============================] - 0s 424us/step - loss: 0.6896
Epoch 70/400
160/160 [==============================] - 0s 437us/step - loss: 0.6890
Epoch 71/400
160/160 [==============================] - 0s 437us/step - loss: 0.6886
Epoch 72/400
160/160 [==============================] - 0s 399us/step - loss: 0.6892
Epoch 73/400
160/160 [==============================] - 0s 424us/step - loss: 0.6889
Epoch 74/400
160/160 [==============================] - 0s 430us/step - loss: 0.6863
Epoch 75/400
160/160 [==============================] - 0s 424us/step - loss: 0.6885
Epoch 76/400
160/160 [==============================] - 0s 442us/step - loss: 0.6890
Epoch 77/400
160/160 [==============================] - 0s 418us/step - loss: 0.6884
Epoch 78/400
160/160 [==============================] - 0s 468us/step - loss: 0.6883
Epoch 79/400
160/160 [==============================] - 0s 437us/step - loss: 0.6875
Epoch 80/400
160/160 [==============================] - 0s 430us/step - loss: 0.6876
Epoch 81/400
160/160 [==============================] - 0s 405us/step - loss: 0.6868
Epoch 82/400
160/160 [==============================] - 0s 455us/step - loss: 0.6869
Epoch 83/400
160/160 [==============================] - 0s 424us/step - loss: 0.6868
Epoch 84/400
160/160 [==============================] - 0s 437us/step - loss: 0.6862
Epoch 85/400
160/160 [==============================] - 0s 442us/step - loss: 0.6854
Epoch 86/400
160/160 [==============================] - 0s 430us/step - loss: 0.6866
Epoch 87/400
160/160 [==============================] - 0s 443us/step - loss: 0.6854
Epoch 88/400
160/160 [==============================] - 0s 436us/step - loss: 0.6862
Epoch 89/400
160/160 [==============================] - 0s 455us/step - loss: 0.6851
Epoch 90/400
```

```
160/160 [==============================] - 0s 424us/step - loss: 0.6857
Epoch 91/400
160/160 [==============================] - 0s 443us/step - loss: 0.6833
Epoch 92/400
160/160 [==============================] - 0s 406us/step - loss: 0.6846
Epoch 93/400
160/160 [==============================] - 0s 424us/step - loss: 0.6839
Epoch 94/400
160/160 [==============================] - 0s 424us/step - loss: 0.6832
Epoch 95/400
160/160 [==============================] - 0s 436us/step - loss: 0.6831
Epoch 96/400
160/160 [==============================] - 0s 474us/step - loss: 0.6818
Epoch 97/400
160/160 [==============================] - 0s 423us/step - loss: 0.6813
Epoch 98/400
160/160 [==============================] - 0s 430us/step - loss: 0.6812
Epoch 99/400
160/160 [==============================] - 0s 418us/step - loss: 0.6823
Epoch 100/400
160/160 [==============================] - 0s 431us/step - loss: 0.6798
Epoch 101/400
160/160 [==============================] - 0s 430us/step - loss: 0.6806
Epoch 102/400
160/160 [==============================] - 0s 430us/step - loss: 0.6810
Epoch 103/400
160/160 [==============================] - 0s 424us/step - loss: 0.6790
Epoch 104/400
160/160 [==============================] - 0s 424us/step - loss: 0.6797
Epoch 105/400
160/160 [==============================] - 0s 455us/step - loss: 0.6781
Epoch 106/400
160/160 [==============================] - 0s 443us/step - loss: 0.6770
Epoch 107/400
160/160 [==============================] - 0s 411us/step - loss: 0.6759
Epoch 108/400
160/160 [==============================] - 0s 436us/step - loss: 0.6750
Epoch 109/400
160/160 [==============================] - 0s 436us/step - loss: 0.6758
Epoch 110/400
160/160 [==============================] - 0s 418us/step - loss: 0.6751
Epoch 111/400
160/160 [==============================] - 0s 430us/step - loss: 0.6740
Epoch 112/400
160/160 [==============================] - 0s 443us/step - loss: 0.6725
Epoch 113/400
160/160 [==============================] - 0s 443us/step - loss: 0.6723
Epoch 114/400
```

```
160/160 [==============================] - 0s 431us/step - loss: 0.6695
Epoch 115/400
160/160 [==============================] - 0s 393us/step - loss: 0.6709
Epoch 116/400
160/160 [==============================] - 0s 418us/step - loss: 0.6708
Epoch 117/400
160/160 [==============================] - 0s 405us/step - loss: 0.6696
Epoch 118/400
160/160 [==============================] - 0s 399us/step - loss: 0.6675
Epoch 119/400
160/160 [==============================] - 0s 417us/step - loss: 0.6665
Epoch 120/400
160/160 [==============================] - 0s 418us/step - loss: 0.6648
Epoch 121/400
160/160 [==============================] - 0s 411us/step - loss: 0.6657
Epoch 122/400
160/160 [==============================] - 0s 430us/step - loss: 0.6624
Epoch 123/400
160/160 [==============================] - 0s 424us/step - loss: 0.6600
Epoch 124/400
160/160 [==============================] - 0s 417us/step - loss: 0.6597
Epoch 125/400
160/160 [==============================] - 0s 424us/step - loss: 0.6562
Epoch 126/400
160/160 [==============================] - 0s 430us/step - loss: 0.6580
Epoch 127/400
160/160 [==============================] - 0s 461us/step - loss: 0.6552
Epoch 128/400
160/160 [==============================] - 0s 436us/step - loss: 0.6515
Epoch 129/400
160/160 [==============================] - 0s 399us/step - loss: 0.6498
Epoch 130/400
160/160 [==============================] - 0s 443us/step - loss: 0.6495
Epoch 131/400
160/160 [==============================] - 0s 424us/step - loss: 0.6474
Epoch 132/400
160/160 [==============================] - 0s 449us/step - loss: 0.6470
Epoch 133/400
160/160 [==============================] - 0s 438us/step - loss: 0.6449
Epoch 134/400
160/160 [==============================] - 0s 429us/step - loss: 0.6433
Epoch 135/400
160/160 [==============================] - 0s 418us/step - loss: 0.6419
Epoch 136/400
160/160 [==============================] - 0s 449us/step - loss: 0.6403
Epoch 137/400
160/160 [==============================] - 0s 430us/step - loss: 0.6379
Epoch 138/400
```

```
160/160 [==============================] - 0s 430us/step - loss: 0.6331
Epoch 139/400
160/160 [==============================] - 0s 455us/step - loss: 0.6283
Epoch 140/400
160/160 [==============================] - 0s 419us/step - loss: 0.6287
Epoch 141/400
160/160 [==============================] - 0s 436us/step - loss: 0.6234
Epoch 142/400
160/160 [==============================] - 0s 436us/step - loss: 0.6212
Epoch 143/400
160/160 [==============================] - 0s 424us/step - loss: 0.6177
Epoch 144/400
160/160 [==============================] - 0s 430us/step - loss: 0.6162
Epoch 145/400
160/160 [==============================] - 0s 449us/step - loss: 0.6159
Epoch 146/400
160/160 [==============================] - 0s 412us/step - loss: 0.6105
Epoch 147/400
160/160 [==============================] - 0s 411us/step - loss: 0.6124
Epoch 148/400
160/160 [==============================] - 0s 424us/step - loss: 0.6070
Epoch 149/400
160/160 [==============================] - 0s 419us/step - loss: 0.6016
Epoch 150/400
160/160 [==============================] - 0s 430us/step - loss: 0.6037
Epoch 151/400
160/160 [==============================] - 0s 449us/step - loss: 0.6002
Epoch 152/400
160/160 [==============================] - 0s 430us/step - loss: 0.6022
Epoch 153/400
160/160 [==============================] - 0s 436us/step - loss: 0.5977
Epoch 154/400
160/160 [==============================] - 0s 418us/step - loss: 0.5952
Epoch 155/400
160/160 [==============================] - 0s 430us/step - loss: 0.5917
Epoch 156/400
160/160 [==============================] - 0s 424us/step - loss: 0.5830
Epoch 157/400
160/160 [==============================] - 0s 436us/step - loss: 0.5922
Epoch 158/400
160/160 [==============================] - 0s 436us/step - loss: 0.5875
Epoch 159/400
160/160 [==============================] - 0s 430us/step - loss: 0.5865
Epoch 160/400
160/160 [==============================] - 0s 399us/step - loss: 0.5811
Epoch 161/400
160/160 [==============================] - 0s 443us/step - loss: 0.5868
Epoch 162/400
```

```
160/160 [==============================] - 0s 455us/step - loss: 0.5808
Epoch 163/400
160/160 [==============================] - 0s 431us/step - loss: 0.5783
Epoch 164/400
160/160 [==============================] - 0s 418us/step - loss: 0.5791
Epoch 165/400
160/160 [==============================] - 0s 436us/step - loss: 0.5727
Epoch 166/400
160/160 [==============================] - 0s 436us/step - loss: 0.5742
Epoch 167/400
160/160 [==============================] - 0s 418us/step - loss: 0.5709
Epoch 168/400
160/160 [==============================] - 0s 474us/step - loss: 0.5702
Epoch 169/400
160/160 [==============================] - 0s 449us/step - loss: 0.5711
Epoch 170/400
160/160 [==============================] - 0s 474us/step - loss: 0.5668
Epoch 171/400
160/160 [==============================] - 0s 430us/step - loss: 0.5696
Epoch 172/400
160/160 [==============================] - 0s 443us/step - loss: 0.5645
Epoch 173/400
160/160 [==============================] - 0s 405us/step - loss: 0.5637
Epoch 174/400
160/160 [==============================] - 0s 436us/step - loss: 0.5622
Epoch 175/400
160/160 [==============================] - 0s 430us/step - loss: 0.5576
Epoch 176/400
160/160 [==============================] - 0s 449us/step - loss: 0.5569
Epoch 177/400
160/160 [==============================] - 0s 424us/step - loss: 0.5596
Epoch 178/400
160/160 [==============================] - 0s 430us/step - loss: 0.5535
Epoch 179/400
160/160 [==============================] - 0s 449us/step - loss: 0.5501
Epoch 180/400
160/160 [==============================] - 0s 436us/step - loss: 0.5450
Epoch 181/400
160/160 [==============================] - 0s 430us/step - loss: 0.5492
Epoch 182/400
160/160 [==============================] - 0s 443us/step - loss: 0.5515
Epoch 183/400
160/160 [==============================] - 0s 436us/step - loss: 0.5434
Epoch 184/400
160/160 [==============================] - 0s 443us/step - loss: 0.5372
Epoch 185/400
160/160 [==============================] - 0s 436us/step - loss: 0.5367
Epoch 186/400
```

```
160/160 [==============================] - 0s 437us/step - loss: 0.5328
Epoch 187/400
160/160 [==============================] - 0s 435us/step - loss: 0.5333
Epoch 188/400
160/160 [==============================] - 0s 436us/step - loss: 0.5284
Epoch 189/400
160/160 [==============================] - 0s 424us/step - loss: 0.5208
Epoch 190/400
160/160 [==============================] - 0s 455us/step - loss: 0.5216
Epoch 191/400
160/160 [==============================] - 0s 443us/step - loss: 0.5167
Epoch 192/400
160/160 [==============================] - 0s 455us/step - loss: 0.5110
Epoch 193/400
160/160 [==============================] - 0s 455us/step - loss: 0.5019
Epoch 194/400
160/160 [==============================] - 0s 424us/step - loss: 0.5090
Epoch 195/400
160/160 [==============================] - 0s 430us/step - loss: 0.5002
Epoch 196/400
160/160 [==============================] - 0s 430us/step - loss: 0.4916
Epoch 197/400
160/160 [==============================] - 0s 431us/step - loss: 0.4914
Epoch 198/400
160/160 [==============================] - 0s 443us/step - loss: 0.4773
Epoch 199/400
160/160 [==============================] - 0s 431us/step - loss: 0.4879
Epoch 200/400
160/160 [==============================] - 0s 411us/step - loss: 0.4723
Epoch 201/400
160/160 [==============================] - 0s 417us/step - loss: 0.4592
Epoch 202/400
160/160 [==============================] - 0s 430us/step - loss: 0.4657
Epoch 203/400
160/160 [==============================] - 0s 405us/step - loss: 0.4656
Epoch 204/400
160/160 [==============================] - 0s 424us/step - loss: 0.4603
Epoch 205/400
160/160 [==============================] - 0s 430us/step - loss: 0.4450
Epoch 206/400
160/160 [==============================] - 0s 418us/step - loss: 0.4405
Epoch 207/400
160/160 [==============================] - 0s 443us/step - loss: 0.4406
Epoch 208/400
160/160 [==============================] - 0s 405us/step - loss: 0.4405
Epoch 209/400
160/160 [==============================] - 0s 418us/step - loss: 0.4375
Epoch 210/400
```

```
160/160 [==============================] - 0s 405us/step - loss: 0.4229
Epoch 211/400
160/160 [==============================] - 0s 430us/step - loss: 0.4315
Epoch 212/400
160/160 [==============================] - 0s 424us/step - loss: 0.4120
Epoch 213/400
160/160 [==============================] - 0s 436us/step - loss: 0.4158
Epoch 214/400
160/160 [==============================] - 0s 418us/step - loss: 0.3985
Epoch 215/400
160/160 [==============================] - 0s 405us/step - loss: 0.4086
Epoch 216/400
160/160 [==============================] - 0s 424us/step - loss: 0.3810
Epoch 217/400
160/160 [==============================] - 0s 418us/step - loss: 0.3883
Epoch 218/400
160/160 [==============================] - 0s 418us/step - loss: 0.3889
Epoch 219/400
160/160 [==============================] - 0s 417us/step - loss: 0.3959
Epoch 220/400
160/160 [==============================] - 0s 399us/step - loss: 0.3839
Epoch 221/400
160/160 [==============================] - 0s 436us/step - loss: 0.3877
Epoch 222/400
160/160 [==============================] - 0s 424us/step - loss: 0.3803
Epoch 223/400
160/160 [==============================] - 0s 411us/step - loss: 0.3773
Epoch 224/400
160/160 [==============================] - 0s 411us/step - loss: 0.3653
Epoch 225/400
160/160 [==============================] - 0s 405us/step - loss: 0.3788
Epoch 226/400
160/160 [==============================] - 0s 424us/step - loss: 0.3728
Epoch 227/400
160/160 [==============================] - 0s 430us/step - loss: 0.3659
Epoch 228/400
160/160 [==============================] - 0s 424us/step - loss: 0.3738
Epoch 229/400
160/160 [==============================] - 0s 411us/step - loss: 0.3628
Epoch 230/400
160/160 [==============================] - 0s 430us/step - loss: 0.3527
Epoch 231/400
160/160 [==============================] - 0s 411us/step - loss: 0.3542
Epoch 232/400
160/160 [==============================] - 0s 449us/step - loss: 0.3504
Epoch 233/400
160/160 [==============================] - 0s 449us/step - loss: 0.3596
Epoch 234/400
```

```
160/160 [==============================] - 0s 436us/step - loss: 0.3514
Epoch 235/400
160/160 [==============================] - 0s 411us/step - loss: 0.3376
Epoch 236/400
160/160 [==============================] - 0s 436us/step - loss: 0.3462
Epoch 237/400
160/160 [==============================] - 0s 405us/step - loss: 0.3448
Epoch 238/400
160/160 [==============================] - 0s 419us/step - loss: 0.3442
Epoch 239/400
160/160 [==============================] - 0s 430us/step - loss: 0.3333
Epoch 240/400
160/160 [==============================] - 0s 430us/step - loss: 0.3375
Epoch 241/400
160/160 [==============================] - 0s 407us/step - loss: 0.3447
Epoch 242/400
160/160 [==============================] - 0s 417us/step - loss: 0.3354
Epoch 243/400
160/160 [==============================] - 0s 424us/step - loss: 0.3363
Epoch 244/400
160/160 [==============================] - 0s 436us/step - loss: 0.3396
Epoch 245/400
160/160 [==============================] - 0s 430us/step - loss: 0.3323
Epoch 246/400
160/160 [==============================] - 0s 411us/step - loss: 0.3315
Epoch 247/400
160/160 [==============================] - 0s 418us/step - loss: 0.3226
Epoch 248/400
160/160 [==============================] - 0s 424us/step - loss: 0.3173
Epoch 249/400
160/160 [==============================] - 0s 418us/step - loss: 0.3219
Epoch 250/400
160/160 [==============================] - 0s 430us/step - loss: 0.3204
Epoch 251/400
160/160 [==============================] - 0s 424us/step - loss: 0.3304
Epoch 252/400
160/160 [==============================] - 0s 424us/step - loss: 0.3133
Epoch 253/400
160/160 [==============================] - 0s 431us/step - loss: 0.3281
Epoch 254/400
160/160 [==============================] - 0s 430us/step - loss: 0.3177
Epoch 255/400
160/160 [==============================] - 0s 436us/step - loss: 0.3302
Epoch 256/400
160/160 [==============================] - 0s 430us/step - loss: 0.3220
Epoch 257/400
160/160 [==============================] - 0s 424us/step - loss: 0.2900
Epoch 258/400
```

```
160/160 [==============================] - 0s 430us/step - loss: 0.3017
Epoch 259/400
160/160 [==============================] - 0s 436us/step - loss: 0.3094
Epoch 260/400
160/160 [==============================] - 0s 430us/step - loss: 0.3160
Epoch 261/400
160/160 [==============================] - 0s 425us/step - loss: 0.3004
Epoch 262/400
160/160 [==============================] - 0s 399us/step - loss: 0.3100
Epoch 263/400
160/160 [==============================] - 0s 418us/step - loss: 0.3075
Epoch 264/400
160/160 [==============================] - 0s 437us/step - loss: 0.2972
Epoch 265/400
160/160 [==============================] - 0s 430us/step - loss: 0.3083
Epoch 266/400
160/160 [==============================] - 0s 437us/step - loss: 0.2988
Epoch 267/400
160/160 [==============================] - 0s 442us/step - loss: 0.2972
Epoch 268/400
160/160 [==============================] - 0s 424us/step - loss: 0.3023
Epoch 269/400
160/160 [==============================] - 0s 431us/step - loss: 0.2958
Epoch 270/400
160/160 [==============================] - 0s 436us/step - loss: 0.2942
Epoch 271/400
160/160 [==============================] - 0s 443us/step - loss: 0.3046
Epoch 272/400
160/160 [==============================] - 0s 467us/step - loss: 0.2900
Epoch 273/400
160/160 [==============================] - 0s 467us/step - loss: 0.2951
Epoch 274/400
160/160 [==============================] - 0s 455us/step - loss: 0.2857
Epoch 275/400
160/160 [==============================] - 0s 436us/step - loss: 0.2861
Epoch 276/400
160/160 [==============================] - 0s 443us/step - loss: 0.2766
Epoch 277/400
160/160 [==============================] - 0s 430us/step - loss: 0.2908
Epoch 278/400
160/160 [==============================] - 0s 431us/step - loss: 0.2841
Epoch 279/400
160/160 [==============================] - 0s 411us/step - loss: 0.2880
Epoch 280/400
160/160 [==============================] - 0s 405us/step - loss: 0.2906
Epoch 281/400
160/160 [==============================] - 0s 449us/step - loss: 0.2923
Epoch 282/400
```

```
160/160 [==============================] - 0s 418us/step - loss: 0.2835
Epoch 283/400
160/160 [==============================] - 0s 436us/step - loss: 0.2675
Epoch 284/400
160/160 [==============================] - 0s 449us/step - loss: 0.2609
Epoch 285/400
160/160 [==============================] - 0s 455us/step - loss: 0.2850
Epoch 286/400
160/160 [==============================] - 0s 430us/step - loss: 0.2668
Epoch 287/400
160/160 [==============================] - 0s 417us/step - loss: 0.2752
Epoch 288/400
160/160 [==============================] - 0s 436us/step - loss: 0.2747
Epoch 289/400
160/160 [==============================] - 0s 430us/step - loss: 0.2541
Epoch 290/400
160/160 [==============================] - 0s 405us/step - loss: 0.2641
Epoch 291/400
160/160 [==============================] - 0s 430us/step - loss: 0.2859
Epoch 292/400
160/160 [==============================] - 0s 424us/step - loss: 0.2707
Epoch 293/400
160/160 [==============================] - 0s 411us/step - loss: 0.2629
Epoch 294/400
160/160 [==============================] - 0s 399us/step - loss: 0.2640
Epoch 295/400
160/160 [==============================] - 0s 405us/step - loss: 0.2608
Epoch 296/400
160/160 [==============================] - 0s 436us/step - loss: 0.2559
Epoch 297/400
160/160 [==============================] - 0s 424us/step - loss: 0.2534
Epoch 298/400
160/160 [==============================] - 0s 424us/step - loss: 0.2543
Epoch 299/400
160/160 [==============================] - 0s 399us/step - loss: 0.2592
Epoch 300/400
160/160 [==============================] - 0s 424us/step - loss: 0.2531
Epoch 301/400
160/160 [==============================] - 0s 430us/step - loss: 0.2378
Epoch 302/400
160/160 [==============================] - 0s 418us/step - loss: 0.2429
Epoch 303/400
160/160 [==============================] - 0s 436us/step - loss: 0.2459
Epoch 304/400
160/160 [==============================] - 0s 418us/step - loss: 0.2458
Epoch 305/400
160/160 [==============================] - 0s 405us/step - loss: 0.2482
Epoch 306/400
```

```
160/160 [==============================] - 0s 417us/step - loss: 0.2270
Epoch 307/400
160/160 [==============================] - 0s 430us/step - loss: 0.2259
Epoch 308/400
160/160 [==============================] - 0s 398us/step - loss: 0.2540
Epoch 309/400
160/160 [==============================] - 0s 424us/step - loss: 0.2334
Epoch 310/400
160/160 [==============================] - 0s 411us/step - loss: 0.2385
Epoch 311/400
160/160 [==============================] - 0s 399us/step - loss: 0.2335
Epoch 312/400
160/160 [==============================] - 0s 406us/step - loss: 0.2201
Epoch 313/400
160/160 [==============================] - 0s 411us/step - loss: 0.2363
Epoch 314/400
160/160 [==============================] - 0s 412us/step - loss: 0.2196
Epoch 315/400
160/160 [==============================] - 0s 430us/step - loss: 0.2243
Epoch 316/400
160/160 [==============================] - 0s 412us/step - loss: 0.2305
Epoch 317/400
160/160 [==============================] - 0s 412us/step - loss: 0.2220
Epoch 318/400
160/160 [==============================] - 0s 417us/step - loss: 0.2369
Epoch 319/400
160/160 [==============================] - 0s 430us/step - loss: 0.2239
Epoch 320/400
160/160 [==============================] - 0s 443us/step - loss: 0.2205
Epoch 321/400
160/160 [==============================] - 0s 431us/step - loss: 0.2210
Epoch 322/400
160/160 [==============================] - 0s 430us/step - loss: 0.2257
Epoch 323/400
160/160 [==============================] - 0s 424us/step - loss: 0.2141
Epoch 324/400
160/160 [==============================] - 0s 424us/step - loss: 0.2119
Epoch 325/400
160/160 [==============================] - 0s 411us/step - loss: 0.2242
Epoch 326/400
160/160 [==============================] - 0s 431us/step - loss: 0.2164
Epoch 327/400
160/160 [==============================] - 0s 411us/step - loss: 0.2007
Epoch 328/400
160/160 [==============================] - 0s 436us/step - loss: 0.2083
Epoch 329/400
160/160 [==============================] - 0s 430us/step - loss: 0.2222
Epoch 330/400
```

```
160/160 [==============================] - 0s 406us/step - loss: 0.2032
Epoch 331/400
160/160 [==============================] - 0s 412us/step - loss: 0.2136
Epoch 332/400
160/160 [==============================] - 0s 430us/step - loss: 0.2063
Epoch 333/400
160/160 [==============================] - 0s 424us/step - loss: 0.2033
Epoch 334/400
160/160 [==============================] - 0s 418us/step - loss: 0.2043
Epoch 335/400
160/160 [==============================] - 0s 406us/step - loss: 0.2024
Epoch 336/400
160/160 [==============================] - 0s 405us/step - loss: 0.1848
Epoch 337/400
160/160 [==============================] - 0s 436us/step - loss: 0.2078
Epoch 338/400
160/160 [==============================] - 0s 431us/step - loss: 0.1960
Epoch 339/400
160/160 [==============================] - 0s 436us/step - loss: 0.1764
Epoch 340/400
160/160 [==============================] - 0s 430us/step - loss: 0.2014
Epoch 341/400
160/160 [==============================] - 0s 418us/step - loss: 0.1894
Epoch 342/400
160/160 [==============================] - 0s 418us/step - loss: 0.1946
Epoch 343/400
160/160 [==============================] - 0s 424us/step - loss: 0.1871
Epoch 344/400
160/160 [==============================] - 0s 419us/step - loss: 0.1931
Epoch 345/400
160/160 [==============================] - 0s 399us/step - loss: 0.1875
Epoch 346/400
160/160 [==============================] - 0s 399us/step - loss: 0.1850
Epoch 347/400
160/160 [==============================] - 0s 430us/step - loss: 0.1756
Epoch 348/400
160/160 [==============================] - 0s 449us/step - loss: 0.1762
Epoch 349/400
160/160 [==============================] - 0s 436us/step - loss: 0.1732
Epoch 350/400
160/160 [==============================] - 0s 474us/step - loss: 0.1710
Epoch 351/400
160/160 [==============================] - 0s 418us/step - loss: 0.1738
Epoch 352/400
160/160 [==============================] - 0s 424us/step - loss: 0.1826
Epoch 353/400
160/160 [==============================] - 0s 419us/step - loss: 0.1812
Epoch 354/400
```

```
160/160 [==============================] - 0s 424us/step - loss: 0.1542
Epoch 355/400
160/160 [==============================] - 0s 424us/step - loss: 0.1736
Epoch 356/400
160/160 [==============================] - 0s 424us/step - loss: 0.1608
Epoch 357/400
160/160 [==============================] - 0s 430us/step - loss: 0.1716
Epoch 358/400
160/160 [==============================] - 0s 424us/step - loss: 0.1595
Epoch 359/400
160/160 [==============================] - 0s 424us/step - loss: 0.1741
Epoch 360/400
160/160 [==============================] - 0s 411us/step - loss: 0.1624
Epoch 361/400
160/160 [==============================] - 0s 425us/step - loss: 0.1664
Epoch 362/400
160/160 [==============================] - 0s 432us/step - loss: 0.1672
Epoch 363/400
160/160 [==============================] - 0s 430us/step - loss: 0.1695
Epoch 364/400
160/160 [==============================] - 0s 418us/step - loss: 0.1635
Epoch 365/400
160/160 [==============================] - 0s 455us/step - loss: 0.1439
Epoch 366/400
160/160 [==============================] - 0s 430us/step - loss: 0.1580
Epoch 367/400
160/160 [==============================] - 0s 399us/step - loss: 0.1584
Epoch 368/400
160/160 [==============================] - 0s 461us/step - loss: 0.1582
Epoch 369/400
160/160 [==============================] - 0s 480us/step - loss: 0.1410
Epoch 370/400
160/160 [==============================] - 0s 463us/step - loss: 0.1276
Epoch 371/400
160/160 [==============================] - 0s 455us/step - loss: 0.1611
Epoch 372/400
160/160 [==============================] - 0s 437us/step - loss: 0.1370
Epoch 373/400
160/160 [==============================] - 0s 461us/step - loss: 0.1432
Epoch 374/400
160/160 [==============================] - 0s 430us/step - loss: 0.1488
Epoch 375/400
160/160 [==============================] - 0s 424us/step - loss: 0.1383
Epoch 376/400
160/160 [==============================] - 0s 424us/step - loss: 0.1312
Epoch 377/400
160/160 [==============================] - 0s 480us/step - loss: 0.1424
Epoch 378/400
```

```
160/160 [==============================] - 0s 455us/step - loss: 0.1478
Epoch 379/400
160/160 [==============================] - 0s 492us/step - loss: 0.1479
Epoch 380/400
160/160 [==============================] - 0s 474us/step - loss: 0.1329
Epoch 381/400
160/160 [==============================] - 0s 480us/step - loss: 0.1387
Epoch 382/400
160/160 [==============================] - 0s 443us/step - loss: 0.1506
Epoch 383/400
160/160 [==============================] - 0s 424us/step - loss: 0.1332
Epoch 384/400
160/160 [==============================] - 0s 447us/step - loss: 0.1345
Epoch 385/400
160/160 [==============================] - 0s 449us/step - loss: 0.1268
Epoch 386/400
160/160 [==============================] - 0s 474us/step - loss: 0.1358
Epoch 387/400
160/160 [==============================] - 0s 424us/step - loss: 0.1296
Epoch 388/400
160/160 [==============================] - 0s 424us/step - loss: 0.1449
Epoch 389/400
160/160 [==============================] - 0s 418us/step - loss: 0.1298
Epoch 390/400
160/160 [==============================] - 0s 411us/step - loss: 0.1242
Epoch 391/400
160/160 [==============================] - 0s 430us/step - loss: 0.1318
Epoch 392/400
160/160 [==============================] - 0s 437us/step - loss: 0.1153
Epoch 393/400
160/160 [==============================] - 0s 405us/step - loss: 0.1227
Epoch 394/400
160/160 [==============================] - 0s 430us/step - loss: 0.1215
Epoch 395/400
160/160 [==============================] - 0s 418us/step - loss: 0.1177
Epoch 396/400
160/160 [==============================] - 0s 405us/step - loss: 0.1154
Epoch 397/400
160/160 [==============================] - 0s 430us/step - loss: 0.1164
Epoch 398/400
160/160 [==============================] - 0s 418us/step - loss: 0.1095
Epoch 399/400
160/160 [==============================] - 0s 411us/step - loss: 0.1275
Epoch 400/400
160/160 [==============================] - 0s 405us/step - loss: 0.1202
[0.8519477  0.95273894 0.95273894 0.95273894 0.95273894 0.95273894
 0.95273894 0.9158932  0.9187307  0.95273894 0.95273894 0.95273894
 0.95273894 0.8652734  0.95273894 0.793161   0.62796533 0.95273894
```

```
 0.95273894 0.8131461  0.95273894 0.95273894 0.54545224 0.95273894
 0.95273894 0.74413764 0.95273894 0.95273894 0.95273894 0.95273894
 0.95273894 0.95273894 0.95273894 0.95273894 0.95273894 0.95273894
 0.95273894 0.95273894 0.95273894 0.95273894 0.56626326 0.9990658
 0.9997311  0.99926573 0.9997247  0.99990416 0.99916804 0.7288067
 0.7877059  0.99988127 0.99959534 0.99964297 0.99943954 0.59749776
 0.9919085  0.41576284 0.19471245 0.99980193 0.9998679  0.44310656
 0.9999603  0.9999589  0.12833291 0.9975815  0.999926   0.34546074
 0.99993193 0.9999784  0.9999654  0.9993986  0.98917    0.931149
 0.99166507 0.9993942  0.9994863  0.99981326 0.95245606 0.9887011
 0.9982217  0.96554637 0.22551015 0.00242417 0.01427971 0.00266184
 0.00375884 0.01259523 0.00404182 0.4698996  0.00240458 0.01532848
 0.00342473 0.00333894 0.01761719 0.33432168 0.01016748 0.40067875
 0.00454786 0.01642716 0.00462124 0.6315703  0.0213581  0.00681457
 0.01430802 0.0023384  0.00558624 0.01473019 0.02599336 0.01678378
 0.01451145 0.00554866 0.1262698  0.04152257 0.00338241 0.00523655
 0.0284448  0.00413068 0.05020541 0.00532544 0.00232331 0.00515574
 0.02010289 0.06415282 0.00611726 0.05498074 0.03220348 0.00667918
 0.02671879 0.07282501 0.05815351 0.00602149 0.03639665 0.03848889
 0.00540533 0.04046583 0.00686442 0.7862534  0.09514432 0.00574108
 0.02294303 0.17696995 0.0052916  0.01224337 0.19275032 0.07300681
 0.01681749 0.00531176 0.00474077 0.00606008 0.00640392 0.01557965
 0.00670361 0.36045402 0.03439933 0.01722503 0.00424926 0.02732051
 0.40125814 0.01556083 0.06685412 0.01610983]
160/160 [==============================] - 0s 1ms/step
```

```
In [70]: scores = model.evaluate(X, y)
         scores, model.metrics_names

160/160 [==============================] - 0s 25us/step
```

```
Out[70]: (0.12049313932657242, ['loss'])
```

```
In [77]: model = Sequential()

         model.add(Dense(5, input_dim=2, activation='sigmoid'))
         model.add(Dense(4, input_dim=2, activation='sigmoid'))
         model.add(Dense(3, input_dim=2, activation='relu'))
         model.add(Dense(2, input_dim=2, activation='relu'))  #sigmoid, relu
         # model.add(Dense(2, activation='tanh'))
         model.add(Dense(1, activation='sigmoid'))
         # model.add(Dense(1,input_dim=2, activation='sigmoid'))


         sgd = SGD(lr=0.1)
         model.compile(loss='binary_crossentropy', optimizer='sgd')
```

```
        model.fit(X, y, batch_size=3, epochs=400) #160/4 = 40 per epoch
        print(model.predict_proba(X).reshape(4*n))

        # evaluate the model
        scores = model.evaluate(X, y)
```

```
Epoch 1/400
160/160 [==============================] - 11s 69ms/step - loss: 0.6935
Epoch 2/400
160/160 [==============================] - 0s 324us/step - loss: 0.6936
Epoch 3/400
160/160 [==============================] - 0s 299us/step - loss: 0.6936
Epoch 4/400
160/160 [==============================] - 0s 305us/step - loss: 0.6936
Epoch 5/400
160/160 [==============================] - 0s 318us/step - loss: 0.6936
Epoch 6/400
160/160 [==============================] - 0s 318us/step - loss: 0.6935
Epoch 7/400
160/160 [==============================] - 0s 312us/step - loss: 0.6935
Epoch 8/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 9/400
160/160 [==============================] - 0s 299us/step - loss: 0.6935
Epoch 10/400
160/160 [==============================] - 0s 324us/step - loss: 0.6935
Epoch 11/400
160/160 [==============================] - 0s 299us/step - loss: 0.6935
Epoch 12/400
160/160 [==============================] - 0s 305us/step - loss: 0.6936
Epoch 13/400
160/160 [==============================] - 0s 312us/step - loss: 0.6936
Epoch 14/400
160/160 [==============================] - 0s 305us/step - loss: 0.6936
Epoch 15/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 16/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 17/400
160/160 [==============================] - 0s 505us/step - loss: 0.6936
Epoch 18/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 19/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 20/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 21/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
```

```
Epoch 22/400
160/160 [==============================] - 0s 280us/step - loss: 0.6937
Epoch 23/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 24/400
160/160 [==============================] - 0s 268us/step - loss: 0.6934
Epoch 25/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 26/400
160/160 [==============================] - 0s 288us/step - loss: 0.6936
Epoch 27/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 28/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 29/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 30/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 31/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 32/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 33/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 34/400
160/160 [==============================] - 0s 275us/step - loss: 0.6935
Epoch 35/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 36/400
160/160 [==============================] - 0s 286us/step - loss: 0.6935
Epoch 37/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 38/400
160/160 [==============================] - 0s 275us/step - loss: 0.6936
Epoch 39/400
160/160 [==============================] - 0s 293us/step - loss: 0.6936
Epoch 40/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 41/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 42/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 43/400
160/160 [==============================] - 0s 287us/step - loss: 0.6937
Epoch 44/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 45/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
```

```
Epoch 46/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 47/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 48/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 49/400
160/160 [==============================] - 0s 312us/step - loss: 0.6936
Epoch 50/400
160/160 [==============================] - 0s 312us/step - loss: 0.6935
Epoch 51/400
160/160 [==============================] - 0s 312us/step - loss: 0.6936
Epoch 52/400
160/160 [==============================] - 0s 318us/step - loss: 0.6935
Epoch 53/400
160/160 [==============================] - 0s 299us/step - loss: 0.6936
Epoch 54/400
160/160 [==============================] - 0s 318us/step - loss: 0.6935
Epoch 55/400
160/160 [==============================] - 0s 305us/step - loss: 0.6935
Epoch 56/400
160/160 [==============================] - 0s 343us/step - loss: 0.6937
Epoch 57/400
160/160 [==============================] - 0s 293us/step - loss: 0.6936
Epoch 58/400
160/160 [==============================] - 0s 318us/step - loss: 0.6936
Epoch 59/400
160/160 [==============================] - 0s 306us/step - loss: 0.6936
Epoch 60/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 61/400
160/160 [==============================] - 0s 293us/step - loss: 0.6936
Epoch 62/400
160/160 [==============================] - 0s 287us/step - loss: 0.6937
Epoch 63/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 64/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 65/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 66/400
160/160 [==============================] - 0s 312us/step - loss: 0.6935
Epoch 67/400
160/160 [==============================] - 0s 299us/step - loss: 0.6937
Epoch 68/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 69/400
160/160 [==============================] - 0s 299us/step - loss: 0.6935
```

```
Epoch 70/400
160/160 [==============================] - 0s 299us/step - loss: 0.6935
Epoch 71/400
160/160 [==============================] - 0s 293us/step - loss: 0.6934
Epoch 72/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 73/400
160/160 [==============================] - 0s 306us/step - loss: 0.6936
Epoch 74/400
160/160 [==============================] - 0s 305us/step - loss: 0.6936
Epoch 75/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 76/400
160/160 [==============================] - 0s 305us/step - loss: 0.6935
Epoch 77/400
160/160 [==============================] - 0s 299us/step - loss: 0.6936
Epoch 78/400
160/160 [==============================] - 0s 299us/step - loss: 0.6936
Epoch 79/400
160/160 [==============================] - 0s 318us/step - loss: 0.6935
Epoch 80/400
160/160 [==============================] - 0s 312us/step - loss: 0.6937
Epoch 81/400
160/160 [==============================] - 0s 305us/step - loss: 0.6936
Epoch 82/400
160/160 [==============================] - 0s 318us/step - loss: 0.6935
Epoch 83/400
160/160 [==============================] - 0s 330us/step - loss: 0.6936
Epoch 84/400
160/160 [==============================] - 0s 324us/step - loss: 0.6936
Epoch 85/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 86/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 87/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 88/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 89/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 90/400
160/160 [==============================] - 0s 299us/step - loss: 0.6936
Epoch 91/400
160/160 [==============================] - 0s 299us/step - loss: 0.6935
Epoch 92/400
160/160 [==============================] - 0s 324us/step - loss: 0.6935
Epoch 93/400
160/160 [==============================] - 0s 343us/step - loss: 0.6935
```

```
Epoch 94/400
160/160 [==============================] - 0s 380us/step - loss: 0.6935
Epoch 95/400
160/160 [==============================] - 0s 355us/step - loss: 0.6936
Epoch 96/400
160/160 [==============================] - 0s 299us/step - loss: 0.6935
Epoch 97/400
160/160 [==============================] - 0s 299us/step - loss: 0.6936
Epoch 98/400
160/160 [==============================] - 0s 299us/step - loss: 0.6936
Epoch 99/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 100/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 101/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 102/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 103/400
160/160 [==============================] - 0s 274us/step - loss: 0.6937
Epoch 104/400
160/160 [==============================] - 0s 275us/step - loss: 0.6935
Epoch 105/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 106/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 107/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 108/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 109/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 110/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 111/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 112/400
160/160 [==============================] - 0s 305us/step - loss: 0.6935
Epoch 113/400
160/160 [==============================] - 0s 362us/step - loss: 0.6935
Epoch 114/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 115/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 116/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 117/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
```

```
Epoch 118/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 119/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 120/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 121/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 122/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 123/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 124/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 125/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 126/400
160/160 [==============================] - 0s 274us/step - loss: 0.6934
Epoch 127/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 128/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 129/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 130/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 131/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 132/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 133/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 134/400
160/160 [==============================] - 0s 275us/step - loss: 0.6935
Epoch 135/400
160/160 [==============================] - 0s 286us/step - loss: 0.6936
Epoch 136/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 137/400
160/160 [==============================] - 0s 275us/step - loss: 0.6936
Epoch 138/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 139/400
160/160 [==============================] - 0s 299us/step - loss: 0.6936
Epoch 140/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 141/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
```

```
Epoch 142/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 143/400
160/160 [==============================] - 0s 280us/step - loss: 0.6937
Epoch 144/400
160/160 [==============================] - 0s 281us/step - loss: 0.6937
Epoch 145/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 146/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 147/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 148/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 149/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 150/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 151/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 152/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 153/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 154/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 155/400
160/160 [==============================] - 0s 281us/step - loss: 0.6937
Epoch 156/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 157/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 158/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 159/400
160/160 [==============================] - 0s 293us/step - loss: 0.6936
Epoch 160/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 161/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 162/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 163/400
160/160 [==============================] - 0s 344us/step - loss: 0.6936
Epoch 164/400
160/160 [==============================] - 0s 318us/step - loss: 0.6936
Epoch 165/400
160/160 [==============================] - 0s 275us/step - loss: 0.6936
```

```
Epoch 166/400
160/160 [==============================] - 0s 293us/step - loss: 0.6936
Epoch 167/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 168/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 169/400
160/160 [==============================] - 0s 299us/step - loss: 0.6936
Epoch 170/400
160/160 [==============================] - 0s 318us/step - loss: 0.6935
Epoch 171/400
160/160 [==============================] - 0s 285us/step - loss: 0.6935
Epoch 172/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 173/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 174/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 175/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 176/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 177/400
160/160 [==============================] - 0s 299us/step - loss: 0.6935
Epoch 178/400
160/160 [==============================] - 0s 368us/step - loss: 0.6935
Epoch 179/400
160/160 [==============================] - 0s 347us/step - loss: 0.6935
Epoch 180/400
160/160 [==============================] - 0s 318us/step - loss: 0.6936
Epoch 181/400
160/160 [==============================] - 0s 312us/step - loss: 0.6935
Epoch 182/400
160/160 [==============================] - 0s 318us/step - loss: 0.6936
Epoch 183/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 184/400
160/160 [==============================] - 0s 293us/step - loss: 0.6937
Epoch 185/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 186/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 187/400
160/160 [==============================] - 0s 294us/step - loss: 0.6936
Epoch 188/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 189/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
```

```
Epoch 190/400
160/160 [==============================] - 0s 275us/step - loss: 0.6935
Epoch 191/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 192/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 193/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 194/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 195/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 196/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 197/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 198/400
160/160 [==============================] - 0s 287us/step - loss: 0.6937
Epoch 199/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 200/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 201/400
160/160 [==============================] - 0s 274us/step - loss: 0.6934
Epoch 202/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 203/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 204/400
160/160 [==============================] - 0s 280us/step - loss: 0.6938
Epoch 205/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 206/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 207/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 208/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 209/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 210/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 211/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 212/400
160/160 [==============================] - 0s 274us/step - loss: 0.6934
Epoch 213/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
```

```
Epoch 214/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 215/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 216/400
160/160 [==============================] - 0s 268us/step - loss: 0.6937
Epoch 217/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 218/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 219/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 220/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 221/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 222/400
160/160 [==============================] - 0s 299us/step - loss: 0.6935
Epoch 223/400
160/160 [==============================] - 0s 275us/step - loss: 0.6935
Epoch 224/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 225/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 226/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 227/400
160/160 [==============================] - 0s 375us/step - loss: 0.6936
Epoch 228/400
160/160 [==============================] - 0s 355us/step - loss: 0.6936
Epoch 229/400
160/160 [==============================] - 0s 337us/step - loss: 0.6935
Epoch 230/400
160/160 [==============================] - 0s 337us/step - loss: 0.6934
Epoch 231/400
160/160 [==============================] - 0s 305us/step - loss: 0.6936
Epoch 232/400
160/160 [==============================] - 0s 343us/step - loss: 0.6936
Epoch 233/400
160/160 [==============================] - 0s 293us/step - loss: 0.6936
Epoch 234/400
160/160 [==============================] - 0s 274us/step - loss: 0.6934
Epoch 235/400
160/160 [==============================] - 0s 287us/step - loss: 0.6934
Epoch 236/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 237/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
```

```
Epoch 238/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 239/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 240/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 241/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 242/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 243/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 244/400
160/160 [==============================] - 0s 274us/step - loss: 0.6937
Epoch 245/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 246/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 247/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 248/400
160/160 [==============================] - 0s 281us/step - loss: 0.6934
Epoch 249/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 250/400
160/160 [==============================] - 0s 287us/step - loss: 0.6934
Epoch 251/400
160/160 [==============================] - 0s 293us/step - loss: 0.6936
Epoch 252/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 253/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 254/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 255/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 256/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 257/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 258/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 259/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 260/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 261/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
```

```
Epoch 262/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 263/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 264/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 265/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 266/400
160/160 [==============================] - 0s 281us/step - loss: 0.6934
Epoch 267/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 268/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 269/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 270/400
160/160 [==============================] - 0s 299us/step - loss: 0.6935
Epoch 271/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 272/400
160/160 [==============================] - 0s 293us/step - loss: 0.6936
Epoch 273/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 274/400
160/160 [==============================] - 0s 318us/step - loss: 0.6936
Epoch 275/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 276/400
160/160 [==============================] - 0s 275us/step - loss: 0.6936
Epoch 277/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 278/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 279/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 280/400
160/160 [==============================] - 0s 287us/step - loss: 0.6938
Epoch 281/400
160/160 [==============================] - 0s 274us/step - loss: 0.6937
Epoch 282/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 283/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 284/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 285/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
```

```
Epoch 286/400
160/160 [==============================] - 0s 287us/step - loss: 0.6937
Epoch 287/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 288/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 289/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 290/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 291/400
160/160 [==============================] - 0s 275us/step - loss: 0.6935
Epoch 292/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 293/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 294/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 295/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 296/400
160/160 [==============================] - 0s 262us/step - loss: 0.6935
Epoch 297/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 298/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 299/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 300/400
160/160 [==============================] - 0s 274us/step - loss: 0.6938
Epoch 301/400
160/160 [==============================] - 0s 275us/step - loss: 0.6936
Epoch 302/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 303/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 304/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 305/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 306/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 307/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 308/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 309/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
```

```
Epoch 310/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 311/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 312/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 313/400
160/160 [==============================] - 0s 275us/step - loss: 0.6936
Epoch 314/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 315/400
160/160 [==============================] - 0s 293us/step - loss: 0.6937
Epoch 316/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 317/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 318/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 319/400
160/160 [==============================] - 0s 262us/step - loss: 0.6935
Epoch 320/400
160/160 [==============================] - 0s 282us/step - loss: 0.6935
Epoch 321/400
160/160 [==============================] - 0s 307us/step - loss: 0.6935
Epoch 322/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 323/400
160/160 [==============================] - 0s 280us/step - loss: 0.6934
Epoch 324/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 325/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 326/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 327/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 328/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 329/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 330/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 331/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 332/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 333/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
```

```
Epoch 334/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 335/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 336/400
160/160 [==============================] - 0s 269us/step - loss: 0.6935
Epoch 337/400
160/160 [==============================] - 0s 273us/step - loss: 0.6935
Epoch 338/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 339/400
160/160 [==============================] - 0s 268us/step - loss: 0.6934
Epoch 340/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 341/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 342/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 343/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 344/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 345/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 346/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 347/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 348/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 349/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 350/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 351/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 352/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 353/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 354/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 355/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 356/400
160/160 [==============================] - 0s 275us/step - loss: 0.6936
Epoch 357/400
160/160 [==============================] - 0s 274us/step - loss: 0.6937
```

```
Epoch 358/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 359/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 360/400
160/160 [==============================] - 0s 293us/step - loss: 0.6936
Epoch 361/400
160/160 [==============================] - 0s 274us/step - loss: 0.6934
Epoch 362/400
160/160 [==============================] - 0s 275us/step - loss: 0.6936
Epoch 363/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 364/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 365/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 366/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 367/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 368/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
Epoch 369/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 370/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 371/400
160/160 [==============================] - 0s 280us/step - loss: 0.6936
Epoch 372/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 373/400
160/160 [==============================] - 0s 293us/step - loss: 0.6935
Epoch 374/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 375/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 376/400
160/160 [==============================] - 0s 280us/step - loss: 0.6935
Epoch 377/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 378/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 379/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 380/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 381/400
160/160 [==============================] - 0s 287us/step - loss: 0.6936
```

```
Epoch 382/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 383/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 384/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 385/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 386/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 387/400
160/160 [==============================] - 0s 274us/step - loss: 0.6937
Epoch 388/400
160/160 [==============================] - 0s 261us/step - loss: 0.6936
Epoch 389/400
160/160 [==============================] - 0s 262us/step - loss: 0.6935
Epoch 390/400
160/160 [==============================] - 0s 262us/step - loss: 0.6935
Epoch 391/400
160/160 [==============================] - 0s 281us/step - loss: 0.6936
Epoch 392/400
160/160 [==============================] - 0s 287us/step - loss: 0.6935
Epoch 393/400
160/160 [==============================] - 0s 268us/step - loss: 0.6936
Epoch 394/400
160/160 [==============================] - 0s 274us/step - loss: 0.6935
Epoch 395/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
Epoch 396/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 397/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 398/400
160/160 [==============================] - 0s 281us/step - loss: 0.6935
Epoch 399/400
160/160 [==============================] - 0s 274us/step - loss: 0.6936
Epoch 400/400
160/160 [==============================] - 0s 268us/step - loss: 0.6935
[0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
```

```
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862 0.49704862
 0.49704862 0.49704862 0.49704862 0.49704862]
160/160 [==============================] - 4s 24ms/step
```

```
In [78]: scores = model.evaluate(X, y)
         scores, model.metrics_names
```

```
160/160 [==============================] - 0s 31us/step
```

```
Out[78]: (0.6931646227836609, ['loss'])
```

```
In [79]: model = Sequential()

         model.add(Dense(5, input_dim=2, activation='sigmoid'))
         model.add(Dense(4, input_dim=2, activation='sigmoid'))
         model.add(Dense(3, input_dim=2, activation='relu'))
         model.add(Dense(2, input_dim=2, activation='relu'))  #sigmoid, relu
         # model.add(Dense(2, activation='tanh'))
         model.add(Dense(1, activation='sigmoid'))
         # model.add(Dense(1,input_dim=2, activation='sigmoid'))


         sgd = SGD(lr=0.1)
         model.compile(loss='binary_crossentropy', optimizer='sgd')

         model.fit(X, y, batch_size=4, epochs=400) #160/4 = 40 per epoch
         print(model.predict_proba(X).reshape(4*n))

         # evaluate the model
         scores = model.evaluate(X, y)
```

```
Epoch 1/400
160/160 [==============================] - 11s 67ms/step - loss: 0.6998
```

```
Epoch 2/400
160/160 [==============================] - 0s 230us/step - loss: 0.6956
Epoch 3/400
160/160 [==============================] - 0s 243us/step - loss: 0.6946
Epoch 4/400
160/160 [==============================] - 0s 224us/step - loss: 0.6953
Epoch 5/400
160/160 [==============================] - 0s 231us/step - loss: 0.6953
Epoch 6/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 7/400
160/160 [==============================] - ETA: 0s - loss: 0.689 - 0s 218us/step - loss: 0.6948
Epoch 8/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
Epoch 9/400
160/160 [==============================] - 0s 224us/step - loss: 0.6945
Epoch 10/400
160/160 [==============================] - 0s 225us/step - loss: 0.6953
Epoch 11/400
160/160 [==============================] - 0s 224us/step - loss: 0.6945
Epoch 12/400
160/160 [==============================] - 0s 224us/step - loss: 0.6950
Epoch 13/400
160/160 [==============================] - 0s 213us/step - loss: 0.6948
Epoch 14/400
160/160 [==============================] - 0s 218us/step - loss: 0.6945
Epoch 15/400
160/160 [==============================] - 0s 224us/step - loss: 0.6948
Epoch 16/400
160/160 [==============================] - 0s 231us/step - loss: 0.6947
Epoch 17/400
160/160 [==============================] - 0s 225us/step - loss: 0.6944
Epoch 18/400
160/160 [==============================] - 0s 224us/step - loss: 0.6946
Epoch 19/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 20/400
160/160 [==============================] - 0s 219us/step - loss: 0.6945
Epoch 21/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 22/400
160/160 [==============================] - 0s 230us/step - loss: 0.6947
Epoch 23/400
160/160 [==============================] - 0s 224us/step - loss: 0.6944
Epoch 24/400
160/160 [==============================] - 0s 212us/step - loss: 0.6950
Epoch 25/400
160/160 [==============================] - 0s 225us/step - loss: 0.6944
```

```
Epoch 26/400
160/160 [==============================] - 0s 237us/step - loss: 0.6946
Epoch 27/400
160/160 [==============================] - 0s 241us/step - loss: 0.6958
Epoch 28/400
160/160 [==============================] - 0s 249us/step - loss: 0.6950
Epoch 29/400
160/160 [==============================] - 0s 231us/step - loss: 0.6949
Epoch 30/400
160/160 [==============================] - 0s 224us/step - loss: 0.6948
Epoch 31/400
160/160 [==============================] - 0s 230us/step - loss: 0.6950
Epoch 32/400
160/160 [==============================] - 0s 231us/step - loss: 0.6946
Epoch 33/400
160/160 [==============================] - 0s 231us/step - loss: 0.6949
Epoch 34/400
160/160 [==============================] - 0s 230us/step - loss: 0.6945
Epoch 35/400
160/160 [==============================] - 0s 224us/step - loss: 0.6944
Epoch 36/400
160/160 [==============================] - 0s 224us/step - loss: 0.6950
Epoch 37/400
160/160 [==============================] - 0s 218us/step - loss: 0.6948
Epoch 38/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 39/400
160/160 [==============================] - 0s 237us/step - loss: 0.6951
Epoch 40/400
160/160 [==============================] - 0s 237us/step - loss: 0.6948
Epoch 41/400
160/160 [==============================] - 0s 224us/step - loss: 0.6955
Epoch 42/400
160/160 [==============================] - 0s 231us/step - loss: 0.6948
Epoch 43/400
160/160 [==============================] - 0s 237us/step - loss: 0.6951
Epoch 44/400
160/160 [==============================] - 0s 231us/step - loss: 0.6944
Epoch 45/400
160/160 [==============================] - 0s 230us/step - loss: 0.6947
Epoch 46/400
160/160 [==============================] - 0s 243us/step - loss: 0.6947
Epoch 47/400
160/160 [==============================] - 0s 237us/step - loss: 0.6942
Epoch 48/400
160/160 [==============================] - 0s 237us/step - loss: 0.6948
Epoch 49/400
160/160 [==============================] - 0s 232us/step - loss: 0.6949
```

```
Epoch 50/400
160/160 [==============================] - 0s 243us/step - loss: 0.6951
Epoch 51/400
160/160 [==============================] - 0s 231us/step - loss: 0.6947
Epoch 52/400
160/160 [==============================] - 0s 224us/step - loss: 0.6947
Epoch 53/400
160/160 [==============================] - 0s 224us/step - loss: 0.6944
Epoch 54/400
160/160 [==============================] - 0s 237us/step - loss: 0.6950
Epoch 55/400
160/160 [==============================] - 0s 231us/step - loss: 0.6948
Epoch 56/400
160/160 [==============================] - 0s 218us/step - loss: 0.6953
Epoch 57/400
160/160 [==============================] - 0s 250us/step - loss: 0.6953
Epoch 58/400
160/160 [==============================] - 0s 224us/step - loss: 0.6945
Epoch 59/400
160/160 [==============================] - 0s 212us/step - loss: 0.6953
Epoch 60/400
160/160 [==============================] - 0s 284us/step - loss: 0.6955
Epoch 61/400
160/160 [==============================] - 0s 225us/step - loss: 0.6945
Epoch 62/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 63/400
160/160 [==============================] - 0s 218us/step - loss: 0.6943
Epoch 64/400
160/160 [==============================] - 0s 225us/step - loss: 0.6942
Epoch 65/400
160/160 [==============================] - 0s 219us/step - loss: 0.6952
Epoch 66/400
160/160 [==============================] - 0s 218us/step - loss: 0.6949
Epoch 67/400
160/160 [==============================] - 0s 206us/step - loss: 0.6952
Epoch 68/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 69/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 70/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 71/400
160/160 [==============================] - 0s 218us/step - loss: 0.6951
Epoch 72/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 73/400
160/160 [==============================] - 0s 218us/step - loss: 0.6949
```

```
Epoch 74/400
160/160 [==============================] - 0s 237us/step - loss: 0.6943
Epoch 75/400
160/160 [==============================] - 0s 243us/step - loss: 0.6949
Epoch 76/400
160/160 [==============================] - 0s 225us/step - loss: 0.6948
Epoch 77/400
160/160 [==============================] - 0s 218us/step - loss: 0.6948
Epoch 78/400
160/160 [==============================] - 0s 231us/step - loss: 0.6947
Epoch 79/400
160/160 [==============================] - 0s 224us/step - loss: 0.6946
Epoch 80/400
160/160 [==============================] - 0s 218us/step - loss: 0.6951
Epoch 81/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
Epoch 82/400
160/160 [==============================] - 0s 218us/step - loss: 0.6945
Epoch 83/400
160/160 [==============================] - 0s 237us/step - loss: 0.6945
Epoch 84/400
160/160 [==============================] - 0s 218us/step - loss: 0.6949
Epoch 85/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
Epoch 86/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 87/400
160/160 [==============================] - 0s 231us/step - loss: 0.6947
Epoch 88/400
160/160 [==============================] - 0s 218us/step - loss: 0.6942
Epoch 89/400
160/160 [==============================] - 0s 225us/step - loss: 0.6945
Epoch 90/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 91/400
160/160 [==============================] - 0s 218us/step - loss: 0.6951
Epoch 92/400
160/160 [==============================] - 0s 206us/step - loss: 0.6953
Epoch 93/400
160/160 [==============================] - 0s 224us/step - loss: 0.6946
Epoch 94/400
160/160 [==============================] - 0s 205us/step - loss: 0.6945
Epoch 95/400
160/160 [==============================] - 0s 218us/step - loss: 0.6942
Epoch 96/400
160/160 [==============================] - 0s 212us/step - loss: 0.6953
Epoch 97/400
160/160 [==============================] - 0s 224us/step - loss: 0.6948
```

```
Epoch 98/400
160/160 [==============================] - 0s 218us/step - loss: 0.6954
Epoch 99/400
160/160 [==============================] - 0s 218us/step - loss: 0.6945
Epoch 100/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
Epoch 101/400
160/160 [==============================] - 0s 224us/step - loss: 0.6953
Epoch 102/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 103/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 104/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 105/400
160/160 [==============================] - 0s 225us/step - loss: 0.6945
Epoch 106/400
160/160 [==============================] - 0s 218us/step - loss: 0.6943
Epoch 107/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 108/400
160/160 [==============================] - 0s 212us/step - loss: 0.6941
Epoch 109/400
160/160 [==============================] - 0s 210us/step - loss: 0.6952
Epoch 110/400
160/160 [==============================] - 0s 212us/step - loss: 0.6950
Epoch 111/400
160/160 [==============================] - 0s 218us/step - loss: 0.6948
Epoch 112/400
160/160 [==============================] - 0s 200us/step - loss: 0.6948
Epoch 113/400
160/160 [==============================] - 0s 219us/step - loss: 0.6946
Epoch 114/400
160/160 [==============================] - 0s 217us/step - loss: 0.6948
Epoch 115/400
160/160 [==============================] - 0s 255us/step - loss: 0.6947
Epoch 116/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
Epoch 117/400
160/160 [==============================] - 0s 206us/step - loss: 0.6949
Epoch 118/400
160/160 [==============================] - 0s 212us/step - loss: 0.6954
Epoch 119/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 120/400
160/160 [==============================] - 0s 218us/step - loss: 0.6954
Epoch 121/400
160/160 [==============================] - 0s 218us/step - loss: 0.6952
```

```
Epoch 122/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 123/400
160/160 [==============================] - 0s 218us/step - loss: 0.6953
Epoch 124/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 125/400
160/160 [==============================] - 0s 218us/step - loss: 0.6943
Epoch 126/400
160/160 [==============================] - 0s 206us/step - loss: 0.6944
Epoch 127/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 128/400
160/160 [==============================] - 0s 205us/step - loss: 0.6948
Epoch 129/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 130/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 131/400
160/160 [==============================] - 0s 218us/step - loss: 0.6951
Epoch 132/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 133/400
160/160 [==============================] - 0s 217us/step - loss: 0.6945
Epoch 134/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 135/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 136/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 137/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 138/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
Epoch 139/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 140/400
160/160 [==============================] - 0s 224us/step - loss: 0.6946
Epoch 141/400
160/160 [==============================] - 0s 212us/step - loss: 0.6949
Epoch 142/400
160/160 [==============================] - 0s 212us/step - loss: 0.6945
Epoch 143/400
160/160 [==============================] - 0s 219us/step - loss: 0.6949
Epoch 144/400
160/160 [==============================] - 0s 224us/step - loss: 0.6942
Epoch 145/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
```

```
Epoch 146/400
160/160 [==============================] - 0s 218us/step - loss: 0.6943
Epoch 147/400
160/160 [==============================] - 0s 224us/step - loss: 0.6951
Epoch 148/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
Epoch 149/400
160/160 [==============================] - 0s 212us/step - loss: 0.6936
Epoch 150/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 151/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 152/400
160/160 [==============================] - 0s 212us/step - loss: 0.6941
Epoch 153/400
160/160 [==============================] - 0s 224us/step - loss: 0.6946
Epoch 154/400
160/160 [==============================] - 0s 224us/step - loss: 0.6946
Epoch 155/400
160/160 [==============================] - 0s 212us/step - loss: 0.6945
Epoch 156/400
160/160 [==============================] - 0s 218us/step - loss: 0.6948
Epoch 157/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 158/400
160/160 [==============================] - 0s 212us/step - loss: 0.6949
Epoch 159/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 160/400
160/160 [==============================] - 0s 206us/step - loss: 0.6945
Epoch 161/400
160/160 [==============================] - 0s 224us/step - loss: 0.6941
Epoch 162/400
160/160 [==============================] - 0s 212us/step - loss: 0.6950
Epoch 163/400
160/160 [==============================] - 0s 218us/step - loss: 0.6949
Epoch 164/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 165/400
160/160 [==============================] - 0s 212us/step - loss: 0.6950
Epoch 166/400
160/160 [==============================] - 0s 211us/step - loss: 0.6940
Epoch 167/400
160/160 [==============================] - 0s 205us/step - loss: 0.6950
Epoch 168/400
160/160 [==============================] - 0s 224us/step - loss: 0.6943
Epoch 169/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
```

```
Epoch 170/400
160/160 [==============================] - 0s 212us/step - loss: 0.6945
Epoch 171/400
160/160 [==============================] - 0s 224us/step - loss: 0.6947
Epoch 172/400
160/160 [==============================] - 0s 218us/step - loss: 0.6949
Epoch 173/400
160/160 [==============================] - 0s 237us/step - loss: 0.6942
Epoch 174/400
160/160 [==============================] - 0s 206us/step - loss: 0.6945
Epoch 175/400
160/160 [==============================] - 0s 206us/step - loss: 0.6946
Epoch 176/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 177/400
160/160 [==============================] - 0s 230us/step - loss: 0.6947
Epoch 178/400
160/160 [==============================] - 0s 224us/step - loss: 0.6942
Epoch 179/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 180/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 181/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 182/400
160/160 [==============================] - 0s 206us/step - loss: 0.6945
Epoch 183/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 184/400
160/160 [==============================] - 0s 218us/step - loss: 0.6940
Epoch 185/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 186/400
160/160 [==============================] - 0s 217us/step - loss: 0.6955
Epoch 187/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 188/400
160/160 [==============================] - 0s 232us/step - loss: 0.6945
Epoch 189/400
160/160 [==============================] - 0s 218us/step - loss: 0.6957
Epoch 190/400
160/160 [==============================] - 0s 206us/step - loss: 0.6950
Epoch 191/400
160/160 [==============================] - 0s 231us/step - loss: 0.6946
Epoch 192/400
160/160 [==============================] - 0s 212us/step - loss: 0.6950
Epoch 193/400
160/160 [==============================] - 0s 225us/step - loss: 0.6939
```

```
Epoch 194/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 195/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 196/400
160/160 [==============================] - 0s 218us/step - loss: 0.6945
Epoch 197/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 198/400
160/160 [==============================] - 0s 212us/step - loss: 0.6955
Epoch 199/400
160/160 [==============================] - 0s 212us/step - loss: 0.6949
Epoch 200/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 201/400
160/160 [==============================] - 0s 212us/step - loss: 0.6941
Epoch 202/400
160/160 [==============================] - 0s 199us/step - loss: 0.6949
Epoch 203/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 204/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 205/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 206/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 207/400
160/160 [==============================] - 0s 218us/step - loss: 0.6940
Epoch 208/400
160/160 [==============================] - 0s 218us/step - loss: 0.6939
Epoch 209/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 210/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 211/400
160/160 [==============================] - 0s 212us/step - loss: 0.6949
Epoch 212/400
160/160 [==============================] - 0s 212us/step - loss: 0.6949
Epoch 213/400
160/160 [==============================] - 0s 212us/step - loss: 0.6940
Epoch 214/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 215/400
160/160 [==============================] - 0s 218us/step - loss: 0.6949
Epoch 216/400
160/160 [==============================] - 0s 219us/step - loss: 0.6948
Epoch 217/400
160/160 [==============================] - 0s 217us/step - loss: 0.6943
```

```
Epoch 218/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 219/400
160/160 [==============================] - 0s 218us/step - loss: 0.6942
Epoch 220/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 221/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 222/400
160/160 [==============================] - 0s 224us/step - loss: 0.6947
Epoch 223/400
160/160 [==============================] - 0s 212us/step - loss: 0.6941
Epoch 224/400
160/160 [==============================] - 0s 206us/step - loss: 0.6951
Epoch 225/400
160/160 [==============================] - 0s 224us/step - loss: 0.6948
Epoch 226/400
160/160 [==============================] - 0s 218us/step - loss: 0.6943
Epoch 227/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 228/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 229/400
160/160 [==============================] - 0s 225us/step - loss: 0.6946
Epoch 230/400
160/160 [==============================] - 0s 218us/step - loss: 0.6957
Epoch 231/400
160/160 [==============================] - 0s 224us/step - loss: 0.6948
Epoch 232/400
160/160 [==============================] - 0s 229us/step - loss: 0.6951
Epoch 233/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 234/400
160/160 [==============================] - 0s 206us/step - loss: 0.6948
Epoch 235/400
160/160 [==============================] - 0s 212us/step - loss: 0.6951
Epoch 236/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
Epoch 237/400
160/160 [==============================] - 0s 224us/step - loss: 0.6942
Epoch 238/400
160/160 [==============================] - 0s 218us/step - loss: 0.6953
Epoch 239/400
160/160 [==============================] - 0s 218us/step - loss: 0.6949
Epoch 240/400
160/160 [==============================] - 0s 224us/step - loss: 0.6942
Epoch 241/400
160/160 [==============================] - 0s 224us/step - loss: 0.6945
```

```
Epoch 242/400
160/160 [==============================] - 0s 206us/step - loss: 0.6946
Epoch 243/400
160/160 [==============================] - 0s 224us/step - loss: 0.6942
Epoch 244/400
160/160 [==============================] - 0s 218us/step - loss: 0.6945
Epoch 245/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 246/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 247/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 248/400
160/160 [==============================] - 0s 205us/step - loss: 0.6947
Epoch 249/400
160/160 [==============================] - 0s 218us/step - loss: 0.6942
Epoch 250/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 251/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 252/400
160/160 [==============================] - 0s 206us/step - loss: 0.6949
Epoch 253/400
160/160 [==============================] - 0s 237us/step - loss: 0.6945
Epoch 254/400
160/160 [==============================] - 0s 213us/step - loss: 0.6951
Epoch 255/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 256/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 257/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 258/400
160/160 [==============================] - 0s 206us/step - loss: 0.6950
Epoch 259/400
160/160 [==============================] - 0s 225us/step - loss: 0.6948
Epoch 260/400
160/160 [==============================] - 0s 218us/step - loss: 0.6949
Epoch 261/400
160/160 [==============================] - 0s 225us/step - loss: 0.6946
Epoch 262/400
160/160 [==============================] - 0s 218us/step - loss: 0.6941
Epoch 263/400
160/160 [==============================] - 0s 224us/step - loss: 0.6942
Epoch 264/400
160/160 [==============================] - 0s 224us/step - loss: 0.6946
Epoch 265/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
```

```
Epoch 266/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 267/400
160/160 [==============================] - 0s 206us/step - loss: 0.6945
Epoch 268/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 269/400
160/160 [==============================] - 0s 213us/step - loss: 0.6943
Epoch 270/400
160/160 [==============================] - 0s 212us/step - loss: 0.6949
Epoch 271/400
160/160 [==============================] - 0s 212us/step - loss: 0.6950
Epoch 272/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 273/400
160/160 [==============================] - 0s 218us/step - loss: 0.6951
Epoch 274/400
160/160 [==============================] - 0s 206us/step - loss: 0.6942
Epoch 275/400
160/160 [==============================] - 0s 218us/step - loss: 0.6951
Epoch 276/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 277/400
160/160 [==============================] - 0s 218us/step - loss: 0.6942
Epoch 278/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 279/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 280/400
160/160 [==============================] - 0s 224us/step - loss: 0.6943
Epoch 281/400
160/160 [==============================] - 0s 219us/step - loss: 0.6944
Epoch 282/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 283/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 284/400
160/160 [==============================] - 0s 225us/step - loss: 0.6947
Epoch 285/400
160/160 [==============================] - 0s 218us/step - loss: 0.6942
Epoch 286/400
160/160 [==============================] - 0s 218us/step - loss: 0.6953
Epoch 287/400
160/160 [==============================] - 0s 205us/step - loss: 0.6949
Epoch 288/400
160/160 [==============================] - 0s 206us/step - loss: 0.6951
Epoch 289/400
160/160 [==============================] - 0s 206us/step - loss: 0.6947
```

```
Epoch 290/400
160/160 [==============================] - 0s 237us/step - loss: 0.6941
Epoch 291/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 292/400
160/160 [==============================] - 0s 218us/step - loss: 0.6943
Epoch 293/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 294/400
160/160 [==============================] - 0s 219us/step - loss: 0.6942
Epoch 295/400
160/160 [==============================] - 0s 211us/step - loss: 0.6942
Epoch 296/400
160/160 [==============================] - 0s 206us/step - loss: 0.6942
Epoch 297/400
160/160 [==============================] - 0s 206us/step - loss: 0.6945
Epoch 298/400
160/160 [==============================] - 0s 206us/step - loss: 0.6947
Epoch 299/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 300/400
160/160 [==============================] - 0s 212us/step - loss: 0.6937
Epoch 301/400
160/160 [==============================] - 0s 224us/step - loss: 0.6949
Epoch 302/400
160/160 [==============================] - 0s 212us/step - loss: 0.6940
Epoch 303/400
160/160 [==============================] - 0s 224us/step - loss: 0.6943
Epoch 304/400
160/160 [==============================] - 0s 212us/step - loss: 0.6941
Epoch 305/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 306/400
160/160 [==============================] - 0s 206us/step - loss: 0.6945
Epoch 307/400
160/160 [==============================] - 0s 212us/step - loss: 0.6942
Epoch 308/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 309/400
160/160 [==============================] - 0s 212us/step - loss: 0.6949
Epoch 310/400
160/160 [==============================] - 0s 224us/step - loss: 0.6945
Epoch 311/400
160/160 [==============================] - 0s 225us/step - loss: 0.6945
Epoch 312/400
160/160 [==============================] - 0s 212us/step - loss: 0.6941
Epoch 313/400
160/160 [==============================] - 0s 219us/step - loss: 0.6943
```

```
Epoch 314/400
160/160 [==============================] - 0s 212us/step - loss: 0.6945
Epoch 315/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 316/400
160/160 [==============================] - 0s 218us/step - loss: 0.6945
Epoch 317/400
160/160 [==============================] - 0s 206us/step - loss: 0.6941
Epoch 318/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 319/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 320/400
160/160 [==============================] - 0s 218us/step - loss: 0.6943
Epoch 321/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 322/400
160/160 [==============================] - 0s 218us/step - loss: 0.6949
Epoch 323/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 324/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 325/400
160/160 [==============================] - 0s 212us/step - loss: 0.6951
Epoch 326/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 327/400
160/160 [==============================] - 0s 206us/step - loss: 0.6950
Epoch 328/400
160/160 [==============================] - 0s 218us/step - loss: 0.6948
Epoch 329/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 330/400
160/160 [==============================] - 0s 218us/step - loss: 0.6941
Epoch 331/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 332/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
Epoch 333/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 334/400
160/160 [==============================] - 0s 206us/step - loss: 0.6946
Epoch 335/400
160/160 [==============================] - 0s 212us/step - loss: 0.6941
Epoch 336/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
Epoch 337/400
160/160 [==============================] - 0s 217us/step - loss: 0.6947
```

```
Epoch 338/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 339/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 340/400
160/160 [==============================] - 0s 218us/step - loss: 0.6952
Epoch 341/400
160/160 [==============================] - 0s 218us/step - loss: 0.6941
Epoch 342/400
160/160 [==============================] - 0s 231us/step - loss: 0.6941
Epoch 343/400
160/160 [==============================] - 0s 212us/step - loss: 0.6950
Epoch 344/400
160/160 [==============================] - 0s 218us/step - loss: 0.6945
Epoch 345/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 346/400
160/160 [==============================] - 0s 206us/step - loss: 0.6945
Epoch 347/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 348/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 349/400
160/160 [==============================] - 0s 222us/step - loss: 0.6941
Epoch 350/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 351/400
160/160 [==============================] - 0s 212us/step - loss: 0.6945
Epoch 352/400
160/160 [==============================] - 0s 212us/step - loss: 0.6950
Epoch 353/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 354/400
160/160 [==============================] - 0s 206us/step - loss: 0.6946
Epoch 355/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 356/400
160/160 [==============================] - 0s 199us/step - loss: 0.6948
Epoch 357/400
160/160 [==============================] - 0s 219us/step - loss: 0.6949
Epoch 358/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 359/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 360/400
160/160 [==============================] - 0s 207us/step - loss: 0.6949
Epoch 361/400
160/160 [==============================] - 0s 206us/step - loss: 0.6945
```

```
Epoch 362/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 363/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 364/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 365/400
160/160 [==============================] - 0s 224us/step - loss: 0.6949
Epoch 366/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 367/400
160/160 [==============================] - 0s 225us/step - loss: 0.6947
Epoch 368/400
160/160 [==============================] - 0s 224us/step - loss: 0.6944
Epoch 369/400
160/160 [==============================] - 0s 218us/step - loss: 0.6941
Epoch 370/400
160/160 [==============================] - 0s 212us/step - loss: 0.6939
Epoch 371/400
160/160 [==============================] - 0s 224us/step - loss: 0.6943
Epoch 372/400
160/160 [==============================] - 0s 224us/step - loss: 0.6942
Epoch 373/400
160/160 [==============================] - 0s 211us/step - loss: 0.6948
Epoch 374/400
160/160 [==============================] - 0s 212us/step - loss: 0.6943
Epoch 375/400
160/160 [==============================] - 0s 218us/step - loss: 0.6945
Epoch 376/400
160/160 [==============================] - 0s 212us/step - loss: 0.6948
Epoch 377/400
160/160 [==============================] - 0s 224us/step - loss: 0.6947
Epoch 378/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 379/400
160/160 [==============================] - 0s 212us/step - loss: 0.6946
Epoch 380/400
160/160 [==============================] - 0s 224us/step - loss: 0.6947
Epoch 381/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 382/400
160/160 [==============================] - 0s 218us/step - loss: 0.6944
Epoch 383/400
160/160 [==============================] - 0s 225us/step - loss: 0.6941
Epoch 384/400
160/160 [==============================] - 0s 218us/step - loss: 0.6946
Epoch 385/400
160/160 [==============================] - 0s 218us/step - loss: 0.6950
```

```
Epoch 386/400
160/160 [==============================] - 0s 212us/step - loss: 0.6941
Epoch 387/400
160/160 [==============================] - 0s 212us/step - loss: 0.6944
Epoch 388/400
160/160 [==============================] - 0s 219us/step - loss: 0.6945
Epoch 389/400
160/160 [==============================] - 0s 223us/step - loss: 0.6949
Epoch 390/400
160/160 [==============================] - 0s 218us/step - loss: 0.6947
Epoch 391/400
160/160 [==============================] - 0s 212us/step - loss: 0.6949
Epoch 392/400
160/160 [==============================] - 0s 206us/step - loss: 0.6945
Epoch 393/400
160/160 [==============================] - 0s 218us/step - loss: 0.6938
Epoch 394/400
160/160 [==============================] - 0s 231us/step - loss: 0.6940
Epoch 395/400
160/160 [==============================] - 0s 218us/step - loss: 0.6948
Epoch 396/400
160/160 [==============================] - 0s 224us/step - loss: 0.6950
Epoch 397/400
160/160 [==============================] - 0s 218us/step - loss: 0.6943
Epoch 398/400
160/160 [==============================] - 0s 218us/step - loss: 0.6945
Epoch 399/400
160/160 [==============================] - 0s 205us/step - loss: 0.6945
Epoch 400/400
160/160 [==============================] - 0s 212us/step - loss: 0.6947
[0.50049686 0.5004238  0.5003806  0.50042653 0.50036347 0.5003473
 0.5004463  0.5003445  0.5005531  0.500346   0.50041705 0.5003978
 0.5003959  0.5004757  0.5004777  0.50052166 0.50058895 0.5003625
 0.50035    0.5004234  0.5002658  0.50029975 0.5005985  0.50047106
 0.5003325  0.500557   0.5002725  0.50024945 0.50028974 0.50043315
 0.50035214 0.50053483 0.50049764 0.5004346  0.5003641  0.50037485
 0.50049376 0.5004958  0.5004627  0.50051486 0.50080585 0.500885
 0.5009263  0.50088173 0.5009493  0.50096136 0.5008596  0.5009605
 0.50074977 0.5009623  0.5008911  0.500912   0.5009102  0.5008272
 0.5008263  0.50078565 0.5007134  0.500945   0.5009628  0.50088006
 0.50104606 0.5010152  0.5007039  0.50083464 0.5009807  0.5007454
 0.5010382  0.50106484 0.5010221  0.5008728  0.5009536  0.5007693
 0.50080645 0.5008714  0.5009426  0.5009361  0.50081307 0.500808
 0.50084335 0.5007885  0.5005184  0.5006394  0.50048834 0.5006269
 0.5006136  0.50047255 0.50058657 0.50035894 0.5006352  0.5004607
 0.5006025  0.5006129  0.50049144 0.50049365 0.50055957 0.50078464
 0.50065523 0.50046927 0.50058264 0.5004294  0.5003761  0.50051415
 0.5006703  0.5006298  0.5005519  0.5005975  0.5003683  0.50038654
```

```
 0.50042665 0.50056106 0.50039583 0.50068367 0.50060713 0.5005655
 0.50044894 0.5005918  0.50071853 0.50058746 0.5006271  0.50059676
 0.5007838  0.5006644  0.5008137  0.5006764  0.5006912  0.5008297
 0.5007157  0.5009451  0.5006668  0.50084156 0.5007004  0.50069076
 0.50081056 0.50080866 0.5007422  0.5005227  0.50064677 0.50083286
 0.50072145 0.50087374 0.5009271  0.50078976 0.5006318  0.5006729
 0.5007519  0.50070435 0.5009349  0.5009169  0.5008761  0.500741
 0.5009072  0.5006193  0.5006949  0.50073653 0.5008533  0.5007118
 0.50058633 0.5007144  0.50067556 0.5007051 ]
160/160 [==============================] - 4s 24ms/step


In [80]: scores = model.evaluate(X, y)
         scores, model.metrics_names

160/160 [==============================] - 0s 31us/step


Out[80]: (0.693146002292633, ['loss'])

In [81]: model = Sequential()

         model.add(Dense(5, input_dim=2, activation='sigmoid'))
         model.add(Dense(4, input_dim=2, activation='sigmoid'))
         model.add(Dense(3, input_dim=2, activation='relu'))
         model.add(Dense(2, input_dim=2, activation='relu'))  #sigmoid, relu
         # model.add(Dense(2, activation='tanh'))
         model.add(Dense(1, activation='sigmoid'))
         # model.add(Dense(1,input_dim=2, activation='sigmoid'))


         sgd = SGD(lr=0.1)
         model.compile(loss='binary_crossentropy', optimizer='adam')

         model.fit(X, y, batch_size=2, epochs=400) #160/4 = 40 per epoch
         print(model.predict_proba(X).reshape(4*n))

         # evaluate the model
         scores = model.evaluate(X, y)

Epoch 1/400
160/160 [==============================] - 11s 68ms/step - loss: 0.7305
Epoch 2/400
160/160 [==============================] - 0s 467us/step - loss: 0.7101
Epoch 3/400
160/160 [==============================] - 0s 462us/step - loss: 0.7026
Epoch 4/400
160/160 [==============================] - 0s 487us/step - loss: 0.6976
Epoch 5/400
```

```
160/160 [==============================] - 0s 455us/step - loss: 0.6957
Epoch 6/400
160/160 [==============================] - 0s 467us/step - loss: 0.6951
Epoch 7/400
160/160 [==============================] - 0s 480us/step - loss: 0.6937
Epoch 8/400
160/160 [==============================] - 0s 462us/step - loss: 0.6939
Epoch 9/400
160/160 [==============================] - 0s 449us/step - loss: 0.6933
Epoch 10/400
160/160 [==============================] - 0s 455us/step - loss: 0.6929
Epoch 11/400
160/160 [==============================] - 0s 463us/step - loss: 0.6925
Epoch 12/400
160/160 [==============================] - 0s 449us/step - loss: 0.6926
Epoch 13/400
160/160 [==============================] - 0s 467us/step - loss: 0.6921
Epoch 14/400
160/160 [==============================] - 0s 468us/step - loss: 0.6916
Epoch 15/400
160/160 [==============================] - 0s 461us/step - loss: 0.6914
Epoch 16/400
160/160 [==============================] - 0s 462us/step - loss: 0.6917
Epoch 17/400
160/160 [==============================] - 0s 455us/step - loss: 0.6911
Epoch 18/400
160/160 [==============================] - 0s 461us/step - loss: 0.6907
Epoch 19/400
160/160 [==============================] - 0s 455us/step - loss: 0.6902
Epoch 20/400
160/160 [==============================] - 0s 468us/step - loss: 0.6900
Epoch 21/400
160/160 [==============================] - 0s 468us/step - loss: 0.6891
Epoch 22/400
160/160 [==============================] - 0s 455us/step - loss: 0.6888
Epoch 23/400
160/160 [==============================] - 0s 455us/step - loss: 0.6882
Epoch 24/400
160/160 [==============================] - 0s 455us/step - loss: 0.6878
Epoch 25/400
160/160 [==============================] - 0s 461us/step - loss: 0.6874
Epoch 26/400
160/160 [==============================] - 0s 449us/step - loss: 0.6864
Epoch 27/400
160/160 [==============================] - 0s 455us/step - loss: 0.6848
Epoch 28/400
160/160 [==============================] - 0s 474us/step - loss: 0.6836
Epoch 29/400
```

```
160/160 [==============================] - 0s 449us/step - loss: 0.6823
Epoch 30/400
160/160 [==============================] - 0s 461us/step - loss: 0.6812
Epoch 31/400
160/160 [==============================] - 0s 455us/step - loss: 0.6789
Epoch 32/400
160/160 [==============================] - 0s 467us/step - loss: 0.6764
Epoch 33/400
160/160 [==============================] - 0s 455us/step - loss: 0.6753
Epoch 34/400
160/160 [==============================] - 0s 480us/step - loss: 0.6735
Epoch 35/400
160/160 [==============================] - 0s 474us/step - loss: 0.6691
Epoch 36/400
160/160 [==============================] - 0s 449us/step - loss: 0.6652
Epoch 37/400
160/160 [==============================] - 0s 462us/step - loss: 0.6620
Epoch 38/400
160/160 [==============================] - 0s 455us/step - loss: 0.6574
Epoch 39/400
160/160 [==============================] - 0s 468us/step - loss: 0.6544
Epoch 40/400
160/160 [==============================] - 0s 461us/step - loss: 0.6493
Epoch 41/400
160/160 [==============================] - 0s 462us/step - loss: 0.6445
Epoch 42/400
160/160 [==============================] - 0s 505us/step - loss: 0.6399
Epoch 43/400
160/160 [==============================] - 0s 486us/step - loss: 0.6354
Epoch 44/400
160/160 [==============================] - 0s 493us/step - loss: 0.6310
Epoch 45/400
160/160 [==============================] - 0s 505us/step - loss: 0.6262
Epoch 46/400
160/160 [==============================] - 0s 505us/step - loss: 0.6222
Epoch 47/400
160/160 [==============================] - 0s 493us/step - loss: 0.6177
Epoch 48/400
160/160 [==============================] - 0s 486us/step - loss: 0.6142
Epoch 49/400
160/160 [==============================] - 0s 480us/step - loss: 0.6100
Epoch 50/400
160/160 [==============================] - 0s 480us/step - loss: 0.6066
Epoch 51/400
160/160 [==============================] - 0s 461us/step - loss: 0.6025
Epoch 52/400
160/160 [==============================] - 0s 468us/step - loss: 0.5993
Epoch 53/400
```

```
160/160 [==============================] - 0s 461us/step - loss: 0.5974
Epoch 54/400
160/160 [==============================] - 0s 461us/step - loss: 0.5931
Epoch 55/400
160/160 [==============================] - 0s 474us/step - loss: 0.5920
Epoch 56/400
160/160 [==============================] - 0s 455us/step - loss: 0.5896
Epoch 57/400
160/160 [==============================] - 0s 461us/step - loss: 0.5878
Epoch 58/400
160/160 [==============================] - 0s 474us/step - loss: 0.5829
Epoch 59/400
160/160 [==============================] - 0s 499us/step - loss: 0.5813
Epoch 60/400
160/160 [==============================] - 0s 480us/step - loss: 0.5786
Epoch 61/400
160/160 [==============================] - 0s 468us/step - loss: 0.5771
Epoch 62/400
160/160 [==============================] - 0s 461us/step - loss: 0.5755
Epoch 63/400
160/160 [==============================] - 0s 486us/step - loss: 0.5734
Epoch 64/400
160/160 [==============================] - 0s 480us/step - loss: 0.5702
Epoch 65/400
160/160 [==============================] - 0s 461us/step - loss: 0.5684
Epoch 66/400
160/160 [==============================] - 0s 480us/step - loss: 0.5664
Epoch 67/400
160/160 [==============================] - 0s 455us/step - loss: 0.5641
Epoch 68/400
160/160 [==============================] - 0s 455us/step - loss: 0.5626
Epoch 69/400
160/160 [==============================] - 0s 455us/step - loss: 0.5605
Epoch 70/400
160/160 [==============================] - 0s 468us/step - loss: 0.5590
Epoch 71/400
160/160 [==============================] - 0s 455us/step - loss: 0.5560
Epoch 72/400
160/160 [==============================] - 0s 455us/step - loss: 0.5527
Epoch 73/400
160/160 [==============================] - 0s 492us/step - loss: 0.5518
Epoch 74/400
160/160 [==============================] - 0s 461us/step - loss: 0.5478
Epoch 75/400
160/160 [==============================] - 0s 493us/step - loss: 0.5446
Epoch 76/400
160/160 [==============================] - 0s 455us/step - loss: 0.5429
Epoch 77/400
```

```
160/160 [==============================] - 0s 480us/step - loss: 0.5410
Epoch 78/400
160/160 [==============================] - 0s 474us/step - loss: 0.5369
Epoch 79/400
160/160 [==============================] - 0s 474us/step - loss: 0.5338
Epoch 80/400
160/160 [==============================] - 0s 480us/step - loss: 0.5325
Epoch 81/400
160/160 [==============================] - 0s 468us/step - loss: 0.5296
Epoch 82/400
160/160 [==============================] - 0s 455us/step - loss: 0.5251
Epoch 83/400
160/160 [==============================] - 0s 467us/step - loss: 0.5219
Epoch 84/400
160/160 [==============================] - 0s 480us/step - loss: 0.5181
Epoch 85/400
160/160 [==============================] - 0s 467us/step - loss: 0.5173
Epoch 86/400
160/160 [==============================] - 0s 490us/step - loss: 0.5104
Epoch 87/400
160/160 [==============================] - 0s 499us/step - loss: 0.5073
Epoch 88/400
160/160 [==============================] - 0s 461us/step - loss: 0.5038
Epoch 89/400
160/160 [==============================] - 0s 480us/step - loss: 0.5003
Epoch 90/400
160/160 [==============================] - 0s 481us/step - loss: 0.4956
Epoch 91/400
160/160 [==============================] - 0s 492us/step - loss: 0.4920
Epoch 92/400
160/160 [==============================] - 0s 486us/step - loss: 0.4887
Epoch 93/400
160/160 [==============================] - 0s 499us/step - loss: 0.4840
Epoch 94/400
160/160 [==============================] - 0s 511us/step - loss: 0.4790
Epoch 95/400
160/160 [==============================] - 0s 489us/step - loss: 0.4752
Epoch 96/400
160/160 [==============================] - 0s 499us/step - loss: 0.4705
Epoch 97/400
160/160 [==============================] - 0s 487us/step - loss: 0.4656
Epoch 98/400
160/160 [==============================] - 0s 468us/step - loss: 0.4627
Epoch 99/400
160/160 [==============================] - 0s 468us/step - loss: 0.4605
Epoch 100/400
160/160 [==============================] - 0s 449us/step - loss: 0.4530
Epoch 101/400
```

```
160/160 [==============================] - 0s 499us/step - loss: 0.4518
Epoch 102/400
160/160 [==============================] - 0s 499us/step - loss: 0.4466
Epoch 103/400
160/160 [==============================] - 0s 482us/step - loss: 0.4404
Epoch 104/400
160/160 [==============================] - 0s 468us/step - loss: 0.4380
Epoch 105/400
160/160 [==============================] - 0s 455us/step - loss: 0.4337
Epoch 106/400
160/160 [==============================] - 0s 449us/step - loss: 0.4279
Epoch 107/400
160/160 [==============================] - 0s 449us/step - loss: 0.4231
Epoch 108/400
160/160 [==============================] - 0s 474us/step - loss: 0.4205
Epoch 109/400
160/160 [==============================] - 0s 443us/step - loss: 0.4155
Epoch 110/400
160/160 [==============================] - 0s 455us/step - loss: 0.4113
Epoch 111/400
160/160 [==============================] - 0s 461us/step - loss: 0.4087
Epoch 112/400
160/160 [==============================] - 0s 449us/step - loss: 0.4053
Epoch 113/400
160/160 [==============================] - 0s 480us/step - loss: 0.4017
Epoch 114/400
160/160 [==============================] - 0s 474us/step - loss: 0.3983
Epoch 115/400
160/160 [==============================] - 0s 443us/step - loss: 0.3921
Epoch 116/400
160/160 [==============================] - 0s 455us/step - loss: 0.3903
Epoch 117/400
160/160 [==============================] - 0s 473us/step - loss: 0.3852
Epoch 118/400
160/160 [==============================] - 0s 480us/step - loss: 0.3827
Epoch 119/400
160/160 [==============================] - 0s 487us/step - loss: 0.3808
Epoch 120/400
160/160 [==============================] - 0s 461us/step - loss: 0.3764
Epoch 121/400
160/160 [==============================] - 0s 461us/step - loss: 0.3735
Epoch 122/400
160/160 [==============================] - 0s 474us/step - loss: 0.3719
Epoch 123/400
160/160 [==============================] - 0s 480us/step - loss: 0.3686
Epoch 124/400
160/160 [==============================] - 0s 461us/step - loss: 0.3655
Epoch 125/400
```

```
160/160 [==============================] - 0s 461us/step - loss: 0.3664
Epoch 126/400
160/160 [==============================] - 0s 442us/step - loss: 0.3637
Epoch 127/400
160/160 [==============================] - 0s 461us/step - loss: 0.3566
Epoch 128/400
160/160 [==============================] - 0s 461us/step - loss: 0.3559
Epoch 129/400
160/160 [==============================] - 0s 461us/step - loss: 0.3519
Epoch 130/400
160/160 [==============================] - 0s 474us/step - loss: 0.3504
Epoch 131/400
160/160 [==============================] - 0s 449us/step - loss: 0.3495
Epoch 132/400
160/160 [==============================] - 0s 468us/step - loss: 0.3450
Epoch 133/400
160/160 [==============================] - 0s 460us/step - loss: 0.3454
Epoch 134/400
160/160 [==============================] - 0s 474us/step - loss: 0.3435
Epoch 135/400
160/160 [==============================] - 0s 449us/step - loss: 0.3405
Epoch 136/400
160/160 [==============================] - 0s 468us/step - loss: 0.3397
Epoch 137/400
160/160 [==============================] - 0s 455us/step - loss: 0.3380
Epoch 138/400
160/160 [==============================] - 0s 455us/step - loss: 0.3356
Epoch 139/400
160/160 [==============================] - 0s 461us/step - loss: 0.3335
Epoch 140/400
160/160 [==============================] - 0s 461us/step - loss: 0.3314
Epoch 141/400
160/160 [==============================] - 0s 498us/step - loss: 0.3288
Epoch 142/400
160/160 [==============================] - 0s 461us/step - loss: 0.3338
Epoch 143/400
160/160 [==============================] - 0s 462us/step - loss: 0.3260
Epoch 144/400
160/160 [==============================] - 0s 486us/step - loss: 0.3249
Epoch 145/400
160/160 [==============================] - 0s 455us/step - loss: 0.3239
Epoch 146/400
160/160 [==============================] - 0s 474us/step - loss: 0.3228
Epoch 147/400
160/160 [==============================] - 0s 455us/step - loss: 0.3231
Epoch 148/400
160/160 [==============================] - 0s 481us/step - loss: 0.3216
Epoch 149/400
```

```
160/160 [==============================] - 0s 454us/step - loss: 0.3212
Epoch 150/400
160/160 [==============================] - 0s 456us/step - loss: 0.3184
Epoch 151/400
160/160 [==============================] - 0s 455us/step - loss: 0.3157
Epoch 152/400
160/160 [==============================] - 0s 456us/step - loss: 0.3167
Epoch 153/400
160/160 [==============================] - 0s 468us/step - loss: 0.3129
Epoch 154/400
160/160 [==============================] - 0s 455us/step - loss: 0.3130
Epoch 155/400
160/160 [==============================] - 0s 468us/step - loss: 0.3104
Epoch 156/400
160/160 [==============================] - 0s 455us/step - loss: 0.3125
Epoch 157/400
160/160 [==============================] - 0s 480us/step - loss: 0.3103
Epoch 158/400
160/160 [==============================] - 0s 467us/step - loss: 0.3069
Epoch 159/400
160/160 [==============================] - 0s 455us/step - loss: 0.3047
Epoch 160/400
160/160 [==============================] - 0s 480us/step - loss: 0.3037
Epoch 161/400
160/160 [==============================] - 0s 456us/step - loss: 0.3007
Epoch 162/400
160/160 [==============================] - 0s 492us/step - loss: 0.3015
Epoch 163/400
160/160 [==============================] - 0s 455us/step - loss: 0.3005
Epoch 164/400
160/160 [==============================] - 0s 474us/step - loss: 0.2994
Epoch 165/400
160/160 [==============================] - 0s 480us/step - loss: 0.2963
Epoch 166/400
160/160 [==============================] - 0s 455us/step - loss: 0.2962
Epoch 167/400
160/160 [==============================] - 0s 474us/step - loss: 0.2936
Epoch 168/400
160/160 [==============================] - 0s 474us/step - loss: 0.2918
Epoch 169/400
160/160 [==============================] - 0s 480us/step - loss: 0.2946
Epoch 170/400
160/160 [==============================] - 0s 455us/step - loss: 0.2900
Epoch 171/400
160/160 [==============================] - 0s 461us/step - loss: 0.2885
Epoch 172/400
160/160 [==============================] - 0s 450us/step - loss: 0.2847
Epoch 173/400
```

```
160/160 [==============================] - 0s 474us/step - loss: 0.2835
Epoch 174/400
160/160 [==============================] - 0s 468us/step - loss: 0.2842
Epoch 175/400
160/160 [==============================] - 0s 486us/step - loss: 0.2821
Epoch 176/400
160/160 [==============================] - 0s 449us/step - loss: 0.2791
Epoch 177/400
160/160 [==============================] - 0s 486us/step - loss: 0.2776
Epoch 178/400
160/160 [==============================] - 0s 480us/step - loss: 0.2790
Epoch 179/400
160/160 [==============================] - 0s 468us/step - loss: 0.2747
Epoch 180/400
160/160 [==============================] - 0s 474us/step - loss: 0.2740
Epoch 181/400
160/160 [==============================] - 0s 461us/step - loss: 0.2753
Epoch 182/400
160/160 [==============================] - 0s 480us/step - loss: 0.2734
Epoch 183/400
160/160 [==============================] - 0s 468us/step - loss: 0.2702
Epoch 184/400
160/160 [==============================] - 0s 467us/step - loss: 0.2708
Epoch 185/400
160/160 [==============================] - 0s 461us/step - loss: 0.2659
Epoch 186/400
160/160 [==============================] - 0s 474us/step - loss: 0.2655
Epoch 187/400
160/160 [==============================] - 0s 461us/step - loss: 0.2645
Epoch 188/400
160/160 [==============================] - 0s 493us/step - loss: 0.2625
Epoch 189/400
160/160 [==============================] - 0s 486us/step - loss: 0.2610
Epoch 190/400
160/160 [==============================] - 0s 468us/step - loss: 0.2607
Epoch 191/400
160/160 [==============================] - 0s 474us/step - loss: 0.2569
Epoch 192/400
160/160 [==============================] - 0s 462us/step - loss: 0.2574
Epoch 193/400
160/160 [==============================] - 0s 462us/step - loss: 0.2544
Epoch 194/400
160/160 [==============================] - 0s 449us/step - loss: 0.2531
Epoch 195/400
160/160 [==============================] - 0s 486us/step - loss: 0.2513
Epoch 196/400
160/160 [==============================] - 0s 443us/step - loss: 0.2507
Epoch 197/400
```

```
160/160 [==============================] - 0s 462us/step - loss: 0.2500
Epoch 198/400
160/160 [==============================] - 0s 436us/step - loss: 0.2470
Epoch 199/400
160/160 [==============================] - 0s 449us/step - loss: 0.2466
Epoch 200/400
160/160 [==============================] - 0s 461us/step - loss: 0.2511
Epoch 201/400
160/160 [==============================] - 0s 455us/step - loss: 0.2453
Epoch 202/400
160/160 [==============================] - 0s 461us/step - loss: 0.2423
Epoch 203/400
160/160 [==============================] - 0s 461us/step - loss: 0.2417
Epoch 204/400
160/160 [==============================] - 0s 461us/step - loss: 0.2401
Epoch 205/400
160/160 [==============================] - 0s 455us/step - loss: 0.2386
Epoch 206/400
160/160 [==============================] - 0s 467us/step - loss: 0.2390
Epoch 207/400
160/160 [==============================] - 0s 455us/step - loss: 0.2357
Epoch 208/400
160/160 [==============================] - 0s 474us/step - loss: 0.2334
Epoch 209/400
160/160 [==============================] - 0s 455us/step - loss: 0.2333
Epoch 210/400
160/160 [==============================] - 0s 474us/step - loss: 0.2312
Epoch 211/400
160/160 [==============================] - 0s 461us/step - loss: 0.2295
Epoch 212/400
160/160 [==============================] - 0s 474us/step - loss: 0.2297
Epoch 213/400
160/160 [==============================] - 0s 461us/step - loss: 0.2270
Epoch 214/400
160/160 [==============================] - 0s 461us/step - loss: 0.2281
Epoch 215/400
160/160 [==============================] - 0s 455us/step - loss: 0.2239
Epoch 216/400
160/160 [==============================] - 0s 474us/step - loss: 0.2222
Epoch 217/400
160/160 [==============================] - 0s 467us/step - loss: 0.2210
Epoch 218/400
160/160 [==============================] - 0s 462us/step - loss: 0.2221
Epoch 219/400
160/160 [==============================] - 0s 467us/step - loss: 0.2172
Epoch 220/400
160/160 [==============================] - 0s 468us/step - loss: 0.2161
Epoch 221/400
```

```
160/160 [==============================] - 0s 461us/step - loss: 0.2171
Epoch 222/400
160/160 [==============================] - 0s 480us/step - loss: 0.2129
Epoch 223/400
160/160 [==============================] - 0s 461us/step - loss: 0.2111
Epoch 224/400
160/160 [==============================] - 0s 455us/step - loss: 0.2112
Epoch 225/400
160/160 [==============================] - 0s 449us/step - loss: 0.2089
Epoch 226/400
160/160 [==============================] - 0s 455us/step - loss: 0.2078
Epoch 227/400
160/160 [==============================] - 0s 455us/step - loss: 0.2066
Epoch 228/400
160/160 [==============================] - 0s 486us/step - loss: 0.2055
Epoch 229/400
160/160 [==============================] - 0s 455us/step - loss: 0.2034
Epoch 230/400
160/160 [==============================] - 0s 455us/step - loss: 0.2022
Epoch 231/400
160/160 [==============================] - 0s 467us/step - loss: 0.2014
Epoch 232/400
160/160 [==============================] - 0s 474us/step - loss: 0.2005
Epoch 233/400
160/160 [==============================] - 0s 461us/step - loss: 0.1971
Epoch 234/400
160/160 [==============================] - 0s 467us/step - loss: 0.1973
Epoch 235/400
160/160 [==============================] - 0s 449us/step - loss: 0.1953
Epoch 236/400
160/160 [==============================] - 0s 473us/step - loss: 0.1943
Epoch 237/400
160/160 [==============================] - 0s 455us/step - loss: 0.1949
Epoch 238/400
160/160 [==============================] - 0s 461us/step - loss: 0.1938
Epoch 239/400
160/160 [==============================] - 0s 455us/step - loss: 0.1895
Epoch 240/400
160/160 [==============================] - 0s 474us/step - loss: 0.1875
Epoch 241/400
160/160 [==============================] - 0s 456us/step - loss: 0.1887
Epoch 242/400
160/160 [==============================] - 0s 443us/step - loss: 0.1865
Epoch 243/400
160/160 [==============================] - 0s 468us/step - loss: 0.1836
Epoch 244/400
160/160 [==============================] - 0s 461us/step - loss: 0.1824
Epoch 245/400
```

```
160/160 [==============================] - 0s 455us/step - loss: 0.1811
Epoch 246/400
160/160 [==============================] - 0s 467us/step - loss: 0.1789
Epoch 247/400
160/160 [==============================] - 0s 474us/step - loss: 0.1783
Epoch 248/400
160/160 [==============================] - 0s 455us/step - loss: 0.1790
Epoch 249/400
160/160 [==============================] - 0s 468us/step - loss: 0.1755
Epoch 250/400
160/160 [==============================] - 0s 492us/step - loss: 0.1754
Epoch 251/400
160/160 [==============================] - 0s 455us/step - loss: 0.1729
Epoch 252/400
160/160 [==============================] - 0s 463us/step - loss: 0.1712
Epoch 253/400
160/160 [==============================] - 0s 455us/step - loss: 0.1706
Epoch 254/400
160/160 [==============================] - 0s 461us/step - loss: 0.1698
Epoch 255/400
160/160 [==============================] - 0s 455us/step - loss: 0.1676
Epoch 256/400
160/160 [==============================] - 0s 455us/step - loss: 0.1659
Epoch 257/400
160/160 [==============================] - 0s 461us/step - loss: 0.1663
Epoch 258/400
160/160 [==============================] - 0s 455us/step - loss: 0.1639
Epoch 259/400
160/160 [==============================] - 0s 467us/step - loss: 0.1612
Epoch 260/400
160/160 [==============================] - 0s 461us/step - loss: 0.1628
Epoch 261/400
160/160 [==============================] - 0s 461us/step - loss: 0.1590
Epoch 262/400
160/160 [==============================] - 0s 474us/step - loss: 0.1579
Epoch 263/400
160/160 [==============================] - 0s 486us/step - loss: 0.1594
Epoch 264/400
160/160 [==============================] - 0s 505us/step - loss: 0.1556
Epoch 265/400
160/160 [==============================] - 0s 468us/step - loss: 0.1550
Epoch 266/400
160/160 [==============================] - 0s 486us/step - loss: 0.1529
Epoch 267/400
160/160 [==============================] - 0s 467us/step - loss: 0.1526
Epoch 268/400
160/160 [==============================] - 0s 474us/step - loss: 0.1512
Epoch 269/400
```

```
160/160 [==============================] - 0s 461us/step - loss: 0.1502
Epoch 270/400
160/160 [==============================] - 0s 455us/step - loss: 0.1479
Epoch 271/400
160/160 [==============================] - 0s 461us/step - loss: 0.1461
Epoch 272/400
160/160 [==============================] - 0s 476us/step - loss: 0.1467
Epoch 273/400
160/160 [==============================] - 0s 461us/step - loss: 0.1428
Epoch 274/400
160/160 [==============================] - 0s 455us/step - loss: 0.1452
Epoch 275/400
160/160 [==============================] - 0s 455us/step - loss: 0.1414
Epoch 276/400
160/160 [==============================] - 0s 474us/step - loss: 0.1405
Epoch 277/400
160/160 [==============================] - 0s 474us/step - loss: 0.1399
Epoch 278/400
160/160 [==============================] - 0s 474us/step - loss: 0.1373
Epoch 279/400
160/160 [==============================] - 0s 443us/step - loss: 0.1358
Epoch 280/400
160/160 [==============================] - 0s 462us/step - loss: 0.1356
Epoch 281/400
160/160 [==============================] - 0s 455us/step - loss: 0.1347
Epoch 282/400
160/160 [==============================] - 0s 468us/step - loss: 0.1341
Epoch 283/400
160/160 [==============================] - 0s 461us/step - loss: 0.1324
Epoch 284/400
160/160 [==============================] - 0s 461us/step - loss: 0.1294
Epoch 285/400
160/160 [==============================] - 0s 455us/step - loss: 0.1304
Epoch 286/400
160/160 [==============================] - 0s 480us/step - loss: 0.1298
Epoch 287/400
160/160 [==============================] - 0s 467us/step - loss: 0.1268
Epoch 288/400
160/160 [==============================] - 0s 449us/step - loss: 0.1254
Epoch 289/400
160/160 [==============================] - 0s 449us/step - loss: 0.1242
Epoch 290/400
160/160 [==============================] - 0s 461us/step - loss: 0.1251
Epoch 291/400
160/160 [==============================] - 0s 449us/step - loss: 0.1235
Epoch 292/400
160/160 [==============================] - 0s 448us/step - loss: 0.1235
Epoch 293/400
```

```
160/160 [==============================] - 0s 455us/step - loss: 0.1212
Epoch 294/400
160/160 [==============================] - 0s 443us/step - loss: 0.1183
Epoch 295/400
160/160 [==============================] - 0s 449us/step - loss: 0.1173
Epoch 296/400
160/160 [==============================] - 0s 436us/step - loss: 0.1165
Epoch 297/400
160/160 [==============================] - 0s 443us/step - loss: 0.1150
Epoch 298/400
160/160 [==============================] - 0s 449us/step - loss: 0.1138
Epoch 299/400
160/160 [==============================] - 0s 449us/step - loss: 0.1150
Epoch 300/400
160/160 [==============================] - 0s 455us/step - loss: 0.1109
Epoch 301/400
160/160 [==============================] - 0s 455us/step - loss: 0.1106
Epoch 302/400
160/160 [==============================] - 0s 456us/step - loss: 0.1120
Epoch 303/400
160/160 [==============================] - 0s 455us/step - loss: 0.1106
Epoch 304/400
160/160 [==============================] - 0s 449us/step - loss: 0.1093
Epoch 305/400
160/160 [==============================] - 0s 467us/step - loss: 0.1065
Epoch 306/400
160/160 [==============================] - 0s 449us/step - loss: 0.1062
Epoch 307/400
160/160 [==============================] - 0s 467us/step - loss: 0.1044
Epoch 308/400
160/160 [==============================] - 0s 449us/step - loss: 0.1025
Epoch 309/400
160/160 [==============================] - 0s 449us/step - loss: 0.1031
Epoch 310/400
160/160 [==============================] - 0s 455us/step - loss: 0.1018
Epoch 311/400
160/160 [==============================] - 0s 449us/step - loss: 0.1003
Epoch 312/400
160/160 [==============================] - 0s 437us/step - loss: 0.0996
Epoch 313/400
160/160 [==============================] - 0s 451us/step - loss: 0.0986
Epoch 314/400
160/160 [==============================] - 0s 442us/step - loss: 0.0990
Epoch 315/400
160/160 [==============================] - 0s 443us/step - loss: 0.0985
Epoch 316/400
160/160 [==============================] - 0s 524us/step - loss: 0.0959
Epoch 317/400
```

```
160/160 [==============================] - 0s 505us/step - loss: 0.0954
Epoch 318/400
160/160 [==============================] - 0s 461us/step - loss: 0.0943
Epoch 319/400
160/160 [==============================] - 0s 455us/step - loss: 0.0926
Epoch 320/400
160/160 [==============================] - 0s 468us/step - loss: 0.0925
Epoch 321/400
160/160 [==============================] - 0s 455us/step - loss: 0.0922
Epoch 322/400
160/160 [==============================] - 0s 443us/step - loss: 0.0898
Epoch 323/400
160/160 [==============================] - 0s 449us/step - loss: 0.0896
Epoch 324/400
160/160 [==============================] - 0s 455us/step - loss: 0.0892
Epoch 325/400
160/160 [==============================] - 0s 449us/step - loss: 0.0892
Epoch 326/400
160/160 [==============================] - 0s 455us/step - loss: 0.0879
Epoch 327/400
160/160 [==============================] - 0s 455us/step - loss: 0.0863
Epoch 328/400
160/160 [==============================] - 0s 449us/step - loss: 0.0843
Epoch 329/400
160/160 [==============================] - 0s 443us/step - loss: 0.0850
Epoch 330/400
160/160 [==============================] - 0s 455us/step - loss: 0.0854
Epoch 331/400
160/160 [==============================] - 0s 468us/step - loss: 0.0845
Epoch 332/400
160/160 [==============================] - 0s 449us/step - loss: 0.0828
Epoch 333/400
160/160 [==============================] - 0s 479us/step - loss: 0.0808
Epoch 334/400
160/160 [==============================] - 0s 455us/step - loss: 0.0809
Epoch 335/400
160/160 [==============================] - 0s 449us/step - loss: 0.0785
Epoch 336/400
160/160 [==============================] - 0s 449us/step - loss: 0.0780
Epoch 337/400
160/160 [==============================] - 0s 455us/step - loss: 0.0787
Epoch 338/400
160/160 [==============================] - 0s 455us/step - loss: 0.0774
Epoch 339/400
160/160 [==============================] - 0s 455us/step - loss: 0.0757
Epoch 340/400
160/160 [==============================] - 0s 449us/step - loss: 0.0746
Epoch 341/400
```

```
160/160 [==============================] - 0s 461us/step - loss: 0.0740
Epoch 342/400
160/160 [==============================] - 0s 442us/step - loss: 0.0737
Epoch 343/400
160/160 [==============================] - 0s 468us/step - loss: 0.0726
Epoch 344/400
160/160 [==============================] - 0s 449us/step - loss: 0.0720
Epoch 345/400
160/160 [==============================] - 0s 455us/step - loss: 0.0712
Epoch 346/400
160/160 [==============================] - 0s 455us/step - loss: 0.0710
Epoch 347/400
160/160 [==============================] - 0s 467us/step - loss: 0.0701
Epoch 348/400
160/160 [==============================] - 0s 455us/step - loss: 0.0701
Epoch 349/400
160/160 [==============================] - 0s 455us/step - loss: 0.0691
Epoch 350/400
160/160 [==============================] - 0s 461us/step - loss: 0.0674
Epoch 351/400
160/160 [==============================] - 0s 443us/step - loss: 0.0680
Epoch 352/400
160/160 [==============================] - 0s 449us/step - loss: 0.0664
Epoch 353/400
160/160 [==============================] - 0s 449us/step - loss: 0.0663
Epoch 354/400
160/160 [==============================] - 0s 455us/step - loss: 0.0648
Epoch 355/400
160/160 [==============================] - 0s 468us/step - loss: 0.0655
Epoch 356/400
160/160 [==============================] - 0s 461us/step - loss: 0.0648
Epoch 357/400
160/160 [==============================] - 0s 474us/step - loss: 0.0636
Epoch 358/400
160/160 [==============================] - 0s 455us/step - loss: 0.0631
Epoch 359/400
160/160 [==============================] - 0s 474us/step - loss: 0.0607
Epoch 360/400
160/160 [==============================] - 0s 444us/step - loss: 0.0611
Epoch 361/400
160/160 [==============================] - 0s 480us/step - loss: 0.0610
Epoch 362/400
160/160 [==============================] - 0s 455us/step - loss: 0.0602
Epoch 363/400
160/160 [==============================] - 0s 486us/step - loss: 0.0598
Epoch 364/400
160/160 [==============================] - 0s 455us/step - loss: 0.0591
Epoch 365/400
```

```
160/160 [==============================] - 0s 442us/step - loss: 0.0586
Epoch 366/400
160/160 [==============================] - 0s 474us/step - loss: 0.0602
Epoch 367/400
160/160 [==============================] - 0s 461us/step - loss: 0.0571
Epoch 368/400
160/160 [==============================] - 0s 453us/step - loss: 0.0572
Epoch 369/400
160/160 [==============================] - 0s 455us/step - loss: 0.0568
Epoch 370/400
160/160 [==============================] - 0s 443us/step - loss: 0.0552
Epoch 371/400
160/160 [==============================] - 0s 461us/step - loss: 0.0545
Epoch 372/400
160/160 [==============================] - 0s 468us/step - loss: 0.0545
Epoch 373/400
160/160 [==============================] - 0s 455us/step - loss: 0.0547
Epoch 374/400
160/160 [==============================] - 0s 455us/step - loss: 0.0537
Epoch 375/400
160/160 [==============================] - 0s 449us/step - loss: 0.0539
Epoch 376/400
160/160 [==============================] - 0s 462us/step - loss: 0.0524
Epoch 377/400
160/160 [==============================] - 0s 461us/step - loss: 0.0532
Epoch 378/400
160/160 [==============================] - 0s 449us/step - loss: 0.0536
Epoch 379/400
160/160 [==============================] - 0s 468us/step - loss: 0.0527
Epoch 380/400
160/160 [==============================] - 0s 462us/step - loss: 0.0525
Epoch 381/400
160/160 [==============================] - 0s 468us/step - loss: 0.0512
Epoch 382/400
160/160 [==============================] - 0s 468us/step - loss: 0.0503
Epoch 383/400
160/160 [==============================] - 0s 449us/step - loss: 0.0503
Epoch 384/400
160/160 [==============================] - 0s 449us/step - loss: 0.0497
Epoch 385/400
160/160 [==============================] - 0s 455us/step - loss: 0.0498
Epoch 386/400
160/160 [==============================] - 0s 452us/step - loss: 0.0499
Epoch 387/400
160/160 [==============================] - 0s 443us/step - loss: 0.0486
Epoch 388/400
160/160 [==============================] - 0s 474us/step - loss: 0.0472
Epoch 389/400
```

```
160/160 [==============================] - 0s 468us/step - loss: 0.0480
Epoch 390/400
160/160 [==============================] - 0s 461us/step - loss: 0.0471
Epoch 391/400
160/160 [==============================] - 0s 443us/step - loss: 0.0466
Epoch 392/400
160/160 [==============================] - 0s 436us/step - loss: 0.0475
Epoch 393/400
160/160 [==============================] - 0s 462us/step - loss: 0.0465
Epoch 394/400
160/160 [==============================] - 0s 442us/step - loss: 0.0469
Epoch 395/400
160/160 [==============================] - 0s 443us/step - loss: 0.0459
Epoch 396/400
160/160 [==============================] - 0s 449us/step - loss: 0.0453
Epoch 397/400
160/160 [==============================] - 0s 443us/step - loss: 0.0463
Epoch 398/400
160/160 [==============================] - 0s 443us/step - loss: 0.0456
Epoch 399/400
160/160 [==============================] - 0s 461us/step - loss: 0.0447
Epoch 400/400
160/160 [==============================] - 0s 449us/step - loss: 0.0435
[9.74545956e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 8.96550715e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.44295108e-01 9.82507050e-01 4.97702122e-01
 9.79741216e-01 9.82507050e-01 9.82507050e-01 6.62391067e-01
 9.82507050e-01 9.82507050e-01 9.00422990e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.65593696e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.80062544e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.80723560e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.70003426e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.62512493e-01 9.82507050e-01 3.97629797e-01
 9.80032861e-01 9.82507050e-01 9.82507050e-01 7.72769988e-01
 9.82507050e-01 9.82507050e-01 9.10894215e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.45568502e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.57048774e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 5.40484525e-02 2.86063703e-04 8.59212232e-05 2.44663039e-04
 1.26180530e-04 5.84878217e-05 2.07704768e-04 3.53891216e-02
 9.48898029e-03 5.96899117e-05 1.66638638e-04 1.57594564e-04
 1.15701354e-04 6.10994175e-02 5.55858132e-04 3.77336204e-01
 1.37244657e-01 7.22708792e-05 8.90824595e-05 2.00179189e-01
```

```
 3.53971373e-05 5.05412754e-05 2.62616396e-01 4.74228698e-04
 6.76084892e-05 5.39410636e-02 3.91237154e-05 3.23277600e-05
 3.92937691e-05 1.57473492e-04 6.07761904e-04 9.52027738e-03
 7.16223149e-04 1.61742166e-04 9.75319199e-05 1.09556633e-04
 9.87216644e-03 7.41550408e-04 3.95427982e-04 1.58217701e-03
 1.49925854e-02 8.27044369e-06 1.21722155e-06 6.08873779e-06
 2.67320047e-06 7.48933928e-07 3.85473049e-06 2.75743734e-02
 9.73752991e-04 7.80999358e-07 3.21458811e-06 3.28315241e-06
 1.85195927e-06 2.20701881e-02 1.51170780e-05 4.70909268e-01
 4.42191996e-02 9.97671691e-07 1.52739858e-06 1.94775894e-01
 4.46130457e-07 7.12439885e-07 1.26112461e-01 1.44704045e-05
 1.02130355e-06 9.61226132e-03 5.16223963e-07 4.05624974e-07
 4.88392232e-07 2.55034797e-06 4.09759705e-05 1.55351765e-03
 2.22959679e-05 2.65530275e-06 1.65727033e-06 1.94146219e-06
 2.44146166e-03 2.23932620e-05 1.11450408e-05 6.69347864e-05]
160/160 [==============================] - 4s 24ms/step


In [82]: scores = model.evaluate(X, y)
         scores, model.metrics_names

160/160 [==============================] - 0s 31us/step


Out[82]: (0.041048002615571025, ['loss'])

In [83]: scores = model.evaluate(X, y)
         scores, model.metrics_names

160/160 [==============================] - 0s 44us/step


Out[83]: (0.041048002615571025, ['loss'])

In [84]: print(model.predict_proba(X).reshape(4*n))

[9.74545956e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 8.96550715e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.44295108e-01 9.82507050e-01 4.97702122e-01
 9.79741216e-01 9.82507050e-01 9.82507050e-01 6.62391067e-01
 9.82507050e-01 9.82507050e-01 9.00422990e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.65593696e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.80062544e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.80723560e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.70003426e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
```

```
 9.82507050e-01 9.62512493e-01 9.82507050e-01 3.97629797e-01
 9.80032861e-01 9.82507050e-01 9.82507050e-01 7.72769988e-01
 9.82507050e-01 9.82507050e-01 9.10894215e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.45568502e-01
 9.82507050e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 9.57048774e-01 9.82507050e-01 9.82507050e-01 9.82507050e-01
 5.40484525e-02 2.86063703e-04 8.59212232e-05 2.44663039e-04
 1.26180530e-04 5.84878217e-05 2.07704768e-04 3.53891216e-02
 9.48898029e-03 5.96899117e-05 1.66638638e-04 1.57594564e-04
 1.15701354e-04 6.10994175e-02 5.55858132e-04 3.77336204e-01
 1.37244657e-01 7.22708792e-05 8.90824595e-05 2.00179189e-01
 3.53971373e-05 5.05412754e-05 2.62616396e-01 4.74228698e-04
 6.76084892e-05 5.39410636e-02 3.91237154e-05 3.23277600e-05
 3.92937691e-05 1.57473492e-04 6.07761904e-04 9.52027738e-03
 7.16223149e-04 1.61742166e-04 9.75319199e-05 1.09556633e-04
 9.87216644e-03 7.41550408e-04 3.95427982e-04 1.58217701e-03
 1.49925854e-02 8.27044369e-06 1.21722155e-06 6.08873779e-06
 2.67320047e-06 7.48933928e-07 3.85473049e-06 2.75743734e-02
 9.73752991e-04 7.80999358e-07 3.21458811e-06 3.28315241e-06
 1.85195927e-06 2.20701881e-02 1.51170780e-05 4.70909268e-01
 4.42191996e-02 9.97671691e-07 1.52739858e-06 1.94775894e-01
 4.46130457e-07 7.12439885e-07 1.26112461e-01 1.44704045e-05
 1.02130355e-06 9.61226132e-03 5.16223963e-07 4.05624974e-07
 4.88392232e-07 2.55034797e-06 4.09759705e-05 1.55351765e-03
 2.22959679e-05 2.65530275e-06 1.65727033e-06 1.94146219e-06
 2.44146166e-03 2.23932620e-05 1.11450408e-05 6.69347864e-05]
```

```
In [85]: plt.scatter(*zip(*X), c=model.predict_classes(X))
```

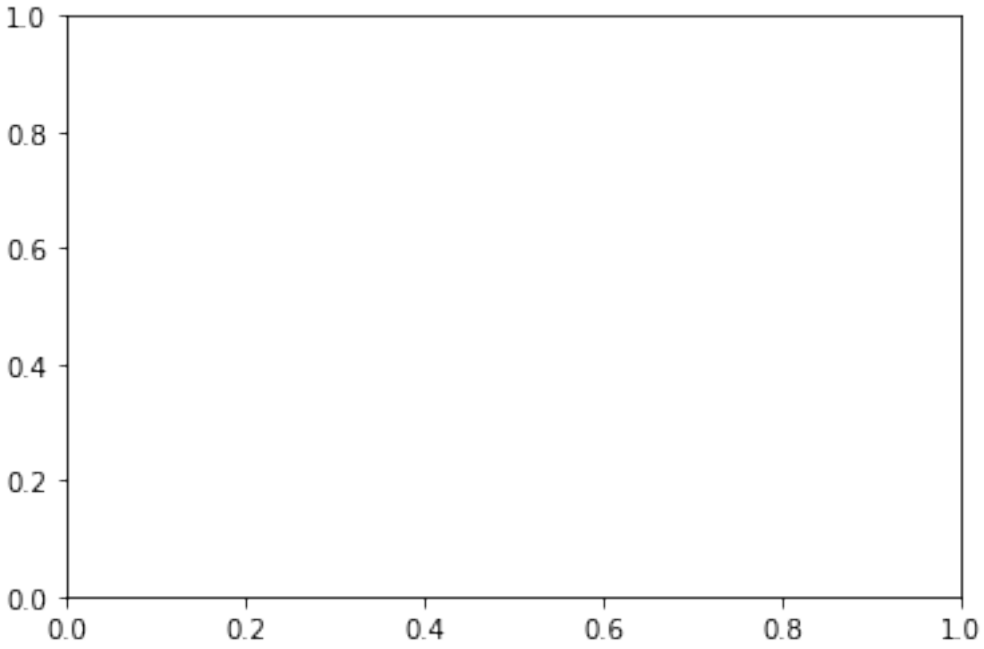
```
---------------------------------------------------------------------------

TypeError                                 Traceback (most recent call last)

~\Anaconda3\lib\site-packages\matplotlib\colors.py in to_rgba(c, alpha)
    165     try:
--> 166         rgba = _colors_full_map.cache[c, alpha]
    167     except (KeyError, TypeError):  # Not in cache, or unhashable.


TypeError: unhashable type: 'numpy.ndarray'


During handling of the above exception, another exception occurred:
```

```
    ValueError                                Traceback (most recent call last)

    ~\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py in scatter(self, x, y, s, c, ma
   4273                 # must be acceptable as PathCollection facecolors
-> 4274                 colors = mcolors.to_rgba_array(c)
   4275             except ValueError:


    ~\Anaconda3\lib\site-packages\matplotlib\colors.py in to_rgba_array(c, alpha)
    266     for i, cc in enumerate(c):
--> 267         result[i] = to_rgba(cc, alpha)
    268     return result


    ~\Anaconda3\lib\site-packages\matplotlib\colors.py in to_rgba(c, alpha)
    167     except (KeyError, TypeError):  # Not in cache, or unhashable.
--> 168         rgba = _to_rgba_no_colorcycle(c, alpha)
    169         try:


    ~\Anaconda3\lib\site-packages\matplotlib\colors.py in _to_rgba_no_colorcycle(c, alpha)
    222     if len(c) not in [3, 4]:
--> 223         raise ValueError("RGBA sequence should have length 3 or 4")
    224     if len(c) == 3 and alpha is None:


    ValueError: RGBA sequence should have length 3 or 4


During handling of the above exception, another exception occurred:


    ValueError                                Traceback (most recent call last)

    <ipython-input-85-dac360f4adbb> in <module>()
----> 1 plt.scatter(*zip(*X), c=model.predict_classes(X))


    ~\Anaconda3\lib\site-packages\matplotlib\pyplot.py in scatter(x, y, s, c, marker, cmap
   3468                         vmin=vmin, vmax=vmax, alpha=alpha,
   3469                         linewidths=linewidths, verts=verts,
-> 3470                         edgecolors=edgecolors, data=data, **kwargs)
   3471     finally:
   3472         ax._hold = washold


    ~\Anaconda3\lib\site-packages\matplotlib\__init__.py in inner(ax, *args, **kwargs)
   1853                         "the Matplotlib list!)" % (label_namer, func.__name__),
```

```
   1854                         RuntimeWarning, stacklevel=2)
-> 1855             return func(ax, *args, **kwargs)
   1856
   1857         inner.__doc__ = _add_data_doc(inner.__doc__,
```

```
~\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py in scatter(self, x, y, s, c, ma
   4277                 raise ValueError("c of shape {} not acceptable as a color "
   4278                                  "sequence for x with size {}, y with size {}"
-> 4279                                  .format(c.shape, x.size, y.size))
   4280         else:
   4281             colors = None  # use cmap, norm after collection is created
```

```
ValueError: c of shape (160, 1) not acceptable as a color sequence for x with size 160
```

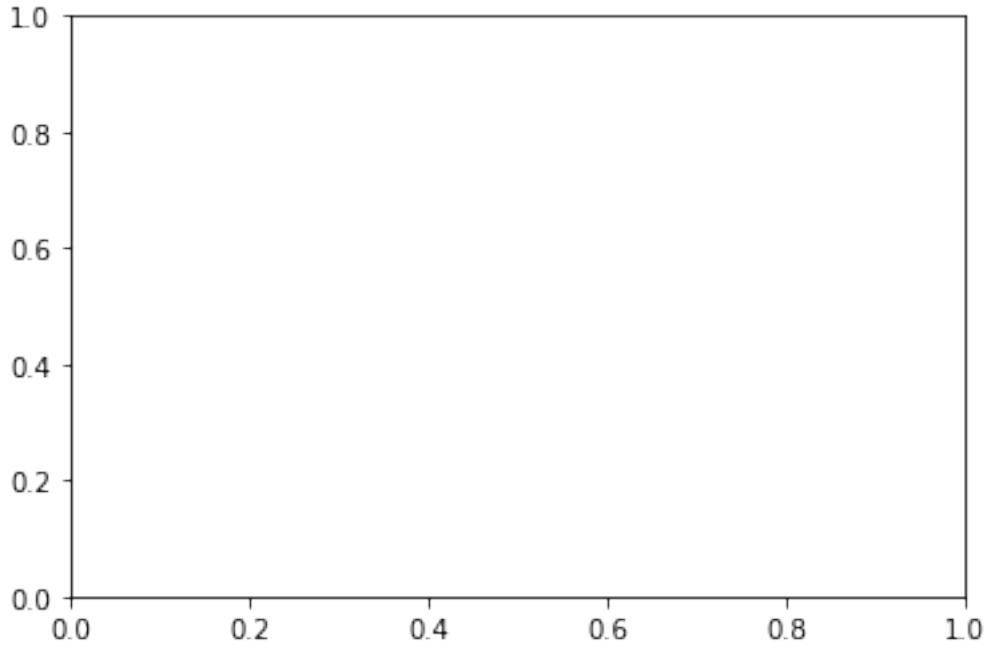



```
In [86]: plt.scatter(*zip(*X), c=model.predict(X))
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)

~\Anaconda3\lib\site-packages\matplotlib\colors.py in to_rgba(c, alpha)
165     try:
```

```
--> 166         rgba = _colors_full_map.cache[c, alpha]
    167     except (KeyError, TypeError):  # Not in cache, or unhashable.


    TypeError: unhashable type: 'numpy.ndarray'


During handling of the above exception, another exception occurred:


    ValueError                                Traceback (most recent call last)

    ~\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py in scatter(self, x, y, s, c, ma
   4273                 # must be acceptable as PathCollection facecolors
-> 4274                 colors = mcolors.to_rgba_array(c)
   4275             except ValueError:


    ~\Anaconda3\lib\site-packages\matplotlib\colors.py in to_rgba_array(c, alpha)
    266     for i, cc in enumerate(c):
--> 267         result[i] = to_rgba(cc, alpha)
    268     return result


    ~\Anaconda3\lib\site-packages\matplotlib\colors.py in to_rgba(c, alpha)
    167     except (KeyError, TypeError):  # Not in cache, or unhashable.
--> 168         rgba = _to_rgba_no_colorcycle(c, alpha)
    169         try:


    ~\Anaconda3\lib\site-packages\matplotlib\colors.py in _to_rgba_no_colorcycle(c, alpha)
    222     if len(c) not in [3, 4]:
--> 223         raise ValueError("RGBA sequence should have length 3 or 4")
    224     if len(c) == 3 and alpha is None:


    ValueError: RGBA sequence should have length 3 or 4


During handling of the above exception, another exception occurred:


    ValueError                                Traceback (most recent call last)

    <ipython-input-86-4b2f90686766> in <module>()
----> 1 plt.scatter(*zip(*X), c=model.predict(X))
```

```
 ~\Anaconda3\lib\site-packages\matplotlib\pyplot.py in scatter(x, y, s, c, marker, cmap
3468                          vmin=vmin, vmax=vmax, alpha=alpha,
3469                          linewidths=linewidths, verts=verts,
-> 3470                          edgecolors=edgecolors, data=data, **kwargs)
3471     finally:
3472         ax._hold = washold


 ~\Anaconda3\lib\site-packages\matplotlib\__init__.py in inner(ax, *args, **kwargs)
1853                          "the Matplotlib list!)" % (label_namer, func.__name__),
1854                          RuntimeWarning, stacklevel=2)
-> 1855             return func(ax, *args, **kwargs)
1856
1857         inner.__doc__ = _add_data_doc(inner.__doc__,


 ~\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py in scatter(self, x, y, s, c, ma
4277                 raise ValueError("c of shape {} not acceptable as a color "
4278                                  "sequence for x with size {}, y with size {}"
-> 4279                                  .format(c.shape, x.size, y.size))
4280         else:
4281             colors = None  # use cmap, norm after collection is created


ValueError: c of shape (160, 1) not acceptable as a color sequence for x with size 160
```



1.3 Using Diabetes data

http://archive.ics.uci.edu/ml/machine-learning-databases/pima-indians-diabetes/pima-indians-diabetes.data

1. Number of times pregnant
2. Plasma glucose concentration a 2 hours in an oral glucose tolerance test
3. Diastolic blood pressure (mm Hg)
4. Triceps skin fold thickness (mm)
5. 2-Hour serum insulin (mu U/ml)
6. Body mass index (weight in kg/(height in m)^2)
7. Diabetes pedigree function
8. Age (years)
9. Class variable (0 or 1)

```
In [88]: # load pima indians dataset
         dataset = np.loadtxt("C:/Users/Erin/Desktop/mlnn/data/pima-indians-diabetes.data", del
         # split into input (X) and output (Y) variables
         X = dataset[:,0:8]
         Y = dataset[:,8]

In [89]: X[1]

Out[89]: array([ 1.   , 85.   , 66.   , 29.   ,  0.   , 26.6  ,  0.351, 31.   ])

In [90]: # create model
         model = Sequential()
         model.add(Dense(16, input_dim=8, activation='tanh'))
         model.add(Dense(16, activation='tanh'))
         model.add(Dense(1, activation='sigmoid'))
         # Compile model
         model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
         # Fit the model
         model.fit(X, Y, epochs=1000, batch_size=10)
         # evaluate the model
         scores = model.evaluate(X, Y)
         print("\n%s: %.2f%%" % (model.metrics_names[1], scores[1]*100))
```

```
Epoch 1/1000
768/768 [==============================] - 11s 14ms/step - loss: 0.6557 - acc: 0.6471
Epoch 2/1000
768/768 [==============================] - 0s 94us/step - loss: 0.6161 - acc: 0.6576
Epoch 3/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6007 - acc: 0.6745
Epoch 4/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5967 - acc: 0.6706
Epoch 5/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5920 - acc: 0.6758
Epoch 6/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.5954 - acc: 0.6745
Epoch 7/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5854 - acc: 0.6940
Epoch 8/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5862 - acc: 0.6953
Epoch 9/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5871 - acc: 0.6745
Epoch 10/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5866 - acc: 0.6797
Epoch 11/1000
768/768 [==============================] - 0s 103us/step - loss: 0.5808 - acc: 0.6966
Epoch 12/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5805 - acc: 0.6940
Epoch 13/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5775 - acc: 0.6979
Epoch 14/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5755 - acc: 0.6953
Epoch 15/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5744 - acc: 0.6953
Epoch 16/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5694 - acc: 0.7070
Epoch 17/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5799 - acc: 0.6914
Epoch 18/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5784 - acc: 0.6836
Epoch 19/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5704 - acc: 0.6966
Epoch 20/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5710 - acc: 0.6953
Epoch 21/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5702 - acc: 0.6849
Epoch 22/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5714 - acc: 0.6966
Epoch 23/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5705 - acc: 0.7057
Epoch 24/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5668 - acc: 0.6927
Epoch 25/1000
768/768 [==============================] - 0s 97us/step - loss: 0.5688 - acc: 0.6940
Epoch 26/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5647 - acc: 0.7122
Epoch 27/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5642 - acc: 0.7031
Epoch 28/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5675 - acc: 0.6992
Epoch 29/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5675 - acc: 0.7018
Epoch 30/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.5633 - acc: 0.7083
Epoch 31/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5684 - acc: 0.7096
Epoch 32/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5619 - acc: 0.7057
Epoch 33/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5614 - acc: 0.7148
Epoch 34/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5624 - acc: 0.7174
Epoch 35/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5588 - acc: 0.7148
Epoch 36/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5605 - acc: 0.7135
Epoch 37/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5646 - acc: 0.7201
Epoch 38/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5646 - acc: 0.7083
Epoch 39/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5571 - acc: 0.7240
Epoch 40/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5553 - acc: 0.7240
Epoch 41/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5535 - acc: 0.7161
Epoch 42/1000
768/768 [==============================] - 0s 101us/step - loss: 0.5547 - acc: 0.7201
Epoch 43/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5558 - acc: 0.7174
Epoch 44/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5541 - acc: 0.7318
Epoch 45/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5558 - acc: 0.7174
Epoch 46/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5574 - acc: 0.7096
Epoch 47/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5524 - acc: 0.7240
Epoch 48/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5504 - acc: 0.7266
Epoch 49/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5473 - acc: 0.7214
Epoch 50/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5509 - acc: 0.7279
Epoch 51/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5445 - acc: 0.7305
Epoch 52/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5453 - acc: 0.7253
Epoch 53/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5430 - acc: 0.7370
Epoch 54/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.5415 - acc: 0.7227
Epoch 55/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5437 - acc: 0.7396
Epoch 56/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5455 - acc: 0.7135
Epoch 57/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5450 - acc: 0.7148
Epoch 58/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5424 - acc: 0.7448
Epoch 59/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5486 - acc: 0.7266
Epoch 60/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5442 - acc: 0.7279
Epoch 61/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5380 - acc: 0.7474
Epoch 62/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5426 - acc: 0.7396
Epoch 63/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5450 - acc: 0.7305
Epoch 64/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5401 - acc: 0.7435
Epoch 65/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5385 - acc: 0.7500
Epoch 66/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5412 - acc: 0.7487
Epoch 67/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5384 - acc: 0.7461
Epoch 68/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5333 - acc: 0.7435
Epoch 69/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5399 - acc: 0.7370
Epoch 70/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5427 - acc: 0.7474
Epoch 71/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5340 - acc: 0.7513
Epoch 72/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5305 - acc: 0.7461
Epoch 73/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5390 - acc: 0.7344
Epoch 74/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5374 - acc: 0.7305
Epoch 75/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5281 - acc: 0.7513
Epoch 76/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5318 - acc: 0.7500
Epoch 77/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5249 - acc: 0.7513
Epoch 78/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.5251 - acc: 0.7474
Epoch 79/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5260 - acc: 0.7578
Epoch 80/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5315 - acc: 0.7591
Epoch 81/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5304 - acc: 0.7565
Epoch 82/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5206 - acc: 0.7669
Epoch 83/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5201 - acc: 0.7591
Epoch 84/1000
768/768 [==============================] - 0s 99us/step - loss: 0.5254 - acc: 0.7513
Epoch 85/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5232 - acc: 0.7461
Epoch 86/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5347 - acc: 0.7435
Epoch 87/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5202 - acc: 0.7656
Epoch 88/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5184 - acc: 0.7578
Epoch 89/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5210 - acc: 0.7604
Epoch 90/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5256 - acc: 0.7487
Epoch 91/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5208 - acc: 0.7578
Epoch 92/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5197 - acc: 0.7565
Epoch 93/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5170 - acc: 0.7656
Epoch 94/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5228 - acc: 0.7500
Epoch 95/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5202 - acc: 0.7591
Epoch 96/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5176 - acc: 0.7682
Epoch 97/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5235 - acc: 0.7513
Epoch 98/1000
768/768 [==============================] - 0s 103us/step - loss: 0.5125 - acc: 0.7708
Epoch 99/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5251 - acc: 0.7604
Epoch 100/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5167 - acc: 0.7578
Epoch 101/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5313 - acc: 0.7552
Epoch 102/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5204 - acc: 0.7591
Epoch 103/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5176 - acc: 0.7656
Epoch 104/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5100 - acc: 0.7669
Epoch 105/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5162 - acc: 0.7669
Epoch 106/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5107 - acc: 0.7734
Epoch 107/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5147 - acc: 0.7656
Epoch 108/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5145 - acc: 0.7578
Epoch 109/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5110 - acc: 0.7721
Epoch 110/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5157 - acc: 0.7682
Epoch 111/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5108 - acc: 0.7617
Epoch 112/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5179 - acc: 0.7617
Epoch 113/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5093 - acc: 0.7643
Epoch 114/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5112 - acc: 0.7669
Epoch 115/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5090 - acc: 0.7708
Epoch 116/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5114 - acc: 0.7734
Epoch 117/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5123 - acc: 0.7695
Epoch 118/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5188 - acc: 0.7643
Epoch 119/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5121 - acc: 0.7617
Epoch 120/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5109 - acc: 0.7695
Epoch 121/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5140 - acc: 0.7643
Epoch 122/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5143 - acc: 0.7604
Epoch 123/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5051 - acc: 0.7747
Epoch 124/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5096 - acc: 0.7708
Epoch 125/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5059 - acc: 0.7773
Epoch 126/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.5027 - acc: 0.7721
Epoch 127/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5053 - acc: 0.7708
Epoch 128/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5057 - acc: 0.7747
Epoch 129/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5104 - acc: 0.7708
Epoch 130/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5147 - acc: 0.7578
Epoch 131/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5090 - acc: 0.7708
Epoch 132/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5164 - acc: 0.7565
Epoch 133/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5068 - acc: 0.7721
Epoch 134/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5213 - acc: 0.7604
Epoch 135/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5168 - acc: 0.7617
Epoch 136/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5184 - acc: 0.7656
Epoch 137/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5117 - acc: 0.7643
Epoch 138/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5064 - acc: 0.7591
Epoch 139/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5161 - acc: 0.7461
Epoch 140/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5103 - acc: 0.7682
Epoch 141/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5073 - acc: 0.7682
Epoch 142/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5062 - acc: 0.7578
Epoch 143/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5099 - acc: 0.7591
Epoch 144/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5066 - acc: 0.7630
Epoch 145/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5027 - acc: 0.7695
Epoch 146/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5141 - acc: 0.7565
Epoch 147/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5093 - acc: 0.7643
Epoch 148/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5106 - acc: 0.7656
Epoch 149/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5072 - acc: 0.7656
Epoch 150/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.5102 - acc: 0.7656
Epoch 151/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5045 - acc: 0.7617
Epoch 152/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5119 - acc: 0.7656
Epoch 153/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5043 - acc: 0.7721
Epoch 154/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5033 - acc: 0.7643
Epoch 155/1000
768/768 [==============================] - 0s 97us/step - loss: 0.5032 - acc: 0.7747
Epoch 156/1000
768/768 [==============================] - 0s 101us/step - loss: 0.5072 - acc: 0.7617
Epoch 157/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5011 - acc: 0.7682
Epoch 158/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5010 - acc: 0.7747
Epoch 159/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5022 - acc: 0.7734
Epoch 160/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5002 - acc: 0.7734
Epoch 161/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5035 - acc: 0.7669
Epoch 162/1000
768/768 [==============================] - 0s 99us/step - loss: 0.5012 - acc: 0.7604
Epoch 163/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5112 - acc: 0.7721
Epoch 164/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5040 - acc: 0.7682
Epoch 165/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4952 - acc: 0.7747
Epoch 166/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5108 - acc: 0.7786
Epoch 167/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5132 - acc: 0.7591
Epoch 168/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5030 - acc: 0.7630
Epoch 169/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4961 - acc: 0.7734
Epoch 170/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5029 - acc: 0.7643
Epoch 171/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5040 - acc: 0.7630
Epoch 172/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4989 - acc: 0.7682
Epoch 173/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5014 - acc: 0.7682
Epoch 174/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.5028 - acc: 0.7630
Epoch 175/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5028 - acc: 0.7617
Epoch 176/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4994 - acc: 0.7630
Epoch 177/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4980 - acc: 0.7630
Epoch 178/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4965 - acc: 0.7773
Epoch 179/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5034 - acc: 0.7682
Epoch 180/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4938 - acc: 0.7708
Epoch 181/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4954 - acc: 0.7708
Epoch 182/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4988 - acc: 0.7656
Epoch 183/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4981 - acc: 0.7617
Epoch 184/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5118 - acc: 0.7656
Epoch 185/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4979 - acc: 0.7760
Epoch 186/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4962 - acc: 0.7708
Epoch 187/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5066 - acc: 0.7526
Epoch 188/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4959 - acc: 0.7721
Epoch 189/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4997 - acc: 0.7760
Epoch 190/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4944 - acc: 0.7747
Epoch 191/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5002 - acc: 0.7773
Epoch 192/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4930 - acc: 0.7721
Epoch 193/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4951 - acc: 0.7721
Epoch 194/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4939 - acc: 0.7747
Epoch 195/1000
768/768 [==============================] - 0s 97us/step - loss: 0.4988 - acc: 0.7695
Epoch 196/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4921 - acc: 0.7747
Epoch 197/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4979 - acc: 0.7721
Epoch 198/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.4980 - acc: 0.7721
Epoch 199/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4964 - acc: 0.7747
Epoch 200/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4953 - acc: 0.7734
Epoch 201/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4938 - acc: 0.7682
Epoch 202/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4948 - acc: 0.7656
Epoch 203/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4899 - acc: 0.7721
Epoch 204/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4935 - acc: 0.7669
Epoch 205/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4938 - acc: 0.7747
Epoch 206/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5002 - acc: 0.7643
Epoch 207/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4938 - acc: 0.7734
Epoch 208/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4942 - acc: 0.7734
Epoch 209/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5126 - acc: 0.7604
Epoch 210/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4957 - acc: 0.7760
Epoch 211/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4905 - acc: 0.7760
Epoch 212/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4918 - acc: 0.7760
Epoch 213/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4893 - acc: 0.7708
Epoch 214/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5070 - acc: 0.7721
Epoch 215/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4972 - acc: 0.7721
Epoch 216/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5027 - acc: 0.7643
Epoch 217/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4903 - acc: 0.7747
Epoch 218/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4964 - acc: 0.7617
Epoch 219/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4911 - acc: 0.7760
Epoch 220/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4933 - acc: 0.7695
Epoch 221/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4942 - acc: 0.7734
Epoch 222/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.4852 - acc: 0.7708
Epoch 223/1000
768/768 [==============================] - 0s 89us/step - loss: 0.4894 - acc: 0.7799
Epoch 224/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4932 - acc: 0.7760
Epoch 225/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4891 - acc: 0.7760
Epoch 226/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4919 - acc: 0.7734
Epoch 227/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5086 - acc: 0.7682
Epoch 228/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4903 - acc: 0.7747
Epoch 229/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4836 - acc: 0.7708
Epoch 230/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4858 - acc: 0.7760
Epoch 231/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4908 - acc: 0.7708
Epoch 232/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4890 - acc: 0.7708
Epoch 233/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4847 - acc: 0.7695
Epoch 234/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4960 - acc: 0.7708
Epoch 235/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4884 - acc: 0.7721
Epoch 236/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4987 - acc: 0.7643
Epoch 237/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4893 - acc: 0.7643
Epoch 238/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4864 - acc: 0.7747
Epoch 239/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4816 - acc: 0.7799
Epoch 240/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4894 - acc: 0.7734
Epoch 241/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4904 - acc: 0.7708
Epoch 242/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4845 - acc: 0.7786
Epoch 243/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4874 - acc: 0.7773
Epoch 244/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4804 - acc: 0.7839
Epoch 245/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4833 - acc: 0.7786
Epoch 246/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.4860 - acc: 0.7708
Epoch 247/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4918 - acc: 0.7734
Epoch 248/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4849 - acc: 0.7643
Epoch 249/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4779 - acc: 0.7812
Epoch 250/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4802 - acc: 0.7786
Epoch 251/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4837 - acc: 0.7826
Epoch 252/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4806 - acc: 0.7852
Epoch 253/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4858 - acc: 0.7760
Epoch 254/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4760 - acc: 0.7812
Epoch 255/1000
768/768 [==============================] - 0s 105us/step - loss: 0.4790 - acc: 0.7747
Epoch 256/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4828 - acc: 0.7826
Epoch 257/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4823 - acc: 0.7773
Epoch 258/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4795 - acc: 0.7786
Epoch 259/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4894 - acc: 0.7786
Epoch 260/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4769 - acc: 0.7826
Epoch 261/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4818 - acc: 0.7760
Epoch 262/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4776 - acc: 0.7773
Epoch 263/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4757 - acc: 0.7786
Epoch 264/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4735 - acc: 0.7826
Epoch 265/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4830 - acc: 0.7773
Epoch 266/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4744 - acc: 0.7878
Epoch 267/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4773 - acc: 0.7891
Epoch 268/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4789 - acc: 0.7852
Epoch 269/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4798 - acc: 0.7799
Epoch 270/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.4788 - acc: 0.7812
Epoch 271/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4828 - acc: 0.7812
Epoch 272/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4836 - acc: 0.7760
Epoch 273/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4820 - acc: 0.7799
Epoch 274/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4854 - acc: 0.7786
Epoch 275/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4763 - acc: 0.7826
Epoch 276/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4918 - acc: 0.7695
Epoch 277/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4995 - acc: 0.7643
Epoch 278/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4899 - acc: 0.7682
Epoch 279/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4735 - acc: 0.7891
Epoch 280/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4707 - acc: 0.7891
Epoch 281/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4775 - acc: 0.7786
Epoch 282/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4707 - acc: 0.7865
Epoch 283/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4842 - acc: 0.7812
Epoch 284/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4966 - acc: 0.7526
Epoch 285/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4801 - acc: 0.7734
Epoch 286/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4734 - acc: 0.7826
Epoch 287/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4741 - acc: 0.7760
Epoch 288/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4711 - acc: 0.7865
Epoch 289/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4793 - acc: 0.7786
Epoch 290/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4682 - acc: 0.7878
Epoch 291/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4712 - acc: 0.7839
Epoch 292/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4721 - acc: 0.7812
Epoch 293/1000
768/768 [==============================] - 0s 89us/step - loss: 0.4700 - acc: 0.7878
Epoch 294/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.4727 - acc: 0.7878
Epoch 295/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4775 - acc: 0.7852
Epoch 296/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4763 - acc: 0.7917
Epoch 297/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4734 - acc: 0.7865
Epoch 298/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4670 - acc: 0.7930
Epoch 299/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4703 - acc: 0.7812
Epoch 300/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4650 - acc: 0.7878
Epoch 301/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4666 - acc: 0.7878
Epoch 302/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4695 - acc: 0.7826
Epoch 303/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4732 - acc: 0.7799
Epoch 304/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4678 - acc: 0.7904
Epoch 305/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4674 - acc: 0.7904
Epoch 306/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4663 - acc: 0.7930
Epoch 307/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4628 - acc: 0.7930
Epoch 308/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4660 - acc: 0.7865
Epoch 309/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4683 - acc: 0.7865
Epoch 310/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4679 - acc: 0.7943
Epoch 311/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4831 - acc: 0.7721
Epoch 312/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4893 - acc: 0.7669
Epoch 313/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4670 - acc: 0.7839
Epoch 314/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4719 - acc: 0.7747
Epoch 315/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4720 - acc: 0.7826
Epoch 316/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4709 - acc: 0.7786
Epoch 317/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4725 - acc: 0.7891
Epoch 318/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.4708 - acc: 0.7760
Epoch 319/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4650 - acc: 0.7826
Epoch 320/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4733 - acc: 0.7812
Epoch 321/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4619 - acc: 0.7917
Epoch 322/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4627 - acc: 0.7969
Epoch 323/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4799 - acc: 0.7799
Epoch 324/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4664 - acc: 0.7786
Epoch 325/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4701 - acc: 0.7773
Epoch 326/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4629 - acc: 0.7852
Epoch 327/1000
768/768 [==============================] - 0s 103us/step - loss: 0.4683 - acc: 0.7865
Epoch 328/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4726 - acc: 0.7799
Epoch 329/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4721 - acc: 0.7734
Epoch 330/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4778 - acc: 0.7786
Epoch 331/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4706 - acc: 0.7813
Epoch 332/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4681 - acc: 0.7865
Epoch 333/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4602 - acc: 0.7878
Epoch 334/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4649 - acc: 0.7891
Epoch 335/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4619 - acc: 0.7878
Epoch 336/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4679 - acc: 0.7852
Epoch 337/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4736 - acc: 0.7891
Epoch 338/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4584 - acc: 0.7943
Epoch 339/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4625 - acc: 0.7839
Epoch 340/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4592 - acc: 0.7799
Epoch 341/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4556 - acc: 0.7917
Epoch 342/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.4612 - acc: 0.7878
Epoch 343/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4539 - acc: 0.7930
Epoch 344/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4701 - acc: 0.7839
Epoch 345/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4653 - acc: 0.7865
Epoch 346/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4649 - acc: 0.7812
Epoch 347/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4628 - acc: 0.7930
Epoch 348/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4621 - acc: 0.7891
Epoch 349/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4659 - acc: 0.7812
Epoch 350/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4694 - acc: 0.7839
Epoch 351/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4664 - acc: 0.7865
Epoch 352/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4581 - acc: 0.7839
Epoch 353/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4600 - acc: 0.7878
Epoch 354/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4592 - acc: 0.7930
Epoch 355/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4732 - acc: 0.7799
Epoch 356/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4576 - acc: 0.7930
Epoch 357/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4638 - acc: 0.7865
Epoch 358/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4678 - acc: 0.7878
Epoch 359/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4652 - acc: 0.7852
Epoch 360/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4560 - acc: 0.7839
Epoch 361/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4695 - acc: 0.7773
Epoch 362/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4583 - acc: 0.7891
Epoch 363/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4636 - acc: 0.7891
Epoch 364/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4583 - acc: 0.7982
Epoch 365/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4575 - acc: 0.7930
Epoch 366/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.4721 - acc: 0.7747
Epoch 367/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4663 - acc: 0.7773
Epoch 368/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4595 - acc: 0.7891
Epoch 369/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4593 - acc: 0.7917
Epoch 370/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4652 - acc: 0.7839
Epoch 371/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4635 - acc: 0.7826
Epoch 372/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4706 - acc: 0.7865
Epoch 373/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4701 - acc: 0.7773
Epoch 374/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4699 - acc: 0.7917
Epoch 375/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4569 - acc: 0.7930
Epoch 376/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4603 - acc: 0.7891
Epoch 377/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4612 - acc: 0.7852
Epoch 378/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4549 - acc: 0.7930
Epoch 379/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4596 - acc: 0.7956
Epoch 380/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4566 - acc: 0.7930
Epoch 381/1000
768/768 [==============================] - 0s 98us/step - loss: 0.4550 - acc: 0.7878
Epoch 382/1000
768/768 [==============================] - 0s 98us/step - loss: 0.4529 - acc: 0.7904
Epoch 383/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4556 - acc: 0.7891
Epoch 384/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4584 - acc: 0.7878
Epoch 385/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4625 - acc: 0.7917
Epoch 386/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4644 - acc: 0.7878
Epoch 387/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4599 - acc: 0.7917
Epoch 388/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4542 - acc: 0.7982
Epoch 389/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4630 - acc: 0.7865
Epoch 390/1000
```

```
768/768 [==============================] - 0s 100us/step - loss: 0.4601 - acc: 0.7852
Epoch 391/1000
768/768 [==============================] - 0s 98us/step - loss: 0.4570 - acc: 0.7930
Epoch 392/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4556 - acc: 0.7891
Epoch 393/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4545 - acc: 0.7956
Epoch 394/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4596 - acc: 0.7930
Epoch 395/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4538 - acc: 0.7969
Epoch 396/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4636 - acc: 0.7878
Epoch 397/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4593 - acc: 0.7878
Epoch 398/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4632 - acc: 0.7891
Epoch 399/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4536 - acc: 0.7917
Epoch 400/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4555 - acc: 0.7930
Epoch 401/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4575 - acc: 0.7930
Epoch 402/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4559 - acc: 0.7956
Epoch 403/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4532 - acc: 0.7995
Epoch 404/1000
768/768 [==============================] - 0s 97us/step - loss: 0.4612 - acc: 0.7891
Epoch 405/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4548 - acc: 0.7930
Epoch 406/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4521 - acc: 0.7982
Epoch 407/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4586 - acc: 0.7956
Epoch 408/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4572 - acc: 0.7982
Epoch 409/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4606 - acc: 0.7943
Epoch 410/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4574 - acc: 0.7891
Epoch 411/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4553 - acc: 0.7891
Epoch 412/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4536 - acc: 0.7982
Epoch 413/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4594 - acc: 0.7917
Epoch 414/1000
```

```
768/768 [==============================] - 0s 95us/step - loss: 0.4483 - acc: 0.7995
Epoch 415/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4526 - acc: 0.8008
Epoch 416/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4616 - acc: 0.7852
Epoch 417/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4655 - acc: 0.7839
Epoch 418/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4533 - acc: 0.7917
Epoch 419/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4574 - acc: 0.7839
Epoch 420/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4510 - acc: 0.7956
Epoch 421/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4567 - acc: 0.8008
Epoch 422/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4485 - acc: 0.8021
Epoch 423/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4615 - acc: 0.7969
Epoch 424/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4614 - acc: 0.7865
Epoch 425/1000
768/768 [==============================] - 0s 101us/step - loss: 0.4509 - acc: 0.7878
Epoch 426/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4487 - acc: 0.8021
Epoch 427/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4553 - acc: 0.7904
Epoch 428/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4651 - acc: 0.7917
Epoch 429/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4588 - acc: 0.7917
Epoch 430/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4577 - acc: 0.7878
Epoch 431/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4493 - acc: 0.7943
Epoch 432/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4535 - acc: 0.7930
Epoch 433/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4607 - acc: 0.7930
Epoch 434/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4572 - acc: 0.7956
Epoch 435/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4594 - acc: 0.7865
Epoch 436/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4701 - acc: 0.7786
Epoch 437/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4975 - acc: 0.7878
Epoch 438/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.4713 - acc: 0.7891
Epoch 439/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4501 - acc: 0.7969
Epoch 440/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4499 - acc: 0.7995
Epoch 441/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4495 - acc: 0.8008
Epoch 442/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4479 - acc: 0.7969
Epoch 443/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4581 - acc: 0.7917
Epoch 444/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4513 - acc: 0.7943
Epoch 445/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4510 - acc: 0.7956
Epoch 446/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4550 - acc: 0.7956
Epoch 447/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4599 - acc: 0.7917
Epoch 448/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4523 - acc: 0.8021
Epoch 449/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4487 - acc: 0.8008
Epoch 450/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4438 - acc: 0.8060
Epoch 451/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4473 - acc: 0.7969
Epoch 452/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4559 - acc: 0.7826
Epoch 453/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4539 - acc: 0.7969
Epoch 454/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4515 - acc: 0.7982
Epoch 455/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4519 - acc: 0.7891
Epoch 456/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4530 - acc: 0.7930
Epoch 457/1000
768/768 [==============================] - 0s 101us/step - loss: 0.4518 - acc: 0.7969
Epoch 458/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4471 - acc: 0.7943
Epoch 459/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4648 - acc: 0.7878
Epoch 460/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4604 - acc: 0.7917
Epoch 461/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4555 - acc: 0.7982
Epoch 462/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.4457 - acc: 0.7904
Epoch 463/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4541 - acc: 0.7995
Epoch 464/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4746 - acc: 0.7799
Epoch 465/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4632 - acc: 0.7917
Epoch 466/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4546 - acc: 0.7930
Epoch 467/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4598 - acc: 0.7852
Epoch 468/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4672 - acc: 0.7930
Epoch 469/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4628 - acc: 0.7904
Epoch 470/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4491 - acc: 0.7930
Epoch 471/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4500 - acc: 0.7917
Epoch 472/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4530 - acc: 0.7878
Epoch 473/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4551 - acc: 0.7930
Epoch 474/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4539 - acc: 0.7956
Epoch 475/1000
768/768 [==============================] - 0s 89us/step - loss: 0.4525 - acc: 0.8034
Epoch 476/1000
768/768 [==============================] - 0s 84us/step - loss: 0.4500 - acc: 0.7891
Epoch 477/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4519 - acc: 0.7891
Epoch 478/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4514 - acc: 0.7969
Epoch 479/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4654 - acc: 0.7904
Epoch 480/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4457 - acc: 0.8008
Epoch 481/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4431 - acc: 0.7956
Epoch 482/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4557 - acc: 0.7930
Epoch 483/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4494 - acc: 0.7904
Epoch 484/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4470 - acc: 0.7982
Epoch 485/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4468 - acc: 0.7982
Epoch 486/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.4433 - acc: 0.8034
Epoch 487/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4536 - acc: 0.7969
Epoch 488/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4525 - acc: 0.8034
Epoch 489/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4463 - acc: 0.8008
Epoch 490/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4468 - acc: 0.7995
Epoch 491/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4468 - acc: 0.7969
Epoch 492/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4481 - acc: 0.7982
Epoch 493/1000
768/768 [==============================] - 0s 97us/step - loss: 0.4459 - acc: 0.7982
Epoch 494/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4564 - acc: 0.7917
Epoch 495/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4577 - acc: 0.7878
Epoch 496/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4537 - acc: 0.7917
Epoch 497/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4553 - acc: 0.7917
Epoch 498/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4463 - acc: 0.7891
Epoch 499/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4432 - acc: 0.8021
Epoch 500/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4629 - acc: 0.7852
Epoch 501/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4542 - acc: 0.7982
Epoch 502/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4609 - acc: 0.7930
Epoch 503/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4480 - acc: 0.8008
Epoch 504/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4485 - acc: 0.8021
Epoch 505/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4400 - acc: 0.7995
Epoch 506/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4550 - acc: 0.7852
Epoch 507/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4639 - acc: 0.7943
Epoch 508/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4477 - acc: 0.7995
Epoch 509/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4428 - acc: 0.8060
Epoch 510/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.4488 - acc: 0.7904
Epoch 511/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4424 - acc: 0.8086
Epoch 512/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4408 - acc: 0.8034
Epoch 513/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4398 - acc: 0.7969
Epoch 514/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4394 - acc: 0.7956
Epoch 515/1000
768/768 [==============================] - 0s 104us/step - loss: 0.4421 - acc: 0.7982
Epoch 516/1000
768/768 [==============================] - 0s 100us/step - loss: 0.4378 - acc: 0.8034
Epoch 517/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4456 - acc: 0.7904
Epoch 518/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4454 - acc: 0.7982
Epoch 519/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4443 - acc: 0.7995
Epoch 520/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4366 - acc: 0.8060
Epoch 521/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4540 - acc: 0.7943
Epoch 522/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4438 - acc: 0.8021
Epoch 523/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4477 - acc: 0.7943
Epoch 524/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4405 - acc: 0.7917
Epoch 525/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4623 - acc: 0.7786
Epoch 526/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4556 - acc: 0.7956
Epoch 527/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4425 - acc: 0.7969
Epoch 528/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4479 - acc: 0.7969
Epoch 529/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4510 - acc: 0.7917
Epoch 530/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4699 - acc: 0.7812
Epoch 531/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4500 - acc: 0.7930
Epoch 532/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4376 - acc: 0.8008
Epoch 533/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4470 - acc: 0.7982
Epoch 534/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.4426 - acc: 0.7943
Epoch 535/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4393 - acc: 0.8008
Epoch 536/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4411 - acc: 0.8008
Epoch 537/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4405 - acc: 0.7956
Epoch 538/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4400 - acc: 0.8060
Epoch 539/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4551 - acc: 0.7943
Epoch 540/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4407 - acc: 0.7969
Epoch 541/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4394 - acc: 0.7995
Epoch 542/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4471 - acc: 0.8034
Epoch 543/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4415 - acc: 0.8008
Epoch 544/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4761 - acc: 0.7695
Epoch 545/1000
768/768 [==============================] - 0s 89us/step - loss: 0.4663 - acc: 0.7760
Epoch 546/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4596 - acc: 0.7826
Epoch 547/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4641 - acc: 0.7721
Epoch 548/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4625 - acc: 0.7786
Epoch 549/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4661 - acc: 0.7812
Epoch 550/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4511 - acc: 0.7917
Epoch 551/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4539 - acc: 0.7917
Epoch 552/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4874 - acc: 0.7760
Epoch 553/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4641 - acc: 0.7826
Epoch 554/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4550 - acc: 0.7917
Epoch 555/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4510 - acc: 0.7930
Epoch 556/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4521 - acc: 0.7943
Epoch 557/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4420 - acc: 0.7969
Epoch 558/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.4582 - acc: 0.7904
Epoch 559/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4589 - acc: 0.7878
Epoch 560/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4537 - acc: 0.7956
Epoch 561/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4679 - acc: 0.7799
Epoch 562/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4697 - acc: 0.7799
Epoch 563/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4573 - acc: 0.7904
Epoch 564/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4559 - acc: 0.8034
Epoch 565/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4496 - acc: 0.7943
Epoch 566/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4495 - acc: 0.7969
Epoch 567/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4483 - acc: 0.7969
Epoch 568/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4483 - acc: 0.7852
Epoch 569/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4569 - acc: 0.7904
Epoch 570/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4584 - acc: 0.7865
Epoch 571/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4538 - acc: 0.7865
Epoch 572/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4583 - acc: 0.7930
Epoch 573/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4464 - acc: 0.7956
Epoch 574/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4556 - acc: 0.7812
Epoch 575/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4431 - acc: 0.8021
Epoch 576/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4384 - acc: 0.8021
Epoch 577/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4379 - acc: 0.8034
Epoch 578/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4445 - acc: 0.7956
Epoch 579/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4489 - acc: 0.7930
Epoch 580/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4446 - acc: 0.7943
Epoch 581/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4606 - acc: 0.7852
Epoch 582/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.4539 - acc: 0.7878
Epoch 583/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4522 - acc: 0.7865
Epoch 584/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4527 - acc: 0.7865
Epoch 585/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4467 - acc: 0.7891
Epoch 586/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4500 - acc: 0.7904
Epoch 587/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4454 - acc: 0.7969
Epoch 588/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4380 - acc: 0.8008
Epoch 589/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4496 - acc: 0.7956
Epoch 590/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4437 - acc: 0.7982
Epoch 591/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4478 - acc: 0.7930
Epoch 592/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4478 - acc: 0.7969
Epoch 593/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4382 - acc: 0.7943
Epoch 594/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4448 - acc: 0.7995
Epoch 595/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4307 - acc: 0.8021
Epoch 596/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4401 - acc: 0.8099
Epoch 597/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4399 - acc: 0.7995
Epoch 598/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4424 - acc: 0.7995
Epoch 599/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4342 - acc: 0.8008
Epoch 600/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4444 - acc: 0.7982
Epoch 601/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4460 - acc: 0.7917
Epoch 602/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4422 - acc: 0.8008
Epoch 603/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4363 - acc: 0.8047
Epoch 604/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4310 - acc: 0.8034
Epoch 605/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4389 - acc: 0.8008
Epoch 606/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.4460 - acc: 0.7995
Epoch 607/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4405 - acc: 0.7969
Epoch 608/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4480 - acc: 0.7956
Epoch 609/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4364 - acc: 0.8047
Epoch 610/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4370 - acc: 0.7904
Epoch 611/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4395 - acc: 0.7956
Epoch 612/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4424 - acc: 0.7995
Epoch 613/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4392 - acc: 0.8086
Epoch 614/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4450 - acc: 0.7917
Epoch 615/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4330 - acc: 0.8034
Epoch 616/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4334 - acc: 0.8034
Epoch 617/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4449 - acc: 0.7982
Epoch 618/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4424 - acc: 0.7995
Epoch 619/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4301 - acc: 0.8047
Epoch 620/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4358 - acc: 0.7969
Epoch 621/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4675 - acc: 0.7839
Epoch 622/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4485 - acc: 0.7930
Epoch 623/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4407 - acc: 0.7956
Epoch 624/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4431 - acc: 0.7995
Epoch 625/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4416 - acc: 0.8008
Epoch 626/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4412 - acc: 0.8008
Epoch 627/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4363 - acc: 0.8008
Epoch 628/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4445 - acc: 0.8008
Epoch 629/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4580 - acc: 0.7852
Epoch 630/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.4609 - acc: 0.7917
Epoch 631/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4374 - acc: 0.8047
Epoch 632/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4391 - acc: 0.8060
Epoch 633/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4561 - acc: 0.7839
Epoch 634/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4626 - acc: 0.7839
Epoch 635/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4371 - acc: 0.7969
Epoch 636/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4298 - acc: 0.8073
Epoch 637/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4425 - acc: 0.7930
Epoch 638/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4384 - acc: 0.8060
Epoch 639/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4318 - acc: 0.8034
Epoch 640/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4377 - acc: 0.8060
Epoch 641/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4308 - acc: 0.8047
Epoch 642/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4374 - acc: 0.8008
Epoch 643/1000
768/768 [==============================] - 0s 97us/step - loss: 0.4302 - acc: 0.8034
Epoch 644/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4381 - acc: 0.8034
Epoch 645/1000
768/768 [==============================] - 0s 89us/step - loss: 0.4406 - acc: 0.7982
Epoch 646/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4351 - acc: 0.7995
Epoch 647/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4489 - acc: 0.7878
Epoch 648/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4308 - acc: 0.8125
Epoch 649/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4469 - acc: 0.7943
Epoch 650/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4468 - acc: 0.7956
Epoch 651/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4566 - acc: 0.7813
Epoch 652/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4318 - acc: 0.8034
Epoch 653/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4327 - acc: 0.8034
Epoch 654/1000
```

```
768/768 [==============================] - 0s 95us/step - loss: 0.4296 - acc: 0.8112
Epoch 655/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4342 - acc: 0.8021
Epoch 656/1000
768/768 [==============================] - 0s 89us/step - loss: 0.4512 - acc: 0.7904
Epoch 657/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4292 - acc: 0.8021
Epoch 658/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4278 - acc: 0.8099
Epoch 659/1000
768/768 [==============================] - 0s 101us/step - loss: 0.4347 - acc: 0.8034
Epoch 660/1000
768/768 [==============================] - 0s 100us/step - loss: 0.4481 - acc: 0.7917
Epoch 661/1000
768/768 [==============================] - 0s 103us/step - loss: 0.4491 - acc: 0.7891
Epoch 662/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4427 - acc: 0.8021
Epoch 663/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4420 - acc: 0.7956
Epoch 664/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4356 - acc: 0.8034
Epoch 665/1000
768/768 [==============================] - 0s 106us/step - loss: 0.4383 - acc: 0.8008
Epoch 666/1000
768/768 [==============================] - 0s 97us/step - loss: 0.4488 - acc: 0.7943
Epoch 667/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4474 - acc: 0.7917
Epoch 668/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4379 - acc: 0.8008
Epoch 669/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4404 - acc: 0.8034
Epoch 670/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4342 - acc: 0.8008
Epoch 671/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4310 - acc: 0.8099
Epoch 672/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4362 - acc: 0.8021
Epoch 673/1000
768/768 [==============================] - 0s 85us/step - loss: 0.4410 - acc: 0.7982
Epoch 674/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4292 - acc: 0.8060
Epoch 675/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4366 - acc: 0.8073
Epoch 676/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4393 - acc: 0.8073
Epoch 677/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4266 - acc: 0.8073
Epoch 678/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.4307 - acc: 0.8086
Epoch 679/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4446 - acc: 0.7969
Epoch 680/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4435 - acc: 0.7956
Epoch 681/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4312 - acc: 0.8112
Epoch 682/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4315 - acc: 0.8125
Epoch 683/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4397 - acc: 0.8021
Epoch 684/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4319 - acc: 0.7995
Epoch 685/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4539 - acc: 0.7917
Epoch 686/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4405 - acc: 0.8021
Epoch 687/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4330 - acc: 0.8086
Epoch 688/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4381 - acc: 0.7969
Epoch 689/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4360 - acc: 0.8021
Epoch 690/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4354 - acc: 0.8047
Epoch 691/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4437 - acc: 0.7904
Epoch 692/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4338 - acc: 0.8060
Epoch 693/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4344 - acc: 0.8047
Epoch 694/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4349 - acc: 0.8021
Epoch 695/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4292 - acc: 0.8112
Epoch 696/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4425 - acc: 0.7969
Epoch 697/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4399 - acc: 0.7995
Epoch 698/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4395 - acc: 0.7969
Epoch 699/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4454 - acc: 0.8073
Epoch 700/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4481 - acc: 0.7982
Epoch 701/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4425 - acc: 0.8073
Epoch 702/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.4378 - acc: 0.7995
Epoch 703/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4434 - acc: 0.8008
Epoch 704/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4391 - acc: 0.7995
Epoch 705/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4348 - acc: 0.7969
Epoch 706/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4380 - acc: 0.8047
Epoch 707/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4537 - acc: 0.7969
Epoch 708/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4430 - acc: 0.8021
Epoch 709/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4409 - acc: 0.7995
Epoch 710/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4340 - acc: 0.8008
Epoch 711/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4437 - acc: 0.8008
Epoch 712/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4389 - acc: 0.7995
Epoch 713/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4324 - acc: 0.8060
Epoch 714/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4360 - acc: 0.8073
Epoch 715/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4440 - acc: 0.7891
Epoch 716/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4400 - acc: 0.7995
Epoch 717/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4323 - acc: 0.8060
Epoch 718/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4434 - acc: 0.7917
Epoch 719/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4381 - acc: 0.7995
Epoch 720/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4326 - acc: 0.8112
Epoch 721/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4575 - acc: 0.7891
Epoch 722/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4485 - acc: 0.7943
Epoch 723/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4395 - acc: 0.8060
Epoch 724/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4399 - acc: 0.7878
Epoch 725/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4337 - acc: 0.8034
Epoch 726/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.4358 - acc: 0.8099
Epoch 727/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4305 - acc: 0.8047
Epoch 728/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4408 - acc: 0.7904
Epoch 729/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4358 - acc: 0.8034
Epoch 730/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4399 - acc: 0.7982
Epoch 731/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4842 - acc: 0.7812
Epoch 732/1000
768/768 [==============================] - 0s 97us/step - loss: 0.4471 - acc: 0.8008
Epoch 733/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4468 - acc: 0.7917
Epoch 734/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4495 - acc: 0.8060
Epoch 735/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4573 - acc: 0.7930
Epoch 736/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4573 - acc: 0.7865
Epoch 737/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4395 - acc: 0.7995
Epoch 738/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4483 - acc: 0.8047
Epoch 739/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4379 - acc: 0.8099
Epoch 740/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4394 - acc: 0.7969
Epoch 741/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4334 - acc: 0.8021
Epoch 742/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4287 - acc: 0.8086
Epoch 743/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4299 - acc: 0.8125
Epoch 744/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4437 - acc: 0.8034
Epoch 745/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4395 - acc: 0.7969
Epoch 746/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4339 - acc: 0.8060
Epoch 747/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4436 - acc: 0.7891
Epoch 748/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4301 - acc: 0.8034
Epoch 749/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4451 - acc: 0.7943
Epoch 750/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.4336 - acc: 0.8047
Epoch 751/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4416 - acc: 0.7943
Epoch 752/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4374 - acc: 0.8073
Epoch 753/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4232 - acc: 0.8073
Epoch 754/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4194 - acc: 0.8125
Epoch 755/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4278 - acc: 0.8034
Epoch 756/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4251 - acc: 0.8060
Epoch 757/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4335 - acc: 0.8112
Epoch 758/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4289 - acc: 0.8060
Epoch 759/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4232 - acc: 0.8203
Epoch 760/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4281 - acc: 0.8060
Epoch 761/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4309 - acc: 0.8073
Epoch 762/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4176 - acc: 0.8229
Epoch 763/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4293 - acc: 0.8112
Epoch 764/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4417 - acc: 0.7930
Epoch 765/1000
768/768 [==============================] - 0s 84us/step - loss: 0.4234 - acc: 0.8125
Epoch 766/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4370 - acc: 0.8047
Epoch 767/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4308 - acc: 0.8060
Epoch 768/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4246 - acc: 0.8138
Epoch 769/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4345 - acc: 0.8125
Epoch 770/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4277 - acc: 0.8112
Epoch 771/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4313 - acc: 0.8086
Epoch 772/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4253 - acc: 0.8164
Epoch 773/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4414 - acc: 0.7982
Epoch 774/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.4328 - acc: 0.8086
Epoch 775/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4602 - acc: 0.7773
Epoch 776/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4524 - acc: 0.7943
Epoch 777/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4315 - acc: 0.8073
Epoch 778/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4323 - acc: 0.8060
Epoch 779/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4348 - acc: 0.8060
Epoch 780/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4363 - acc: 0.8021
Epoch 781/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4270 - acc: 0.8086
Epoch 782/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4195 - acc: 0.8099
Epoch 783/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4238 - acc: 0.8073
Epoch 784/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4189 - acc: 0.8164
Epoch 785/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4196 - acc: 0.8190
Epoch 786/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4203 - acc: 0.8138
Epoch 787/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4220 - acc: 0.8034
Epoch 788/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4464 - acc: 0.8086
Epoch 789/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4429 - acc: 0.8008
Epoch 790/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4321 - acc: 0.8099
Epoch 791/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4356 - acc: 0.8086
Epoch 792/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4570 - acc: 0.7891
Epoch 793/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4364 - acc: 0.8086
Epoch 794/1000
768/768 [==============================] - 0s 89us/step - loss: 0.4274 - acc: 0.8151
Epoch 795/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4269 - acc: 0.8203
Epoch 796/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4386 - acc: 0.8099
Epoch 797/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4505 - acc: 0.7917
Epoch 798/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.4254 - acc: 0.8125
Epoch 799/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4279 - acc: 0.8138
Epoch 800/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4257 - acc: 0.8125
Epoch 801/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4242 - acc: 0.8138
Epoch 802/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4318 - acc: 0.8125
Epoch 803/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4311 - acc: 0.8138
Epoch 804/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4398 - acc: 0.8047
Epoch 805/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4440 - acc: 0.8034
Epoch 806/1000
768/768 [==============================] - 0s 110us/step - loss: 0.4249 - acc: 0.8125
Epoch 807/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4261 - acc: 0.8138
Epoch 808/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4298 - acc: 0.8073
Epoch 809/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4257 - acc: 0.8112
Epoch 810/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4160 - acc: 0.8190
Epoch 811/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4301 - acc: 0.8060
Epoch 812/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4329 - acc: 0.8060
Epoch 813/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4319 - acc: 0.8099
Epoch 814/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4328 - acc: 0.8073
Epoch 815/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4199 - acc: 0.8138
Epoch 816/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4356 - acc: 0.7995
Epoch 817/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4363 - acc: 0.7943
Epoch 818/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4336 - acc: 0.8008
Epoch 819/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4259 - acc: 0.8086
Epoch 820/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4396 - acc: 0.7969
Epoch 821/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4294 - acc: 0.8047
Epoch 822/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.4200 - acc: 0.8112
Epoch 823/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4191 - acc: 0.8177
Epoch 824/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4193 - acc: 0.8099
Epoch 825/1000
768/768 [==============================] - 0s 86us/step - loss: 0.4349 - acc: 0.8125
Epoch 826/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4251 - acc: 0.8138
Epoch 827/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4220 - acc: 0.8151
Epoch 828/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4219 - acc: 0.8060
Epoch 829/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4305 - acc: 0.8086
Epoch 830/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4335 - acc: 0.8060
Epoch 831/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4272 - acc: 0.8099
Epoch 832/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4181 - acc: 0.8112
Epoch 833/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4104 - acc: 0.8190
Epoch 834/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4267 - acc: 0.8112
Epoch 835/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4216 - acc: 0.8151
Epoch 836/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4248 - acc: 0.8112
Epoch 837/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4166 - acc: 0.8151
Epoch 838/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4277 - acc: 0.8021
Epoch 839/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4369 - acc: 0.8021
Epoch 840/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4215 - acc: 0.8125
Epoch 841/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4108 - acc: 0.8164
Epoch 842/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4097 - acc: 0.8229
Epoch 843/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4182 - acc: 0.8151
Epoch 844/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4342 - acc: 0.8021
Epoch 845/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4344 - acc: 0.7969
Epoch 846/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.4335 - acc: 0.8047
Epoch 847/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4424 - acc: 0.7956
Epoch 848/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4417 - acc: 0.7982
Epoch 849/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4337 - acc: 0.8073
Epoch 850/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4286 - acc: 0.8047
Epoch 851/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4398 - acc: 0.8008
Epoch 852/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4189 - acc: 0.8138
Epoch 853/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4148 - acc: 0.8151
Epoch 854/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4234 - acc: 0.8125
Epoch 855/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4352 - acc: 0.8138
Epoch 856/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4394 - acc: 0.8060
Epoch 857/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4297 - acc: 0.8047
Epoch 858/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4636 - acc: 0.7878
Epoch 859/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4441 - acc: 0.7982
Epoch 860/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4209 - acc: 0.8177
Epoch 861/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4183 - acc: 0.8138
Epoch 862/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4142 - acc: 0.8138
Epoch 863/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4179 - acc: 0.8099
Epoch 864/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4166 - acc: 0.8164
Epoch 865/1000
768/768 [==============================] - 0s 97us/step - loss: 0.4106 - acc: 0.8190
Epoch 866/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4237 - acc: 0.8112
Epoch 867/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4259 - acc: 0.8099
Epoch 868/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4335 - acc: 0.8138
Epoch 869/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4377 - acc: 0.8047
Epoch 870/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.4269 - acc: 0.8034
Epoch 871/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4268 - acc: 0.8112
Epoch 872/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4151 - acc: 0.8190
Epoch 873/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4240 - acc: 0.8086
Epoch 874/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4286 - acc: 0.8086
Epoch 875/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4250 - acc: 0.8060
Epoch 876/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4165 - acc: 0.8138
Epoch 877/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4199 - acc: 0.8190
Epoch 878/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4206 - acc: 0.8112
Epoch 879/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4341 - acc: 0.8073
Epoch 880/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4351 - acc: 0.8021
Epoch 881/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4243 - acc: 0.8112
Epoch 882/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4185 - acc: 0.8138
Epoch 883/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4297 - acc: 0.8021
Epoch 884/1000
768/768 [==============================] - 0s 97us/step - loss: 0.4186 - acc: 0.8125
Epoch 885/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4115 - acc: 0.8216
Epoch 886/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4111 - acc: 0.8138
Epoch 887/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4113 - acc: 0.8164
Epoch 888/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4210 - acc: 0.8086
Epoch 889/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4146 - acc: 0.8164
Epoch 890/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4156 - acc: 0.8086
Epoch 891/1000
768/768 [==============================] - 0s 89us/step - loss: 0.4235 - acc: 0.8034
Epoch 892/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4226 - acc: 0.8099
Epoch 893/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4223 - acc: 0.8125
Epoch 894/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.4093 - acc: 0.8190
Epoch 895/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4268 - acc: 0.8125
Epoch 896/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4151 - acc: 0.8112
Epoch 897/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4067 - acc: 0.8216
Epoch 898/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4167 - acc: 0.8099
Epoch 899/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4161 - acc: 0.8177
Epoch 900/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4264 - acc: 0.8047
Epoch 901/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4177 - acc: 0.8164
Epoch 902/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4114 - acc: 0.8203
Epoch 903/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4229 - acc: 0.8099
Epoch 904/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4213 - acc: 0.8086
Epoch 905/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4175 - acc: 0.8151
Epoch 906/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4108 - acc: 0.8190
Epoch 907/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4249 - acc: 0.8138
Epoch 908/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4257 - acc: 0.8164
Epoch 909/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4191 - acc: 0.8086
Epoch 910/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4220 - acc: 0.8125
Epoch 911/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4133 - acc: 0.8190
Epoch 912/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4146 - acc: 0.8125
Epoch 913/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4435 - acc: 0.8021
Epoch 914/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4533 - acc: 0.7982
Epoch 915/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4434 - acc: 0.8060
Epoch 916/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4275 - acc: 0.8216
Epoch 917/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4304 - acc: 0.8125
Epoch 918/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.4326 - acc: 0.8086
Epoch 919/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4213 - acc: 0.8164
Epoch 920/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4141 - acc: 0.8138
Epoch 921/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4091 - acc: 0.8242
Epoch 922/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4075 - acc: 0.8242
Epoch 923/1000
768/768 [==============================] - 0s 100us/step - loss: 0.4075 - acc: 0.8138
Epoch 924/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4176 - acc: 0.8164
Epoch 925/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4232 - acc: 0.8138
Epoch 926/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4142 - acc: 0.8242
Epoch 927/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4061 - acc: 0.8216
Epoch 928/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4177 - acc: 0.8164
Epoch 929/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4219 - acc: 0.8164
Epoch 930/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4117 - acc: 0.8164
Epoch 931/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4204 - acc: 0.8099
Epoch 932/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4208 - acc: 0.8151
Epoch 933/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4194 - acc: 0.8125
Epoch 934/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4063 - acc: 0.8203
Epoch 935/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4140 - acc: 0.8138
Epoch 936/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4185 - acc: 0.8112
Epoch 937/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4054 - acc: 0.8242
Epoch 938/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4086 - acc: 0.8203
Epoch 939/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4213 - acc: 0.8138
Epoch 940/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4192 - acc: 0.8112
Epoch 941/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4363 - acc: 0.7969
Epoch 942/1000
```

```
768/768 [==============================] - 0s 95us/step - loss: 0.4182 - acc: 0.8099
Epoch 943/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4134 - acc: 0.8190
Epoch 944/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4157 - acc: 0.8190
Epoch 945/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4202 - acc: 0.8125
Epoch 946/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4085 - acc: 0.8151
Epoch 947/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4060 - acc: 0.8229
Epoch 948/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4094 - acc: 0.8190
Epoch 949/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4079 - acc: 0.8190
Epoch 950/1000
768/768 [==============================] - 0s 89us/step - loss: 0.4219 - acc: 0.8099
Epoch 951/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4149 - acc: 0.8125
Epoch 952/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4306 - acc: 0.8008
Epoch 953/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4338 - acc: 0.8047
Epoch 954/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4174 - acc: 0.8242
Epoch 955/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4258 - acc: 0.8073
Epoch 956/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4181 - acc: 0.8190
Epoch 957/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4098 - acc: 0.8177
Epoch 958/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4200 - acc: 0.8112
Epoch 959/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4138 - acc: 0.8190
Epoch 960/1000
768/768 [==============================] - 0s 94us/step - loss: 0.4106 - acc: 0.8164
Epoch 961/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4077 - acc: 0.8255
Epoch 962/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4116 - acc: 0.8177
Epoch 963/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4252 - acc: 0.8164
Epoch 964/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4234 - acc: 0.8138
Epoch 965/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4144 - acc: 0.8151
Epoch 966/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.4249 - acc: 0.8151
Epoch 967/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4026 - acc: 0.8229
Epoch 968/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4030 - acc: 0.8229
Epoch 969/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4094 - acc: 0.8164
Epoch 970/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4254 - acc: 0.8112
Epoch 971/1000
768/768 [==============================] - 0s 97us/step - loss: 0.4317 - acc: 0.8047
Epoch 972/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4218 - acc: 0.8190
Epoch 973/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4145 - acc: 0.8125
Epoch 974/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4015 - acc: 0.8242
Epoch 975/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4095 - acc: 0.8164
Epoch 976/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4119 - acc: 0.8190
Epoch 977/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4050 - acc: 0.8255
Epoch 978/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4114 - acc: 0.8164
Epoch 979/1000
768/768 [==============================] - 0s 93us/step - loss: 0.4029 - acc: 0.8216
Epoch 980/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4085 - acc: 0.8190
Epoch 981/1000
768/768 [==============================] - 0s 95us/step - loss: 0.4241 - acc: 0.8177
Epoch 982/1000
768/768 [==============================] - 0s 99us/step - loss: 0.4087 - acc: 0.8125
Epoch 983/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4251 - acc: 0.8151
Epoch 984/1000
768/768 [==============================] - 0s 96us/step - loss: 0.4247 - acc: 0.8125
Epoch 985/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4148 - acc: 0.8125
Epoch 986/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4367 - acc: 0.8008
Epoch 987/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4308 - acc: 0.8099
Epoch 988/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4033 - acc: 0.8216
Epoch 989/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4227 - acc: 0.8138
Epoch 990/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.4179 - acc: 0.8229
Epoch 991/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4076 - acc: 0.8216
Epoch 992/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4063 - acc: 0.8203
Epoch 993/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4065 - acc: 0.8190
Epoch 994/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4156 - acc: 0.8151
Epoch 995/1000
768/768 [==============================] - 0s 92us/step - loss: 0.4193 - acc: 0.8125
Epoch 996/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4373 - acc: 0.8034
Epoch 997/1000
768/768 [==============================] - 0s 90us/step - loss: 0.4018 - acc: 0.8255
Epoch 998/1000
768/768 [==============================] - 0s 87us/step - loss: 0.4080 - acc: 0.8164
Epoch 999/1000
768/768 [==============================] - 0s 88us/step - loss: 0.4079 - acc: 0.8203
Epoch 1000/1000
768/768 [==============================] - 0s 91us/step - loss: 0.4093 - acc: 0.8164
768/768 [==============================] - 4s 5ms/step

acc: 82.68%


In [91]: scores = model.evaluate(X, y)
         scores, model.metrics_names


        ---------------------------------------------------------------------------

        ValueError                                Traceback (most recent call last)

        <ipython-input-91-de45a522aad9> in <module>()
    ----> 1 scores = model.evaluate(X, y)
          2 scores, model.metrics_names


        ~\Anaconda3\lib\site-packages\keras\engine\training.py in evaluate(self, x, y, batch_s
       1100             x, y,
       1101             sample_weight=sample_weight,
    -> 1102             batch_size=batch_size)
       1103         # Prepare inputs, delegate logic to `test_loop`.
       1104         if self._uses_dynamic_learning_phase():


        ~\Anaconda3\lib\site-packages\keras\engine\training.py in _standardize_user_data(self,
```

```
    802             ]
    803             # Check that all arrays have the same length.
--> 804             check_array_length_consistency(x, y, sample_weights)
    805             if self._is_graph_network:
    806                 # Additional checks to avoid users mistakenly


~\Anaconda3\lib\site-packages\keras\engine\training_utils.py in check_array_length_cons
    235                          'the same number of samples as target arrays. '
    236                          'Found ' + str(list(set_x)[0]) + ' input samples '
--> 237                          'and ' + str(list(set_y)[0]) + ' target samples.')
    238     if len(set_w) > 1:
    239         raise ValueError('All sample_weight arrays should have '


ValueError: Input arrays should have the same number of samples as target arrays. Found
```

```
In [92]: # create model
         model = Sequential()
         model.add(Dense(16, input_dim=8, activation='tanh'))
         model.add(Dense(16, activation='tanh'))
         model.add(Dense(1, activation='sigmoid'))
         # Compile model
         model.compile(loss='binary_crossentropy', optimizer='sgd', metrics=['accuracy'])
         # Fit the model
         model.fit(X, Y, epochs=1000, batch_size=10)
         # evaluate the model
         scores = model.evaluate(X, Y)
         print("\n%s: %.2f%%" % (model.metrics_names[1], scores[1]*100))
```

```
Epoch 1/1000
768/768 [==============================] - 11s 14ms/step - loss: 0.6477 - acc: 0.6484
Epoch 2/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6372 - acc: 0.6510
Epoch 3/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6319 - acc: 0.6510
Epoch 4/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6230 - acc: 0.6510
Epoch 5/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6233 - acc: 0.6510
Epoch 6/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6237 - acc: 0.6510
Epoch 7/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6286 - acc: 0.6510
Epoch 8/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6283 - acc: 0.6510
Epoch 9/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.6208 - acc: 0.6510
Epoch 10/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6199 - acc: 0.6523
Epoch 11/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6185 - acc: 0.6549
Epoch 12/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6195 - acc: 0.6523
Epoch 13/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6402 - acc: 0.6536
Epoch 14/1000
768/768 [==============================] - 0s 93us/step - loss: 0.6280 - acc: 0.6549
Epoch 15/1000
768/768 [==============================] - 0s 106us/step - loss: 0.6231 - acc: 0.6549
Epoch 16/1000
768/768 [==============================] - 0s 104us/step - loss: 0.6238 - acc: 0.6510
Epoch 17/1000
768/768 [==============================] - 0s 99us/step - loss: 0.6197 - acc: 0.6536
Epoch 18/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6205 - acc: 0.6549
Epoch 19/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6146 - acc: 0.6563
Epoch 20/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6293 - acc: 0.6563
Epoch 21/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6273 - acc: 0.6563
Epoch 22/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6243 - acc: 0.6549
Epoch 23/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6171 - acc: 0.6549
Epoch 24/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6151 - acc: 0.6549
Epoch 25/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6236 - acc: 0.6510
Epoch 26/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6137 - acc: 0.6536
Epoch 27/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6214 - acc: 0.6549
Epoch 28/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6251 - acc: 0.6549
Epoch 29/1000
768/768 [==============================] - 0s 85us/step - loss: 0.6157 - acc: 0.6549
Epoch 30/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6147 - acc: 0.6549
Epoch 31/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6171 - acc: 0.6536
Epoch 32/1000
768/768 [==============================] - 0s 85us/step - loss: 0.6186 - acc: 0.6484
Epoch 33/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.6122 - acc: 0.6445
Epoch 34/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6086 - acc: 0.6615
Epoch 35/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6260 - acc: 0.6549
Epoch 36/1000
768/768 [==============================] - 0s 85us/step - loss: 0.6280 - acc: 0.6445
Epoch 37/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6159 - acc: 0.6523
Epoch 38/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6150 - acc: 0.6536
Epoch 39/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6154 - acc: 0.6523
Epoch 40/1000
768/768 [==============================] - 0s 89us/step - loss: 0.6137 - acc: 0.6523
Epoch 41/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6170 - acc: 0.6628
Epoch 42/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6184 - acc: 0.6510
Epoch 43/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6193 - acc: 0.6523
Epoch 44/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6092 - acc: 0.6536
Epoch 45/1000
768/768 [==============================] - 0s 94us/step - loss: 0.6195 - acc: 0.6615
Epoch 46/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6271 - acc: 0.6445
Epoch 47/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6100 - acc: 0.6497
Epoch 48/1000
768/768 [==============================] - 0s 113us/step - loss: 0.6079 - acc: 0.6602
Epoch 49/1000
768/768 [==============================] - 0s 116us/step - loss: 0.6206 - acc: 0.6536
Epoch 50/1000
768/768 [==============================] - 0s 109us/step - loss: 0.6207 - acc: 0.6549
Epoch 51/1000
768/768 [==============================] - 0s 104us/step - loss: 0.6206 - acc: 0.6549
Epoch 52/1000
768/768 [==============================] - 0s 100us/step - loss: 0.6170 - acc: 0.6549
Epoch 53/1000
768/768 [==============================] - 0s 94us/step - loss: 0.6113 - acc: 0.6523
Epoch 54/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6151 - acc: 0.6549
Epoch 55/1000
768/768 [==============================] - 0s 94us/step - loss: 0.6165 - acc: 0.6536
Epoch 56/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6159 - acc: 0.6549
Epoch 57/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.6274 - acc: 0.6563
Epoch 58/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6318 - acc: 0.6615
Epoch 59/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6348 - acc: 0.6576
Epoch 60/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6281 - acc: 0.6602
Epoch 61/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6234 - acc: 0.6602
Epoch 62/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6269 - acc: 0.6549
Epoch 63/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6275 - acc: 0.6536
Epoch 64/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6313 - acc: 0.6549
Epoch 65/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6379 - acc: 0.6510
Epoch 66/1000
768/768 [==============================] - 0s 93us/step - loss: 0.6332 - acc: 0.6563
Epoch 67/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6225 - acc: 0.6510
Epoch 68/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6203 - acc: 0.6549
Epoch 69/1000
768/768 [==============================] - 0s 93us/step - loss: 0.6183 - acc: 0.6523
Epoch 70/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6185 - acc: 0.6536
Epoch 71/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6153 - acc: 0.6484
Epoch 72/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6197 - acc: 0.6510
Epoch 73/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6120 - acc: 0.6654
Epoch 74/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6140 - acc: 0.6758
Epoch 75/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6099 - acc: 0.6732
Epoch 76/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6129 - acc: 0.6836
Epoch 77/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6096 - acc: 0.6784
Epoch 78/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6146 - acc: 0.6667
Epoch 79/1000
768/768 [==============================] - 0s 93us/step - loss: 0.6153 - acc: 0.6732
Epoch 80/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6072 - acc: 0.6758
Epoch 81/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.6061 - acc: 0.6328
Epoch 82/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6036 - acc: 0.6667
Epoch 83/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6055 - acc: 0.6263
Epoch 84/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6165 - acc: 0.6563
Epoch 85/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6200 - acc: 0.6706
Epoch 86/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6115 - acc: 0.6732
Epoch 87/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6145 - acc: 0.6576
Epoch 88/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6133 - acc: 0.6836
Epoch 89/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6170 - acc: 0.6732
Epoch 90/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6127 - acc: 0.6536
Epoch 91/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6082 - acc: 0.6576
Epoch 92/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6109 - acc: 0.6628
Epoch 93/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6079 - acc: 0.6589
Epoch 94/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6051 - acc: 0.6732
Epoch 95/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6077 - acc: 0.6706
Epoch 96/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6016 - acc: 0.6654
Epoch 97/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6189 - acc: 0.6224
Epoch 98/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6075 - acc: 0.6523
Epoch 99/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6160 - acc: 0.6549
Epoch 100/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6095 - acc: 0.6549
Epoch 101/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6145 - acc: 0.6549
Epoch 102/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6103 - acc: 0.6576
Epoch 103/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6132 - acc: 0.6628
Epoch 104/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6101 - acc: 0.6497
Epoch 105/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.6038 - acc: 0.6589
Epoch 106/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6093 - acc: 0.6602
Epoch 107/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6097 - acc: 0.6797
Epoch 108/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6187 - acc: 0.6771
Epoch 109/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6134 - acc: 0.6654
Epoch 110/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6125 - acc: 0.6628
Epoch 111/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6029 - acc: 0.6745
Epoch 112/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6025 - acc: 0.6849
Epoch 113/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6179 - acc: 0.6589
Epoch 114/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6120 - acc: 0.6549
Epoch 115/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6083 - acc: 0.6849
Epoch 116/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6099 - acc: 0.6810
Epoch 117/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6123 - acc: 0.6719
Epoch 118/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6056 - acc: 0.6641
Epoch 119/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6058 - acc: 0.6823
Epoch 120/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6091 - acc: 0.6784
Epoch 121/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6105 - acc: 0.6797
Epoch 122/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6179 - acc: 0.6758
Epoch 123/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6070 - acc: 0.6810
Epoch 124/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6018 - acc: 0.6771
Epoch 125/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6055 - acc: 0.6771
Epoch 126/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6071 - acc: 0.6589
Epoch 127/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6131 - acc: 0.6641
Epoch 128/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6150 - acc: 0.6523
Epoch 129/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.6124 - acc: 0.6497
Epoch 130/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6099 - acc: 0.6536
Epoch 131/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6095 - acc: 0.6602
Epoch 132/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6057 - acc: 0.6628
Epoch 133/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6078 - acc: 0.6445
Epoch 134/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6020 - acc: 0.6523
Epoch 135/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6135 - acc: 0.6510
Epoch 136/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6038 - acc: 0.6510
Epoch 137/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6038 - acc: 0.6523
Epoch 138/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6134 - acc: 0.6497
Epoch 139/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6108 - acc: 0.6419
Epoch 140/1000
768/768 [==============================] - 0s 96us/step - loss: 0.6190 - acc: 0.6523
Epoch 141/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6114 - acc: 0.6510
Epoch 142/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6107 - acc: 0.6563
Epoch 143/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6121 - acc: 0.6536
Epoch 144/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6075 - acc: 0.6589
Epoch 145/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6075 - acc: 0.6615
Epoch 146/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6060 - acc: 0.6693
Epoch 147/1000
768/768 [==============================] - 0s 89us/step - loss: 0.6056 - acc: 0.6706
Epoch 148/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6040 - acc: 0.6758
Epoch 149/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6113 - acc: 0.6628
Epoch 150/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6008 - acc: 0.6745
Epoch 151/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6100 - acc: 0.6693
Epoch 152/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6179 - acc: 0.6458
Epoch 153/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.6204 - acc: 0.6523
Epoch 154/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6117 - acc: 0.6549
Epoch 155/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6191 - acc: 0.6536
Epoch 156/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6149 - acc: 0.6576
Epoch 157/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6135 - acc: 0.6589
Epoch 158/1000
768/768 [==============================] - 0s 93us/step - loss: 0.6088 - acc: 0.6784
Epoch 159/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6036 - acc: 0.6745
Epoch 160/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6112 - acc: 0.6706
Epoch 161/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6047 - acc: 0.6667
Epoch 162/1000
768/768 [==============================] - 0s 94us/step - loss: 0.6049 - acc: 0.6693
Epoch 163/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5964 - acc: 0.6823
Epoch 164/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6019 - acc: 0.6849
Epoch 165/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6033 - acc: 0.6719
Epoch 166/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5963 - acc: 0.6823
Epoch 167/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6040 - acc: 0.6706
Epoch 168/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6002 - acc: 0.6745
Epoch 169/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5997 - acc: 0.6745
Epoch 170/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5966 - acc: 0.6823
Epoch 171/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6068 - acc: 0.6667
Epoch 172/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6001 - acc: 0.6732
Epoch 173/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6064 - acc: 0.6654
Epoch 174/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6032 - acc: 0.6823
Epoch 175/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5946 - acc: 0.6823
Epoch 176/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6097 - acc: 0.6641
Epoch 177/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5991 - acc: 0.6784
Epoch 178/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6037 - acc: 0.6536
Epoch 179/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5985 - acc: 0.6471
Epoch 180/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6258 - acc: 0.6576
Epoch 181/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6138 - acc: 0.6549
Epoch 182/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5987 - acc: 0.6523
Epoch 183/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5984 - acc: 0.6602
Epoch 184/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6030 - acc: 0.6823
Epoch 185/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6017 - acc: 0.6797
Epoch 186/1000
768/768 [==============================] - 0s 94us/step - loss: 0.6002 - acc: 0.6641
Epoch 187/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5991 - acc: 0.6628
Epoch 188/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6081 - acc: 0.6693
Epoch 189/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6134 - acc: 0.6641
Epoch 190/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5984 - acc: 0.6836
Epoch 191/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6063 - acc: 0.6784
Epoch 192/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6011 - acc: 0.6797
Epoch 193/1000
768/768 [==============================] - 0s 97us/step - loss: 0.5972 - acc: 0.6706
Epoch 194/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5927 - acc: 0.6771
Epoch 195/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6073 - acc: 0.6732
Epoch 196/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6032 - acc: 0.6901
Epoch 197/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6108 - acc: 0.6471
Epoch 198/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6051 - acc: 0.6471
Epoch 199/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6001 - acc: 0.6445
Epoch 200/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5959 - acc: 0.6536
Epoch 201/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.6051 - acc: 0.6536
Epoch 202/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6138 - acc: 0.6549
Epoch 203/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6135 - acc: 0.6497
Epoch 204/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6125 - acc: 0.6576
Epoch 205/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6132 - acc: 0.6536
Epoch 206/1000
768/768 [==============================] - 0s 85us/step - loss: 0.6007 - acc: 0.6536
Epoch 207/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6044 - acc: 0.6549
Epoch 208/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6063 - acc: 0.6510
Epoch 209/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6115 - acc: 0.6484
Epoch 210/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6094 - acc: 0.6549
Epoch 211/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6037 - acc: 0.6549
Epoch 212/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5973 - acc: 0.6549
Epoch 213/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6068 - acc: 0.6576
Epoch 214/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6102 - acc: 0.6536
Epoch 215/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6047 - acc: 0.6510
Epoch 216/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6024 - acc: 0.6602
Epoch 217/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5981 - acc: 0.6563
Epoch 218/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6021 - acc: 0.6393
Epoch 219/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6041 - acc: 0.6563
Epoch 220/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6142 - acc: 0.6510
Epoch 221/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6025 - acc: 0.6549
Epoch 222/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6015 - acc: 0.6471
Epoch 223/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5986 - acc: 0.6784
Epoch 224/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6011 - acc: 0.6797
Epoch 225/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.6002 - acc: 0.6745
Epoch 226/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6017 - acc: 0.6549
Epoch 227/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5975 - acc: 0.6563
Epoch 228/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6000 - acc: 0.6563
Epoch 229/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6025 - acc: 0.6549
Epoch 230/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5981 - acc: 0.6510
Epoch 231/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5975 - acc: 0.6706
Epoch 232/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5950 - acc: 0.6667
Epoch 233/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5996 - acc: 0.6745
Epoch 234/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5967 - acc: 0.6836
Epoch 235/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5928 - acc: 0.6680
Epoch 236/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5957 - acc: 0.6589
Epoch 237/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5981 - acc: 0.6497
Epoch 238/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5938 - acc: 0.6589
Epoch 239/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5997 - acc: 0.6393
Epoch 240/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5923 - acc: 0.6719
Epoch 241/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6051 - acc: 0.6875
Epoch 242/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6077 - acc: 0.6836
Epoch 243/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6052 - acc: 0.6602
Epoch 244/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5964 - acc: 0.6745
Epoch 245/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6036 - acc: 0.6719
Epoch 246/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5993 - acc: 0.6680
Epoch 247/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5939 - acc: 0.6589
Epoch 248/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5983 - acc: 0.6745
Epoch 249/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.6000 - acc: 0.6745
Epoch 250/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5959 - acc: 0.6823
Epoch 251/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5988 - acc: 0.6602
Epoch 252/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5898 - acc: 0.6680
Epoch 253/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6007 - acc: 0.6706
Epoch 254/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5955 - acc: 0.6888
Epoch 255/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5971 - acc: 0.6615
Epoch 256/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6028 - acc: 0.6693
Epoch 257/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6083 - acc: 0.6471
Epoch 258/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6129 - acc: 0.6172
Epoch 259/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6036 - acc: 0.6563
Epoch 260/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6057 - acc: 0.6393
Epoch 261/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5999 - acc: 0.6393
Epoch 262/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6010 - acc: 0.6406
Epoch 263/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5975 - acc: 0.6471
Epoch 264/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6019 - acc: 0.6445
Epoch 265/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6022 - acc: 0.6784
Epoch 266/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5999 - acc: 0.6732
Epoch 267/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6064 - acc: 0.6862
Epoch 268/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5955 - acc: 0.6784
Epoch 269/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5946 - acc: 0.6784
Epoch 270/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5993 - acc: 0.6875
Epoch 271/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5965 - acc: 0.6693
Epoch 272/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6018 - acc: 0.6602
Epoch 273/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5952 - acc: 0.6771
Epoch 274/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5967 - acc: 0.6706
Epoch 275/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5952 - acc: 0.6758
Epoch 276/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5909 - acc: 0.6875
Epoch 277/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5917 - acc: 0.6810
Epoch 278/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5875 - acc: 0.6823
Epoch 279/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5952 - acc: 0.6758
Epoch 280/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5998 - acc: 0.6615
Epoch 281/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6107 - acc: 0.6745
Epoch 282/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5967 - acc: 0.6888
Epoch 283/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5938 - acc: 0.6784
Epoch 284/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5949 - acc: 0.6875
Epoch 285/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5997 - acc: 0.6849
Epoch 286/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5998 - acc: 0.6771
Epoch 287/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5966 - acc: 0.6667
Epoch 288/1000
768/768 [==============================] - 0s 85us/step - loss: 0.6014 - acc: 0.6654
Epoch 289/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6124 - acc: 0.6667
Epoch 290/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6021 - acc: 0.6810
Epoch 291/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5942 - acc: 0.6823
Epoch 292/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5932 - acc: 0.6823
Epoch 293/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5933 - acc: 0.6784
Epoch 294/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5956 - acc: 0.6797
Epoch 295/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5935 - acc: 0.6849
Epoch 296/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5968 - acc: 0.6823
Epoch 297/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5962 - acc: 0.6771
Epoch 298/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5946 - acc: 0.6667
Epoch 299/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6015 - acc: 0.6693
Epoch 300/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5960 - acc: 0.6888
Epoch 301/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6048 - acc: 0.6667
Epoch 302/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5908 - acc: 0.6875
Epoch 303/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5869 - acc: 0.6888
Epoch 304/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5857 - acc: 0.6888
Epoch 305/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5874 - acc: 0.6888
Epoch 306/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5859 - acc: 0.6862
Epoch 307/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5976 - acc: 0.6576
Epoch 308/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6011 - acc: 0.6576
Epoch 309/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5987 - acc: 0.6497
Epoch 310/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5996 - acc: 0.6771
Epoch 311/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5941 - acc: 0.6901
Epoch 312/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5962 - acc: 0.6784
Epoch 313/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5888 - acc: 0.6940
Epoch 314/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5812 - acc: 0.6927
Epoch 315/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5894 - acc: 0.6862
Epoch 316/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5965 - acc: 0.6680
Epoch 317/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5921 - acc: 0.6836
Epoch 318/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5860 - acc: 0.6745
Epoch 319/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5799 - acc: 0.6862
Epoch 320/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5864 - acc: 0.6823
Epoch 321/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5806 - acc: 0.6784
Epoch 322/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5869 - acc: 0.6823
Epoch 323/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5934 - acc: 0.6693
Epoch 324/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5838 - acc: 0.6966
Epoch 325/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5963 - acc: 0.6953
Epoch 326/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5966 - acc: 0.6836
Epoch 327/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5869 - acc: 0.6823
Epoch 328/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5977 - acc: 0.6771
Epoch 329/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6029 - acc: 0.6536
Epoch 330/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6045 - acc: 0.6367
Epoch 331/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6065 - acc: 0.6523
Epoch 332/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5903 - acc: 0.6628
Epoch 333/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5933 - acc: 0.6497
Epoch 334/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5868 - acc: 0.6758
Epoch 335/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5889 - acc: 0.6680
Epoch 336/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5929 - acc: 0.6693
Epoch 337/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5858 - acc: 0.6836
Epoch 338/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5867 - acc: 0.6862
Epoch 339/1000
768/768 [==============================] - 0s 82us/step - loss: 0.6053 - acc: 0.6810
Epoch 340/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5926 - acc: 0.6927
Epoch 341/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5835 - acc: 0.7018
Epoch 342/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5849 - acc: 0.7005
Epoch 343/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5835 - acc: 0.6836
Epoch 344/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5964 - acc: 0.6797
Epoch 345/1000
```

```
768/768 [==============================] - 0s 83us/step - loss: 0.5844 - acc: 0.6771
Epoch 346/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5901 - acc: 0.6875
Epoch 347/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5891 - acc: 0.6836
Epoch 348/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5926 - acc: 0.6758
Epoch 349/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5837 - acc: 0.7005
Epoch 350/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5835 - acc: 0.6966
Epoch 351/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5831 - acc: 0.6836
Epoch 352/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5765 - acc: 0.6875
Epoch 353/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5874 - acc: 0.6888
Epoch 354/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5794 - acc: 0.6875
Epoch 355/1000
768/768 [==============================] - 0s 85us/step - loss: 0.6014 - acc: 0.6263
Epoch 356/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5887 - acc: 0.6497
Epoch 357/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5876 - acc: 0.6693
Epoch 358/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5883 - acc: 0.6823
Epoch 359/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6027 - acc: 0.6484
Epoch 360/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5880 - acc: 0.6680
Epoch 361/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5890 - acc: 0.6732
Epoch 362/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5831 - acc: 0.6745
Epoch 363/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5820 - acc: 0.6927
Epoch 364/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5925 - acc: 0.6888
Epoch 365/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5881 - acc: 0.6771
Epoch 366/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5765 - acc: 0.6901
Epoch 367/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5796 - acc: 0.6875
Epoch 368/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5961 - acc: 0.6784
Epoch 369/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5853 - acc: 0.7044
Epoch 370/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5781 - acc: 0.7109
Epoch 371/1000
768/768 [==============================] - 0s 82us/step - loss: 0.5801 - acc: 0.6862
Epoch 372/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5864 - acc: 0.6914
Epoch 373/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5965 - acc: 0.6940
Epoch 374/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5789 - acc: 0.7096
Epoch 375/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5800 - acc: 0.6927
Epoch 376/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5878 - acc: 0.6797
Epoch 377/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5834 - acc: 0.6823
Epoch 378/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6107 - acc: 0.6510
Epoch 379/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5972 - acc: 0.6458
Epoch 380/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6027 - acc: 0.6445
Epoch 381/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5896 - acc: 0.6576
Epoch 382/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5855 - acc: 0.6849
Epoch 383/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5866 - acc: 0.6810
Epoch 384/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5884 - acc: 0.6862
Epoch 385/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5818 - acc: 0.7018
Epoch 386/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5792 - acc: 0.6914
Epoch 387/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5765 - acc: 0.7096
Epoch 388/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5981 - acc: 0.6966
Epoch 389/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5770 - acc: 0.6849
Epoch 390/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5871 - acc: 0.6784
Epoch 391/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5892 - acc: 0.6680
Epoch 392/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5884 - acc: 0.6523
Epoch 393/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5927 - acc: 0.6901
Epoch 394/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5935 - acc: 0.6706
Epoch 395/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5952 - acc: 0.6641
Epoch 396/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6084 - acc: 0.6380
Epoch 397/1000
768/768 [==============================] - 0s 108us/step - loss: 0.5948 - acc: 0.6315
Epoch 398/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5919 - acc: 0.6393
Epoch 399/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5893 - acc: 0.6732
Epoch 400/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5887 - acc: 0.6732
Epoch 401/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5934 - acc: 0.6823
Epoch 402/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5803 - acc: 0.6797
Epoch 403/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5898 - acc: 0.6706
Epoch 404/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5795 - acc: 0.6849
Epoch 405/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5830 - acc: 0.6914
Epoch 406/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5776 - acc: 0.6927
Epoch 407/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5810 - acc: 0.6953
Epoch 408/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5877 - acc: 0.6914
Epoch 409/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5930 - acc: 0.6953
Epoch 410/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5919 - acc: 0.6901
Epoch 411/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6090 - acc: 0.6120
Epoch 412/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6081 - acc: 0.6354
Epoch 413/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6138 - acc: 0.6523
Epoch 414/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6041 - acc: 0.6484
Epoch 415/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6116 - acc: 0.6510
Epoch 416/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6025 - acc: 0.6510
Epoch 417/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5990 - acc: 0.6536
Epoch 418/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6071 - acc: 0.6615
Epoch 419/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5999 - acc: 0.6693
Epoch 420/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5946 - acc: 0.6849
Epoch 421/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6037 - acc: 0.6654
Epoch 422/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5948 - acc: 0.6862
Epoch 423/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5944 - acc: 0.6927
Epoch 424/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6037 - acc: 0.6810
Epoch 425/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6020 - acc: 0.6914
Epoch 426/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5969 - acc: 0.6810
Epoch 427/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6001 - acc: 0.6680
Epoch 428/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6104 - acc: 0.6380
Epoch 429/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6087 - acc: 0.6250
Epoch 430/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6056 - acc: 0.6523
Epoch 431/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6014 - acc: 0.6536
Epoch 432/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6013 - acc: 0.6510
Epoch 433/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6096 - acc: 0.6536
Epoch 434/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6082 - acc: 0.6536
Epoch 435/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6117 - acc: 0.6536
Epoch 436/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6003 - acc: 0.6549
Epoch 437/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5980 - acc: 0.6536
Epoch 438/1000
768/768 [==============================] - 0s 82us/step - loss: 0.5991 - acc: 0.6510
Epoch 439/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5827 - acc: 0.6445
Epoch 440/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5839 - acc: 0.6888
Epoch 441/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5768 - acc: 0.7174
Epoch 442/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5783 - acc: 0.6992
Epoch 443/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5678 - acc: 0.7148
Epoch 444/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5832 - acc: 0.6888
Epoch 445/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5881 - acc: 0.6992
Epoch 446/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5974 - acc: 0.6641
Epoch 447/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5899 - acc: 0.6966
Epoch 448/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5896 - acc: 0.6940
Epoch 449/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5796 - acc: 0.7005
Epoch 450/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5758 - acc: 0.7135
Epoch 451/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5874 - acc: 0.6823
Epoch 452/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5769 - acc: 0.6758
Epoch 453/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5830 - acc: 0.6914
Epoch 454/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5917 - acc: 0.6849
Epoch 455/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5896 - acc: 0.6732
Epoch 456/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5718 - acc: 0.6888
Epoch 457/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5918 - acc: 0.6966
Epoch 458/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5821 - acc: 0.6849
Epoch 459/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5882 - acc: 0.6862
Epoch 460/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5876 - acc: 0.6719
Epoch 461/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5845 - acc: 0.6888
Epoch 462/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5827 - acc: 0.6849
Epoch 463/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5874 - acc: 0.6927
Epoch 464/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5794 - acc: 0.6927
Epoch 465/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5817 - acc: 0.6875
Epoch 466/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5881 - acc: 0.6888
Epoch 467/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5813 - acc: 0.6927
Epoch 468/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5869 - acc: 0.6823
Epoch 469/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5790 - acc: 0.6992
Epoch 470/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5802 - acc: 0.6953
Epoch 471/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5834 - acc: 0.6927
Epoch 472/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5760 - acc: 0.6979
Epoch 473/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5780 - acc: 0.7227
Epoch 474/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5708 - acc: 0.7161
Epoch 475/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5805 - acc: 0.7096
Epoch 476/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5884 - acc: 0.6523
Epoch 477/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5906 - acc: 0.6445
Epoch 478/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5946 - acc: 0.6549
Epoch 479/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5813 - acc: 0.6953
Epoch 480/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5696 - acc: 0.7135
Epoch 481/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5729 - acc: 0.7109
Epoch 482/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5671 - acc: 0.7174
Epoch 483/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5757 - acc: 0.7044
Epoch 484/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5861 - acc: 0.6966
Epoch 485/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5987 - acc: 0.6784
Epoch 486/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5981 - acc: 0.6680
Epoch 487/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6013 - acc: 0.6615
Epoch 488/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5967 - acc: 0.6706
Epoch 489/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.6023 - acc: 0.6693
Epoch 490/1000
768/768 [==============================] - 0s 83us/step - loss: 0.6059 - acc: 0.6732
Epoch 491/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5791 - acc: 0.7109
Epoch 492/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5738 - acc: 0.7083
Epoch 493/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5778 - acc: 0.7109
Epoch 494/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5834 - acc: 0.6940
Epoch 495/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5765 - acc: 0.6901
Epoch 496/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5794 - acc: 0.6966
Epoch 497/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5759 - acc: 0.7083
Epoch 498/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5774 - acc: 0.7096
Epoch 499/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5810 - acc: 0.7057
Epoch 500/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5945 - acc: 0.6862
Epoch 501/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5868 - acc: 0.7005
Epoch 502/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5791 - acc: 0.7044
Epoch 503/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5850 - acc: 0.7005
Epoch 504/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5907 - acc: 0.6927
Epoch 505/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5927 - acc: 0.6875
Epoch 506/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5883 - acc: 0.6497
Epoch 507/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5732 - acc: 0.7018
Epoch 508/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5905 - acc: 0.6497
Epoch 509/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5793 - acc: 0.6654
Epoch 510/1000
768/768 [==============================] - 0s 82us/step - loss: 0.5786 - acc: 0.6797
Epoch 511/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5732 - acc: 0.6927
Epoch 512/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5707 - acc: 0.7083
Epoch 513/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5797 - acc: 0.7044
Epoch 514/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5994 - acc: 0.6758
Epoch 515/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5765 - acc: 0.7070
Epoch 516/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5845 - acc: 0.6862
Epoch 517/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5825 - acc: 0.6953
Epoch 518/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5909 - acc: 0.6901
Epoch 519/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5797 - acc: 0.6927
Epoch 520/1000
768/768 [==============================] - 0s 82us/step - loss: 0.5895 - acc: 0.6823
Epoch 521/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5837 - acc: 0.6901
Epoch 522/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5845 - acc: 0.6628
Epoch 523/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5861 - acc: 0.6628
Epoch 524/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5878 - acc: 0.6510
Epoch 525/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5952 - acc: 0.6510
Epoch 526/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5956 - acc: 0.6602
Epoch 527/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5937 - acc: 0.6549
Epoch 528/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5885 - acc: 0.6549
Epoch 529/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5928 - acc: 0.6393
Epoch 530/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5837 - acc: 0.6823
Epoch 531/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5887 - acc: 0.6680
Epoch 532/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5727 - acc: 0.7122
Epoch 533/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5994 - acc: 0.7109
Epoch 534/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5782 - acc: 0.6810
Epoch 535/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5802 - acc: 0.7018
Epoch 536/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5748 - acc: 0.7044
Epoch 537/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5778 - acc: 0.7005
Epoch 538/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5778 - acc: 0.6901
Epoch 539/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5769 - acc: 0.7005
Epoch 540/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5723 - acc: 0.7057
Epoch 541/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5858 - acc: 0.6849
Epoch 542/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5840 - acc: 0.6953
Epoch 543/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5819 - acc: 0.6992
Epoch 544/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5845 - acc: 0.6992
Epoch 545/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5805 - acc: 0.6966
Epoch 546/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5834 - acc: 0.6992
Epoch 547/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5752 - acc: 0.7044
Epoch 548/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5868 - acc: 0.6862
Epoch 549/1000
768/768 [==============================] - 0s 82us/step - loss: 0.5891 - acc: 0.6927
Epoch 550/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5812 - acc: 0.7044
Epoch 551/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5746 - acc: 0.7057
Epoch 552/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5808 - acc: 0.7083
Epoch 553/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5810 - acc: 0.7122
Epoch 554/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5833 - acc: 0.7018
Epoch 555/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5904 - acc: 0.6940
Epoch 556/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5771 - acc: 0.7135
Epoch 557/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5738 - acc: 0.7148
Epoch 558/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5753 - acc: 0.7148
Epoch 559/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5633 - acc: 0.7292
Epoch 560/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5668 - acc: 0.7201
Epoch 561/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5732 - acc: 0.6992
Epoch 562/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5699 - acc: 0.7135
Epoch 563/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5739 - acc: 0.7044
Epoch 564/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5722 - acc: 0.7109
Epoch 565/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5803 - acc: 0.6940
Epoch 566/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5878 - acc: 0.6901
Epoch 567/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5950 - acc: 0.6940
Epoch 568/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5758 - acc: 0.7044
Epoch 569/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5820 - acc: 0.7122
Epoch 570/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5883 - acc: 0.6875
Epoch 571/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5823 - acc: 0.7005
Epoch 572/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5787 - acc: 0.6966
Epoch 573/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5679 - acc: 0.7109
Epoch 574/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5657 - acc: 0.6849
Epoch 575/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5868 - acc: 0.6771
Epoch 576/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5839 - acc: 0.6823
Epoch 577/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5788 - acc: 0.6823
Epoch 578/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5728 - acc: 0.7109
Epoch 579/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5735 - acc: 0.7096
Epoch 580/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5738 - acc: 0.7018
Epoch 581/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5764 - acc: 0.7135
Epoch 582/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5782 - acc: 0.7031
Epoch 583/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5793 - acc: 0.7070
Epoch 584/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5725 - acc: 0.7161
Epoch 585/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.5757 - acc: 0.6966
Epoch 586/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5924 - acc: 0.6706
Epoch 587/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5863 - acc: 0.6654
Epoch 588/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5804 - acc: 0.7083
Epoch 589/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5746 - acc: 0.7174
Epoch 590/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5685 - acc: 0.7266
Epoch 591/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5771 - acc: 0.6992
Epoch 592/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5810 - acc: 0.6966
Epoch 593/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5706 - acc: 0.6927
Epoch 594/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5745 - acc: 0.6979
Epoch 595/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5734 - acc: 0.6875
Epoch 596/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5683 - acc: 0.7018
Epoch 597/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5775 - acc: 0.7148
Epoch 598/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5742 - acc: 0.6901
Epoch 599/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5709 - acc: 0.6875
Epoch 600/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5787 - acc: 0.6849
Epoch 601/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5838 - acc: 0.6914
Epoch 602/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5783 - acc: 0.6953
Epoch 603/1000
768/768 [==============================] - 0s 82us/step - loss: 0.5687 - acc: 0.6953
Epoch 604/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5764 - acc: 0.6732
Epoch 605/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5932 - acc: 0.6471
Epoch 606/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5826 - acc: 0.6875
Epoch 607/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5884 - acc: 0.6797
Epoch 608/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5811 - acc: 0.6979
Epoch 609/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5849 - acc: 0.6667
Epoch 610/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5734 - acc: 0.6888
Epoch 611/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5815 - acc: 0.6992
Epoch 612/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5778 - acc: 0.6771
Epoch 613/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5706 - acc: 0.7044
Epoch 614/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5723 - acc: 0.7109
Epoch 615/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5675 - acc: 0.7161
Epoch 616/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5889 - acc: 0.6979
Epoch 617/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5816 - acc: 0.7057
Epoch 618/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6105 - acc: 0.6810
Epoch 619/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5922 - acc: 0.6979
Epoch 620/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5865 - acc: 0.6966
Epoch 621/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5824 - acc: 0.7083
Epoch 622/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5893 - acc: 0.6953
Epoch 623/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5959 - acc: 0.6823
Epoch 624/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5897 - acc: 0.6966
Epoch 625/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5908 - acc: 0.7070
Epoch 626/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5811 - acc: 0.7044
Epoch 627/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5823 - acc: 0.7070
Epoch 628/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5818 - acc: 0.7083
Epoch 629/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5839 - acc: 0.7083
Epoch 630/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5901 - acc: 0.7070
Epoch 631/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5674 - acc: 0.7135
Epoch 632/1000
768/768 [==============================] - 0s 110us/step - loss: 0.5680 - acc: 0.7148
Epoch 633/1000
```

```
768/768 [==============================] - 0s 103us/step - loss: 0.5680 - acc: 0.7148
Epoch 634/1000
768/768 [==============================] - 0s 105us/step - loss: 0.5846 - acc: 0.6979
Epoch 635/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5755 - acc: 0.6992
Epoch 636/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5738 - acc: 0.7109
Epoch 637/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5718 - acc: 0.7057
Epoch 638/1000
768/768 [==============================] - 0s 82us/step - loss: 0.5676 - acc: 0.7135
Epoch 639/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5617 - acc: 0.7279
Epoch 640/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5771 - acc: 0.7122
Epoch 641/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5779 - acc: 0.6992
Epoch 642/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5817 - acc: 0.7174
Epoch 643/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5788 - acc: 0.7083
Epoch 644/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5740 - acc: 0.7018
Epoch 645/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5702 - acc: 0.7109
Epoch 646/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5769 - acc: 0.6927
Epoch 647/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5831 - acc: 0.6966
Epoch 648/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5754 - acc: 0.6823
Epoch 649/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5692 - acc: 0.7083
Epoch 650/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5736 - acc: 0.7044
Epoch 651/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5779 - acc: 0.6758
Epoch 652/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5679 - acc: 0.6810
Epoch 653/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5785 - acc: 0.6745
Epoch 654/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5612 - acc: 0.7279
Epoch 655/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5683 - acc: 0.7188
Epoch 656/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5775 - acc: 0.7083
Epoch 657/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5931 - acc: 0.6563
Epoch 658/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5800 - acc: 0.7070
Epoch 659/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5735 - acc: 0.6953
Epoch 660/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5752 - acc: 0.6745
Epoch 661/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5701 - acc: 0.7070
Epoch 662/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5820 - acc: 0.7005
Epoch 663/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5756 - acc: 0.7109
Epoch 664/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5753 - acc: 0.7031
Epoch 665/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5678 - acc: 0.7096
Epoch 666/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5817 - acc: 0.6927
Epoch 667/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5714 - acc: 0.7214
Epoch 668/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5782 - acc: 0.7070
Epoch 669/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5703 - acc: 0.7135
Epoch 670/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5809 - acc: 0.7122
Epoch 671/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5694 - acc: 0.7214
Epoch 672/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5753 - acc: 0.7109
Epoch 673/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5617 - acc: 0.7214
Epoch 674/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5695 - acc: 0.7005
Epoch 675/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5781 - acc: 0.7083
Epoch 676/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5684 - acc: 0.7122
Epoch 677/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5674 - acc: 0.7227
Epoch 678/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5713 - acc: 0.7057
Epoch 679/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5693 - acc: 0.7148
Epoch 680/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5797 - acc: 0.6901
Epoch 681/1000
```

```
768/768 [==============================] - 0s 83us/step - loss: 0.5686 - acc: 0.7096
Epoch 682/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5735 - acc: 0.7031
Epoch 683/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5763 - acc: 0.7109
Epoch 684/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5735 - acc: 0.7161
Epoch 685/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5819 - acc: 0.6810
Epoch 686/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5706 - acc: 0.7070
Epoch 687/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5601 - acc: 0.7135
Epoch 688/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5742 - acc: 0.7031
Epoch 689/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5776 - acc: 0.6732
Epoch 690/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5763 - acc: 0.6758
Epoch 691/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5638 - acc: 0.7031
Epoch 692/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5677 - acc: 0.6901
Epoch 693/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5812 - acc: 0.6758
Epoch 694/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5794 - acc: 0.6706
Epoch 695/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5912 - acc: 0.6615
Epoch 696/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5777 - acc: 0.6719
Epoch 697/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5687 - acc: 0.7083
Epoch 698/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5664 - acc: 0.7201
Epoch 699/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5663 - acc: 0.7240
Epoch 700/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5776 - acc: 0.7018
Epoch 701/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5664 - acc: 0.7109
Epoch 702/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5737 - acc: 0.7031
Epoch 703/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5678 - acc: 0.7253
Epoch 704/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5766 - acc: 0.7057
Epoch 705/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5969 - acc: 0.6693
Epoch 706/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5895 - acc: 0.6680
Epoch 707/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5952 - acc: 0.6719
Epoch 708/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5903 - acc: 0.6784
Epoch 709/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5864 - acc: 0.6953
Epoch 710/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5784 - acc: 0.7031
Epoch 711/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5814 - acc: 0.7096
Epoch 712/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5798 - acc: 0.7083
Epoch 713/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5686 - acc: 0.7266
Epoch 714/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5697 - acc: 0.7122
Epoch 715/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5798 - acc: 0.7044
Epoch 716/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5751 - acc: 0.7122
Epoch 717/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5729 - acc: 0.7109
Epoch 718/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5661 - acc: 0.7122
Epoch 719/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5631 - acc: 0.7201
Epoch 720/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5821 - acc: 0.6992
Epoch 721/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5732 - acc: 0.7083
Epoch 722/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5778 - acc: 0.6966
Epoch 723/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5823 - acc: 0.6979
Epoch 724/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5759 - acc: 0.7083
Epoch 725/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5610 - acc: 0.7227
Epoch 726/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5639 - acc: 0.7240
Epoch 727/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5731 - acc: 0.7005
Epoch 728/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5613 - acc: 0.7279
Epoch 729/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5744 - acc: 0.7135
Epoch 730/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5670 - acc: 0.7161
Epoch 731/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5842 - acc: 0.6823
Epoch 732/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5826 - acc: 0.6667
Epoch 733/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5745 - acc: 0.7083
Epoch 734/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5769 - acc: 0.7018
Epoch 735/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5650 - acc: 0.7214
Epoch 736/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5721 - acc: 0.7044
Epoch 737/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5788 - acc: 0.6862
Epoch 738/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5852 - acc: 0.6549
Epoch 739/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5730 - acc: 0.6693
Epoch 740/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5796 - acc: 0.6667
Epoch 741/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5733 - acc: 0.6849
Epoch 742/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5710 - acc: 0.6940
Epoch 743/1000
768/768 [==============================] - 0s 82us/step - loss: 0.5715 - acc: 0.6914
Epoch 744/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5689 - acc: 0.6992
Epoch 745/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5692 - acc: 0.7044
Epoch 746/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5617 - acc: 0.6810
Epoch 747/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5774 - acc: 0.6823
Epoch 748/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5771 - acc: 0.6927
Epoch 749/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5673 - acc: 0.7096
Epoch 750/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5764 - acc: 0.7070
Epoch 751/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5754 - acc: 0.7031
Epoch 752/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5763 - acc: 0.7057
Epoch 753/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5732 - acc: 0.7135
Epoch 754/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5700 - acc: 0.7083
Epoch 755/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5801 - acc: 0.6940
Epoch 756/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5830 - acc: 0.6510
Epoch 757/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5919 - acc: 0.6497
Epoch 758/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5787 - acc: 0.6784
Epoch 759/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5690 - acc: 0.6979
Epoch 760/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5700 - acc: 0.7201
Epoch 761/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5694 - acc: 0.7057
Epoch 762/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5662 - acc: 0.7109
Epoch 763/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5654 - acc: 0.6875
Epoch 764/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5636 - acc: 0.6992
Epoch 765/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5746 - acc: 0.6758
Epoch 766/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5743 - acc: 0.6914
Epoch 767/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5700 - acc: 0.7031
Epoch 768/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5649 - acc: 0.7109
Epoch 769/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5691 - acc: 0.7135
Epoch 770/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5730 - acc: 0.7096
Epoch 771/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5752 - acc: 0.7109
Epoch 772/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5739 - acc: 0.6914
Epoch 773/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5665 - acc: 0.7109
Epoch 774/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5745 - acc: 0.6628
Epoch 775/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5766 - acc: 0.6836
Epoch 776/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5736 - acc: 0.6888
Epoch 777/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5773 - acc: 0.6888
Epoch 778/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5860 - acc: 0.6914
Epoch 779/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5920 - acc: 0.6953
Epoch 780/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5653 - acc: 0.7174
Epoch 781/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5751 - acc: 0.7057
Epoch 782/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5608 - acc: 0.7161
Epoch 783/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5666 - acc: 0.7187
Epoch 784/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5705 - acc: 0.7122
Epoch 785/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5712 - acc: 0.7057
Epoch 786/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5686 - acc: 0.7018
Epoch 787/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5655 - acc: 0.7135
Epoch 788/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5554 - acc: 0.7227
Epoch 789/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5730 - acc: 0.6732
Epoch 790/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5694 - acc: 0.7096
Epoch 791/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5702 - acc: 0.7083
Epoch 792/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5665 - acc: 0.7148
Epoch 793/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5715 - acc: 0.7109
Epoch 794/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5839 - acc: 0.6901
Epoch 795/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5849 - acc: 0.6849
Epoch 796/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5769 - acc: 0.7044
Epoch 797/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5748 - acc: 0.7122
Epoch 798/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5616 - acc: 0.7214
Epoch 799/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5876 - acc: 0.6823
Epoch 800/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5855 - acc: 0.6849
Epoch 801/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5832 - acc: 0.6849
Epoch 802/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5696 - acc: 0.6901
Epoch 803/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5806 - acc: 0.6758
Epoch 804/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5675 - acc: 0.6927
Epoch 805/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5745 - acc: 0.6966
Epoch 806/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5703 - acc: 0.7070
Epoch 807/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5828 - acc: 0.7070
Epoch 808/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5776 - acc: 0.7070
Epoch 809/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5759 - acc: 0.7148
Epoch 810/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5751 - acc: 0.7057
Epoch 811/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5710 - acc: 0.7188
Epoch 812/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5764 - acc: 0.7109
Epoch 813/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5805 - acc: 0.6992
Epoch 814/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5771 - acc: 0.7005
Epoch 815/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5770 - acc: 0.7109
Epoch 816/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5589 - acc: 0.7253
Epoch 817/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5731 - acc: 0.7096
Epoch 818/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5629 - acc: 0.7227
Epoch 819/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5684 - acc: 0.7096
Epoch 820/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5752 - acc: 0.6745
Epoch 821/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5892 - acc: 0.6237
Epoch 822/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5908 - acc: 0.6654
Epoch 823/1000
768/768 [==============================] - 0s 82us/step - loss: 0.6022 - acc: 0.6419
Epoch 824/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5837 - acc: 0.6732
Epoch 825/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5938 - acc: 0.6536
Epoch 826/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5866 - acc: 0.6510
Epoch 827/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5818 - acc: 0.6602
Epoch 828/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5946 - acc: 0.6536
Epoch 829/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5896 - acc: 0.6549
Epoch 830/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5904 - acc: 0.6549
Epoch 831/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5905 - acc: 0.6380
Epoch 832/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5871 - acc: 0.6549
Epoch 833/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5918 - acc: 0.6419
Epoch 834/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5999 - acc: 0.6510
Epoch 835/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5954 - acc: 0.6393
Epoch 836/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5949 - acc: 0.6615
Epoch 837/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5916 - acc: 0.6549
Epoch 838/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5873 - acc: 0.6432
Epoch 839/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5868 - acc: 0.6471
Epoch 840/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5750 - acc: 0.6836
Epoch 841/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5785 - acc: 0.7083
Epoch 842/1000
768/768 [==============================] - 0s 82us/step - loss: 0.5869 - acc: 0.6979
Epoch 843/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5762 - acc: 0.7083
Epoch 844/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5807 - acc: 0.6914
Epoch 845/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5728 - acc: 0.7109
Epoch 846/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5754 - acc: 0.7122
Epoch 847/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5761 - acc: 0.7070
Epoch 848/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5683 - acc: 0.7096
Epoch 849/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.5638 - acc: 0.7201
Epoch 850/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5649 - acc: 0.7240
Epoch 851/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5699 - acc: 0.7148
Epoch 852/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5765 - acc: 0.7031
Epoch 853/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5760 - acc: 0.7070
Epoch 854/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5661 - acc: 0.7161
Epoch 855/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5692 - acc: 0.7057
Epoch 856/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5768 - acc: 0.6966
Epoch 857/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5790 - acc: 0.7018
Epoch 858/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5779 - acc: 0.7057
Epoch 859/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5757 - acc: 0.7083
Epoch 860/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5879 - acc: 0.6875
Epoch 861/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5838 - acc: 0.6953
Epoch 862/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5887 - acc: 0.6823
Epoch 863/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5927 - acc: 0.6797
Epoch 864/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5820 - acc: 0.6940
Epoch 865/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5710 - acc: 0.7201
Epoch 866/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5664 - acc: 0.7122
Epoch 867/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5620 - acc: 0.7227
Epoch 868/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5716 - acc: 0.7148
Epoch 869/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5652 - acc: 0.7161
Epoch 870/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5736 - acc: 0.7161
Epoch 871/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5755 - acc: 0.7188
Epoch 872/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5695 - acc: 0.7266
Epoch 873/1000
```

```
768/768 [==============================] - 0s 92us/step - loss: 0.5717 - acc: 0.7161
Epoch 874/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5540 - acc: 0.7279
Epoch 875/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5594 - acc: 0.7305
Epoch 876/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5710 - acc: 0.7135
Epoch 877/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5672 - acc: 0.7161
Epoch 878/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5749 - acc: 0.6888
Epoch 879/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5737 - acc: 0.6992
Epoch 880/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5737 - acc: 0.6901
Epoch 881/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5797 - acc: 0.6914
Epoch 882/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5655 - acc: 0.7044
Epoch 883/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5691 - acc: 0.7227
Epoch 884/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5644 - acc: 0.7292
Epoch 885/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5737 - acc: 0.7187
Epoch 886/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5738 - acc: 0.7135
Epoch 887/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5698 - acc: 0.7148
Epoch 888/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5747 - acc: 0.7122
Epoch 889/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5666 - acc: 0.7240
Epoch 890/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5820 - acc: 0.7044
Epoch 891/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5755 - acc: 0.7109
Epoch 892/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5690 - acc: 0.7148
Epoch 893/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5700 - acc: 0.7148
Epoch 894/1000
768/768 [==============================] - 0s 97us/step - loss: 0.5728 - acc: 0.7083
Epoch 895/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5656 - acc: 0.7070
Epoch 896/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5678 - acc: 0.7031
Epoch 897/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5672 - acc: 0.6927
Epoch 898/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5733 - acc: 0.6797
Epoch 899/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5684 - acc: 0.6966
Epoch 900/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5654 - acc: 0.7096
Epoch 901/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5643 - acc: 0.7122
Epoch 902/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5727 - acc: 0.6992
Epoch 903/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5722 - acc: 0.6992
Epoch 904/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5660 - acc: 0.6914
Epoch 905/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5659 - acc: 0.7083
Epoch 906/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5591 - acc: 0.7214
Epoch 907/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5754 - acc: 0.6992
Epoch 908/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5716 - acc: 0.6797
Epoch 909/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5806 - acc: 0.6862
Epoch 910/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5785 - acc: 0.7044
Epoch 911/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5674 - acc: 0.7044
Epoch 912/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5694 - acc: 0.7135
Epoch 913/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5788 - acc: 0.7057
Epoch 914/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5594 - acc: 0.7227
Epoch 915/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5608 - acc: 0.7240
Epoch 916/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5716 - acc: 0.7174
Epoch 917/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5672 - acc: 0.7174
Epoch 918/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5720 - acc: 0.7135
Epoch 919/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5691 - acc: 0.7174
Epoch 920/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5672 - acc: 0.7044
Epoch 921/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.5644 - acc: 0.6979
Epoch 922/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5697 - acc: 0.6888
Epoch 923/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5829 - acc: 0.6927
Epoch 924/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5711 - acc: 0.6810
Epoch 925/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5636 - acc: 0.7057
Epoch 926/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5650 - acc: 0.7096
Epoch 927/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5691 - acc: 0.7070
Epoch 928/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5783 - acc: 0.7005
Epoch 929/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5673 - acc: 0.7083
Epoch 930/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5738 - acc: 0.7083
Epoch 931/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5621 - acc: 0.7005
Epoch 932/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5640 - acc: 0.7096
Epoch 933/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5725 - acc: 0.6797
Epoch 934/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5699 - acc: 0.6940
Epoch 935/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5735 - acc: 0.6927
Epoch 936/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5920 - acc: 0.7083
Epoch 937/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5883 - acc: 0.7083
Epoch 938/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5695 - acc: 0.6888
Epoch 939/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5662 - acc: 0.7109
Epoch 940/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5675 - acc: 0.6888
Epoch 941/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5898 - acc: 0.6654
Epoch 942/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5749 - acc: 0.6810
Epoch 943/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5777 - acc: 0.6914
Epoch 944/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5749 - acc: 0.6992
Epoch 945/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.5699 - acc: 0.7135
Epoch 946/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5673 - acc: 0.7201
Epoch 947/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5718 - acc: 0.7174
Epoch 948/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5722 - acc: 0.6992
Epoch 949/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5824 - acc: 0.6732
Epoch 950/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5738 - acc: 0.6914
Epoch 951/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5752 - acc: 0.6992
Epoch 952/1000
768/768 [==============================] - 0s 104us/step - loss: 0.5568 - acc: 0.7279
Epoch 953/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5601 - acc: 0.7240
Epoch 954/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5599 - acc: 0.7187
Epoch 955/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5709 - acc: 0.6992
Epoch 956/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5718 - acc: 0.7096
Epoch 957/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5580 - acc: 0.7201
Epoch 958/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5639 - acc: 0.7227
Epoch 959/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5632 - acc: 0.6875
Epoch 960/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5764 - acc: 0.6836
Epoch 961/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5709 - acc: 0.6836
Epoch 962/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5683 - acc: 0.6940
Epoch 963/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5762 - acc: 0.6836
Epoch 964/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5699 - acc: 0.6901
Epoch 965/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5703 - acc: 0.6966
Epoch 966/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5669 - acc: 0.6862
Epoch 967/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5689 - acc: 0.7018
Epoch 968/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5716 - acc: 0.6836
Epoch 969/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.5701 - acc: 0.7018
Epoch 970/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5679 - acc: 0.6966
Epoch 971/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5660 - acc: 0.7005
Epoch 972/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5684 - acc: 0.7005
Epoch 973/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5653 - acc: 0.7057
Epoch 974/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5666 - acc: 0.6810
Epoch 975/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5806 - acc: 0.6875
Epoch 976/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5654 - acc: 0.7083
Epoch 977/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5819 - acc: 0.6849
Epoch 978/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5735 - acc: 0.6862
Epoch 979/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5773 - acc: 0.6719
Epoch 980/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5792 - acc: 0.6654
Epoch 981/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5771 - acc: 0.6745
Epoch 982/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5707 - acc: 0.6914
Epoch 983/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5716 - acc: 0.6901
Epoch 984/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5629 - acc: 0.7070
Epoch 985/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5640 - acc: 0.7018
Epoch 986/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5652 - acc: 0.7044
Epoch 987/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5717 - acc: 0.6966
Epoch 988/1000
768/768 [==============================] - 0s 105us/step - loss: 0.5711 - acc: 0.6927
Epoch 989/1000
768/768 [==============================] - 0s 106us/step - loss: 0.5720 - acc: 0.7005
Epoch 990/1000
768/768 [==============================] - 0s 114us/step - loss: 0.5752 - acc: 0.6940
Epoch 991/1000
768/768 [==============================] - 0s 98us/step - loss: 0.5709 - acc: 0.6979
Epoch 992/1000
768/768 [==============================] - 0s 103us/step - loss: 0.5665 - acc: 0.7083
Epoch 993/1000
```

```
768/768 [==============================] - 0s 104us/step - loss: 0.5712 - acc: 0.6966
Epoch 994/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5845 - acc: 0.6940
Epoch 995/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5711 - acc: 0.6901
Epoch 996/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5695 - acc: 0.6888
Epoch 997/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5827 - acc: 0.6849
Epoch 998/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5736 - acc: 0.6966
Epoch 999/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5713 - acc: 0.7005
Epoch 1000/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5793 - acc: 0.6901
768/768 [==============================] - 4s 5ms/step

acc: 70.18%


In [93]: scores = model.evaluate(X, y)
         scores, model.metrics_names


        ---------------------------------------------------------------------------

        ValueError                                Traceback (most recent call last)

        <ipython-input-93-de45a522aad9> in <module>()
    ----> 1 scores = model.evaluate(X, y)
          2 scores, model.metrics_names


        ~\Anaconda3\lib\site-packages\keras\engine\training.py in evaluate(self, x, y, batch_si
       1100             x, y,
       1101             sample_weight=sample_weight,
    -> 1102             batch_size=batch_size)
       1103         # Prepare inputs, delegate logic to `test_loop`.
       1104         if self._uses_dynamic_learning_phase():


        ~\Anaconda3\lib\site-packages\keras\engine\training.py in _standardize_user_data(self,
        802             ]
        803             # Check that all arrays have the same length.
    --> 804             check_array_length_consistency(x, y, sample_weights)
        805             if self._is_graph_network:
        806                 # Additional checks to avoid users mistakenly
```

```
~\Anaconda3\lib\site-packages\keras\engine\training_utils.py in check_array_length_cons
235                          'the same number of samples as target arrays. '
236                          'Found ' + str(list(set_x)[0]) + ' input samples '
--> 237                          'and ' + str(list(set_y)[0]) + ' target samples.')
238     if len(set_w) > 1:
239         raise ValueError('All sample_weight arrays should have '


ValueError: Input arrays should have the same number of samples as target arrays. Found
```

```
In [96]: # create model
         model = Sequential()
         model.add(Dense(16, input_dim=8, activation='sigmoid'))
         model.add(Dense(16, activation='sigmoid'))
         model.add(Dense(1, activation='sigmoid'))
         # Compile model
         model.compile(loss='binary_crossentropy', optimizer='sgd', metrics=['accuracy'])
         # Fit the model
         model.fit(X, Y, epochs=1000, batch_size=10)
         # evaluate the model
         scores = model.evaluate(X, Y)
         print("\n%s: %.2f%%" % (model.metrics_names[1], scores[1]*100))
```

```
Epoch 1/1000
768/768 [==============================] - 11s 14ms/step - loss: 0.6530 - acc: 0.6510
Epoch 2/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6468 - acc: 0.6510
Epoch 3/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6449 - acc: 0.6510
Epoch 4/1000
768/768 [==============================] - 0s 104us/step - loss: 0.6430 - acc: 0.6510
Epoch 5/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6420 - acc: 0.6510
Epoch 6/1000
768/768 [==============================] - 0s 85us/step - loss: 0.6420 - acc: 0.6510
Epoch 7/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6416 - acc: 0.6510
Epoch 8/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6399 - acc: 0.6510
Epoch 9/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6406 - acc: 0.6510
Epoch 10/1000
768/768 [==============================] - 0s 89us/step - loss: 0.6394 - acc: 0.6510
Epoch 11/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6385 - acc: 0.6510
Epoch 12/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.6383 - acc: 0.6510
Epoch 13/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6386 - acc: 0.6510
Epoch 14/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6376 - acc: 0.6510
Epoch 15/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6374 - acc: 0.6510
Epoch 16/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6372 - acc: 0.6510
Epoch 17/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6365 - acc: 0.6510
Epoch 18/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6360 - acc: 0.6510
Epoch 19/1000
768/768 [==============================] - 0s 97us/step - loss: 0.6354 - acc: 0.6510
Epoch 20/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6350 - acc: 0.6510
Epoch 21/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6341 - acc: 0.6510
Epoch 22/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6339 - acc: 0.6510
Epoch 23/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6334 - acc: 0.6510
Epoch 24/1000
768/768 [==============================] - 0s 106us/step - loss: 0.6329 - acc: 0.6510
Epoch 25/1000
768/768 [==============================] - 0s 112us/step - loss: 0.6322 - acc: 0.6510
Epoch 26/1000
768/768 [==============================] - 0s 106us/step - loss: 0.6318 - acc: 0.6510
Epoch 27/1000
768/768 [==============================] - 0s 100us/step - loss: 0.6315 - acc: 0.6510
Epoch 28/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6314 - acc: 0.6510
Epoch 29/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6312 - acc: 0.6510
Epoch 30/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6304 - acc: 0.6510
Epoch 31/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6297 - acc: 0.6510
Epoch 32/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6292 - acc: 0.6510
Epoch 33/1000
768/768 [==============================] - 0s 93us/step - loss: 0.6291 - acc: 0.6510
Epoch 34/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6278 - acc: 0.6510
Epoch 35/1000
768/768 [==============================] - 0s 89us/step - loss: 0.6275 - acc: 0.6510
Epoch 36/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.6273 - acc: 0.6510
Epoch 37/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6264 - acc: 0.6510
Epoch 38/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6263 - acc: 0.6510
Epoch 39/1000
768/768 [==============================] - 0s 86us/step - loss: 0.6259 - acc: 0.6510
Epoch 40/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6253 - acc: 0.6510
Epoch 41/1000
768/768 [==============================] - 0s 99us/step - loss: 0.6247 - acc: 0.6510
Epoch 42/1000
768/768 [==============================] - 0s 98us/step - loss: 0.6242 - acc: 0.6510
Epoch 43/1000
768/768 [==============================] - 0s 103us/step - loss: 0.6235 - acc: 0.6510
Epoch 44/1000
768/768 [==============================] - 0s 105us/step - loss: 0.6233 - acc: 0.6510
Epoch 45/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6223 - acc: 0.6510
Epoch 46/1000
768/768 [==============================] - 0s 91us/step - loss: 0.6220 - acc: 0.6510
Epoch 47/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6218 - acc: 0.6510
Epoch 48/1000
768/768 [==============================] - 0s 84us/step - loss: 0.6214 - acc: 0.6510
Epoch 49/1000
768/768 [==============================] - 0s 105us/step - loss: 0.6206 - acc: 0.6510
Epoch 50/1000
768/768 [==============================] - 0s 116us/step - loss: 0.6198 - acc: 0.6510
Epoch 51/1000
768/768 [==============================] - 0s 108us/step - loss: 0.6192 - acc: 0.6510
Epoch 52/1000
768/768 [==============================] - 0s 97us/step - loss: 0.6189 - acc: 0.6510
Epoch 53/1000
768/768 [==============================] - 0s 93us/step - loss: 0.6172 - acc: 0.6510
Epoch 54/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6167 - acc: 0.6510
Epoch 55/1000
768/768 [==============================] - 0s 92us/step - loss: 0.6161 - acc: 0.6510
Epoch 56/1000
768/768 [==============================] - 0s 96us/step - loss: 0.6155 - acc: 0.6510
Epoch 57/1000
768/768 [==============================] - 0s 87us/step - loss: 0.6144 - acc: 0.6510
Epoch 58/1000
768/768 [==============================] - 0s 88us/step - loss: 0.6133 - acc: 0.6510
Epoch 59/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6120 - acc: 0.6510
Epoch 60/1000
```

```
768/768 [==============================] - 0s 127us/step - loss: 0.6124 - acc: 0.6510
Epoch 61/1000
768/768 [==============================] - 0s 101us/step - loss: 0.6113 - acc: 0.6510
Epoch 62/1000
768/768 [==============================] - 0s 103us/step - loss: 0.6105 - acc: 0.6510
Epoch 63/1000
768/768 [==============================] - 0s 101us/step - loss: 0.6096 - acc: 0.6510
Epoch 64/1000
768/768 [==============================] - 0s 100us/step - loss: 0.6101 - acc: 0.6510
Epoch 65/1000
768/768 [==============================] - 0s 96us/step - loss: 0.6086 - acc: 0.6510
Epoch 66/1000
768/768 [==============================] - 0s 94us/step - loss: 0.6081 - acc: 0.6510
Epoch 67/1000
768/768 [==============================] - 0s 93us/step - loss: 0.6073 - acc: 0.6510
Epoch 68/1000
768/768 [==============================] - 0s 101us/step - loss: 0.6075 - acc: 0.6510
Epoch 69/1000
768/768 [==============================] - 0s 97us/step - loss: 0.6065 - acc: 0.6510
Epoch 70/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6049 - acc: 0.6510
Epoch 71/1000
768/768 [==============================] - 0s 93us/step - loss: 0.6044 - acc: 0.6510
Epoch 72/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6050 - acc: 0.6510
Epoch 73/1000
768/768 [==============================] - 0s 100us/step - loss: 0.6025 - acc: 0.6523
Epoch 74/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6013 - acc: 0.6536
Epoch 75/1000
768/768 [==============================] - 0s 97us/step - loss: 0.6012 - acc: 0.6510
Epoch 76/1000
768/768 [==============================] - 0s 96us/step - loss: 0.6017 - acc: 0.6576
Epoch 77/1000
768/768 [==============================] - 0s 97us/step - loss: 0.6003 - acc: 0.6536
Epoch 78/1000
768/768 [==============================] - 0s 96us/step - loss: 0.6000 - acc: 0.6510
Epoch 79/1000
768/768 [==============================] - 0s 97us/step - loss: 0.6029 - acc: 0.6510
Epoch 80/1000
768/768 [==============================] - 0s 96us/step - loss: 0.6023 - acc: 0.6510
Epoch 81/1000
768/768 [==============================] - 0s 94us/step - loss: 0.6011 - acc: 0.6510
Epoch 82/1000
768/768 [==============================] - 0s 95us/step - loss: 0.6014 - acc: 0.6563
Epoch 83/1000
768/768 [==============================] - 0s 90us/step - loss: 0.6003 - acc: 0.6628
Epoch 84/1000
```

```
768/768 [==============================] - 0s 105us/step - loss: 0.5953 - acc: 0.6654
Epoch 85/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5954 - acc: 0.6654
Epoch 86/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5942 - acc: 0.6641
Epoch 87/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5930 - acc: 0.6732
Epoch 88/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5903 - acc: 0.6615
Epoch 89/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5914 - acc: 0.6563
Epoch 90/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5887 - acc: 0.6927
Epoch 91/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5926 - acc: 0.6836
Epoch 92/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5884 - acc: 0.6901
Epoch 93/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5866 - acc: 0.6888
Epoch 94/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5831 - acc: 0.7031
Epoch 95/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5934 - acc: 0.6771
Epoch 96/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5895 - acc: 0.6784
Epoch 97/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5854 - acc: 0.6940
Epoch 98/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5866 - acc: 0.6966
Epoch 99/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5851 - acc: 0.6966
Epoch 100/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5853 - acc: 0.6927
Epoch 101/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5866 - acc: 0.6966
Epoch 102/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5831 - acc: 0.7044
Epoch 103/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5826 - acc: 0.6810
Epoch 104/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5861 - acc: 0.6823
Epoch 105/1000
768/768 [==============================] - 0s 99us/step - loss: 0.5800 - acc: 0.6979
Epoch 106/1000
768/768 [==============================] - 0s 104us/step - loss: 0.5830 - acc: 0.6992
Epoch 107/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5788 - acc: 0.6953
Epoch 108/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5812 - acc: 0.6940
Epoch 109/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5808 - acc: 0.6953
Epoch 110/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5778 - acc: 0.6992
Epoch 111/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5793 - acc: 0.6875
Epoch 112/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5775 - acc: 0.6888
Epoch 113/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5823 - acc: 0.6862
Epoch 114/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5785 - acc: 0.6836
Epoch 115/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5799 - acc: 0.6862
Epoch 116/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5761 - acc: 0.6888
Epoch 117/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5794 - acc: 0.6849
Epoch 118/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5802 - acc: 0.6888
Epoch 119/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5771 - acc: 0.6914
Epoch 120/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5823 - acc: 0.6966
Epoch 121/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5739 - acc: 0.6966
Epoch 122/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5762 - acc: 0.6732
Epoch 123/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5834 - acc: 0.6771
Epoch 124/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5705 - acc: 0.6849
Epoch 125/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5780 - acc: 0.6862
Epoch 126/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5710 - acc: 0.6901
Epoch 127/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5796 - acc: 0.6849
Epoch 128/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5730 - acc: 0.6914
Epoch 129/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5795 - acc: 0.6823
Epoch 130/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5718 - acc: 0.6888
Epoch 131/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5772 - acc: 0.6862
Epoch 132/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5766 - acc: 0.6849
Epoch 133/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5792 - acc: 0.6784
Epoch 134/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5800 - acc: 0.6875
Epoch 135/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5769 - acc: 0.6927
Epoch 136/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5739 - acc: 0.6940
Epoch 137/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5703 - acc: 0.6927
Epoch 138/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5770 - acc: 0.6823
Epoch 139/1000
768/768 [==============================] - 0s 106us/step - loss: 0.5763 - acc: 0.6875
Epoch 140/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5798 - acc: 0.6810
Epoch 141/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5697 - acc: 0.7005
Epoch 142/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5762 - acc: 0.6914
Epoch 143/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5738 - acc: 0.6849
Epoch 144/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5715 - acc: 0.6862
Epoch 145/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5784 - acc: 0.6940
Epoch 146/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5772 - acc: 0.6901
Epoch 147/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5808 - acc: 0.6875
Epoch 148/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5735 - acc: 0.6836
Epoch 149/1000
768/768 [==============================] - 0s 97us/step - loss: 0.5743 - acc: 0.6875
Epoch 150/1000
768/768 [==============================] - 0s 97us/step - loss: 0.5779 - acc: 0.6862
Epoch 151/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5752 - acc: 0.6875
Epoch 152/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5793 - acc: 0.6875
Epoch 153/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5759 - acc: 0.6888
Epoch 154/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5713 - acc: 0.6979
Epoch 155/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5752 - acc: 0.7044
Epoch 156/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.5787 - acc: 0.6862
Epoch 157/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5788 - acc: 0.6927
Epoch 158/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5764 - acc: 0.6888
Epoch 159/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5717 - acc: 0.6784
Epoch 160/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5725 - acc: 0.6953
Epoch 161/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5801 - acc: 0.6849
Epoch 162/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5745 - acc: 0.6875
Epoch 163/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5775 - acc: 0.6914
Epoch 164/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5740 - acc: 0.6953
Epoch 165/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5664 - acc: 0.7018
Epoch 166/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5762 - acc: 0.6784
Epoch 167/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5697 - acc: 0.6979
Epoch 168/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5815 - acc: 0.6953
Epoch 169/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5758 - acc: 0.6784
Epoch 170/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5719 - acc: 0.6901
Epoch 171/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5735 - acc: 0.6927
Epoch 172/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5697 - acc: 0.6927
Epoch 173/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5674 - acc: 0.6953
Epoch 174/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5713 - acc: 0.7018
Epoch 175/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5747 - acc: 0.6966
Epoch 176/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5701 - acc: 0.6992
Epoch 177/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5695 - acc: 0.6992
Epoch 178/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5782 - acc: 0.6992
Epoch 179/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5715 - acc: 0.6901
Epoch 180/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.5802 - acc: 0.6810
Epoch 181/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5720 - acc: 0.6992
Epoch 182/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5810 - acc: 0.6823
Epoch 183/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5747 - acc: 0.6966
Epoch 184/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5703 - acc: 0.7083
Epoch 185/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5703 - acc: 0.7096
Epoch 186/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5685 - acc: 0.7005
Epoch 187/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5687 - acc: 0.7122
Epoch 188/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5671 - acc: 0.7096
Epoch 189/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5787 - acc: 0.6953
Epoch 190/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5781 - acc: 0.6940
Epoch 191/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5766 - acc: 0.6901
Epoch 192/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5692 - acc: 0.7096
Epoch 193/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5662 - acc: 0.7044
Epoch 194/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5746 - acc: 0.6992
Epoch 195/1000
768/768 [==============================] - 0s 97us/step - loss: 0.5660 - acc: 0.6966
Epoch 196/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5683 - acc: 0.6992
Epoch 197/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5721 - acc: 0.6953
Epoch 198/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5676 - acc: 0.6966
Epoch 199/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5712 - acc: 0.6966
Epoch 200/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5729 - acc: 0.6979
Epoch 201/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5698 - acc: 0.7122
Epoch 202/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5689 - acc: 0.7018
Epoch 203/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5696 - acc: 0.7018
Epoch 204/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5669 - acc: 0.7122
Epoch 205/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5650 - acc: 0.7331
Epoch 206/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5750 - acc: 0.7005
Epoch 207/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5627 - acc: 0.7122
Epoch 208/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5742 - acc: 0.6979
Epoch 209/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5714 - acc: 0.7018
Epoch 210/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5754 - acc: 0.6888
Epoch 211/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5659 - acc: 0.7174
Epoch 212/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5723 - acc: 0.6953
Epoch 213/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5718 - acc: 0.6953
Epoch 214/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5795 - acc: 0.6901
Epoch 215/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5709 - acc: 0.7018
Epoch 216/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5611 - acc: 0.7148
Epoch 217/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5683 - acc: 0.7135
Epoch 218/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5740 - acc: 0.7057
Epoch 219/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5676 - acc: 0.7122
Epoch 220/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5647 - acc: 0.7240
Epoch 221/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5642 - acc: 0.7240
Epoch 222/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5669 - acc: 0.7018
Epoch 223/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5664 - acc: 0.7083
Epoch 224/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5716 - acc: 0.7083
Epoch 225/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5700 - acc: 0.7135
Epoch 226/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5676 - acc: 0.7083
Epoch 227/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5677 - acc: 0.7109
Epoch 228/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.5689 - acc: 0.7214
Epoch 229/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5728 - acc: 0.6979
Epoch 230/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5664 - acc: 0.7109
Epoch 231/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5696 - acc: 0.7057
Epoch 232/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5650 - acc: 0.7161
Epoch 233/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5676 - acc: 0.7161
Epoch 234/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5639 - acc: 0.7018
Epoch 235/1000
768/768 [==============================] - 0s 97us/step - loss: 0.5630 - acc: 0.7135
Epoch 236/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5668 - acc: 0.7070
Epoch 237/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5655 - acc: 0.7057
Epoch 238/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5631 - acc: 0.7083
Epoch 239/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5623 - acc: 0.7161
Epoch 240/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5609 - acc: 0.7135
Epoch 241/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5704 - acc: 0.7122
Epoch 242/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5676 - acc: 0.7214
Epoch 243/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5737 - acc: 0.7148
Epoch 244/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5662 - acc: 0.7018
Epoch 245/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5673 - acc: 0.6992
Epoch 246/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5640 - acc: 0.7240
Epoch 247/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5602 - acc: 0.7135
Epoch 248/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5649 - acc: 0.7031
Epoch 249/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5570 - acc: 0.7266
Epoch 250/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5640 - acc: 0.7279
Epoch 251/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5616 - acc: 0.7161
Epoch 252/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5658 - acc: 0.7122
Epoch 253/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5625 - acc: 0.7044
Epoch 254/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5664 - acc: 0.7083
Epoch 255/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5621 - acc: 0.7201
Epoch 256/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5606 - acc: 0.7253
Epoch 257/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5679 - acc: 0.7174
Epoch 258/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5662 - acc: 0.6966
Epoch 259/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5596 - acc: 0.7174
Epoch 260/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5671 - acc: 0.7057
Epoch 261/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5524 - acc: 0.7253
Epoch 262/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5670 - acc: 0.7070
Epoch 263/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5630 - acc: 0.7266
Epoch 264/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5726 - acc: 0.7109
Epoch 265/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5792 - acc: 0.6901
Epoch 266/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5795 - acc: 0.6914
Epoch 267/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5713 - acc: 0.6862
Epoch 268/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5760 - acc: 0.6914
Epoch 269/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5639 - acc: 0.6979
Epoch 270/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5753 - acc: 0.6849
Epoch 271/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5617 - acc: 0.7135
Epoch 272/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5606 - acc: 0.6966
Epoch 273/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5630 - acc: 0.6979
Epoch 274/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5620 - acc: 0.6927
Epoch 275/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5653 - acc: 0.6784
Epoch 276/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5595 - acc: 0.7070
Epoch 277/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5641 - acc: 0.6875
Epoch 278/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5597 - acc: 0.7044
Epoch 279/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5593 - acc: 0.7057
Epoch 280/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5633 - acc: 0.6927
Epoch 281/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5635 - acc: 0.6979
Epoch 282/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5707 - acc: 0.7018
Epoch 283/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5642 - acc: 0.7253
Epoch 284/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5618 - acc: 0.7161
Epoch 285/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5594 - acc: 0.7188
Epoch 286/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5716 - acc: 0.7057
Epoch 287/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5702 - acc: 0.7253
Epoch 288/1000
768/768 [==============================] - 0s 99us/step - loss: 0.5636 - acc: 0.7161
Epoch 289/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5582 - acc: 0.7227
Epoch 290/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5625 - acc: 0.7057
Epoch 291/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5590 - acc: 0.7188
Epoch 292/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5626 - acc: 0.7135
Epoch 293/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5647 - acc: 0.7148
Epoch 294/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5643 - acc: 0.7109
Epoch 295/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5594 - acc: 0.7305
Epoch 296/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5650 - acc: 0.7109
Epoch 297/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5638 - acc: 0.6992
Epoch 298/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5632 - acc: 0.7083
Epoch 299/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5730 - acc: 0.6888
Epoch 300/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.5562 - acc: 0.7188
Epoch 301/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5590 - acc: 0.7135
Epoch 302/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5657 - acc: 0.7018
Epoch 303/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5589 - acc: 0.7096
Epoch 304/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5753 - acc: 0.6992
Epoch 305/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5655 - acc: 0.7109
Epoch 306/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5633 - acc: 0.7135
Epoch 307/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5527 - acc: 0.7266
Epoch 308/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5639 - acc: 0.6966
Epoch 309/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5585 - acc: 0.7083
Epoch 310/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5677 - acc: 0.7031
Epoch 311/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5652 - acc: 0.7096
Epoch 312/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5610 - acc: 0.7214
Epoch 313/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5620 - acc: 0.7266
Epoch 314/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5562 - acc: 0.7318
Epoch 315/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5654 - acc: 0.7148
Epoch 316/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5547 - acc: 0.7227
Epoch 317/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5502 - acc: 0.7253
Epoch 318/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5573 - acc: 0.7201
Epoch 319/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5568 - acc: 0.7240
Epoch 320/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5633 - acc: 0.7122
Epoch 321/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5580 - acc: 0.7214
Epoch 322/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5627 - acc: 0.7188
Epoch 323/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5554 - acc: 0.7174
Epoch 324/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5581 - acc: 0.7122
Epoch 325/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5664 - acc: 0.7109
Epoch 326/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5549 - acc: 0.7240
Epoch 327/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5585 - acc: 0.7135
Epoch 328/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5555 - acc: 0.7227
Epoch 329/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5584 - acc: 0.7214
Epoch 330/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5577 - acc: 0.7135
Epoch 331/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5568 - acc: 0.7201
Epoch 332/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5650 - acc: 0.7005
Epoch 333/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5629 - acc: 0.6823
Epoch 334/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5673 - acc: 0.6953
Epoch 335/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5661 - acc: 0.7005
Epoch 336/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5638 - acc: 0.6966
Epoch 337/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5655 - acc: 0.7096
Epoch 338/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5600 - acc: 0.7031
Epoch 339/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5554 - acc: 0.6940
Epoch 340/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5594 - acc: 0.6836
Epoch 341/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5597 - acc: 0.6953
Epoch 342/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5592 - acc: 0.6875
Epoch 343/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5616 - acc: 0.6875
Epoch 344/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5584 - acc: 0.6992
Epoch 345/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5631 - acc: 0.7122
Epoch 346/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5513 - acc: 0.7044
Epoch 347/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5503 - acc: 0.7174
Epoch 348/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5567 - acc: 0.7096
Epoch 349/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5530 - acc: 0.7096
Epoch 350/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5517 - acc: 0.7122
Epoch 351/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5617 - acc: 0.7096
Epoch 352/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5661 - acc: 0.7083
Epoch 353/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5548 - acc: 0.7201
Epoch 354/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5611 - acc: 0.7070
Epoch 355/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5594 - acc: 0.7070
Epoch 356/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5615 - acc: 0.7135
Epoch 357/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5585 - acc: 0.7070
Epoch 358/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5608 - acc: 0.7109
Epoch 359/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5561 - acc: 0.7109
Epoch 360/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5580 - acc: 0.6940
Epoch 361/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5588 - acc: 0.7083
Epoch 362/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5568 - acc: 0.7122
Epoch 363/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5597 - acc: 0.7005
Epoch 364/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5614 - acc: 0.6966
Epoch 365/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5540 - acc: 0.6914
Epoch 366/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5531 - acc: 0.7214
Epoch 367/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5597 - acc: 0.7083
Epoch 368/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5602 - acc: 0.7031
Epoch 369/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5623 - acc: 0.7057
Epoch 370/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5692 - acc: 0.7044
Epoch 371/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5625 - acc: 0.7083
Epoch 372/1000
```

```
768/768 [==============================] - 0s 94us/step - loss: 0.5561 - acc: 0.7135
Epoch 373/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5622 - acc: 0.7135
Epoch 374/1000
768/768 [==============================] - 0s 103us/step - loss: 0.5590 - acc: 0.7174
Epoch 375/1000
768/768 [==============================] - 0s 98us/step - loss: 0.5612 - acc: 0.7083
Epoch 376/1000
768/768 [==============================] - 0s 99us/step - loss: 0.5591 - acc: 0.6914
Epoch 377/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5609 - acc: 0.7253
Epoch 378/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5595 - acc: 0.7227
Epoch 379/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5506 - acc: 0.7383
Epoch 380/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5647 - acc: 0.6979
Epoch 381/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5500 - acc: 0.7161
Epoch 382/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5509 - acc: 0.7096
Epoch 383/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5619 - acc: 0.6979
Epoch 384/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5682 - acc: 0.7031
Epoch 385/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5662 - acc: 0.7031
Epoch 386/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5615 - acc: 0.7148
Epoch 387/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5627 - acc: 0.7161
Epoch 388/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5627 - acc: 0.7174
Epoch 389/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5646 - acc: 0.6992
Epoch 390/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5562 - acc: 0.7005
Epoch 391/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5620 - acc: 0.6927
Epoch 392/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5596 - acc: 0.7148
Epoch 393/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5551 - acc: 0.7070
Epoch 394/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5520 - acc: 0.6979
Epoch 395/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5539 - acc: 0.6914
Epoch 396/1000
```

```
768/768 [==============================] - 0s 91us/step - loss: 0.5531 - acc: 0.7096
Epoch 397/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5561 - acc: 0.7044
Epoch 398/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5639 - acc: 0.7174
Epoch 399/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5533 - acc: 0.7070
Epoch 400/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5649 - acc: 0.6901
Epoch 401/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5585 - acc: 0.7070
Epoch 402/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5583 - acc: 0.6888
Epoch 403/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5529 - acc: 0.6914
Epoch 404/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5524 - acc: 0.7174
Epoch 405/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5467 - acc: 0.6940
Epoch 406/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5548 - acc: 0.7018
Epoch 407/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5474 - acc: 0.7240
Epoch 408/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5556 - acc: 0.7135
Epoch 409/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5564 - acc: 0.7096
Epoch 410/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5545 - acc: 0.7057
Epoch 411/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5560 - acc: 0.7005
Epoch 412/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5595 - acc: 0.7096
Epoch 413/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5538 - acc: 0.7253
Epoch 414/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5557 - acc: 0.6979
Epoch 415/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5452 - acc: 0.7188
Epoch 416/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5469 - acc: 0.7279
Epoch 417/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5569 - acc: 0.6992
Epoch 418/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5566 - acc: 0.7148
Epoch 419/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5616 - acc: 0.7070
Epoch 420/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5589 - acc: 0.7227
Epoch 421/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5562 - acc: 0.7240
Epoch 422/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5505 - acc: 0.7279
Epoch 423/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5493 - acc: 0.7305
Epoch 424/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5617 - acc: 0.6953
Epoch 425/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5515 - acc: 0.7122
Epoch 426/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5515 - acc: 0.7161
Epoch 427/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5527 - acc: 0.7044
Epoch 428/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5535 - acc: 0.6966
Epoch 429/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5524 - acc: 0.6927
Epoch 430/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5611 - acc: 0.6836
Epoch 431/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5482 - acc: 0.7201
Epoch 432/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5485 - acc: 0.7005
Epoch 433/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5550 - acc: 0.7083
Epoch 434/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5527 - acc: 0.7083
Epoch 435/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5506 - acc: 0.7161
Epoch 436/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5581 - acc: 0.7201
Epoch 437/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5538 - acc: 0.7201
Epoch 438/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5507 - acc: 0.7070
Epoch 439/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5478 - acc: 0.7331
Epoch 440/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5562 - acc: 0.7148
Epoch 441/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5620 - acc: 0.7109
Epoch 442/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5534 - acc: 0.7240
Epoch 443/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5563 - acc: 0.7253
Epoch 444/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5492 - acc: 0.7266
Epoch 445/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5523 - acc: 0.7227
Epoch 446/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5505 - acc: 0.7214
Epoch 447/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5550 - acc: 0.7057
Epoch 448/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5554 - acc: 0.6953
Epoch 449/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5511 - acc: 0.7018
Epoch 450/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5544 - acc: 0.7018
Epoch 451/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5555 - acc: 0.7096
Epoch 452/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5483 - acc: 0.7279
Epoch 453/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5515 - acc: 0.7135
Epoch 454/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5471 - acc: 0.7044
Epoch 455/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5468 - acc: 0.7266
Epoch 456/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5505 - acc: 0.7305
Epoch 457/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5585 - acc: 0.7018
Epoch 458/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5457 - acc: 0.7292
Epoch 459/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5461 - acc: 0.7253
Epoch 460/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5615 - acc: 0.7135
Epoch 461/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5511 - acc: 0.7227
Epoch 462/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5509 - acc: 0.7240
Epoch 463/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5476 - acc: 0.7279
Epoch 464/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5551 - acc: 0.7214
Epoch 465/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5574 - acc: 0.7057
Epoch 466/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5620 - acc: 0.6992
Epoch 467/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5577 - acc: 0.7070
Epoch 468/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5517 - acc: 0.7161
Epoch 469/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5538 - acc: 0.7044
Epoch 470/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5436 - acc: 0.7240
Epoch 471/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5504 - acc: 0.7188
Epoch 472/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5513 - acc: 0.7227
Epoch 473/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5593 - acc: 0.7083
Epoch 474/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5505 - acc: 0.7240
Epoch 475/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5535 - acc: 0.7044
Epoch 476/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5460 - acc: 0.7135
Epoch 477/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5477 - acc: 0.6966
Epoch 478/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5551 - acc: 0.6927
Epoch 479/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5489 - acc: 0.6992
Epoch 480/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5525 - acc: 0.7083
Epoch 481/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5480 - acc: 0.7474
Epoch 482/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5471 - acc: 0.7383
Epoch 483/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5523 - acc: 0.7201
Epoch 484/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5474 - acc: 0.7344
Epoch 485/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5491 - acc: 0.7148
Epoch 486/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5488 - acc: 0.7279
Epoch 487/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5540 - acc: 0.7331
Epoch 488/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5646 - acc: 0.6992
Epoch 489/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5619 - acc: 0.7109
Epoch 490/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5616 - acc: 0.7135
Epoch 491/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5600 - acc: 0.7096
Epoch 492/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5549 - acc: 0.7083
Epoch 493/1000
768/768 [==============================] - 0s 93us/step - loss: 0.5584 - acc: 0.7174
Epoch 494/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5548 - acc: 0.7174
Epoch 495/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5551 - acc: 0.7109
Epoch 496/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5547 - acc: 0.7083
Epoch 497/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5565 - acc: 0.6992
Epoch 498/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5573 - acc: 0.7057
Epoch 499/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5542 - acc: 0.7096
Epoch 500/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5529 - acc: 0.7044
Epoch 501/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5513 - acc: 0.7057
Epoch 502/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5532 - acc: 0.7070
Epoch 503/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5558 - acc: 0.7057
Epoch 504/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5517 - acc: 0.7070
Epoch 505/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5523 - acc: 0.7083
Epoch 506/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5497 - acc: 0.7044
Epoch 507/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5568 - acc: 0.6927
Epoch 508/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5485 - acc: 0.7109
Epoch 509/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5498 - acc: 0.7148
Epoch 510/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5489 - acc: 0.7148
Epoch 511/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5505 - acc: 0.7161
Epoch 512/1000
768/768 [==============================] - 0s 79us/step - loss: 0.5572 - acc: 0.7083
Epoch 513/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5478 - acc: 0.7044
Epoch 514/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5528 - acc: 0.7109
Epoch 515/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5474 - acc: 0.7227
Epoch 516/1000
```

```
768/768 [==============================] - 0s 88us/step - loss: 0.5499 - acc: 0.7096
Epoch 517/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5445 - acc: 0.7122
Epoch 518/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5555 - acc: 0.7109
Epoch 519/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5491 - acc: 0.7201
Epoch 520/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5477 - acc: 0.7109
Epoch 521/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5460 - acc: 0.7187
Epoch 522/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5482 - acc: 0.7109
Epoch 523/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5529 - acc: 0.7096
Epoch 524/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5536 - acc: 0.7148
Epoch 525/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5498 - acc: 0.6979
Epoch 526/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5528 - acc: 0.7057
Epoch 527/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5437 - acc: 0.7253
Epoch 528/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5517 - acc: 0.7148
Epoch 529/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5471 - acc: 0.7135
Epoch 530/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5479 - acc: 0.7148
Epoch 531/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5499 - acc: 0.7135
Epoch 532/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5505 - acc: 0.7122
Epoch 533/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5456 - acc: 0.7083
Epoch 534/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5494 - acc: 0.7044
Epoch 535/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5500 - acc: 0.7096
Epoch 536/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5525 - acc: 0.7201
Epoch 537/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5432 - acc: 0.7227
Epoch 538/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5492 - acc: 0.6979
Epoch 539/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5493 - acc: 0.7174
Epoch 540/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.5435 - acc: 0.7188
Epoch 541/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5480 - acc: 0.7057
Epoch 542/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5481 - acc: 0.7240
Epoch 543/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5489 - acc: 0.7214
Epoch 544/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5545 - acc: 0.7122
Epoch 545/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5460 - acc: 0.7122
Epoch 546/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5521 - acc: 0.7070
Epoch 547/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5565 - acc: 0.6992
Epoch 548/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5548 - acc: 0.7044
Epoch 549/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5461 - acc: 0.7135
Epoch 550/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5461 - acc: 0.7135
Epoch 551/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5450 - acc: 0.7070
Epoch 552/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5463 - acc: 0.7148
Epoch 553/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5494 - acc: 0.7070
Epoch 554/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5443 - acc: 0.7188
Epoch 555/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5443 - acc: 0.7188
Epoch 556/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5513 - acc: 0.7201
Epoch 557/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5435 - acc: 0.7135
Epoch 558/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5545 - acc: 0.7070
Epoch 559/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5542 - acc: 0.7174
Epoch 560/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5567 - acc: 0.7135
Epoch 561/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5557 - acc: 0.6992
Epoch 562/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5572 - acc: 0.7070
Epoch 563/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5605 - acc: 0.7083
Epoch 564/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5541 - acc: 0.7174
Epoch 565/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5490 - acc: 0.7240
Epoch 566/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5552 - acc: 0.7148
Epoch 567/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5457 - acc: 0.7161
Epoch 568/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5467 - acc: 0.7122
Epoch 569/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5470 - acc: 0.6966
Epoch 570/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5517 - acc: 0.7031
Epoch 571/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5465 - acc: 0.7096
Epoch 572/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5421 - acc: 0.7161
Epoch 573/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5434 - acc: 0.7201
Epoch 574/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5452 - acc: 0.7109
Epoch 575/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5430 - acc: 0.7083
Epoch 576/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5447 - acc: 0.7201
Epoch 577/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5447 - acc: 0.7122
Epoch 578/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5494 - acc: 0.7174
Epoch 579/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5446 - acc: 0.7174
Epoch 580/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5467 - acc: 0.7135
Epoch 581/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5415 - acc: 0.7174
Epoch 582/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5507 - acc: 0.7135
Epoch 583/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5541 - acc: 0.7122
Epoch 584/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5490 - acc: 0.7174
Epoch 585/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5441 - acc: 0.7109
Epoch 586/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5459 - acc: 0.7083
Epoch 587/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5477 - acc: 0.7122
Epoch 588/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5493 - acc: 0.7109
Epoch 589/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5419 - acc: 0.7201
Epoch 590/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5455 - acc: 0.7135
Epoch 591/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5532 - acc: 0.7044
Epoch 592/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5608 - acc: 0.7096
Epoch 593/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5501 - acc: 0.7031
Epoch 594/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5536 - acc: 0.7096
Epoch 595/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5495 - acc: 0.7148
Epoch 596/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5539 - acc: 0.7070
Epoch 597/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5555 - acc: 0.7122
Epoch 598/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5478 - acc: 0.7122
Epoch 599/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5575 - acc: 0.7070
Epoch 600/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5533 - acc: 0.7083
Epoch 601/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5408 - acc: 0.7344
Epoch 602/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5658 - acc: 0.6940
Epoch 603/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5611 - acc: 0.7122
Epoch 604/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5550 - acc: 0.7070
Epoch 605/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5453 - acc: 0.7070
Epoch 606/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5477 - acc: 0.7096
Epoch 607/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5418 - acc: 0.7031
Epoch 608/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5486 - acc: 0.7044
Epoch 609/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5462 - acc: 0.7096
Epoch 610/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5491 - acc: 0.7122
Epoch 611/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5423 - acc: 0.7174
Epoch 612/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5419 - acc: 0.7253
Epoch 613/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5467 - acc: 0.7057
Epoch 614/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5466 - acc: 0.7161
Epoch 615/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5443 - acc: 0.7109
Epoch 616/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5520 - acc: 0.6953
Epoch 617/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5466 - acc: 0.7148
Epoch 618/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5466 - acc: 0.7161
Epoch 619/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5519 - acc: 0.7031
Epoch 620/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5469 - acc: 0.7148
Epoch 621/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5394 - acc: 0.7214
Epoch 622/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5419 - acc: 0.7096
Epoch 623/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5424 - acc: 0.7122
Epoch 624/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5509 - acc: 0.7148
Epoch 625/1000
768/768 [==============================] - 0s 100us/step - loss: 0.5499 - acc: 0.7122
Epoch 626/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5515 - acc: 0.7188
Epoch 627/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5423 - acc: 0.7227
Epoch 628/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5502 - acc: 0.7096
Epoch 629/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5455 - acc: 0.7148
Epoch 630/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5479 - acc: 0.7070
Epoch 631/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5410 - acc: 0.7174
Epoch 632/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5436 - acc: 0.7109
Epoch 633/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5491 - acc: 0.7253
Epoch 634/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5516 - acc: 0.7057
Epoch 635/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5459 - acc: 0.7044
Epoch 636/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5452 - acc: 0.7122
Epoch 637/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5397 - acc: 0.7266
Epoch 638/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5432 - acc: 0.7227
Epoch 639/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5400 - acc: 0.7227
Epoch 640/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5448 - acc: 0.7122
Epoch 641/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5480 - acc: 0.7279
Epoch 642/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5446 - acc: 0.7135
Epoch 643/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5481 - acc: 0.7148
Epoch 644/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5435 - acc: 0.7214
Epoch 645/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5445 - acc: 0.7122
Epoch 646/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5445 - acc: 0.7227
Epoch 647/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5458 - acc: 0.7135
Epoch 648/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5491 - acc: 0.7096
Epoch 649/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5476 - acc: 0.7240
Epoch 650/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5419 - acc: 0.7214
Epoch 651/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5427 - acc: 0.7214
Epoch 652/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5392 - acc: 0.7240
Epoch 653/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5473 - acc: 0.7148
Epoch 654/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5493 - acc: 0.7174
Epoch 655/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5542 - acc: 0.7109
Epoch 656/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5510 - acc: 0.7187
Epoch 657/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5453 - acc: 0.7161
Epoch 658/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5440 - acc: 0.7083
Epoch 659/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5561 - acc: 0.7201
Epoch 660/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5494 - acc: 0.7109
Epoch 661/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5481 - acc: 0.7187
Epoch 662/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5433 - acc: 0.7214
Epoch 663/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5373 - acc: 0.7279
Epoch 664/1000
768/768 [==============================] - 0s 89us/step - loss: 0.5504 - acc: 0.7188
Epoch 665/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5440 - acc: 0.7227
Epoch 666/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5473 - acc: 0.7122
Epoch 667/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5480 - acc: 0.7201
Epoch 668/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5457 - acc: 0.7187
Epoch 669/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5474 - acc: 0.7174
Epoch 670/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5512 - acc: 0.7070
Epoch 671/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5426 - acc: 0.7201
Epoch 672/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5401 - acc: 0.7201
Epoch 673/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5431 - acc: 0.7227
Epoch 674/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5454 - acc: 0.7070
Epoch 675/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5473 - acc: 0.7122
Epoch 676/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5462 - acc: 0.7187
Epoch 677/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5415 - acc: 0.7187
Epoch 678/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5445 - acc: 0.7148
Epoch 679/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5424 - acc: 0.7135
Epoch 680/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5416 - acc: 0.7214
Epoch 681/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5464 - acc: 0.7122
Epoch 682/1000
768/768 [==============================] - 0s 108us/step - loss: 0.5479 - acc: 0.7018
Epoch 683/1000
768/768 [==============================] - 0s 96us/step - loss: 0.5499 - acc: 0.7057
Epoch 684/1000
```

```
768/768 [==============================] - 0s 90us/step - loss: 0.5451 - acc: 0.7188
Epoch 685/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5412 - acc: 0.7253
Epoch 686/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5520 - acc: 0.7122
Epoch 687/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5416 - acc: 0.7174
Epoch 688/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5523 - acc: 0.7083
Epoch 689/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5470 - acc: 0.7109
Epoch 690/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5415 - acc: 0.7214
Epoch 691/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5464 - acc: 0.7201
Epoch 692/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5460 - acc: 0.7122
Epoch 693/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5465 - acc: 0.7187
Epoch 694/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5517 - acc: 0.7240
Epoch 695/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5473 - acc: 0.7201
Epoch 696/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5457 - acc: 0.7135
Epoch 697/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5508 - acc: 0.7148
Epoch 698/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5542 - acc: 0.7109
Epoch 699/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5501 - acc: 0.7201
Epoch 700/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5516 - acc: 0.7135
Epoch 701/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5491 - acc: 0.7266
Epoch 702/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5426 - acc: 0.7083
Epoch 703/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5377 - acc: 0.7253
Epoch 704/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5470 - acc: 0.7161
Epoch 705/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5435 - acc: 0.7057
Epoch 706/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5456 - acc: 0.7109
Epoch 707/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5466 - acc: 0.7096
Epoch 708/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5536 - acc: 0.7018
Epoch 709/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5429 - acc: 0.7201
Epoch 710/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5459 - acc: 0.7279
Epoch 711/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5468 - acc: 0.7227
Epoch 712/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5511 - acc: 0.7174
Epoch 713/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5490 - acc: 0.7148
Epoch 714/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5478 - acc: 0.7201
Epoch 715/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5398 - acc: 0.7188
Epoch 716/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5457 - acc: 0.7227
Epoch 717/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5402 - acc: 0.7161
Epoch 718/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5500 - acc: 0.7227
Epoch 719/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5460 - acc: 0.7174
Epoch 720/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5490 - acc: 0.7122
Epoch 721/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5433 - acc: 0.7266
Epoch 722/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5501 - acc: 0.7201
Epoch 723/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5394 - acc: 0.7279
Epoch 724/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5471 - acc: 0.7161
Epoch 725/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5436 - acc: 0.7201
Epoch 726/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5434 - acc: 0.7240
Epoch 727/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5488 - acc: 0.7174
Epoch 728/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5460 - acc: 0.7148
Epoch 729/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5395 - acc: 0.7240
Epoch 730/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5441 - acc: 0.7214
Epoch 731/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5384 - acc: 0.7240
Epoch 732/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5429 - acc: 0.7253
Epoch 733/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5428 - acc: 0.7174
Epoch 734/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5428 - acc: 0.7240
Epoch 735/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5437 - acc: 0.7148
Epoch 736/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5512 - acc: 0.7083
Epoch 737/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5427 - acc: 0.7188
Epoch 738/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5368 - acc: 0.7201
Epoch 739/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5484 - acc: 0.7109
Epoch 740/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5427 - acc: 0.7096
Epoch 741/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5402 - acc: 0.7187
Epoch 742/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5400 - acc: 0.7240
Epoch 743/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5463 - acc: 0.7201
Epoch 744/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5465 - acc: 0.7135
Epoch 745/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5493 - acc: 0.7266
Epoch 746/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5454 - acc: 0.7214
Epoch 747/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5443 - acc: 0.7122
Epoch 748/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5464 - acc: 0.7044
Epoch 749/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5460 - acc: 0.7188
Epoch 750/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5419 - acc: 0.7148
Epoch 751/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5392 - acc: 0.7201
Epoch 752/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5511 - acc: 0.7096
Epoch 753/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5536 - acc: 0.7005
Epoch 754/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5480 - acc: 0.7148
Epoch 755/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5480 - acc: 0.7070
Epoch 756/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5519 - acc: 0.7044
Epoch 757/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5529 - acc: 0.6979
Epoch 758/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5582 - acc: 0.6927
Epoch 759/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5502 - acc: 0.7083
Epoch 760/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5490 - acc: 0.7018
Epoch 761/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5462 - acc: 0.7096
Epoch 762/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5536 - acc: 0.7279
Epoch 763/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5558 - acc: 0.7148
Epoch 764/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5552 - acc: 0.6836
Epoch 765/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5611 - acc: 0.7083
Epoch 766/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5533 - acc: 0.7057
Epoch 767/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5538 - acc: 0.7227
Epoch 768/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5510 - acc: 0.7266
Epoch 769/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5504 - acc: 0.7240
Epoch 770/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5493 - acc: 0.7188
Epoch 771/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5507 - acc: 0.7253
Epoch 772/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5501 - acc: 0.7227
Epoch 773/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5553 - acc: 0.7096
Epoch 774/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5459 - acc: 0.7188
Epoch 775/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5510 - acc: 0.7135
Epoch 776/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5500 - acc: 0.7214
Epoch 777/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5420 - acc: 0.7227
Epoch 778/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5482 - acc: 0.7253
Epoch 779/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5465 - acc: 0.7253
Epoch 780/1000
```

```
768/768 [==============================] - 0s 83us/step - loss: 0.5468 - acc: 0.7148
Epoch 781/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5440 - acc: 0.7253
Epoch 782/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5442 - acc: 0.7174
Epoch 783/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5490 - acc: 0.7214
Epoch 784/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5456 - acc: 0.7201
Epoch 785/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5468 - acc: 0.7188
Epoch 786/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5449 - acc: 0.7305
Epoch 787/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5540 - acc: 0.7161
Epoch 788/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5436 - acc: 0.7266
Epoch 789/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5431 - acc: 0.7266
Epoch 790/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5416 - acc: 0.7318
Epoch 791/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5443 - acc: 0.7174
Epoch 792/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5421 - acc: 0.7266
Epoch 793/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5476 - acc: 0.7266
Epoch 794/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5477 - acc: 0.7305
Epoch 795/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5515 - acc: 0.7214
Epoch 796/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5422 - acc: 0.7279
Epoch 797/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5422 - acc: 0.7187
Epoch 798/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5460 - acc: 0.7331
Epoch 799/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5439 - acc: 0.7227
Epoch 800/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5503 - acc: 0.7174
Epoch 801/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5490 - acc: 0.7174
Epoch 802/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5437 - acc: 0.7148
Epoch 803/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5409 - acc: 0.7227
Epoch 804/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5430 - acc: 0.7201
Epoch 805/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5486 - acc: 0.7122
Epoch 806/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5469 - acc: 0.7109
Epoch 807/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5518 - acc: 0.7057
Epoch 808/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5453 - acc: 0.7227
Epoch 809/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5474 - acc: 0.7057
Epoch 810/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5508 - acc: 0.7044
Epoch 811/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5427 - acc: 0.7227
Epoch 812/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5423 - acc: 0.7174
Epoch 813/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5583 - acc: 0.7122
Epoch 814/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5513 - acc: 0.7135
Epoch 815/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5401 - acc: 0.7253
Epoch 816/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5448 - acc: 0.7135
Epoch 817/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5395 - acc: 0.7227
Epoch 818/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5468 - acc: 0.7201
Epoch 819/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5569 - acc: 0.7057
Epoch 820/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5494 - acc: 0.7135
Epoch 821/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5434 - acc: 0.7266
Epoch 822/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5426 - acc: 0.7188
Epoch 823/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5446 - acc: 0.7148
Epoch 824/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5425 - acc: 0.7292
Epoch 825/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5393 - acc: 0.7383
Epoch 826/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5454 - acc: 0.7148
Epoch 827/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5454 - acc: 0.7188
Epoch 828/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5394 - acc: 0.7279
Epoch 829/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5447 - acc: 0.7227
Epoch 830/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5398 - acc: 0.7227
Epoch 831/1000
768/768 [==============================] - 0s 94us/step - loss: 0.5507 - acc: 0.7070
Epoch 832/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5433 - acc: 0.7214
Epoch 833/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5428 - acc: 0.7148
Epoch 834/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5392 - acc: 0.7214
Epoch 835/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5421 - acc: 0.7161
Epoch 836/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5461 - acc: 0.7214
Epoch 837/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5438 - acc: 0.7188
Epoch 838/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5491 - acc: 0.7174
Epoch 839/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5492 - acc: 0.7135
Epoch 840/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5455 - acc: 0.7279
Epoch 841/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5470 - acc: 0.7266
Epoch 842/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5422 - acc: 0.7266
Epoch 843/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5403 - acc: 0.7227
Epoch 844/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5478 - acc: 0.7253
Epoch 845/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5493 - acc: 0.7214
Epoch 846/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5338 - acc: 0.7344
Epoch 847/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5438 - acc: 0.7201
Epoch 848/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5426 - acc: 0.7227
Epoch 849/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5480 - acc: 0.7174
Epoch 850/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5445 - acc: 0.7240
Epoch 851/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5410 - acc: 0.7148
Epoch 852/1000
```

```
768/768 [==============================] - 0s 83us/step - loss: 0.5420 - acc: 0.7253
Epoch 853/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5508 - acc: 0.7148
Epoch 854/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5457 - acc: 0.7122
Epoch 855/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5490 - acc: 0.7227
Epoch 856/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5524 - acc: 0.7109
Epoch 857/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5444 - acc: 0.7135
Epoch 858/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5411 - acc: 0.7240
Epoch 859/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5428 - acc: 0.7201
Epoch 860/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5382 - acc: 0.7253
Epoch 861/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5501 - acc: 0.7174
Epoch 862/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5429 - acc: 0.7214
Epoch 863/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5439 - acc: 0.7122
Epoch 864/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5518 - acc: 0.7227
Epoch 865/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5417 - acc: 0.7161
Epoch 866/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5477 - acc: 0.7174
Epoch 867/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5500 - acc: 0.7057
Epoch 868/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5437 - acc: 0.7266
Epoch 869/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5448 - acc: 0.7174
Epoch 870/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5397 - acc: 0.7292
Epoch 871/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5448 - acc: 0.7174
Epoch 872/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5588 - acc: 0.7083
Epoch 873/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5534 - acc: 0.7109
Epoch 874/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5452 - acc: 0.7253
Epoch 875/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5393 - acc: 0.7227
Epoch 876/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5419 - acc: 0.7214
Epoch 877/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5437 - acc: 0.7253
Epoch 878/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5387 - acc: 0.7305
Epoch 879/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5417 - acc: 0.7331
Epoch 880/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5388 - acc: 0.7292
Epoch 881/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5394 - acc: 0.7318
Epoch 882/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5493 - acc: 0.7109
Epoch 883/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5430 - acc: 0.7161
Epoch 884/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5448 - acc: 0.7201
Epoch 885/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5454 - acc: 0.7214
Epoch 886/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5402 - acc: 0.7201
Epoch 887/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5461 - acc: 0.7109
Epoch 888/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5391 - acc: 0.7214
Epoch 889/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5422 - acc: 0.7227
Epoch 890/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5393 - acc: 0.7318
Epoch 891/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5425 - acc: 0.7135
Epoch 892/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5364 - acc: 0.7253
Epoch 893/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5351 - acc: 0.7253
Epoch 894/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5398 - acc: 0.7214
Epoch 895/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5443 - acc: 0.7214
Epoch 896/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5382 - acc: 0.7279
Epoch 897/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5468 - acc: 0.7201
Epoch 898/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5491 - acc: 0.7214
Epoch 899/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5451 - acc: 0.7135
Epoch 900/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5386 - acc: 0.7227
Epoch 901/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5397 - acc: 0.7188
Epoch 902/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5381 - acc: 0.7227
Epoch 903/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5479 - acc: 0.7161
Epoch 904/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5489 - acc: 0.7188
Epoch 905/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5448 - acc: 0.7292
Epoch 906/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5470 - acc: 0.7174
Epoch 907/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5428 - acc: 0.7161
Epoch 908/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5422 - acc: 0.7227
Epoch 909/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5423 - acc: 0.7370
Epoch 910/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5433 - acc: 0.7214
Epoch 911/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5435 - acc: 0.7161
Epoch 912/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5414 - acc: 0.7240
Epoch 913/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5397 - acc: 0.7253
Epoch 914/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5357 - acc: 0.7227
Epoch 915/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5423 - acc: 0.7174
Epoch 916/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5442 - acc: 0.7201
Epoch 917/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5444 - acc: 0.7240
Epoch 918/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5406 - acc: 0.7318
Epoch 919/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5500 - acc: 0.7174
Epoch 920/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5525 - acc: 0.7070
Epoch 921/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5604 - acc: 0.6953
Epoch 922/1000
768/768 [==============================] - 0s 92us/step - loss: 0.5573 - acc: 0.7057
Epoch 923/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5566 - acc: 0.7083
Epoch 924/1000
```

```
768/768 [==============================] - 0s 86us/step - loss: 0.5540 - acc: 0.7096
Epoch 925/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5563 - acc: 0.7070
Epoch 926/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5507 - acc: 0.7096
Epoch 927/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5550 - acc: 0.6979
Epoch 928/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5549 - acc: 0.7044
Epoch 929/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5539 - acc: 0.7044
Epoch 930/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5538 - acc: 0.7122
Epoch 931/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5585 - acc: 0.6992
Epoch 932/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5558 - acc: 0.7057
Epoch 933/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5591 - acc: 0.7018
Epoch 934/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5540 - acc: 0.7096
Epoch 935/1000
768/768 [==============================] - 0s 85us/step - loss: 0.5536 - acc: 0.7031
Epoch 936/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5594 - acc: 0.7044
Epoch 937/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5560 - acc: 0.7031
Epoch 938/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5576 - acc: 0.7096
Epoch 939/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5570 - acc: 0.7044
Epoch 940/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5515 - acc: 0.7109
Epoch 941/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5524 - acc: 0.7057
Epoch 942/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5543 - acc: 0.7044
Epoch 943/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5555 - acc: 0.7044
Epoch 944/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5584 - acc: 0.7005
Epoch 945/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5543 - acc: 0.7096
Epoch 946/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5540 - acc: 0.7083
Epoch 947/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5569 - acc: 0.7083
Epoch 948/1000
```

```
768/768 [==============================] - 0s 84us/step - loss: 0.5557 - acc: 0.7044
Epoch 949/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5586 - acc: 0.7083
Epoch 950/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5601 - acc: 0.7018
Epoch 951/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5587 - acc: 0.7031
Epoch 952/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5600 - acc: 0.6966
Epoch 953/1000
768/768 [==============================] - 0s 90us/step - loss: 0.5614 - acc: 0.7018
Epoch 954/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5556 - acc: 0.7057
Epoch 955/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5543 - acc: 0.7018
Epoch 956/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5591 - acc: 0.7044
Epoch 957/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5552 - acc: 0.7083
Epoch 958/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5553 - acc: 0.7031
Epoch 959/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5565 - acc: 0.7031
Epoch 960/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5528 - acc: 0.7096
Epoch 961/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5545 - acc: 0.7057
Epoch 962/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5534 - acc: 0.7044
Epoch 963/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5476 - acc: 0.7148
Epoch 964/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5534 - acc: 0.7057
Epoch 965/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5524 - acc: 0.7057
Epoch 966/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5507 - acc: 0.7057
Epoch 967/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5512 - acc: 0.7109
Epoch 968/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5508 - acc: 0.7057
Epoch 969/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5517 - acc: 0.7109
Epoch 970/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5510 - acc: 0.7057
Epoch 971/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5489 - acc: 0.7096
Epoch 972/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5527 - acc: 0.7083
Epoch 973/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5543 - acc: 0.7096
Epoch 974/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5505 - acc: 0.7083
Epoch 975/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5499 - acc: 0.7018
Epoch 976/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5505 - acc: 0.7070
Epoch 977/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5556 - acc: 0.7031
Epoch 978/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5499 - acc: 0.7057
Epoch 979/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5519 - acc: 0.7031
Epoch 980/1000
768/768 [==============================] - 0s 91us/step - loss: 0.5498 - acc: 0.7109
Epoch 981/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5497 - acc: 0.7057
Epoch 982/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5542 - acc: 0.7031
Epoch 983/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5531 - acc: 0.7083
Epoch 984/1000
768/768 [==============================] - 0s 95us/step - loss: 0.5557 - acc: 0.7005
Epoch 985/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5743 - acc: 0.6875
Epoch 986/1000
768/768 [==============================] - 0s 88us/step - loss: 0.5677 - acc: 0.7005
Epoch 987/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5645 - acc: 0.7096
Epoch 988/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5702 - acc: 0.7018
Epoch 989/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5658 - acc: 0.7227
Epoch 990/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5576 - acc: 0.7266
Epoch 991/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5713 - acc: 0.6979
Epoch 992/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5582 - acc: 0.7240
Epoch 993/1000
768/768 [==============================] - 0s 83us/step - loss: 0.5613 - acc: 0.7122
Epoch 994/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5494 - acc: 0.7227
Epoch 995/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5556 - acc: 0.7148
Epoch 996/1000
```

```
768/768 [==============================] - 0s 87us/step - loss: 0.5485 - acc: 0.7253
Epoch 997/1000
768/768 [==============================] - 0s 84us/step - loss: 0.5626 - acc: 0.6992
Epoch 998/1000
768/768 [==============================] - 0s 87us/step - loss: 0.5499 - acc: 0.7187
Epoch 999/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5431 - acc: 0.7266
Epoch 1000/1000
768/768 [==============================] - 0s 86us/step - loss: 0.5420 - acc: 0.7253
768/768 [==============================] - 4s 5ms/step

acc: 73.18%


In [97]: scores = model.evaluate(X, y)
         scores, model.metrics_names


        ---------------------------------------------------------------------------

        ValueError                                Traceback (most recent call last)

        <ipython-input-97-de45a522aad9> in <module>()
    ----> 1 scores = model.evaluate(X, y)
          2 scores, model.metrics_names


        ~\Anaconda3\lib\site-packages\keras\engine\training.py in evaluate(self, x, y, batch_si
       1100             x, y,
       1101             sample_weight=sample_weight,
    -> 1102             batch_size=batch_size)
       1103         # Prepare inputs, delegate logic to `test_loop`.
       1104         if self._uses_dynamic_learning_phase():


        ~\Anaconda3\lib\site-packages\keras\engine\training.py in _standardize_user_data(self,
        802             ]
        803             # Check that all arrays have the same length.
    --> 804             check_array_length_consistency(x, y, sample_weights)
        805             if self._is_graph_network:
        806                 # Additional checks to avoid users mistakenly


        ~\Anaconda3\lib\site-packages\keras\engine\training_utils.py in check_array_length_cons
        235                          'the same number of samples as target arrays. '
        236                          'Found ' + str(list(set_x)[0]) + ' input samples '
    --> 237                          'and ' + str(list(set_y)[0]) + ' target samples.')
        238     if len(set_w) > 1:
```

```
        239         raise ValueError('All sample_weight arrays should have '

        ValueError: Input arrays should have the same number of samples as target arrays. Found
```

```
In [98]: print(model.predict_proba(X).reshape(4*n))
```

```
        ---------------------------------------------------------------------------

        ValueError                                Traceback (most recent call last)

        <ipython-input-98-16a951889d5d> in <module>()
    ----> 1 print(model.predict_proba(X).reshape(4*n))

        ValueError: cannot reshape array of size 768 into shape (160,)
```