

11-Copy1

November 11, 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 [ ]: # !pip3 install tensorflow keras
```

```
In [1]: 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
```

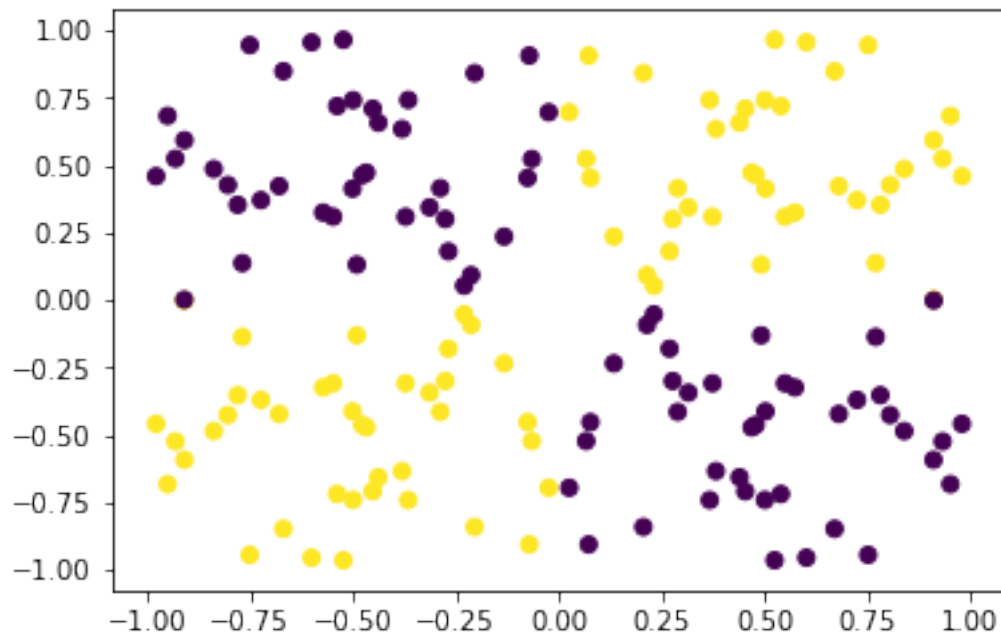
Using TensorFlow backend.

```
In [2]: n = 40
        xx = np.random.random((n,1))
        yy = np.random.random((n,1))

In [3]: 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 [4]: plt.scatter(*zip(*X), c=y)

Out[4]: <matplotlib.collections.PathCollection at 0xb23b8d3c8>
```



```
In [5]: # 1 hidden layer with 2 neurons
        model = Sequential()

        # First layer with 2 neurons, expecting 2 input variables
        model.add(Dense(2, input_dim=2, activation='tanh'))

        # The output has 1 neuron for predicting whatever we are iterating
        model.add(Dense(1, activation='tanh'))

        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))
```

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

```
Epoch 1/400  
160/160 [=====] - 0s 2ms/step - loss: 1.1850  
Epoch 2/400  
160/160 [=====] - 0s 540us/step - loss: 0.6913  
Epoch 3/400  
160/160 [=====] - 0s 571us/step - loss: 0.6310  
Epoch 4/400  
160/160 [=====] - 0s 558us/step - loss: 0.6066  
Epoch 5/400  
160/160 [=====] - 0s 527us/step - loss: 0.5913  
Epoch 6/400  
160/160 [=====] - 0s 1ms/step - loss: 0.5807  
Epoch 7/400  
160/160 [=====] - 0s 621us/step - loss: 0.5622  
Epoch 8/400  
160/160 [=====] - 0s 718us/step - loss: 0.5517  
Epoch 9/400  
160/160 [=====] - 0s 720us/step - loss: 0.5351  
Epoch 10/400  
160/160 [=====] - 0s 605us/step - loss: 0.5172  
Epoch 11/400  
160/160 [=====] - 0s 453us/step - loss: 0.4971  
Epoch 12/400  
160/160 [=====] - 0s 445us/step - loss: 0.4841  
Epoch 13/400  
160/160 [=====] - 0s 529us/step - loss: 0.4630  
Epoch 14/400  
160/160 [=====] - 0s 486us/step - loss: 0.4392  
Epoch 15/400  
160/160 [=====] - 0s 487us/step - loss: 0.4256  
Epoch 16/400  
160/160 [=====] - 0s 517us/step - loss: 0.4095  
Epoch 17/400  
160/160 [=====] - 0s 489us/step - loss: 0.3922  
Epoch 18/400  
160/160 [=====] - 0s 552us/step - loss: 0.3871  
Epoch 19/400  
160/160 [=====] - 0s 520us/step - loss: 0.3792  
Epoch 20/400  
160/160 [=====] - 0s 474us/step - loss: 0.3706  
Epoch 21/400  
160/160 [=====] - 0s 507us/step - loss: 0.3659  
Epoch 22/400
```

```

160/160 [=====] - 0s 565us/step - loss: 0.3586
Epoch 23/400
160/160 [=====] - 0s 700us/step - loss: 0.3548
Epoch 24/400
160/160 [=====] - 0s 598us/step - loss: 0.3501
Epoch 25/400
160/160 [=====] - 0s 578us/step - loss: 0.3458
Epoch 26/400
160/160 [=====] - 0s 486us/step - loss: 0.3498
Epoch 27/400
160/160 [=====] - 0s 506us/step - loss: 0.3385
Epoch 28/400
160/160 [=====] - 0s 451us/step - loss: 0.3422
Epoch 29/400
160/160 [=====] - 0s 508us/step - loss: 0.3436
Epoch 30/400
160/160 [=====] - 0s 547us/step - loss: 0.3396
Epoch 31/400
160/160 [=====] - 0s 557us/step - loss: 0.3375
Epoch 32/400
160/160 [=====] - 0s 582us/step - loss: 0.3531
Epoch 33/400
160/160 [=====] - 0s 646us/step - loss: 0.3456
Epoch 34/400
160/160 [=====] - 0s 692us/step - loss: 0.3401
Epoch 35/400
160/160 [=====] - 0s 824us/step - loss: 0.3342
Epoch 36/400
160/160 [=====] - 0s 678us/step - loss: 0.3378
Epoch 37/400
160/160 [=====] - 0s 746us/step - loss: 0.3306
Epoch 38/400
160/160 [=====] - 0s 514us/step - loss: 0.5345
Epoch 39/400
160/160 [=====] - 0s 484us/step - loss: 1.8789
Epoch 40/400
160/160 [=====] - 0s 602us/step - loss: 1.5351
Epoch 41/400
160/160 [=====] - 0s 580us/step - loss: 1.2554
Epoch 42/400
160/160 [=====] - 0s 603us/step - loss: 0.7448
Epoch 43/400
160/160 [=====] - 0s 555us/step - loss: 0.7018
Epoch 44/400
160/160 [=====] - 0s 512us/step - loss: 0.5037
Epoch 45/400
160/160 [=====] - 0s 512us/step - loss: 0.4695
Epoch 46/400

```

160/160 [=====] - 0s 509us/step - loss: 0.4495
 Epoch 47/400
 160/160 [=====] - 0s 526us/step - loss: 0.4336
 Epoch 48/400
 160/160 [=====] - 0s 587us/step - loss: 0.4153
 Epoch 49/400
 160/160 [=====] - 0s 531us/step - loss: 0.4042
 Epoch 50/400
 160/160 [=====] - 0s 631us/step - loss: 0.4349
 Epoch 51/400
 160/160 [=====] - 0s 590us/step - loss: 0.4171
 Epoch 52/400
 160/160 [=====] - 0s 564us/step - loss: 0.3822
 Epoch 53/400
 160/160 [=====] - 0s 535us/step - loss: 0.3710
 Epoch 54/400
 160/160 [=====] - 0s 674us/step - loss: 0.3634
 Epoch 55/400
 160/160 [=====] - 0s 543us/step - loss: 0.3593
 Epoch 56/400
 160/160 [=====] - 0s 543us/step - loss: 0.3858
 Epoch 57/400
 160/160 [=====] - 0s 537us/step - loss: 0.5168
 Epoch 58/400
 160/160 [=====] - 0s 589us/step - loss: 0.3828
 Epoch 59/400
 160/160 [=====] - 0s 623us/step - loss: 0.3479
 Epoch 60/400
 160/160 [=====] - 0s 602us/step - loss: 0.3511
 Epoch 61/400
 160/160 [=====] - 0s 595us/step - loss: 0.3460
 Epoch 62/400
 160/160 [=====] - 0s 610us/step - loss: 0.3437
 Epoch 63/400
 160/160 [=====] - 0s 672us/step - loss: 0.3423
 Epoch 64/400
 160/160 [=====] - 0s 984us/step - loss: 0.3416
 Epoch 65/400
 160/160 [=====] - 0s 637us/step - loss: 0.3424
 Epoch 66/400
 160/160 [=====] - 0s 530us/step - loss: 0.3385
 Epoch 67/400
 160/160 [=====] - 0s 559us/step - loss: 0.3510
 Epoch 68/400
 160/160 [=====] - 0s 533us/step - loss: 0.3747
 Epoch 69/400
 160/160 [=====] - 0s 637us/step - loss: 0.3455
 Epoch 70/400

```

160/160 [=====] - 0s 594us/step - loss: 0.3392
Epoch 71/400
160/160 [=====] - 0s 512us/step - loss: 0.3437
Epoch 72/400
160/160 [=====] - 0s 510us/step - loss: 0.3474
Epoch 73/400
160/160 [=====] - 0s 505us/step - loss: 0.3430
Epoch 74/400
160/160 [=====] - 0s 535us/step - loss: 0.3451
Epoch 75/400
160/160 [=====] - 0s 619us/step - loss: 0.3371
Epoch 76/400
160/160 [=====] - 0s 518us/step - loss: 0.3498
Epoch 77/400
160/160 [=====] - 0s 540us/step - loss: 0.3490
Epoch 78/400
160/160 [=====] - 0s 521us/step - loss: 0.3384
Epoch 79/400
160/160 [=====] - 0s 521us/step - loss: 0.3413
Epoch 80/400
160/160 [=====] - 0s 488us/step - loss: 0.3393
Epoch 81/400
160/160 [=====] - 0s 503us/step - loss: 0.4178
Epoch 82/400
160/160 [=====] - 0s 567us/step - loss: 0.4174
Epoch 83/400
160/160 [=====] - 0s 504us/step - loss: 0.3922
Epoch 84/400
160/160 [=====] - 0s 510us/step - loss: 0.3372
Epoch 85/400
160/160 [=====] - 0s 497us/step - loss: 0.3392
Epoch 86/400
160/160 [=====] - 0s 550us/step - loss: 0.3370
Epoch 87/400
160/160 [=====] - 0s 729us/step - loss: 0.3647
Epoch 88/400
160/160 [=====] - 0s 617us/step - loss: 0.3415
Epoch 89/400
160/160 [=====] - 0s 586us/step - loss: 0.3375
Epoch 90/400
160/160 [=====] - 0s 532us/step - loss: 0.4200
Epoch 91/400
160/160 [=====] - 0s 563us/step - loss: 0.3648
Epoch 92/400
160/160 [=====] - 0s 601us/step - loss: 0.4203
Epoch 93/400
160/160 [=====] - 0s 1ms/step - loss: 0.3298
Epoch 94/400

```

160/160 [=====] - 0s 550us/step - loss: 0.3927
Epoch 95/400
160/160 [=====] - 0s 512us/step - loss: 0.7723
Epoch 96/400
160/160 [=====] - 0s 494us/step - loss: 0.4991
Epoch 97/400
160/160 [=====] - 0s 487us/step - loss: 0.4267
Epoch 98/400
160/160 [=====] - 0s 524us/step - loss: 0.4072
Epoch 99/400
160/160 [=====] - 0s 597us/step - loss: 0.3665
Epoch 100/400
160/160 [=====] - 0s 491us/step - loss: 0.3385
Epoch 101/400
160/160 [=====] - 0s 506us/step - loss: 0.3428
Epoch 102/400
160/160 [=====] - 0s 574us/step - loss: 0.3354
Epoch 103/400
160/160 [=====] - 0s 641us/step - loss: 0.3438
Epoch 104/400
160/160 [=====] - 0s 606us/step - loss: 0.3325
Epoch 105/400
160/160 [=====] - 0s 604us/step - loss: 0.3381
Epoch 106/400
160/160 [=====] - 0s 740us/step - loss: 0.3361
Epoch 107/400
160/160 [=====] - 0s 587us/step - loss: 0.3277
Epoch 108/400
160/160 [=====] - 0s 502us/step - loss: 0.4165
Epoch 109/400
160/160 [=====] - 0s 531us/step - loss: 0.5022
Epoch 110/400
160/160 [=====] - 0s 566us/step - loss: 0.4040
Epoch 111/400
160/160 [=====] - 0s 579us/step - loss: 0.4248
Epoch 112/400
160/160 [=====] - 0s 576us/step - loss: 0.3654
Epoch 113/400
160/160 [=====] - 0s 553us/step - loss: 0.3385
Epoch 114/400
160/160 [=====] - 0s 489us/step - loss: 0.3367
Epoch 115/400
160/160 [=====] - 0s 541us/step - loss: 0.3399
Epoch 116/400
160/160 [=====] - 0s 533us/step - loss: 0.3339
Epoch 117/400
160/160 [=====] - 0s 581us/step - loss: 0.3340
Epoch 118/400

160/160 [=====] - 0s 545us/step - loss: 0.5551
 Epoch 119/400
 160/160 [=====] - 0s 507us/step - loss: 0.4527
 Epoch 120/400
 160/160 [=====] - 0s 588us/step - loss: 0.3491
 Epoch 121/400
 160/160 [=====] - 0s 532us/step - loss: 0.3458
 Epoch 122/400
 160/160 [=====] - 0s 1ms/step - loss: 0.3482
 Epoch 123/400
 160/160 [=====] - 0s 903us/step - loss: 0.3336
 Epoch 124/400
 160/160 [=====] - 0s 747us/step - loss: 0.3516
 Epoch 125/400
 160/160 [=====] - 0s 698us/step - loss: 0.3401
 Epoch 126/400
 160/160 [=====] - 0s 722us/step - loss: 0.3272
 Epoch 127/400
 160/160 [=====] - 0s 509us/step - loss: 0.3351
 Epoch 128/400
 160/160 [=====] - 0s 583us/step - loss: 0.3352
 Epoch 129/400
 160/160 [=====] - 0s 554us/step - loss: 0.3276
 Epoch 130/400
 160/160 [=====] - 0s 535us/step - loss: 0.3316
 Epoch 131/400
 160/160 [=====] - 0s 532us/step - loss: 0.3280
 Epoch 132/400
 160/160 [=====] - 0s 786us/step - loss: 0.3259
 Epoch 133/400
 160/160 [=====] - 0s 639us/step - loss: 0.3398
 Epoch 134/400
 160/160 [=====] - 0s 554us/step - loss: 0.3262
 Epoch 135/400
 160/160 [=====] - 0s 440us/step - loss: 0.4164
 Epoch 136/400
 160/160 [=====] - 0s 481us/step - loss: 0.3363
 Epoch 137/400
 160/160 [=====] - 0s 467us/step - loss: 0.5082
 Epoch 138/400
 160/160 [=====] - 0s 461us/step - loss: 0.4554
 Epoch 139/400
 160/160 [=====] - 0s 546us/step - loss: 0.3345
 Epoch 140/400
 160/160 [=====] - 0s 594us/step - loss: 0.3375
 Epoch 141/400
 160/160 [=====] - 0s 513us/step - loss: 0.3349
 Epoch 142/400

160/160 [=====] - 0s 686us/step - loss: 0.4269
 Epoch 143/400
 160/160 [=====] - 0s 824us/step - loss: 0.3561
 Epoch 144/400
 160/160 [=====] - 0s 626us/step - loss: 0.3354
 Epoch 145/400
 160/160 [=====] - 0s 1ms/step - loss: 0.8577
 Epoch 146/400
 160/160 [=====] - 0s 844us/step - loss: 1.6443
 Epoch 147/400
 160/160 [=====] - 0s 1ms/step - loss: 1.3454
 Epoch 148/400
 160/160 [=====] - 0s 727us/step - loss: 0.9782
 Epoch 149/400
 160/160 [=====] - 0s 863us/step - loss: 0.7597
 Epoch 150/400
 160/160 [=====] - 0s 556us/step - loss: 0.5525
 Epoch 151/400
 160/160 [=====] - 0s 556us/step - loss: 0.4029
 Epoch 152/400
 160/160 [=====] - 0s 546us/step - loss: 0.3876
 Epoch 153/400
 160/160 [=====] - 0s 539us/step - loss: 0.3787
 Epoch 154/400
 160/160 [=====] - 0s 548us/step - loss: 0.3684
 Epoch 155/400
 160/160 [=====] - 0s 534us/step - loss: 0.3624
 Epoch 156/400
 160/160 [=====] - 0s 490us/step - loss: 0.3548
 Epoch 157/400
 160/160 [=====] - 0s 598us/step - loss: 0.3546
 Epoch 158/400
 160/160 [=====] - 0s 577us/step - loss: 0.3480
 Epoch 159/400
 160/160 [=====] - 0s 489us/step - loss: 0.3473
 Epoch 160/400
 160/160 [=====] - 0s 491us/step - loss: 0.3415
 Epoch 161/400
 160/160 [=====] - 0s 497us/step - loss: 0.3435
 Epoch 162/400
 160/160 [=====] - 0s 608us/step - loss: 0.3378
 Epoch 163/400
 160/160 [=====] - 0s 598us/step - loss: 0.3366
 Epoch 164/400
 160/160 [=====] - 0s 628us/step - loss: 0.3387
 Epoch 165/400
 160/160 [=====] - 0s 561us/step - loss: 0.3365
 Epoch 166/400

```

160/160 [=====] - 0s 704us/step - loss: 0.3389
Epoch 167/400
160/160 [=====] - 0s 569us/step - loss: 0.3360
Epoch 168/400
160/160 [=====] - 0s 547us/step - loss: 0.3296
Epoch 169/400
160/160 [=====] - 0s 767us/step - loss: 0.3441
Epoch 170/400
160/160 [=====] - 0s 591us/step - loss: 0.3362
Epoch 171/400
160/160 [=====] - 0s 609us/step - loss: 0.3321
Epoch 172/400
160/160 [=====] - 0s 609us/step - loss: 0.3414
Epoch 173/400
160/160 [=====] - 0s 862us/step - loss: 0.3297
Epoch 174/400
160/160 [=====] - 0s 1ms/step - loss: 0.5092
Epoch 175/400
160/160 [=====] - 0s 1ms/step - loss: 0.4744
Epoch 176/400
160/160 [=====] - 0s 1ms/step - loss: 0.3422
Epoch 177/400
160/160 [=====] - 0s 1ms/step - loss: 0.3384
Epoch 178/400
160/160 [=====] - 0s 757us/step - loss: 0.3364
Epoch 179/400
160/160 [=====] - 0s 788us/step - loss: 0.3358
Epoch 180/400
160/160 [=====] - 0s 605us/step - loss: 0.3960
Epoch 181/400
160/160 [=====] - 0s 726us/step - loss: 0.3387
Epoch 182/400
160/160 [=====] - 0s 708us/step - loss: 0.3409
Epoch 183/400
160/160 [=====] - 0s 670us/step - loss: 0.3294
Epoch 184/400
160/160 [=====] - 0s 475us/step - loss: 0.3310
Epoch 185/400
160/160 [=====] - 0s 507us/step - loss: 0.4880
Epoch 186/400
160/160 [=====] - 0s 532us/step - loss: 0.5454
Epoch 187/400
160/160 [=====] - 0s 582us/step - loss: 0.3755
Epoch 188/400
160/160 [=====] - 0s 523us/step - loss: 0.3345
Epoch 189/400
160/160 [=====] - 0s 484us/step - loss: 0.3272
Epoch 190/400

```

160/160 [=====] - 0s 503us/step - loss: 0.3476
Epoch 191/400
160/160 [=====] - 0s 532us/step - loss: 0.3314
Epoch 192/400
160/160 [=====] - 0s 509us/step - loss: 0.3360
Epoch 193/400
160/160 [=====] - 0s 492us/step - loss: 0.3270
Epoch 194/400
160/160 [=====] - 0s 510us/step - loss: 0.3338
Epoch 195/400
160/160 [=====] - 0s 465us/step - loss: 0.3289
Epoch 196/400
160/160 [=====] - 0s 482us/step - loss: 0.4253
Epoch 197/400
160/160 [=====] - 0s 461us/step - loss: 1.0418
Epoch 198/400
160/160 [=====] - 0s 458us/step - loss: 0.5775
Epoch 199/400
160/160 [=====] - 0s 481us/step - loss: 0.3934
Epoch 200/400
160/160 [=====] - 0s 490us/step - loss: 0.3543
Epoch 201/400
160/160 [=====] - 0s 510us/step - loss: 0.3467
Epoch 202/400
160/160 [=====] - 0s 497us/step - loss: 0.3434
Epoch 203/400
160/160 [=====] - 0s 593us/step - loss: 0.3374
Epoch 204/400
160/160 [=====] - 0s 582us/step - loss: 0.3345
Epoch 205/400
160/160 [=====] - 0s 526us/step - loss: 0.3332
Epoch 206/400
160/160 [=====] - 0s 534us/step - loss: 0.3344
Epoch 207/400
160/160 [=====] - 0s 466us/step - loss: 0.3328
Epoch 208/400
160/160 [=====] - 0s 508us/step - loss: 0.3371
Epoch 209/400
160/160 [=====] - 0s 508us/step - loss: 0.3309
Epoch 210/400
160/160 [=====] - 0s 531us/step - loss: 0.3336
Epoch 211/400
160/160 [=====] - 0s 511us/step - loss: 0.3323
Epoch 212/400
160/160 [=====] - 0s 521us/step - loss: 0.3329
Epoch 213/400
160/160 [=====] - 0s 490us/step - loss: 0.3283
Epoch 214/400

160/160 [=====] - 0s 450us/step - loss: 0.3380
 Epoch 215/400
 160/160 [=====] - 0s 462us/step - loss: 0.3304
 Epoch 216/400
 160/160 [=====] - 0s 468us/step - loss: 0.3297
 Epoch 217/400
 160/160 [=====] - 0s 507us/step - loss: 0.7680
 Epoch 218/400
 160/160 [=====] - 0s 470us/step - loss: 1.6226
 Epoch 219/400
 160/160 [=====] - 0s 467us/step - loss: 1.2251
 Epoch 220/400
 160/160 [=====] - 0s 461us/step - loss: 0.9308
 Epoch 221/400
 160/160 [=====] - 0s 750us/step - loss: 0.7372
 Epoch 222/400
 160/160 [=====] - 0s 690us/step - loss: 0.5467
 Epoch 223/400
 160/160 [=====] - 0s 564us/step - loss: 0.4077
 Epoch 224/400
 160/160 [=====] - 0s 498us/step - loss: 0.3865
 Epoch 225/400
 160/160 [=====] - 0s 491us/step - loss: 0.3781
 Epoch 226/400
 160/160 [=====] - 0s 527us/step - loss: 0.3688
 Epoch 227/400
 160/160 [=====] - 0s 577us/step - loss: 0.3657
 Epoch 228/400
 160/160 [=====] - 0s 520us/step - loss: 0.3517
 Epoch 229/400
 160/160 [=====] - 0s 452us/step - loss: 0.3492
 Epoch 230/400
 160/160 [=====] - 0s 469us/step - loss: 0.3465
 Epoch 231/400
 160/160 [=====] - 0s 461us/step - loss: 0.3379
 Epoch 232/400
 160/160 [=====] - 0s 623us/step - loss: 0.3411
 Epoch 233/400
 160/160 [=====] - 0s 602us/step - loss: 0.3393
 Epoch 234/400
 160/160 [=====] - 0s 525us/step - loss: 0.3327
 Epoch 235/400
 160/160 [=====] - 0s 462us/step - loss: 0.3364
 Epoch 236/400
 160/160 [=====] - 0s 594us/step - loss: 0.4596
 Epoch 237/400
 160/160 [=====] - 0s 501us/step - loss: 0.6794
 Epoch 238/400

160/160 [=====] - 0s 516us/step - loss: 0.4066
Epoch 239/400
160/160 [=====] - 0s 553us/step - loss: 0.3510
Epoch 240/400
160/160 [=====] - 0s 612us/step - loss: 0.3447
Epoch 241/400
160/160 [=====] - 0s 480us/step - loss: 0.3404
Epoch 242/400
160/160 [=====] - 0s 468us/step - loss: 0.3389
Epoch 243/400
160/160 [=====] - 0s 629us/step - loss: 0.3383
Epoch 244/400
160/160 [=====] - 0s 827us/step - loss: 0.3324
Epoch 245/400
160/160 [=====] - 0s 626us/step - loss: 0.3347
Epoch 246/400
160/160 [=====] - 0s 582us/step - loss: 0.3389
Epoch 247/400
160/160 [=====] - 0s 628us/step - loss: 0.3342
Epoch 248/400
160/160 [=====] - 0s 540us/step - loss: 0.3370
Epoch 249/400
160/160 [=====] - 0s 461us/step - loss: 0.3411
Epoch 250/400
160/160 [=====] - 0s 774us/step - loss: 0.3353
Epoch 251/400
160/160 [=====] - 0s 549us/step - loss: 0.3317
Epoch 252/400
160/160 [=====] - 0s 478us/step - loss: 0.3268
Epoch 253/400
160/160 [=====] - 0s 504us/step - loss: 0.3297
Epoch 254/400
160/160 [=====] - 0s 529us/step - loss: 0.3325
Epoch 255/400
160/160 [=====] - 0s 592us/step - loss: 0.3353
Epoch 256/400
160/160 [=====] - 0s 686us/step - loss: 0.3322
Epoch 257/400
160/160 [=====] - 0s 479us/step - loss: 0.3320
Epoch 258/400
160/160 [=====] - 0s 457us/step - loss: 0.3281
Epoch 259/400
160/160 [=====] - 0s 459us/step - loss: 0.3295
Epoch 260/400
160/160 [=====] - 0s 516us/step - loss: 0.3431
Epoch 261/400
160/160 [=====] - 0s 469us/step - loss: 0.3353
Epoch 262/400

160/160 [=====] - 0s 618us/step - loss: 0.4109
Epoch 263/400
160/160 [=====] - 0s 529us/step - loss: 0.3924
Epoch 264/400
160/160 [=====] - 0s 500us/step - loss: 0.3486
Epoch 265/400
160/160 [=====] - 0s 713us/step - loss: 0.3312
Epoch 266/400
160/160 [=====] - 0s 897us/step - loss: 0.3309
Epoch 267/400
160/160 [=====] - 0s 775us/step - loss: 0.3409
Epoch 268/400
160/160 [=====] - 0s 512us/step - loss: 0.3270
Epoch 269/400
160/160 [=====] - 0s 514us/step - loss: 0.3423
Epoch 270/400
160/160 [=====] - 0s 495us/step - loss: 0.3338
Epoch 271/400
160/160 [=====] - 0s 549us/step - loss: 0.3338
Epoch 272/400
160/160 [=====] - 0s 555us/step - loss: 0.4161
Epoch 273/400
160/160 [=====] - 0s 782us/step - loss: 0.4302
Epoch 274/400
160/160 [=====] - 0s 586us/step - loss: 0.3674
Epoch 275/400
160/160 [=====] - 0s 803us/step - loss: 0.3412
Epoch 276/400
160/160 [=====] - 0s 804us/step - loss: 0.3294
Epoch 277/400
160/160 [=====] - 0s 750us/step - loss: 0.3311
Epoch 278/400
160/160 [=====] - 0s 810us/step - loss: 0.3287
Epoch 279/400
160/160 [=====] - 0s 626us/step - loss: 0.3347
Epoch 280/400
160/160 [=====] - 0s 714us/step - loss: 0.3273
Epoch 281/400
160/160 [=====] - 0s 591us/step - loss: 0.3268
Epoch 282/400
160/160 [=====] - 0s 728us/step - loss: 0.3279
Epoch 283/400
160/160 [=====] - 0s 619us/step - loss: 0.3264
Epoch 284/400
160/160 [=====] - 0s 632us/step - loss: 0.4096
Epoch 285/400
160/160 [=====] - 0s 801us/step - loss: 0.3349
Epoch 286/400

160/160 [=====] - 0s 2ms/step - loss: 0.4077
Epoch 287/400
160/160 [=====] - 0s 1ms/step - loss: 0.4647
Epoch 288/400
160/160 [=====] - 0s 2ms/step - loss: 0.3305
Epoch 289/400
160/160 [=====] - 0s 1ms/step - loss: 0.3394
Epoch 290/400
160/160 [=====] - 0s 969us/step - loss: 0.3302
Epoch 291/400
160/160 [=====] - 0s 877us/step - loss: 0.3368
Epoch 292/400
160/160 [=====] - 0s 897us/step - loss: 0.3240
Epoch 293/400
160/160 [=====] - 0s 1ms/step - loss: 0.3400
Epoch 294/400
160/160 [=====] - 0s 1ms/step - loss: 0.3297
Epoch 295/400
160/160 [=====] - 0s 1ms/step - loss: 0.3177
Epoch 296/400
160/160 [=====] - 0s 1ms/step - loss: 0.3292
Epoch 297/400
160/160 [=====] - 0s 1ms/step - loss: 0.3284
Epoch 298/400
160/160 [=====] - 0s 1ms/step - loss: 0.3406
Epoch 299/400
160/160 [=====] - 0s 1ms/step - loss: 0.3391
Epoch 300/400
160/160 [=====] - 0s 946us/step - loss: 0.4140
Epoch 301/400
160/160 [=====] - 0s 887us/step - loss: 0.3204
Epoch 302/400
160/160 [=====] - 0s 912us/step - loss: 0.3476
Epoch 303/400
160/160 [=====] - 0s 997us/step - loss: 0.4107
Epoch 304/400
160/160 [=====] - 0s 890us/step - loss: 0.3279
Epoch 305/400
160/160 [=====] - 0s 941us/step - loss: 0.3345
Epoch 306/400
160/160 [=====] - 0s 1ms/step - loss: 0.3402
Epoch 307/400
160/160 [=====] - 0s 1ms/step - loss: 0.3301
Epoch 308/400
160/160 [=====] - 0s 1ms/step - loss: 0.3275
Epoch 309/400
160/160 [=====] - 0s 1ms/step - loss: 0.3258
Epoch 310/400

160/160 [=====] - 0s 1ms/step - loss: 0.3202
Epoch 311/400
160/160 [=====] - 0s 1ms/step - loss: 0.4117
Epoch 312/400
160/160 [=====] - 0s 1ms/step - loss: 0.3391
Epoch 313/400
160/160 [=====] - 0s 933us/step - loss: 0.3354
Epoch 314/400
160/160 [=====] - 0s 1ms/step - loss: 0.9816
Epoch 315/400
160/160 [=====] - 0s 1ms/step - loss: 0.6986
Epoch 316/400
160/160 [=====] - 0s 970us/step - loss: 0.3579
Epoch 317/400
160/160 [=====] - 0s 938us/step - loss: 0.3781
Epoch 318/400
160/160 [=====] - 0s 1ms/step - loss: 0.5014
Epoch 319/400
160/160 [=====] - 0s 933us/step - loss: 0.4002
Epoch 320/400
160/160 [=====] - 0s 960us/step - loss: 0.3597
Epoch 321/400
160/160 [=====] - 0s 2ms/step - loss: 0.3310
Epoch 322/400
160/160 [=====] - 0s 1ms/step - loss: 0.3366
Epoch 323/400
160/160 [=====] - 0s 3ms/step - loss: 0.3310
Epoch 324/400
160/160 [=====] - 0s 1ms/step - loss: 0.3221
Epoch 325/400
160/160 [=====] - 0s 1ms/step - loss: 0.3272
Epoch 326/400
160/160 [=====] - 0s 918us/step - loss: 0.3278
Epoch 327/400
160/160 [=====] - 0s 928us/step - loss: 0.3502
Epoch 328/400
160/160 [=====] - 0s 1ms/step - loss: 0.3206
Epoch 329/400
160/160 [=====] - 0s 908us/step - loss: 0.5089
Epoch 330/400
160/160 [=====] - 0s 854us/step - loss: 0.5048
Epoch 331/400
160/160 [=====] - 0s 939us/step - loss: 0.4240
Epoch 332/400
160/160 [=====] - 0s 1ms/step - loss: 0.4616
Epoch 333/400
160/160 [=====] - 0s 851us/step - loss: 0.3279
Epoch 334/400

160/160 [=====] - 0s 960us/step - loss: 0.4081
Epoch 335/400
160/160 [=====] - 0s 1ms/step - loss: 0.3381
Epoch 336/400
160/160 [=====] - 0s 914us/step - loss: 0.3284
Epoch 337/400
160/160 [=====] - 0s 850us/step - loss: 0.3281
Epoch 338/400
160/160 [=====] - 0s 2ms/step - loss: 0.4071
Epoch 339/400
160/160 [=====] - 0s 1ms/step - loss: 0.3262
Epoch 340/400
160/160 [=====] - 0s 1ms/step - loss: 0.3451
Epoch 341/400
160/160 [=====] - 0s 1ms/step - loss: 0.3276
Epoch 342/400
160/160 [=====] - 0s 963us/step - loss: 0.3265
Epoch 343/400
160/160 [=====] - 0s 902us/step - loss: 0.4148
Epoch 344/400
160/160 [=====] - 0s 877us/step - loss: 0.3605
Epoch 345/400
160/160 [=====] - 0s 875us/step - loss: 0.3324
Epoch 346/400
160/160 [=====] - 0s 965us/step - loss: 0.3307
Epoch 347/400
160/160 [=====] - 0s 897us/step - loss: 0.3247
Epoch 348/400
160/160 [=====] - 0s 809us/step - loss: 0.3194
Epoch 349/400
160/160 [=====] - 0s 1ms/step - loss: 0.3371
Epoch 350/400
160/160 [=====] - 0s 800us/step - loss: 0.3344
Epoch 351/400
160/160 [=====] - 0s 949us/step - loss: 0.3218
Epoch 352/400
160/160 [=====] - 0s 1ms/step - loss: 0.3248
Epoch 353/400
160/160 [=====] - 0s 849us/step - loss: 0.3356
Epoch 354/400
160/160 [=====] - 0s 965us/step - loss: 0.3163
Epoch 355/400
160/160 [=====] - 0s 861us/step - loss: 0.3561
Epoch 356/400
160/160 [=====] - 0s 905us/step - loss: 0.3308
Epoch 357/400
160/160 [=====] - 0s 959us/step - loss: 0.3232
Epoch 358/400

160/160 [=====] - 0s 1ms/step - loss: 0.3312
Epoch 359/400
160/160 [=====] - 0s 1ms/step - loss: 0.3304
Epoch 360/400
160/160 [=====] - 0s 1ms/step - loss: 0.3288
Epoch 361/400
160/160 [=====] - 0s 951us/step - loss: 0.3352
Epoch 362/400
160/160 [=====] - 0s 893us/step - loss: 0.3191
Epoch 363/400
160/160 [=====] - 0s 901us/step - loss: 0.3273
Epoch 364/400
160/160 [=====] - 0s 900us/step - loss: 0.3339
Epoch 365/400
160/160 [=====] - 0s 893us/step - loss: 0.3315
Epoch 366/400
160/160 [=====] - 0s 853us/step - loss: 0.4379
Epoch 367/400
160/160 [=====] - 0s 961us/step - loss: 0.3354
Epoch 368/400
160/160 [=====] - 0s 979us/step - loss: 0.3325
Epoch 369/400
160/160 [=====] - 0s 910us/step - loss: 0.3196
Epoch 370/400
160/160 [=====] - 0s 724us/step - loss: 0.4015
Epoch 371/400
160/160 [=====] - 0s 631us/step - loss: 0.3386
Epoch 372/400
160/160 [=====] - 0s 625us/step - loss: 0.4983
Epoch 373/400
160/160 [=====] - 0s 797us/step - loss: 0.8925
Epoch 374/400
160/160 [=====] - 0s 722us/step - loss: 0.7350
Epoch 375/400
160/160 [=====] - 0s 615us/step - loss: 0.4005
Epoch 376/400
160/160 [=====] - 0s 771us/step - loss: 0.3415
Epoch 377/400
160/160 [=====] - 0s 663us/step - loss: 0.3498
Epoch 378/400
160/160 [=====] - 0s 613us/step - loss: 0.3281
Epoch 379/400
160/160 [=====] - 0s 605us/step - loss: 0.3233
Epoch 380/400
160/160 [=====] - 0s 595us/step - loss: 0.3265
Epoch 381/400
160/160 [=====] - 0s 824us/step - loss: 0.3299
Epoch 382/400

```

160/160 [=====] - 0s 805us/step - loss: 0.3260
Epoch 383/400
160/160 [=====] - 0s 756us/step - loss: 0.3166
Epoch 384/400
160/160 [=====] - 0s 742us/step - loss: 0.4204
Epoch 385/400
160/160 [=====] - 0s 813us/step - loss: 0.3319
Epoch 386/400
160/160 [=====] - 0s 786us/step - loss: 0.3272
Epoch 387/400
160/160 [=====] - 0s 954us/step - loss: 0.3200
Epoch 388/400
160/160 [=====] - 0s 846us/step - loss: 0.3285
Epoch 389/400
160/160 [=====] - 0s 799us/step - loss: 0.3442
Epoch 390/400
160/160 [=====] - 0s 750us/step - loss: 0.3206
Epoch 391/400
160/160 [=====] - 0s 787us/step - loss: 0.3246
Epoch 392/400
160/160 [=====] - 0s 617us/step - loss: 0.3484
Epoch 393/400
160/160 [=====] - 0s 614us/step - loss: 0.3418
Epoch 394/400
160/160 [=====] - 0s 614us/step - loss: 0.3255
Epoch 395/400
160/160 [=====] - 0s 649us/step - loss: 0.3310
Epoch 396/400
160/160 [=====] - 0s 812us/step - loss: 0.3685
Epoch 397/400
160/160 [=====] - 0s 740us/step - loss: 0.3448
Epoch 398/400
160/160 [=====] - 0s 728us/step - loss: 0.4432
Epoch 399/400
160/160 [=====] - 0s 848us/step - loss: 0.5820
Epoch 400/400
160/160 [=====] - 0s 682us/step - loss: 0.3458
[ 0.85152465  0.8011812  0.91846204  0.8543261  0.7002266  0.9262276
  0.9337925  0.2831255  0.9350613  0.91370237  0.8984664  0.8369166
  0.90943485  0.7900678  0.9325074  0.20157652  0.9322451  0.90901244
  0.8111198  0.5154746  0.8736347  0.8896887  0.9242226  0.90599746
  0.8688911  0.93458015  0.8168392  0.92499167  0.92704487  0.9383813
  0.5767225  0.8573127  0.9362984  0.93805224  0.85792565  0.8515462
  0.5680492  0.93847764  0.90304697  0.9385974  0.86380243  0.7901943
  0.9232736  0.8487144  0.6811263  0.9302752  0.9344613  0.34392583
  0.9350074  0.91949564  0.89694715  0.8302629  0.9153064  0.81112134
  0.9347389  0.16065606  0.93162954  0.9152921  0.8032351  0.56794393
  0.88648725  0.88931936  0.92276305  0.90435207  0.86648303  0.9360006

```

```

0.838678    0.9300259    0.93144155    0.9397373    0.62710834    0.84971887
0.93679756    0.93927777    0.87161225    0.8467995    0.5321193    0.9396235
0.90126663    0.93958944    0.7083095    0.01336416    0.03678656    0.03253674
-0.06173114 -0.02637831    0.16916637    0.12455824    0.78663933 -0.02133875
0.02944576 -0.02137891    0.08737936    0.63118255    0.45051542    0.15793374
0.8836497    0.00638659 -0.06360736    0.43763372 -0.07152975 -0.07696892
0.89265025    0.2279723    -0.06804587    0.8521119    -0.0654873    -0.0794006
-0.06865966    0.14570485    0.07059997    0.561766    0.4790306    0.14509702
0.03201324 -0.04384037    0.16814138    0.5178657    0.1837452    0.6379067
0.73861444    0.04184511    0.07123892    0.0641474    -0.04833096 -0.00361734
0.21618474    0.17368643    0.8042124    0.00263635    0.06096653    0.00119178
0.12892468    0.6709168    0.50116646    0.19872037    0.889498    0.03585641
-0.05059907    0.49409214 -0.06027626 -0.06782065    0.897342    0.27688128
-0.05619352    0.8625286    -0.05227845 -0.07091776 -0.05662345    0.19161566
0.11188975    0.6006018    0.52635944    0.19083615    0.0663162    -0.02591382
0.2113638    0.5636266    0.23053685    0.67326885]
160/160 [=====] - 0s 334us/step

```

```

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '

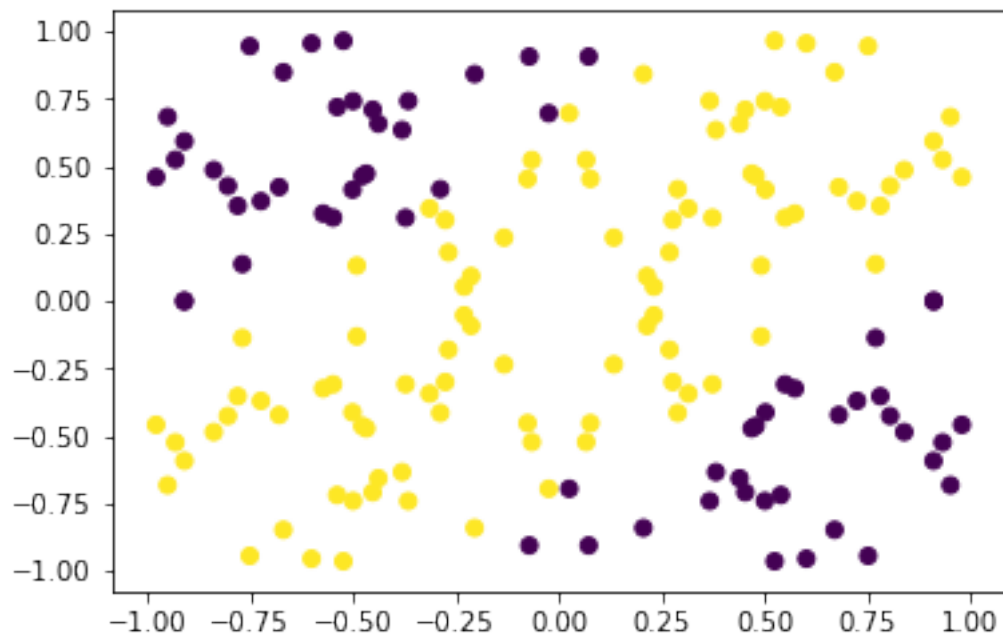
```

```
In [6]: scores, model.metrics_names
```

```
Out[6]: (0.3242959648370743, ['loss'])
```

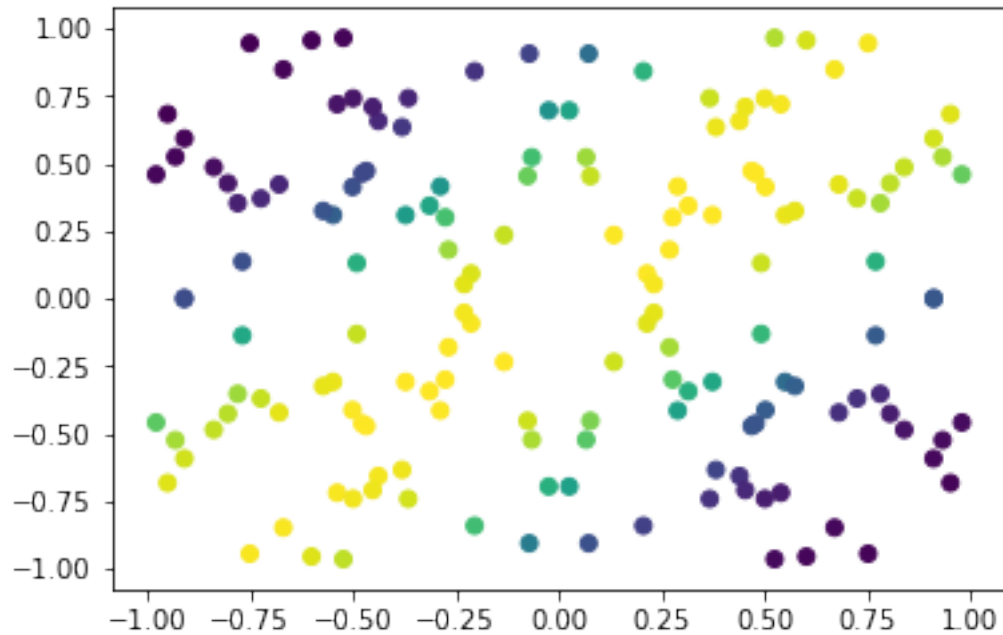
```
In [7]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[7]: <matplotlib.collections.PathCollection at 0xb23fcc0b8>
```



```
In [8]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[8]: <matplotlib.collections.PathCollection at 0xb2408f9e8>
```



```
In [9]: # 2 hidden layer with 2 neurons. A pretty much a copy and paste
model = Sequential()

model.add(Dense(2, input_dim=2, activation='tanh'))
model.add(Dense(2, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

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

Epoch 1/400

160/160 [=====] - 0s 3ms/step - loss: 4.3467

Epoch 2/400
160/160 [=====] - 0s 781us/step - loss: 4.3077
Epoch 3/400
160/160 [=====] - 0s 773us/step - loss: 4.2750
Epoch 4/400
160/160 [=====] - 0s 785us/step - loss: 4.2425
Epoch 5/400
160/160 [=====] - 0s 742us/step - loss: 4.2370
Epoch 6/400
160/160 [=====] - 0s 755us/step - loss: 4.2260
Epoch 7/400
160/160 [=====] - 0s 707us/step - loss: 4.2233
Epoch 8/400
160/160 [=====] - 0s 598us/step - loss: 4.2224
Epoch 9/400
160/160 [=====] - 0s 663us/step - loss: 4.2097
Epoch 10/400
160/160 [=====] - 0s 621us/step - loss: 4.2087
Epoch 11/400
160/160 [=====] - 0s 635us/step - loss: 4.2157
Epoch 12/400
160/160 [=====] - 0s 760us/step - loss: 4.2042
Epoch 13/400
160/160 [=====] - 0s 633us/step - loss: 4.2987
Epoch 14/400
160/160 [=====] - 0s 675us/step - loss: 4.2289
Epoch 15/400
160/160 [=====] - 0s 723us/step - loss: 4.2032
Epoch 16/400
160/160 [=====] - 0s 623us/step - loss: 4.3624
Epoch 17/400
160/160 [=====] - 0s 816us/step - loss: 4.1923
Epoch 18/400
160/160 [=====] - 0s 646us/step - loss: 4.2455
Epoch 19/400
160/160 [=====] - 0s 618us/step - loss: 4.1877
Epoch 20/400
160/160 [=====] - 0s 732us/step - loss: 4.2733
Epoch 21/400
160/160 [=====] - 0s 721us/step - loss: 4.3049
Epoch 22/400
160/160 [=====] - 0s 856us/step - loss: 4.1872
Epoch 23/400
160/160 [=====] - 0s 695us/step - loss: 4.3713
Epoch 24/400
160/160 [=====] - 0s 668us/step - loss: 4.2262
Epoch 25/400
160/160 [=====] - 0s 779us/step - loss: 4.2180

Epoch 26/400
160/160 [=====] - 0s 889us/step - loss: 3.3990
Epoch 27/400
160/160 [=====] - 0s 879us/step - loss: 1.2536
Epoch 28/400
160/160 [=====] - 0s 868us/step - loss: 0.7217
Epoch 29/400
160/160 [=====] - 0s 765us/step - loss: 0.7064
Epoch 30/400
160/160 [=====] - 0s 851us/step - loss: 0.6875
Epoch 31/400
160/160 [=====] - 0s 788us/step - loss: 0.6766
Epoch 32/400
160/160 [=====] - 0s 718us/step - loss: 0.6663
Epoch 33/400
160/160 [=====] - 0s 581us/step - loss: 0.6587
Epoch 34/400
160/160 [=====] - 0s 612us/step - loss: 0.6483
Epoch 35/400
160/160 [=====] - 0s 716us/step - loss: 0.6408
Epoch 36/400
160/160 [=====] - 0s 594us/step - loss: 0.6322
Epoch 37/400
160/160 [=====] - 0s 854us/step - loss: 0.6246
Epoch 38/400
160/160 [=====] - 0s 897us/step - loss: 0.6263
Epoch 39/400
160/160 [=====] - 0s 778us/step - loss: 0.6190
Epoch 40/400
160/160 [=====] - 0s 843us/step - loss: 0.6145
Epoch 41/400
160/160 [=====] - 0s 938us/step - loss: 0.6187
Epoch 42/400
160/160 [=====] - 0s 875us/step - loss: 0.6126
Epoch 43/400
160/160 [=====] - 0s 860us/step - loss: 0.6062
Epoch 44/400
160/160 [=====] - 0s 768us/step - loss: 0.6088
Epoch 45/400
160/160 [=====] - 0s 777us/step - loss: 0.6034
Epoch 46/400
160/160 [=====] - 0s 840us/step - loss: 0.6082
Epoch 47/400
160/160 [=====] - 0s 825us/step - loss: 0.6066
Epoch 48/400
160/160 [=====] - 0s 832us/step - loss: 0.5839
Epoch 49/400
160/160 [=====] - 0s 785us/step - loss: 0.6107

Epoch 50/400
160/160 [=====] - 0s 829us/step - loss: 0.5956
Epoch 51/400
160/160 [=====] - 0s 791us/step - loss: 0.6010
Epoch 52/400
160/160 [=====] - 0s 750us/step - loss: 0.5961
Epoch 53/400
160/160 [=====] - 0s 829us/step - loss: 0.5961
Epoch 54/400
160/160 [=====] - 0s 701us/step - loss: 0.5992
Epoch 55/400
160/160 [=====] - 0s 593us/step - loss: 0.5889
Epoch 56/400
160/160 [=====] - 0s 576us/step - loss: 0.5941
Epoch 57/400
160/160 [=====] - 0s 570us/step - loss: 0.5815
Epoch 58/400
160/160 [=====] - 0s 557us/step - loss: 0.5912
Epoch 59/400
160/160 [=====] - 0s 560us/step - loss: 0.5828
Epoch 60/400
160/160 [=====] - 0s 755us/step - loss: 0.5782
Epoch 61/400
160/160 [=====] - 0s 765us/step - loss: 0.5831
Epoch 62/400
160/160 [=====] - 0s 774us/step - loss: 0.5847
Epoch 63/400
160/160 [=====] - 0s 797us/step - loss: 0.5825
Epoch 64/400
160/160 [=====] - 0s 706us/step - loss: 0.5831
Epoch 65/400
160/160 [=====] - 0s 898us/step - loss: 0.5733
Epoch 66/400
160/160 [=====] - 0s 814us/step - loss: 0.5691
Epoch 67/400
160/160 [=====] - 0s 803us/step - loss: 0.5612
Epoch 68/400
160/160 [=====] - 0s 806us/step - loss: 0.5455
Epoch 69/400
160/160 [=====] - 0s 873us/step - loss: 0.5298
Epoch 70/400
160/160 [=====] - 0s 882us/step - loss: 0.5067
Epoch 71/400
160/160 [=====] - 0s 811us/step - loss: 0.4755
Epoch 72/400
160/160 [=====] - 0s 772us/step - loss: 0.4777
Epoch 73/400
160/160 [=====] - 0s 639us/step - loss: 0.4463

Epoch 74/400
160/160 [=====] - 0s 614us/step - loss: 0.4924
Epoch 75/400
160/160 [=====] - 0s 603us/step - loss: 0.4271
Epoch 76/400
160/160 [=====] - 0s 650us/step - loss: 0.4797
Epoch 77/400
160/160 [=====] - 0s 639us/step - loss: 0.4587
Epoch 78/400
160/160 [=====] - 0s 630us/step - loss: 0.7063
Epoch 79/400
160/160 [=====] - 0s 616us/step - loss: 0.8196
Epoch 80/400
160/160 [=====] - 0s 698us/step - loss: 1.0028
Epoch 81/400
160/160 [=====] - 0s 660us/step - loss: 0.4717
Epoch 82/400
160/160 [=====] - 0s 688us/step - loss: 0.3902
Epoch 83/400
160/160 [=====] - 0s 614us/step - loss: 0.3534
Epoch 84/400
160/160 [=====] - 0s 592us/step - loss: 0.4437
Epoch 85/400
160/160 [=====] - 0s 610us/step - loss: 0.6839
Epoch 86/400
160/160 [=====] - 0s 590us/step - loss: 0.5310
Epoch 87/400
160/160 [=====] - 0s 573us/step - loss: 0.4727
Epoch 88/400
160/160 [=====] - 0s 607us/step - loss: 0.4668
Epoch 89/400
160/160 [=====] - 0s 602us/step - loss: 0.4520
Epoch 90/400
160/160 [=====] - 0s 624us/step - loss: 0.3325
Epoch 91/400
160/160 [=====] - 0s 629us/step - loss: 0.6449
Epoch 92/400
160/160 [=====] - 0s 598us/step - loss: 0.5241
Epoch 93/400
160/160 [=====] - 0s 560us/step - loss: 0.3712
Epoch 94/400
160/160 [=====] - 0s 568us/step - loss: 0.5505
Epoch 95/400
160/160 [=====] - 0s 593us/step - loss: 0.3601
Epoch 96/400
160/160 [=====] - 0s 602us/step - loss: 0.5557
Epoch 97/400
160/160 [=====] - 0s 622us/step - loss: 0.5448

Epoch 98/400
160/160 [=====] - 0s 627us/step - loss: 0.3523
Epoch 99/400
160/160 [=====] - 0s 610us/step - loss: 0.4447
Epoch 100/400
160/160 [=====] - 0s 608us/step - loss: 0.3420
Epoch 101/400
160/160 [=====] - 0s 592us/step - loss: 0.6070
Epoch 102/400
160/160 [=====] - 0s 625us/step - loss: 0.3561
Epoch 103/400
160/160 [=====] - 0s 741us/step - loss: 0.3700
Epoch 104/400
160/160 [=====] - 0s 873us/step - loss: 0.3429
Epoch 105/400
160/160 [=====] - 0s 690us/step - loss: 0.3227
Epoch 106/400
160/160 [=====] - 0s 606us/step - loss: 0.3970
Epoch 107/400
160/160 [=====] - 0s 612us/step - loss: 0.3922
Epoch 108/400
160/160 [=====] - 0s 656us/step - loss: 0.4429
Epoch 109/400
160/160 [=====] - 0s 835us/step - loss: 0.3556
Epoch 110/400
160/160 [=====] - 0s 727us/step - loss: 0.6213
Epoch 111/400
160/160 [=====] - 0s 571us/step - loss: 0.6584
Epoch 112/400
160/160 [=====] - 0s 576us/step - loss: 0.3525
Epoch 113/400
160/160 [=====] - 0s 594us/step - loss: 0.4919
Epoch 114/400
160/160 [=====] - 0s 582us/step - loss: 0.3471
Epoch 115/400
160/160 [=====] - 0s 596us/step - loss: 0.5217
Epoch 116/400
160/160 [=====] - 0s 575us/step - loss: 0.3983
Epoch 117/400
160/160 [=====] - 0s 610us/step - loss: 0.3616
Epoch 118/400
160/160 [=====] - 0s 611us/step - loss: 0.3570
Epoch 119/400
160/160 [=====] - 0s 579us/step - loss: 0.5224
Epoch 120/400
160/160 [=====] - 0s 569us/step - loss: 0.3483
Epoch 121/400
160/160 [=====] - 0s 643us/step - loss: 0.8530

Epoch 122/400
160/160 [=====] - 0s 717us/step - loss: 0.3847
Epoch 123/400
160/160 [=====] - 0s 695us/step - loss: 0.3512
Epoch 124/400
160/160 [=====] - 0s 636us/step - loss: 0.3606
Epoch 125/400
160/160 [=====] - 0s 908us/step - loss: 0.3475
Epoch 126/400
160/160 [=====] - 0s 805us/step - loss: 0.4053
Epoch 127/400
160/160 [=====] - 0s 639us/step - loss: 0.3612
Epoch 128/400
160/160 [=====] - 0s 605us/step - loss: 0.4021
Epoch 129/400
160/160 [=====] - 0s 614us/step - loss: 0.3474
Epoch 130/400
160/160 [=====] - 0s 592us/step - loss: 0.3227
Epoch 131/400
160/160 [=====] - 0s 559us/step - loss: 0.5252
Epoch 132/400
160/160 [=====] - 0s 576us/step - loss: 0.4558
Epoch 133/400
160/160 [=====] - 0s 601us/step - loss: 0.3559
Epoch 134/400
160/160 [=====] - 0s 777us/step - loss: 0.3446
Epoch 135/400
160/160 [=====] - 0s 923us/step - loss: 0.4671
Epoch 136/400
160/160 [=====] - 0s 766us/step - loss: 0.4957
Epoch 137/400
160/160 [=====] - 0s 636us/step - loss: 0.3744
Epoch 138/400
160/160 [=====] - 0s 636us/step - loss: 0.3766
Epoch 139/400
160/160 [=====] - 0s 667us/step - loss: 0.3413
Epoch 140/400
160/160 [=====] - 0s 622us/step - loss: 0.4610
Epoch 141/400
160/160 [=====] - 0s 644us/step - loss: 0.5906
Epoch 142/400
160/160 [=====] - 0s 935us/step - loss: 0.5060
Epoch 143/400
160/160 [=====] - 0s 855us/step - loss: 0.3626
Epoch 144/400
160/160 [=====] - 0s 798us/step - loss: 0.6805
Epoch 145/400
160/160 [=====] - 0s 858us/step - loss: 0.4870

Epoch 146/400
160/160 [=====] - 0s 862us/step - loss: 0.3594
Epoch 147/400
160/160 [=====] - 0s 630us/step - loss: 0.3414
Epoch 148/400
160/160 [=====] - 0s 634us/step - loss: 0.3528
Epoch 149/400
160/160 [=====] - 0s 625us/step - loss: 6.9491
Epoch 150/400
160/160 [=====] - 0s 636us/step - loss: 7.9712
Epoch 151/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 152/400
160/160 [=====] - 0s 734us/step - loss: 7.9712
Epoch 153/400
160/160 [=====] - 0s 732us/step - loss: 7.9712
Epoch 154/400
160/160 [=====] - 0s 671us/step - loss: 7.9712
Epoch 155/400
160/160 [=====] - 0s 631us/step - loss: 7.9712
Epoch 156/400
160/160 [=====] - 0s 679us/step - loss: 7.9712
Epoch 157/400
160/160 [=====] - 0s 750us/step - loss: 7.9712
Epoch 158/400
160/160 [=====] - 0s 806us/step - loss: 7.9712
Epoch 159/400
160/160 [=====] - 0s 764us/step - loss: 7.9712
Epoch 160/400
160/160 [=====] - 0s 671us/step - loss: 7.9712
Epoch 161/400
160/160 [=====] - 0s 609us/step - loss: 7.9712
Epoch 162/400
160/160 [=====] - 0s 614us/step - loss: 7.9712
Epoch 163/400
160/160 [=====] - 0s 698us/step - loss: 7.9712
Epoch 164/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 165/400
160/160 [=====] - 0s 722us/step - loss: 7.9712
Epoch 166/400
160/160 [=====] - 0s 607us/step - loss: 7.9712
Epoch 167/400
160/160 [=====] - 0s 595us/step - loss: 7.9712
Epoch 168/400
160/160 [=====] - 0s 598us/step - loss: 7.9712
Epoch 169/400
160/160 [=====] - 0s 764us/step - loss: 7.9712

Epoch 170/400
160/160 [=====] - 0s 802us/step - loss: 7.9712
Epoch 171/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 172/400
160/160 [=====] - 0s 638us/step - loss: 7.9712
Epoch 173/400
160/160 [=====] - 0s 606us/step - loss: 7.9712
Epoch 174/400
160/160 [=====] - 0s 636us/step - loss: 7.9712
Epoch 175/400
160/160 [=====] - 0s 633us/step - loss: 7.9712
Epoch 176/400
160/160 [=====] - 0s 600us/step - loss: 7.9712
Epoch 177/400
160/160 [=====] - 0s 635us/step - loss: 7.9712
Epoch 178/400
160/160 [=====] - 0s 611us/step - loss: 7.9712
Epoch 179/400
160/160 [=====] - 0s 594us/step - loss: 7.9712
Epoch 180/400
160/160 [=====] - 0s 618us/step - loss: 7.9712
Epoch 181/400
160/160 [=====] - 0s 594us/step - loss: 7.9712
Epoch 182/400
160/160 [=====] - 0s 591us/step - loss: 7.9712
Epoch 183/400
160/160 [=====] - 0s 593us/step - loss: 7.9712
Epoch 184/400
160/160 [=====] - 0s 593us/step - loss: 7.9712
Epoch 185/400
160/160 [=====] - 0s 666us/step - loss: 7.9712
Epoch 186/400
160/160 [=====] - 0s 632us/step - loss: 7.9712
Epoch 187/400
160/160 [=====] - 0s 952us/step - loss: 7.9712
Epoch 188/400
160/160 [=====] - 0s 924us/step - loss: 7.9712
Epoch 189/400
160/160 [=====] - 0s 611us/step - loss: 7.9712
Epoch 190/400
160/160 [=====] - 0s 659us/step - loss: 7.9712
Epoch 191/400
160/160 [=====] - 0s 591us/step - loss: 7.9712
Epoch 192/400
160/160 [=====] - 0s 706us/step - loss: 7.9712
Epoch 193/400
160/160 [=====] - 0s 814us/step - loss: 7.9712

Epoch 194/400
160/160 [=====] - 0s 775us/step - loss: 7.9712
Epoch 195/400
160/160 [=====] - 0s 942us/step - loss: 7.9712
Epoch 196/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 197/400
160/160 [=====] - 0s 898us/step - loss: 7.9712
Epoch 198/400
160/160 [=====] - 0s 786us/step - loss: 7.9712
Epoch 199/400
160/160 [=====] - 0s 641us/step - loss: 7.9712
Epoch 200/400
160/160 [=====] - 0s 647us/step - loss: 7.9712
Epoch 201/400
160/160 [=====] - 0s 589us/step - loss: 7.9712
Epoch 202/400
160/160 [=====] - 0s 686us/step - loss: 7.9712
Epoch 203/400
160/160 [=====] - 0s 582us/step - loss: 7.9712
Epoch 204/400
160/160 [=====] - 0s 645us/step - loss: 7.9712
Epoch 205/400
160/160 [=====] - 0s 613us/step - loss: 7.9712
Epoch 206/400
160/160 [=====] - 0s 605us/step - loss: 7.9712
Epoch 207/400
160/160 [=====] - 0s 623us/step - loss: 7.9712
Epoch 208/400
160/160 [=====] - 0s 721us/step - loss: 7.9712
Epoch 209/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 210/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 211/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 212/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 213/400
160/160 [=====] - 0s 838us/step - loss: 7.9712
Epoch 214/400
160/160 [=====] - 0s 921us/step - loss: 7.9712
Epoch 215/400
160/160 [=====] - 0s 918us/step - loss: 7.9712
Epoch 216/400
160/160 [=====] - 0s 872us/step - loss: 7.9712
Epoch 217/400
160/160 [=====] - 0s 891us/step - loss: 7.9712

Epoch 218/400
160/160 [=====] - 0s 916us/step - loss: 7.9712
Epoch 219/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 220/400
160/160 [=====] - 0s 788us/step - loss: 7.9712
Epoch 221/400
160/160 [=====] - 0s 904us/step - loss: 7.9712
Epoch 222/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 223/400
160/160 [=====] - 0s 769us/step - loss: 7.9712
Epoch 224/400
160/160 [=====] - 0s 675us/step - loss: 7.9712
Epoch 225/400
160/160 [=====] - 0s 676us/step - loss: 7.9712
Epoch 226/400
160/160 [=====] - 0s 762us/step - loss: 7.9712
Epoch 227/400
160/160 [=====] - 0s 813us/step - loss: 7.9712
Epoch 228/400
160/160 [=====] - 0s 732us/step - loss: 7.9712
Epoch 229/400
160/160 [=====] - 0s 687us/step - loss: 7.9712
Epoch 230/400
160/160 [=====] - 0s 694us/step - loss: 7.9712
Epoch 231/400
160/160 [=====] - 0s 641us/step - loss: 7.9712
Epoch 232/400
160/160 [=====] - 0s 602us/step - loss: 7.9712
Epoch 233/400
160/160 [=====] - 0s 677us/step - loss: 7.9712
Epoch 234/400
160/160 [=====] - 0s 664us/step - loss: 7.9712
Epoch 235/400
160/160 [=====] - 0s 875us/step - loss: 7.9712
Epoch 236/400
160/160 [=====] - 0s 625us/step - loss: 7.9712
Epoch 237/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 238/400
160/160 [=====] - 0s 555us/step - loss: 7.9712
Epoch 239/400
160/160 [=====] - 0s 670us/step - loss: 7.9712
Epoch 240/400
160/160 [=====] - 0s 633us/step - loss: 7.9712
Epoch 241/400
160/160 [=====] - 0s 689us/step - loss: 7.9712

Epoch 242/400
160/160 [=====] - 0s 640us/step - loss: 7.9712
Epoch 243/400
160/160 [=====] - 0s 685us/step - loss: 7.9712
Epoch 244/400
160/160 [=====] - 0s 813us/step - loss: 7.9712
Epoch 245/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 246/400
160/160 [=====] - 0s 796us/step - loss: 7.9712
Epoch 247/400
160/160 [=====] - 0s 784us/step - loss: 7.9712
Epoch 248/400
160/160 [=====] - 0s 645us/step - loss: 7.9712
Epoch 249/400
160/160 [=====] - 0s 756us/step - loss: 7.9712
Epoch 250/400
160/160 [=====] - 0s 594us/step - loss: 7.9712
Epoch 251/400
160/160 [=====] - 0s 576us/step - loss: 7.9712
Epoch 252/400
160/160 [=====] - 0s 577us/step - loss: 7.9712
Epoch 253/400
160/160 [=====] - 0s 634us/step - loss: 7.9712
Epoch 254/400
160/160 [=====] - 0s 692us/step - loss: 7.9712
Epoch 255/400
160/160 [=====] - 0s 778us/step - loss: 7.9712
Epoch 256/400
160/160 [=====] - 0s 634us/step - loss: 7.9712
Epoch 257/400
160/160 [=====] - 0s 696us/step - loss: 7.9712
Epoch 258/400
160/160 [=====] - 0s 788us/step - loss: 7.9712
Epoch 259/400
160/160 [=====] - 0s 848us/step - loss: 7.9712
Epoch 260/400
160/160 [=====] - 0s 707us/step - loss: 7.9712
Epoch 261/400
160/160 [=====] - 0s 618us/step - loss: 7.9712
Epoch 262/400
160/160 [=====] - 0s 607us/step - loss: 7.9712
Epoch 263/400
160/160 [=====] - 0s 618us/step - loss: 7.9712
Epoch 264/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 265/400
160/160 [=====] - 0s 623us/step - loss: 7.9712

Epoch 266/400
160/160 [=====] - 0s 732us/step - loss: 7.9712
Epoch 267/400
160/160 [=====] - 0s 768us/step - loss: 7.9712
Epoch 268/400
160/160 [=====] - 0s 739us/step - loss: 7.9712
Epoch 269/400
160/160 [=====] - 0s 614us/step - loss: 7.9712
Epoch 270/400
160/160 [=====] - 0s 580us/step - loss: 7.9712
Epoch 271/400
160/160 [=====] - 0s 600us/step - loss: 7.9712
Epoch 272/400
160/160 [=====] - 0s 604us/step - loss: 7.9712
Epoch 273/400
160/160 [=====] - 0s 585us/step - loss: 7.9712
Epoch 274/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 275/400
160/160 [=====] - 0s 599us/step - loss: 7.9712
Epoch 276/400
160/160 [=====] - 0s 700us/step - loss: 7.9712
Epoch 277/400
160/160 [=====] - 0s 630us/step - loss: 7.9712
Epoch 278/400
160/160 [=====] - 0s 609us/step - loss: 7.9712
Epoch 279/400
160/160 [=====] - 0s 603us/step - loss: 7.9712
Epoch 280/400
160/160 [=====] - 0s 600us/step - loss: 7.9712
Epoch 281/400
160/160 [=====] - 0s 646us/step - loss: 7.9712
Epoch 282/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 283/400
160/160 [=====] - 0s 621us/step - loss: 7.9712
Epoch 284/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 285/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 286/400
160/160 [=====] - 0s 633us/step - loss: 7.9712
Epoch 287/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 288/400
160/160 [=====] - 0s 604us/step - loss: 7.9712
Epoch 289/400
160/160 [=====] - 0s 558us/step - loss: 7.9712

Epoch 290/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 291/400
160/160 [=====] - 0s 816us/step - loss: 7.9712
Epoch 292/400
160/160 [=====] - 0s 626us/step - loss: 7.9712
Epoch 293/400
160/160 [=====] - 0s 708us/step - loss: 7.9712
Epoch 294/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 295/400
160/160 [=====] - 0s 601us/step - loss: 7.9712
Epoch 296/400
160/160 [=====] - 0s 885us/step - loss: 7.9712
Epoch 297/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 298/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 299/400
160/160 [=====] - 0s 951us/step - loss: 7.9712
Epoch 300/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 301/400
160/160 [=====] - 0s 949us/step - loss: 7.9712
Epoch 302/400
160/160 [=====] - 0s 932us/step - loss: 7.9712
Epoch 303/400
160/160 [=====] - 0s 965us/step - loss: 7.9712
Epoch 304/400
160/160 [=====] - 0s 808us/step - loss: 7.9712
Epoch 305/400
160/160 [=====] - 0s 771us/step - loss: 7.9712
Epoch 306/400
160/160 [=====] - 0s 962us/step - loss: 7.9712
Epoch 307/400
160/160 [=====] - 0s 856us/step - loss: 7.9712
Epoch 308/400
160/160 [=====] - 0s 924us/step - loss: 7.9712
Epoch 309/400
160/160 [=====] - 0s 942us/step - loss: 7.9712
Epoch 310/400
160/160 [=====] - 0s 914us/step - loss: 7.9712
Epoch 311/400
160/160 [=====] - 0s 802us/step - loss: 7.9712
Epoch 312/400
160/160 [=====] - 0s 640us/step - loss: 7.9712
Epoch 313/400
160/160 [=====] - 0s 642us/step - loss: 7.9712

Epoch 314/400
160/160 [=====] - 0s 625us/step - loss: 7.9712
Epoch 315/400
160/160 [=====] - 0s 652us/step - loss: 7.9712
Epoch 316/400
160/160 [=====] - 0s 940us/step - loss: 7.9712
Epoch 317/400
160/160 [=====] - 0s 816us/step - loss: 7.9712
Epoch 318/400
160/160 [=====] - 0s 769us/step - loss: 7.9712
Epoch 319/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 320/400
160/160 [=====] - 0s 770us/step - loss: 7.9712
Epoch 321/400
160/160 [=====] - 0s 771us/step - loss: 7.9712
Epoch 322/400
160/160 [=====] - 0s 666us/step - loss: 7.9712
Epoch 323/400
160/160 [=====] - 0s 634us/step - loss: 7.9712
Epoch 324/400
160/160 [=====] - 0s 604us/step - loss: 7.9712
Epoch 325/400
160/160 [=====] - 0s 622us/step - loss: 7.9712
Epoch 326/400
160/160 [=====] - 0s 741us/step - loss: 7.9712
Epoch 327/400
160/160 [=====] - 0s 852us/step - loss: 7.9712
Epoch 328/400
160/160 [=====] - 0s 935us/step - loss: 7.9712
Epoch 329/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 330/400
160/160 [=====] - 0s 673us/step - loss: 7.9712
Epoch 331/400
160/160 [=====] - 0s 794us/step - loss: 7.9712
Epoch 332/400
160/160 [=====] - 0s 954us/step - loss: 7.9712
Epoch 333/400
160/160 [=====] - 0s 855us/step - loss: 7.9712
Epoch 334/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 335/400
160/160 [=====] - 0s 589us/step - loss: 7.9712
Epoch 336/400
160/160 [=====] - 0s 652us/step - loss: 7.9712
Epoch 337/400
160/160 [=====] - 0s 720us/step - loss: 7.9712

Epoch 338/400
160/160 [=====] - 0s 683us/step - loss: 7.9712
Epoch 339/400
160/160 [=====] - 0s 651us/step - loss: 7.9712
Epoch 340/400
160/160 [=====] - 0s 932us/step - loss: 7.9712
Epoch 341/400
160/160 [=====] - 0s 938us/step - loss: 7.9712
Epoch 342/400
160/160 [=====] - 0s 912us/step - loss: 7.9712
Epoch 343/400
160/160 [=====] - 0s 936us/step - loss: 7.9712
Epoch 344/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 345/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 346/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 347/400
160/160 [=====] - 0s 841us/step - loss: 7.9712
Epoch 348/400
160/160 [=====] - 0s 594us/step - loss: 7.9712
Epoch 349/400
160/160 [=====] - 0s 601us/step - loss: 7.9712
Epoch 350/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 351/400
160/160 [=====] - 0s 672us/step - loss: 7.9712
Epoch 352/400
160/160 [=====] - 0s 674us/step - loss: 7.9712
Epoch 353/400
160/160 [=====] - 0s 624us/step - loss: 7.9712
Epoch 354/400
160/160 [=====] - 0s 765us/step - loss: 7.9712
Epoch 355/400
160/160 [=====] - 0s 758us/step - loss: 7.9712
Epoch 356/400
160/160 [=====] - 0s 801us/step - loss: 7.9712
Epoch 357/400
160/160 [=====] - 0s 799us/step - loss: 7.9712
Epoch 358/400
160/160 [=====] - 0s 616us/step - loss: 7.9712
Epoch 359/400
160/160 [=====] - 0s 620us/step - loss: 7.9712
Epoch 360/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 361/400
160/160 [=====] - 0s 887us/step - loss: 7.9712

Epoch 362/400
160/160 [=====] - 0s 651us/step - loss: 7.9712
Epoch 363/400
160/160 [=====] - 0s 606us/step - loss: 7.9712
Epoch 364/400
160/160 [=====] - 0s 771us/step - loss: 7.9712
Epoch 365/400
160/160 [=====] - 0s 670us/step - loss: 7.9712
Epoch 366/400
160/160 [=====] - 0s 616us/step - loss: 7.9712
Epoch 367/400
160/160 [=====] - 0s 568us/step - loss: 7.9712
Epoch 368/400
160/160 [=====] - 0s 579us/step - loss: 7.9712
Epoch 369/400
160/160 [=====] - 0s 621us/step - loss: 7.9712
Epoch 370/400
160/160 [=====] - 0s 602us/step - loss: 7.9712
Epoch 371/400
160/160 [=====] - 0s 633us/step - loss: 7.9712
Epoch 372/400
160/160 [=====] - 0s 664us/step - loss: 7.9712
Epoch 373/400
160/160 [=====] - 0s 633us/step - loss: 7.9712
Epoch 374/400
160/160 [=====] - 0s 644us/step - loss: 7.9712
Epoch 375/400
160/160 [=====] - 0s 610us/step - loss: 7.9712
Epoch 376/400
160/160 [=====] - 0s 843us/step - loss: 7.9712
Epoch 377/400
160/160 [=====] - 0s 608us/step - loss: 7.9712
Epoch 378/400
160/160 [=====] - 0s 641us/step - loss: 7.9712
Epoch 379/400
160/160 [=====] - 0s 620us/step - loss: 7.9712
Epoch 380/400
160/160 [=====] - 0s 620us/step - loss: 7.9712
Epoch 381/400
160/160 [=====] - 0s 603us/step - loss: 7.9712
Epoch 382/400
160/160 [=====] - 0s 663us/step - loss: 7.9712
Epoch 383/400
160/160 [=====] - 0s 602us/step - loss: 7.9712
Epoch 384/400
160/160 [=====] - 0s 628us/step - loss: 7.9712
Epoch 385/400
160/160 [=====] - 0s 596us/step - loss: 7.9712


```

1.      1.      1.      1.      1.      1.
1.      1.      1.      1.      1.      1.
1.      1.      1.      1.      1.      1.
1.      1.      1.      1.      1.      1.
1.      1.      1.      1.      1.      1.
1.      1.      1.      1.      1.      1.
1.      1.      1.      1.      1.      1.
1.      1.      1.      1.      1.      1.
1.      1.      1.      1.      1.      1.
1.      1.      1.      1.      ]
160/160 [=====] - 0s 349us/step

```

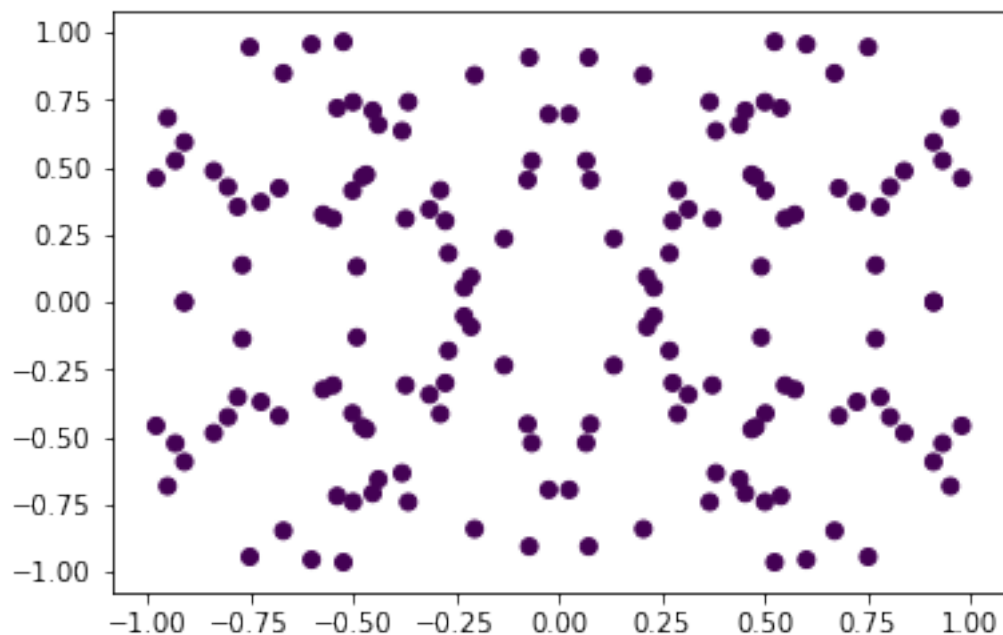
```
In [10]: scores, model.metrics_names
```

Wow, what happened here? I noticed that outputs are not always the same.

```
Out[10]: (7.971192407608049, ['loss'])
```

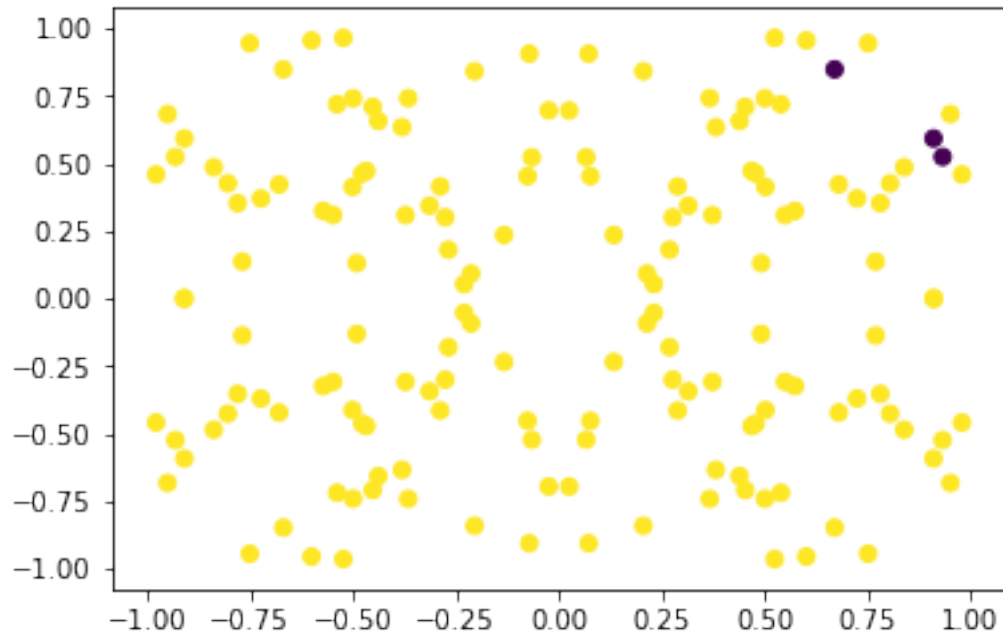
```
In [11]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[11]: <matplotlib.collections.PathCollection at 0xb244826a0>
```



```
In [12]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[12]: <matplotlib.collections.PathCollection at 0xb244e3a58>
```



```
In [13]: # 3 hidden layers with 2 neurons
model = Sequential()

model.add(Dense(2, input_dim=2, activation='tanh'))
model.add(Dense(2, activation='tanh'))
model.add(Dense(2, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 4ms/step - loss: 4.2701
Epoch 2/400
160/160 [=====] - 0s 942us/step - loss: 4.2534
Epoch 3/400
160/160 [=====] - 0s 789us/step - loss: 4.2234
Epoch 4/400
160/160 [=====] - 0s 741us/step - loss: 3.2672
```


Epoch 5/400
160/160 [=====] - 0s 738us/step - loss: 0.9961
Epoch 6/400
160/160 [=====] - 0s 771us/step - loss: 0.7032
Epoch 7/400
160/160 [=====] - 0s 961us/step - loss: 0.6997
Epoch 8/400
160/160 [=====] - 0s 978us/step - loss: 0.7011
Epoch 9/400
160/160 [=====] - 0s 1ms/step - loss: 0.7036
Epoch 10/400
160/160 [=====] - 0s 746us/step - loss: 0.7008
Epoch 11/400
160/160 [=====] - 0s 708us/step - loss: 0.7016
Epoch 12/400
160/160 [=====] - 0s 708us/step - loss: 0.7005
Epoch 13/400
160/160 [=====] - 0s 689us/step - loss: 0.6978
Epoch 14/400
160/160 [=====] - 0s 677us/step - loss: 0.7015
Epoch 15/400
160/160 [=====] - 0s 758us/step - loss: 0.6965
Epoch 16/400
160/160 [=====] - 0s 765us/step - loss: 0.6986
Epoch 17/400
160/160 [=====] - 0s 642us/step - loss: 0.6966
Epoch 18/400
160/160 [=====] - 0s 693us/step - loss: 0.6954
Epoch 19/400
160/160 [=====] - 0s 737us/step - loss: 0.6966
Epoch 20/400
160/160 [=====] - 0s 670us/step - loss: 0.6920
Epoch 21/400
160/160 [=====] - 0s 648us/step - loss: 0.6900
Epoch 22/400
160/160 [=====] - 0s 630us/step - loss: 0.6761
Epoch 23/400
160/160 [=====] - 0s 583us/step - loss: 0.6804
Epoch 24/400
160/160 [=====] - 0s 722us/step - loss: 0.6684
Epoch 25/400
160/160 [=====] - 0s 686us/step - loss: 0.6725
Epoch 26/400
160/160 [=====] - 0s 608us/step - loss: 0.6641
Epoch 27/400
160/160 [=====] - 0s 640us/step - loss: 0.6514
Epoch 28/400
160/160 [=====] - 0s 620us/step - loss: 0.6478

Epoch 29/400
160/160 [=====] - 0s 594us/step - loss: 0.6370
Epoch 30/400
160/160 [=====] - 0s 637us/step - loss: 0.6424
Epoch 31/400
160/160 [=====] - 0s 618us/step - loss: 0.6263
Epoch 32/400
160/160 [=====] - 0s 625us/step - loss: 0.6260
Epoch 33/400
160/160 [=====] - 0s 706us/step - loss: 0.6192
Epoch 34/400
160/160 [=====] - 0s 2ms/step - loss: 0.6157
Epoch 35/400
160/160 [=====] - 0s 1ms/step - loss: 0.6138
Epoch 36/400
160/160 [=====] - 0s 935us/step - loss: 0.6063
Epoch 37/400
160/160 [=====] - 0s 1ms/step - loss: 0.6130
Epoch 38/400
160/160 [=====] - 0s 1ms/step - loss: 0.6094
Epoch 39/400
160/160 [=====] - 0s 1ms/step - loss: 0.6146
Epoch 40/400
160/160 [=====] - 0s 934us/step - loss: 0.6082
Epoch 41/400
160/160 [=====] - 0s 1ms/step - loss: 0.6044
Epoch 42/400
160/160 [=====] - 0s 934us/step - loss: 0.6060
Epoch 43/400
160/160 [=====] - 0s 1ms/step - loss: 0.5998
Epoch 44/400
160/160 [=====] - 0s 739us/step - loss: 0.6049
Epoch 45/400
160/160 [=====] - 0s 679us/step - loss: 0.5932
Epoch 46/400
160/160 [=====] - 0s 691us/step - loss: 0.6007
Epoch 47/400
160/160 [=====] - 0s 707us/step - loss: 0.5980
Epoch 48/400
160/160 [=====] - 0s 1ms/step - loss: 0.5987
Epoch 49/400
160/160 [=====] - 0s 2ms/step - loss: 0.5945
Epoch 50/400
160/160 [=====] - 0s 1ms/step - loss: 0.5980
Epoch 51/400
160/160 [=====] - 0s 957us/step - loss: 0.5966
Epoch 52/400
160/160 [=====] - 0s 1ms/step - loss: 0.5977

Epoch 53/400
160/160 [=====] - 0s 890us/step - loss: 0.5903
Epoch 54/400
160/160 [=====] - 0s 766us/step - loss: 0.6015
Epoch 55/400
160/160 [=====] - 0s 693us/step - loss: 0.5875
Epoch 56/400
160/160 [=====] - 0s 709us/step - loss: 0.6010
Epoch 57/400
160/160 [=====] - 0s 724us/step - loss: 0.5902
Epoch 58/400
160/160 [=====] - 0s 671us/step - loss: 0.5897
Epoch 59/400
160/160 [=====] - 0s 882us/step - loss: 0.5849
Epoch 60/400
160/160 [=====] - 0s 611us/step - loss: 0.5929
Epoch 61/400
160/160 [=====] - 0s 688us/step - loss: 0.5948
Epoch 62/400
160/160 [=====] - 0s 761us/step - loss: 0.5874
Epoch 63/400
160/160 [=====] - 0s 761us/step - loss: 0.5930
Epoch 64/400
160/160 [=====] - 0s 2ms/step - loss: 0.5971
Epoch 65/400
160/160 [=====] - 0s 1ms/step - loss: 0.5943
Epoch 66/400
160/160 [=====] - 0s 1ms/step - loss: 0.5915
Epoch 67/400
160/160 [=====] - 0s 1ms/step - loss: 0.5928
Epoch 68/400
160/160 [=====] - 0s 942us/step - loss: 0.5950
Epoch 69/400
160/160 [=====] - 0s 898us/step - loss: 0.5937
Epoch 70/400
160/160 [=====] - 0s 931us/step - loss: 0.5920
Epoch 71/400
160/160 [=====] - 0s 1ms/step - loss: 0.5895
Epoch 72/400
160/160 [=====] - 0s 981us/step - loss: 0.5960
Epoch 73/400
160/160 [=====] - 0s 933us/step - loss: 0.5806
Epoch 74/400
160/160 [=====] - 0s 974us/step - loss: 0.5863
Epoch 75/400
160/160 [=====] - 0s 729us/step - loss: 0.5855
Epoch 76/400
160/160 [=====] - 0s 671us/step - loss: 0.5717

Epoch 77/400
160/160 [=====] - 0s 663us/step - loss: 0.5862
Epoch 78/400
160/160 [=====] - 0s 624us/step - loss: 0.5914
Epoch 79/400
160/160 [=====] - 0s 608us/step - loss: 0.5908
Epoch 80/400
160/160 [=====] - 0s 619us/step - loss: 0.5901
Epoch 81/400
160/160 [=====] - 0s 644us/step - loss: 0.5833
Epoch 82/400
160/160 [=====] - 0s 621us/step - loss: 0.6003
Epoch 83/400
160/160 [=====] - 0s 671us/step - loss: 0.5901
Epoch 84/400
160/160 [=====] - 0s 628us/step - loss: 0.5872
Epoch 85/400
160/160 [=====] - 0s 586us/step - loss: 0.5901
Epoch 86/400
160/160 [=====] - 0s 607us/step - loss: 0.5860
Epoch 87/400
160/160 [=====] - 0s 598us/step - loss: 0.5864
Epoch 88/400
160/160 [=====] - 0s 763us/step - loss: 0.5808
Epoch 89/400
160/160 [=====] - 0s 715us/step - loss: 0.5909
Epoch 90/400
160/160 [=====] - 0s 720us/step - loss: 0.5750
Epoch 91/400
160/160 [=====] - 0s 756us/step - loss: 0.5901
Epoch 92/400
160/160 [=====] - 0s 738us/step - loss: 0.5837
Epoch 93/400
160/160 [=====] - 1s 4ms/step - loss: 0.5842
Epoch 94/400
160/160 [=====] - 0s 2ms/step - loss: 0.5938
Epoch 95/400
160/160 [=====] - 1s 3ms/step - loss: 0.5870
Epoch 96/400
160/160 [=====] - 0s 1ms/step - loss: 0.5875
Epoch 97/400
160/160 [=====] - 0s 1ms/step - loss: 0.5939
Epoch 98/400
160/160 [=====] - 0s 954us/step - loss: 0.5926
Epoch 99/400
160/160 [=====] - 0s 805us/step - loss: 0.5884
Epoch 100/400
160/160 [=====] - 0s 873us/step - loss: 0.5862

Epoch 101/400
160/160 [=====] - 0s 689us/step - loss: 0.5848
Epoch 102/400
160/160 [=====] - 0s 909us/step - loss: 0.5940
Epoch 103/400
160/160 [=====] - 0s 971us/step - loss: 0.5911
Epoch 104/400
160/160 [=====] - 0s 740us/step - loss: 0.5919
Epoch 105/400
160/160 [=====] - 0s 689us/step - loss: 0.5881
Epoch 106/400
160/160 [=====] - 0s 870us/step - loss: 0.5874
Epoch 107/400
160/160 [=====] - 0s 676us/step - loss: 0.5905
Epoch 108/400
160/160 [=====] - 0s 950us/step - loss: 0.5870
Epoch 109/400
160/160 [=====] - 0s 948us/step - loss: 0.5892
Epoch 110/400
160/160 [=====] - 0s 918us/step - loss: 0.5803
Epoch 111/400
160/160 [=====] - 0s 978us/step - loss: 0.5864
Epoch 112/400
160/160 [=====] - 0s 744us/step - loss: 0.5848
Epoch 113/400
160/160 [=====] - 0s 791us/step - loss: 0.5914
Epoch 114/400
160/160 [=====] - 0s 707us/step - loss: 0.5874
Epoch 115/400
160/160 [=====] - 0s 609us/step - loss: 0.5855
Epoch 116/400
160/160 [=====] - 0s 637us/step - loss: 0.5719
Epoch 117/400
160/160 [=====] - 0s 608us/step - loss: 0.5922
Epoch 118/400
160/160 [=====] - 0s 572us/step - loss: 0.5872
Epoch 119/400
160/160 [=====] - 0s 585us/step - loss: 0.5872
Epoch 120/400
160/160 [=====] - 0s 584us/step - loss: 0.5810
Epoch 121/400
160/160 [=====] - 0s 712us/step - loss: 0.5812
Epoch 122/400
160/160 [=====] - 0s 823us/step - loss: 0.5881
Epoch 123/400
160/160 [=====] - 0s 969us/step - loss: 0.5843
Epoch 124/400
160/160 [=====] - 0s 888us/step - loss: 0.5868

Epoch 125/400
160/160 [=====] - 0s 836us/step - loss: 0.5924
Epoch 126/400
160/160 [=====] - 0s 703us/step - loss: 0.5884
Epoch 127/400
160/160 [=====] - 0s 842us/step - loss: 0.5868
Epoch 128/400
160/160 [=====] - 0s 881us/step - loss: 0.5886
Epoch 129/400
160/160 [=====] - 0s 834us/step - loss: 0.5915
Epoch 130/400
160/160 [=====] - 0s 916us/step - loss: 0.5900
Epoch 131/400
160/160 [=====] - 0s 902us/step - loss: 0.5721
Epoch 132/400
160/160 [=====] - 0s 896us/step - loss: 0.5919
Epoch 133/400
160/160 [=====] - 0s 647us/step - loss: 0.5817 0s - loss: 0.608
Epoch 134/400
160/160 [=====] - 0s 586us/step - loss: 0.5906
Epoch 135/400
160/160 [=====] - 0s 603us/step - loss: 0.5856
Epoch 136/400
160/160 [=====] - 0s 2ms/step - loss: 0.5838
Epoch 137/400
160/160 [=====] - 0s 1ms/step - loss: 0.5907
Epoch 138/400
160/160 [=====] - 0s 949us/step - loss: 0.5876
Epoch 139/400
160/160 [=====] - 0s 869us/step - loss: 0.5853
Epoch 140/400
160/160 [=====] - 0s 795us/step - loss: 0.5891
Epoch 141/400
160/160 [=====] - 0s 689us/step - loss: 0.5880
Epoch 142/400
160/160 [=====] - 0s 680us/step - loss: 0.5784
Epoch 143/400
160/160 [=====] - 0s 702us/step - loss: 0.5847
Epoch 144/400
160/160 [=====] - 0s 799us/step - loss: 0.5799
Epoch 145/400
160/160 [=====] - 0s 698us/step - loss: 0.5844
Epoch 146/400
160/160 [=====] - 0s 730us/step - loss: 0.5869
Epoch 147/400
160/160 [=====] - 0s 1ms/step - loss: 0.5876
Epoch 148/400
160/160 [=====] - 0s 1ms/step - loss: 0.5924

Epoch 149/400
160/160 [=====] - 0s 1ms/step - loss: 0.5900
Epoch 150/400
160/160 [=====] - 0s 771us/step - loss: 0.5880
Epoch 151/400
160/160 [=====] - 0s 657us/step - loss: 0.5838
Epoch 152/400
160/160 [=====] - 0s 649us/step - loss: 0.5762
Epoch 153/400
160/160 [=====] - 0s 662us/step - loss: 0.5908
Epoch 154/400
160/160 [=====] - 0s 617us/step - loss: 0.5863
Epoch 155/400
160/160 [=====] - 0s 696us/step - loss: 0.5858
Epoch 156/400
160/160 [=====] - 0s 876us/step - loss: 0.5902
Epoch 157/400
160/160 [=====] - 0s 799us/step - loss: 0.5817
Epoch 158/400
160/160 [=====] - 0s 877us/step - loss: 0.5852
Epoch 159/400
160/160 [=====] - 0s 823us/step - loss: 0.5901
Epoch 160/400
160/160 [=====] - 0s 825us/step - loss: 0.5900
Epoch 161/400
160/160 [=====] - 0s 834us/step - loss: 0.5910
Epoch 162/400
160/160 [=====] - 0s 808us/step - loss: 0.5938
Epoch 163/400
160/160 [=====] - 0s 865us/step - loss: 0.5884
Epoch 164/400
160/160 [=====] - 0s 795us/step - loss: 0.5893
Epoch 165/400
160/160 [=====] - 0s 804us/step - loss: 0.5897
Epoch 166/400
160/160 [=====] - 0s 794us/step - loss: 0.5871
Epoch 167/400
160/160 [=====] - 0s 864us/step - loss: 0.5869
Epoch 168/400
160/160 [=====] - 0s 862us/step - loss: 0.5868
Epoch 169/400
160/160 [=====] - 0s 876us/step - loss: 0.5937
Epoch 170/400
160/160 [=====] - 0s 788us/step - loss: 0.5852
Epoch 171/400
160/160 [=====] - 0s 673us/step - loss: 0.5789
Epoch 172/400
160/160 [=====] - 0s 819us/step - loss: 0.5873

Epoch 173/400
160/160 [=====] - 0s 794us/step - loss: 0.5874
Epoch 174/400
160/160 [=====] - 0s 776us/step - loss: 0.5879
Epoch 175/400
160/160 [=====] - 0s 603us/step - loss: 0.5910
Epoch 176/400
160/160 [=====] - 0s 2ms/step - loss: 0.5902
Epoch 177/400
160/160 [=====] - 0s 937us/step - loss: 0.5877
Epoch 178/400
160/160 [=====] - 0s 876us/step - loss: 0.5895
Epoch 179/400
160/160 [=====] - 0s 884us/step - loss: 0.5850
Epoch 180/400
160/160 [=====] - 0s 764us/step - loss: 0.5908
Epoch 181/400
160/160 [=====] - 0s 723us/step - loss: 0.5887
Epoch 182/400
160/160 [=====] - 0s 673us/step - loss: 0.5858
Epoch 183/400
160/160 [=====] - 0s 696us/step - loss: 0.5865
Epoch 184/400
160/160 [=====] - 0s 701us/step - loss: 0.5864
Epoch 185/400
160/160 [=====] - 0s 1ms/step - loss: 0.5877
Epoch 186/400
160/160 [=====] - 0s 857us/step - loss: 0.5769
Epoch 187/400
160/160 [=====] - 0s 2ms/step - loss: 0.5832
Epoch 188/400
160/160 [=====] - 0s 1ms/step - loss: 0.5889
Epoch 189/400
160/160 [=====] - 0s 1ms/step - loss: 0.5838
Epoch 190/400
160/160 [=====] - 0s 677us/step - loss: 0.5934
Epoch 191/400
160/160 [=====] - 0s 764us/step - loss: 0.5871
Epoch 192/400
160/160 [=====] - 0s 624us/step - loss: 0.5867
Epoch 193/400
160/160 [=====] - 0s 686us/step - loss: 0.5935
Epoch 194/400
160/160 [=====] - 0s 710us/step - loss: 0.5834
Epoch 195/400
160/160 [=====] - 0s 721us/step - loss: 0.5898
Epoch 196/400
160/160 [=====] - 0s 848us/step - loss: 0.5837

Epoch 197/400
160/160 [=====] - 0s 847us/step - loss: 0.5887
Epoch 198/400
160/160 [=====] - 0s 632us/step - loss: 0.5831
Epoch 199/400
160/160 [=====] - 0s 615us/step - loss: 0.5901
Epoch 200/400
160/160 [=====] - 0s 678us/step - loss: 0.5893
Epoch 201/400
160/160 [=====] - 0s 675us/step - loss: 0.5916
Epoch 202/400
160/160 [=====] - 0s 725us/step - loss: 0.5889
Epoch 203/400
160/160 [=====] - 0s 576us/step - loss: 0.5846
Epoch 204/400
160/160 [=====] - 0s 555us/step - loss: 0.5806
Epoch 205/400
160/160 [=====] - 0s 602us/step - loss: 0.5892
Epoch 206/400
160/160 [=====] - 0s 557us/step - loss: 0.5885
Epoch 207/400
160/160 [=====] - 0s 696us/step - loss: 0.5891
Epoch 208/400
160/160 [=====] - 0s 814us/step - loss: 0.5876
Epoch 209/400
160/160 [=====] - 0s 550us/step - loss: 0.5767
Epoch 210/400
160/160 [=====] - 0s 535us/step - loss: 0.5914
Epoch 211/400
160/160 [=====] - 0s 538us/step - loss: 0.5884
Epoch 212/400
160/160 [=====] - 0s 549us/step - loss: 0.5800
Epoch 213/400
160/160 [=====] - 0s 569us/step - loss: 0.5869
Epoch 214/400
160/160 [=====] - 0s 603us/step - loss: 0.5871
Epoch 215/400
160/160 [=====] - 0s 661us/step - loss: 0.5868
Epoch 216/400
160/160 [=====] - 0s 560us/step - loss: 0.5830
Epoch 217/400
160/160 [=====] - 0s 720us/step - loss: 0.5874
Epoch 218/400
160/160 [=====] - 0s 573us/step - loss: 0.5879
Epoch 219/400
160/160 [=====] - 0s 567us/step - loss: 0.5877
Epoch 220/400
160/160 [=====] - 0s 558us/step - loss: 0.5855

Epoch 221/400
160/160 [=====] - 0s 572us/step - loss: 0.5880
Epoch 222/400
160/160 [=====] - 0s 547us/step - loss: 0.5864
Epoch 223/400
160/160 [=====] - 0s 570us/step - loss: 0.5886
Epoch 224/400
160/160 [=====] - 0s 576us/step - loss: 0.5904
Epoch 225/400
160/160 [=====] - 0s 629us/step - loss: 0.5871
Epoch 226/400
160/160 [=====] - 0s 1ms/step - loss: 0.5882
Epoch 227/400
160/160 [=====] - 0s 737us/step - loss: 0.5860
Epoch 228/400
160/160 [=====] - 0s 699us/step - loss: 0.5822
Epoch 229/400
160/160 [=====] - 0s 1ms/step - loss: 0.5926
Epoch 230/400
160/160 [=====] - 0s 869us/step - loss: 0.5802
Epoch 231/400
160/160 [=====] - 0s 750us/step - loss: 0.5743
Epoch 232/400
160/160 [=====] - 0s 574us/step - loss: 0.5936
Epoch 233/400
160/160 [=====] - 0s 709us/step - loss: 0.5729
Epoch 234/400
160/160 [=====] - 0s 692us/step - loss: 0.5831
Epoch 235/400
160/160 [=====] - 0s 669us/step - loss: 0.5731
Epoch 236/400
160/160 [=====] - 0s 635us/step - loss: 0.5896
Epoch 237/400
160/160 [=====] - 0s 630us/step - loss: 0.5909
Epoch 238/400
160/160 [=====] - 0s 584us/step - loss: 0.5844
Epoch 239/400
160/160 [=====] - 0s 609us/step - loss: 0.5780
Epoch 240/400
160/160 [=====] - 0s 614us/step - loss: 0.5919
Epoch 241/400
160/160 [=====] - 0s 588us/step - loss: 0.5831
Epoch 242/400
160/160 [=====] - 0s 616us/step - loss: 0.5885
Epoch 243/400
160/160 [=====] - 0s 663us/step - loss: 0.5838
Epoch 244/400
160/160 [=====] - 0s 623us/step - loss: 0.5793

Epoch 245/400
160/160 [=====] - 0s 702us/step - loss: 0.5862
Epoch 246/400
160/160 [=====] - 0s 621us/step - loss: 0.5861
Epoch 247/400
160/160 [=====] - 0s 650us/step - loss: 0.5872
Epoch 248/400
160/160 [=====] - 0s 933us/step - loss: 0.5850
Epoch 249/400
160/160 [=====] - 0s 759us/step - loss: 0.5876
Epoch 250/400
160/160 [=====] - 0s 786us/step - loss: 0.5910
Epoch 251/400
160/160 [=====] - 0s 846us/step - loss: 0.5880
Epoch 252/400
160/160 [=====] - 0s 718us/step - loss: 0.5885
Epoch 253/400
160/160 [=====] - 0s 741us/step - loss: 0.5863
Epoch 254/400
160/160 [=====] - 0s 758us/step - loss: 0.5892
Epoch 255/400
160/160 [=====] - 0s 771us/step - loss: 0.5707
Epoch 256/400
160/160 [=====] - 0s 774us/step - loss: 0.5853
Epoch 257/400
160/160 [=====] - 0s 750us/step - loss: 0.5877
Epoch 258/400
160/160 [=====] - 0s 635us/step - loss: 0.5917
Epoch 259/400
160/160 [=====] - 0s 776us/step - loss: 0.5876
Epoch 260/400
160/160 [=====] - 0s 698us/step - loss: 0.5746
Epoch 261/400
160/160 [=====] - 0s 771us/step - loss: 0.5813
Epoch 262/400
160/160 [=====] - 0s 774us/step - loss: 0.5888
Epoch 263/400
160/160 [=====] - 0s 752us/step - loss: 0.5862
Epoch 264/400
160/160 [=====] - 0s 710us/step - loss: 0.5881
Epoch 265/400
160/160 [=====] - 0s 630us/step - loss: 0.5877
Epoch 266/400
160/160 [=====] - 0s 659us/step - loss: 0.5849
Epoch 267/400
160/160 [=====] - 0s 647us/step - loss: 0.5864
Epoch 268/400
160/160 [=====] - 0s 646us/step - loss: 0.5879

Epoch 269/400
160/160 [=====] - 0s 745us/step - loss: 0.5915
Epoch 270/400
160/160 [=====] - 0s 800us/step - loss: 0.5835
Epoch 271/400
160/160 [=====] - 0s 776us/step - loss: 0.5892
Epoch 272/400
160/160 [=====] - 0s 734us/step - loss: 0.5872
Epoch 273/400
160/160 [=====] - 0s 634us/step - loss: 0.5862
Epoch 274/400
160/160 [=====] - 0s 783us/step - loss: 0.5867
Epoch 275/400
160/160 [=====] - 0s 638us/step - loss: 0.5868
Epoch 276/400
160/160 [=====] - 0s 662us/step - loss: 0.5912
Epoch 277/400
160/160 [=====] - 0s 592us/step - loss: 0.5891
Epoch 278/400
160/160 [=====] - 0s 708us/step - loss: 0.5876
Epoch 279/400
160/160 [=====] - 0s 1ms/step - loss: 0.5817
Epoch 280/400
160/160 [=====] - 0s 597us/step - loss: 0.5888
Epoch 281/400
160/160 [=====] - 0s 826us/step - loss: 0.5900
Epoch 282/400
160/160 [=====] - 0s 681us/step - loss: 0.5868
Epoch 283/400
160/160 [=====] - 0s 749us/step - loss: 0.5862
Epoch 284/400
160/160 [=====] - 0s 767us/step - loss: 0.5878
Epoch 285/400
160/160 [=====] - 0s 865us/step - loss: 0.5822
Epoch 286/400
160/160 [=====] - 0s 776us/step - loss: 0.5819
Epoch 287/400
160/160 [=====] - 0s 802us/step - loss: 0.5897
Epoch 288/400
160/160 [=====] - 0s 691us/step - loss: 0.5867
Epoch 289/400
160/160 [=====] - 0s 694us/step - loss: 0.5867
Epoch 290/400
160/160 [=====] - 0s 640us/step - loss: 0.5773
Epoch 291/400
160/160 [=====] - 0s 883us/step - loss: 0.5873
Epoch 292/400
160/160 [=====] - 0s 1ms/step - loss: 0.5846

Epoch 293/400
160/160 [=====] - 0s 831us/step - loss: 0.5786
Epoch 294/400
160/160 [=====] - 0s 962us/step - loss: 0.5915
Epoch 295/400
160/160 [=====] - 0s 793us/step - loss: 0.5900
Epoch 296/400
160/160 [=====] - 0s 811us/step - loss: 0.5851
Epoch 297/400
160/160 [=====] - 0s 839us/step - loss: 0.5873
Epoch 298/400
160/160 [=====] - 0s 887us/step - loss: 0.5832
Epoch 299/400
160/160 [=====] - 0s 849us/step - loss: 0.5901
Epoch 300/400
160/160 [=====] - 0s 723us/step - loss: 0.5852
Epoch 301/400
160/160 [=====] - 0s 631us/step - loss: 0.5862
Epoch 302/400
160/160 [=====] - 0s 623us/step - loss: 0.5831
Epoch 303/400
160/160 [=====] - 0s 622us/step - loss: 0.5865
Epoch 304/400
160/160 [=====] - 0s 603us/step - loss: 0.5719
Epoch 305/400
160/160 [=====] - 0s 628us/step - loss: 0.5885
Epoch 306/400
160/160 [=====] - 0s 632us/step - loss: 0.5805
Epoch 307/400
160/160 [=====] - 0s 597us/step - loss: 0.5933
Epoch 308/400
160/160 [=====] - 0s 617us/step - loss: 0.5889
Epoch 309/400
160/160 [=====] - 0s 727us/step - loss: 0.5824
Epoch 310/400
160/160 [=====] - 0s 1ms/step - loss: 0.5839
Epoch 311/400
160/160 [=====] - 0s 1ms/step - loss: 0.5905
Epoch 312/400
160/160 [=====] - 0s 1ms/step - loss: 0.5825
Epoch 313/400
160/160 [=====] - 0s 838us/step - loss: 0.5838
Epoch 314/400
160/160 [=====] - 0s 626us/step - loss: 0.5885
Epoch 315/400
160/160 [=====] - 0s 639us/step - loss: 0.5864
Epoch 316/400
160/160 [=====] - 0s 611us/step - loss: 0.5841

Epoch 317/400
160/160 [=====] - 0s 565us/step - loss: 0.5872
Epoch 318/400
160/160 [=====] - 0s 574us/step - loss: 0.5875
Epoch 319/400
160/160 [=====] - 0s 532us/step - loss: 0.5867
Epoch 320/400
160/160 [=====] - 0s 541us/step - loss: 0.5823
Epoch 321/400
160/160 [=====] - 0s 550us/step - loss: 0.5879
Epoch 322/400
160/160 [=====] - 0s 549us/step - loss: 0.5827
Epoch 323/400
160/160 [=====] - 0s 527us/step - loss: 0.5790
Epoch 324/400
160/160 [=====] - 0s 544us/step - loss: 0.5871
Epoch 325/400
160/160 [=====] - 0s 706us/step - loss: 0.5816
Epoch 326/400
160/160 [=====] - 0s 710us/step - loss: 0.5791
Epoch 327/400
160/160 [=====] - 0s 690us/step - loss: 0.5894
Epoch 328/400
160/160 [=====] - 0s 601us/step - loss: 0.5861
Epoch 329/400
160/160 [=====] - 0s 616us/step - loss: 0.5877
Epoch 330/400
160/160 [=====] - 0s 831us/step - loss: 0.5896
Epoch 331/400
160/160 [=====] - 0s 808us/step - loss: 0.5790
Epoch 332/400
160/160 [=====] - 0s 908us/step - loss: 0.5835
Epoch 333/400
160/160 [=====] - 0s 852us/step - loss: 0.5793
Epoch 334/400
160/160 [=====] - 0s 723us/step - loss: 0.5922
Epoch 335/400
160/160 [=====] - 0s 621us/step - loss: 0.5873
Epoch 336/400
160/160 [=====] - 0s 860us/step - loss: 0.5841
Epoch 337/400
160/160 [=====] - 0s 917us/step - loss: 0.5865
Epoch 338/400
160/160 [=====] - 0s 887us/step - loss: 0.5883
Epoch 339/400
160/160 [=====] - 0s 809us/step - loss: 0.5879
Epoch 340/400
160/160 [=====] - 0s 776us/step - loss: 0.5863

Epoch 341/400
160/160 [=====] - 0s 781us/step - loss: 0.5864
Epoch 342/400
160/160 [=====] - 0s 782us/step - loss: 0.5864
Epoch 343/400
160/160 [=====] - 0s 884us/step - loss: 0.5846
Epoch 344/400
160/160 [=====] - 0s 883us/step - loss: 0.5881
Epoch 345/400
160/160 [=====] - 0s 787us/step - loss: 0.5866
Epoch 346/400
160/160 [=====] - 0s 625us/step - loss: 0.5856
Epoch 347/400
160/160 [=====] - 0s 620us/step - loss: 0.5866
Epoch 348/400
160/160 [=====] - 0s 690us/step - loss: 0.5666
Epoch 349/400
160/160 [=====] - 0s 694us/step - loss: 0.5785
Epoch 350/400
160/160 [=====] - 0s 713us/step - loss: 0.5853
Epoch 351/400
160/160 [=====] - 0s 678us/step - loss: 0.5845
Epoch 352/400
160/160 [=====] - 0s 831us/step - loss: 0.5897
Epoch 353/400
160/160 [=====] - 0s 763us/step - loss: 0.5847
Epoch 354/400
160/160 [=====] - 0s 811us/step - loss: 0.5842
Epoch 355/400
160/160 [=====] - 0s 671us/step - loss: 0.5915
Epoch 356/400
160/160 [=====] - 0s 639us/step - loss: 0.5677
Epoch 357/400
160/160 [=====] - 0s 636us/step - loss: 0.5859
Epoch 358/400
160/160 [=====] - 0s 610us/step - loss: 0.5823
Epoch 359/400
160/160 [=====] - 0s 613us/step - loss: 0.5876
Epoch 360/400
160/160 [=====] - 0s 706us/step - loss: 0.5849
Epoch 361/400
160/160 [=====] - 0s 573us/step - loss: 0.5815
Epoch 362/400
160/160 [=====] - 0s 601us/step - loss: 0.5833
Epoch 363/400
160/160 [=====] - 0s 606us/step - loss: 0.5847
Epoch 364/400
160/160 [=====] - 0s 580us/step - loss: 0.5838

Epoch 365/400
160/160 [=====] - 0s 584us/step - loss: 0.5816
Epoch 366/400
160/160 [=====] - 0s 587us/step - loss: 0.5860
Epoch 367/400
160/160 [=====] - 0s 616us/step - loss: 0.5875
Epoch 368/400
160/160 [=====] - 0s 625us/step - loss: 0.5812
Epoch 369/400
160/160 [=====] - 0s 675us/step - loss: 0.5814
Epoch 370/400
160/160 [=====] - 0s 670us/step - loss: 0.5860
Epoch 371/400
160/160 [=====] - 0s 617us/step - loss: 0.5781
Epoch 372/400
160/160 [=====] - 0s 578us/step - loss: 0.5892
Epoch 373/400
160/160 [=====] - 0s 592us/step - loss: 0.5847
Epoch 374/400
160/160 [=====] - 0s 579us/step - loss: 0.5828
Epoch 375/400
160/160 [=====] - 0s 554us/step - loss: 0.5814
Epoch 376/400
160/160 [=====] - 0s 628us/step - loss: 0.5879
Epoch 377/400
160/160 [=====] - 0s 603us/step - loss: 0.5806
Epoch 378/400
160/160 [=====] - 0s 616us/step - loss: 0.5833
Epoch 379/400
160/160 [=====] - 0s 606us/step - loss: 0.5810
Epoch 380/400
160/160 [=====] - 0s 637us/step - loss: 0.5815
Epoch 381/400
160/160 [=====] - 0s 669us/step - loss: 0.5831
Epoch 382/400
160/160 [=====] - 0s 655us/step - loss: 0.5882
Epoch 383/400
160/160 [=====] - 0s 655us/step - loss: 0.5877
Epoch 384/400
160/160 [=====] - 0s 611us/step - loss: 0.5880
Epoch 385/400
160/160 [=====] - 0s 585us/step - loss: 0.5822
Epoch 386/400
160/160 [=====] - 0s 614us/step - loss: 0.5846
Epoch 387/400
160/160 [=====] - 0s 624us/step - loss: 0.5882
Epoch 388/400
160/160 [=====] - 0s 750us/step - loss: 0.5868

Epoch 389/400
160/160 [=====] - 0s 693us/step - loss: 0.5875
Epoch 390/400
160/160 [=====] - 0s 625us/step - loss: 0.5642
Epoch 391/400
160/160 [=====] - 0s 721us/step - loss: 0.5897
Epoch 392/400
160/160 [=====] - 0s 803us/step - loss: 0.5893
Epoch 393/400
160/160 [=====] - 0s 960us/step - loss: 0.5851
Epoch 394/400
160/160 [=====] - 0s 631us/step - loss: 0.5833
Epoch 395/400
160/160 [=====] - 0s 605us/step - loss: 0.5824
Epoch 396/400
160/160 [=====] - ETA: 0s - loss: 0.591 - 0s 623us/step - loss: 0.5799
Epoch 397/400
160/160 [=====] - 0s 601us/step - loss: 0.5787
Epoch 398/400
160/160 [=====] - 0s 609us/step - loss: 0.5859
Epoch 399/400
160/160 [=====] - 0s 612us/step - loss: 0.5836
Epoch 400/400
160/160 [=====] - 0s 637us/step - loss: 0.5893
[0.42832693 0.9916327 0.99150443 0.9894188 0.9961999 0.9957827
0.91654515 0.9630104 0.4140018 0.9956465 0.9905505 0.9947701
0.9811302 0.44630328 0.53311145 0.86619776 0.40397385 0.9942931
0.99636114 0.5437931 0.9968203 0.9967289 0.40302446 0.81922126
0.99653125 0.40766138 0.9967566 0.9968868 0.9967471 0.9441811
0.98631114 0.45943245 0.5080409 0.94420755 0.9923089 0.9958294
0.8794791 0.48729914 0.88874745 0.44191378 0.39669505 0.3973198
0.39655903 0.3972444 0.39732802 0.39654902 0.39699474 0.3960347
0.39736736 0.3964887 0.39712277 0.3972236 0.39655033 0.39655474
0.39685073 0.39795002 0.3976612 0.39649618 0.39718556 0.39626166
0.39629164 0.3969601 0.3977882 0.39721197 0.39706022 0.39724016
0.39622757 0.39641598 0.396477 0.39686912 0.39616868 0.39752296
0.397102 0.39689213 0.39638993 0.39716062 0.39765933 0.3970027
0.3972018 0.3970778 0.40882805 0.3985389 0.4028464 0.39863282
0.39862055 0.40211424 0.39934188 0.7295552 0.39885312 0.40332693
0.39885414 0.3986855 0.4036745 0.41596973 0.40102988 0.3979542
0.39850244 0.4037521 0.39876923 0.49033487 0.40662414 0.3991046
0.39824587 0.39870253 0.39894685 0.40030155 0.41182736 0.40221274
0.4020438 0.39994723 0.45959073 0.39817825 0.39925894 0.39980835
0.4084476 0.39878765 0.39811906 0.39990115 0.3987139 0.39976656
0.39670023 0.4076089 0.39643458 0.40328965 0.41761324 0.39640328
0.39799738 0.39598042 0.39872235 0.3962901 0.40017033 0.4041922
0.39643043 0.3965367 0.39706004 0.8615396 0.39935613 0.3963141
0.40559152 0.3962444 0.39596817 0.39988363 0.4002156 0.4002127

```
0.40132925 0.39759597 0.39591318 0.39615798 0.39626235 0.39731777
0.39601913 0.40489537 0.39811906 0.39742675 0.39618245 0.4028492
0.45630142 0.39753285 0.4003253 0.39767328]
160/160 [=====] - 0s 606us/step
```

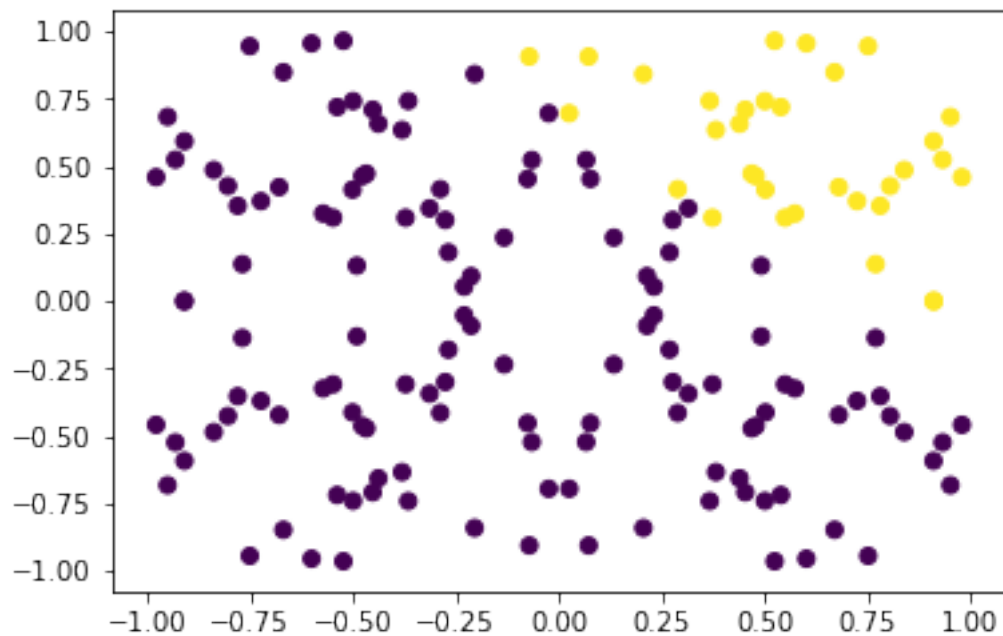
```
In [14]: scores, model.metrics_names
```

```
Out[14]: (0.5682669639587402, ['loss'])
```

```
In [15]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

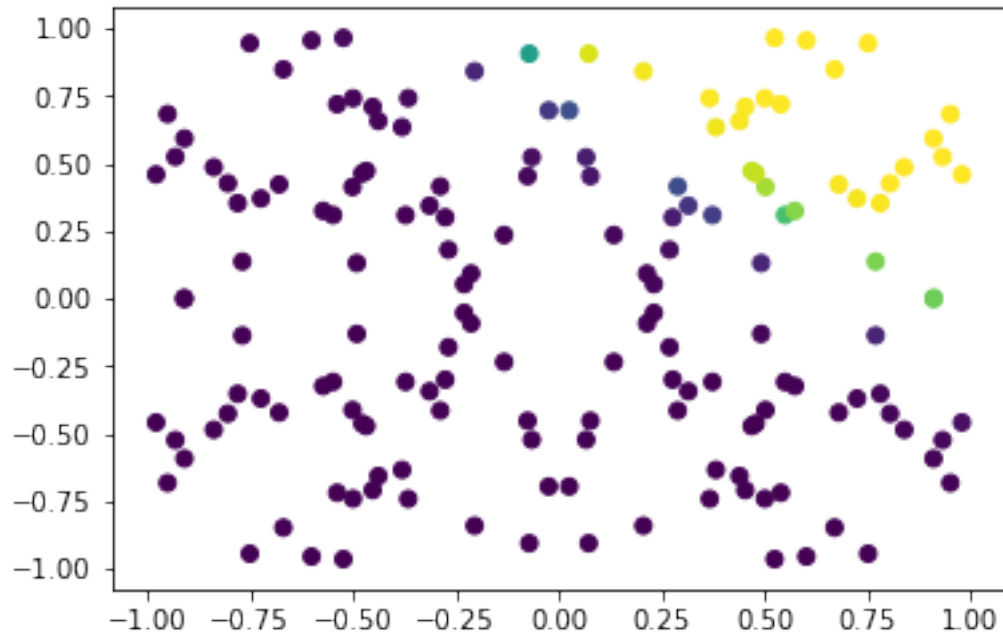
```
# This came out pretty nice
```

```
Out[15]: <matplotlib.collections.PathCollection at 0xb24996668>
```



```
In [16]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[16]: <matplotlib.collections.PathCollection at 0xb24a5aa20>
```



```
In [17]: # 4 hidden layers with 2 neurons
model = Sequential()

model.add(Dense(2, input_dim=2, activation='tanh'))
model.add(Dense(2, activation='tanh'))
model.add(Dense(2, activation='tanh'))
model.add(Dense(2, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

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

```
Epoch 1/400
160/160 [=====] - 0s 3ms/step - loss: 4.2775
Epoch 2/400
160/160 [=====] - 0s 890us/step - loss: 4.1138
Epoch 3/400
160/160 [=====] - 0s 762us/step - loss: 0.7373
Epoch 4/400
```

160/160 [=====] - 0s 590us/step - loss: 0.6896
Epoch 5/400
160/160 [=====] - 0s 568us/step - loss: 0.6827
Epoch 6/400
160/160 [=====] - 0s 690us/step - loss: 0.6874
Epoch 7/400
160/160 [=====] - 0s 611us/step - loss: 0.6854
Epoch 8/400
160/160 [=====] - 0s 609us/step - loss: 0.6722
Epoch 9/400
160/160 [=====] - 0s 746us/step - loss: 0.6633
Epoch 10/400
160/160 [=====] - 0s 656us/step - loss: 0.6568
Epoch 11/400
160/160 [=====] - 0s 697us/step - loss: 0.6591
Epoch 12/400
160/160 [=====] - 0s 903us/step - loss: 0.6478
Epoch 13/400
160/160 [=====] - 0s 935us/step - loss: 0.6485
Epoch 14/400
160/160 [=====] - 0s 890us/step - loss: 0.6410
Epoch 15/400
160/160 [=====] - 0s 848us/step - loss: 0.6346
Epoch 16/400
160/160 [=====] - 0s 919us/step - loss: 0.6207
Epoch 17/400
160/160 [=====] - 0s 934us/step - loss: 0.6196
Epoch 18/400
160/160 [=====] - 0s 967us/step - loss: 0.6244
Epoch 19/400
160/160 [=====] - 0s 842us/step - loss: 0.6081
Epoch 20/400
160/160 [=====] - 0s 804us/step - loss: 0.6122
Epoch 21/400
160/160 [=====] - 0s 851us/step - loss: 0.6027
Epoch 22/400
160/160 [=====] - 0s 815us/step - loss: 0.5959
Epoch 23/400
160/160 [=====] - 0s 818us/step - loss: 0.6031
Epoch 24/400
160/160 [=====] - 0s 829us/step - loss: 0.5959
Epoch 25/400
160/160 [=====] - 0s 881us/step - loss: 0.5952
Epoch 26/400
160/160 [=====] - 0s 902us/step - loss: 0.5960
Epoch 27/400
160/160 [=====] - 0s 862us/step - loss: 0.5907
Epoch 28/400

160/160 [=====] - 0s 857us/step - loss: 0.5944
 Epoch 29/400
 160/160 [=====] - 0s 778us/step - loss: 0.5810
 Epoch 30/400
 160/160 [=====] - 0s 759us/step - loss: 0.5816
 Epoch 31/400
 160/160 [=====] - 0s 602us/step - loss: 0.5823
 Epoch 32/400
 160/160 [=====] - 0s 610us/step - loss: 0.5783
 Epoch 33/400
 160/160 [=====] - 0s 605us/step - loss: 0.5702
 Epoch 34/400
 160/160 [=====] - 0s 576us/step - loss: 0.5395
 Epoch 35/400
 160/160 [=====] - 0s 583us/step - loss: 0.5101
 Epoch 36/400
 160/160 [=====] - 0s 578us/step - loss: 0.4866
 Epoch 37/400
 160/160 [=====] - 0s 581us/step - loss: 1.2007
 Epoch 38/400
 160/160 [=====] - 0s 573us/step - loss: 0.5198
 Epoch 39/400
 160/160 [=====] - 0s 585us/step - loss: 0.7627
 Epoch 40/400
 160/160 [=====] - 0s 570us/step - loss: 0.6084
 Epoch 41/400
 160/160 [=====] - 0s 556us/step - loss: 0.6061
 Epoch 42/400
 160/160 [=====] - 0s 575us/step - loss: 0.6011
 Epoch 43/400
 160/160 [=====] - 0s 589us/step - loss: 0.5976
 Epoch 44/400
 160/160 [=====] - 0s 617us/step - loss: 0.5988
 Epoch 45/400
 160/160 [=====] - 0s 790us/step - loss: 0.5948
 Epoch 46/400
 160/160 [=====] - 0s 805us/step - loss: 0.5920
 Epoch 47/400
 160/160 [=====] - 0s 782us/step - loss: 0.6036
 Epoch 48/400
 160/160 [=====] - 0s 658us/step - loss: 0.5874
 Epoch 49/400
 160/160 [=====] - 0s 961us/step - loss: 0.5865
 Epoch 50/400
 160/160 [=====] - 0s 758us/step - loss: 0.5958
 Epoch 51/400
 160/160 [=====] - 0s 742us/step - loss: 0.5947
 Epoch 52/400

160/160 [=====] - 0s 811us/step - loss: 0.5940
Epoch 53/400
160/160 [=====] - 0s 791us/step - loss: 0.5900
Epoch 54/400
160/160 [=====] - 0s 607us/step - loss: 0.5904
Epoch 55/400
160/160 [=====] - 0s 588us/step - loss: 0.5920
Epoch 56/400
160/160 [=====] - 0s 586us/step - loss: 0.5857
Epoch 57/400
160/160 [=====] - 0s 597us/step - loss: 0.5941
Epoch 58/400
160/160 [=====] - 0s 621us/step - loss: 0.5976
Epoch 59/400
160/160 [=====] - 0s 718us/step - loss: 0.5937
Epoch 60/400
160/160 [=====] - 0s 799us/step - loss: 0.5960
Epoch 61/400
160/160 [=====] - 0s 756us/step - loss: 0.5944
Epoch 62/400
160/160 [=====] - 0s 742us/step - loss: 0.5923
Epoch 63/400
160/160 [=====] - 0s 818us/step - loss: 0.5878
Epoch 64/400
160/160 [=====] - 0s 764us/step - loss: 0.5933
Epoch 65/400
160/160 [=====] - 0s 814us/step - loss: 0.5937
Epoch 66/400
160/160 [=====] - 0s 755us/step - loss: 0.5866
Epoch 67/400
160/160 [=====] - 0s 860us/step - loss: 0.5899
Epoch 68/400
160/160 [=====] - 0s 821us/step - loss: 0.5853
Epoch 69/400
160/160 [=====] - 0s 702us/step - loss: 0.5917
Epoch 70/400
160/160 [=====] - 0s 819us/step - loss: 0.5912
Epoch 71/400
160/160 [=====] - 0s 655us/step - loss: 0.5907
Epoch 72/400
160/160 [=====] - 0s 645us/step - loss: 0.5920
Epoch 73/400
160/160 [=====] - 0s 635us/step - loss: 0.5846
Epoch 74/400
160/160 [=====] - 0s 664us/step - loss: 0.5919
Epoch 75/400
160/160 [=====] - 0s 625us/step - loss: 0.5933
Epoch 76/400

160/160 [=====] - 0s 663us/step - loss: 0.5735
 Epoch 77/400
 160/160 [=====] - 0s 627us/step - loss: 0.5955
 Epoch 78/400
 160/160 [=====] - 0s 749us/step - loss: 0.5925
 Epoch 79/400
 160/160 [=====] - 0s 786us/step - loss: 0.5913
 Epoch 80/400
 160/160 [=====] - 0s 721us/step - loss: 0.5935
 Epoch 81/400
 160/160 [=====] - 0s 587us/step - loss: 0.5924
 Epoch 82/400
 160/160 [=====] - 0s 595us/step - loss: 0.5893
 Epoch 83/400
 160/160 [=====] - 0s 589us/step - loss: 0.5978
 Epoch 84/400
 160/160 [=====] - 0s 633us/step - loss: 0.5869
 Epoch 85/400
 160/160 [=====] - 0s 786us/step - loss: 0.5926
 Epoch 86/400
 160/160 [=====] - 0s 733us/step - loss: 0.5807
 Epoch 87/400
 160/160 [=====] - 0s 623us/step - loss: 0.5959
 Epoch 88/400
 160/160 [=====] - 0s 695us/step - loss: 0.5865
 Epoch 89/400
 160/160 [=====] - 0s 726us/step - loss: 0.5989
 Epoch 90/400
 160/160 [=====] - 0s 636us/step - loss: 0.5928
 Epoch 91/400
 160/160 [=====] - 0s 631us/step - loss: 0.5936
 Epoch 92/400
 160/160 [=====] - 0s 643us/step - loss: 0.5904
 Epoch 93/400
 160/160 [=====] - 0s 716us/step - loss: 0.5930
 Epoch 94/400
 160/160 [=====] - 0s 759us/step - loss: 0.5893
 Epoch 95/400
 160/160 [=====] - 0s 657us/step - loss: 0.5865
 Epoch 96/400
 160/160 [=====] - 0s 686us/step - loss: 0.5941
 Epoch 97/400
 160/160 [=====] - 0s 729us/step - loss: 0.5879
 Epoch 98/400
 160/160 [=====] - 0s 615us/step - loss: 0.5902
 Epoch 99/400
 160/160 [=====] - 0s 599us/step - loss: 0.5924
 Epoch 100/400

160/160 [=====] - 0s 930us/step - loss: 0.5964
 Epoch 101/400
 160/160 [=====] - 0s 640us/step - loss: 0.5930
 Epoch 102/400
 160/160 [=====] - 0s 692us/step - loss: 0.5864
 Epoch 103/400
 160/160 [=====] - 0s 746us/step - loss: 0.5939
 Epoch 104/400
 160/160 [=====] - 0s 764us/step - loss: 0.5902
 Epoch 105/400
 160/160 [=====] - 0s 656us/step - loss: 0.5960
 Epoch 106/400
 160/160 [=====] - 0s 613us/step - loss: 0.5914
 Epoch 107/400
 160/160 [=====] - 0s 670us/step - loss: 0.5928
 Epoch 108/400
 160/160 [=====] - 0s 762us/step - loss: 0.5917
 Epoch 109/400
 160/160 [=====] - 0s 625us/step - loss: 0.5813
 Epoch 110/400
 160/160 [=====] - 0s 610us/step - loss: 0.5918
 Epoch 111/400
 160/160 [=====] - 0s 647us/step - loss: 0.5879
 Epoch 112/400
 160/160 [=====] - 0s 680us/step - loss: 0.5920
 Epoch 113/400
 160/160 [=====] - 0s 798us/step - loss: 0.5913
 Epoch 114/400
 160/160 [=====] - 0s 806us/step - loss: 0.5961
 Epoch 115/400
 160/160 [=====] - 0s 791us/step - loss: 0.5941
 Epoch 116/400
 160/160 [=====] - 0s 636us/step - loss: 0.5886
 Epoch 117/400
 160/160 [=====] - 0s 656us/step - loss: 0.5918
 Epoch 118/400
 160/160 [=====] - 0s 608us/step - loss: 0.5914
 Epoch 119/400
 160/160 [=====] - 0s 848us/step - loss: 0.5914
 Epoch 120/400
 160/160 [=====] - 0s 599us/step - loss: 0.5895
 Epoch 121/400
 160/160 [=====] - 0s 578us/step - loss: 0.5902
 Epoch 122/400
 160/160 [=====] - 0s 879us/step - loss: 0.5945
 Epoch 123/400
 160/160 [=====] - 0s 744us/step - loss: 0.5853
 Epoch 124/400

160/160 [=====] - 0s 632us/step - loss: 0.5885
 Epoch 125/400
 160/160 [=====] - 0s 724us/step - loss: 0.5890
 Epoch 126/400
 160/160 [=====] - 0s 756us/step - loss: 0.5916
 Epoch 127/400
 160/160 [=====] - 0s 693us/step - loss: 0.5890
 Epoch 128/400
 160/160 [=====] - 0s 617us/step - loss: 0.5844
 Epoch 129/400
 160/160 [=====] - 0s 602us/step - loss: 0.5880
 Epoch 130/400
 160/160 [=====] - 0s 731us/step - loss: 0.5955
 Epoch 131/400
 160/160 [=====] - 0s 766us/step - loss: 0.5884
 Epoch 132/400
 160/160 [=====] - 0s 657us/step - loss: 0.5843
 Epoch 133/400
 160/160 [=====] - 0s 625us/step - loss: 0.5841
 Epoch 134/400
 160/160 [=====] - 0s 599us/step - loss: 0.5908
 Epoch 135/400
 160/160 [=====] - 0s 579us/step - loss: 0.5852
 Epoch 136/400
 160/160 [=====] - 0s 577us/step - loss: 0.5884
 Epoch 137/400
 160/160 [=====] - 0s 613us/step - loss: 0.5888
 Epoch 138/400
 160/160 [=====] - 0s 601us/step - loss: 0.5814
 Epoch 139/400
 160/160 [=====] - 0s 602us/step - loss: 0.5899
 Epoch 140/400
 160/160 [=====] - 0s 594us/step - loss: 0.5922
 Epoch 141/400
 160/160 [=====] - 0s 599us/step - loss: 0.5911
 Epoch 142/400
 160/160 [=====] - 0s 581us/step - loss: 0.5873
 Epoch 143/400
 160/160 [=====] - 0s 580us/step - loss: 0.5956
 Epoch 144/400
 160/160 [=====] - 0s 568us/step - loss: 0.5886
 Epoch 145/400
 160/160 [=====] - 0s 563us/step - loss: 0.5872
 Epoch 146/400
 160/160 [=====] - 0s 585us/step - loss: 0.5946
 Epoch 147/400
 160/160 [=====] - 0s 597us/step - loss: 0.5930
 Epoch 148/400

160/160 [=====] - 0s 562us/step - loss: 0.5876
 Epoch 149/400
 160/160 [=====] - 0s 587us/step - loss: 0.5873
 Epoch 150/400
 160/160 [=====] - 0s 563us/step - loss: 0.5893
 Epoch 151/400
 160/160 [=====] - 0s 565us/step - loss: 0.5880
 Epoch 152/400
 160/160 [=====] - 0s 583us/step - loss: 0.5855
 Epoch 153/400
 160/160 [=====] - 0s 582us/step - loss: 0.5925
 Epoch 154/400
 160/160 [=====] - 0s 598us/step - loss: 0.5880
 Epoch 155/400
 160/160 [=====] - 0s 600us/step - loss: 0.5914
 Epoch 156/400
 160/160 [=====] - 0s 606us/step - loss: 0.5919
 Epoch 157/400
 160/160 [=====] - 0s 632us/step - loss: 0.5851
 Epoch 158/400
 160/160 [=====] - 0s 630us/step - loss: 0.5882
 Epoch 159/400
 160/160 [=====] - 0s 595us/step - loss: 0.5903
 Epoch 160/400
 160/160 [=====] - 0s 619us/step - loss: 0.5866
 Epoch 161/400
 160/160 [=====] - 0s 615us/step - loss: 0.5910
 Epoch 162/400
 160/160 [=====] - 0s 639us/step - loss: 0.5843
 Epoch 163/400
 160/160 [=====] - 0s 610us/step - loss: 0.5877
 Epoch 164/400
 160/160 [=====] - 0s 659us/step - loss: 0.5843
 Epoch 165/400
 160/160 [=====] - 0s 618us/step - loss: 0.5900
 Epoch 166/400
 160/160 [=====] - 0s 621us/step - loss: 0.5929
 Epoch 167/400
 160/160 [=====] - 0s 629us/step - loss: 0.5866
 Epoch 168/400
 160/160 [=====] - 0s 608us/step - loss: 0.5761
 Epoch 169/400
 160/160 [=====] - 0s 627us/step - loss: 0.5934
 Epoch 170/400
 160/160 [=====] - 0s 625us/step - loss: 0.5834
 Epoch 171/400
 160/160 [=====] - 0s 679us/step - loss: 0.5905
 Epoch 172/400

160/160 [=====] - 0s 682us/step - loss: 0.5875
 Epoch 173/400
 160/160 [=====] - 0s 633us/step - loss: 0.5884
 Epoch 174/400
 160/160 [=====] - 0s 629us/step - loss: 0.5974
 Epoch 175/400
 160/160 [=====] - 0s 585us/step - loss: 0.5914
 Epoch 176/400
 160/160 [=====] - 0s 609us/step - loss: 0.5939
 Epoch 177/400
 160/160 [=====] - 0s 641us/step - loss: 0.5880
 Epoch 178/400
 160/160 [=====] - 0s 593us/step - loss: 0.5872
 Epoch 179/400
 160/160 [=====] - 0s 597us/step - loss: 0.5928
 Epoch 180/400
 160/160 [=====] - 0s 581us/step - loss: 0.5878
 Epoch 181/400
 160/160 [=====] - 0s 585us/step - loss: 0.5927
 Epoch 182/400
 160/160 [=====] - 0s 603us/step - loss: 0.5898
 Epoch 183/400
 160/160 [=====] - 0s 600us/step - loss: 0.5933
 Epoch 184/400
 160/160 [=====] - 0s 594us/step - loss: 0.5913
 Epoch 185/400
 160/160 [=====] - 0s 584us/step - loss: 0.5736
 Epoch 186/400
 160/160 [=====] - 0s 609us/step - loss: 0.5994
 Epoch 187/400
 160/160 [=====] - 0s 608us/step - loss: 0.5890
 Epoch 188/400
 160/160 [=====] - 0s 599us/step - loss: 0.5808
 Epoch 189/400
 160/160 [=====] - 0s 585us/step - loss: 0.5905
 Epoch 190/400
 160/160 [=====] - 0s 595us/step - loss: 0.5769
 Epoch 191/400
 160/160 [=====] - 0s 583us/step - loss: 0.5921
 Epoch 192/400
 160/160 [=====] - 0s 612us/step - loss: 0.5922
 Epoch 193/400
 160/160 [=====] - 0s 582us/step - loss: 0.5888
 Epoch 194/400
 160/160 [=====] - 0s 576us/step - loss: 0.5820
 Epoch 195/400
 160/160 [=====] - 0s 591us/step - loss: 0.5880
 Epoch 196/400

160/160 [=====] - 0s 577us/step - loss: 0.5922
Epoch 197/400
160/160 [=====] - 0s 609us/step - loss: 0.5874
Epoch 198/400
160/160 [=====] - 0s 623us/step - loss: 0.5822
Epoch 199/400
160/160 [=====] - 0s 578us/step - loss: 0.5844
Epoch 200/400
160/160 [=====] - 0s 599us/step - loss: 0.5873
Epoch 201/400
160/160 [=====] - 0s 590us/step - loss: 0.5904
Epoch 202/400
160/160 [=====] - 0s 604us/step - loss: 0.5868
Epoch 203/400
160/160 [=====] - 0s 590us/step - loss: 0.5832
Epoch 204/400
160/160 [=====] - 0s 606us/step - loss: 0.5882
Epoch 205/400
160/160 [=====] - 0s 591us/step - loss: 0.5887
Epoch 206/400
160/160 [=====] - 0s 606us/step - loss: 0.5867
Epoch 207/400
160/160 [=====] - 0s 616us/step - loss: 0.5882
Epoch 208/400
160/160 [=====] - 0s 612us/step - loss: 0.5902
Epoch 209/400
160/160 [=====] - 0s 586us/step - loss: 0.5862
Epoch 210/400
160/160 [=====] - 0s 598us/step - loss: 0.5905
Epoch 211/400
160/160 [=====] - 0s 607us/step - loss: 0.5834
Epoch 212/400
160/160 [=====] - 0s 592us/step - loss: 0.5886
Epoch 213/400
160/160 [=====] - 0s 601us/step - loss: 0.5887
Epoch 214/400
160/160 [=====] - 0s 581us/step - loss: 0.5849
Epoch 215/400
160/160 [=====] - 0s 573us/step - loss: 0.5916
Epoch 216/400
160/160 [=====] - 0s 586us/step - loss: 0.5869
Epoch 217/400
160/160 [=====] - 0s 579us/step - loss: 0.5836
Epoch 218/400
160/160 [=====] - 0s 593us/step - loss: 0.5841
Epoch 219/400
160/160 [=====] - 0s 601us/step - loss: 0.5873
Epoch 220/400

160/160 [=====] - 0s 621us/step - loss: 0.5821
 Epoch 221/400
 160/160 [=====] - 0s 584us/step - loss: 0.5855
 Epoch 222/400
 160/160 [=====] - 0s 615us/step - loss: 0.5674
 Epoch 223/400
 160/160 [=====] - 0s 599us/step - loss: 0.5922
 Epoch 224/400
 160/160 [=====] - 0s 601us/step - loss: 0.5848
 Epoch 225/400
 160/160 [=====] - 0s 592us/step - loss: 0.5868
 Epoch 226/400
 160/160 [=====] - 0s 586us/step - loss: 0.5807
 Epoch 227/400
 160/160 [=====] - 0s 586us/step - loss: 0.5922
 Epoch 228/400
 160/160 [=====] - 0s 596us/step - loss: 0.5920
 Epoch 229/400
 160/160 [=====] - 0s 594us/step - loss: 0.5880
 Epoch 230/400
 160/160 [=====] - 0s 582us/step - loss: 0.5921
 Epoch 231/400
 160/160 [=====] - 0s 594us/step - loss: 0.5900
 Epoch 232/400
 160/160 [=====] - 0s 600us/step - loss: 0.5836
 Epoch 233/400
 160/160 [=====] - 0s 588us/step - loss: 0.5941
 Epoch 234/400
 160/160 [=====] - 0s 609us/step - loss: 0.5886
 Epoch 235/400
 160/160 [=====] - 0s 602us/step - loss: 0.5879
 Epoch 236/400
 160/160 [=====] - 0s 625us/step - loss: 0.5770
 Epoch 237/400
 160/160 [=====] - 0s 623us/step - loss: 0.5873
 Epoch 238/400
 160/160 [=====] - 0s 623us/step - loss: 0.5864
 Epoch 239/400
 160/160 [=====] - 0s 641us/step - loss: 0.5809
 Epoch 240/400
 160/160 [=====] - 0s 604us/step - loss: 0.5862
 Epoch 241/400
 160/160 [=====] - 0s 623us/step - loss: 0.5890
 Epoch 242/400
 160/160 [=====] - 0s 624us/step - loss: 0.5872
 Epoch 243/400
 160/160 [=====] - 0s 649us/step - loss: 0.5847
 Epoch 244/400

160/160 [=====] - 0s 614us/step - loss: 0.5931
 Epoch 245/400
 160/160 [=====] - 0s 617us/step - loss: 0.5844
 Epoch 246/400
 160/160 [=====] - 0s 605us/step - loss: 0.5910
 Epoch 247/400
 160/160 [=====] - 0s 609us/step - loss: 0.5874
 Epoch 248/400
 160/160 [=====] - 0s 616us/step - loss: 0.5879
 Epoch 249/400
 160/160 [=====] - 0s 665us/step - loss: 0.5889
 Epoch 250/400
 160/160 [=====] - 0s 633us/step - loss: 0.5916
 Epoch 251/400
 160/160 [=====] - 0s 621us/step - loss: 0.5865
 Epoch 252/400
 160/160 [=====] - 0s 698us/step - loss: 0.5900
 Epoch 253/400
 160/160 [=====] - 0s 605us/step - loss: 0.5795
 Epoch 254/400
 160/160 [=====] - 0s 629us/step - loss: 0.5837
 Epoch 255/400
 160/160 [=====] - 0s 606us/step - loss: 0.5881
 Epoch 256/400
 160/160 [=====] - 0s 610us/step - loss: 0.5839
 Epoch 257/400
 160/160 [=====] - 0s 600us/step - loss: 0.5909
 Epoch 258/400
 160/160 [=====] - 0s 584us/step - loss: 0.5814
 Epoch 259/400
 160/160 [=====] - 0s 591us/step - loss: 0.5880
 Epoch 260/400
 160/160 [=====] - 0s 574us/step - loss: 0.5927
 Epoch 261/400
 160/160 [=====] - 0s 573us/step - loss: 0.5853
 Epoch 262/400
 160/160 [=====] - 0s 645us/step - loss: 0.5776
 Epoch 263/400
 160/160 [=====] - 0s 595us/step - loss: 0.5904
 Epoch 264/400
 160/160 [=====] - 0s 638us/step - loss: 0.5830 0s - loss: 0.562
 Epoch 265/400
 160/160 [=====] - 0s 602us/step - loss: 0.5886
 Epoch 266/400
 160/160 [=====] - 0s 612us/step - loss: 0.5905
 Epoch 267/400
 160/160 [=====] - 0s 625us/step - loss: 0.5736
 Epoch 268/400

160/160 [=====] - 0s 576us/step - loss: 0.5912
Epoch 269/400
160/160 [=====] - 0s 617us/step - loss: 0.5912
Epoch 270/400
160/160 [=====] - 0s 588us/step - loss: 0.5794
Epoch 271/400
160/160 [=====] - 0s 577us/step - loss: 0.5863
Epoch 272/400
160/160 [=====] - 0s 578us/step - loss: 0.5884
Epoch 273/400
160/160 [=====] - 0s 587us/step - loss: 0.5824
Epoch 274/400
160/160 [=====] - 0s 604us/step - loss: 0.5866
Epoch 275/400
160/160 [=====] - 0s 584us/step - loss: 0.5830
Epoch 276/400
160/160 [=====] - 0s 623us/step - loss: 0.5898
Epoch 277/400
160/160 [=====] - 0s 598us/step - loss: 0.5870
Epoch 278/400
160/160 [=====] - 0s 603us/step - loss: 0.5865
Epoch 279/400
160/160 [=====] - 0s 628us/step - loss: 0.5820
Epoch 280/400
160/160 [=====] - 0s 615us/step - loss: 0.5878
Epoch 281/400
160/160 [=====] - 0s 610us/step - loss: 0.5871
Epoch 282/400
160/160 [=====] - 0s 611us/step - loss: 0.5858
Epoch 283/400
160/160 [=====] - 0s 625us/step - loss: 0.5878
Epoch 284/400
160/160 [=====] - 0s 629us/step - loss: 0.5884
Epoch 285/400
160/160 [=====] - 0s 586us/step - loss: 0.5778
Epoch 286/400
160/160 [=====] - 0s 675us/step - loss: 0.5828
Epoch 287/400
160/160 [=====] - 0s 612us/step - loss: 0.5864
Epoch 288/400
160/160 [=====] - 0s 610us/step - loss: 0.5819
Epoch 289/400
160/160 [=====] - 0s 601us/step - loss: 0.5844
Epoch 290/400
160/160 [=====] - 0s 607us/step - loss: 0.5807
Epoch 291/400
160/160 [=====] - 0s 604us/step - loss: 0.5811
Epoch 292/400

160/160 [=====] - 0s 608us/step - loss: 0.5824
Epoch 293/400
160/160 [=====] - 0s 615us/step - loss: 0.5872
Epoch 294/400
160/160 [=====] - 0s 620us/step - loss: 0.5864
Epoch 295/400
160/160 [=====] - 0s 617us/step - loss: 0.5772
Epoch 296/400
160/160 [=====] - 0s 617us/step - loss: 0.5923
Epoch 297/400
160/160 [=====] - 0s 604us/step - loss: 0.5840
Epoch 298/400
160/160 [=====] - 0s 602us/step - loss: 0.5789
Epoch 299/400
160/160 [=====] - 0s 584us/step - loss: 0.5828
Epoch 300/400
160/160 [=====] - 0s 590us/step - loss: 0.5862
Epoch 301/400
160/160 [=====] - 0s 581us/step - loss: 0.5770
Epoch 302/400
160/160 [=====] - 0s 586us/step - loss: 0.5893
Epoch 303/400
160/160 [=====] - 0s 577us/step - loss: 0.5809
Epoch 304/400
160/160 [=====] - 0s 585us/step - loss: 0.5739
Epoch 305/400
160/160 [=====] - 0s 602us/step - loss: 0.5784
Epoch 306/400
160/160 [=====] - 0s 585us/step - loss: 0.5840
Epoch 307/400
160/160 [=====] - 0s 598us/step - loss: 0.5812
Epoch 308/400
160/160 [=====] - 0s 606us/step - loss: 0.5714
Epoch 309/400
160/160 [=====] - 0s 596us/step - loss: 0.5802
Epoch 310/400
160/160 [=====] - 0s 624us/step - loss: 0.5843
Epoch 311/400
160/160 [=====] - 0s 578us/step - loss: 0.5818
Epoch 312/400
160/160 [=====] - 0s 587us/step - loss: 0.5770
Epoch 313/400
160/160 [=====] - 0s 581us/step - loss: 0.5823
Epoch 314/400
160/160 [=====] - 0s 590us/step - loss: 0.5840
Epoch 315/400
160/160 [=====] - 0s 591us/step - loss: 0.5801
Epoch 316/400

160/160 [=====] - 0s 582us/step - loss: 0.5833
Epoch 317/400
160/160 [=====] - 0s 604us/step - loss: 0.5698
Epoch 318/400
160/160 [=====] - 0s 589us/step - loss: 0.5797
Epoch 319/400
160/160 [=====] - 0s 580us/step - loss: 0.5838
Epoch 320/400
160/160 [=====] - 0s 624us/step - loss: 0.5852
Epoch 321/400
160/160 [=====] - 0s 566us/step - loss: 0.5570
Epoch 322/400
160/160 [=====] - 0s 602us/step - loss: 0.5858
Epoch 323/400
160/160 [=====] - 0s 622us/step - loss: 0.5841
Epoch 324/400
160/160 [=====] - 0s 606us/step - loss: 0.5743
Epoch 325/400
160/160 [=====] - 0s 617us/step - loss: 0.5803
Epoch 326/400
160/160 [=====] - 0s 579us/step - loss: 0.5722
Epoch 327/400
160/160 [=====] - 0s 569us/step - loss: 0.5811
Epoch 328/400
160/160 [=====] - 0s 577us/step - loss: 0.5821
Epoch 329/400
160/160 [=====] - 0s 596us/step - loss: 0.5716
Epoch 330/400
160/160 [=====] - 0s 588us/step - loss: 0.5827
Epoch 331/400
160/160 [=====] - 0s 605us/step - loss: 0.5765
Epoch 332/400
160/160 [=====] - 0s 611us/step - loss: 0.5769
Epoch 333/400
160/160 [=====] - 0s 596us/step - loss: 0.5773
Epoch 334/400
160/160 [=====] - 0s 602us/step - loss: 0.5781
Epoch 335/400
160/160 [=====] - 0s 605us/step - loss: 0.5778
Epoch 336/400
160/160 [=====] - 0s 602us/step - loss: 0.5769
Epoch 337/400
160/160 [=====] - 0s 597us/step - loss: 0.5708
Epoch 338/400
160/160 [=====] - 0s 597us/step - loss: 0.5698
Epoch 339/400
160/160 [=====] - 0s 597us/step - loss: 0.5703
Epoch 340/400

160/160 [=====] - 0s 579us/step - loss: 0.5697
 Epoch 341/400
 160/160 [=====] - 0s 591us/step - loss: 0.5663
 Epoch 342/400
 160/160 [=====] - 0s 583us/step - loss: 0.5654
 Epoch 343/400
 160/160 [=====] - 0s 643us/step - loss: 0.5755
 Epoch 344/400
 160/160 [=====] - 0s 616us/step - loss: 0.5679
 Epoch 345/400
 160/160 [=====] - 0s 596us/step - loss: 0.5680
 Epoch 346/400
 160/160 [=====] - 0s 611us/step - loss: 0.5743
 Epoch 347/400
 160/160 [=====] - 0s 586us/step - loss: 0.5695
 Epoch 348/400
 160/160 [=====] - 0s 596us/step - loss: 0.5696
 Epoch 349/400
 160/160 [=====] - 0s 615us/step - loss: 0.5649
 Epoch 350/400
 160/160 [=====] - 0s 606us/step - loss: 0.5554
 Epoch 351/400
 160/160 [=====] - 0s 640us/step - loss: 0.5716
 Epoch 352/400
 160/160 [=====] - 0s 602us/step - loss: 0.5643
 Epoch 353/400
 160/160 [=====] - 0s 606us/step - loss: 0.5693
 Epoch 354/400
 160/160 [=====] - 0s 624us/step - loss: 0.5696
 Epoch 355/400
 160/160 [=====] - 0s 639us/step - loss: 0.5626
 Epoch 356/400
 160/160 [=====] - 0s 740us/step - loss: 0.5656
 Epoch 357/400
 160/160 [=====] - 0s 726us/step - loss: 0.5608
 Epoch 358/400
 160/160 [=====] - 0s 703us/step - loss: 0.5521
 Epoch 359/400
 160/160 [=====] - 0s 730us/step - loss: 0.5618
 Epoch 360/400
 160/160 [=====] - 0s 591us/step - loss: 0.5553
 Epoch 361/400
 160/160 [=====] - 0s 748us/step - loss: 0.5618
 Epoch 362/400
 160/160 [=====] - 0s 617us/step - loss: 0.5637
 Epoch 363/400
 160/160 [=====] - 0s 632us/step - loss: 0.5612
 Epoch 364/400

160/160 [=====] - 0s 648us/step - loss: 0.5583
 Epoch 365/400
 160/160 [=====] - 0s 642us/step - loss: 0.5373
 Epoch 366/400
 160/160 [=====] - 0s 767us/step - loss: 0.5584
 Epoch 367/400
 160/160 [=====] - 0s 766us/step - loss: 0.5487
 Epoch 368/400
 160/160 [=====] - 0s 719us/step - loss: 0.5557
 Epoch 369/400
 160/160 [=====] - 0s 649us/step - loss: 0.5560
 Epoch 370/400
 160/160 [=====] - 0s 701us/step - loss: 0.5536
 Epoch 371/400
 160/160 [=====] - 0s 683us/step - loss: 0.5555
 Epoch 372/400
 160/160 [=====] - 0s 803us/step - loss: 0.5470
 Epoch 373/400
 160/160 [=====] - 0s 762us/step - loss: 0.5400
 Epoch 374/400
 160/160 [=====] - 0s 796us/step - loss: 0.5528
 Epoch 375/400
 160/160 [=====] - 0s 656us/step - loss: 0.5524
 Epoch 376/400
 160/160 [=====] - 0s 722us/step - loss: 0.5497
 Epoch 377/400
 160/160 [=====] - 0s 799us/step - loss: 0.5519
 Epoch 378/400
 160/160 [=====] - 0s 792us/step - loss: 0.5435
 Epoch 379/400
 160/160 [=====] - 0s 713us/step - loss: 0.5481
 Epoch 380/400
 160/160 [=====] - 0s 832us/step - loss: 0.5499
 Epoch 381/400
 160/160 [=====] - 0s 1ms/step - loss: 0.5373
 Epoch 382/400
 160/160 [=====] - 0s 1ms/step - loss: 0.5455
 Epoch 383/400
 160/160 [=====] - 0s 962us/step - loss: 0.5406
 Epoch 384/400
 160/160 [=====] - 0s 1ms/step - loss: 0.5475
 Epoch 385/400
 160/160 [=====] - 0s 1ms/step - loss: 0.5378
 Epoch 386/400
 160/160 [=====] - 0s 691us/step - loss: 0.5378
 Epoch 387/400
 160/160 [=====] - 0s 690us/step - loss: 0.5320
 Epoch 388/400

```

160/160 [=====] - 0s 665us/step - loss: 0.5366
Epoch 389/400
160/160 [=====] - 0s 680us/step - loss: 0.5311
Epoch 390/400
160/160 [=====] - 0s 736us/step - loss: 0.5347
Epoch 391/400
160/160 [=====] - 0s 637us/step - loss: 0.5225
Epoch 392/400
160/160 [=====] - 0s 577us/step - loss: 0.5416
Epoch 393/400
160/160 [=====] - 0s 650us/step - loss: 0.5397
Epoch 394/400
160/160 [=====] - 0s 579us/step - loss: 0.5254
Epoch 395/400
160/160 [=====] - 0s 604us/step - loss: 0.5356
Epoch 396/400
160/160 [=====] - 0s 566us/step - loss: 0.5296
Epoch 397/400
160/160 [=====] - 0s 588us/step - loss: 0.5331
Epoch 398/400
160/160 [=====] - 0s 573us/step - loss: 0.5332
Epoch 399/400
160/160 [=====] - 0s 812us/step - loss: 0.5248
Epoch 400/400
160/160 [=====] - 0s 609us/step - loss: 0.5250
[0.78735435 0.99467367 0.995299 0.9947833 0.99540603 0.99557424
0.99458027 0.9156585 0.76107436 0.99552935 0.99510074 0.9952259
0.9950082 0.8217017 0.9907828 0.50399363 0.36444688 0.99540013
0.99556565 0.72956735 0.9957212 0.99575156 0.32912558 0.9931081
0.99566585 0.52381015 0.9956402 0.9957993 0.99574506 0.9948544
0.9920129 0.90009713 0.98900956 0.99484277 0.9950905 0.9954551
0.96103555 0.9881474 0.99368316 0.9734331 0.260083 0.25985304
0.259852 0.25985235 0.25984046 0.25984177 0.2598611 0.26002187
0.26004788 0.25984424 0.25984836 0.2598448 0.25986123 0.26006842
0.2599094 0.26001742 0.26030052 0.25984913 0.25983736 0.26009023
0.25983655 0.25983256 0.26037216 0.2598727 0.2598349 0.26018804
0.2598409 0.25983202 0.2598348 0.25985873 0.25991297 0.25995773
0.25990638 0.25985846 0.2598609 0.25984022 0.25991416 0.25991696
0.25986734 0.25995284 0.31392485 0.26100394 0.26386273 0.26112777
0.26130453 0.263064 0.2619331 0.36037388 0.26177838 0.26342615
0.26141715 0.26127985 0.26476496 0.3417908 0.26508564 0.2600208
0.26138493 0.2638626 0.26154298 0.48785356 0.2630246 0.26194653
0.2609053 0.2611398 0.26175871 0.26783818 0.263509 0.26253685
0.26265815 0.26253653 0.27774477 0.26044443 0.26205775 0.26240134
0.26560205 0.26147512 0.26027507 0.2632839 0.2611619 0.26342058
0.2604491 0.26507097 0.26141047 0.26450697 0.2633712 0.26154175
0.26291707 0.2602524 0.26581153 0.2614288 0.2634705 0.26365498
0.2612783 0.2603417 0.26162446 0.4934538 0.26964164 0.26136038

```

```

0.26275626 0.2601748 0.2614205 0.2620503 0.2767335 0.2653196
0.2623525 0.26177683 0.26130253 0.26157615 0.26157615 0.2622215
0.2605791 0.28226247 0.26357046 0.26233095 0.26108792 0.2630063
0.29050177 0.2624286 0.2650156 0.26261386]
160/160 [=====] - 0s 463us/step

```

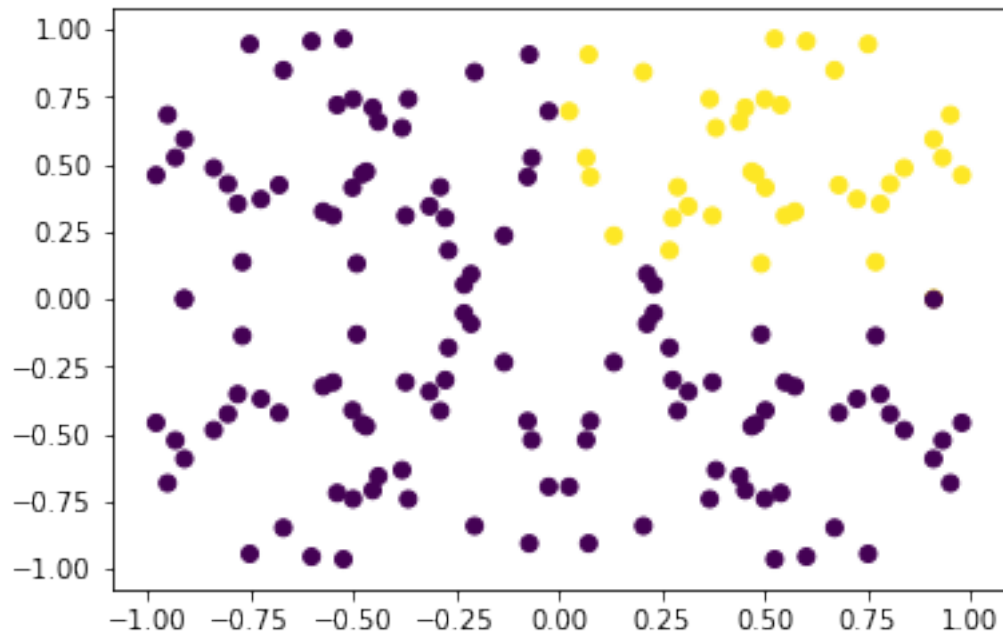
```
In [18]: scores, model.metrics_names
```

```
# I guess more hidden layer is not necessarily better
```

```
Out[18]: (0.527001416683197, ['loss'])
```

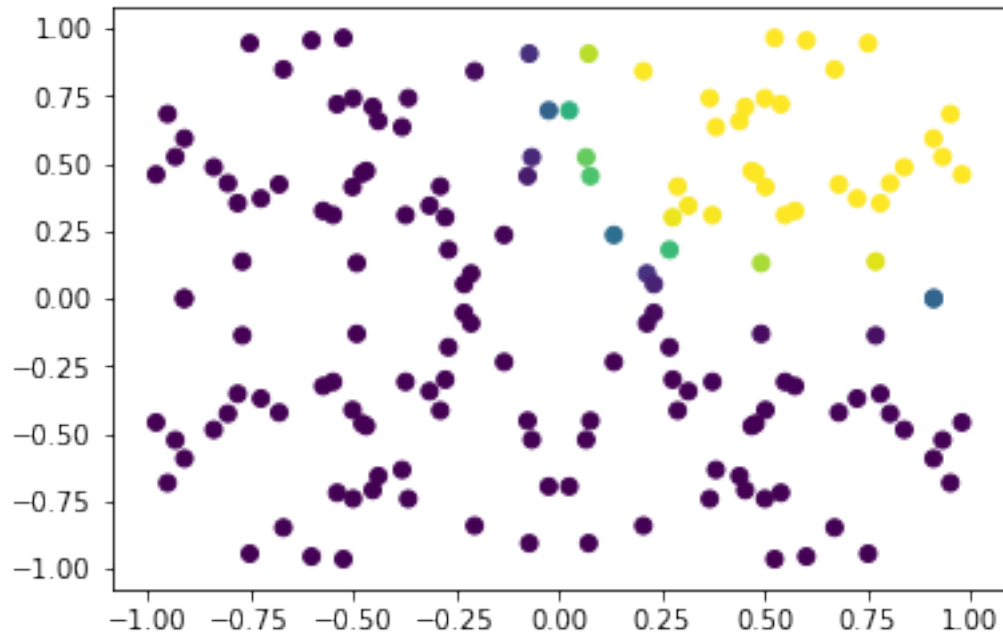
```
In [19]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[19]: <matplotlib.collections.PathCollection at 0xb24ef7d30>
```



```
In [20]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[20]: <matplotlib.collections.PathCollection at 0xb24f61278>
```



```
In [21]: # 5 hidden layers with 2 neurons
model = Sequential()

model.add(Dense(2, input_dim=2, activation='tanh'))
model.add(Dense(2, activation='tanh'))
model.add(Dense(2, activation='tanh'))
model.add(Dense(2, activation='tanh'))
model.add(Dense(2, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 3ms/step - loss: 0.7482
Epoch 2/400
160/160 [=====] - 0s 698us/step - loss: 0.6865
Epoch 3/400
160/160 [=====] - 0s 632us/step - loss: 0.6697
```

Epoch 4/400
160/160 [=====] - 0s 641us/step - loss: 0.6412
Epoch 5/400
160/160 [=====] - 0s 613us/step - loss: 0.6177
Epoch 6/400
160/160 [=====] - 0s 722us/step - loss: 0.6979
Epoch 7/400
160/160 [=====] - 0s 740us/step - loss: 0.6332
Epoch 8/400
160/160 [=====] - 0s 673us/step - loss: 0.6260
Epoch 9/400
160/160 [=====] - 0s 695us/step - loss: 0.6009
Epoch 10/400
160/160 [=====] - 0s 727us/step - loss: 0.5946
Epoch 11/400
160/160 [=====] - 0s 679us/step - loss: 0.5930
Epoch 12/400
160/160 [=====] - 0s 719us/step - loss: 0.5997
Epoch 13/400
160/160 [=====] - 0s 662us/step - loss: 0.5956
Epoch 14/400
160/160 [=====] - 0s 668us/step - loss: 0.5957
Epoch 15/400
160/160 [=====] - 0s 728us/step - loss: 0.6731
Epoch 16/400
160/160 [=====] - 0s 692us/step - loss: 0.7571
Epoch 17/400
160/160 [=====] - 0s 718us/step - loss: 0.5970
Epoch 18/400
160/160 [=====] - 0s 786us/step - loss: 0.6636
Epoch 19/400
160/160 [=====] - 0s 684us/step - loss: 0.6722
Epoch 20/400
160/160 [=====] - 0s 629us/step - loss: 0.6903
Epoch 21/400
160/160 [=====] - 0s 693us/step - loss: 0.6694
Epoch 22/400
160/160 [=====] - 0s 777us/step - loss: 0.6165
Epoch 23/400
160/160 [=====] - 0s 742us/step - loss: 0.5900
Epoch 24/400
160/160 [=====] - 0s 774us/step - loss: 0.5873
Epoch 25/400
160/160 [=====] - 0s 795us/step - loss: 0.5710
Epoch 26/400
160/160 [=====] - 0s 808us/step - loss: 0.5847
Epoch 27/400
160/160 [=====] - 0s 707us/step - loss: 0.6266

Epoch 28/400
160/160 [=====] - 0s 608us/step - loss: 0.6003
Epoch 29/400
160/160 [=====] - 0s 744us/step - loss: 0.5870
Epoch 30/400
160/160 [=====] - 0s 645us/step - loss: 0.5839
Epoch 31/400
160/160 [=====] - 0s 742us/step - loss: 0.6644
Epoch 32/400
160/160 [=====] - 0s 710us/step - loss: 0.7010
Epoch 33/400
160/160 [=====] - 0s 723us/step - loss: 0.6901
Epoch 34/400
160/160 [=====] - 0s 634us/step - loss: 0.7053
Epoch 35/400
160/160 [=====] - 0s 623us/step - loss: 0.6996
Epoch 36/400
160/160 [=====] - 0s 824us/step - loss: 0.7043
Epoch 37/400
160/160 [=====] - 0s 645us/step - loss: 0.6968
Epoch 38/400
160/160 [=====] - 0s 1ms/step - loss: 0.7061
Epoch 39/400
160/160 [=====] - 0s 638us/step - loss: 0.6992
Epoch 40/400
160/160 [=====] - 0s 626us/step - loss: 0.7020
Epoch 41/400
160/160 [=====] - 0s 575us/step - loss: 0.7027
Epoch 42/400
160/160 [=====] - 0s 719us/step - loss: 0.7023
Epoch 43/400
160/160 [=====] - 0s 574us/step - loss: 0.7008
Epoch 44/400
160/160 [=====] - 0s 617us/step - loss: 0.7008
Epoch 45/400
160/160 [=====] - 0s 721us/step - loss: 0.6994
Epoch 46/400
160/160 [=====] - 0s 555us/step - loss: 0.7010
Epoch 47/400
160/160 [=====] - 0s 583us/step - loss: 0.6998
Epoch 48/400
160/160 [=====] - 0s 628us/step - loss: 0.7021
Epoch 49/400
160/160 [=====] - 0s 787us/step - loss: 0.6966
Epoch 50/400
160/160 [=====] - 0s 634us/step - loss: 0.6985
Epoch 51/400
160/160 [=====] - 0s 750us/step - loss: 0.6935

Epoch 52/400
160/160 [=====] - 0s 680us/step - loss: 0.6998
Epoch 53/400
160/160 [=====] - 0s 604us/step - loss: 0.6948
Epoch 54/400
160/160 [=====] - 0s 688us/step - loss: 0.6913
Epoch 55/400
160/160 [=====] - 0s 725us/step - loss: 0.6888
Epoch 56/400
160/160 [=====] - 0s 627us/step - loss: 0.6856
Epoch 57/400
160/160 [=====] - 0s 646us/step - loss: 0.6756
Epoch 58/400
160/160 [=====] - 0s 693us/step - loss: 0.6739
Epoch 59/400
160/160 [=====] - 0s 811us/step - loss: 0.6546
Epoch 60/400
160/160 [=====] - 0s 733us/step - loss: 0.6358
Epoch 61/400
160/160 [=====] - 0s 681us/step - loss: 0.5984
Epoch 62/400
160/160 [=====] - 0s 688us/step - loss: 0.5930
Epoch 63/400
160/160 [=====] - 0s 978us/step - loss: 0.5832
Epoch 64/400
160/160 [=====] - 0s 679us/step - loss: 0.5942
Epoch 65/400
160/160 [=====] - 0s 1ms/step - loss: 0.5854
Epoch 66/400
160/160 [=====] - 0s 861us/step - loss: 0.5819
Epoch 67/400
160/160 [=====] - 0s 727us/step - loss: 0.5875
Epoch 68/400
160/160 [=====] - 0s 778us/step - loss: 0.5824
Epoch 69/400
160/160 [=====] - 0s 704us/step - loss: 0.5787
Epoch 70/400
160/160 [=====] - 0s 694us/step - loss: 0.5763
Epoch 71/400
160/160 [=====] - 0s 733us/step - loss: 0.5798
Epoch 72/400
160/160 [=====] - 0s 685us/step - loss: 0.5794
Epoch 73/400
160/160 [=====] - 0s 636us/step - loss: 0.5837
Epoch 74/400
160/160 [=====] - 0s 616us/step - loss: 0.5790
Epoch 75/400
160/160 [=====] - 0s 674us/step - loss: 0.6043

Epoch 76/400
160/160 [=====] - 0s 715us/step - loss: 0.6133
Epoch 77/400
160/160 [=====] - 0s 687us/step - loss: 0.5835
Epoch 78/400
160/160 [=====] - 0s 783us/step - loss: 0.5835
Epoch 79/400
160/160 [=====] - 0s 722us/step - loss: 0.5798
Epoch 80/400
160/160 [=====] - 0s 859us/step - loss: 0.5784
Epoch 81/400
160/160 [=====] - 0s 889us/step - loss: 0.5746
Epoch 82/400
160/160 [=====] - 0s 738us/step - loss: 0.5804
Epoch 83/400
160/160 [=====] - 0s 571us/step - loss: 0.5720
Epoch 84/400
160/160 [=====] - 0s 694us/step - loss: 0.5727
Epoch 85/400
160/160 [=====] - 0s 822us/step - loss: 0.5776
Epoch 86/400
160/160 [=====] - 0s 614us/step - loss: 0.5766
Epoch 87/400
160/160 [=====] - 0s 718us/step - loss: 0.5778
Epoch 88/400
160/160 [=====] - 0s 585us/step - loss: 0.5713
Epoch 89/400
160/160 [=====] - 0s 595us/step - loss: 0.5838
Epoch 90/400
160/160 [=====] - 0s 677us/step - loss: 0.5657
Epoch 91/400
160/160 [=====] - 0s 583us/step - loss: 0.5692
Epoch 92/400
160/160 [=====] - 0s 569us/step - loss: 0.5713
Epoch 93/400
160/160 [=====] - 0s 572us/step - loss: 0.5734
Epoch 94/400
160/160 [=====] - 0s 610us/step - loss: 0.5719
Epoch 95/400
160/160 [=====] - 0s 628us/step - loss: 0.5747
Epoch 96/400
160/160 [=====] - 0s 618us/step - loss: 0.5725
Epoch 97/400
160/160 [=====] - 0s 682us/step - loss: 0.5671
Epoch 98/400
160/160 [=====] - 0s 601us/step - loss: 0.5694
Epoch 99/400
160/160 [=====] - 0s 584us/step - loss: 0.5638

Epoch 100/400
160/160 [=====] - 0s 698us/step - loss: 0.5687
Epoch 101/400
160/160 [=====] - 0s 585us/step - loss: 0.5657
Epoch 102/400
160/160 [=====] - 0s 615us/step - loss: 0.5592
Epoch 103/400
160/160 [=====] - 0s 663us/step - loss: 0.5553
Epoch 104/400
160/160 [=====] - 0s 585us/step - loss: 0.5469
Epoch 105/400
160/160 [=====] - 0s 578us/step - loss: 0.5542
Epoch 106/400
160/160 [=====] - 0s 589us/step - loss: 0.5429
Epoch 107/400
160/160 [=====] - 0s 598us/step - loss: 0.5409
Epoch 108/400
160/160 [=====] - 0s 585us/step - loss: 0.5646
Epoch 109/400
160/160 [=====] - 0s 586us/step - loss: 0.5371
Epoch 110/400
160/160 [=====] - 0s 585us/step - loss: 0.5556
Epoch 111/400
160/160 [=====] - 0s 631us/step - loss: 0.7820
Epoch 112/400
160/160 [=====] - 0s 607us/step - loss: 0.7093
Epoch 113/400
160/160 [=====] - 0s 638us/step - loss: 0.6793
Epoch 114/400
160/160 [=====] - 0s 677us/step - loss: 0.6354
Epoch 115/400
160/160 [=====] - 0s 600us/step - loss: 0.5789
Epoch 116/400
160/160 [=====] - 0s 576us/step - loss: 0.5289
Epoch 117/400
160/160 [=====] - 0s 588us/step - loss: 0.5123
Epoch 118/400
160/160 [=====] - 0s 630us/step - loss: 0.5020
Epoch 119/400
160/160 [=====] - 0s 679us/step - loss: 0.4942
Epoch 120/400
160/160 [=====] - 0s 628us/step - loss: 0.4942
Epoch 121/400
160/160 [=====] - 0s 594us/step - loss: 0.4788
Epoch 122/400
160/160 [=====] - 0s 581us/step - loss: 0.4805
Epoch 123/400
160/160 [=====] - 0s 587us/step - loss: 0.4740

Epoch 124/400
160/160 [=====] - 0s 581us/step - loss: 0.4656
Epoch 125/400
160/160 [=====] - 0s 592us/step - loss: 0.4590
Epoch 126/400
160/160 [=====] - 0s 640us/step - loss: 0.4560
Epoch 127/400
160/160 [=====] - 0s 594us/step - loss: 0.4563
Epoch 128/400
160/160 [=====] - 0s 595us/step - loss: 0.4438
Epoch 129/400
160/160 [=====] - 0s 722us/step - loss: 0.4451
Epoch 130/400
160/160 [=====] - ETA: 0s - loss: 0.440 - 0s 880us/step - loss: 0.4398
Epoch 131/400
160/160 [=====] - 0s 685us/step - loss: 0.4423
Epoch 132/400
160/160 [=====] - 0s 593us/step - loss: 0.4422
Epoch 133/400
160/160 [=====] - 0s 581us/step - loss: 0.4300
Epoch 134/400
160/160 [=====] - 0s 613us/step - loss: 0.4345
Epoch 135/400
160/160 [=====] - 0s 582us/step - loss: 0.4335
Epoch 136/400
160/160 [=====] - 0s 600us/step - loss: 0.4284
Epoch 137/400
160/160 [=====] - 0s 805us/step - loss: 0.4257
Epoch 138/400
160/160 [=====] - 0s 707us/step - loss: 0.4208
Epoch 139/400
160/160 [=====] - 0s 658us/step - loss: 0.4270
Epoch 140/400
160/160 [=====] - 0s 612us/step - loss: 0.4173
Epoch 141/400
160/160 [=====] - 0s 608us/step - loss: 0.4154
Epoch 142/400
160/160 [=====] - 0s 595us/step - loss: 0.4205
Epoch 143/400
160/160 [=====] - 0s 720us/step - loss: 0.4088
Epoch 144/400
160/160 [=====] - 0s 617us/step - loss: 0.4288
Epoch 145/400
160/160 [=====] - 0s 664us/step - loss: 0.4126
Epoch 146/400
160/160 [=====] - 0s 727us/step - loss: 0.4167
Epoch 147/400
160/160 [=====] - 0s 676us/step - loss: 0.4180

Epoch 148/400
160/160 [=====] - 0s 587us/step - loss: 0.4075
Epoch 149/400
160/160 [=====] - 0s 610us/step - loss: 0.4116
Epoch 150/400
160/160 [=====] - 0s 700us/step - loss: 0.4105
Epoch 151/400
160/160 [=====] - 0s 609us/step - loss: 0.4100
Epoch 152/400
160/160 [=====] - 0s 579us/step - loss: 0.4088
Epoch 153/400
160/160 [=====] - 0s 750us/step - loss: 0.4110
Epoch 154/400
160/160 [=====] - 0s 671us/step - loss: 0.4245
Epoch 155/400
160/160 [=====] - 0s 622us/step - loss: 0.4219
Epoch 156/400
160/160 [=====] - 0s 634us/step - loss: 0.4018
Epoch 157/400
160/160 [=====] - 0s 625us/step - loss: 0.4039
Epoch 158/400
160/160 [=====] - 0s 648us/step - loss: 0.4043
Epoch 159/400
160/160 [=====] - 0s 629us/step - loss: 0.4046
Epoch 160/400
160/160 [=====] - 0s 706us/step - loss: 0.4012
Epoch 161/400
160/160 [=====] - 0s 632us/step - loss: 0.4237
Epoch 162/400
160/160 [=====] - 0s 654us/step - loss: 0.4031
Epoch 163/400
160/160 [=====] - 0s 645us/step - loss: 0.3912
Epoch 164/400
160/160 [=====] - 0s 652us/step - loss: 0.4071
Epoch 165/400
160/160 [=====] - 0s 773us/step - loss: 0.4300
Epoch 166/400
160/160 [=====] - 0s 1ms/step - loss: 0.4031
Epoch 167/400
160/160 [=====] - 0s 830us/step - loss: 0.3912
Epoch 168/400
160/160 [=====] - 0s 814us/step - loss: 0.3939
Epoch 169/400
160/160 [=====] - 0s 695us/step - loss: 0.4001
Epoch 170/400
160/160 [=====] - 0s 647us/step - loss: 0.3929
Epoch 171/400
160/160 [=====] - 0s 814us/step - loss: 0.3885

Epoch 172/400
160/160 [=====] - 0s 668us/step - loss: 0.3973
Epoch 173/400
160/160 [=====] - 0s 777us/step - loss: 0.3949
Epoch 174/400
160/160 [=====] - 0s 622us/step - loss: 0.4300
Epoch 175/400
160/160 [=====] - 0s 715us/step - loss: 0.3990
Epoch 176/400
160/160 [=====] - 0s 624us/step - loss: 0.4290
Epoch 177/400
160/160 [=====] - 0s 581us/step - loss: 0.3920
Epoch 178/400
160/160 [=====] - 0s 586us/step - loss: 0.4037
Epoch 179/400
160/160 [=====] - 0s 589us/step - loss: 0.3925
Epoch 180/400
160/160 [=====] - 0s 623us/step - loss: 0.3988
Epoch 181/400
160/160 [=====] - 0s 732us/step - loss: 0.3885
Epoch 182/400
160/160 [=====] - 0s 709us/step - loss: 0.3894
Epoch 183/400
160/160 [=====] - 0s 786us/step - loss: 0.3956
Epoch 184/400
160/160 [=====] - 0s 714us/step - loss: 0.3952
Epoch 185/400
160/160 [=====] - 0s 706us/step - loss: 0.3921
Epoch 186/400
160/160 [=====] - 0s 684us/step - loss: 0.3940
Epoch 187/400
160/160 [=====] - 0s 681us/step - loss: 0.4085
Epoch 188/400
160/160 [=====] - 0s 705us/step - loss: 0.3889
Epoch 189/400
160/160 [=====] - 0s 757us/step - loss: 0.4178
Epoch 190/400
160/160 [=====] - 0s 665us/step - loss: 0.4323
Epoch 191/400
160/160 [=====] - 0s 597us/step - loss: 0.3910
Epoch 192/400
160/160 [=====] - 0s 587us/step - loss: 0.3962
Epoch 193/400
160/160 [=====] - 0s 607us/step - loss: 0.3874
Epoch 194/400
160/160 [=====] - 0s 656us/step - loss: 0.3901
Epoch 195/400
160/160 [=====] - 0s 605us/step - loss: 0.3846

Epoch 196/400
160/160 [=====] - 0s 599us/step - loss: 0.3890
Epoch 197/400
160/160 [=====] - 0s 612us/step - loss: 0.3866
Epoch 198/400
160/160 [=====] - 0s 591us/step - loss: 0.3869
Epoch 199/400
160/160 [=====] - 0s 592us/step - loss: 0.3773
Epoch 200/400
160/160 [=====] - 0s 585us/step - loss: 0.3675
Epoch 201/400
160/160 [=====] - 0s 595us/step - loss: 0.3739
Epoch 202/400
160/160 [=====] - 0s 595us/step - loss: 0.3789
Epoch 203/400
160/160 [=====] - 0s 596us/step - loss: 0.3904
Epoch 204/400
160/160 [=====] - 0s 635us/step - loss: 0.3836
Epoch 205/400
160/160 [=====] - 0s 575us/step - loss: 0.4130
Epoch 206/400
160/160 [=====] - 0s 809us/step - loss: 0.3921
Epoch 207/400
160/160 [=====] - 0s 802us/step - loss: 0.3792
Epoch 208/400
160/160 [=====] - 0s 685us/step - loss: 0.3853
Epoch 209/400
160/160 [=====] - 0s 742us/step - loss: 0.3977
Epoch 210/400
160/160 [=====] - 0s 666us/step - loss: 0.3765
Epoch 211/400
160/160 [=====] - 0s 738us/step - loss: 0.3743
Epoch 212/400
160/160 [=====] - 0s 816us/step - loss: 0.3767
Epoch 213/400
160/160 [=====] - 0s 820us/step - loss: 0.3935
Epoch 214/400
160/160 [=====] - 0s 948us/step - loss: 0.3961
Epoch 215/400
160/160 [=====] - 0s 741us/step - loss: 0.3787
Epoch 216/400
160/160 [=====] - 0s 824us/step - loss: 0.3784
Epoch 217/400
160/160 [=====] - 0s 751us/step - loss: 0.3815
Epoch 218/400
160/160 [=====] - 0s 727us/step - loss: 0.3743
Epoch 219/400
160/160 [=====] - 0s 596us/step - loss: 0.3714

Epoch 220/400
160/160 [=====] - 0s 698us/step - loss: 0.3891
Epoch 221/400
160/160 [=====] - 0s 675us/step - loss: 0.4440
Epoch 222/400
160/160 [=====] - 0s 603us/step - loss: 0.3724
Epoch 223/400
160/160 [=====] - 0s 576us/step - loss: 0.3764
Epoch 224/400
160/160 [=====] - 0s 598us/step - loss: 0.3789
Epoch 225/400
160/160 [=====] - 0s 575us/step - loss: 0.3798
Epoch 226/400
160/160 [=====] - 0s 585us/step - loss: 0.3720
Epoch 227/400
160/160 [=====] - 0s 588us/step - loss: 0.3852
Epoch 228/400
160/160 [=====] - 0s 580us/step - loss: 0.3786
Epoch 229/400
160/160 [=====] - 0s 586us/step - loss: 0.4689
Epoch 230/400
160/160 [=====] - 0s 628us/step - loss: 0.3768
Epoch 231/400
160/160 [=====] - 0s 610us/step - loss: 0.3760
Epoch 232/400
160/160 [=====] - 0s 603us/step - loss: 0.3749
Epoch 233/400
160/160 [=====] - 0s 581us/step - loss: 0.3752
Epoch 234/400
160/160 [=====] - 0s 591us/step - loss: 0.3825
Epoch 235/400
160/160 [=====] - 0s 585us/step - loss: 0.3869
Epoch 236/400
160/160 [=====] - 0s 742us/step - loss: 0.5003
Epoch 237/400
160/160 [=====] - 0s 639us/step - loss: 0.3905
Epoch 238/400
160/160 [=====] - 0s 712us/step - loss: 0.3808
Epoch 239/400
160/160 [=====] - 0s 719us/step - loss: 0.3849
Epoch 240/400
160/160 [=====] - 0s 793us/step - loss: 0.3779
Epoch 241/400
160/160 [=====] - 0s 753us/step - loss: 0.3867
Epoch 242/400
160/160 [=====] - 0s 868us/step - loss: 0.4423
Epoch 243/400
160/160 [=====] - 0s 752us/step - loss: 0.3788

Epoch 244/400
160/160 [=====] - 0s 858us/step - loss: 0.3768
Epoch 245/400
160/160 [=====] - 0s 810us/step - loss: 0.3744
Epoch 246/400
160/160 [=====] - 0s 1ms/step - loss: 0.3767
Epoch 247/400
160/160 [=====] - 0s 833us/step - loss: 0.3797
Epoch 248/400
160/160 [=====] - 0s 663us/step - loss: 0.3788
Epoch 249/400
160/160 [=====] - 0s 862us/step - loss: 0.3828
Epoch 250/400
160/160 [=====] - 0s 824us/step - loss: 0.3758
Epoch 251/400
160/160 [=====] - 0s 773us/step - loss: 0.3717
Epoch 252/400
160/160 [=====] - 0s 750us/step - loss: 0.4019
Epoch 253/400
160/160 [=====] - 0s 960us/step - loss: 0.3779
Epoch 254/400
160/160 [=====] - 0s 649us/step - loss: 0.3829
Epoch 255/400
160/160 [=====] - 0s 625us/step - loss: 0.3877
Epoch 256/400
160/160 [=====] - 0s 812us/step - loss: 0.3709
Epoch 257/400
160/160 [=====] - 0s 580us/step - loss: 0.3840
Epoch 258/400
160/160 [=====] - 0s 627us/step - loss: 0.4321
Epoch 259/400
160/160 [=====] - 0s 757us/step - loss: 0.3849
Epoch 260/400
160/160 [=====] - 0s 894us/step - loss: 0.4077
Epoch 261/400
160/160 [=====] - 0s 893us/step - loss: 0.3755
Epoch 262/400
160/160 [=====] - 0s 775us/step - loss: 0.3702
Epoch 263/400
160/160 [=====] - 0s 752us/step - loss: 0.3764
Epoch 264/400
160/160 [=====] - 0s 755us/step - loss: 0.3721
Epoch 265/400
160/160 [=====] - 0s 718us/step - loss: 0.4171
Epoch 266/400
160/160 [=====] - 0s 700us/step - loss: 0.3841
Epoch 267/400
160/160 [=====] - 0s 765us/step - loss: 0.3778

Epoch 268/400
160/160 [=====] - 0s 717us/step - loss: 0.3745
Epoch 269/400
160/160 [=====] - 0s 828us/step - loss: 0.4027
Epoch 270/400
160/160 [=====] - 0s 887us/step - loss: 0.3775
Epoch 271/400
160/160 [=====] - 0s 1ms/step - loss: 0.3764
Epoch 272/400
160/160 [=====] - 0s 896us/step - loss: 0.3736
Epoch 273/400
160/160 [=====] - 0s 798us/step - loss: 0.3677
Epoch 274/400
160/160 [=====] - 0s 763us/step - loss: 0.3768
Epoch 275/400
160/160 [=====] - 0s 729us/step - loss: 0.3678
Epoch 276/400
160/160 [=====] - 0s 656us/step - loss: 0.3753
Epoch 277/400
160/160 [=====] - 0s 592us/step - loss: 0.3724
Epoch 278/400
160/160 [=====] - 0s 966us/step - loss: 0.3759
Epoch 279/400
160/160 [=====] - 0s 583us/step - loss: 0.3706
Epoch 280/400
160/160 [=====] - 0s 582us/step - loss: 0.3761
Epoch 281/400
160/160 [=====] - 0s 589us/step - loss: 0.3745
Epoch 282/400
160/160 [=====] - 0s 571us/step - loss: 0.3679
Epoch 283/400
160/160 [=====] - 0s 649us/step - loss: 0.5216
Epoch 284/400
160/160 [=====] - 0s 623us/step - loss: 0.5916
Epoch 285/400
160/160 [=====] - 0s 661us/step - loss: 0.4857
Epoch 286/400
160/160 [=====] - 0s 599us/step - loss: 0.4677
Epoch 287/400
160/160 [=====] - 0s 952us/step - loss: 0.4319
Epoch 288/400
160/160 [=====] - 0s 647us/step - loss: 0.4004
Epoch 289/400
160/160 [=====] - 0s 585us/step - loss: 0.3862
Epoch 290/400
160/160 [=====] - 0s 587us/step - loss: 0.3812
Epoch 291/400
160/160 [=====] - 0s 576us/step - loss: 0.3783

Epoch 292/400
160/160 [=====] - 0s 590us/step - loss: 0.3725
Epoch 293/400
160/160 [=====] - 0s 601us/step - loss: 0.3741
Epoch 294/400
160/160 [=====] - 0s 575us/step - loss: 0.3785
Epoch 295/400
160/160 [=====] - 0s 603us/step - loss: 0.3749
Epoch 296/400
160/160 [=====] - 0s 586us/step - loss: 0.3673
Epoch 297/400
160/160 [=====] - 0s 667us/step - loss: 0.3763
Epoch 298/400
160/160 [=====] - 0s 657us/step - loss: 0.3770
Epoch 299/400
160/160 [=====] - 0s 602us/step - loss: 0.4866
Epoch 300/400
160/160 [=====] - 0s 602us/step - loss: 0.3775
Epoch 301/400
160/160 [=====] - 0s 602us/step - loss: 0.3805
Epoch 302/400
160/160 [=====] - 0s 585us/step - loss: 0.3934
Epoch 303/400
160/160 [=====] - 0s 1ms/step - loss: 0.3722A: 0s - loss: 0.42
Epoch 304/400
160/160 [=====] - 0s 583us/step - loss: 0.3769
Epoch 305/400
160/160 [=====] - 0s 585us/step - loss: 0.3768
Epoch 306/400
160/160 [=====] - 0s 595us/step - loss: 0.3781
Epoch 307/400
160/160 [=====] - 0s 595us/step - loss: 0.3686
Epoch 308/400
160/160 [=====] - 0s 593us/step - loss: 0.3789
Epoch 309/400
160/160 [=====] - 0s 621us/step - loss: 0.3705
Epoch 310/400
160/160 [=====] - 0s 717us/step - loss: 0.3862
Epoch 311/400
160/160 [=====] - 0s 630us/step - loss: 0.3677
Epoch 312/400
160/160 [=====] - 0s 740us/step - loss: 0.3701
Epoch 313/400
160/160 [=====] - 0s 638us/step - loss: 0.3737
Epoch 314/400
160/160 [=====] - 0s 602us/step - loss: 0.3720
Epoch 315/400
160/160 [=====] - 0s 546us/step - loss: 0.3894

Epoch 316/400
160/160 [=====] - 0s 578us/step - loss: 0.3725
Epoch 317/400
160/160 [=====] - 0s 582us/step - loss: 0.3777
Epoch 318/400
160/160 [=====] - 0s 581us/step - loss: 0.3719
Epoch 319/400
160/160 [=====] - 0s 579us/step - loss: 0.3752
Epoch 320/400
160/160 [=====] - 0s 580us/step - loss: 0.3696
Epoch 321/400
160/160 [=====] - 0s 539us/step - loss: 0.3726
Epoch 322/400
160/160 [=====] - 0s 553us/step - loss: 0.3700
Epoch 323/400
160/160 [=====] - 0s 562us/step - loss: 0.3682
Epoch 324/400
160/160 [=====] - 0s 577us/step - loss: 0.3723
Epoch 325/400
160/160 [=====] - 0s 574us/step - loss: 0.3936
Epoch 326/400
160/160 [=====] - 0s 591us/step - loss: 0.3705
Epoch 327/400
160/160 [=====] - 0s 586us/step - loss: 0.3832
Epoch 328/400
160/160 [=====] - 0s 584us/step - loss: 0.3711
Epoch 329/400
160/160 [=====] - 0s 571us/step - loss: 0.3743
Epoch 330/400
160/160 [=====] - 0s 582us/step - loss: 0.4681
Epoch 331/400
160/160 [=====] - 0s 583us/step - loss: 0.3735
Epoch 332/400
160/160 [=====] - 0s 574us/step - loss: 0.3829
Epoch 333/400
160/160 [=====] - 0s 829us/step - loss: 0.3695
Epoch 334/400
160/160 [=====] - 0s 667us/step - loss: 0.4682
Epoch 335/400
160/160 [=====] - 0s 608us/step - loss: 0.3685
Epoch 336/400
160/160 [=====] - 0s 593us/step - loss: 0.3716
Epoch 337/400
160/160 [=====] - 0s 580us/step - loss: 0.3875
Epoch 338/400
160/160 [=====] - 0s 582us/step - loss: 0.3679
Epoch 339/400
160/160 [=====] - 0s 577us/step - loss: 0.3688

Epoch 340/400
160/160 [=====] - 0s 576us/step - loss: 0.3794
Epoch 341/400
160/160 [=====] - 0s 568us/step - loss: 0.3753
Epoch 342/400
160/160 [=====] - 0s 568us/step - loss: 0.3930
Epoch 343/400
160/160 [=====] - 0s 580us/step - loss: 0.3719
Epoch 344/400
160/160 [=====] - 0s 577us/step - loss: 0.3708
Epoch 345/400
160/160 [=====] - 0s 578us/step - loss: 0.3706
Epoch 346/400
160/160 [=====] - 0s 589us/step - loss: 0.4729
Epoch 347/400
160/160 [=====] - 0s 571us/step - loss: 0.3741
Epoch 348/400
160/160 [=====] - 0s 566us/step - loss: 0.4684
Epoch 349/400
160/160 [=====] - 0s 568us/step - loss: 0.3695
Epoch 350/400
160/160 [=====] - 0s 572us/step - loss: 0.3649
Epoch 351/400
160/160 [=====] - 0s 583us/step - loss: 0.3704
Epoch 352/400
160/160 [=====] - 0s 579us/step - loss: 0.3708
Epoch 353/400
160/160 [=====] - 0s 581us/step - loss: 0.3770
Epoch 354/400
160/160 [=====] - 0s 578us/step - loss: 0.3680
Epoch 355/400
160/160 [=====] - 0s 585us/step - loss: 0.3729
Epoch 356/400
160/160 [=====] - 0s 607us/step - loss: 0.4021
Epoch 357/400
160/160 [=====] - 0s 701us/step - loss: 0.4180
Epoch 358/400
160/160 [=====] - 0s 676us/step - loss: 0.3691
Epoch 359/400
160/160 [=====] - 0s 618us/step - loss: 0.3706
Epoch 360/400
160/160 [=====] - 0s 602us/step - loss: 0.4689
Epoch 361/400
160/160 [=====] - 0s 589us/step - loss: 0.3743
Epoch 362/400
160/160 [=====] - 0s 602us/step - loss: 0.3656
Epoch 363/400
160/160 [=====] - 0s 590us/step - loss: 0.3724

Epoch 364/400
160/160 [=====] - 0s 591us/step - loss: 0.3996
Epoch 365/400
160/160 [=====] - 0s 575us/step - loss: 0.3652
Epoch 366/400
160/160 [=====] - 0s 599us/step - loss: 0.3944
Epoch 367/400
160/160 [=====] - 0s 655us/step - loss: 0.3757
Epoch 368/400
160/160 [=====] - 0s 655us/step - loss: 0.3667
Epoch 369/400
160/160 [=====] - 0s 908us/step - loss: 0.3888
Epoch 370/400
160/160 [=====] - 0s 920us/step - loss: 0.3761
Epoch 371/400
160/160 [=====] - 0s 1ms/step - loss: 0.3705
Epoch 372/400
160/160 [=====] - 0s 634us/step - loss: 0.3710
Epoch 373/400
160/160 [=====] - 0s 592us/step - loss: 0.3645
Epoch 374/400
160/160 [=====] - 0s 596us/step - loss: 0.4021
Epoch 375/400
160/160 [=====] - 0s 633us/step - loss: 0.3622
Epoch 376/400
160/160 [=====] - 0s 701us/step - loss: 0.3776
Epoch 377/400
160/160 [=====] - 0s 623us/step - loss: 0.3866
Epoch 378/400
160/160 [=====] - 0s 646us/step - loss: 0.4440
Epoch 379/400
160/160 [=====] - 0s 624us/step - loss: 0.3802
Epoch 380/400
160/160 [=====] - 0s 673us/step - loss: 0.3760
Epoch 381/400
160/160 [=====] - 0s 643us/step - loss: 0.3750
Epoch 382/400
160/160 [=====] - 0s 632us/step - loss: 0.3689
Epoch 383/400
160/160 [=====] - 0s 632us/step - loss: 0.3682
Epoch 384/400
160/160 [=====] - 0s 608us/step - loss: 0.3705
Epoch 385/400
160/160 [=====] - 0s 598us/step - loss: 0.3728
Epoch 386/400
160/160 [=====] - 0s 578us/step - loss: 0.3750
Epoch 387/400
160/160 [=====] - 0s 580us/step - loss: 0.3707

Epoch 388/400
160/160 [=====] - 0s 591us/step - loss: 0.4549
Epoch 389/400
160/160 [=====] - 0s 776us/step - loss: 0.5236
Epoch 390/400
160/160 [=====] - 0s 670us/step - loss: 0.4465
Epoch 391/400
160/160 [=====] - 0s 624us/step - loss: 0.4075
Epoch 392/400
160/160 [=====] - 0s 596us/step - loss: 0.4711
Epoch 393/400
160/160 [=====] - 0s 591us/step - loss: 0.5849
Epoch 394/400
160/160 [=====] - 0s 565us/step - loss: 0.4955
Epoch 395/400
160/160 [=====] - 0s 555us/step - loss: 0.4832
Epoch 396/400
160/160 [=====] - 0s 551us/step - loss: 0.4536
Epoch 397/400
160/160 [=====] - 0s 558us/step - loss: 0.4227
Epoch 398/400
160/160 [=====] - 0s 708us/step - loss: 0.3977
Epoch 399/400
160/160 [=====] - 0s 652us/step - loss: 0.3844
Epoch 400/400
160/160 [=====] - 0s 630us/step - loss: 0.4033
[0.95546013 0.9916079 0.98901886 0.99134606 0.9906703 0.9891679
0.9906459 0.907777 0.9906937 0.98902166 0.99077946 0.99083775
0.98877406 0.9318088 0.98961455 0.54379046 0.5474771 0.9889254
0.9902115 0.42504245 0.9889759 0.98958236 0.541177 0.99199814
0.98987174 0.98678315 0.9888099 0.98912644 0.9891516 0.9900736
0.98340344 0.9285618 0.9916881 0.9901683 0.9882915 0.9904022
0.8840954 0.9908679 0.99179214 0.99138266 0.5450471 0.5440899
0.5447321 0.5441649 0.5442527 0.5446357 0.5444725 0.5450571
0.5445652 0.5446793 0.5442988 0.54424274 0.5448047 0.54505235
0.5448614 0.5415765 0.5444193 0.5447275 0.5443486 0.5450592
0.5446218 0.5444589 0.5439925 0.5441775 0.5444133 0.54496723
0.5446838 0.54455215 0.54457164 0.5445929 0.54501474 0.5434645
0.54455787 0.54456925 0.5448447 0.5443233 0.543156 0.5447536
0.544187 0.5447879 -0.78884065 -0.47806552 -0.8049228 -0.5678853
-0.7401396 -0.8016303 -0.73159313 -0.7802716 0.44142878 -0.8040994
-0.7049437 -0.70501274 -0.80780923 -0.7773416 -0.79842 0.54151523
0.53558487 -0.8057582 -0.7694157 -0.6580807 -0.8035372 -0.7918184
0.5407139 -0.17781094 -0.7833619 -0.68069315 -0.806052 -0.8004959
-0.8005877 -0.7782904 -0.8124848 0.5328838 -0.5544873 -0.7729356
-0.81074053 -0.7543723 0.53167534 -0.74859506 -0.3153765 -0.7066062
0.5450535 0.5450271 0.5450494 0.5450298 0.54504067 0.5450495
0.54503554 0.5450606 0.5449438 0.54505014 0.54503614 0.54503715

```

0.54504985 0.5450566 0.5450405 0.5438533 0.54474217 0.5450502
0.545044 0.5450601 0.5450512 0.5450485 0.54445666 0.5450155
0.5450465 0.54501057 0.54505134 0.54505074 0.5450503 0.5450417
0.54505646 0.5448302 0.5450179 0.54504067 0.5450519 0.54504174
0.5448715 0.5450288 0.54501975 0.5450201 ]
160/160 [=====] - 0s 483us/step

```

```

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '

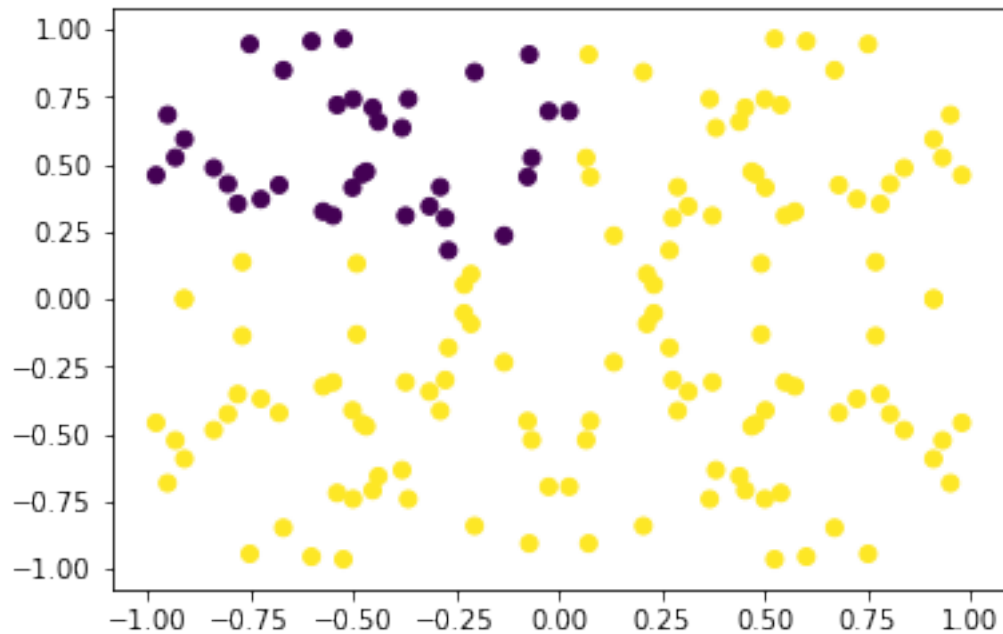
```

```
In [22]: scores, model.metrics_names
```

```
Out[22]: (0.39782775193452835, ['loss'])
```

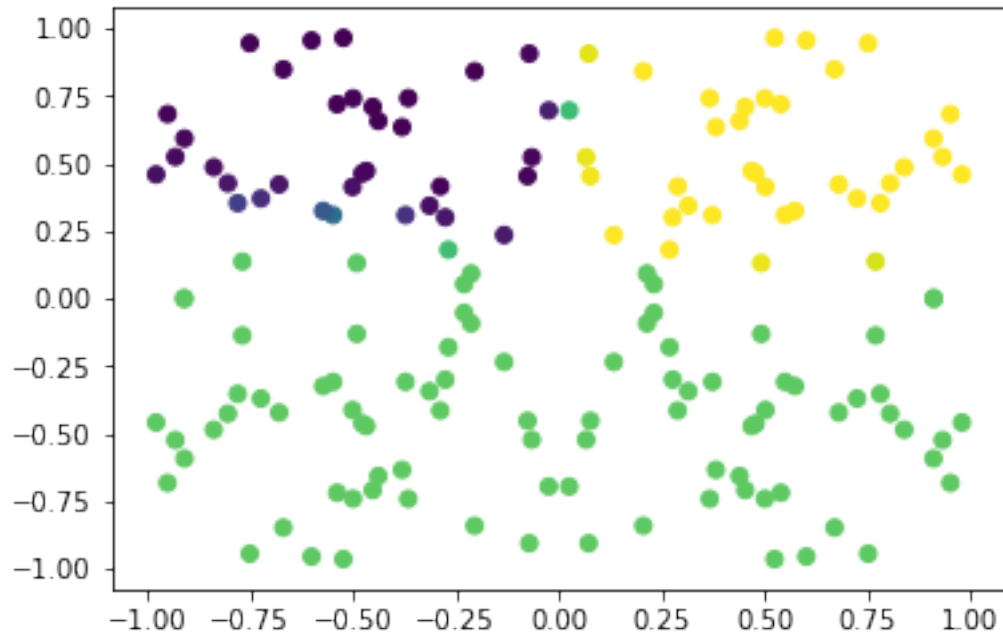
```
In [23]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[23]: <matplotlib.collections.PathCollection at 0xb254c06a0>
```



```
In [24]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[24]: <matplotlib.collections.PathCollection at 0xb25522a58>
```

```
In [25]: # Sigmoid 1
         model = Sequential()

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

         # The output has 1 neuron for predicting whatever we are iterating
         model.add(Dense(1, 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))

         scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 0s 2ms/step - loss: 0.6961
Epoch 2/400
160/160 [=====] - 0s 473us/step - loss: 0.6952
Epoch 3/400
160/160 [=====] - 0s 472us/step - loss: 0.6948
Epoch 4/400
160/160 [=====] - 0s 490us/step - loss: 0.6946
Epoch 5/400
160/160 [=====] - 0s 482us/step - loss: 0.6942
```

Epoch 6/400
160/160 [=====] - 0s 489us/step - loss: 0.6943
Epoch 7/400
160/160 [=====] - 0s 475us/step - loss: 0.6940
Epoch 8/400
160/160 [=====] - 0s 484us/step - loss: 0.6940
Epoch 9/400
160/160 [=====] - 0s 483us/step - loss: 0.6940
Epoch 10/400
160/160 [=====] - 0s 496us/step - loss: 0.6941
Epoch 11/400
160/160 [=====] - 0s 550us/step - loss: 0.6941
Epoch 12/400
160/160 [=====] - 0s 531us/step - loss: 0.6941
Epoch 13/400
160/160 [=====] - 0s 505us/step - loss: 0.6942
Epoch 14/400
160/160 [=====] - 0s 492us/step - loss: 0.6940
Epoch 15/400
160/160 [=====] - 0s 480us/step - loss: 0.6941
Epoch 16/400
160/160 [=====] - 0s 457us/step - loss: 0.6938
Epoch 17/400
160/160 [=====] - 0s 471us/step - loss: 0.6941
Epoch 18/400
160/160 [=====] - 0s 481us/step - loss: 0.6940
Epoch 19/400
160/160 [=====] - 0s 473us/step - loss: 0.6942
Epoch 20/400
160/160 [=====] - 0s 475us/step - loss: 0.6940
Epoch 21/400
160/160 [=====] - 0s 484us/step - loss: 0.6942
Epoch 22/400
160/160 [=====] - 0s 469us/step - loss: 0.6941
Epoch 23/400
160/160 [=====] - 0s 487us/step - loss: 0.6941
Epoch 24/400
160/160 [=====] - 0s 483us/step - loss: 0.6940
Epoch 25/400
160/160 [=====] - 0s 483us/step - loss: 0.6940
Epoch 26/400
160/160 [=====] - 0s 476us/step - loss: 0.6941
Epoch 27/400
160/160 [=====] - 0s 483us/step - loss: 0.6939
Epoch 28/400
160/160 [=====] - 0s 477us/step - loss: 0.6941
Epoch 29/400
160/160 [=====] - 0s 475us/step - loss: 0.6942

Epoch 30/400
160/160 [=====] - 0s 480us/step - loss: 0.6941
Epoch 31/400
160/160 [=====] - 0s 482us/step - loss: 0.6942
Epoch 32/400
160/160 [=====] - 0s 476us/step - loss: 0.6941
Epoch 33/400
160/160 [=====] - 0s 473us/step - loss: 0.6941
Epoch 34/400
160/160 [=====] - 0s 473us/step - loss: 0.6942
Epoch 35/400
160/160 [=====] - 0s 468us/step - loss: 0.6940
Epoch 36/400
160/160 [=====] - 0s 469us/step - loss: 0.6941
Epoch 37/400
160/160 [=====] - 0s 461us/step - loss: 0.6938
Epoch 38/400
160/160 [=====] - 0s 480us/step - loss: 0.6939
Epoch 39/400
160/160 [=====] - 0s 478us/step - loss: 0.6942
Epoch 40/400
160/160 [=====] - 0s 480us/step - loss: 0.6939
Epoch 41/400
160/160 [=====] - 0s 478us/step - loss: 0.6940
Epoch 42/400
160/160 [=====] - 0s 473us/step - loss: 0.6940
Epoch 43/400
160/160 [=====] - 0s 470us/step - loss: 0.6942
Epoch 44/400
160/160 [=====] - 0s 474us/step - loss: 0.6942
Epoch 45/400
160/160 [=====] - 0s 475us/step - loss: 0.6940
Epoch 46/400
160/160 [=====] - 0s 472us/step - loss: 0.6941
Epoch 47/400
160/160 [=====] - 0s 483us/step - loss: 0.6940
Epoch 48/400
160/160 [=====] - 0s 474us/step - loss: 0.6941
Epoch 49/400
160/160 [=====] - 0s 471us/step - loss: 0.6941
Epoch 50/400
160/160 [=====] - 0s 470us/step - loss: 0.6939
Epoch 51/400
160/160 [=====] - 0s 481us/step - loss: 0.6941
Epoch 52/400
160/160 [=====] - 0s 471us/step - loss: 0.6942
Epoch 53/400
160/160 [=====] - 0s 470us/step - loss: 0.6941

Epoch 54/400
160/160 [=====] - 0s 456us/step - loss: 0.6942
Epoch 55/400
160/160 [=====] - 0s 448us/step - loss: 0.6940
Epoch 56/400
160/160 [=====] - 0s 457us/step - loss: 0.6939
Epoch 57/400
160/160 [=====] - 0s 474us/step - loss: 0.6940
Epoch 58/400
160/160 [=====] - 0s 468us/step - loss: 0.6940
Epoch 59/400
160/160 [=====] - 0s 480us/step - loss: 0.6940
Epoch 60/400
160/160 [=====] - 0s 475us/step - loss: 0.6940
Epoch 61/400
160/160 [=====] - 0s 480us/step - loss: 0.6940
Epoch 62/400
160/160 [=====] - 0s 471us/step - loss: 0.6940
Epoch 63/400
160/160 [=====] - 0s 477us/step - loss: 0.6942
Epoch 64/400
160/160 [=====] - 0s 470us/step - loss: 0.6940
Epoch 65/400
160/160 [=====] - 0s 477us/step - loss: 0.6940
Epoch 66/400
160/160 [=====] - 0s 473us/step - loss: 0.6938
Epoch 67/400
160/160 [=====] - 0s 470us/step - loss: 0.6941
Epoch 68/400
160/160 [=====] - 0s 468us/step - loss: 0.6941
Epoch 69/400
160/160 [=====] - 0s 483us/step - loss: 0.6942
Epoch 70/400
160/160 [=====] - 0s 478us/step - loss: 0.6941
Epoch 71/400
160/160 [=====] - 0s 485us/step - loss: 0.6941
Epoch 72/400
160/160 [=====] - 0s 479us/step - loss: 0.6939
Epoch 73/400
160/160 [=====] - 0s 489us/step - loss: 0.6940
Epoch 74/400
160/160 [=====] - 0s 470us/step - loss: 0.6941
Epoch 75/400
160/160 [=====] - 0s 473us/step - loss: 0.6942
Epoch 76/400
160/160 [=====] - 0s 473us/step - loss: 0.6941
Epoch 77/400
160/160 [=====] - 0s 458us/step - loss: 0.6941

Epoch 78/400
160/160 [=====] - 0s 453us/step - loss: 0.6937
Epoch 79/400
160/160 [=====] - 0s 454us/step - loss: 0.6940
Epoch 80/400
160/160 [=====] - 0s 453us/step - loss: 0.6941
Epoch 81/400
160/160 [=====] - 0s 473us/step - loss: 0.6940
Epoch 82/400
160/160 [=====] - 0s 482us/step - loss: 0.6940
Epoch 83/400
160/160 [=====] - 0s 473us/step - loss: 0.6940
Epoch 84/400
160/160 [=====] - 0s 474us/step - loss: 0.6939
Epoch 85/400
160/160 [=====] - 0s 473us/step - loss: 0.6938
Epoch 86/400
160/160 [=====] - 0s 486us/step - loss: 0.6939
Epoch 87/400
160/160 [=====] - 0s 479us/step - loss: 0.6938
Epoch 88/400
160/160 [=====] - 0s 470us/step - loss: 0.6940
Epoch 89/400
160/160 [=====] - 0s 478us/step - loss: 0.6941
Epoch 90/400
160/160 [=====] - 0s 473us/step - loss: 0.6941
Epoch 91/400
160/160 [=====] - 0s 475us/step - loss: 0.6939
Epoch 92/400
160/160 [=====] - 0s 494us/step - loss: 0.6940
Epoch 93/400
160/160 [=====] - 0s 476us/step - loss: 0.6940
Epoch 94/400
160/160 [=====] - 0s 477us/step - loss: 0.6940
Epoch 95/400
160/160 [=====] - 0s 477us/step - loss: 0.6938
Epoch 96/400
160/160 [=====] - 0s 481us/step - loss: 0.6939
Epoch 97/400
160/160 [=====] - 0s 467us/step - loss: 0.6939
Epoch 98/400
160/160 [=====] - 0s 473us/step - loss: 0.6941
Epoch 99/400
160/160 [=====] - 0s 482us/step - loss: 0.6939
Epoch 100/400
160/160 [=====] - 0s 483us/step - loss: 0.6940
Epoch 101/400
160/160 [=====] - 0s 507us/step - loss: 0.6938

Epoch 102/400
160/160 [=====] - 0s 474us/step - loss: 0.6940
Epoch 103/400
160/160 [=====] - 0s 467us/step - loss: 0.6941
Epoch 104/400
160/160 [=====] - 0s 487us/step - loss: 0.6939
Epoch 105/400
160/160 [=====] - 0s 477us/step - loss: 0.6939
Epoch 106/400
160/160 [=====] - 0s 475us/step - loss: 0.6939
Epoch 107/400
160/160 [=====] - 0s 471us/step - loss: 0.6939
Epoch 108/400
160/160 [=====] - 0s 477us/step - loss: 0.6939
Epoch 109/400
160/160 [=====] - 0s 482us/step - loss: 0.6939
Epoch 110/400
160/160 [=====] - 0s 473us/step - loss: 0.6941
Epoch 111/400
160/160 [=====] - 0s 483us/step - loss: 0.6938
Epoch 112/400
160/160 [=====] - 0s 483us/step - loss: 0.6940
Epoch 113/400
160/160 [=====] - 0s 477us/step - loss: 0.6938
Epoch 114/400
160/160 [=====] - 0s 476us/step - loss: 0.6938
Epoch 115/400
160/160 [=====] - 0s 466us/step - loss: 0.6938
Epoch 116/400
160/160 [=====] - 0s 477us/step - loss: 0.6939
Epoch 117/400
160/160 [=====] - 0s 472us/step - loss: 0.6937
Epoch 118/400
160/160 [=====] - 0s 468us/step - loss: 0.6939
Epoch 119/400
160/160 [=====] - 0s 485us/step - loss: 0.6938
Epoch 120/400
160/160 [=====] - 0s 484us/step - loss: 0.6938
Epoch 121/400
160/160 [=====] - 0s 490us/step - loss: 0.6938
Epoch 122/400
160/160 [=====] - 0s 480us/step - loss: 0.6939
Epoch 123/400
160/160 [=====] - 0s 475us/step - loss: 0.6939
Epoch 124/400
160/160 [=====] - 0s 483us/step - loss: 0.6939
Epoch 125/400
160/160 [=====] - 0s 468us/step - loss: 0.6938

Epoch 126/400
160/160 [=====] - 0s 469us/step - loss: 0.6938
Epoch 127/400
160/160 [=====] - 0s 472us/step - loss: 0.6938
Epoch 128/400
160/160 [=====] - 0s 477us/step - loss: 0.6938
Epoch 129/400
160/160 [=====] - 0s 486us/step - loss: 0.6940
Epoch 130/400
160/160 [=====] - 0s 467us/step - loss: 0.6938
Epoch 131/400
160/160 [=====] - 0s 476us/step - loss: 0.6939
Epoch 132/400
160/160 [=====] - 0s 475us/step - loss: 0.6938
Epoch 133/400
160/160 [=====] - 0s 503us/step - loss: 0.6939
Epoch 134/400
160/160 [=====] - 0s 533us/step - loss: 0.6937
Epoch 135/400
160/160 [=====] - 0s 600us/step - loss: 0.6938
Epoch 136/400
160/160 [=====] - 0s 562us/step - loss: 0.6937
Epoch 137/400
160/160 [=====] - 0s 749us/step - loss: 0.6939
Epoch 138/400
160/160 [=====] - 0s 493us/step - loss: 0.6938
Epoch 139/400
160/160 [=====] - 0s 487us/step - loss: 0.6937
Epoch 140/400
160/160 [=====] - 0s 590us/step - loss: 0.6936
Epoch 141/400
160/160 [=====] - 0s 541us/step - loss: 0.6939
Epoch 142/400
160/160 [=====] - 0s 517us/step - loss: 0.6938
Epoch 143/400
160/160 [=====] - 0s 478us/step - loss: 0.6937
Epoch 144/400
160/160 [=====] - 0s 482us/step - loss: 0.6938
Epoch 145/400
160/160 [=====] - 0s 497us/step - loss: 0.6938
Epoch 146/400
160/160 [=====] - 0s 482us/step - loss: 0.6938
Epoch 147/400
160/160 [=====] - 0s 480us/step - loss: 0.6940
Epoch 148/400
160/160 [=====] - 0s 481us/step - loss: 0.6938
Epoch 149/400
160/160 [=====] - 0s 469us/step - loss: 0.6938

Epoch 150/400
160/160 [=====] - 0s 489us/step - loss: 0.6939
Epoch 151/400
160/160 [=====] - 0s 468us/step - loss: 0.6938
Epoch 152/400
160/160 [=====] - 0s 497us/step - loss: 0.6938
Epoch 153/400
160/160 [=====] - 0s 485us/step - loss: 0.6937
Epoch 154/400
160/160 [=====] - 0s 492us/step - loss: 0.6939
Epoch 155/400
160/160 [=====] - 0s 475us/step - loss: 0.6941
Epoch 156/400
160/160 [=====] - 0s 469us/step - loss: 0.6939
Epoch 157/400
160/160 [=====] - 0s 471us/step - loss: 0.6937
Epoch 158/400
160/160 [=====] - 0s 479us/step - loss: 0.6938
Epoch 159/400
160/160 [=====] - 0s 475us/step - loss: 0.6937
Epoch 160/400
160/160 [=====] - 0s 466us/step - loss: 0.6937
Epoch 161/400
160/160 [=====] - 0s 467us/step - loss: 0.6939
Epoch 162/400
160/160 [=====] - 0s 549us/step - loss: 0.6939
Epoch 163/400
160/160 [=====] - 0s 482us/step - loss: 0.6941
Epoch 164/400
160/160 [=====] - 0s 481us/step - loss: 0.6939
Epoch 165/400
160/160 [=====] - 0s 475us/step - loss: 0.6938
Epoch 166/400
160/160 [=====] - 0s 476us/step - loss: 0.6939
Epoch 167/400
160/160 [=====] - 0s 480us/step - loss: 0.6938
Epoch 168/400
160/160 [=====] - 0s 478us/step - loss: 0.6938
Epoch 169/400
160/160 [=====] - 0s 472us/step - loss: 0.6939
Epoch 170/400
160/160 [=====] - 0s 494us/step - loss: 0.6938
Epoch 171/400
160/160 [=====] - 0s 480us/step - loss: 0.6938
Epoch 172/400
160/160 [=====] - 0s 478us/step - loss: 0.6939
Epoch 173/400
160/160 [=====] - 0s 467us/step - loss: 0.6938

Epoch 174/400
160/160 [=====] - 0s 487us/step - loss: 0.6938
Epoch 175/400
160/160 [=====] - 0s 479us/step - loss: 0.6937
Epoch 176/400
160/160 [=====] - 0s 473us/step - loss: 0.6938
Epoch 177/400
160/160 [=====] - 0s 484us/step - loss: 0.6939
Epoch 178/400
160/160 [=====] - 0s 473us/step - loss: 0.6938
Epoch 179/400
160/160 [=====] - 0s 476us/step - loss: 0.6938
Epoch 180/400
160/160 [=====] - 0s 472us/step - loss: 0.6940
Epoch 181/400
160/160 [=====] - 0s 479us/step - loss: 0.6938
Epoch 182/400
160/160 [=====] - 0s 493us/step - loss: 0.6937
Epoch 183/400
160/160 [=====] - 0s 473us/step - loss: 0.6937
Epoch 184/400
160/160 [=====] - 0s 477us/step - loss: 0.6938
Epoch 185/400
160/160 [=====] - 0s 469us/step - loss: 0.6939
Epoch 186/400
160/160 [=====] - 0s 465us/step - loss: 0.6938
Epoch 187/400
160/160 [=====] - 0s 475us/step - loss: 0.6939
Epoch 188/400
160/160 [=====] - 0s 474us/step - loss: 0.6938
Epoch 189/400
160/160 [=====] - 0s 506us/step - loss: 0.6940
Epoch 190/400
160/160 [=====] - 0s 478us/step - loss: 0.6938
Epoch 191/400
160/160 [=====] - 0s 471us/step - loss: 0.6937
Epoch 192/400
160/160 [=====] - 0s 484us/step - loss: 0.6938
Epoch 193/400
160/160 [=====] - 0s 477us/step - loss: 0.6939
Epoch 194/400
160/160 [=====] - 0s 474us/step - loss: 0.6937
Epoch 195/400
160/160 [=====] - 0s 464us/step - loss: 0.6936
Epoch 196/400
160/160 [=====] - 0s 457us/step - loss: 0.6936
Epoch 197/400
160/160 [=====] - 0s 466us/step - loss: 0.6939

Epoch 198/400
160/160 [=====] - 0s 494us/step - loss: 0.6938
Epoch 199/400
160/160 [=====] - 0s 483us/step - loss: 0.6937
Epoch 200/400
160/160 [=====] - 0s 476us/step - loss: 0.6937
Epoch 201/400
160/160 [=====] - 0s 475us/step - loss: 0.6937
Epoch 202/400
160/160 [=====] - 0s 526us/step - loss: 0.6939
Epoch 203/400
160/160 [=====] - 0s 480us/step - loss: 0.6937
Epoch 204/400
160/160 [=====] - 0s 483us/step - loss: 0.6937
Epoch 205/400
160/160 [=====] - 0s 494us/step - loss: 0.6937
Epoch 206/400
160/160 [=====] - 0s 566us/step - loss: 0.6939
Epoch 207/400
160/160 [=====] - 0s 478us/step - loss: 0.6939
Epoch 208/400
160/160 [=====] - 0s 480us/step - loss: 0.6935
Epoch 209/400
160/160 [=====] - 0s 487us/step - loss: 0.6937
Epoch 210/400
160/160 [=====] - 0s 470us/step - loss: 0.6940
Epoch 211/400
160/160 [=====] - 0s 469us/step - loss: 0.6938
Epoch 212/400
160/160 [=====] - 0s 472us/step - loss: 0.6937
Epoch 213/400
160/160 [=====] - 0s 476us/step - loss: 0.6937
Epoch 214/400
160/160 [=====] - 0s 474us/step - loss: 0.6937
Epoch 215/400
160/160 [=====] - 0s 481us/step - loss: 0.6937
Epoch 216/400
160/160 [=====] - 0s 478us/step - loss: 0.6938
Epoch 217/400
160/160 [=====] - 0s 480us/step - loss: 0.6938
Epoch 218/400
160/160 [=====] - 0s 478us/step - loss: 0.6938
Epoch 219/400
160/160 [=====] - 0s 475us/step - loss: 0.6937
Epoch 220/400
160/160 [=====] - 0s 474us/step - loss: 0.6938
Epoch 221/400
160/160 [=====] - 0s 476us/step - loss: 0.6937

Epoch 222/400
160/160 [=====] - 0s 485us/step - loss: 0.6938
Epoch 223/400
160/160 [=====] - 0s 471us/step - loss: 0.6936
Epoch 224/400
160/160 [=====] - 0s 467us/step - loss: 0.6937
Epoch 225/400
160/160 [=====] - 0s 475us/step - loss: 0.6936
Epoch 226/400
160/160 [=====] - 0s 472us/step - loss: 0.6935
Epoch 227/400
160/160 [=====] - 0s 474us/step - loss: 0.6940
Epoch 228/400
160/160 [=====] - 0s 481us/step - loss: 0.6937
Epoch 229/400
160/160 [=====] - 0s 473us/step - loss: 0.6936
Epoch 230/400
160/160 [=====] - 0s 520us/step - loss: 0.6936
Epoch 231/400
160/160 [=====] - 0s 465us/step - loss: 0.6937
Epoch 232/400
160/160 [=====] - 0s 505us/step - loss: 0.6935
Epoch 233/400
160/160 [=====] - 0s 540us/step - loss: 0.6937
Epoch 234/400
160/160 [=====] - 0s 506us/step - loss: 0.6938
Epoch 235/400
160/160 [=====] - 0s 500us/step - loss: 0.6936
Epoch 236/400
160/160 [=====] - 0s 546us/step - loss: 0.6938
Epoch 237/400
160/160 [=====] - 0s 522us/step - loss: 0.6938
Epoch 238/400
160/160 [=====] - 0s 524us/step - loss: 0.6937
Epoch 239/400
160/160 [=====] - 0s 535us/step - loss: 0.6938
Epoch 240/400
160/160 [=====] - 0s 496us/step - loss: 0.6936
Epoch 241/400
160/160 [=====] - 0s 476us/step - loss: 0.6937
Epoch 242/400
160/160 [=====] - 0s 480us/step - loss: 0.6936
Epoch 243/400
160/160 [=====] - 0s 467us/step - loss: 0.6935
Epoch 244/400
160/160 [=====] - 0s 477us/step - loss: 0.6937
Epoch 245/400
160/160 [=====] - 0s 470us/step - loss: 0.6937

Epoch 246/400
160/160 [=====] - 0s 479us/step - loss: 0.6934
Epoch 247/400
160/160 [=====] - 0s 477us/step - loss: 0.6936
Epoch 248/400
160/160 [=====] - 0s 474us/step - loss: 0.6938
Epoch 249/400
160/160 [=====] - 0s 492us/step - loss: 0.6935
Epoch 250/400
160/160 [=====] - 0s 485us/step - loss: 0.6937
Epoch 251/400
160/160 [=====] - 0s 497us/step - loss: 0.6936
Epoch 252/400
160/160 [=====] - 0s 499us/step - loss: 0.6936
Epoch 253/400
160/160 [=====] - 0s 470us/step - loss: 0.6938
Epoch 254/400
160/160 [=====] - 0s 476us/step - loss: 0.6935
Epoch 255/400
160/160 [=====] - 0s 469us/step - loss: 0.6937
Epoch 256/400
160/160 [=====] - 0s 468us/step - loss: 0.6937
Epoch 257/400
160/160 [=====] - 0s 479us/step - loss: 0.6935
Epoch 258/400
160/160 [=====] - 0s 476us/step - loss: 0.6935
Epoch 259/400
160/160 [=====] - 0s 490us/step - loss: 0.6938
Epoch 260/400
160/160 [=====] - 0s 490us/step - loss: 0.6936
Epoch 261/400
160/160 [=====] - 0s 470us/step - loss: 0.6935
Epoch 262/400
160/160 [=====] - 0s 477us/step - loss: 0.6933
Epoch 263/400
160/160 [=====] - 0s 469us/step - loss: 0.6935
Epoch 264/400
160/160 [=====] - 0s 486us/step - loss: 0.6935
Epoch 265/400
160/160 [=====] - 0s 477us/step - loss: 0.6937
Epoch 266/400
160/160 [=====] - 0s 476us/step - loss: 0.6937
Epoch 267/400
160/160 [=====] - 0s 470us/step - loss: 0.6935
Epoch 268/400
160/160 [=====] - 0s 482us/step - loss: 0.6936
Epoch 269/400
160/160 [=====] - 0s 469us/step - loss: 0.6935

Epoch 270/400
160/160 [=====] - 0s 464us/step - loss: 0.6936
Epoch 271/400
160/160 [=====] - 0s 439us/step - loss: 0.6934
Epoch 272/400
160/160 [=====] - 0s 448us/step - loss: 0.6937
Epoch 273/400
160/160 [=====] - 0s 469us/step - loss: 0.6933
Epoch 274/400
160/160 [=====] - 0s 480us/step - loss: 0.6933
Epoch 275/400
160/160 [=====] - 0s 474us/step - loss: 0.6936
Epoch 276/400
160/160 [=====] - 0s 475us/step - loss: 0.6934
Epoch 277/400
160/160 [=====] - 0s 477us/step - loss: 0.6936
Epoch 278/400
160/160 [=====] - 0s 471us/step - loss: 0.6935
Epoch 279/400
160/160 [=====] - 0s 471us/step - loss: 0.6933
Epoch 280/400
160/160 [=====] - 0s 474us/step - loss: 0.6934
Epoch 281/400
160/160 [=====] - 0s 480us/step - loss: 0.6935
Epoch 282/400
160/160 [=====] - 0s 463us/step - loss: 0.6934
Epoch 283/400
160/160 [=====] - 0s 479us/step - loss: 0.6933
Epoch 284/400
160/160 [=====] - 0s 444us/step - loss: 0.6937
Epoch 285/400
160/160 [=====] - 0s 459us/step - loss: 0.6934
Epoch 286/400
160/160 [=====] - 0s 492us/step - loss: 0.6935
Epoch 287/400
160/160 [=====] - 0s 479us/step - loss: 0.6934
Epoch 288/400
160/160 [=====] - 0s 467us/step - loss: 0.6934
Epoch 289/400
160/160 [=====] - 0s 445us/step - loss: 0.6933
Epoch 290/400
160/160 [=====] - 0s 474us/step - loss: 0.6934
Epoch 291/400
160/160 [=====] - 0s 478us/step - loss: 0.6932
Epoch 292/400
160/160 [=====] - 0s 470us/step - loss: 0.6934
Epoch 293/400
160/160 [=====] - 0s 476us/step - loss: 0.6933

Epoch 294/400
160/160 [=====] - 0s 469us/step - loss: 0.6933
Epoch 295/400
160/160 [=====] - 0s 472us/step - loss: 0.6936
Epoch 296/400
160/160 [=====] - 0s 476us/step - loss: 0.6934
Epoch 297/400
160/160 [=====] - 0s 472us/step - loss: 0.6932
Epoch 298/400
160/160 [=====] - 0s 471us/step - loss: 0.6936
Epoch 299/400
160/160 [=====] - 0s 481us/step - loss: 0.6933
Epoch 300/400
160/160 [=====] - 0s 487us/step - loss: 0.6932
Epoch 301/400
160/160 [=====] - 0s 484us/step - loss: 0.6934
Epoch 302/400
160/160 [=====] - 0s 484us/step - loss: 0.6935
Epoch 303/400
160/160 [=====] - 0s 478us/step - loss: 0.6933
Epoch 304/400
160/160 [=====] - 0s 468us/step - loss: 0.6933
Epoch 305/400
160/160 [=====] - 0s 475us/step - loss: 0.6933
Epoch 306/400
160/160 [=====] - 0s 467us/step - loss: 0.6933
Epoch 307/400
160/160 [=====] - 0s 480us/step - loss: 0.6933
Epoch 308/400
160/160 [=====] - 0s 478us/step - loss: 0.6935
Epoch 309/400
160/160 [=====] - 0s 478us/step - loss: 0.6932
Epoch 310/400
160/160 [=====] - 0s 464us/step - loss: 0.6933
Epoch 311/400
160/160 [=====] - 0s 474us/step - loss: 0.6933
Epoch 312/400
160/160 [=====] - 0s 479us/step - loss: 0.6933
Epoch 313/400
160/160 [=====] - 0s 463us/step - loss: 0.6932
Epoch 314/400
160/160 [=====] - 0s 465us/step - loss: 0.6932
Epoch 315/400
160/160 [=====] - 0s 474us/step - loss: 0.6933
Epoch 316/400
160/160 [=====] - 0s 470us/step - loss: 0.6931
Epoch 317/400
160/160 [=====] - 0s 481us/step - loss: 0.6930

Epoch 318/400
160/160 [=====] - 0s 473us/step - loss: 0.6934
Epoch 319/400
160/160 [=====] - 0s 466us/step - loss: 0.6934
Epoch 320/400
160/160 [=====] - 0s 472us/step - loss: 0.6933
Epoch 321/400
160/160 [=====] - 0s 451us/step - loss: 0.6934
Epoch 322/400
160/160 [=====] - 0s 454us/step - loss: 0.6933
Epoch 323/400
160/160 [=====] - 0s 465us/step - loss: 0.6932
Epoch 324/400
160/160 [=====] - 0s 469us/step - loss: 0.6933
Epoch 325/400
160/160 [=====] - 0s 483us/step - loss: 0.6932
Epoch 326/400
160/160 [=====] - 0s 477us/step - loss: 0.6933
Epoch 327/400
160/160 [=====] - 0s 474us/step - loss: 0.6932
Epoch 328/400
160/160 [=====] - 0s 480us/step - loss: 0.6933
Epoch 329/400
160/160 [=====] - 0s 471us/step - loss: 0.6932
Epoch 330/400
160/160 [=====] - 0s 471us/step - loss: 0.6933
Epoch 331/400
160/160 [=====] - 0s 469us/step - loss: 0.6933
Epoch 332/400
160/160 [=====] - 0s 481us/step - loss: 0.6931
Epoch 333/400
160/160 [=====] - 0s 474us/step - loss: 0.6932
Epoch 334/400
160/160 [=====] - 0s 474us/step - loss: 0.6931
Epoch 335/400
160/160 [=====] - 0s 469us/step - loss: 0.6931
Epoch 336/400
160/160 [=====] - 0s 471us/step - loss: 0.6933
Epoch 337/400
160/160 [=====] - 0s 473us/step - loss: 0.6931
Epoch 338/400
160/160 [=====] - 0s 480us/step - loss: 0.6931
Epoch 339/400
160/160 [=====] - 0s 490us/step - loss: 0.6932
Epoch 340/400
160/160 [=====] - 0s 472us/step - loss: 0.6930
Epoch 341/400
160/160 [=====] - 0s 478us/step - loss: 0.6931

Epoch 342/400
160/160 [=====] - 0s 473us/step - loss: 0.6933
Epoch 343/400
160/160 [=====] - 0s 476us/step - loss: 0.6931
Epoch 344/400
160/160 [=====] - 0s 472us/step - loss: 0.6932
Epoch 345/400
160/160 [=====] - 0s 483us/step - loss: 0.6931
Epoch 346/400
160/160 [=====] - 0s 469us/step - loss: 0.6931
Epoch 347/400
160/160 [=====] - 0s 483us/step - loss: 0.6930
Epoch 348/400
160/160 [=====] - 0s 478us/step - loss: 0.6930
Epoch 349/400
160/160 [=====] - 0s 492us/step - loss: 0.6931
Epoch 350/400
160/160 [=====] - 0s 480us/step - loss: 0.6932
Epoch 351/400
160/160 [=====] - 0s 472us/step - loss: 0.6932
Epoch 352/400
160/160 [=====] - 0s 450us/step - loss: 0.6929
Epoch 353/400
160/160 [=====] - 0s 448us/step - loss: 0.6930
Epoch 354/400
160/160 [=====] - 0s 466us/step - loss: 0.6930
Epoch 355/400
160/160 [=====] - 0s 472us/step - loss: 0.6929
Epoch 356/400
160/160 [=====] - 0s 475us/step - loss: 0.6932
Epoch 357/400
160/160 [=====] - 0s 479us/step - loss: 0.6929
Epoch 358/400
160/160 [=====] - 0s 469us/step - loss: 0.6929
Epoch 359/400
160/160 [=====] - 0s 470us/step - loss: 0.6930
Epoch 360/400
160/160 [=====] - 0s 482us/step - loss: 0.6928
Epoch 361/400
160/160 [=====] - 0s 473us/step - loss: 0.6930
Epoch 362/400
160/160 [=====] - 0s 486us/step - loss: 0.6930
Epoch 363/400
160/160 [=====] - 0s 475us/step - loss: 0.6929
Epoch 364/400
160/160 [=====] - 0s 477us/step - loss: 0.6931
Epoch 365/400
160/160 [=====] - 0s 482us/step - loss: 0.6929

Epoch 366/400
160/160 [=====] - 0s 479us/step - loss: 0.6929
Epoch 367/400
160/160 [=====] - 0s 479us/step - loss: 0.6929
Epoch 368/400
160/160 [=====] - 0s 473us/step - loss: 0.6928
Epoch 369/400
160/160 [=====] - 0s 471us/step - loss: 0.6927
Epoch 370/400
160/160 [=====] - 0s 472us/step - loss: 0.6927
Epoch 371/400
160/160 [=====] - 0s 469us/step - loss: 0.6928
Epoch 372/400
160/160 [=====] - 0s 468us/step - loss: 0.6928
Epoch 373/400
160/160 [=====] - 0s 478us/step - loss: 0.6928
Epoch 374/400
160/160 [=====] - 0s 496us/step - loss: 0.6927
Epoch 375/400
160/160 [=====] - 0s 478us/step - loss: 0.6929
Epoch 376/400
160/160 [=====] - 0s 479us/step - loss: 0.6928
Epoch 377/400
160/160 [=====] - 0s 480us/step - loss: 0.6926
Epoch 378/400
160/160 [=====] - 0s 477us/step - loss: 0.6927
Epoch 379/400
160/160 [=====] - 0s 475us/step - loss: 0.6927
Epoch 380/400
160/160 [=====] - 0s 478us/step - loss: 0.6926
Epoch 381/400
160/160 [=====] - 0s 474us/step - loss: 0.6925
Epoch 382/400
160/160 [=====] - 0s 474us/step - loss: 0.6927
Epoch 383/400
160/160 [=====] - 0s 474us/step - loss: 0.6929
Epoch 384/400
160/160 [=====] - 0s 479us/step - loss: 0.6926
Epoch 385/400
160/160 [=====] - 0s 474us/step - loss: 0.6926
Epoch 386/400
160/160 [=====] - 0s 474us/step - loss: 0.6925
Epoch 387/400
160/160 [=====] - 0s 475us/step - loss: 0.6925
Epoch 388/400
160/160 [=====] - 0s 489us/step - loss: 0.6927
Epoch 389/400
160/160 [=====] - 0s 475us/step - loss: 0.6925

Epoch 390/400
160/160 [=====] - 0s 476us/step - loss: 0.6926
Epoch 391/400
160/160 [=====] - 0s 475us/step - loss: 0.6925
Epoch 392/400
160/160 [=====] - 0s 473us/step - loss: 0.6926
Epoch 393/400
160/160 [=====] - 0s 490us/step - loss: 0.6926
Epoch 394/400
160/160 [=====] - 0s 475us/step - loss: 0.6928
Epoch 395/400
160/160 [=====] - 0s 477us/step - loss: 0.6925
Epoch 396/400
160/160 [=====] - 0s 477us/step - loss: 0.6926
Epoch 397/400
160/160 [=====] - 0s 476us/step - loss: 0.6925
Epoch 398/400
160/160 [=====] - 0s 466us/step - loss: 0.6926
Epoch 399/400
160/160 [=====] - 0s 485us/step - loss: 0.6925
Epoch 400/400
160/160 [=====] - 0s 480us/step - loss: 0.6922
[0.49410895 0.48830715 0.48902524 0.4886195 0.48651814 0.4879212
0.49014786 0.49041057 0.49443722 0.48806652 0.4886357 0.48772871
0.48964226 0.49358746 0.49215347 0.48950568 0.4959525 0.48859766
0.48648632 0.4925188 0.48639396 0.48576373 0.49613625 0.4904764
0.48631254 0.49551657 0.48677313 0.4857119 0.48648924 0.49002004
0.4897135 0.49243376 0.49217123 0.49000183 0.4890582 0.487202
0.48976806 0.49248272 0.49014947 0.49325922 0.5063767 0.51639247
0.51486903 0.5157111 0.52087444 0.5172859 0.5126726 0.5122061
0.5059256 0.5169513 0.5156784 0.5177265 0.5136363 0.5071086
0.5092548 0.51388186 0.50397307 0.5157711 0.5209693 0.50869226
0.52126294 0.52320457 0.50374794 0.51207083 0.52148 0.50451773
0.520191 0.523397 0.5209803 0.5129121 0.5135053 0.5088125
0.5092248 0.5129459 0.51480424 0.51903 0.51337844 0.50874114
0.51266706 0.5075783 0.49592096 0.5071643 0.4984573 0.5060548
0.5089481 0.49913615 0.5021446 0.4917719 0.5014985 0.49837127
0.50471437 0.5066001 0.49793857 0.4951057 0.49908775 0.5138444
0.50173867 0.49807635 0.50735873 0.4930465 0.49740377 0.50563604
0.5024553 0.5041222 0.50613934 0.4989613 0.49631935 0.49953538
0.4994932 0.500958 0.49372855 0.5054526 0.5014974 0.5012062
0.49661335 0.5063805 0.50978416 0.5002544 0.50429785 0.5002122
0.5040149 0.49353927 0.50110084 0.49433658 0.49233878 0.50038654
0.49750364 0.5098749 0.4980873 0.5011936 0.4953566 0.49393898
0.50166446 0.50504595 0.5004362 0.4895248 0.49786884 0.5015134
0.49340186 0.5078972 0.50226384 0.49464586 0.49723133 0.49582902
0.49427232 0.50056744 0.5035329 0.49997807 0.5000208 0.49858874
0.506913 0.49478915 0.49808794 0.49835646 0.50317967 0.49409705]

```
0.49181426 0.4992634 0.4956877 0.49930465]
160/160 [=====] - 0s 490us/step
```

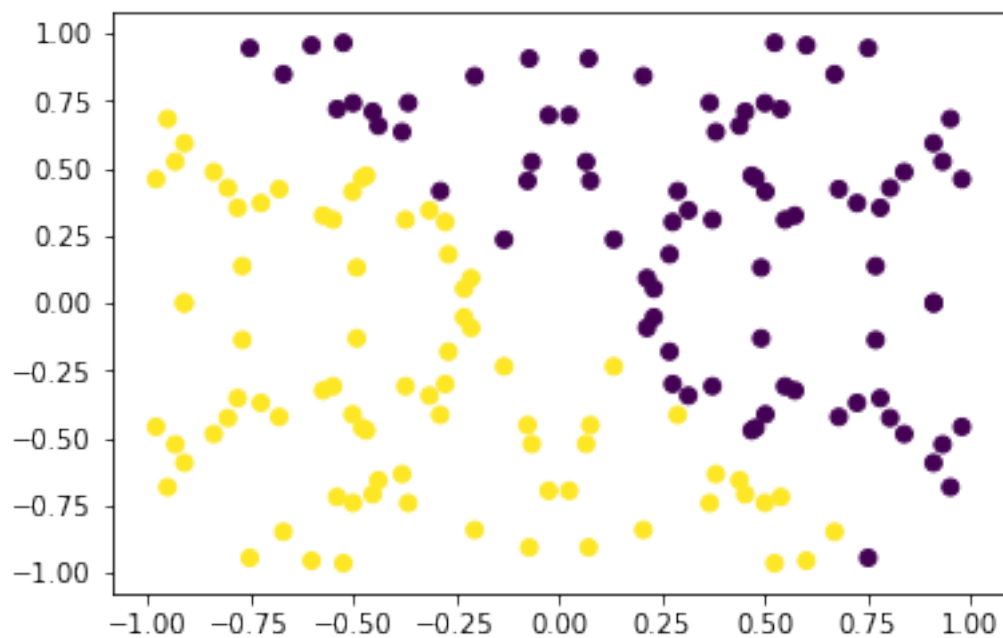
```
In [26]: scores, model.metrics_names
```

```
# a lot of loss compared to tanh
```

```
Out[26]: (0.691536819934845, ['loss'])
```

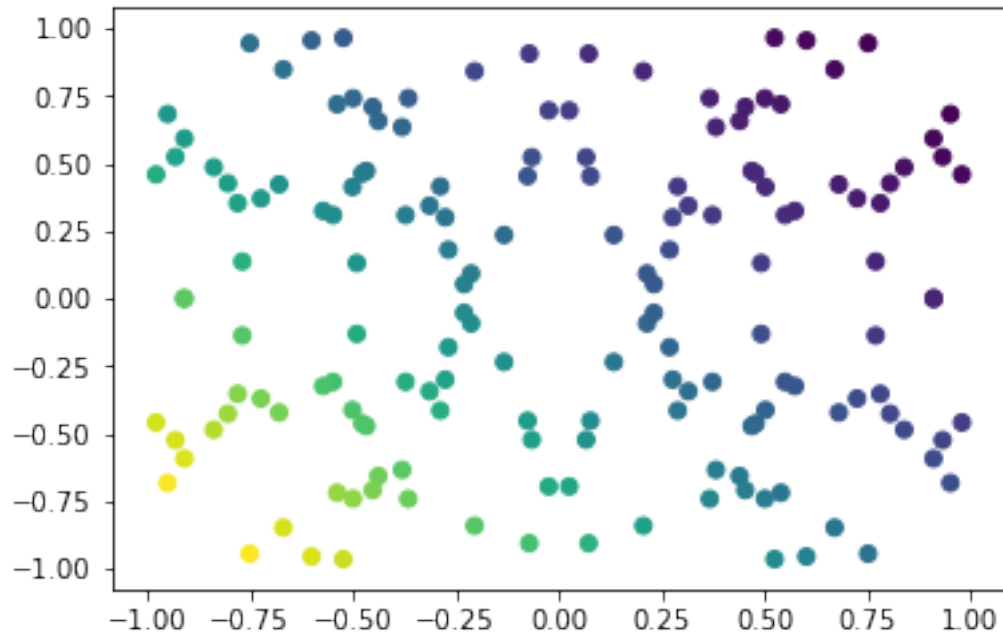
```
In [27]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[27]: <matplotlib.collections.PathCollection at 0xb25913630>
```



```
In [28]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[28]: <matplotlib.collections.PathCollection at 0xb259d79e8>
```



```
In [29]: # Sigmoid 2
model = Sequential()

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

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, 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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 0s 2ms/step - loss: 0.7009
Epoch 2/400
160/160 [=====] - 0s 507us/step - loss: 0.6976
Epoch 3/400
160/160 [=====] - 0s 516us/step - loss: 0.6957
Epoch 4/400
160/160 [=====] - 0s 507us/step - loss: 0.6952
Epoch 5/400
```

160/160 [=====] - 0s 511us/step - loss: 0.6945
Epoch 6/400
160/160 [=====] - 0s 510us/step - loss: 0.6943
Epoch 7/400
160/160 [=====] - 0s 511us/step - loss: 0.6943
Epoch 8/400
160/160 [=====] - 0s 515us/step - loss: 0.6944
Epoch 9/400
160/160 [=====] - 0s 657us/step - loss: 0.6942
Epoch 10/400
160/160 [=====] - 0s 594us/step - loss: 0.6940
Epoch 11/400
160/160 [=====] - 0s 516us/step - loss: 0.6938
Epoch 12/400
160/160 [=====] - 0s 786us/step - loss: 0.6943
Epoch 13/400
160/160 [=====] - 0s 542us/step - loss: 0.6939
Epoch 14/400
160/160 [=====] - 0s 511us/step - loss: 0.6939
Epoch 15/400
160/160 [=====] - 0s 503us/step - loss: 0.6940
Epoch 16/400
160/160 [=====] - 0s 512us/step - loss: 0.6941
Epoch 17/400
160/160 [=====] - 0s 511us/step - loss: 0.6940
Epoch 18/400
160/160 [=====] - 0s 499us/step - loss: 0.6940
Epoch 19/400
160/160 [=====] - 0s 520us/step - loss: 0.6940
Epoch 20/400
160/160 [=====] - 0s 501us/step - loss: 0.6941
Epoch 21/400
160/160 [=====] - 0s 499us/step - loss: 0.6942
Epoch 22/400
160/160 [=====] - 0s 516us/step - loss: 0.6939
Epoch 23/400
160/160 [=====] - 0s 499us/step - loss: 0.6939
Epoch 24/400
160/160 [=====] - 0s 506us/step - loss: 0.6940
Epoch 25/400
160/160 [=====] - 0s 507us/step - loss: 0.6942
Epoch 26/400
160/160 [=====] - 0s 521us/step - loss: 0.6942
Epoch 27/400
160/160 [=====] - 0s 521us/step - loss: 0.6940
Epoch 28/400
160/160 [=====] - 0s 522us/step - loss: 0.6941
Epoch 29/400

160/160 [=====] - 0s 549us/step - loss: 0.6941
Epoch 30/400
160/160 [=====] - 0s 657us/step - loss: 0.6942
Epoch 31/400
160/160 [=====] - 0s 551us/step - loss: 0.6940
Epoch 32/400
160/160 [=====] - 0s 509us/step - loss: 0.6940
Epoch 33/400
160/160 [=====] - 0s 513us/step - loss: 0.6942
Epoch 34/400
160/160 [=====] - 0s 519us/step - loss: 0.6940
Epoch 35/400
160/160 [=====] - 0s 518us/step - loss: 0.6939
Epoch 36/400
160/160 [=====] - 0s 583us/step - loss: 0.6942
Epoch 37/400
160/160 [=====] - 0s 519us/step - loss: 0.6940
Epoch 38/400
160/160 [=====] - 0s 559us/step - loss: 0.6941
Epoch 39/400
160/160 [=====] - 0s 610us/step - loss: 0.6942
Epoch 40/400
160/160 [=====] - 0s 573us/step - loss: 0.6940
Epoch 41/400
160/160 [=====] - 0s 669us/step - loss: 0.6942
Epoch 42/400
160/160 [=====] - 0s 580us/step - loss: 0.6940
Epoch 43/400
160/160 [=====] - 0s 527us/step - loss: 0.6942
Epoch 44/400
160/160 [=====] - 0s 537us/step - loss: 0.6940
Epoch 45/400
160/160 [=====] - 0s 583us/step - loss: 0.6941
Epoch 46/400
160/160 [=====] - 0s 547us/step - loss: 0.6942
Epoch 47/400
160/160 [=====] - 0s 553us/step - loss: 0.6940
Epoch 48/400
160/160 [=====] - 0s 573us/step - loss: 0.6943
Epoch 49/400
160/160 [=====] - 0s 557us/step - loss: 0.6939
Epoch 50/400
160/160 [=====] - 0s 578us/step - loss: 0.6941
Epoch 51/400
160/160 [=====] - 0s 562us/step - loss: 0.6941
Epoch 52/400
160/160 [=====] - 0s 544us/step - loss: 0.6942
Epoch 53/400

160/160 [=====] - 0s 533us/step - loss: 0.6940
Epoch 54/400
160/160 [=====] - 0s 562us/step - loss: 0.6940
Epoch 55/400
160/160 [=====] - 0s 564us/step - loss: 0.6941
Epoch 56/400
160/160 [=====] - 0s 563us/step - loss: 0.6939
Epoch 57/400
160/160 [=====] - 0s 588us/step - loss: 0.6940
Epoch 58/400
160/160 [=====] - 0s 530us/step - loss: 0.6941
Epoch 59/400
160/160 [=====] - 0s 506us/step - loss: 0.6942
Epoch 60/400
160/160 [=====] - 0s 515us/step - loss: 0.6942
Epoch 61/400
160/160 [=====] - 0s 512us/step - loss: 0.6939
Epoch 62/400
160/160 [=====] - 0s 530us/step - loss: 0.6941
Epoch 63/400
160/160 [=====] - 0s 594us/step - loss: 0.6942
Epoch 64/400
160/160 [=====] - 0s 540us/step - loss: 0.6940
Epoch 65/400
160/160 [=====] - 0s 544us/step - loss: 0.6938
Epoch 66/400
160/160 [=====] - 0s 509us/step - loss: 0.6942
Epoch 67/400
160/160 [=====] - 0s 523us/step - loss: 0.6941
Epoch 68/400
160/160 [=====] - 0s 507us/step - loss: 0.6940
Epoch 69/400
160/160 [=====] - 0s 510us/step - loss: 0.6942
Epoch 70/400
160/160 [=====] - 0s 502us/step - loss: 0.6941
Epoch 71/400
160/160 [=====] - 0s 509us/step - loss: 0.6940
Epoch 72/400
160/160 [=====] - 0s 526us/step - loss: 0.6941
Epoch 73/400
160/160 [=====] - 0s 599us/step - loss: 0.6942
Epoch 74/400
160/160 [=====] - 0s 564us/step - loss: 0.6942
Epoch 75/400
160/160 [=====] - 0s 558us/step - loss: 0.6942
Epoch 76/400
160/160 [=====] - 0s 618us/step - loss: 0.6940
Epoch 77/400

160/160 [=====] - 0s 517us/step - loss: 0.6940
Epoch 78/400
160/160 [=====] - 0s 554us/step - loss: 0.6940
Epoch 79/400
160/160 [=====] - 0s 595us/step - loss: 0.6940
Epoch 80/400
160/160 [=====] - 0s 586us/step - loss: 0.6942
Epoch 81/400
160/160 [=====] - 0s 565us/step - loss: 0.6940
Epoch 82/400
160/160 [=====] - 0s 682us/step - loss: 0.6942
Epoch 83/400
160/160 [=====] - 0s 598us/step - loss: 0.6941
Epoch 84/400
160/160 [=====] - 0s 544us/step - loss: 0.6941
Epoch 85/400
160/160 [=====] - 0s 530us/step - loss: 0.6940
Epoch 86/400
160/160 [=====] - 0s 570us/step - loss: 0.6943
Epoch 87/400
160/160 [=====] - 0s 552us/step - loss: 0.6941
Epoch 88/400
160/160 [=====] - 0s 513us/step - loss: 0.6940
Epoch 89/400
160/160 [=====] - 0s 555us/step - loss: 0.6941
Epoch 90/400
160/160 [=====] - 0s 691us/step - loss: 0.6940
Epoch 91/400
160/160 [=====] - 0s 553us/step - loss: 0.6940
Epoch 92/400
160/160 [=====] - 0s 560us/step - loss: 0.6940
Epoch 93/400
160/160 [=====] - 0s 552us/step - loss: 0.6941
Epoch 94/400
160/160 [=====] - 0s 618us/step - loss: 0.6941
Epoch 95/400
160/160 [=====] - 0s 634us/step - loss: 0.6941
Epoch 96/400
160/160 [=====] - 0s 592us/step - loss: 0.6940
Epoch 97/400
160/160 [=====] - 0s 565us/step - loss: 0.6940
Epoch 98/400
160/160 [=====] - 0s 579us/step - loss: 0.6941
Epoch 99/400
160/160 [=====] - 0s 552us/step - loss: 0.6939
Epoch 100/400
160/160 [=====] - 0s 535us/step - loss: 0.6940
Epoch 101/400

160/160 [=====] - 0s 543us/step - loss: 0.6941
 Epoch 102/400
 160/160 [=====] - 0s 608us/step - loss: 0.6940
 Epoch 103/400
 160/160 [=====] - 0s 529us/step - loss: 0.6943
 Epoch 104/400
 160/160 [=====] - 0s 536us/step - loss: 0.6940
 Epoch 105/400
 160/160 [=====] - 0s 716us/step - loss: 0.6941
 Epoch 106/400
 160/160 [=====] - 0s 725us/step - loss: 0.6941
 Epoch 107/400
 160/160 [=====] - 0s 591us/step - loss: 0.6940
 Epoch 108/400
 160/160 [=====] - 0s 630us/step - loss: 0.6940
 Epoch 109/400
 160/160 [=====] - 0s 704us/step - loss: 0.6940
 Epoch 110/400
 160/160 [=====] - 0s 762us/step - loss: 0.6940
 Epoch 111/400
 160/160 [=====] - 0s 648us/step - loss: 0.6942
 Epoch 112/400
 160/160 [=====] - 0s 621us/step - loss: 0.6941
 Epoch 113/400
 160/160 [=====] - 0s 583us/step - loss: 0.6940
 Epoch 114/400
 160/160 [=====] - 0s 527us/step - loss: 0.6941
 Epoch 115/400
 160/160 [=====] - 0s 532us/step - loss: 0.6941
 Epoch 116/400
 160/160 [=====] - 0s 529us/step - loss: 0.6939
 Epoch 117/400
 160/160 [=====] - 0s 535us/step - loss: 0.6942
 Epoch 118/400
 160/160 [=====] - 0s 540us/step - loss: 0.6941
 Epoch 119/400
 160/160 [=====] - 0s 534us/step - loss: 0.6941
 Epoch 120/400
 160/160 [=====] - 0s 603us/step - loss: 0.6941
 Epoch 121/400
 160/160 [=====] - 0s 532us/step - loss: 0.6941
 Epoch 122/400
 160/160 [=====] - 0s 537us/step - loss: 0.6941
 Epoch 123/400
 160/160 [=====] - 0s 531us/step - loss: 0.6941
 Epoch 124/400
 160/160 [=====] - 0s 527us/step - loss: 0.6940
 Epoch 125/400

160/160 [=====] - 0s 540us/step - loss: 0.6940
Epoch 126/400
160/160 [=====] - 0s 635us/step - loss: 0.6941
Epoch 127/400
160/160 [=====] - 0s 747us/step - loss: 0.6941
Epoch 128/400
160/160 [=====] - 0s 691us/step - loss: 0.6940
Epoch 129/400
160/160 [=====] - 0s 667us/step - loss: 0.6941
Epoch 130/400
160/160 [=====] - 0s 723us/step - loss: 0.6942
Epoch 131/400
160/160 [=====] - 0s 776us/step - loss: 0.6941
Epoch 132/400
160/160 [=====] - 0s 706us/step - loss: 0.6941
Epoch 133/400
160/160 [=====] - 0s 687us/step - loss: 0.6939
Epoch 134/400
160/160 [=====] - 0s 532us/step - loss: 0.6940
Epoch 135/400
160/160 [=====] - 0s 522us/step - loss: 0.6940
Epoch 136/400
160/160 [=====] - 0s 531us/step - loss: 0.6941
Epoch 137/400
160/160 [=====] - 0s 522us/step - loss: 0.6941
Epoch 138/400
160/160 [=====] - 0s 525us/step - loss: 0.6941
Epoch 139/400
160/160 [=====] - 0s 536us/step - loss: 0.6940
Epoch 140/400
160/160 [=====] - 0s 534us/step - loss: 0.6941
Epoch 141/400
160/160 [=====] - 0s 567us/step - loss: 0.6940
Epoch 142/400
160/160 [=====] - 0s 750us/step - loss: 0.6941
Epoch 143/400
160/160 [=====] - 0s 680us/step - loss: 0.6941
Epoch 144/400
160/160 [=====] - 0s 596us/step - loss: 0.6942
Epoch 145/400
160/160 [=====] - 0s 615us/step - loss: 0.6941
Epoch 146/400
160/160 [=====] - 0s 619us/step - loss: 0.6940
Epoch 147/400
160/160 [=====] - 0s 676us/step - loss: 0.6941
Epoch 148/400
160/160 [=====] - 0s 710us/step - loss: 0.6940
Epoch 149/400

160/160 [=====] - 0s 697us/step - loss: 0.6940
 Epoch 150/400
 160/160 [=====] - 0s 692us/step - loss: 0.6940
 Epoch 151/400
 160/160 [=====] - 0s 727us/step - loss: 0.6940
 Epoch 152/400
 160/160 [=====] - 0s 730us/step - loss: 0.6940
 Epoch 153/400
 160/160 [=====] - 0s 629us/step - loss: 0.6941
 Epoch 154/400
 160/160 [=====] - 0s 540us/step - loss: 0.6940
 Epoch 155/400
 160/160 [=====] - 0s 554us/step - loss: 0.6939
 Epoch 156/400
 160/160 [=====] - 0s 537us/step - loss: 0.6940
 Epoch 157/400
 160/160 [=====] - 0s 524us/step - loss: 0.6941
 Epoch 158/400
 160/160 [=====] - 0s 534us/step - loss: 0.6943
 Epoch 159/400
 160/160 [=====] - 0s 530us/step - loss: 0.6939
 Epoch 160/400
 160/160 [=====] - 0s 541us/step - loss: 0.6943
 Epoch 161/400
 160/160 [=====] - 0s 520us/step - loss: 0.6939
 Epoch 162/400
 160/160 [=====] - 0s 533us/step - loss: 0.6941
 Epoch 163/400
 160/160 [=====] - 0s 542us/step - loss: 0.6941
 Epoch 164/400
 160/160 [=====] - 0s 520us/step - loss: 0.6942
 Epoch 165/400
 160/160 [=====] - 0s 534us/step - loss: 0.6940
 Epoch 166/400
 160/160 [=====] - 0s 526us/step - loss: 0.6939
 Epoch 167/400
 160/160 [=====] - 0s 545us/step - loss: 0.6940
 Epoch 168/400
 160/160 [=====] - 0s 522us/step - loss: 0.6940
 Epoch 169/400
 160/160 [=====] - 0s 532us/step - loss: 0.6942
 Epoch 170/400
 160/160 [=====] - 0s 525us/step - loss: 0.6941
 Epoch 171/400
 160/160 [=====] - 0s 522us/step - loss: 0.6940
 Epoch 172/400
 160/160 [=====] - 0s 532us/step - loss: 0.6940
 Epoch 173/400

160/160 [=====] - 0s 520us/step - loss: 0.6941
 Epoch 174/400
 160/160 [=====] - 0s 534us/step - loss: 0.6939
 Epoch 175/400
 160/160 [=====] - 0s 526us/step - loss: 0.6939
 Epoch 176/400
 160/160 [=====] - 0s 527us/step - loss: 0.6940
 Epoch 177/400
 160/160 [=====] - 0s 527us/step - loss: 0.6942
 Epoch 178/400
 160/160 [=====] - 0s 521us/step - loss: 0.6941
 Epoch 179/400
 160/160 [=====] - 0s 524us/step - loss: 0.6941
 Epoch 180/400
 160/160 [=====] - 0s 534us/step - loss: 0.6940
 Epoch 181/400
 160/160 [=====] - 0s 542us/step - loss: 0.6941
 Epoch 182/400
 160/160 [=====] - 0s 541us/step - loss: 0.6940
 Epoch 183/400
 160/160 [=====] - 0s 712us/step - loss: 0.6940
 Epoch 184/400
 160/160 [=====] - 0s 685us/step - loss: 0.6939
 Epoch 185/400
 160/160 [=====] - 0s 645us/step - loss: 0.6941
 Epoch 186/400
 160/160 [=====] - 0s 542us/step - loss: 0.6940
 Epoch 187/400
 160/160 [=====] - 0s 547us/step - loss: 0.6941
 Epoch 188/400
 160/160 [=====] - 0s 548us/step - loss: 0.6939
 Epoch 189/400
 160/160 [=====] - 0s 538us/step - loss: 0.6940
 Epoch 190/400
 160/160 [=====] - 0s 533us/step - loss: 0.6942
 Epoch 191/400
 160/160 [=====] - 0s 537us/step - loss: 0.6940
 Epoch 192/400
 160/160 [=====] - 0s 591us/step - loss: 0.6941
 Epoch 193/400
 160/160 [=====] - 0s 772us/step - loss: 0.6940
 Epoch 194/400
 160/160 [=====] - 0s 695us/step - loss: 0.6940
 Epoch 195/400
 160/160 [=====] - 0s 544us/step - loss: 0.6942
 Epoch 196/400
 160/160 [=====] - 0s 601us/step - loss: 0.6940
 Epoch 197/400

160/160 [=====] - 0s 544us/step - loss: 0.6940
Epoch 198/400
160/160 [=====] - 0s 540us/step - loss: 0.6941
Epoch 199/400
160/160 [=====] - 0s 686us/step - loss: 0.6940
Epoch 200/400
160/160 [=====] - 0s 743us/step - loss: 0.6939
Epoch 201/400
160/160 [=====] - 0s 614us/step - loss: 0.6941
Epoch 202/400
160/160 [=====] - 0s 533us/step - loss: 0.6941
Epoch 203/400
160/160 [=====] - 0s 542us/step - loss: 0.6940
Epoch 204/400
160/160 [=====] - 0s 588us/step - loss: 0.6942
Epoch 205/400
160/160 [=====] - 0s 722us/step - loss: 0.6940
Epoch 206/400
160/160 [=====] - 0s 554us/step - loss: 0.6940
Epoch 207/400
160/160 [=====] - 0s 534us/step - loss: 0.6940
Epoch 208/400
160/160 [=====] - 0s 543us/step - loss: 0.6942
Epoch 209/400
160/160 [=====] - 0s 563us/step - loss: 0.6941
Epoch 210/400
160/160 [=====] - 0s 527us/step - loss: 0.6942
Epoch 211/400
160/160 [=====] - 0s 535us/step - loss: 0.6942
Epoch 212/400
160/160 [=====] - 0s 530us/step - loss: 0.6940
Epoch 213/400
160/160 [=====] - 0s 550us/step - loss: 0.6940
Epoch 214/400
160/160 [=====] - 0s 523us/step - loss: 0.6940
Epoch 215/400
160/160 [=====] - 0s 548us/step - loss: 0.6940
Epoch 216/400
160/160 [=====] - 0s 530us/step - loss: 0.6939
Epoch 217/400
160/160 [=====] - 0s 539us/step - loss: 0.6940
Epoch 218/400
160/160 [=====] - 0s 595us/step - loss: 0.6942
Epoch 219/400
160/160 [=====] - 0s 717us/step - loss: 0.6941
Epoch 220/400
160/160 [=====] - 0s 689us/step - loss: 0.6941
Epoch 221/400

160/160 [=====] - 0s 632us/step - loss: 0.6940
Epoch 222/400
160/160 [=====] - 0s 648us/step - loss: 0.6940
Epoch 223/400
160/160 [=====] - 0s 684us/step - loss: 0.6940
Epoch 224/400
160/160 [=====] - 0s 695us/step - loss: 0.6939
Epoch 225/400
160/160 [=====] - 0s 643us/step - loss: 0.6939
Epoch 226/400
160/160 [=====] - 0s 701us/step - loss: 0.6942
Epoch 227/400
160/160 [=====] - 0s 644us/step - loss: 0.6941
Epoch 228/400
160/160 [=====] - 0s 541us/step - loss: 0.6941
Epoch 229/400
160/160 [=====] - 0s 508us/step - loss: 0.6940
Epoch 230/400
160/160 [=====] - 0s 532us/step - loss: 0.6940
Epoch 231/400
160/160 [=====] - 0s 628us/step - loss: 0.6941
Epoch 232/400
160/160 [=====] - 0s 616us/step - loss: 0.6940
Epoch 233/400
160/160 [=====] - 0s 711us/step - loss: 0.6942
Epoch 234/400
160/160 [=====] - 0s 609us/step - loss: 0.6941
Epoch 235/400
160/160 [=====] - 0s 528us/step - loss: 0.6940
Epoch 236/400
160/160 [=====] - 0s 537us/step - loss: 0.6941
Epoch 237/400
160/160 [=====] - 0s 548us/step - loss: 0.6941
Epoch 238/400
160/160 [=====] - 0s 627us/step - loss: 0.6938
Epoch 239/400
160/160 [=====] - 0s 690us/step - loss: 0.6939
Epoch 240/400
160/160 [=====] - 0s 634us/step - loss: 0.6940
Epoch 241/400
160/160 [=====] - 0s 716us/step - loss: 0.6940
Epoch 242/400
160/160 [=====] - 0s 620us/step - loss: 0.6941
Epoch 243/400
160/160 [=====] - 0s 627us/step - loss: 0.6943
Epoch 244/400
160/160 [=====] - 0s 636us/step - loss: 0.6940
Epoch 245/400

```

160/160 [=====] - 0s 544us/step - loss: 0.6940
Epoch 246/400
160/160 [=====] - 0s 601us/step - loss: 0.6941
Epoch 247/400
160/160 [=====] - 0s 726us/step - loss: 0.6941
Epoch 248/400
160/160 [=====] - 0s 708us/step - loss: 0.6942
Epoch 249/400
160/160 [=====] - 0s 706us/step - loss: 0.6940
Epoch 250/400
160/160 [=====] - 0s 725us/step - loss: 0.6941
Epoch 251/400
160/160 [=====] - 0s 614us/step - loss: 0.6942
Epoch 252/400
160/160 [=====] - 0s 641us/step - loss: 0.6941
Epoch 253/400
160/160 [=====] - 0s 707us/step - loss: 0.6940
Epoch 254/400
160/160 [=====] - 0s 624us/step - loss: 0.6941
Epoch 255/400
160/160 [=====] - 0s 620us/step - loss: 0.6942
Epoch 256/400
160/160 [=====] - 0s 594us/step - loss: 0.6939 0s - loss: 0.693
Epoch 257/400
160/160 [=====] - 0s 628us/step - loss: 0.6941
Epoch 258/400
160/160 [=====] - 0s 691us/step - loss: 0.6940
Epoch 259/400
160/160 [=====] - 0s 635us/step - loss: 0.6940
Epoch 260/400
160/160 [=====] - 0s 840us/step - loss: 0.6941
Epoch 261/400
160/160 [=====] - 0s 700us/step - loss: 0.6938
Epoch 262/400
160/160 [=====] - 0s 560us/step - loss: 0.6940
Epoch 263/400
160/160 [=====] - 0s 529us/step - loss: 0.6939
Epoch 264/400
160/160 [=====] - 0s 511us/step - loss: 0.6940
Epoch 265/400
160/160 [=====] - 0s 539us/step - loss: 0.6941
Epoch 266/400
160/160 [=====] - 0s 714us/step - loss: 0.6939
Epoch 267/400
160/160 [=====] - 0s 683us/step - loss: 0.6942
Epoch 268/400
160/160 [=====] - 0s 701us/step - loss: 0.6940
Epoch 269/400

```

160/160 [=====] - 0s 696us/step - loss: 0.6940
 Epoch 270/400
 160/160 [=====] - 0s 686us/step - loss: 0.6940
 Epoch 271/400
 160/160 [=====] - 0s 631us/step - loss: 0.6939
 Epoch 272/400
 160/160 [=====] - 0s 763us/step - loss: 0.6941
 Epoch 273/400
 160/160 [=====] - 0s 614us/step - loss: 0.6943
 Epoch 274/400
 160/160 [=====] - 0s 581us/step - loss: 0.6943
 Epoch 275/400
 160/160 [=====] - 0s 550us/step - loss: 0.6941
 Epoch 276/400
 160/160 [=====] - 0s 534us/step - loss: 0.6940
 Epoch 277/400
 160/160 [=====] - 0s 686us/step - loss: 0.6940
 Epoch 278/400
 160/160 [=====] - 0s 684us/step - loss: 0.6940
 Epoch 279/400
 160/160 [=====] - 0s 721us/step - loss: 0.6939
 Epoch 280/400
 160/160 [=====] - 0s 648us/step - loss: 0.6940
 Epoch 281/400
 160/160 [=====] - 0s 538us/step - loss: 0.6940
 Epoch 282/400
 160/160 [=====] - 0s 553us/step - loss: 0.6938
 Epoch 283/400
 160/160 [=====] - 0s 540us/step - loss: 0.6939
 Epoch 284/400
 160/160 [=====] - 0s 675us/step - loss: 0.6940
 Epoch 285/400
 160/160 [=====] - 0s 700us/step - loss: 0.6941
 Epoch 286/400
 160/160 [=====] - 0s 633us/step - loss: 0.6941
 Epoch 287/400
 160/160 [=====] - 0s 687us/step - loss: 0.6940
 Epoch 288/400
 160/160 [=====] - 0s 727us/step - loss: 0.6941
 Epoch 289/400
 160/160 [=====] - 0s 751us/step - loss: 0.6940
 Epoch 290/400
 160/160 [=====] - 0s 733us/step - loss: 0.6937
 Epoch 291/400
 160/160 [=====] - 0s 753us/step - loss: 0.6941
 Epoch 292/400
 160/160 [=====] - 0s 729us/step - loss: 0.6942
 Epoch 293/400

160/160 [=====] - 0s 757us/step - loss: 0.6941
Epoch 294/400
160/160 [=====] - 0s 776us/step - loss: 0.6941
Epoch 295/400
160/160 [=====] - 0s 718us/step - loss: 0.6940
Epoch 296/400
160/160 [=====] - 0s 723us/step - loss: 0.6941
Epoch 297/400
160/160 [=====] - 0s 722us/step - loss: 0.6942
Epoch 298/400
160/160 [=====] - 0s 710us/step - loss: 0.6940
Epoch 299/400
160/160 [=====] - 0s 709us/step - loss: 0.6940
Epoch 300/400
160/160 [=====] - 0s 633us/step - loss: 0.6941
Epoch 301/400
160/160 [=====] - 0s 539us/step - loss: 0.6942
Epoch 302/400
160/160 [=====] - 0s 559us/step - loss: 0.6941
Epoch 303/400
160/160 [=====] - 0s 533us/step - loss: 0.6939
Epoch 304/400
160/160 [=====] - 0s 538us/step - loss: 0.6939
Epoch 305/400
160/160 [=====] - 0s 533us/step - loss: 0.6942
Epoch 306/400
160/160 [=====] - 0s 538us/step - loss: 0.6940
Epoch 307/400
160/160 [=====] - 0s 537us/step - loss: 0.6941
Epoch 308/400
160/160 [=====] - 0s 535us/step - loss: 0.6942
Epoch 309/400
160/160 [=====] - 0s 547us/step - loss: 0.6941
Epoch 310/400
160/160 [=====] - 0s 553us/step - loss: 0.6939
Epoch 311/400
160/160 [=====] - 0s 624us/step - loss: 0.6940
Epoch 312/400
160/160 [=====] - 0s 725us/step - loss: 0.6941
Epoch 313/400
160/160 [=====] - 0s 690us/step - loss: 0.6939
Epoch 314/400
160/160 [=====] - 0s 700us/step - loss: 0.6940
Epoch 315/400
160/160 [=====] - 0s 726us/step - loss: 0.6941
Epoch 316/400
160/160 [=====] - 0s 709us/step - loss: 0.6940
Epoch 317/400

160/160 [=====] - 0s 691us/step - loss: 0.6940
Epoch 318/400
160/160 [=====] - 0s 533us/step - loss: 0.6939
Epoch 319/400
160/160 [=====] - 0s 547us/step - loss: 0.6940
Epoch 320/400
160/160 [=====] - 0s 707us/step - loss: 0.6941
Epoch 321/400
160/160 [=====] - 0s 715us/step - loss: 0.6940
Epoch 322/400
160/160 [=====] - 0s 711us/step - loss: 0.6943
Epoch 323/400
160/160 [=====] - 0s 694us/step - loss: 0.6940
Epoch 324/400
160/160 [=====] - 0s 724us/step - loss: 0.6940
Epoch 325/400
160/160 [=====] - 0s 712us/step - loss: 0.6939
Epoch 326/400
160/160 [=====] - 0s 619us/step - loss: 0.6942
Epoch 327/400
160/160 [=====] - 0s 522us/step - loss: 0.6940
Epoch 328/400
160/160 [=====] - 0s 536us/step - loss: 0.6940
Epoch 329/400
160/160 [=====] - 0s 529us/step - loss: 0.6940
Epoch 330/400
160/160 [=====] - 0s 543us/step - loss: 0.6938
Epoch 331/400
160/160 [=====] - 0s 536us/step - loss: 0.6941
Epoch 332/400
160/160 [=====] - 0s 588us/step - loss: 0.6939
Epoch 333/400
160/160 [=====] - 0s 558us/step - loss: 0.6940
Epoch 334/400
160/160 [=====] - 0s 539us/step - loss: 0.6940
Epoch 335/400
160/160 [=====] - 0s 545us/step - loss: 0.6942
Epoch 336/400
160/160 [=====] - 0s 611us/step - loss: 0.6938
Epoch 337/400
160/160 [=====] - 0s 538us/step - loss: 0.6940
Epoch 338/400
160/160 [=====] - 0s 531us/step - loss: 0.6940
Epoch 339/400
160/160 [=====] - 0s 581us/step - loss: 0.6940
Epoch 340/400
160/160 [=====] - 0s 636us/step - loss: 0.6941
Epoch 341/400

160/160 [=====] - 0s 572us/step - loss: 0.6941
Epoch 342/400
160/160 [=====] - 0s 530us/step - loss: 0.6942
Epoch 343/400
160/160 [=====] - 0s 549us/step - loss: 0.6941
Epoch 344/400
160/160 [=====] - 0s 613us/step - loss: 0.6939
Epoch 345/400
160/160 [=====] - 0s 542us/step - loss: 0.6941
Epoch 346/400
160/160 [=====] - 0s 539us/step - loss: 0.6941
Epoch 347/400
160/160 [=====] - 0s 532us/step - loss: 0.6939
Epoch 348/400
160/160 [=====] - 0s 572us/step - loss: 0.6939
Epoch 349/400
160/160 [=====] - 0s 552us/step - loss: 0.6942
Epoch 350/400
160/160 [=====] - 0s 562us/step - loss: 0.6940
Epoch 351/400
160/160 [=====] - 0s 534us/step - loss: 0.6941
Epoch 352/400
160/160 [=====] - 0s 547us/step - loss: 0.6942
Epoch 353/400
160/160 [=====] - 0s 541us/step - loss: 0.6943
Epoch 354/400
160/160 [=====] - 0s 729us/step - loss: 0.6940
Epoch 355/400
160/160 [=====] - 0s 679us/step - loss: 0.6941
Epoch 356/400
160/160 [=====] - 0s 639us/step - loss: 0.6940
Epoch 357/400
160/160 [=====] - 0s 703us/step - loss: 0.6939
Epoch 358/400
160/160 [=====] - 0s 665us/step - loss: 0.6942
Epoch 359/400
160/160 [=====] - 0s 645us/step - loss: 0.6938
Epoch 360/400
160/160 [=====] - 0s 660us/step - loss: 0.6941
Epoch 361/400
160/160 [=====] - 0s 669us/step - loss: 0.6939
Epoch 362/400
160/160 [=====] - 0s 690us/step - loss: 0.6940
Epoch 363/400
160/160 [=====] - 0s 633us/step - loss: 0.6940
Epoch 364/400
160/160 [=====] - 0s 542us/step - loss: 0.6941
Epoch 365/400

160/160 [=====] - 0s 757us/step - loss: 0.6942
Epoch 366/400
160/160 [=====] - 0s 667us/step - loss: 0.6941
Epoch 367/400
160/160 [=====] - 0s 654us/step - loss: 0.6939
Epoch 368/400
160/160 [=====] - 0s 733us/step - loss: 0.6941
Epoch 369/400
160/160 [=====] - 0s 764us/step - loss: 0.6940
Epoch 370/400
160/160 [=====] - 0s 772us/step - loss: 0.6940
Epoch 371/400
160/160 [=====] - 0s 732us/step - loss: 0.6939
Epoch 372/400
160/160 [=====] - 0s 689us/step - loss: 0.6940
Epoch 373/400
160/160 [=====] - 0s 668us/step - loss: 0.6941
Epoch 374/400
160/160 [=====] - 0s 719us/step - loss: 0.6942
Epoch 375/400
160/160 [=====] - 0s 704us/step - loss: 0.6940
Epoch 376/400
160/160 [=====] - 0s 695us/step - loss: 0.6942
Epoch 377/400
160/160 [=====] - 0s 554us/step - loss: 0.6941
Epoch 378/400
160/160 [=====] - 0s 596us/step - loss: 0.6940
Epoch 379/400
160/160 [=====] - 0s 565us/step - loss: 0.6941
Epoch 380/400
160/160 [=====] - 0s 540us/step - loss: 0.6939
Epoch 381/400
160/160 [=====] - 0s 559us/step - loss: 0.6941
Epoch 382/400
160/160 [=====] - 0s 524us/step - loss: 0.6938
Epoch 383/400
160/160 [=====] - 0s 521us/step - loss: 0.6939
Epoch 384/400
160/160 [=====] - 0s 536us/step - loss: 0.6940
Epoch 385/400
160/160 [=====] - 0s 523us/step - loss: 0.6942
Epoch 386/400
160/160 [=====] - 0s 535us/step - loss: 0.6940
Epoch 387/400
160/160 [=====] - 0s 610us/step - loss: 0.6941
Epoch 388/400
160/160 [=====] - 0s 733us/step - loss: 0.6940
Epoch 389/400

```

160/160 [=====] - 0s 719us/step - loss: 0.6942
Epoch 390/400
160/160 [=====] - 0s 727us/step - loss: 0.6939
Epoch 391/400
160/160 [=====] - 0s 717us/step - loss: 0.6939
Epoch 392/400
160/160 [=====] - 0s 678us/step - loss: 0.6941
Epoch 393/400
160/160 [=====] - 0s 666us/step - loss: 0.6940
Epoch 394/400
160/160 [=====] - 0s 716us/step - loss: 0.6940
Epoch 395/400
160/160 [=====] - 0s 692us/step - loss: 0.6940
Epoch 396/400
160/160 [=====] - 0s 746us/step - loss: 0.6940
Epoch 397/400
160/160 [=====] - 0s 700us/step - loss: 0.6939
Epoch 398/400
160/160 [=====] - 0s 726us/step - loss: 0.6941
Epoch 399/400
160/160 [=====] - 0s 760us/step - loss: 0.6940
Epoch 400/400
160/160 [=====] - 0s 753us/step - loss: 0.6942
[0.50264335 0.50411695 0.50407475 0.50403506 0.50480276 0.5044686
 0.50362426 0.50367033 0.5024532 0.50442624 0.5040664 0.50435466
 0.50387526 0.50278497 0.5031005 0.5035197 0.5020852 0.50423306
 0.50486946 0.5030774 0.50516427 0.5052978 0.50202644 0.5034728
 0.50499266 0.5022479 0.50499696 0.5054898 0.5050818 0.5036925
 0.50389487 0.5028767 0.5030436 0.5036927 0.50409174 0.50457746
 0.5035436 0.502986 0.5035699 0.5027804 0.49992782 0.49847722
 0.49850437 0.49856195 0.49779108 0.49811208 0.49897406 0.49882153
 0.50014436 0.4981487 0.49853304 0.4982431 0.49870148 0.49977568
 0.49948987 0.49901524 0.5005116 0.4983413 0.49773 0.49944925
 0.49739215 0.49730486 0.5005689 0.49912515 0.49760917 0.50034595
 0.4975486 0.49708384 0.49749592 0.49890283 0.49862987 0.49971393
 0.49955413 0.49890342 0.49846965 0.49802214 0.49902925 0.49960935
 0.49902824 0.4998154 0.50223446 0.5001127 0.5016888 0.50029767
 0.49981278 0.5015299 0.5009862 0.503261 0.5010591 0.5016845
 0.5005262 0.50020343 0.501803 0.5024286 0.5015696 0.49902165
 0.50098264 0.5017574 0.5000603 0.5029397 0.5017974 0.500303
 0.5008398 0.50062466 0.5002486 0.5015511 0.5020449 0.5013344
 0.50140023 0.50120884 0.5027432 0.5003595 0.5010935 0.5011618
 0.50207186 0.50023293 0.4996682 0.5013323 0.5005959 0.50133127
 0.50032115 0.5023637 0.50077355 0.50218385 0.50260246 0.50090015
 0.50152075 0.49920726 0.50151545 0.5007473 0.50195044 0.50225115
 0.50067437 0.50011694 0.50096685 0.50351274 0.5016046 0.5006904
 0.50234675 0.4995798 0.50056446 0.5020601 0.5017496 0.501897
 0.5021452 0.50102794 0.500329 0.50100195 0.50097454 0.50129044

```

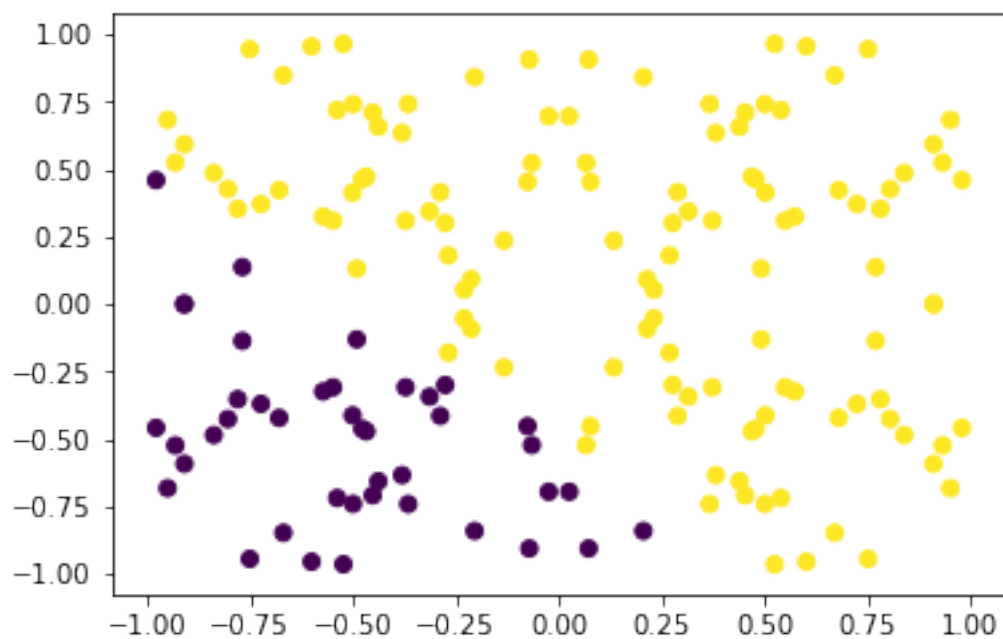
```
0.49971697 0.5022011 0.50145125 0.501338 0.5003834 0.50220096
0.5028578 0.50121355 0.5019191 0.50122595]
160/160 [=====] - 0s 772us/step
```

```
In [30]: scores, model.metrics_names
```

```
Out[30]: (0.6931092262268066, ['loss'])
```

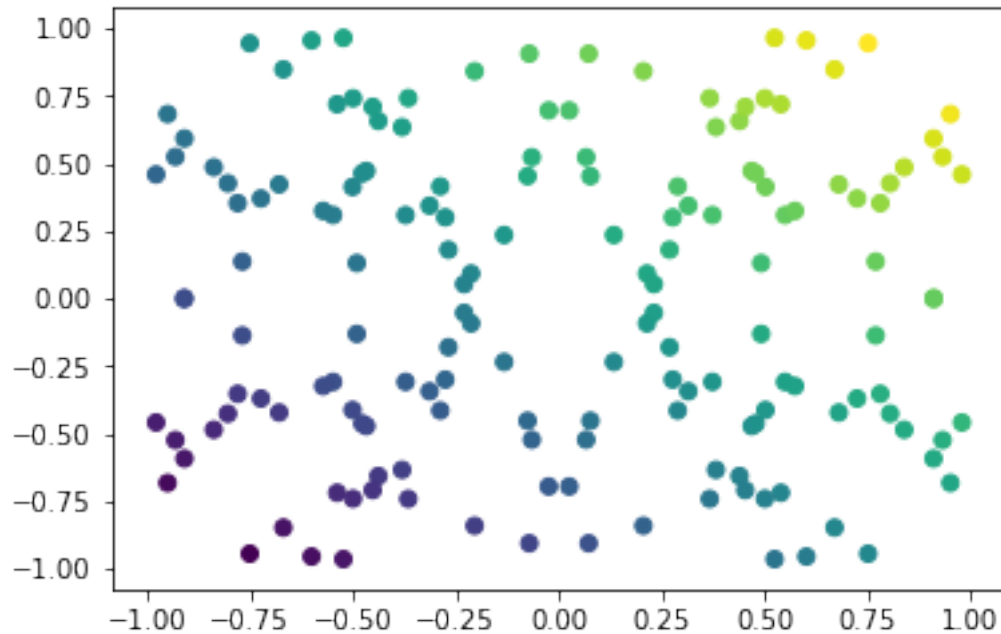
```
In [31]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[31]: <matplotlib.collections.PathCollection at 0xb25dcf7b8>
```



```
In [32]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[32]: <matplotlib.collections.PathCollection at 0xb25e93c18>
```



```
In [33]: # Sigmoid 3
model = Sequential()

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

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, 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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 0s 3ms/step - loss: 0.7322
Epoch 2/400
160/160 [=====] - 0s 610us/step - loss: 0.7137
Epoch 3/400
160/160 [=====] - 0s 691us/step - loss: 0.7047
Epoch 4/400
160/160 [=====] - 0s 608us/step - loss: 0.6996
```

Epoch 5/400
160/160 [=====] - 0s 596us/step - loss: 0.6969
Epoch 6/400
160/160 [=====] - 0s 685us/step - loss: 0.6952
Epoch 7/400
160/160 [=====] - 0s 708us/step - loss: 0.6942
Epoch 8/400
160/160 [=====] - 0s 753us/step - loss: 0.6941
Epoch 9/400
160/160 [=====] - 0s 728us/step - loss: 0.6941
Epoch 10/400
160/160 [=====] - 0s 773us/step - loss: 0.6944
Epoch 11/400
160/160 [=====] - 0s 735us/step - loss: 0.6943
Epoch 12/400
160/160 [=====] - 0s 674us/step - loss: 0.6942
Epoch 13/400
160/160 [=====] - 0s 714us/step - loss: 0.6942
Epoch 14/400
160/160 [=====] - 0s 578us/step - loss: 0.6942
Epoch 15/400
160/160 [=====] - 0s 565us/step - loss: 0.6943
Epoch 16/400
160/160 [=====] - 0s 570us/step - loss: 0.6942
Epoch 17/400
160/160 [=====] - 0s 590us/step - loss: 0.6943
Epoch 18/400
160/160 [=====] - 0s 760us/step - loss: 0.6942
Epoch 19/400
160/160 [=====] - 0s 754us/step - loss: 0.6941
Epoch 20/400
160/160 [=====] - 0s 563us/step - loss: 0.6940
Epoch 21/400
160/160 [=====] - 0s 557us/step - loss: 0.6941
Epoch 22/400
160/160 [=====] - 0s 575us/step - loss: 0.6941
Epoch 23/400
160/160 [=====] - 0s 745us/step - loss: 0.6943
Epoch 24/400
160/160 [=====] - 0s 729us/step - loss: 0.6943
Epoch 25/400
160/160 [=====] - 0s 733us/step - loss: 0.6942
Epoch 26/400
160/160 [=====] - 0s 801us/step - loss: 0.6938
Epoch 27/400
160/160 [=====] - 0s 766us/step - loss: 0.6940
Epoch 28/400
160/160 [=====] - 0s 730us/step - loss: 0.6941

Epoch 29/400
160/160 [=====] - 0s 781us/step - loss: 0.6940
Epoch 30/400
160/160 [=====] - 0s 762us/step - loss: 0.6942
Epoch 31/400
160/160 [=====] - 0s 760us/step - loss: 0.6941
Epoch 32/400
160/160 [=====] - 0s 743us/step - loss: 0.6941
Epoch 33/400
160/160 [=====] - 0s 724us/step - loss: 0.6942
Epoch 34/400
160/160 [=====] - 0s 748us/step - loss: 0.6941
Epoch 35/400
160/160 [=====] - 0s 784us/step - loss: 0.6941
Epoch 36/400
160/160 [=====] - 0s 755us/step - loss: 0.6942
Epoch 37/400
160/160 [=====] - 0s 749us/step - loss: 0.6940
Epoch 38/400
160/160 [=====] - 0s 732us/step - loss: 0.6942
Epoch 39/400
160/160 [=====] - 0s 885us/step - loss: 0.6943
Epoch 40/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 41/400
160/160 [=====] - 0s 919us/step - loss: 0.6942
Epoch 42/400
160/160 [=====] - 0s 811us/step - loss: 0.6942
Epoch 43/400
160/160 [=====] - 0s 691us/step - loss: 0.6938
Epoch 44/400
160/160 [=====] - 0s 719us/step - loss: 0.6939
Epoch 45/400
160/160 [=====] - 0s 704us/step - loss: 0.6940
Epoch 46/400
160/160 [=====] - 0s 700us/step - loss: 0.6941
Epoch 47/400
160/160 [=====] - 0s 718us/step - loss: 0.6942
Epoch 48/400
160/160 [=====] - 0s 730us/step - loss: 0.6943
Epoch 49/400
160/160 [=====] - 0s 628us/step - loss: 0.6939
Epoch 50/400
160/160 [=====] - 0s 575us/step - loss: 0.6942
Epoch 51/400
160/160 [=====] - 0s 589us/step - loss: 0.6940
Epoch 52/400
160/160 [=====] - 0s 585us/step - loss: 0.6942

Epoch 53/400
160/160 [=====] - 0s 563us/step - loss: 0.6942
Epoch 54/400
160/160 [=====] - 0s 573us/step - loss: 0.6942
Epoch 55/400
160/160 [=====] - 0s 569us/step - loss: 0.6941
Epoch 56/400
160/160 [=====] - 0s 586us/step - loss: 0.6941
Epoch 57/400
160/160 [=====] - 0s 737us/step - loss: 0.6943
Epoch 58/400
160/160 [=====] - 0s 759us/step - loss: 0.6941
Epoch 59/400
160/160 [=====] - 0s 746us/step - loss: 0.6941
Epoch 60/400
160/160 [=====] - 0s 714us/step - loss: 0.6940
Epoch 61/400
160/160 [=====] - 0s 711us/step - loss: 0.6943
Epoch 62/400
160/160 [=====] - 0s 685us/step - loss: 0.6941
Epoch 63/400
160/160 [=====] - 0s 665us/step - loss: 0.6941
Epoch 64/400
160/160 [=====] - 0s 730us/step - loss: 0.6942
Epoch 65/400
160/160 [=====] - 0s 741us/step - loss: 0.6940
Epoch 66/400
160/160 [=====] - 0s 699us/step - loss: 0.6942
Epoch 67/400
160/160 [=====] - 0s 636us/step - loss: 0.6941
Epoch 68/400
160/160 [=====] - 0s 546us/step - loss: 0.6942
Epoch 69/400
160/160 [=====] - 0s 587us/step - loss: 0.6939
Epoch 70/400
160/160 [=====] - 0s 560us/step - loss: 0.6943
Epoch 71/400
160/160 [=====] - 0s 579us/step - loss: 0.6939
Epoch 72/400
160/160 [=====] - 0s 642us/step - loss: 0.6941
Epoch 73/400
160/160 [=====] - 0s 645us/step - loss: 0.6941
Epoch 74/400
160/160 [=====] - 0s 708us/step - loss: 0.6940
Epoch 75/400
160/160 [=====] - 0s 684us/step - loss: 0.6940
Epoch 76/400
160/160 [=====] - 0s 732us/step - loss: 0.6941

Epoch 77/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 78/400
160/160 [=====] - 0s 898us/step - loss: 0.6942
Epoch 79/400
160/160 [=====] - 0s 718us/step - loss: 0.6940
Epoch 80/400
160/160 [=====] - 0s 835us/step - loss: 0.6940
Epoch 81/400
160/160 [=====] - 0s 890us/step - loss: 0.6940
Epoch 82/400
160/160 [=====] - 0s 799us/step - loss: 0.6941
Epoch 83/400
160/160 [=====] - 0s 776us/step - loss: 0.6941
Epoch 84/400
160/160 [=====] - 0s 748us/step - loss: 0.6941
Epoch 85/400
160/160 [=====] - 0s 722us/step - loss: 0.6939
Epoch 86/400
160/160 [=====] - 0s 729us/step - loss: 0.6940
Epoch 87/400
160/160 [=====] - 0s 677us/step - loss: 0.6942
Epoch 88/400
160/160 [=====] - 0s 569us/step - loss: 0.6942
Epoch 89/400
160/160 [=====] - 0s 566us/step - loss: 0.6941
Epoch 90/400
160/160 [=====] - 0s 570us/step - loss: 0.6942
Epoch 91/400
160/160 [=====] - 0s 572us/step - loss: 0.6940
Epoch 92/400
160/160 [=====] - 0s 759us/step - loss: 0.6940
Epoch 93/400
160/160 [=====] - 0s 701us/step - loss: 0.6942
Epoch 94/400
160/160 [=====] - 0s 689us/step - loss: 0.6941
Epoch 95/400
160/160 [=====] - 0s 696us/step - loss: 0.6940
Epoch 96/400
160/160 [=====] - 0s 721us/step - loss: 0.6940
Epoch 97/400
160/160 [=====] - 0s 711us/step - loss: 0.6940
Epoch 98/400
160/160 [=====] - 0s 783us/step - loss: 0.6942
Epoch 99/400
160/160 [=====] - 0s 758us/step - loss: 0.6943
Epoch 100/400
160/160 [=====] - 0s 753us/step - loss: 0.6942

Epoch 101/400
160/160 [=====] - 0s 716us/step - loss: 0.6943
Epoch 102/400
160/160 [=====] - 0s 705us/step - loss: 0.6940
Epoch 103/400
160/160 [=====] - 0s 737us/step - loss: 0.6942
Epoch 104/400
160/160 [=====] - 0s 745us/step - loss: 0.6939
Epoch 105/400
160/160 [=====] - 0s 732us/step - loss: 0.6943
Epoch 106/400
160/160 [=====] - 0s 702us/step - loss: 0.6941
Epoch 107/400
160/160 [=====] - 0s 729us/step - loss: 0.6941
Epoch 108/400
160/160 [=====] - 0s 690us/step - loss: 0.6942
Epoch 109/400
160/160 [=====] - 0s 592us/step - loss: 0.6942
Epoch 110/400
160/160 [=====] - 0s 588us/step - loss: 0.6941
Epoch 111/400
160/160 [=====] - 0s 594us/step - loss: 0.6939
Epoch 112/400
160/160 [=====] - 0s 580us/step - loss: 0.6943
Epoch 113/400
160/160 [=====] - 0s 584us/step - loss: 0.6942
Epoch 114/400
160/160 [=====] - 0s 557us/step - loss: 0.6940
Epoch 115/400
160/160 [=====] - 0s 670us/step - loss: 0.6940
Epoch 116/400
160/160 [=====] - 0s 625us/step - loss: 0.6938
Epoch 117/400
160/160 [=====] - 0s 549us/step - loss: 0.6940
Epoch 118/400
160/160 [=====] - 0s 546us/step - loss: 0.6941
Epoch 119/400
160/160 [=====] - 0s 626us/step - loss: 0.6943
Epoch 120/400
160/160 [=====] - 0s 760us/step - loss: 0.6942
Epoch 121/400
160/160 [=====] - 0s 768us/step - loss: 0.6942
Epoch 122/400
160/160 [=====] - 0s 585us/step - loss: 0.6941
Epoch 123/400
160/160 [=====] - 0s 762us/step - loss: 0.6942
Epoch 124/400
160/160 [=====] - 0s 663us/step - loss: 0.6941

Epoch 125/400
160/160 [=====] - 0s 766us/step - loss: 0.6941
Epoch 126/400
160/160 [=====] - 0s 758us/step - loss: 0.6941
Epoch 127/400
160/160 [=====] - 0s 655us/step - loss: 0.6939
Epoch 128/400
160/160 [=====] - 0s 683us/step - loss: 0.6941
Epoch 129/400
160/160 [=====] - 0s 766us/step - loss: 0.6942
Epoch 130/400
160/160 [=====] - 0s 756us/step - loss: 0.6941
Epoch 131/400
160/160 [=====] - 0s 590us/step - loss: 0.6942
Epoch 132/400
160/160 [=====] - 0s 591us/step - loss: 0.6942
Epoch 133/400
160/160 [=====] - 0s 573us/step - loss: 0.6938
Epoch 134/400
160/160 [=====] - 0s 572us/step - loss: 0.6942
Epoch 135/400
160/160 [=====] - 0s 579us/step - loss: 0.6941
Epoch 136/400
160/160 [=====] - 0s 544us/step - loss: 0.6942
Epoch 137/400
160/160 [=====] - 0s 548us/step - loss: 0.6940
Epoch 138/400
160/160 [=====] - 0s 618us/step - loss: 0.6941
Epoch 139/400
160/160 [=====] - 0s 784us/step - loss: 0.6942
Epoch 140/400
160/160 [=====] - 0s 715us/step - loss: 0.6943
Epoch 141/400
160/160 [=====] - 0s 578us/step - loss: 0.6940
Epoch 142/400
160/160 [=====] - 0s 585us/step - loss: 0.6941
Epoch 143/400
160/160 [=====] - 0s 583us/step - loss: 0.6940
Epoch 144/400
160/160 [=====] - 0s 674us/step - loss: 0.6940
Epoch 145/400
160/160 [=====] - 0s 629us/step - loss: 0.6942
Epoch 146/400
160/160 [=====] - 0s 564us/step - loss: 0.6941
Epoch 147/400
160/160 [=====] - 0s 614us/step - loss: 0.6942
Epoch 148/400
160/160 [=====] - 0s 606us/step - loss: 0.6943

Epoch 149/400
160/160 [=====] - 0s 552us/step - loss: 0.6938
Epoch 150/400
160/160 [=====] - 0s 559us/step - loss: 0.6940
Epoch 151/400
160/160 [=====] - 0s 565us/step - loss: 0.6941
Epoch 152/400
160/160 [=====] - 0s 637us/step - loss: 0.6943
Epoch 153/400
160/160 [=====] - 0s 632us/step - loss: 0.6943
Epoch 154/400
160/160 [=====] - 0s 570us/step - loss: 0.6942
Epoch 155/400
160/160 [=====] - 0s 698us/step - loss: 0.6942
Epoch 156/400
160/160 [=====] - 0s 610us/step - loss: 0.6942
Epoch 157/400
160/160 [=====] - 0s 548us/step - loss: 0.6942
Epoch 158/400
160/160 [=====] - 0s 590us/step - loss: 0.6941
Epoch 159/400
160/160 [=====] - 0s 634us/step - loss: 0.6942
Epoch 160/400
160/160 [=====] - 0s 528us/step - loss: 0.6940
Epoch 161/400
160/160 [=====] - 0s 547us/step - loss: 0.6941
Epoch 162/400
160/160 [=====] - 0s 539us/step - loss: 0.6942
Epoch 163/400
160/160 [=====] - 0s 570us/step - loss: 0.6941
Epoch 164/400
160/160 [=====] - 0s 592us/step - loss: 0.6942
Epoch 165/400
160/160 [=====] - 0s 564us/step - loss: 0.6941
Epoch 166/400
160/160 [=====] - 0s 577us/step - loss: 0.6938
Epoch 167/400
160/160 [=====] - 0s 710us/step - loss: 0.6941
Epoch 168/400
160/160 [=====] - 0s 776us/step - loss: 0.6941
Epoch 169/400
160/160 [=====] - 0s 675us/step - loss: 0.6942
Epoch 170/400
160/160 [=====] - 0s 593us/step - loss: 0.6941
Epoch 171/400
160/160 [=====] - 0s 585us/step - loss: 0.6942
Epoch 172/400
160/160 [=====] - 0s 644us/step - loss: 0.6941

Epoch 173/400
160/160 [=====] - 0s 935us/step - loss: 0.6940
Epoch 174/400
160/160 [=====] - 0s 925us/step - loss: 0.6942
Epoch 175/400
160/160 [=====] - 0s 853us/step - loss: 0.6940
Epoch 176/400
160/160 [=====] - 0s 918us/step - loss: 0.6944
Epoch 177/400
160/160 [=====] - 0s 713us/step - loss: 0.6938
Epoch 178/400
160/160 [=====] - 0s 686us/step - loss: 0.6941
Epoch 179/400
160/160 [=====] - 0s 640us/step - loss: 0.6943
Epoch 180/400
160/160 [=====] - 0s 707us/step - loss: 0.6942
Epoch 181/400
160/160 [=====] - 0s 735us/step - loss: 0.6940
Epoch 182/400
160/160 [=====] - 0s 634us/step - loss: 0.6940
Epoch 183/400
160/160 [=====] - 0s 701us/step - loss: 0.6941
Epoch 184/400
160/160 [=====] - 0s 697us/step - loss: 0.6942
Epoch 185/400
160/160 [=====] - 0s 838us/step - loss: 0.6943
Epoch 186/400
160/160 [=====] - 0s 645us/step - loss: 0.6942
Epoch 187/400
160/160 [=====] - 0s 662us/step - loss: 0.6938
Epoch 188/400
160/160 [=====] - 0s 701us/step - loss: 0.6943
Epoch 189/400
160/160 [=====] - 0s 636us/step - loss: 0.6941
Epoch 190/400
160/160 [=====] - 0s 563us/step - loss: 0.6942
Epoch 191/400
160/160 [=====] - 0s 570us/step - loss: 0.6940
Epoch 192/400
160/160 [=====] - 0s 587us/step - loss: 0.6941
Epoch 193/400
160/160 [=====] - 0s 563us/step - loss: 0.6942
Epoch 194/400
160/160 [=====] - 0s 559us/step - loss: 0.6940
Epoch 195/400
160/160 [=====] - 0s 561us/step - loss: 0.6942
Epoch 196/400
160/160 [=====] - 0s 706us/step - loss: 0.6940

Epoch 197/400
160/160 [=====] - 0s 716us/step - loss: 0.6941
Epoch 198/400
160/160 [=====] - 0s 654us/step - loss: 0.6940
Epoch 199/400
160/160 [=====] - 0s 584us/step - loss: 0.6941
Epoch 200/400
160/160 [=====] - 0s 621us/step - loss: 0.6942
Epoch 201/400
160/160 [=====] - 0s 572us/step - loss: 0.6941
Epoch 202/400
160/160 [=====] - 0s 573us/step - loss: 0.6942
Epoch 203/400
160/160 [=====] - 0s 560us/step - loss: 0.6940
Epoch 204/400
160/160 [=====] - 0s 576us/step - loss: 0.6940
Epoch 205/400
160/160 [=====] - 0s 584us/step - loss: 0.6943
Epoch 206/400
160/160 [=====] - 0s 580us/step - loss: 0.6942
Epoch 207/400
160/160 [=====] - 0s 564us/step - loss: 0.6942
Epoch 208/400
160/160 [=====] - 0s 571us/step - loss: 0.6943
Epoch 209/400
160/160 [=====] - 0s 568us/step - loss: 0.6939
Epoch 210/400
160/160 [=====] - 0s 586us/step - loss: 0.6941
Epoch 211/400
160/160 [=====] - 0s 637us/step - loss: 0.6943
Epoch 212/400
160/160 [=====] - 0s 782us/step - loss: 0.6940
Epoch 213/400
160/160 [=====] - 0s 720us/step - loss: 0.6941
Epoch 214/400
160/160 [=====] - 0s 695us/step - loss: 0.6941
Epoch 215/400
160/160 [=====] - 0s 696us/step - loss: 0.6941
Epoch 216/400
160/160 [=====] - 0s 771us/step - loss: 0.6943
Epoch 217/400
160/160 [=====] - 0s 728us/step - loss: 0.6940
Epoch 218/400
160/160 [=====] - 0s 678us/step - loss: 0.6941
Epoch 219/400
160/160 [=====] - 0s 570us/step - loss: 0.6943
Epoch 220/400
160/160 [=====] - 0s 593us/step - loss: 0.6939

Epoch 221/400
160/160 [=====] - 0s 571us/step - loss: 0.6944
Epoch 222/400
160/160 [=====] - 0s 580us/step - loss: 0.6941
Epoch 223/400
160/160 [=====] - 0s 588us/step - loss: 0.6940
Epoch 224/400
160/160 [=====] - 0s 577us/step - loss: 0.6942
Epoch 225/400
160/160 [=====] - 0s 617us/step - loss: 0.6943
Epoch 226/400
160/160 [=====] - 0s 695us/step - loss: 0.6941
Epoch 227/400
160/160 [=====] - 0s 583us/step - loss: 0.6941
Epoch 228/400
160/160 [=====] - 0s 642us/step - loss: 0.6941
Epoch 229/400
160/160 [=====] - 0s 738us/step - loss: 0.6941
Epoch 230/400
160/160 [=====] - 0s 974us/step - loss: 0.6940
Epoch 231/400
160/160 [=====] - 0s 766us/step - loss: 0.6940
Epoch 232/400
160/160 [=====] - 0s 721us/step - loss: 0.6941
Epoch 233/400
160/160 [=====] - 0s 840us/step - loss: 0.6941
Epoch 234/400
160/160 [=====] - 0s 778us/step - loss: 0.6939
Epoch 235/400
160/160 [=====] - 0s 716us/step - loss: 0.6941
Epoch 236/400
160/160 [=====] - 0s 720us/step - loss: 0.6941
Epoch 237/400
160/160 [=====] - 0s 703us/step - loss: 0.6942
Epoch 238/400
160/160 [=====] - 0s 726us/step - loss: 0.6943
Epoch 239/400
160/160 [=====] - 0s 700us/step - loss: 0.6940
Epoch 240/400
160/160 [=====] - 0s 778us/step - loss: 0.6943
Epoch 241/400
160/160 [=====] - 0s 718us/step - loss: 0.6941
Epoch 242/400
160/160 [=====] - 0s 619us/step - loss: 0.6941
Epoch 243/400
160/160 [=====] - 0s 556us/step - loss: 0.6942
Epoch 244/400
160/160 [=====] - 0s 594us/step - loss: 0.6941

Epoch 245/400
160/160 [=====] - 0s 591us/step - loss: 0.6940
Epoch 246/400
160/160 [=====] - 0s 558us/step - loss: 0.6942
Epoch 247/400
160/160 [=====] - 0s 588us/step - loss: 0.6941
Epoch 248/400
160/160 [=====] - 0s 554us/step - loss: 0.6942
Epoch 249/400
160/160 [=====] - 0s 591us/step - loss: 0.6940
Epoch 250/400
160/160 [=====] - 0s 727us/step - loss: 0.6942
Epoch 251/400
160/160 [=====] - 0s 715us/step - loss: 0.6940
Epoch 252/400
160/160 [=====] - 0s 772us/step - loss: 0.6941
Epoch 253/400
160/160 [=====] - 0s 723us/step - loss: 0.6941
Epoch 254/400
160/160 [=====] - 0s 699us/step - loss: 0.6940
Epoch 255/400
160/160 [=====] - 0s 628us/step - loss: 0.6939
Epoch 256/400
160/160 [=====] - 0s 731us/step - loss: 0.6939
Epoch 257/400
160/160 [=====] - 0s 693us/step - loss: 0.6942
Epoch 258/400
160/160 [=====] - 0s 686us/step - loss: 0.6939
Epoch 259/400
160/160 [=====] - 0s 717us/step - loss: 0.6941
Epoch 260/400
160/160 [=====] - 0s 748us/step - loss: 0.6943
Epoch 261/400
160/160 [=====] - 0s 654us/step - loss: 0.6942
Epoch 262/400
160/160 [=====] - 0s 731us/step - loss: 0.6938
Epoch 263/400
160/160 [=====] - 0s 701us/step - loss: 0.6942
Epoch 264/400
160/160 [=====] - 0s 763us/step - loss: 0.6943
Epoch 265/400
160/160 [=====] - 0s 703us/step - loss: 0.6940
Epoch 266/400
160/160 [=====] - 0s 701us/step - loss: 0.6942
Epoch 267/400
160/160 [=====] - 0s 715us/step - loss: 0.6939
Epoch 268/400
160/160 [=====] - 0s 689us/step - loss: 0.6941

Epoch 269/400
160/160 [=====] - 0s 618us/step - loss: 0.6940
Epoch 270/400
160/160 [=====] - 0s 630us/step - loss: 0.6943
Epoch 271/400
160/160 [=====] - 0s 573us/step - loss: 0.6942
Epoch 272/400
160/160 [=====] - 0s 709us/step - loss: 0.6942
Epoch 273/400
160/160 [=====] - 0s 742us/step - loss: 0.6943
Epoch 274/400
160/160 [=====] - 0s 703us/step - loss: 0.6941
Epoch 275/400
160/160 [=====] - 0s 735us/step - loss: 0.6942
Epoch 276/400
160/160 [=====] - 0s 708us/step - loss: 0.6941
Epoch 277/400
160/160 [=====] - 0s 717us/step - loss: 0.6940
Epoch 278/400
160/160 [=====] - 0s 736us/step - loss: 0.6942
Epoch 279/400
160/160 [=====] - 0s 722us/step - loss: 0.6942
Epoch 280/400
160/160 [=====] - 0s 703us/step - loss: 0.6942
Epoch 281/400
160/160 [=====] - 0s 701us/step - loss: 0.6944
Epoch 282/400
160/160 [=====] - 0s 582us/step - loss: 0.6943
Epoch 283/400
160/160 [=====] - 0s 670us/step - loss: 0.6940
Epoch 284/400
160/160 [=====] - 0s 669us/step - loss: 0.6943
Epoch 285/400
160/160 [=====] - 0s 564us/step - loss: 0.6943
Epoch 286/400
160/160 [=====] - 0s 601us/step - loss: 0.6939
Epoch 287/400
160/160 [=====] - 0s 732us/step - loss: 0.6942
Epoch 288/400
160/160 [=====] - 0s 724us/step - loss: 0.6942
Epoch 289/400
160/160 [=====] - 0s 686us/step - loss: 0.6942
Epoch 290/400
160/160 [=====] - 0s 592us/step - loss: 0.6942
Epoch 291/400
160/160 [=====] - 0s 576us/step - loss: 0.6943
Epoch 292/400
160/160 [=====] - 0s 696us/step - loss: 0.6939

Epoch 293/400
160/160 [=====] - 0s 589us/step - loss: 0.6943
Epoch 294/400
160/160 [=====] - 0s 569us/step - loss: 0.6941
Epoch 295/400
160/160 [=====] - 0s 684us/step - loss: 0.6940
Epoch 296/400
160/160 [=====] - 0s 594us/step - loss: 0.6941
Epoch 297/400
160/160 [=====] - 0s 566us/step - loss: 0.6942
Epoch 298/400
160/160 [=====] - 0s 575us/step - loss: 0.6940
Epoch 299/400
160/160 [=====] - 0s 713us/step - loss: 0.6940
Epoch 300/400
160/160 [=====] - 0s 676us/step - loss: 0.6940
Epoch 301/400
160/160 [=====] - 0s 718us/step - loss: 0.6941
Epoch 302/400
160/160 [=====] - 0s 713us/step - loss: 0.6942
Epoch 303/400
160/160 [=====] - 0s 724us/step - loss: 0.6943
Epoch 304/400
160/160 [=====] - 0s 724us/step - loss: 0.6940
Epoch 305/400
160/160 [=====] - 0s 731us/step - loss: 0.6941
Epoch 306/400
160/160 [=====] - 0s 757us/step - loss: 0.6941
Epoch 307/400
160/160 [=====] - 0s 785us/step - loss: 0.6943
Epoch 308/400
160/160 [=====] - 0s 731us/step - loss: 0.6942
Epoch 309/400
160/160 [=====] - 0s 773us/step - loss: 0.6940
Epoch 310/400
160/160 [=====] - 0s 729us/step - loss: 0.6941
Epoch 311/400
160/160 [=====] - 0s 710us/step - loss: 0.6942
Epoch 312/400
160/160 [=====] - 0s 750us/step - loss: 0.6941
Epoch 313/400
160/160 [=====] - 0s 739us/step - loss: 0.6941
Epoch 314/400
160/160 [=====] - 0s 723us/step - loss: 0.6943
Epoch 315/400
160/160 [=====] - 0s 617us/step - loss: 0.6941
Epoch 316/400
160/160 [=====] - 0s 627us/step - loss: 0.6942

Epoch 317/400
160/160 [=====] - 0s 591us/step - loss: 0.6942
Epoch 318/400
160/160 [=====] - 0s 582us/step - loss: 0.6941
Epoch 319/400
160/160 [=====] - 0s 573us/step - loss: 0.6942
Epoch 320/400
160/160 [=====] - 0s 604us/step - loss: 0.6940
Epoch 321/400
160/160 [=====] - 0s 574us/step - loss: 0.6942
Epoch 322/400
160/160 [=====] - 0s 551us/step - loss: 0.6940
Epoch 323/400
160/160 [=====] - 0s 539us/step - loss: 0.6941
Epoch 324/400
160/160 [=====] - 0s 522us/step - loss: 0.6943
Epoch 325/400
160/160 [=====] - 0s 536us/step - loss: 0.6943
Epoch 326/400
160/160 [=====] - 0s 539us/step - loss: 0.6940
Epoch 327/400
160/160 [=====] - 0s 567us/step - loss: 0.6940
Epoch 328/400
160/160 [=====] - 0s 565us/step - loss: 0.6941
Epoch 329/400
160/160 [=====] - 0s 572us/step - loss: 0.6940
Epoch 330/400
160/160 [=====] - 0s 584us/step - loss: 0.6941
Epoch 331/400
160/160 [=====] - 0s 579us/step - loss: 0.6943
Epoch 332/400
160/160 [=====] - 0s 590us/step - loss: 0.6941
Epoch 333/400
160/160 [=====] - 0s 580us/step - loss: 0.6942
Epoch 334/400
160/160 [=====] - 0s 575us/step - loss: 0.6940
Epoch 335/400
160/160 [=====] - 0s 555us/step - loss: 0.6940
Epoch 336/400
160/160 [=====] - 0s 558us/step - loss: 0.6941
Epoch 337/400
160/160 [=====] - 0s 556us/step - loss: 0.6942
Epoch 338/400
160/160 [=====] - 0s 548us/step - loss: 0.6941
Epoch 339/400
160/160 [=====] - 0s 575us/step - loss: 0.6939
Epoch 340/400
160/160 [=====] - 0s 563us/step - loss: 0.6941

Epoch 341/400
160/160 [=====] - 0s 554us/step - loss: 0.6942
Epoch 342/400
160/160 [=====] - 0s 570us/step - loss: 0.6940
Epoch 343/400
160/160 [=====] - 0s 533us/step - loss: 0.6939
Epoch 344/400
160/160 [=====] - 0s 553us/step - loss: 0.6942
Epoch 345/400
160/160 [=====] - 0s 591us/step - loss: 0.6944
Epoch 346/400
160/160 [=====] - 0s 557us/step - loss: 0.6941
Epoch 347/400
160/160 [=====] - 0s 564us/step - loss: 0.6941
Epoch 348/400
160/160 [=====] - 0s 570us/step - loss: 0.6941
Epoch 349/400
160/160 [=====] - 0s 576us/step - loss: 0.6940
Epoch 350/400
160/160 [=====] - 0s 586us/step - loss: 0.6941
Epoch 351/400
160/160 [=====] - 0s 565us/step - loss: 0.6941
Epoch 352/400
160/160 [=====] - 0s 579us/step - loss: 0.6941
Epoch 353/400
160/160 [=====] - 0s 576us/step - loss: 0.6941
Epoch 354/400
160/160 [=====] - 0s 565us/step - loss: 0.6941
Epoch 355/400
160/160 [=====] - 0s 560us/step - loss: 0.6941
Epoch 356/400
160/160 [=====] - 0s 567us/step - loss: 0.6944
Epoch 357/400
160/160 [=====] - 0s 558us/step - loss: 0.6941
Epoch 358/400
160/160 [=====] - 0s 567us/step - loss: 0.6942
Epoch 359/400
160/160 [=====] - 0s 564us/step - loss: 0.6942
Epoch 360/400
160/160 [=====] - 0s 570us/step - loss: 0.6941
Epoch 361/400
160/160 [=====] - 0s 567us/step - loss: 0.6940
Epoch 362/400
160/160 [=====] - 0s 572us/step - loss: 0.6943
Epoch 363/400
160/160 [=====] - 0s 594us/step - loss: 0.6941
Epoch 364/400
160/160 [=====] - 0s 564us/step - loss: 0.6941

Epoch 365/400
160/160 [=====] - 0s 559us/step - loss: 0.6941
Epoch 366/400
160/160 [=====] - 0s 555us/step - loss: 0.6940
Epoch 367/400
160/160 [=====] - 0s 576us/step - loss: 0.6940
Epoch 368/400
160/160 [=====] - 0s 555us/step - loss: 0.6943
Epoch 369/400
160/160 [=====] - 0s 544us/step - loss: 0.6943
Epoch 370/400
160/160 [=====] - 0s 550us/step - loss: 0.6941
Epoch 371/400
160/160 [=====] - 0s 574us/step - loss: 0.6940
Epoch 372/400
160/160 [=====] - 0s 570us/step - loss: 0.6940
Epoch 373/400
160/160 [=====] - 0s 563us/step - loss: 0.6942
Epoch 374/400
160/160 [=====] - 0s 554us/step - loss: 0.6942
Epoch 375/400
160/160 [=====] - 0s 562us/step - loss: 0.6941
Epoch 376/400
160/160 [=====] - 0s 558us/step - loss: 0.6943
Epoch 377/400
160/160 [=====] - 0s 572us/step - loss: 0.6940
Epoch 378/400
160/160 [=====] - 0s 554us/step - loss: 0.6943
Epoch 379/400
160/160 [=====] - 0s 561us/step - loss: 0.6944
Epoch 380/400
160/160 [=====] - 0s 636us/step - loss: 0.6942
Epoch 381/400
160/160 [=====] - 0s 793us/step - loss: 0.6940
Epoch 382/400
160/160 [=====] - 0s 793us/step - loss: 0.6944
Epoch 383/400
160/160 [=====] - 0s 780us/step - loss: 0.6941
Epoch 384/400
160/160 [=====] - 0s 563us/step - loss: 0.6941
Epoch 385/400
160/160 [=====] - 0s 600us/step - loss: 0.6940
Epoch 386/400
160/160 [=====] - 0s 553us/step - loss: 0.6939
Epoch 387/400
160/160 [=====] - 0s 551us/step - loss: 0.6941
Epoch 388/400
160/160 [=====] - 0s 547us/step - loss: 0.6942

Epoch 389/400
160/160 [=====] - 0s 561us/step - loss: 0.6940
Epoch 390/400
160/160 [=====] - 0s 555us/step - loss: 0.6939
Epoch 391/400
160/160 [=====] - 0s 557us/step - loss: 0.6941
Epoch 392/400
160/160 [=====] - 0s 575us/step - loss: 0.6942
Epoch 393/400
160/160 [=====] - 0s 558us/step - loss: 0.6942
Epoch 394/400
160/160 [=====] - 0s 565us/step - loss: 0.6940
Epoch 395/400
160/160 [=====] - 0s 617us/step - loss: 0.6939
Epoch 396/400
160/160 [=====] - 0s 713us/step - loss: 0.6940
Epoch 397/400
160/160 [=====] - 0s 675us/step - loss: 0.6941
Epoch 398/400
160/160 [=====] - 0s 549us/step - loss: 0.6940
Epoch 399/400
160/160 [=====] - 0s 556us/step - loss: 0.6943
Epoch 400/400
160/160 [=====] - 0s 552us/step - loss: 0.6939
[0.4963785 0.4959915 0.49624613 0.4960237 0.49593237 0.49621558
0.49614558 0.49649718 0.49620444 0.4962405 0.4960603 0.49600217
0.4962681 0.49640194 0.49625564 0.49582815 0.4962116 0.4962543
0.49597397 0.49646786 0.49625823 0.49601653 0.49619234 0.49609253
0.4960055 0.49629194 0.49629605 0.49618864 0.49619415 0.49617907
0.49641317 0.49607357 0.49618307 0.49617156 0.4963058 0.49600434
0.49593455 0.496223 0.49608472 0.49623168 0.4962353 0.49664712
0.49637732 0.49661195 0.4967181 0.49641186 0.49647963 0.49611712
0.49641222 0.49638543 0.49657315 0.49663794 0.49635324 0.49621183
0.49636224 0.49681693 0.49640363 0.4963697 0.49667358 0.49614564
0.49637175 0.4966316 0.49642304 0.49653435 0.49664056 0.49632227
0.4963308 0.496448 0.49643895 0.496445 0.4962035 0.49654996
0.496437 0.4964528 0.4963153 0.4966377 0.4967026 0.49639535
0.49654326 0.49638554 0.4964618 0.49683484 0.4967114 0.49680707
0.49697065 0.496781 0.49669087 0.49657103 0.49650285 0.49676415
0.49679416 0.4968655 0.4966741 0.49647346 0.4965708 0.4968177
0.49644983 0.49673063 0.49695933 0.49649426 0.49686474 0.49700397
0.4964497 0.49669322 0.49696192 0.49643984 0.4968246 0.49694502
0.4968808 0.49668574 0.49662545 0.496617 0.496593 0.49668905
0.49669015 0.4968983 0.49677533 0.49656832 0.49671063 0.49653646
0.49615115 0.49579948 0.49590594 0.49582398 0.4956751 0.495839
0.49592993 0.49604177 0.49611264 0.4958544 0.49583417 0.49576947
0.49594188 0.49613947 0.49604422 0.49582738 0.4961649 0.49588677
0.49568254 0.4961188 0.49575564 0.4956371 0.49616545 0.4959301

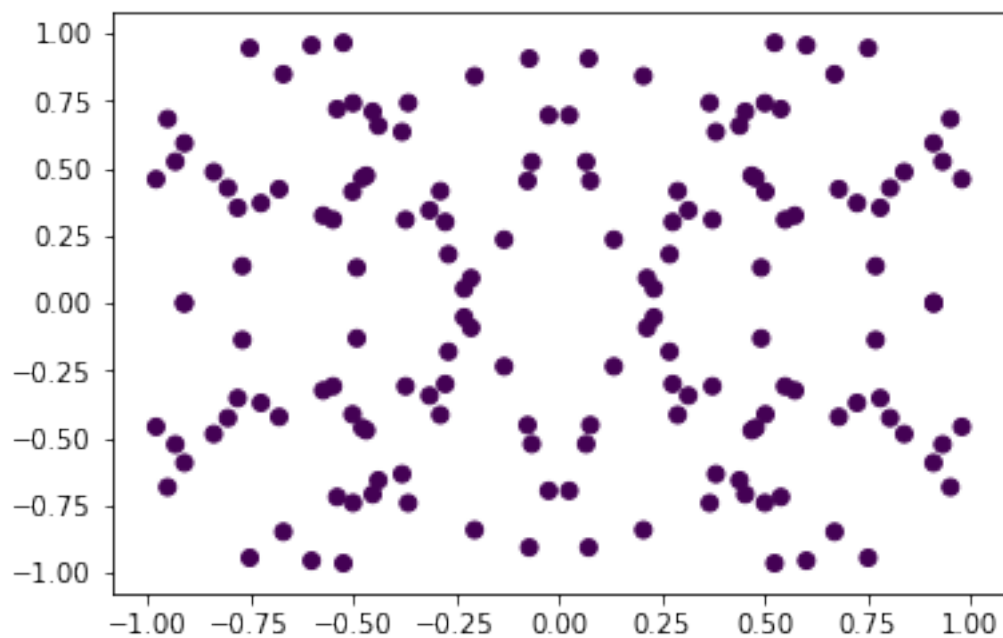

```
0.49567762 0.49617356 0.49579322 0.49568152 0.49574313 0.4959335
0.49598745 0.49600518 0.49602428 0.49593055 0.49592507 0.49573806
0.4958601 0.49604753 0.49591357 0.49607873]
160/160 [=====] - 0s 684us/step
```

```
In [34]: scores, model.metrics_names
```

```
Out[34]: (0.6931724667549133, ['loss'])
```

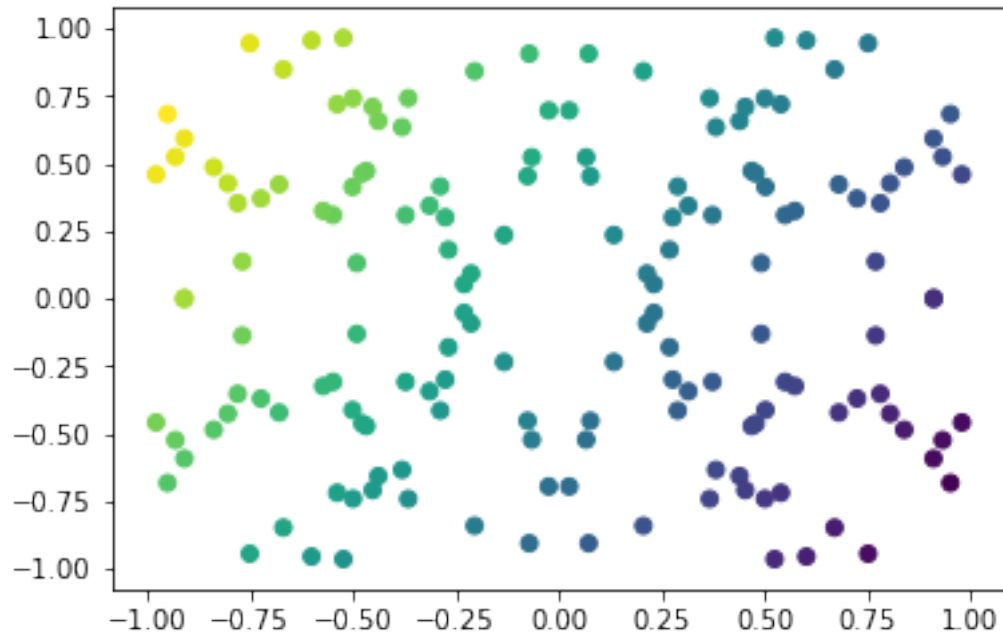
```
In [35]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[35]: <matplotlib.collections.PathCollection at 0xb262e86d8>
```



```
In [36]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[36]: <matplotlib.collections.PathCollection at 0xb2634ba90>
```



```
In [37]: # Sigmoid 4
model = Sequential()

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

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, 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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 3ms/step - loss: 0.6950
Epoch 2/400
160/160 [=====] - 0s 615us/step - loss: 0.6947
Epoch 3/400
160/160 [=====] - 0s 604us/step - loss: 0.6944
Epoch 4/400
```

160/160 [=====] - 0s 605us/step - loss: 0.6941
Epoch 5/400
160/160 [=====] - 0s 629us/step - loss: 0.6941
Epoch 6/400
160/160 [=====] - 0s 648us/step - loss: 0.6941
Epoch 7/400
160/160 [=====] - 0s 626us/step - loss: 0.6939
Epoch 8/400
160/160 [=====] - 0s 602us/step - loss: 0.6939
Epoch 9/400
160/160 [=====] - 0s 612us/step - loss: 0.6942
Epoch 10/400
160/160 [=====] - 0s 612us/step - loss: 0.6940
Epoch 11/400
160/160 [=====] - 0s 578us/step - loss: 0.6940
Epoch 12/400
160/160 [=====] - 0s 577us/step - loss: 0.6942
Epoch 13/400
160/160 [=====] - 0s 598us/step - loss: 0.6941
Epoch 14/400
160/160 [=====] - 0s 600us/step - loss: 0.6942
Epoch 15/400
160/160 [=====] - 0s 600us/step - loss: 0.6939
Epoch 16/400
160/160 [=====] - 0s 619us/step - loss: 0.6941
Epoch 17/400
160/160 [=====] - 0s 613us/step - loss: 0.6939
Epoch 18/400
160/160 [=====] - 0s 627us/step - loss: 0.6940
Epoch 19/400
160/160 [=====] - 0s 621us/step - loss: 0.6939
Epoch 20/400
160/160 [=====] - 0s 657us/step - loss: 0.6938
Epoch 21/400
160/160 [=====] - 0s 684us/step - loss: 0.6940
Epoch 22/400
160/160 [=====] - 0s 643us/step - loss: 0.6941
Epoch 23/400
160/160 [=====] - 0s 629us/step - loss: 0.6940
Epoch 24/400
160/160 [=====] - 0s 660us/step - loss: 0.6939
Epoch 25/400
160/160 [=====] - 0s 635us/step - loss: 0.6940
Epoch 26/400
160/160 [=====] - 0s 611us/step - loss: 0.6940
Epoch 27/400
160/160 [=====] - 0s 654us/step - loss: 0.6938
Epoch 28/400

160/160 [=====] - 0s 600us/step - loss: 0.6939
Epoch 29/400
160/160 [=====] - 0s 587us/step - loss: 0.6942
Epoch 30/400
160/160 [=====] - 0s 588us/step - loss: 0.6940
Epoch 31/400
160/160 [=====] - 0s 581us/step - loss: 0.6940
Epoch 32/400
160/160 [=====] - 0s 605us/step - loss: 0.6940
Epoch 33/400
160/160 [=====] - 0s 613us/step - loss: 0.6939
Epoch 34/400
160/160 [=====] - 0s 622us/step - loss: 0.6940
Epoch 35/400
160/160 [=====] - 0s 662us/step - loss: 0.6939
Epoch 36/400
160/160 [=====] - 0s 642us/step - loss: 0.6941
Epoch 37/400
160/160 [=====] - 0s 678us/step - loss: 0.6939
Epoch 38/400
160/160 [=====] - 0s 721us/step - loss: 0.6940
Epoch 39/400
160/160 [=====] - 0s 798us/step - loss: 0.6941
Epoch 40/400
160/160 [=====] - 0s 1ms/step - loss: 0.6939
Epoch 41/400
160/160 [=====] - 0s 711us/step - loss: 0.6941
Epoch 42/400
160/160 [=====] - 0s 783us/step - loss: 0.6940
Epoch 43/400
160/160 [=====] - 0s 766us/step - loss: 0.6941
Epoch 44/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 45/400
160/160 [=====] - 0s 717us/step - loss: 0.6939
Epoch 46/400
160/160 [=====] - 0s 615us/step - loss: 0.6940
Epoch 47/400
160/160 [=====] - 0s 628us/step - loss: 0.6939
Epoch 48/400
160/160 [=====] - 0s 596us/step - loss: 0.6939
Epoch 49/400
160/160 [=====] - 0s 581us/step - loss: 0.6939
Epoch 50/400
160/160 [=====] - 0s 597us/step - loss: 0.6939
Epoch 51/400
160/160 [=====] - 0s 615us/step - loss: 0.6942
Epoch 52/400

160/160 [=====] - 0s 633us/step - loss: 0.6942
Epoch 53/400
160/160 [=====] - 0s 624us/step - loss: 0.6941
Epoch 54/400
160/160 [=====] - 0s 636us/step - loss: 0.6940
Epoch 55/400
160/160 [=====] - 0s 630us/step - loss: 0.6940
Epoch 56/400
160/160 [=====] - 0s 622us/step - loss: 0.6941
Epoch 57/400
160/160 [=====] - 0s 620us/step - loss: 0.6940
Epoch 58/400
160/160 [=====] - 0s 626us/step - loss: 0.6942
Epoch 59/400
160/160 [=====] - 0s 625us/step - loss: 0.6940
Epoch 60/400
160/160 [=====] - 0s 622us/step - loss: 0.6939
Epoch 61/400
160/160 [=====] - 0s 616us/step - loss: 0.6940
Epoch 62/400
160/160 [=====] - 0s 613us/step - loss: 0.6940
Epoch 63/400
160/160 [=====] - 0s 627us/step - loss: 0.6941
Epoch 64/400
160/160 [=====] - 0s 631us/step - loss: 0.6942
Epoch 65/400
160/160 [=====] - 0s 614us/step - loss: 0.6941
Epoch 66/400
160/160 [=====] - 0s 627us/step - loss: 0.6941
Epoch 67/400
160/160 [=====] - 0s 584us/step - loss: 0.6941
Epoch 68/400
160/160 [=====] - 0s 598us/step - loss: 0.6940
Epoch 69/400
160/160 [=====] - 0s 585us/step - loss: 0.6939
Epoch 70/400
160/160 [=====] - 0s 588us/step - loss: 0.6938
Epoch 71/400
160/160 [=====] - 0s 625us/step - loss: 0.6939
Epoch 72/400
160/160 [=====] - 0s 618us/step - loss: 0.6941
Epoch 73/400
160/160 [=====] - 0s 635us/step - loss: 0.6938
Epoch 74/400
160/160 [=====] - 0s 607us/step - loss: 0.6941
Epoch 75/400
160/160 [=====] - 0s 604us/step - loss: 0.6940
Epoch 76/400

160/160 [=====] - 0s 593us/step - loss: 0.6941
Epoch 77/400
160/160 [=====] - 0s 600us/step - loss: 0.6942
Epoch 78/400
160/160 [=====] - 0s 609us/step - loss: 0.6940
Epoch 79/400
160/160 [=====] - 0s 609us/step - loss: 0.6940
Epoch 80/400
160/160 [=====] - 0s 597us/step - loss: 0.6942
Epoch 81/400
160/160 [=====] - 0s 598us/step - loss: 0.6940
Epoch 82/400
160/160 [=====] - 0s 611us/step - loss: 0.6941
Epoch 83/400
160/160 [=====] - 0s 604us/step - loss: 0.6940
Epoch 84/400
160/160 [=====] - 0s 638us/step - loss: 0.6942
Epoch 85/400
160/160 [=====] - 0s 630us/step - loss: 0.6940
Epoch 86/400
160/160 [=====] - 0s 604us/step - loss: 0.6941
Epoch 87/400
160/160 [=====] - 0s 607us/step - loss: 0.6941
Epoch 88/400
160/160 [=====] - 0s 593us/step - loss: 0.6940
Epoch 89/400
160/160 [=====] - 0s 588us/step - loss: 0.6940
Epoch 90/400
160/160 [=====] - 0s 593us/step - loss: 0.6941
Epoch 91/400
160/160 [=====] - 0s 607us/step - loss: 0.6939
Epoch 92/400
160/160 [=====] - 0s 595us/step - loss: 0.6940
Epoch 93/400
160/160 [=====] - 0s 642us/step - loss: 0.6941
Epoch 94/400
160/160 [=====] - 0s 610us/step - loss: 0.6939
Epoch 95/400
160/160 [=====] - 0s 617us/step - loss: 0.6941
Epoch 96/400
160/160 [=====] - 0s 614us/step - loss: 0.6940
Epoch 97/400
160/160 [=====] - 0s 639us/step - loss: 0.6940
Epoch 98/400
160/160 [=====] - 0s 639us/step - loss: 0.6939
Epoch 99/400
160/160 [=====] - 0s 609us/step - loss: 0.6940
Epoch 100/400

160/160 [=====] - 0s 599us/step - loss: 0.6940
Epoch 101/400
160/160 [=====] - 0s 662us/step - loss: 0.6940
Epoch 102/400
160/160 [=====] - 0s 609us/step - loss: 0.6941
Epoch 103/400
160/160 [=====] - 0s 741us/step - loss: 0.6942
Epoch 104/400
160/160 [=====] - 0s 601us/step - loss: 0.6941
Epoch 105/400
160/160 [=====] - 0s 602us/step - loss: 0.6940
Epoch 106/400
160/160 [=====] - 0s 606us/step - loss: 0.6941
Epoch 107/400
160/160 [=====] - 0s 613us/step - loss: 0.6941
Epoch 108/400
160/160 [=====] - 0s 625us/step - loss: 0.6940
Epoch 109/400
160/160 [=====] - 0s 589us/step - loss: 0.6938
Epoch 110/400
160/160 [=====] - 0s 602us/step - loss: 0.6939
Epoch 111/400
160/160 [=====] - 0s 610us/step - loss: 0.6940
Epoch 112/400
160/160 [=====] - 0s 597us/step - loss: 0.6938
Epoch 113/400
160/160 [=====] - 0s 617us/step - loss: 0.6941
Epoch 114/400
160/160 [=====] - 0s 643us/step - loss: 0.6941
Epoch 115/400
160/160 [=====] - 0s 672us/step - loss: 0.6940
Epoch 116/400
160/160 [=====] - 0s 616us/step - loss: 0.6939
Epoch 117/400
160/160 [=====] - 0s 607us/step - loss: 0.6939
Epoch 118/400
160/160 [=====] - 0s 624us/step - loss: 0.6940
Epoch 119/400
160/160 [=====] - 0s 608us/step - loss: 0.6940
Epoch 120/400
160/160 [=====] - 0s 603us/step - loss: 0.6941
Epoch 121/400
160/160 [=====] - 0s 626us/step - loss: 0.6940
Epoch 122/400
160/160 [=====] - 0s 696us/step - loss: 0.6939
Epoch 123/400
160/160 [=====] - 0s 598us/step - loss: 0.6940
Epoch 124/400

160/160 [=====] - 0s 611us/step - loss: 0.6941
Epoch 125/400
160/160 [=====] - 0s 611us/step - loss: 0.6940
Epoch 126/400
160/160 [=====] - 0s 627us/step - loss: 0.6939
Epoch 127/400
160/160 [=====] - 0s 684us/step - loss: 0.6943
Epoch 128/400
160/160 [=====] - 0s 616us/step - loss: 0.6941
Epoch 129/400
160/160 [=====] - 0s 611us/step - loss: 0.6940
Epoch 130/400
160/160 [=====] - 0s 596us/step - loss: 0.6940
Epoch 131/400
160/160 [=====] - 0s 622us/step - loss: 0.6939
Epoch 132/400
160/160 [=====] - 0s 629us/step - loss: 0.6938
Epoch 133/400
160/160 [=====] - 0s 635us/step - loss: 0.6939
Epoch 134/400
160/160 [=====] - 0s 622us/step - loss: 0.6941
Epoch 135/400
160/160 [=====] - 0s 598us/step - loss: 0.6940
Epoch 136/400
160/160 [=====] - 0s 679us/step - loss: 0.6940
Epoch 137/400
160/160 [=====] - 0s 609us/step - loss: 0.6940
Epoch 138/400
160/160 [=====] - 0s 611us/step - loss: 0.6939
Epoch 139/400
160/160 [=====] - 0s 616us/step - loss: 0.6941
Epoch 140/400
160/160 [=====] - 0s 612us/step - loss: 0.6939
Epoch 141/400
160/160 [=====] - 0s 599us/step - loss: 0.6940
Epoch 142/400
160/160 [=====] - 0s 616us/step - loss: 0.6941
Epoch 143/400
160/160 [=====] - 0s 612us/step - loss: 0.6941
Epoch 144/400
160/160 [=====] - 0s 634us/step - loss: 0.6941
Epoch 145/400
160/160 [=====] - 0s 609us/step - loss: 0.6940
Epoch 146/400
160/160 [=====] - 0s 608us/step - loss: 0.6940
Epoch 147/400
160/160 [=====] - 0s 607us/step - loss: 0.6941
Epoch 148/400

160/160 [=====] - 0s 595us/step - loss: 0.6939
 Epoch 149/400
 160/160 [=====] - 0s 587us/step - loss: 0.6938
 Epoch 150/400
 160/160 [=====] - 0s 588us/step - loss: 0.6938
 Epoch 151/400
 160/160 [=====] - 0s 663us/step - loss: 0.6941
 Epoch 152/400
 160/160 [=====] - 0s 609us/step - loss: 0.6940
 Epoch 153/400
 160/160 [=====] - 0s 657us/step - loss: 0.6940
 Epoch 154/400
 160/160 [=====] - 0s 633us/step - loss: 0.6941
 Epoch 155/400
 160/160 [=====] - 0s 615us/step - loss: 0.6942
 Epoch 156/400
 160/160 [=====] - 0s 632us/step - loss: 0.6940
 Epoch 157/400
 160/160 [=====] - 0s 601us/step - loss: 0.6941
 Epoch 158/400
 160/160 [=====] - 0s 677us/step - loss: 0.6941
 Epoch 159/400
 160/160 [=====] - 0s 809us/step - loss: 0.6941
 Epoch 160/400
 160/160 [=====] - 0s 771us/step - loss: 0.6939
 Epoch 161/400
 160/160 [=====] - 0s 653us/step - loss: 0.6941
 Epoch 162/400
 160/160 [=====] - 0s 731us/step - loss: 0.6940
 Epoch 163/400
 160/160 [=====] - 0s 757us/step - loss: 0.6942
 Epoch 164/400
 160/160 [=====] - 0s 692us/step - loss: 0.6940
 Epoch 165/400
 160/160 [=====] - 0s 654us/step - loss: 0.6940
 Epoch 166/400
 160/160 [=====] - 0s 719us/step - loss: 0.6941
 Epoch 167/400
 160/160 [=====] - 0s 633us/step - loss: 0.6940
 Epoch 168/400
 160/160 [=====] - 0s 608us/step - loss: 0.6938
 Epoch 169/400
 160/160 [=====] - 0s 621us/step - loss: 0.6940
 Epoch 170/400
 160/160 [=====] - 0s 598us/step - loss: 0.6941
 Epoch 171/400
 160/160 [=====] - 0s 580us/step - loss: 0.6941
 Epoch 172/400

160/160 [=====] - 0s 582us/step - loss: 0.6940
 Epoch 173/400
 160/160 [=====] - 0s 605us/step - loss: 0.6942
 Epoch 174/400
 160/160 [=====] - 0s 606us/step - loss: 0.6939
 Epoch 175/400
 160/160 [=====] - 0s 585us/step - loss: 0.6942
 Epoch 176/400
 160/160 [=====] - 0s 604us/step - loss: 0.6940
 Epoch 177/400
 160/160 [=====] - 0s 600us/step - loss: 0.6939
 Epoch 178/400
 160/160 [=====] - 0s 789us/step - loss: 0.6940
 Epoch 179/400
 160/160 [=====] - 0s 1ms/step - loss: 0.6940
 Epoch 180/400
 160/160 [=====] - 0s 610us/step - loss: 0.6940
 Epoch 181/400
 160/160 [=====] - 0s 621us/step - loss: 0.6941
 Epoch 182/400
 160/160 [=====] - 0s 591us/step - loss: 0.6939
 Epoch 183/400
 160/160 [=====] - 0s 595us/step - loss: 0.6940
 Epoch 184/400
 160/160 [=====] - 0s 591us/step - loss: 0.6941
 Epoch 185/400
 160/160 [=====] - 0s 668us/step - loss: 0.6940
 Epoch 186/400
 160/160 [=====] - 0s 592us/step - loss: 0.6941
 Epoch 187/400
 160/160 [=====] - 0s 584us/step - loss: 0.6941
 Epoch 188/400
 160/160 [=====] - 0s 643us/step - loss: 0.6942
 Epoch 189/400
 160/160 [=====] - 0s 607us/step - loss: 0.6939
 Epoch 190/400
 160/160 [=====] - 0s 610us/step - loss: 0.6940
 Epoch 191/400
 160/160 [=====] - 0s 670us/step - loss: 0.6940
 Epoch 192/400
 160/160 [=====] - 0s 791us/step - loss: 0.6938
 Epoch 193/400
 160/160 [=====] - 0s 762us/step - loss: 0.6941
 Epoch 194/400
 160/160 [=====] - 0s 608us/step - loss: 0.6942
 Epoch 195/400
 160/160 [=====] - 0s 637us/step - loss: 0.6942
 Epoch 196/400

160/160 [=====] - 0s 624us/step - loss: 0.6942
Epoch 197/400
160/160 [=====] - 0s 619us/step - loss: 0.6942
Epoch 198/400
160/160 [=====] - 0s 610us/step - loss: 0.6941
Epoch 199/400
160/160 [=====] - 0s 614us/step - loss: 0.6940
Epoch 200/400
160/160 [=====] - 0s 638us/step - loss: 0.6941
Epoch 201/400
160/160 [=====] - 0s 626us/step - loss: 0.6939
Epoch 202/400
160/160 [=====] - 0s 617us/step - loss: 0.6940
Epoch 203/400
160/160 [=====] - 0s 708us/step - loss: 0.6942
Epoch 204/400
160/160 [=====] - 0s 635us/step - loss: 0.6943
Epoch 205/400
160/160 [=====] - 0s 643us/step - loss: 0.6940
Epoch 206/400
160/160 [=====] - 0s 607us/step - loss: 0.6939
Epoch 207/400
160/160 [=====] - 0s 608us/step - loss: 0.6941
Epoch 208/400
160/160 [=====] - 0s 599us/step - loss: 0.6941
Epoch 209/400
160/160 [=====] - 0s 602us/step - loss: 0.6939
Epoch 210/400
160/160 [=====] - 0s 591us/step - loss: 0.6940
Epoch 211/400
160/160 [=====] - 0s 601us/step - loss: 0.6940
Epoch 212/400
160/160 [=====] - 0s 602us/step - loss: 0.6940
Epoch 213/400
160/160 [=====] - 0s 698us/step - loss: 0.6941
Epoch 214/400
160/160 [=====] - 0s 589us/step - loss: 0.6941
Epoch 215/400
160/160 [=====] - 0s 675us/step - loss: 0.6941
Epoch 216/400
160/160 [=====] - 0s 645us/step - loss: 0.6940
Epoch 217/400
160/160 [=====] - 0s 716us/step - loss: 0.6940
Epoch 218/400
160/160 [=====] - 0s 592us/step - loss: 0.6940
Epoch 219/400
160/160 [=====] - 0s 606us/step - loss: 0.6940
Epoch 220/400

160/160 [=====] - 0s 616us/step - loss: 0.6939
 Epoch 221/400
 160/160 [=====] - 0s 618us/step - loss: 0.6940
 Epoch 222/400
 160/160 [=====] - 0s 668us/step - loss: 0.6940
 Epoch 223/400
 160/160 [=====] - 0s 630us/step - loss: 0.6939
 Epoch 224/400
 160/160 [=====] - 0s 612us/step - loss: 0.6940
 Epoch 225/400
 160/160 [=====] - 0s 594us/step - loss: 0.6938
 Epoch 226/400
 160/160 [=====] - 0s 582us/step - loss: 0.6940
 Epoch 227/400
 160/160 [=====] - 0s 578us/step - loss: 0.6940
 Epoch 228/400
 160/160 [=====] - 0s 611us/step - loss: 0.6942
 Epoch 229/400
 160/160 [=====] - 0s 598us/step - loss: 0.6939
 Epoch 230/400
 160/160 [=====] - 0s 626us/step - loss: 0.6938
 Epoch 231/400
 160/160 [=====] - 0s 614us/step - loss: 0.6939
 Epoch 232/400
 160/160 [=====] - 0s 609us/step - loss: 0.6942
 Epoch 233/400
 160/160 [=====] - 0s 617us/step - loss: 0.6940
 Epoch 234/400
 160/160 [=====] - 0s 617us/step - loss: 0.6939
 Epoch 235/400
 160/160 [=====] - 0s 793us/step - loss: 0.6939
 Epoch 236/400
 160/160 [=====] - 0s 818us/step - loss: 0.6938
 Epoch 237/400
 160/160 [=====] - 0s 803us/step - loss: 0.6941
 Epoch 238/400
 160/160 [=====] - 0s 638us/step - loss: 0.6941
 Epoch 239/400
 160/160 [=====] - 0s 642us/step - loss: 0.6940
 Epoch 240/400
 160/160 [=====] - 0s 638us/step - loss: 0.6940
 Epoch 241/400
 160/160 [=====] - 0s 627us/step - loss: 0.6940
 Epoch 242/400
 160/160 [=====] - 0s 615us/step - loss: 0.6941
 Epoch 243/400
 160/160 [=====] - 0s 613us/step - loss: 0.6940
 Epoch 244/400

160/160 [=====] - 0s 605us/step - loss: 0.6941
Epoch 245/400
160/160 [=====] - 0s 580us/step - loss: 0.6941
Epoch 246/400
160/160 [=====] - 0s 600us/step - loss: 0.6941
Epoch 247/400
160/160 [=====] - 0s 783us/step - loss: 0.6940
Epoch 248/400
160/160 [=====] - 0s 798us/step - loss: 0.6939
Epoch 249/400
160/160 [=====] - 0s 817us/step - loss: 0.6941
Epoch 250/400
160/160 [=====] - 0s 739us/step - loss: 0.6939
Epoch 251/400
160/160 [=====] - 0s 640us/step - loss: 0.6940
Epoch 252/400
160/160 [=====] - 0s 728us/step - loss: 0.6941
Epoch 253/400
160/160 [=====] - 0s 628us/step - loss: 0.6941
Epoch 254/400
160/160 [=====] - 0s 621us/step - loss: 0.6942
Epoch 255/400
160/160 [=====] - 0s 721us/step - loss: 0.6939
Epoch 256/400
160/160 [=====] - 0s 874us/step - loss: 0.6939
Epoch 257/400
160/160 [=====] - 0s 704us/step - loss: 0.6940
Epoch 258/400
160/160 [=====] - 0s 702us/step - loss: 0.6940
Epoch 259/400
160/160 [=====] - 0s 698us/step - loss: 0.6941
Epoch 260/400
160/160 [=====] - 0s 753us/step - loss: 0.6940
Epoch 261/400
160/160 [=====] - 0s 758us/step - loss: 0.6941
Epoch 262/400
160/160 [=====] - 0s 707us/step - loss: 0.6940
Epoch 263/400
160/160 [=====] - 0s 770us/step - loss: 0.6941
Epoch 264/400
160/160 [=====] - 0s 761us/step - loss: 0.6941
Epoch 265/400
160/160 [=====] - 0s 803us/step - loss: 0.6941
Epoch 266/400
160/160 [=====] - 0s 845us/step - loss: 0.6941
Epoch 267/400
160/160 [=====] - 0s 1ms/step - loss: 0.6940
Epoch 268/400

160/160 [=====] - 0s 644us/step - loss: 0.6940
 Epoch 269/400
 160/160 [=====] - 0s 600us/step - loss: 0.6940
 Epoch 270/400
 160/160 [=====] - 0s 602us/step - loss: 0.6940
 Epoch 271/400
 160/160 [=====] - 0s 746us/step - loss: 0.6939
 Epoch 272/400
 160/160 [=====] - 0s 752us/step - loss: 0.6939
 Epoch 273/400
 160/160 [=====] - 0s 744us/step - loss: 0.6941
 Epoch 274/400
 160/160 [=====] - 0s 872us/step - loss: 0.6939
 Epoch 275/400
 160/160 [=====] - 0s 854us/step - loss: 0.6941
 Epoch 276/400
 160/160 [=====] - 0s 815us/step - loss: 0.6941
 Epoch 277/400
 160/160 [=====] - 0s 1ms/step - loss: 0.6939
 Epoch 278/400
 160/160 [=====] - 0s 1ms/step - loss: 0.6940
 Epoch 279/400
 160/160 [=====] - 0s 918us/step - loss: 0.6941
 Epoch 280/400
 160/160 [=====] - 0s 728us/step - loss: 0.6943
 Epoch 281/400
 160/160 [=====] - 0s 711us/step - loss: 0.6940
 Epoch 282/400
 160/160 [=====] - 0s 700us/step - loss: 0.6938
 Epoch 283/400
 160/160 [=====] - 0s 756us/step - loss: 0.6939
 Epoch 284/400
 160/160 [=====] - 0s 854us/step - loss: 0.6941
 Epoch 285/400
 160/160 [=====] - 0s 811us/step - loss: 0.6941
 Epoch 286/400
 160/160 [=====] - 0s 876us/step - loss: 0.6942
 Epoch 287/400
 160/160 [=====] - 0s 761us/step - loss: 0.6938
 Epoch 288/400
 160/160 [=====] - 0s 638us/step - loss: 0.6941
 Epoch 289/400
 160/160 [=====] - 0s 741us/step - loss: 0.6941
 Epoch 290/400
 160/160 [=====] - 0s 736us/step - loss: 0.6939
 Epoch 291/400
 160/160 [=====] - 0s 716us/step - loss: 0.6941
 Epoch 292/400

160/160 [=====] - 0s 775us/step - loss: 0.6940
Epoch 293/400
160/160 [=====] - 0s 699us/step - loss: 0.6939
Epoch 294/400
160/160 [=====] - 0s 608us/step - loss: 0.6939
Epoch 295/400
160/160 [=====] - 0s 595us/step - loss: 0.6940
Epoch 296/400
160/160 [=====] - 0s 594us/step - loss: 0.6939
Epoch 297/400
160/160 [=====] - 0s 597us/step - loss: 0.6940
Epoch 298/400
160/160 [=====] - 0s 566us/step - loss: 0.6940
Epoch 299/400
160/160 [=====] - 0s 617us/step - loss: 0.6942
Epoch 300/400
160/160 [=====] - 0s 767us/step - loss: 0.6941
Epoch 301/400
160/160 [=====] - 0s 790us/step - loss: 0.6940
Epoch 302/400
160/160 [=====] - 0s 823us/step - loss: 0.6939
Epoch 303/400
160/160 [=====] - 0s 783us/step - loss: 0.6938
Epoch 304/400
160/160 [=====] - 0s 709us/step - loss: 0.6941
Epoch 305/400
160/160 [=====] - 0s 625us/step - loss: 0.6942
Epoch 306/400
160/160 [=====] - 0s 613us/step - loss: 0.6941
Epoch 307/400
160/160 [=====] - 0s 630us/step - loss: 0.6939
Epoch 308/400
160/160 [=====] - 0s 596us/step - loss: 0.6940
Epoch 309/400
160/160 [=====] - 0s 606us/step - loss: 0.6941
Epoch 310/400
160/160 [=====] - 0s 608us/step - loss: 0.6941
Epoch 311/400
160/160 [=====] - 0s 614us/step - loss: 0.6938
Epoch 312/400
160/160 [=====] - 0s 607us/step - loss: 0.6941
Epoch 313/400
160/160 [=====] - 0s 586us/step - loss: 0.6940
Epoch 314/400
160/160 [=====] - 0s 713us/step - loss: 0.6940
Epoch 315/400
160/160 [=====] - 0s 791us/step - loss: 0.6942
Epoch 316/400

```

160/160 [=====] - 0s 708us/step - loss: 0.6942
Epoch 317/400
160/160 [=====] - 0s 634us/step - loss: 0.6940
Epoch 318/400
160/160 [=====] - 0s 599us/step - loss: 0.6940
Epoch 319/400
160/160 [=====] - 0s 633us/step - loss: 0.6940
Epoch 320/400
160/160 [=====] - 0s 761us/step - loss: 0.6940
Epoch 321/400
160/160 [=====] - 0s 843us/step - loss: 0.6940
Epoch 322/400
160/160 [=====] - 0s 760us/step - loss: 0.6938
Epoch 323/400
160/160 [=====] - 0s 700us/step - loss: 0.6939
Epoch 324/400
160/160 [=====] - 0s 600us/step - loss: 0.6938
Epoch 325/400
160/160 [=====] - ETA: 0s - loss: 0.694 - 0s 636us/step - loss: 0.6941
Epoch 326/400
160/160 [=====] - 0s 758us/step - loss: 0.6939
Epoch 327/400
160/160 [=====] - 0s 659us/step - loss: 0.6939
Epoch 328/400
160/160 [=====] - 0s 701us/step - loss: 0.6941
Epoch 329/400
160/160 [=====] - 0s 598us/step - loss: 0.6940
Epoch 330/400
160/160 [=====] - 0s 557us/step - loss: 0.6938
Epoch 331/400
160/160 [=====] - 0s 582us/step - loss: 0.6941
Epoch 332/400
160/160 [=====] - 0s 620us/step - loss: 0.6942
Epoch 333/400
160/160 [=====] - 0s 763us/step - loss: 0.6940
Epoch 334/400
160/160 [=====] - 0s 620us/step - loss: 0.6941
Epoch 335/400
160/160 [=====] - 0s 617us/step - loss: 0.6940
Epoch 336/400
160/160 [=====] - 0s 803us/step - loss: 0.6939
Epoch 337/400
160/160 [=====] - 0s 770us/step - loss: 0.6941
Epoch 338/400
160/160 [=====] - 0s 790us/step - loss: 0.6941
Epoch 339/400
160/160 [=====] - 0s 604us/step - loss: 0.6939
Epoch 340/400

```


160/160 [=====] - 0s 594us/step - loss: 0.6941
 Epoch 341/400
 160/160 [=====] - 0s 690us/step - loss: 0.6941
 Epoch 342/400
 160/160 [=====] - 0s 698us/step - loss: 0.6941
 Epoch 343/400
 160/160 [=====] - 0s 603us/step - loss: 0.6941
 Epoch 344/400
 160/160 [=====] - 0s 637us/step - loss: 0.6940
 Epoch 345/400
 160/160 [=====] - 0s 749us/step - loss: 0.6941
 Epoch 346/400
 160/160 [=====] - 0s 642us/step - loss: 0.6940
 Epoch 347/400
 160/160 [=====] - 0s 594us/step - loss: 0.6942
 Epoch 348/400
 160/160 [=====] - 0s 695us/step - loss: 0.6939
 Epoch 349/400
 160/160 [=====] - 0s 590us/step - loss: 0.6942
 Epoch 350/400
 160/160 [=====] - 0s 671us/step - loss: 0.6939
 Epoch 351/400
 160/160 [=====] - 0s 724us/step - loss: 0.6939
 Epoch 352/400
 160/160 [=====] - 0s 742us/step - loss: 0.6940
 Epoch 353/400
 160/160 [=====] - 0s 659us/step - loss: 0.6941
 Epoch 354/400
 160/160 [=====] - 0s 596us/step - loss: 0.6939
 Epoch 355/400
 160/160 [=====] - 0s 625us/step - loss: 0.6940
 Epoch 356/400
 160/160 [=====] - 0s 673us/step - loss: 0.6940
 Epoch 357/400
 160/160 [=====] - 0s 616us/step - loss: 0.6942
 Epoch 358/400
 160/160 [=====] - 0s 641us/step - loss: 0.6940
 Epoch 359/400
 160/160 [=====] - 0s 713us/step - loss: 0.6939
 Epoch 360/400
 160/160 [=====] - 0s 739us/step - loss: 0.6939
 Epoch 361/400
 160/160 [=====] - 0s 615us/step - loss: 0.6939
 Epoch 362/400
 160/160 [=====] - 0s 613us/step - loss: 0.6940
 Epoch 363/400
 160/160 [=====] - 0s 619us/step - loss: 0.6941
 Epoch 364/400

160/160 [=====] - 0s 599us/step - loss: 0.6942
 Epoch 365/400
 160/160 [=====] - 0s 611us/step - loss: 0.6940
 Epoch 366/400
 160/160 [=====] - 0s 686us/step - loss: 0.6939
 Epoch 367/400
 160/160 [=====] - 0s 602us/step - loss: 0.6941
 Epoch 368/400
 160/160 [=====] - 0s 589us/step - loss: 0.6940
 Epoch 369/400
 160/160 [=====] - 0s 591us/step - loss: 0.6941
 Epoch 370/400
 160/160 [=====] - 0s 584us/step - loss: 0.6941
 Epoch 371/400
 160/160 [=====] - 0s 689us/step - loss: 0.6941
 Epoch 372/400
 160/160 [=====] - 0s 615us/step - loss: 0.6939
 Epoch 373/400
 160/160 [=====] - 0s 633us/step - loss: 0.6939
 Epoch 374/400
 160/160 [=====] - 0s 608us/step - loss: 0.6942
 Epoch 375/400
 160/160 [=====] - 0s 613us/step - loss: 0.6939
 Epoch 376/400
 160/160 [=====] - 0s 635us/step - loss: 0.6942
 Epoch 377/400
 160/160 [=====] - 0s 629us/step - loss: 0.6939
 Epoch 378/400
 160/160 [=====] - 0s 639us/step - loss: 0.6940
 Epoch 379/400
 160/160 [=====] - 0s 608us/step - loss: 0.6941
 Epoch 380/400
 160/160 [=====] - 0s 629us/step - loss: 0.6942
 Epoch 381/400
 160/160 [=====] - 0s 623us/step - loss: 0.6940
 Epoch 382/400
 160/160 [=====] - 0s 605us/step - loss: 0.6940
 Epoch 383/400
 160/160 [=====] - 0s 605us/step - loss: 0.6943
 Epoch 384/400
 160/160 [=====] - 0s 613us/step - loss: 0.6939
 Epoch 385/400
 160/160 [=====] - 0s 623us/step - loss: 0.6939
 Epoch 386/400
 160/160 [=====] - 0s 636us/step - loss: 0.6940
 Epoch 387/400
 160/160 [=====] - 0s 633us/step - loss: 0.6941
 Epoch 388/400

```

160/160 [=====] - 0s 570us/step - loss: 0.6941
Epoch 389/400
160/160 [=====] - 0s 575us/step - loss: 0.6940
Epoch 390/400
160/160 [=====] - 0s 600us/step - loss: 0.6940
Epoch 391/400
160/160 [=====] - 0s 688us/step - loss: 0.6940
Epoch 392/400
160/160 [=====] - 0s 665us/step - loss: 0.6940
Epoch 393/400
160/160 [=====] - 0s 605us/step - loss: 0.6938
Epoch 394/400
160/160 [=====] - 0s 669us/step - loss: 0.6939
Epoch 395/400
160/160 [=====] - 0s 594us/step - loss: 0.6938
Epoch 396/400
160/160 [=====] - 0s 599us/step - loss: 0.6940
Epoch 397/400
160/160 [=====] - 0s 622us/step - loss: 0.6941
Epoch 398/400
160/160 [=====] - 0s 609us/step - loss: 0.6941
Epoch 399/400
160/160 [=====] - 0s 606us/step - loss: 0.6940
Epoch 400/400
160/160 [=====] - 0s 604us/step - loss: 0.6939
[0.49894792 0.49879545 0.4989522 0.49881074 0.4987966 0.49895552
 0.4988626 0.4990903 0.49882782 0.49896893 0.4988353 0.49881536
 0.49895447 0.4989719 0.4988996 0.49865964 0.4988092 0.4989667
 0.49882606 0.49903306 0.4990214 0.4988754 0.49879378 0.49882072
 0.49885234 0.49886882 0.49903673 0.4989941 0.49897596 0.4988875
 0.49904898 0.49877337 0.4988511 0.4988829 0.49899125 0.49882913
 0.49872723 0.49887234 0.49882165 0.49886498 0.49868774 0.49884206
 0.4986863 0.49882665 0.49884284 0.49868408 0.49877414 0.4985491
 0.498807 0.49867067 0.4988023 0.49882284 0.49868372 0.49866426
 0.49873635 0.49897617 0.49882528 0.49867246 0.49881372 0.4986042
 0.49862105 0.49876606 0.49884063 0.49881548 0.49878797 0.49876595
 0.49860546 0.4986491 0.4986657 0.49874952 0.49859035 0.49886176
 0.49878463 0.49875414 0.49864778 0.49880978 0.49890882 0.4987634
 0.49881476 0.49877042 0.49897394 0.49906304 0.49909756 0.49905872
 0.4991282 0.49913236 0.4990339 0.49911317 0.49892128 0.49913248
 0.49906698 0.49908924 0.49908116 0.49899417 0.4989982 0.49897712
 0.49888378 0.49911538 0.4991395 0.49904126 0.49921012 0.4991883
 0.49887434 0.4990099 0.49915576 0.49891505 0.4992009 0.49923027
 0.49919057 0.49904642 0.49911484 0.49894455 0.49897963 0.49904516
 0.49911097 0.49911264 0.49899477 0.4989804 0.49901894 0.4989604
 0.49866143 0.49857178 0.49853837 0.49857605 0.49850702 0.49850383
 0.49860084 0.49852568 0.498713 0.4985039 0.49856788 0.4985457
 0.49855474 0.4986416 0.4986367 0.4986587 0.49875048 0.49852082

```

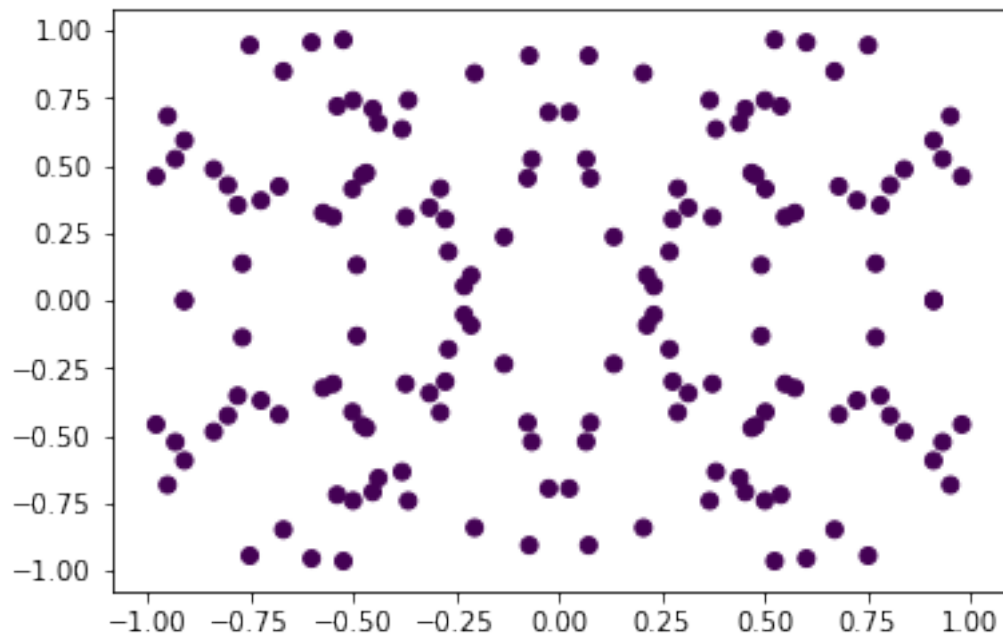
```
0.4984957 0.49859586 0.49842763 0.49844736 0.4987599 0.49862465
0.4984796 0.4987194 0.49843705 0.4984071 0.49844632 0.49858856
0.49852297 0.49868992 0.4986549 0.49858975 0.49852556 0.49852237
0.49864024 0.49865425 0.49861577 0.49867415]
160/160 [=====] - 0s 911us/step
```

```
In [38]: scores, model.metrics_names
```

```
Out[38]: (0.693148922920227, ['loss'])
```

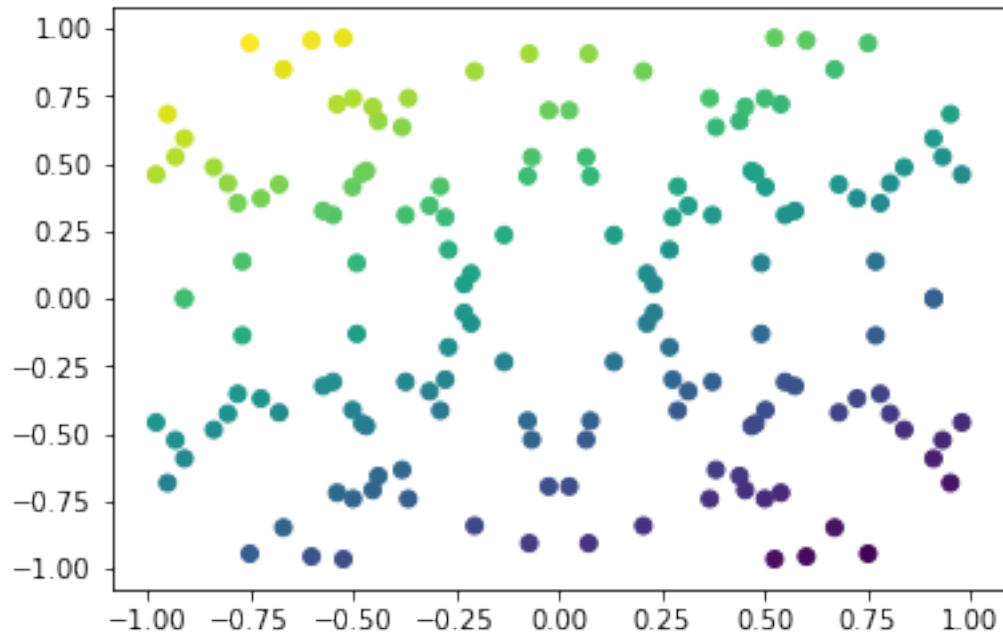
```
In [39]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[39]: <matplotlib.collections.PathCollection at 0xb26846a20>
```



```
In [40]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[40]: <matplotlib.collections.PathCollection at 0xb268a8e80>
```



```
In [41]: # Sigmoid 5
model = Sequential()

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

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, 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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 5ms/step - loss: 0.7457
Epoch 2/400
160/160 [=====] - 0s 1ms/step - loss: 0.7213
Epoch 3/400
160/160 [=====] - 0s 2ms/step - loss: 0.7082
```

Epoch 4/400
160/160 [=====] - 0s 785us/step - loss: 0.7018
Epoch 5/400
160/160 [=====] - 0s 922us/step - loss: 0.6980
Epoch 6/400
160/160 [=====] - 0s 816us/step - loss: 0.6957
Epoch 7/400
160/160 [=====] - 0s 882us/step - loss: 0.6952
Epoch 8/400
160/160 [=====] - 0s 793us/step - loss: 0.6946
Epoch 9/400
160/160 [=====] - 0s 819us/step - loss: 0.6943
Epoch 10/400
160/160 [=====] - 0s 871us/step - loss: 0.6943
Epoch 11/400
160/160 [=====] - 0s 836us/step - loss: 0.6943
Epoch 12/400
160/160 [=====] - 0s 2ms/step - loss: 0.6940
Epoch 13/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 14/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 15/400
160/160 [=====] - 0s 1ms/step - loss: 0.6940
Epoch 16/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 17/400
160/160 [=====] - 0s 905us/step - loss: 0.6940
Epoch 18/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 19/400
160/160 [=====] - 0s 955us/step - loss: 0.6942
Epoch 20/400
160/160 [=====] - 0s 844us/step - loss: 0.6941
Epoch 21/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 22/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 23/400
160/160 [=====] - 0s 853us/step - loss: 0.6940
Epoch 24/400
160/160 [=====] - 0s 832us/step - loss: 0.6943
Epoch 25/400
160/160 [=====] - 0s 870us/step - loss: 0.6940
Epoch 26/400
160/160 [=====] - 0s 959us/step - loss: 0.6943
Epoch 27/400
160/160 [=====] - 0s 1ms/step - loss: 0.6940

Epoch 28/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 29/400
160/160 [=====] - 0s 1ms/step - loss: 0.6939
Epoch 30/400
160/160 [=====] - 0s 1ms/step - loss: 0.6940
Epoch 31/400
160/160 [=====] - 0s 761us/step - loss: 0.6940
Epoch 32/400
160/160 [=====] - 0s 754us/step - loss: 0.6941
Epoch 33/400
160/160 [=====] - 0s 704us/step - loss: 0.6941
Epoch 34/400
160/160 [=====] - 0s 797us/step - loss: 0.6940
Epoch 35/400
160/160 [=====] - 0s 785us/step - loss: 0.6941
Epoch 36/400
160/160 [=====] - 0s 703us/step - loss: 0.6941
Epoch 37/400
160/160 [=====] - 0s 733us/step - loss: 0.6939
Epoch 38/400
160/160 [=====] - 0s 764us/step - loss: 0.6942
Epoch 39/400
160/160 [=====] - 0s 790us/step - loss: 0.6941
Epoch 40/400
160/160 [=====] - 0s 676us/step - loss: 0.6943
Epoch 41/400
160/160 [=====] - 0s 780us/step - loss: 0.6941
Epoch 42/400
160/160 [=====] - 0s 790us/step - loss: 0.6942
Epoch 43/400
160/160 [=====] - 0s 862us/step - loss: 0.6941
Epoch 44/400
160/160 [=====] - 0s 770us/step - loss: 0.6939
Epoch 45/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 46/400
160/160 [=====] - 0s 858us/step - loss: 0.6941
Epoch 47/400
160/160 [=====] - 0s 766us/step - loss: 0.6940
Epoch 48/400
160/160 [=====] - 0s 833us/step - loss: 0.6942
Epoch 49/400
160/160 [=====] - 0s 758us/step - loss: 0.6941
Epoch 50/400
160/160 [=====] - 0s 800us/step - loss: 0.6941
Epoch 51/400
160/160 [=====] - 0s 852us/step - loss: 0.6941

Epoch 52/400
160/160 [=====] - 0s 809us/step - loss: 0.6942
Epoch 53/400
160/160 [=====] - 0s 821us/step - loss: 0.6940
Epoch 54/400
160/160 [=====] - 0s 856us/step - loss: 0.6941
Epoch 55/400
160/160 [=====] - 0s 666us/step - loss: 0.6941
Epoch 56/400
160/160 [=====] - 0s 666us/step - loss: 0.6940
Epoch 57/400
160/160 [=====] - 0s 690us/step - loss: 0.6941
Epoch 58/400
160/160 [=====] - 0s 680us/step - loss: 0.6941
Epoch 59/400
160/160 [=====] - 0s 660us/step - loss: 0.6942
Epoch 60/400
160/160 [=====] - 0s 665us/step - loss: 0.6941
Epoch 61/400
160/160 [=====] - 0s 675us/step - loss: 0.6943
Epoch 62/400
160/160 [=====] - 0s 639us/step - loss: 0.6939
Epoch 63/400
160/160 [=====] - 0s 615us/step - loss: 0.6941
Epoch 64/400
160/160 [=====] - 0s 625us/step - loss: 0.6942
Epoch 65/400
160/160 [=====] - 0s 667us/step - loss: 0.6940
Epoch 66/400
160/160 [=====] - 0s 635us/step - loss: 0.6942
Epoch 67/400
160/160 [=====] - 0s 638us/step - loss: 0.6942
Epoch 68/400
160/160 [=====] - 0s 714us/step - loss: 0.6942
Epoch 69/400
160/160 [=====] - 0s 674us/step - loss: 0.6942
Epoch 70/400
160/160 [=====] - 0s 802us/step - loss: 0.6941
Epoch 71/400
160/160 [=====] - 0s 861us/step - loss: 0.6941
Epoch 72/400
160/160 [=====] - 0s 796us/step - loss: 0.6944
Epoch 73/400
160/160 [=====] - 0s 815us/step - loss: 0.6941
Epoch 74/400
160/160 [=====] - 0s 836us/step - loss: 0.6942
Epoch 75/400
160/160 [=====] - 0s 799us/step - loss: 0.6939

Epoch 76/400
160/160 [=====] - 0s 800us/step - loss: 0.6941
Epoch 77/400
160/160 [=====] - 0s 804us/step - loss: 0.6941
Epoch 78/400
160/160 [=====] - 0s 790us/step - loss: 0.6942
Epoch 79/400
160/160 [=====] - 0s 672us/step - loss: 0.6938
Epoch 80/400
160/160 [=====] - 0s 623us/step - loss: 0.6942
Epoch 81/400
160/160 [=====] - 0s 728us/step - loss: 0.6940
Epoch 82/400
160/160 [=====] - 0s 855us/step - loss: 0.6941
Epoch 83/400
160/160 [=====] - 0s 847us/step - loss: 0.6942
Epoch 84/400
160/160 [=====] - 0s 855us/step - loss: 0.6941
Epoch 85/400
160/160 [=====] - 0s 809us/step - loss: 0.6941
Epoch 86/400
160/160 [=====] - 0s 823us/step - loss: 0.6940
Epoch 87/400
160/160 [=====] - 0s 774us/step - loss: 0.6941
Epoch 88/400
160/160 [=====] - 0s 860us/step - loss: 0.6940
Epoch 89/400
160/160 [=====] - 0s 864us/step - loss: 0.6941
Epoch 90/400
160/160 [=====] - 0s 862us/step - loss: 0.6939
Epoch 91/400
160/160 [=====] - 0s 750us/step - loss: 0.6943
Epoch 92/400
160/160 [=====] - 0s 733us/step - loss: 0.6940
Epoch 93/400
160/160 [=====] - 0s 710us/step - loss: 0.6942
Epoch 94/400
160/160 [=====] - 0s 791us/step - loss: 0.6941
Epoch 95/400
160/160 [=====] - 0s 704us/step - loss: 0.6941
Epoch 96/400
160/160 [=====] - 0s 624us/step - loss: 0.6942
Epoch 97/400
160/160 [=====] - 0s 752us/step - loss: 0.6941
Epoch 98/400
160/160 [=====] - 0s 794us/step - loss: 0.6940
Epoch 99/400
160/160 [=====] - 0s 816us/step - loss: 0.6941

Epoch 100/400
160/160 [=====] - 0s 785us/step - loss: 0.6939
Epoch 101/400
160/160 [=====] - 0s 702us/step - loss: 0.6940
Epoch 102/400
160/160 [=====] - 0s 781us/step - loss: 0.6941
Epoch 103/400
160/160 [=====] - 0s 804us/step - loss: 0.6940
Epoch 104/400
160/160 [=====] - 0s 845us/step - loss: 0.6940
Epoch 105/400
160/160 [=====] - 0s 859us/step - loss: 0.6940
Epoch 106/400
160/160 [=====] - 0s 839us/step - loss: 0.6943
Epoch 107/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 108/400
160/160 [=====] - 0s 892us/step - loss: 0.6940
Epoch 109/400
160/160 [=====] - 0s 820us/step - loss: 0.6943
Epoch 110/400
160/160 [=====] - 0s 829us/step - loss: 0.6940
Epoch 111/400
160/160 [=====] - 0s 846us/step - loss: 0.6939
Epoch 112/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 113/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 114/400
160/160 [=====] - 0s 734us/step - loss: 0.6939
Epoch 115/400
160/160 [=====] - 0s 641us/step - loss: 0.6941
Epoch 116/400
160/160 [=====] - 0s 734us/step - loss: 0.6938
Epoch 117/400
160/160 [=====] - 0s 722us/step - loss: 0.6939
Epoch 118/400
160/160 [=====] - 0s 793us/step - loss: 0.6940
Epoch 119/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 120/400
160/160 [=====] - 0s 998us/step - loss: 0.6940
Epoch 121/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 122/400
160/160 [=====] - 0s 771us/step - loss: 0.6943
Epoch 123/400
160/160 [=====] - 0s 860us/step - loss: 0.6939

Epoch 124/400
160/160 [=====] - 0s 818us/step - loss: 0.6939
Epoch 125/400
160/160 [=====] - 0s 896us/step - loss: 0.6941
Epoch 126/400
160/160 [=====] - 0s 863us/step - loss: 0.6941
Epoch 127/400
160/160 [=====] - 0s 855us/step - loss: 0.6942
Epoch 128/400
160/160 [=====] - 0s 806us/step - loss: 0.6940
Epoch 129/400
160/160 [=====] - 0s 805us/step - loss: 0.6942
Epoch 130/400
160/160 [=====] - 0s 830us/step - loss: 0.6942
Epoch 131/400
160/160 [=====] - 0s 826us/step - loss: 0.6940
Epoch 132/400
160/160 [=====] - 0s 781us/step - loss: 0.6940
Epoch 133/400
160/160 [=====] - 0s 728us/step - loss: 0.6941
Epoch 134/400
160/160 [=====] - 0s 716us/step - loss: 0.6943
Epoch 135/400
160/160 [=====] - 0s 734us/step - loss: 0.6941
Epoch 136/400
160/160 [=====] - 0s 807us/step - loss: 0.6940
Epoch 137/400
160/160 [=====] - 0s 833us/step - loss: 0.6942
Epoch 138/400
160/160 [=====] - 0s 881us/step - loss: 0.6939
Epoch 139/400
160/160 [=====] - 0s 883us/step - loss: 0.6941
Epoch 140/400
160/160 [=====] - 0s 820us/step - loss: 0.6942
Epoch 141/400
160/160 [=====] - 0s 856us/step - loss: 0.6940
Epoch 142/400
160/160 [=====] - 0s 818us/step - loss: 0.6942
Epoch 143/400
160/160 [=====] - 0s 831us/step - loss: 0.6940
Epoch 144/400
160/160 [=====] - 0s 831us/step - loss: 0.6940
Epoch 145/400
160/160 [=====] - 0s 663us/step - loss: 0.6942
Epoch 146/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 147/400
160/160 [=====] - 0s 833us/step - loss: 0.6940

Epoch 148/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 149/400
160/160 [=====] - 0s 949us/step - loss: 0.6939
Epoch 150/400
160/160 [=====] - 0s 832us/step - loss: 0.6940
Epoch 151/400
160/160 [=====] - 0s 852us/step - loss: 0.6940
Epoch 152/400
160/160 [=====] - 0s 789us/step - loss: 0.6941
Epoch 153/400
160/160 [=====] - 0s 793us/step - loss: 0.6939
Epoch 154/400
160/160 [=====] - 0s 820us/step - loss: 0.6941
Epoch 155/400
160/160 [=====] - 0s 806us/step - loss: 0.6941
Epoch 156/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 157/400
160/160 [=====] - 0s 972us/step - loss: 0.6941
Epoch 158/400
160/160 [=====] - 0s 891us/step - loss: 0.6942
Epoch 159/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 160/400
160/160 [=====] - 0s 1ms/step - loss: 0.6940
Epoch 161/400
160/160 [=====] - 0s 888us/step - loss: 0.6939
Epoch 162/400
160/160 [=====] - 0s 857us/step - loss: 0.6941
Epoch 163/400
160/160 [=====] - 0s 668us/step - loss: 0.6940
Epoch 164/400
160/160 [=====] - 0s 718us/step - loss: 0.6940
Epoch 165/400
160/160 [=====] - 0s 863us/step - loss: 0.6941
Epoch 166/400
160/160 [=====] - 0s 826us/step - loss: 0.6942
Epoch 167/400
160/160 [=====] - 0s 613us/step - loss: 0.6942
Epoch 168/400
160/160 [=====] - 0s 610us/step - loss: 0.6942
Epoch 169/400
160/160 [=====] - 0s 568us/step - loss: 0.6942
Epoch 170/400
160/160 [=====] - 0s 828us/step - loss: 0.6940
Epoch 171/400
160/160 [=====] - 0s 941us/step - loss: 0.6941

Epoch 172/400
160/160 [=====] - 0s 773us/step - loss: 0.6941
Epoch 173/400
160/160 [=====] - 0s 671us/step - loss: 0.6941
Epoch 174/400
160/160 [=====] - 0s 708us/step - loss: 0.6942
Epoch 175/400
160/160 [=====] - 0s 767us/step - loss: 0.6941
Epoch 176/400
160/160 [=====] - 0s 769us/step - loss: 0.6941
Epoch 177/400
160/160 [=====] - 0s 893us/step - loss: 0.6942
Epoch 178/400
160/160 [=====] - 0s 885us/step - loss: 0.6942
Epoch 179/400
160/160 [=====] - 0s 712us/step - loss: 0.6943
Epoch 180/400
160/160 [=====] - 0s 670us/step - loss: 0.6942
Epoch 181/400
160/160 [=====] - 0s 703us/step - loss: 0.6941
Epoch 182/400
160/160 [=====] - 0s 891us/step - loss: 0.6942
Epoch 183/400
160/160 [=====] - 0s 796us/step - loss: 0.6943
Epoch 184/400
160/160 [=====] - 0s 645us/step - loss: 0.6939
Epoch 185/400
160/160 [=====] - 0s 623us/step - loss: 0.6940
Epoch 186/400
160/160 [=====] - 0s 623us/step - loss: 0.6941
Epoch 187/400
160/160 [=====] - 0s 631us/step - loss: 0.6941
Epoch 188/400
160/160 [=====] - 0s 808us/step - loss: 0.6942
Epoch 189/400
160/160 [=====] - 0s 910us/step - loss: 0.6940
Epoch 190/400
160/160 [=====] - 0s 820us/step - loss: 0.6943
Epoch 191/400
160/160 [=====] - 0s 861us/step - loss: 0.6941
Epoch 192/400
160/160 [=====] - 0s 801us/step - loss: 0.6941
Epoch 193/400
160/160 [=====] - 0s 843us/step - loss: 0.6941
Epoch 194/400
160/160 [=====] - 0s 877us/step - loss: 0.6941
Epoch 195/400
160/160 [=====] - 0s 757us/step - loss: 0.6940

Epoch 196/400
160/160 [=====] - 0s 668us/step - loss: 0.6941
Epoch 197/400
160/160 [=====] - 0s 684us/step - loss: 0.6940
Epoch 198/400
160/160 [=====] - 0s 677us/step - loss: 0.6940
Epoch 199/400
160/160 [=====] - 0s 783us/step - loss: 0.6942
Epoch 200/400
160/160 [=====] - 0s 867us/step - loss: 0.6941
Epoch 201/400
160/160 [=====] - 0s 633us/step - loss: 0.6939
Epoch 202/400
160/160 [=====] - 0s 627us/step - loss: 0.6941
Epoch 203/400
160/160 [=====] - 0s 841us/step - loss: 0.6941
Epoch 204/400
160/160 [=====] - 0s 870us/step - loss: 0.6943
Epoch 205/400
160/160 [=====] - 0s 833us/step - loss: 0.6938
Epoch 206/400
160/160 [=====] - 0s 750us/step - loss: 0.6943
Epoch 207/400
160/160 [=====] - 0s 794us/step - loss: 0.6942
Epoch 208/400
160/160 [=====] - 0s 763us/step - loss: 0.6941
Epoch 209/400
160/160 [=====] - 0s 787us/step - loss: 0.6940
Epoch 210/400
160/160 [=====] - 0s 778us/step - loss: 0.6942
Epoch 211/400
160/160 [=====] - 0s 642us/step - loss: 0.6940
Epoch 212/400
160/160 [=====] - 0s 642us/step - loss: 0.6940
Epoch 213/400
160/160 [=====] - 0s 616us/step - loss: 0.6942
Epoch 214/400
160/160 [=====] - 0s 613us/step - loss: 0.6941
Epoch 215/400
160/160 [=====] - 0s 632us/step - loss: 0.6942
Epoch 216/400
160/160 [=====] - 0s 704us/step - loss: 0.6941
Epoch 217/400
160/160 [=====] - 0s 852us/step - loss: 0.6939
Epoch 218/400
160/160 [=====] - 0s 837us/step - loss: 0.6943
Epoch 219/400
160/160 [=====] - 0s 869us/step - loss: 0.6942

Epoch 220/400
160/160 [=====] - 0s 838us/step - loss: 0.6941
Epoch 221/400
160/160 [=====] - 0s 767us/step - loss: 0.6942
Epoch 222/400
160/160 [=====] - 0s 772us/step - loss: 0.6941
Epoch 223/400
160/160 [=====] - 0s 768us/step - loss: 0.6942
Epoch 224/400
160/160 [=====] - 0s 787us/step - loss: 0.6942
Epoch 225/400
160/160 [=====] - 0s 761us/step - loss: 0.6941
Epoch 226/400
160/160 [=====] - 0s 820us/step - loss: 0.6942
Epoch 227/400
160/160 [=====] - 0s 770us/step - loss: 0.6942
Epoch 228/400
160/160 [=====] - 0s 750us/step - loss: 0.6941
Epoch 229/400
160/160 [=====] - 0s 663us/step - loss: 0.6941
Epoch 230/400
160/160 [=====] - 0s 674us/step - loss: 0.6940
Epoch 231/400
160/160 [=====] - 0s 675us/step - loss: 0.6939
Epoch 232/400
160/160 [=====] - 0s 789us/step - loss: 0.6941
Epoch 233/400
160/160 [=====] - 0s 849us/step - loss: 0.6941
Epoch 234/400
160/160 [=====] - 0s 862us/step - loss: 0.6942
Epoch 235/400
160/160 [=====] - 0s 867us/step - loss: 0.6941
Epoch 236/400
160/160 [=====] - 0s 883us/step - loss: 0.6943
Epoch 237/400
160/160 [=====] - 0s 787us/step - loss: 0.6942
Epoch 238/400
160/160 [=====] - 0s 733us/step - loss: 0.6945
Epoch 239/400
160/160 [=====] - 0s 688us/step - loss: 0.6942
Epoch 240/400
160/160 [=====] - 0s 725us/step - loss: 0.6941
Epoch 241/400
160/160 [=====] - 0s 800us/step - loss: 0.6940
Epoch 242/400
160/160 [=====] - 0s 846us/step - loss: 0.6941
Epoch 243/400
160/160 [=====] - 0s 827us/step - loss: 0.6942

Epoch 244/400
160/160 [=====] - 0s 841us/step - loss: 0.6942
Epoch 245/400
160/160 [=====] - 0s 820us/step - loss: 0.6941
Epoch 246/400
160/160 [=====] - 0s 853us/step - loss: 0.6940
Epoch 247/400
160/160 [=====] - 0s 915us/step - loss: 0.6940
Epoch 248/400
160/160 [=====] - 0s 1ms/step - loss: 0.6939
Epoch 249/400
160/160 [=====] - 0s 781us/step - loss: 0.6941
Epoch 250/400
160/160 [=====] - 0s 746us/step - loss: 0.6942
Epoch 251/400
160/160 [=====] - 0s 735us/step - loss: 0.6941
Epoch 252/400
160/160 [=====] - 0s 782us/step - loss: 0.6939
Epoch 253/400
160/160 [=====] - 0s 777us/step - loss: 0.6941
Epoch 254/400
160/160 [=====] - 0s 844us/step - loss: 0.6941
Epoch 255/400
160/160 [=====] - 0s 1ms/step - loss: 0.6941
Epoch 256/400
160/160 [=====] - 0s 669us/step - loss: 0.6944
Epoch 257/400
160/160 [=====] - 0s 667us/step - loss: 0.6942
Epoch 258/400
160/160 [=====] - 0s 649us/step - loss: 0.6941
Epoch 259/400
160/160 [=====] - 0s 637us/step - loss: 0.6941
Epoch 260/400
160/160 [=====] - 0s 668us/step - loss: 0.6941
Epoch 261/400
160/160 [=====] - 0s 848us/step - loss: 0.6938
Epoch 262/400
160/160 [=====] - 0s 873us/step - loss: 0.6941
Epoch 263/400
160/160 [=====] - 0s 794us/step - loss: 0.6938
Epoch 264/400
160/160 [=====] - 0s 832us/step - loss: 0.6941
Epoch 265/400
160/160 [=====] - 0s 846us/step - loss: 0.6942
Epoch 266/400
160/160 [=====] - 0s 830us/step - loss: 0.6941
Epoch 267/400
160/160 [=====] - 0s 830us/step - loss: 0.6940

Epoch 268/400
160/160 [=====] - 0s 841us/step - loss: 0.6943
Epoch 269/400
160/160 [=====] - 0s 777us/step - loss: 0.6941
Epoch 270/400
160/160 [=====] - 0s 642us/step - loss: 0.6941
Epoch 271/400
160/160 [=====] - 0s 712us/step - loss: 0.6940
Epoch 272/400
160/160 [=====] - 0s 588us/step - loss: 0.6940
Epoch 273/400
160/160 [=====] - 0s 585us/step - loss: 0.6942
Epoch 274/400
160/160 [=====] - 0s 626us/step - loss: 0.6942
Epoch 275/400
160/160 [=====] - 0s 644us/step - loss: 0.6940
Epoch 276/400
160/160 [=====] - 0s 660us/step - loss: 0.6942
Epoch 277/400
160/160 [=====] - 0s 653us/step - loss: 0.6939
Epoch 278/400
160/160 [=====] - 0s 633us/step - loss: 0.6941
Epoch 279/400
160/160 [=====] - 0s 647us/step - loss: 0.6939
Epoch 280/400
160/160 [=====] - 0s 676us/step - loss: 0.6941
Epoch 281/400
160/160 [=====] - 0s 626us/step - loss: 0.6941
Epoch 282/400
160/160 [=====] - 0s 624us/step - loss: 0.6943
Epoch 283/400
160/160 [=====] - 0s 705us/step - loss: 0.6940
Epoch 284/400
160/160 [=====] - 0s 818us/step - loss: 0.6942
Epoch 285/400
160/160 [=====] - 0s 858us/step - loss: 0.6941
Epoch 286/400
160/160 [=====] - 0s 773us/step - loss: 0.6942
Epoch 287/400
160/160 [=====] - 0s 828us/step - loss: 0.6939
Epoch 288/400
160/160 [=====] - 0s 855us/step - loss: 0.6940
Epoch 289/400
160/160 [=====] - 0s 865us/step - loss: 0.6939
Epoch 290/400
160/160 [=====] - 0s 918us/step - loss: 0.6941
Epoch 291/400
160/160 [=====] - 0s 894us/step - loss: 0.6941

Epoch 292/400
160/160 [=====] - 0s 877us/step - loss: 0.6940
Epoch 293/400
160/160 [=====] - 0s 856us/step - loss: 0.6938
Epoch 294/400
160/160 [=====] - 0s 773us/step - loss: 0.6941
Epoch 295/400
160/160 [=====] - 0s 781us/step - loss: 0.6941
Epoch 296/400
160/160 [=====] - 0s 830us/step - loss: 0.6941
Epoch 297/400
160/160 [=====] - 0s 868us/step - loss: 0.6941
Epoch 298/400
160/160 [=====] - 0s 803us/step - loss: 0.6941
Epoch 299/400
160/160 [=====] - 0s 814us/step - loss: 0.6942
Epoch 300/400
160/160 [=====] - 0s 847us/step - loss: 0.6941
Epoch 301/400
160/160 [=====] - 0s 842us/step - loss: 0.6941
Epoch 302/400
160/160 [=====] - 0s 845us/step - loss: 0.6941
Epoch 303/400
160/160 [=====] - 0s 834us/step - loss: 0.6941
Epoch 304/400
160/160 [=====] - 0s 815us/step - loss: 0.6940
Epoch 305/400
160/160 [=====] - 0s 823us/step - loss: 0.6941
Epoch 306/400
160/160 [=====] - 0s 824us/step - loss: 0.6942
Epoch 307/400
160/160 [=====] - 0s 825us/step - loss: 0.6939
Epoch 308/400
160/160 [=====] - 0s 842us/step - loss: 0.6941
Epoch 309/400
160/160 [=====] - 0s 757us/step - loss: 0.6941
Epoch 310/400
160/160 [=====] - 0s 833us/step - loss: 0.6942
Epoch 311/400
160/160 [=====] - 0s 843us/step - loss: 0.6941
Epoch 312/400
160/160 [=====] - 0s 853us/step - loss: 0.6941
Epoch 313/400
160/160 [=====] - 0s 806us/step - loss: 0.6942
Epoch 314/400
160/160 [=====] - 0s 802us/step - loss: 0.6942
Epoch 315/400
160/160 [=====] - 0s 840us/step - loss: 0.6941

Epoch 316/400
160/160 [=====] - 0s 824us/step - loss: 0.6944
Epoch 317/400
160/160 [=====] - 0s 848us/step - loss: 0.6940
Epoch 318/400
160/160 [=====] - 0s 828us/step - loss: 0.6939
Epoch 319/400
160/160 [=====] - 0s 846us/step - loss: 0.6941
Epoch 320/400
160/160 [=====] - 0s 835us/step - loss: 0.6940
Epoch 321/400
160/160 [=====] - 0s 752us/step - loss: 0.6940
Epoch 322/400
160/160 [=====] - 0s 816us/step - loss: 0.6941
Epoch 323/400
160/160 [=====] - 0s 788us/step - loss: 0.6942
Epoch 324/400
160/160 [=====] - 0s 763us/step - loss: 0.6940
Epoch 325/400
160/160 [=====] - 0s 817us/step - loss: 0.6941
Epoch 326/400
160/160 [=====] - 0s 790us/step - loss: 0.6943
Epoch 327/400
160/160 [=====] - 0s 760us/step - loss: 0.6941
Epoch 328/400
160/160 [=====] - 0s 743us/step - loss: 0.6940
Epoch 329/400
160/160 [=====] - 0s 645us/step - loss: 0.6941
Epoch 330/400
160/160 [=====] - 0s 627us/step - loss: 0.6941
Epoch 331/400
160/160 [=====] - 0s 664us/step - loss: 0.6941
Epoch 332/400
160/160 [=====] - 0s 679us/step - loss: 0.6942
Epoch 333/400
160/160 [=====] - 0s 780us/step - loss: 0.6940
Epoch 334/400
160/160 [=====] - 0s 635us/step - loss: 0.6941
Epoch 335/400
160/160 [=====] - 0s 665us/step - loss: 0.6941
Epoch 336/400
160/160 [=====] - 0s 742us/step - loss: 0.6940
Epoch 337/400
160/160 [=====] - 0s 688us/step - loss: 0.6940
Epoch 338/400
160/160 [=====] - 0s 654us/step - loss: 0.6941
Epoch 339/400
160/160 [=====] - 0s 829us/step - loss: 0.6940

Epoch 340/400
160/160 [=====] - 0s 826us/step - loss: 0.6941
Epoch 341/400
160/160 [=====] - 0s 674us/step - loss: 0.6941
Epoch 342/400
160/160 [=====] - 0s 662us/step - loss: 0.6942
Epoch 343/400
160/160 [=====] - 0s 645us/step - loss: 0.6941
Epoch 344/400
160/160 [=====] - 0s 641us/step - loss: 0.6940
Epoch 345/400
160/160 [=====] - 0s 616us/step - loss: 0.6939
Epoch 346/400
160/160 [=====] - 0s 616us/step - loss: 0.6939
Epoch 347/400
160/160 [=====] - 0s 666us/step - loss: 0.6941
Epoch 348/400
160/160 [=====] - 0s 699us/step - loss: 0.6941
Epoch 349/400
160/160 [=====] - 0s 760us/step - loss: 0.6941
Epoch 350/400
160/160 [=====] - 0s 724us/step - loss: 0.6939
Epoch 351/400
160/160 [=====] - 0s 650us/step - loss: 0.6942
Epoch 352/400
160/160 [=====] - 0s 670us/step - loss: 0.6940
Epoch 353/400
160/160 [=====] - 0s 799us/step - loss: 0.6940
Epoch 354/400
160/160 [=====] - 0s 657us/step - loss: 0.6940
Epoch 355/400
160/160 [=====] - 0s 689us/step - loss: 0.6942
Epoch 356/400
160/160 [=====] - 0s 798us/step - loss: 0.6942
Epoch 357/400
160/160 [=====] - 0s 849us/step - loss: 0.6940
Epoch 358/400
160/160 [=====] - 0s 678us/step - loss: 0.6940
Epoch 359/400
160/160 [=====] - 0s 740us/step - loss: 0.6941
Epoch 360/400
160/160 [=====] - 0s 697us/step - loss: 0.6941
Epoch 361/400
160/160 [=====] - 0s 681us/step - loss: 0.6939
Epoch 362/400
160/160 [=====] - 0s 663us/step - loss: 0.6943
Epoch 363/400
160/160 [=====] - 0s 636us/step - loss: 0.6941

Epoch 364/400
160/160 [=====] - 0s 633us/step - loss: 0.6941
Epoch 365/400
160/160 [=====] - 0s 662us/step - loss: 0.6938
Epoch 366/400
160/160 [=====] - 0s 673us/step - loss: 0.6940
Epoch 367/400
160/160 [=====] - 0s 635us/step - loss: 0.6940
Epoch 368/400
160/160 [=====] - 0s 640us/step - loss: 0.6941
Epoch 369/400
160/160 [=====] - 0s 677us/step - loss: 0.6940
Epoch 370/400
160/160 [=====] - 0s 675us/step - loss: 0.6942
Epoch 371/400
160/160 [=====] - 0s 688us/step - loss: 0.6939
Epoch 372/400
160/160 [=====] - 0s 679us/step - loss: 0.6942
Epoch 373/400
160/160 [=====] - 0s 697us/step - loss: 0.6941
Epoch 374/400
160/160 [=====] - 0s 633us/step - loss: 0.6940
Epoch 375/400
160/160 [=====] - 0s 630us/step - loss: 0.6941
Epoch 376/400
160/160 [=====] - 0s 637us/step - loss: 0.6941
Epoch 377/400
160/160 [=====] - 0s 771us/step - loss: 0.6939
Epoch 378/400
160/160 [=====] - 0s 827us/step - loss: 0.6941
Epoch 379/400
160/160 [=====] - 0s 688us/step - loss: 0.6940
Epoch 380/400
160/160 [=====] - 0s 637us/step - loss: 0.6941
Epoch 381/400
160/160 [=====] - 0s 598us/step - loss: 0.6941
Epoch 382/400
160/160 [=====] - 0s 640us/step - loss: 0.6938
Epoch 383/400
160/160 [=====] - 0s 618us/step - loss: 0.6942
Epoch 384/400
160/160 [=====] - 0s 644us/step - loss: 0.6940
Epoch 385/400
160/160 [=====] - 0s 646us/step - loss: 0.6942
Epoch 386/400
160/160 [=====] - 0s 645us/step - loss: 0.6940
Epoch 387/400
160/160 [=====] - 0s 643us/step - loss: 0.6941

Epoch 388/400
160/160 [=====] - 0s 640us/step - loss: 0.6940
Epoch 389/400
160/160 [=====] - 0s 658us/step - loss: 0.6940
Epoch 390/400
160/160 [=====] - 0s 671us/step - loss: 0.6941
Epoch 391/400
160/160 [=====] - 0s 681us/step - loss: 0.6940
Epoch 392/400
160/160 [=====] - 0s 646us/step - loss: 0.6940
Epoch 393/400
160/160 [=====] - 0s 646us/step - loss: 0.6941
Epoch 394/400
160/160 [=====] - 0s 642us/step - loss: 0.6940
Epoch 395/400
160/160 [=====] - 0s 637us/step - loss: 0.6941
Epoch 396/400
160/160 [=====] - 0s 662us/step - loss: 0.6942
Epoch 397/400
160/160 [=====] - 0s 632us/step - loss: 0.6940
Epoch 398/400
160/160 [=====] - 0s 630us/step - loss: 0.6940
Epoch 399/400
160/160 [=====] - 0s 645us/step - loss: 0.6941
Epoch 400/400
160/160 [=====] - 0s 611us/step - loss: 0.6938
[0.49794242 0.49793538 0.49793765 0.49793586 0.49793303 0.49793634
0.497938 0.49794048 0.4979415 0.4979367 0.4979361 0.4979348
0.49793833 0.49794224 0.49794024 0.49793544 0.49794248 0.4979373
0.4979332 0.49794188 0.4979348 0.49793243 0.49794248 0.49793795
0.49793315 0.49794272 0.4979355 0.4979334 0.4979345 0.4979381
0.49793935 0.4979393 0.49793977 0.49793807 0.49793807 0.49793428
0.49793634 0.4979403 0.49793765 0.4979409 0.497948 0.4979548
0.49795264 0.4979543 0.49795696 0.49795383 0.4979523 0.4979498
0.49794886 0.49795353 0.49795407 0.49795526 0.49795195 0.49794817
0.49795005 0.49795467 0.49794793 0.49795294 0.49795678 0.49794847
0.49795538 0.4979575 0.49794793 0.4979523 0.49795678 0.4979477
0.49795467 0.49795666 0.49795562 0.4979522 0.497951 0.497951
0.49795052 0.49795225 0.4979522 0.49795586 0.49795383 0.49795005
0.49795264 0.49794945 0.4979441 0.497952 0.49794716 0.49795136
0.4979536 0.497948 0.49794886 0.49794212 0.49794734 0.49794745
0.4979507 0.49795195 0.49794662 0.49794367 0.49794656 0.49795467
0.49794716 0.4979471 0.49795282 0.49794248 0.49794763 0.49795243
0.49794745 0.4979498 0.49795237 0.49794567 0.49794674 0.49794927
0.49794883 0.4979483 0.4979438 0.49794993 0.49794793 0.4979484
0.49794602 0.49795207 0.49795276 0.49794716 0.49795 0.49794692
0.49794632 0.49793822 0.4979432 0.49793887 0.49793658 0.49794236
0.4979415 0.4979483 0.49794307 0.4979429 0.4979396 0.49793822]

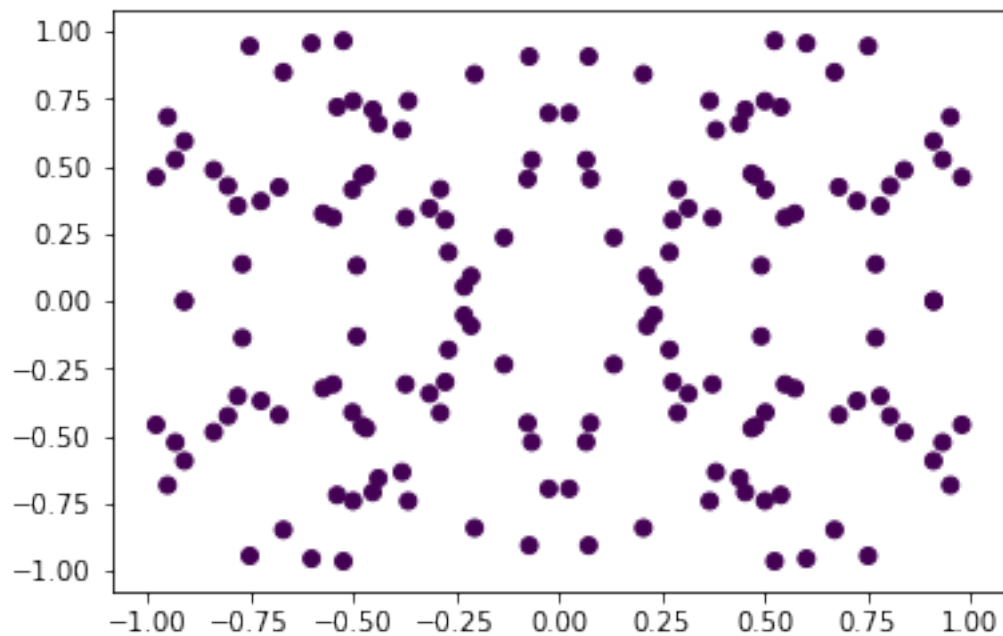
```
0.4979438 0.49794674 0.4979438 0.49793544 0.49794325 0.4979433
0.4979373 0.49794793 0.49794272 0.49793777 0.4979429 0.49794054
0.4979379 0.49794474 0.4979436 0.49794102 0.4979415 0.49794212
0.49794662 0.49794036 0.49794248 0.49794194 0.49794438 0.4979381
0.49793747 0.49794325 0.49794036 0.49794343]
160/160 [=====] - 0s 851us/step
```

```
In [42]: scores, model.metrics_names
```

```
Out[42]: (0.6931556582450866, ['loss'])
```

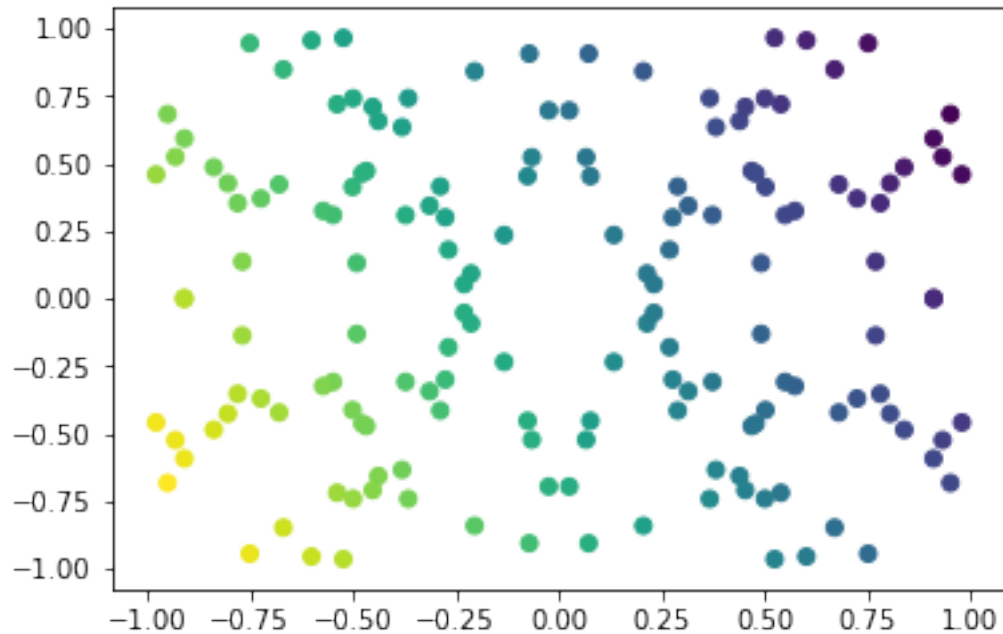
```
In [43]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[43]: <matplotlib.collections.PathCollection at 0xb26e092b0>
```



```
In [44]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[44]: <matplotlib.collections.PathCollection at 0xb26eca780>
```



```
In [45]: # Softplus 1
model = Sequential()

model.add(Dense(2, input_dim=2, activation='softplus'))
model.add(Dense(2, activation='softplus'))
model.add(Dense(2, activation='softplus'))
model.add(Dense(2, activation='softplus'))
model.add(Dense(2, activation='softplus'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='softplus'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 4ms/step - loss: 0.6985
Epoch 2/400
160/160 [=====] - 0s 726us/step - loss: 0.6956
Epoch 3/400
160/160 [=====] - 0s 710us/step - loss: 0.6948
```


Epoch 4/400
160/160 [=====] - 0s 830us/step - loss: 0.6948
Epoch 5/400
160/160 [=====] - 0s 781us/step - loss: 0.6951
Epoch 6/400
160/160 [=====] - 0s 735us/step - loss: 0.6944
Epoch 7/400
160/160 [=====] - 0s 861us/step - loss: 0.6946
Epoch 8/400
160/160 [=====] - 0s 858us/step - loss: 0.6953
Epoch 9/400
160/160 [=====] - 0s 789us/step - loss: 0.6937
Epoch 10/400
160/160 [=====] - 0s 843us/step - loss: 0.6946
Epoch 11/400
160/160 [=====] - 0s 840us/step - loss: 0.6948
Epoch 12/400
160/160 [=====] - 0s 839us/step - loss: 0.6947
Epoch 13/400
160/160 [=====] - 0s 823us/step - loss: 0.6946
Epoch 14/400
160/160 [=====] - 0s 844us/step - loss: 0.6948
Epoch 15/400
160/160 [=====] - 0s 774us/step - loss: 0.6950
Epoch 16/400
160/160 [=====] - 0s 877us/step - loss: 0.6941
Epoch 17/400
160/160 [=====] - 0s 890us/step - loss: 0.6950
Epoch 18/400
160/160 [=====] - 0s 825us/step - loss: 0.6949
Epoch 19/400
160/160 [=====] - 0s 825us/step - loss: 0.6947
Epoch 20/400
160/160 [=====] - 0s 866us/step - loss: 0.6941
Epoch 21/400
160/160 [=====] - 0s 846us/step - loss: 0.6949
Epoch 22/400
160/160 [=====] - 0s 788us/step - loss: 0.6946
Epoch 23/400
160/160 [=====] - 0s 800us/step - loss: 0.6942
Epoch 24/400
160/160 [=====] - 0s 816us/step - loss: 0.6946 0s - loss: 0.69
Epoch 25/400
160/160 [=====] - 0s 879us/step - loss: 0.6947
Epoch 26/400
160/160 [=====] - 0s 859us/step - loss: 0.6944
Epoch 27/400
160/160 [=====] - 0s 889us/step - loss: 0.6941

Epoch 28/400
160/160 [=====] - 0s 845us/step - loss: 0.6940
Epoch 29/400
160/160 [=====] - 0s 821us/step - loss: 0.6943
Epoch 30/400
160/160 [=====] - 0s 860us/step - loss: 0.6942
Epoch 31/400
160/160 [=====] - 0s 767us/step - loss: 0.6945
Epoch 32/400
160/160 [=====] - 0s 853us/step - loss: 0.6942
Epoch 33/400
160/160 [=====] - 0s 850us/step - loss: 0.6948
Epoch 34/400
160/160 [=====] - 0s 874us/step - loss: 0.6943
Epoch 35/400
160/160 [=====] - 0s 783us/step - loss: 0.6941
Epoch 36/400
160/160 [=====] - 0s 662us/step - loss: 0.6938
Epoch 37/400
160/160 [=====] - 0s 680us/step - loss: 0.6948
Epoch 38/400
160/160 [=====] - 0s 716us/step - loss: 0.6947
Epoch 39/400
160/160 [=====] - 0s 782us/step - loss: 0.6944
Epoch 40/400
160/160 [=====] - 0s 864us/step - loss: 0.6948
Epoch 41/400
160/160 [=====] - 0s 814us/step - loss: 0.6946
Epoch 42/400
160/160 [=====] - 0s 705us/step - loss: 0.6948
Epoch 43/400
160/160 [=====] - 0s 676us/step - loss: 0.6938
Epoch 44/400
160/160 [=====] - 0s 699us/step - loss: 0.6941
Epoch 45/400
160/160 [=====] - 0s 755us/step - loss: 0.6941
Epoch 46/400
160/160 [=====] - 0s 881us/step - loss: 0.6942
Epoch 47/400
160/160 [=====] - 0s 897us/step - loss: 0.6945
Epoch 48/400
160/160 [=====] - 0s 894us/step - loss: 0.6942
Epoch 49/400
160/160 [=====] - 0s 832us/step - loss: 0.6943
Epoch 50/400
160/160 [=====] - 0s 806us/step - loss: 0.6941
Epoch 51/400
160/160 [=====] - 0s 857us/step - loss: 0.6945

Epoch 52/400
160/160 [=====] - 0s 820us/step - loss: 0.6945
Epoch 53/400
160/160 [=====] - 0s 762us/step - loss: 0.6947
Epoch 54/400
160/160 [=====] - 0s 720us/step - loss: 0.6942
Epoch 55/400
160/160 [=====] - 0s 723us/step - loss: 0.6944
Epoch 56/400
160/160 [=====] - 0s 718us/step - loss: 0.6939
Epoch 57/400
160/160 [=====] - 0s 781us/step - loss: 0.6943
Epoch 58/400
160/160 [=====] - 0s 826us/step - loss: 0.6945
Epoch 59/400
160/160 [=====] - 0s 862us/step - loss: 0.6945
Epoch 60/400
160/160 [=====] - 0s 845us/step - loss: 0.6943
Epoch 61/400
160/160 [=====] - 0s 811us/step - loss: 0.6941
Epoch 62/400
160/160 [=====] - 0s 715us/step - loss: 0.6942
Epoch 63/400
160/160 [=====] - 0s 733us/step - loss: 0.6942
Epoch 64/400
160/160 [=====] - 0s 824us/step - loss: 0.6947
Epoch 65/400
160/160 [=====] - 0s 733us/step - loss: 0.6946
Epoch 66/400
160/160 [=====] - 0s 758us/step - loss: 0.6944
Epoch 67/400
160/160 [=====] - 0s 709us/step - loss: 0.6940
Epoch 68/400
160/160 [=====] - 0s 695us/step - loss: 0.6936
Epoch 69/400
160/160 [=====] - 0s 700us/step - loss: 0.6942
Epoch 70/400
160/160 [=====] - 0s 679us/step - loss: 0.6947
Epoch 71/400
160/160 [=====] - 0s 662us/step - loss: 0.6941
Epoch 72/400
160/160 [=====] - 0s 786us/step - loss: 0.6943
Epoch 73/400
160/160 [=====] - 0s 845us/step - loss: 0.6944
Epoch 74/400
160/160 [=====] - 0s 787us/step - loss: 0.6947
Epoch 75/400
160/160 [=====] - 0s 807us/step - loss: 0.6942

```

Epoch 76/400
160/160 [=====] - 0s 712us/step - loss: 0.6945
Epoch 77/400
160/160 [=====] - 0s 678us/step - loss: 0.6937
Epoch 78/400
160/160 [=====] - 0s 804us/step - loss: 0.6945
Epoch 79/400
160/160 [=====] - 0s 789us/step - loss: 0.6942
Epoch 80/400
160/160 [=====] - 0s 763us/step - loss: 0.6940
Epoch 81/400
160/160 [=====] - 0s 814us/step - loss: 0.6944 0s - loss: 0.69
Epoch 82/400
160/160 [=====] - 0s 773us/step - loss: 0.6942
Epoch 83/400
160/160 [=====] - 0s 805us/step - loss: 0.6938
Epoch 84/400
160/160 [=====] - 0s 854us/step - loss: 0.6941
Epoch 85/400
160/160 [=====] - 0s 834us/step - loss: 0.6946
Epoch 86/400
160/160 [=====] - 0s 887us/step - loss: 0.6940
Epoch 87/400
160/160 [=====] - 0s 877us/step - loss: 0.6942
Epoch 88/400
160/160 [=====] - 0s 890us/step - loss: 0.6941
Epoch 89/400
160/160 [=====] - 0s 849us/step - loss: 0.6936
Epoch 90/400
160/160 [=====] - 0s 863us/step - loss: 0.6937
Epoch 91/400
160/160 [=====] - 0s 852us/step - loss: 0.6938
Epoch 92/400
160/160 [=====] - 0s 888us/step - loss: 0.6945
Epoch 93/400
160/160 [=====] - 0s 853us/step - loss: 0.6937
Epoch 94/400
160/160 [=====] - 0s 803us/step - loss: 0.6942
Epoch 95/400
160/160 [=====] - 0s 787us/step - loss: 0.6938
Epoch 96/400
160/160 [=====] - 0s 818us/step - loss: 0.6943
Epoch 97/400
160/160 [=====] - 0s 731us/step - loss: 0.6938
Epoch 98/400
160/160 [=====] - 0s 911us/step - loss: 0.6941
Epoch 99/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943

```

Epoch 100/400
160/160 [=====] - 0s 1ms/step - loss: 0.6935
Epoch 101/400
160/160 [=====] - 0s 763us/step - loss: 0.6938
Epoch 102/400
160/160 [=====] - 0s 938us/step - loss: 0.6943
Epoch 103/400
160/160 [=====] - 0s 1ms/step - loss: 0.6938
Epoch 104/400
160/160 [=====] - 0s 956us/step - loss: 0.6941
Epoch 105/400
160/160 [=====] - 0s 1ms/step - loss: 0.6937
Epoch 106/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 107/400
160/160 [=====] - 0s 2ms/step - loss: 0.6942
Epoch 108/400
160/160 [=====] - 0s 971us/step - loss: 0.6943
Epoch 109/400
160/160 [=====] - 0s 994us/step - loss: 0.6939
Epoch 110/400
160/160 [=====] - 0s 960us/step - loss: 0.6937
Epoch 111/400
160/160 [=====] - 0s 754us/step - loss: 0.6935
Epoch 112/400
160/160 [=====] - 0s 814us/step - loss: 0.6938
Epoch 113/400
160/160 [=====] - 0s 757us/step - loss: 0.6938
Epoch 114/400
160/160 [=====] - 0s 1ms/step - loss: 0.6936
Epoch 115/400
160/160 [=====] - 0s 1ms/step - loss: 0.6940
Epoch 116/400
160/160 [=====] - 0s 1ms/step - loss: 0.6933
Epoch 117/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 118/400
160/160 [=====] - 0s 1ms/step - loss: 0.6937
Epoch 119/400
160/160 [=====] - 0s 1ms/step - loss: 0.6932
Epoch 120/400
160/160 [=====] - 0s 895us/step - loss: 0.6936
Epoch 121/400
160/160 [=====] - 0s 851us/step - loss: 0.6937
Epoch 122/400
160/160 [=====] - 0s 811us/step - loss: 0.6938
Epoch 123/400
160/160 [=====] - 0s 811us/step - loss: 0.6934

Epoch 124/400
160/160 [=====] - 0s 788us/step - loss: 0.6943
Epoch 125/400
160/160 [=====] - 0s 744us/step - loss: 0.6938
Epoch 126/400
160/160 [=====] - 0s 642us/step - loss: 0.6934
Epoch 127/400
160/160 [=====] - 0s 674us/step - loss: 0.6938
Epoch 128/400
160/160 [=====] - 0s 893us/step - loss: 0.6935
Epoch 129/400
160/160 [=====] - 0s 874us/step - loss: 0.6935
Epoch 130/400
160/160 [=====] - 0s 868us/step - loss: 0.6931
Epoch 131/400
160/160 [=====] - 0s 876us/step - loss: 0.6935
Epoch 132/400
160/160 [=====] - 0s 923us/step - loss: 0.6938
Epoch 133/400
160/160 [=====] - 0s 807us/step - loss: 0.6938
Epoch 134/400
160/160 [=====] - 0s 834us/step - loss: 0.6930
Epoch 135/400
160/160 [=====] - 0s 843us/step - loss: 0.6935
Epoch 136/400
160/160 [=====] - 0s 821us/step - loss: 0.6936
Epoch 137/400
160/160 [=====] - 0s 755us/step - loss: 0.6936
Epoch 138/400
160/160 [=====] - 0s 798us/step - loss: 0.6930
Epoch 139/400
160/160 [=====] - 0s 827us/step - loss: 0.6932
Epoch 140/400
160/160 [=====] - 0s 848us/step - loss: 0.6937
Epoch 141/400
160/160 [=====] - 0s 813us/step - loss: 0.6935
Epoch 142/400
160/160 [=====] - 0s 857us/step - loss: 0.6931
Epoch 143/400
160/160 [=====] - 0s 835us/step - loss: 0.6935
Epoch 144/400
160/160 [=====] - 0s 788us/step - loss: 0.6928
Epoch 145/400
160/160 [=====] - 0s 695us/step - loss: 0.6939
Epoch 146/400
160/160 [=====] - 0s 735us/step - loss: 0.6933
Epoch 147/400
160/160 [=====] - 0s 1ms/step - loss: 0.6935

Epoch 148/400
160/160 [=====] - 0s 764us/step - loss: 0.6936
Epoch 149/400
160/160 [=====] - 0s 815us/step - loss: 0.6935
Epoch 150/400
160/160 [=====] - 0s 739us/step - loss: 0.6930
Epoch 151/400
160/160 [=====] - 0s 691us/step - loss: 0.6938
Epoch 152/400
160/160 [=====] - 0s 655us/step - loss: 0.6933
Epoch 153/400
160/160 [=====] - 0s 667us/step - loss: 0.6930
Epoch 154/400
160/160 [=====] - 0s 702us/step - loss: 0.6935
Epoch 155/400
160/160 [=====] - 0s 686us/step - loss: 0.6930
Epoch 156/400
160/160 [=====] - 0s 812us/step - loss: 0.6936
Epoch 157/400
160/160 [=====] - 0s 832us/step - loss: 0.6933
Epoch 158/400
160/160 [=====] - 0s 619us/step - loss: 0.6931
Epoch 159/400
160/160 [=====] - 0s 636us/step - loss: 0.6933
Epoch 160/400
160/160 [=====] - 0s 636us/step - loss: 0.6933
Epoch 161/400
160/160 [=====] - 0s 648us/step - loss: 0.6920
Epoch 162/400
160/160 [=====] - 0s 663us/step - loss: 0.6934
Epoch 163/400
160/160 [=====] - 0s 662us/step - loss: 0.6933
Epoch 164/400
160/160 [=====] - 0s 692us/step - loss: 0.6936
Epoch 165/400
160/160 [=====] - 0s 690us/step - loss: 0.6933
Epoch 166/400
160/160 [=====] - 0s 655us/step - loss: 0.6932
Epoch 167/400
160/160 [=====] - 0s 656us/step - loss: 0.6932
Epoch 168/400
160/160 [=====] - 0s 665us/step - loss: 0.6929
Epoch 169/400
160/160 [=====] - 0s 713us/step - loss: 0.6936
Epoch 170/400
160/160 [=====] - 0s 802us/step - loss: 0.6927
Epoch 171/400
160/160 [=====] - 0s 813us/step - loss: 0.6932

Epoch 172/400
160/160 [=====] - 0s 760us/step - loss: 0.6928
Epoch 173/400
160/160 [=====] - 0s 694us/step - loss: 0.6935
Epoch 174/400
160/160 [=====] - 0s 1ms/step - loss: 0.6926
Epoch 175/400
160/160 [=====] - 0s 934us/step - loss: 0.6930
Epoch 176/400
160/160 [=====] - 0s 691us/step - loss: 0.6928
Epoch 177/400
160/160 [=====] - 0s 659us/step - loss: 0.6925
Epoch 178/400
160/160 [=====] - 0s 846us/step - loss: 0.6929
Epoch 179/400
160/160 [=====] - 0s 751us/step - loss: 0.6927
Epoch 180/400
160/160 [=====] - 0s 929us/step - loss: 0.6927
Epoch 181/400
160/160 [=====] - 0s 853us/step - loss: 0.6928
Epoch 182/400
160/160 [=====] - 0s 829us/step - loss: 0.6927
Epoch 183/400
160/160 [=====] - 0s 669us/step - loss: 0.6929
Epoch 184/400
160/160 [=====] - 0s 644us/step - loss: 0.6930
Epoch 185/400
160/160 [=====] - 0s 854us/step - loss: 0.6924
Epoch 186/400
160/160 [=====] - 0s 736us/step - loss: 0.6929
Epoch 187/400
160/160 [=====] - 0s 630us/step - loss: 0.6924
Epoch 188/400
160/160 [=====] - 0s 642us/step - loss: 0.6925
Epoch 189/400
160/160 [=====] - 0s 641us/step - loss: 0.6927
Epoch 190/400
160/160 [=====] - 0s 692us/step - loss: 0.6923
Epoch 191/400
160/160 [=====] - 0s 927us/step - loss: 0.6928
Epoch 192/400
160/160 [=====] - 0s 674us/step - loss: 0.6926
Epoch 193/400
160/160 [=====] - 0s 645us/step - loss: 0.6921
Epoch 194/400
160/160 [=====] - 0s 727us/step - loss: 0.6924
Epoch 195/400
160/160 [=====] - 0s 748us/step - loss: 0.6924

Epoch 196/400
 160/160 [=====] - 0s 642us/step - loss: 0.6918
 Epoch 197/400
 160/160 [=====] - 0s 618us/step - loss: 0.6926
 Epoch 198/400
 160/160 [=====] - 0s 619us/step - loss: 0.6917
 Epoch 199/400
 160/160 [=====] - 0s 776us/step - loss: 0.6918
 Epoch 200/400
 160/160 [=====] - 0s 747us/step - loss: 0.6918
 Epoch 201/400
 160/160 [=====] - 0s 794us/step - loss: 0.6922
 Epoch 202/400
 160/160 [=====] - 0s 779us/step - loss: 0.6927
 Epoch 203/400
 160/160 [=====] - 0s 658us/step - loss: 0.6923
 Epoch 204/400
 160/160 [=====] - 0s 673us/step - loss: 0.6922
 Epoch 205/400
 160/160 [=====] - 0s 741us/step - loss: 0.6919
 Epoch 206/400
 160/160 [=====] - 0s 670us/step - loss: 0.6920
 Epoch 207/400
 160/160 [=====] - 0s 640us/step - loss: 0.6920
 Epoch 208/400
 160/160 [=====] - 0s 805us/step - loss: 0.6919
 Epoch 209/400
 160/160 [=====] - 0s 632us/step - loss: 0.6920
 Epoch 210/400
 160/160 [=====] - 0s 684us/step - loss: 0.6919
 Epoch 211/400
 160/160 [=====] - 0s 792us/step - loss: 0.6915
 Epoch 212/400
 160/160 [=====] - 0s 739us/step - loss: 0.6924
 Epoch 213/400
 160/160 [=====] - 0s 852us/step - loss: 0.6923
 Epoch 214/400
 160/160 [=====] - 0s 689us/step - loss: 0.6918
 Epoch 215/400
 160/160 [=====] - 0s 653us/step - loss: 0.6913
 Epoch 216/400
 160/160 [=====] - 0s 639us/step - loss: 0.6921
 Epoch 217/400
 160/160 [=====] - 0s 627us/step - loss: 0.6920
 Epoch 218/400
 160/160 [=====] - 0s 627us/step - loss: 0.6922
 Epoch 219/400
 160/160 [=====] - 0s 642us/step - loss: 0.6915

Epoch 220/400
160/160 [=====] - 0s 695us/step - loss: 0.6916
Epoch 221/400
160/160 [=====] - 0s 1ms/step - loss: 0.6919
Epoch 222/400
160/160 [=====] - 0s 824us/step - loss: 0.6915
Epoch 223/400
160/160 [=====] - 0s 923us/step - loss: 0.6915
Epoch 224/400
160/160 [=====] - 0s 777us/step - loss: 0.6912
Epoch 225/400
160/160 [=====] - 0s 731us/step - loss: 0.6904
Epoch 226/400
160/160 [=====] - 0s 685us/step - loss: 0.6912
Epoch 227/400
160/160 [=====] - 0s 732us/step - loss: 0.6912
Epoch 228/400
160/160 [=====] - 0s 658us/step - loss: 0.6917
Epoch 229/400
160/160 [=====] - 0s 683us/step - loss: 0.6913
Epoch 230/400
160/160 [=====] - 0s 643us/step - loss: 0.6914
Epoch 231/400
160/160 [=====] - 0s 667us/step - loss: 0.6915
Epoch 232/400
160/160 [=====] - 0s 680us/step - loss: 0.6906
Epoch 233/400
160/160 [=====] - 0s 675us/step - loss: 0.6908
Epoch 234/400
160/160 [=====] - 0s 802us/step - loss: 0.6909
Epoch 235/400
160/160 [=====] - 0s 711us/step - loss: 0.6909
Epoch 236/400
160/160 [=====] - 0s 683us/step - loss: 0.6911
Epoch 237/400
160/160 [=====] - 0s 798us/step - loss: 0.6910
Epoch 238/400
160/160 [=====] - 0s 649us/step - loss: 0.6912
Epoch 239/400
160/160 [=====] - 0s 635us/step - loss: 0.6909
Epoch 240/400
160/160 [=====] - 0s 648us/step - loss: 0.6907
Epoch 241/400
160/160 [=====] - 0s 647us/step - loss: 0.6904
Epoch 242/400
160/160 [=====] - 0s 644us/step - loss: 0.6909
Epoch 243/400
160/160 [=====] - 0s 676us/step - loss: 0.6905

Epoch 244/400
160/160 [=====] - 0s 701us/step - loss: 0.6908
Epoch 245/400
160/160 [=====] - 0s 666us/step - loss: 0.6907
Epoch 246/400
160/160 [=====] - 0s 677us/step - loss: 0.6904
Epoch 247/400
160/160 [=====] - 0s 701us/step - loss: 0.6905
Epoch 248/400
160/160 [=====] - 0s 764us/step - loss: 0.6906
Epoch 249/400
160/160 [=====] - 0s 789us/step - loss: 0.6904
Epoch 250/400
160/160 [=====] - 0s 674us/step - loss: 0.6899
Epoch 251/400
160/160 [=====] - 0s 725us/step - loss: 0.6902
Epoch 252/400
160/160 [=====] - 0s 780us/step - loss: 0.6900
Epoch 253/400
160/160 [=====] - 0s 737us/step - loss: 0.6896
Epoch 254/400
160/160 [=====] - 0s 644us/step - loss: 0.6903
Epoch 255/400
160/160 [=====] - 0s 630us/step - loss: 0.6902
Epoch 256/400
160/160 [=====] - 0s 701us/step - loss: 0.6899
Epoch 257/400
160/160 [=====] - 0s 763us/step - loss: 0.6902
Epoch 258/400
160/160 [=====] - 0s 674us/step - loss: 0.6896
Epoch 259/400
160/160 [=====] - 0s 647us/step - loss: 0.6902
Epoch 260/400
160/160 [=====] - 0s 659us/step - loss: 0.6898
Epoch 261/400
160/160 [=====] - 0s 658us/step - loss: 0.6892
Epoch 262/400
160/160 [=====] - 0s 644us/step - loss: 0.6894
Epoch 263/400
160/160 [=====] - 0s 669us/step - loss: 0.6890
Epoch 264/400
160/160 [=====] - 0s 737us/step - loss: 0.6894
Epoch 265/400
160/160 [=====] - 0s 760us/step - loss: 0.6892
Epoch 266/400
160/160 [=====] - 0s 741us/step - loss: 0.6887
Epoch 267/400
160/160 [=====] - 0s 680us/step - loss: 0.6886

Epoch 268/400
160/160 [=====] - 0s 712us/step - loss: 0.6890
Epoch 269/400
160/160 [=====] - 0s 744us/step - loss: 0.6883
Epoch 270/400
160/160 [=====] - 0s 644us/step - loss: 0.6893
Epoch 271/400
160/160 [=====] - 0s 673us/step - loss: 0.6889
Epoch 272/400
160/160 [=====] - 0s 726us/step - loss: 0.6886
Epoch 273/400
160/160 [=====] - 0s 692us/step - loss: 0.6889
Epoch 274/400
160/160 [=====] - 0s 748us/step - loss: 0.6882
Epoch 275/400
160/160 [=====] - 0s 945us/step - loss: 0.6880
Epoch 276/400
160/160 [=====] - 0s 1ms/step - loss: 0.6880
Epoch 277/400
160/160 [=====] - 0s 1ms/step - loss: 0.6877
Epoch 278/400
160/160 [=====] - 0s 873us/step - loss: 0.6882
Epoch 279/400
160/160 [=====] - 0s 761us/step - loss: 0.6881
Epoch 280/400
160/160 [=====] - 0s 708us/step - loss: 0.6878
Epoch 281/400
160/160 [=====] - 0s 876us/step - loss: 0.6874
Epoch 282/400
160/160 [=====] - 0s 661us/step - loss: 0.6882
Epoch 283/400
160/160 [=====] - 0s 688us/step - loss: 0.6876
Epoch 284/400
160/160 [=====] - 0s 688us/step - loss: 0.6867
Epoch 285/400
160/160 [=====] - 0s 736us/step - loss: 0.6872
Epoch 286/400
160/160 [=====] - 0s 706us/step - loss: 0.6868
Epoch 287/400
160/160 [=====] - 0s 724us/step - loss: 0.6870
Epoch 288/400
160/160 [=====] - 0s 663us/step - loss: 0.6866
Epoch 289/400
160/160 [=====] - 0s 634us/step - loss: 0.6867
Epoch 290/400
160/160 [=====] - 0s 983us/step - loss: 0.6869
Epoch 291/400
160/160 [=====] - 0s 941us/step - loss: 0.6864

Epoch 292/400
160/160 [=====] - 0s 891us/step - loss: 0.6859
Epoch 293/400
160/160 [=====] - 0s 897us/step - loss: 0.6863
Epoch 294/400
160/160 [=====] - 0s 820us/step - loss: 0.6858
Epoch 295/400
160/160 [=====] - 0s 640us/step - loss: 0.6864
Epoch 296/400
160/160 [=====] - 0s 630us/step - loss: 0.6849
Epoch 297/400
160/160 [=====] - 0s 637us/step - loss: 0.6857
Epoch 298/400
160/160 [=====] - 0s 687us/step - loss: 0.6860
Epoch 299/400
160/160 [=====] - 0s 637us/step - loss: 0.6847
Epoch 300/400
160/160 [=====] - 0s 614us/step - loss: 0.6852
Epoch 301/400
160/160 [=====] - 0s 803us/step - loss: 0.6852
Epoch 302/400
160/160 [=====] - 0s 776us/step - loss: 0.6844
Epoch 303/400
160/160 [=====] - 0s 776us/step - loss: 0.6847
Epoch 304/400
160/160 [=====] - 0s 748us/step - loss: 0.6844
Epoch 305/400
160/160 [=====] - 0s 634us/step - loss: 0.6846
Epoch 306/400
160/160 [=====] - 0s 623us/step - loss: 0.6837
Epoch 307/400
160/160 [=====] - 0s 669us/step - loss: 0.6841
Epoch 308/400
160/160 [=====] - 0s 675us/step - loss: 0.6831
Epoch 309/400
160/160 [=====] - 0s 633us/step - loss: 0.6833
Epoch 310/400
160/160 [=====] - 0s 753us/step - loss: 0.6833
Epoch 311/400
160/160 [=====] - 0s 619us/step - loss: 0.6830
Epoch 312/400
160/160 [=====] - 0s 650us/step - loss: 0.6834
Epoch 313/400
160/160 [=====] - 0s 647us/step - loss: 0.6826
Epoch 314/400
160/160 [=====] - 0s 603us/step - loss: 0.6826
Epoch 315/400
160/160 [=====] - 0s 619us/step - loss: 0.6822

Epoch 316/400
160/160 [=====] - 0s 655us/step - loss: 0.6819
Epoch 317/400
160/160 [=====] - 0s 715us/step - loss: 0.6815
Epoch 318/400
160/160 [=====] - 0s 684us/step - loss: 0.6815
Epoch 319/400
160/160 [=====] - 0s 763us/step - loss: 0.6806
Epoch 320/400
160/160 [=====] - 0s 641us/step - loss: 0.6810
Epoch 321/400
160/160 [=====] - 0s 633us/step - loss: 0.6802
Epoch 322/400
160/160 [=====] - 0s 738us/step - loss: 0.6803
Epoch 323/400
160/160 [=====] - 0s 776us/step - loss: 0.6806
Epoch 324/400
160/160 [=====] - 0s 750us/step - loss: 0.6794
Epoch 325/400
160/160 [=====] - 0s 628us/step - loss: 0.6798
Epoch 326/400
160/160 [=====] - 0s 646us/step - loss: 0.6792
Epoch 327/400
160/160 [=====] - 0s 630us/step - loss: 0.6794
Epoch 328/400
160/160 [=====] - 0s 617us/step - loss: 0.6790
Epoch 329/400
160/160 [=====] - 0s 751us/step - loss: 0.6782
Epoch 330/400
160/160 [=====] - 0s 785us/step - loss: 0.6779
Epoch 331/400
160/160 [=====] - 0s 886us/step - loss: 0.6776
Epoch 332/400
160/160 [=====] - 0s 664us/step - loss: 0.6771
Epoch 333/400
160/160 [=====] - 0s 673us/step - loss: 0.6768
Epoch 334/400
160/160 [=====] - 0s 673us/step - loss: 0.6767
Epoch 335/400
160/160 [=====] - 0s 672us/step - loss: 0.6759
Epoch 336/400
160/160 [=====] - 0s 769us/step - loss: 0.6754
Epoch 337/400
160/160 [=====] - 0s 640us/step - loss: 0.6753
Epoch 338/400
160/160 [=====] - 0s 633us/step - loss: 0.6747
Epoch 339/400
160/160 [=====] - 0s 617us/step - loss: 0.6745

Epoch 340/400
160/160 [=====] - 0s 612us/step - loss: 0.6742
Epoch 341/400
160/160 [=====] - 0s 622us/step - loss: 0.6736
Epoch 342/400
160/160 [=====] - 0s 622us/step - loss: 0.6735
Epoch 343/400
160/160 [=====] - 0s 635us/step - loss: 0.6727
Epoch 344/400
160/160 [=====] - 0s 632us/step - loss: 0.6730
Epoch 345/400
160/160 [=====] - 0s 623us/step - loss: 0.6723
Epoch 346/400
160/160 [=====] - 0s 611us/step - loss: 0.6715
Epoch 347/400
160/160 [=====] - 0s 630us/step - loss: 0.6708
Epoch 348/400
160/160 [=====] - 0s 623us/step - loss: 0.6689
Epoch 349/400
160/160 [=====] - 0s 630us/step - loss: 0.6711
Epoch 350/400
160/160 [=====] - 0s 625us/step - loss: 0.6691
Epoch 351/400
160/160 [=====] - 0s 624us/step - loss: 0.6693
Epoch 352/400
160/160 [=====] - 0s 638us/step - loss: 0.6683
Epoch 353/400
160/160 [=====] - 0s 615us/step - loss: 0.6670
Epoch 354/400
160/160 [=====] - 0s 663us/step - loss: 0.6667
Epoch 355/400
160/160 [=====] - 0s 619us/step - loss: 0.6665
Epoch 356/400
160/160 [=====] - 0s 617us/step - loss: 0.6663
Epoch 357/400
160/160 [=====] - 0s 631us/step - loss: 0.6649
Epoch 358/400
160/160 [=====] - 0s 614us/step - loss: 0.6649
Epoch 359/400
160/160 [=====] - 0s 615us/step - loss: 0.6648
Epoch 360/400
160/160 [=====] - 0s 717us/step - loss: 0.6642
Epoch 361/400
160/160 [=====] - 0s 653us/step - loss: 0.6626
Epoch 362/400
160/160 [=====] - 0s 769us/step - loss: 0.6617
Epoch 363/400
160/160 [=====] - 0s 679us/step - loss: 0.6616

Epoch 364/400
160/160 [=====] - 0s 595us/step - loss: 0.6610
Epoch 365/400
160/160 [=====] - 0s 1ms/step - loss: 0.6599
Epoch 366/400
160/160 [=====] - 0s 659us/step - loss: 0.6591
Epoch 367/400
160/160 [=====] - 0s 702us/step - loss: 0.6581
Epoch 368/400
160/160 [=====] - 0s 588us/step - loss: 0.6583
Epoch 369/400
160/160 [=====] - 0s 774us/step - loss: 0.6568
Epoch 370/400
160/160 [=====] - 0s 750us/step - loss: 0.6557
Epoch 371/400
160/160 [=====] - 0s 671us/step - loss: 0.6552
Epoch 372/400
160/160 [=====] - 0s 680us/step - loss: 0.6534
Epoch 373/400
160/160 [=====] - 0s 678us/step - loss: 0.6532
Epoch 374/400
160/160 [=====] - 0s 670us/step - loss: 0.6525
Epoch 375/400
160/160 [=====] - 0s 697us/step - loss: 0.6513
Epoch 376/400
160/160 [=====] - 0s 631us/step - loss: 0.6504
Epoch 377/400
160/160 [=====] - 0s 623us/step - loss: 0.6495
Epoch 378/400
160/160 [=====] - 0s 685us/step - loss: 0.6494
Epoch 379/400
160/160 [=====] - 0s 608us/step - loss: 0.6464
Epoch 380/400
160/160 [=====] - 0s 620us/step - loss: 0.6468
Epoch 381/400
160/160 [=====] - 0s 616us/step - loss: 0.6451
Epoch 382/400
160/160 [=====] - 0s 665us/step - loss: 0.6444
Epoch 383/400
160/160 [=====] - 0s 648us/step - loss: 0.6428
Epoch 384/400
160/160 [=====] - 0s 643us/step - loss: 0.6419
Epoch 385/400
160/160 [=====] - 0s 615us/step - loss: 0.6396
Epoch 386/400
160/160 [=====] - 0s 627us/step - loss: 0.6395
Epoch 387/400
160/160 [=====] - 0s 624us/step - loss: 0.6375

Epoch 388/400
160/160 [=====] - 0s 618us/step - loss: 0.6364
Epoch 389/400
160/160 [=====] - 0s 655us/step - loss: 0.6355
Epoch 390/400
160/160 [=====] - 0s 653us/step - loss: 0.6340
Epoch 391/400
160/160 [=====] - 0s 616us/step - loss: 0.6322
Epoch 392/400
160/160 [=====] - 0s 622us/step - loss: 0.6314
Epoch 393/400
160/160 [=====] - 0s 621us/step - loss: 0.6294
Epoch 394/400
160/160 [=====] - 0s 626us/step - loss: 0.6290
Epoch 395/400
160/160 [=====] - 0s 658us/step - loss: 0.6273
Epoch 396/400
160/160 [=====] - 0s 626us/step - loss: 0.6258
Epoch 397/400
160/160 [=====] - 0s 620us/step - loss: 0.6240
Epoch 398/400
160/160 [=====] - 0s 682us/step - loss: 0.6229
Epoch 399/400
160/160 [=====] - 0s 744us/step - loss: 0.6211
Epoch 400/400
160/160 [=====] - 0s 756us/step - loss: 0.6200
[0.511226 0.58493435 0.53446686 0.5831895 0.5837406 0.5383451
0.5725713 0.33353025 0.5796412 0.5283384 0.57941645 0.5823308
0.5294975 0.48694932 0.5551263 0.59429294 0.5838292 0.5264801
0.5806481 0.4048334 0.50057244 0.57351863 0.58701086 0.5818642
0.57704175 0.5643991 0.478306 0.53089136 0.5352174 0.5646883
0.4148518 0.58927095 0.5743464 0.56639314 0.50071293 0.58039635
0.5916374 0.5668883 0.58170885 0.5687565 0.6024993 0.5462431
0.6044104 0.5608898 0.5320253 0.60490364 0.5896302 0.6089039
0.581519 0.60590297 0.5763765 0.5600732 0.6044355 0.6041618
0.59801245 0.33935463 0.57554674 0.6056085 0.56067336 0.606905
0.60902846 0.5862175 0.5685369 0.5731401 0.5773391 0.5927043
0.6093761 0.60796696 0.6066973 0.59570986 0.6085048 0.5460201
0.5876017 0.59471697 0.60687655 0.5673322 0.469553 0.5931336
0.5728855 0.591682 0.46752378 0.23995134 0.24353921 0.251053
0.17661269 0.20293337 0.3140182 0.27831367 0.5067689 0.20615812
0.24713577 0.21329555 0.26950836 0.4432322 0.40304834 0.33791488
0.54360735 0.22483604 0.17353043 0.3844635 0.16035715 0.15515324
0.549371 0.34239224 0.16757691 0.5236499 0.16699623 0.14994952
0.16437298 0.30150783 0.2561311 0.4529546 0.41790235 0.3017137
0.23883308 0.19354334 0.3315007 0.42555022 0.32490572 0.45911133
0.6032736 0.59987545 0.60508376 0.6004505 0.5993407 0.6050012
0.6021694 0.608546 0.5976438 0.6054121 0.6013187 0.6004862

```

0.60516465 0.6045095 0.6027761 0.5943398 0.5939266 0.6054465
0.60033906 0.60686195 0.60616934 0.60144806 0.5925509 0.6005546
0.60111237 0.5980892 0.6067403 0.6049853 0.60500574 0.6030445
0.60763854 0.5973874 0.60091376 0.6028905 0.6061686 0.60079247
0.59708214 0.6015519 0.60068434 0.6006651 ]
160/160 [=====] - 0s 1ms/step

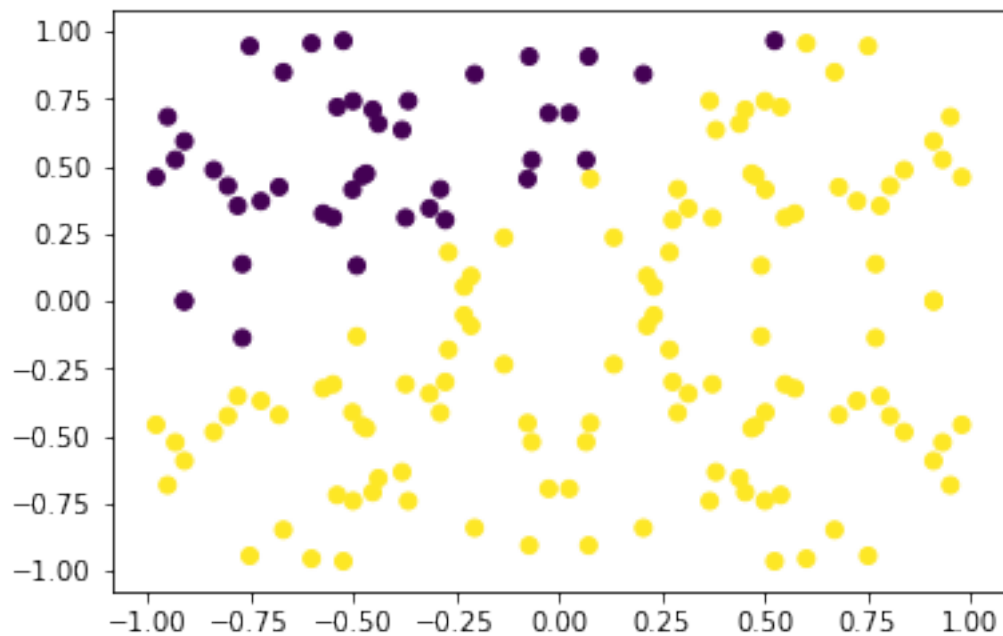
```

```
In [46]: scores, model.metrics_names
```

```
Out[46]: (0.6166699588298797, ['loss'])
```

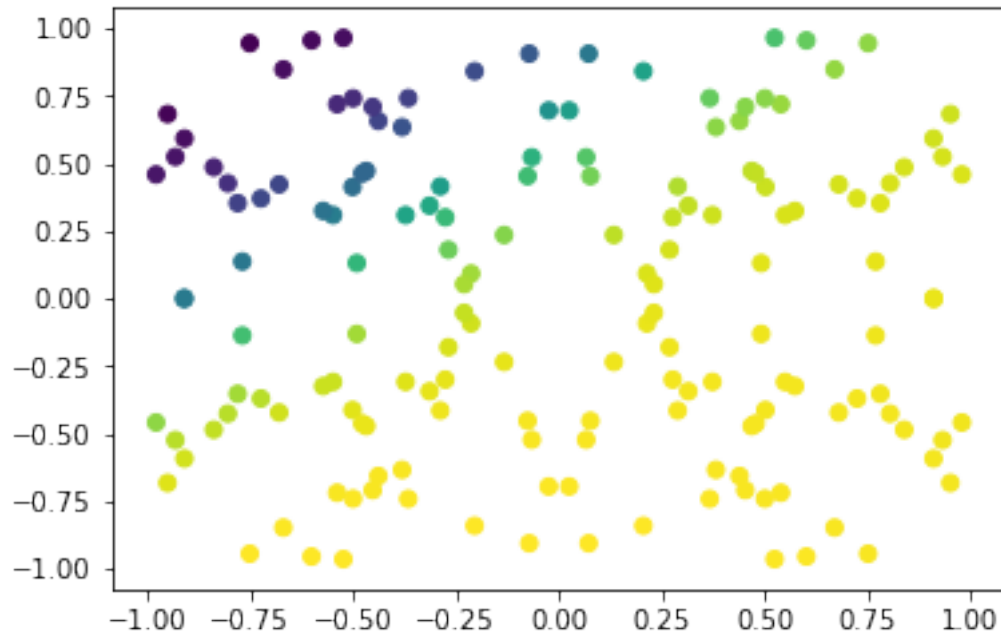
```
In [47]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[47]: <matplotlib.collections.PathCollection at 0xb273c6be0>
```



```
In [48]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[48]: <matplotlib.collections.PathCollection at 0xb273f4080>
```



```
In [49]: # Softplus 2
model = Sequential()

model.add(Dense(2, input_dim=2, activation='softplus'))
model.add(Dense(2, activation='softplus'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='softplus'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 4ms/step - loss: 7.9712
Epoch 2/400
160/160 [=====] - 0s 564us/step - loss: 7.9712
Epoch 3/400
160/160 [=====] - 0s 564us/step - loss: 7.9712
Epoch 4/400
160/160 [=====] - 0s 579us/step - loss: 7.9712
Epoch 5/400
```

160/160 [=====] - 0s 572us/step - loss: 7.9712
Epoch 6/400
160/160 [=====] - 0s 570us/step - loss: 7.9712
Epoch 7/400
160/160 [=====] - 0s 565us/step - loss: 7.9712
Epoch 8/400
160/160 [=====] - 0s 574us/step - loss: 7.9712
Epoch 9/400
160/160 [=====] - 0s 566us/step - loss: 7.9712
Epoch 10/400
160/160 [=====] - 0s 567us/step - loss: 7.9712
Epoch 11/400
160/160 [=====] - 0s 575us/step - loss: 7.9712
Epoch 12/400
160/160 [=====] - 0s 565us/step - loss: 7.9712
Epoch 13/400
160/160 [=====] - 0s 610us/step - loss: 7.9712
Epoch 14/400
160/160 [=====] - 0s 589us/step - loss: 7.9712
Epoch 15/400
160/160 [=====] - 0s 576us/step - loss: 7.9712
Epoch 16/400
160/160 [=====] - 0s 581us/step - loss: 7.9712
Epoch 17/400
160/160 [=====] - 0s 571us/step - loss: 7.9712
Epoch 18/400
160/160 [=====] - 0s 583us/step - loss: 7.9712
Epoch 19/400
160/160 [=====] - 0s 592us/step - loss: 7.9712
Epoch 20/400
160/160 [=====] - 0s 573us/step - loss: 7.9712
Epoch 21/400
160/160 [=====] - 0s 635us/step - loss: 7.9712
Epoch 22/400
160/160 [=====] - 0s 675us/step - loss: 7.9712
Epoch 23/400
160/160 [=====] - 0s 739us/step - loss: 7.9712
Epoch 24/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 25/400
160/160 [=====] - 0s 589us/step - loss: 7.9712
Epoch 26/400
160/160 [=====] - 0s 576us/step - loss: 7.9712
Epoch 27/400
160/160 [=====] - 0s 577us/step - loss: 7.9712
Epoch 28/400
160/160 [=====] - 0s 590us/step - loss: 7.9712
Epoch 29/400

160/160 [=====] - 0s 595us/step - loss: 7.9712
Epoch 30/400
160/160 [=====] - 0s 599us/step - loss: 7.9712
Epoch 31/400
160/160 [=====] - 0s 601us/step - loss: 7.9712
Epoch 32/400
160/160 [=====] - 0s 601us/step - loss: 7.9712
Epoch 33/400
160/160 [=====] - 0s 579us/step - loss: 7.9712
Epoch 34/400
160/160 [=====] - 0s 568us/step - loss: 7.9712
Epoch 35/400
160/160 [=====] - 0s 583us/step - loss: 7.9712
Epoch 36/400
160/160 [=====] - 0s 564us/step - loss: 7.9712
Epoch 37/400
160/160 [=====] - 0s 575us/step - loss: 7.9712
Epoch 38/400
160/160 [=====] - 0s 562us/step - loss: 7.9712
Epoch 39/400
160/160 [=====] - 0s 575us/step - loss: 7.9712
Epoch 40/400
160/160 [=====] - 0s 594us/step - loss: 7.9712
Epoch 41/400
160/160 [=====] - 0s 594us/step - loss: 7.9712
Epoch 42/400
160/160 [=====] - 0s 567us/step - loss: 7.9712
Epoch 43/400
160/160 [=====] - 0s 578us/step - loss: 7.9712
Epoch 44/400
160/160 [=====] - 0s 580us/step - loss: 7.9712
Epoch 45/400
160/160 [=====] - 0s 579us/step - loss: 7.9712
Epoch 46/400
160/160 [=====] - 0s 577us/step - loss: 7.9712
Epoch 47/400
160/160 [=====] - 0s 565us/step - loss: 7.9712
Epoch 48/400
160/160 [=====] - 0s 549us/step - loss: 7.9712
Epoch 49/400
160/160 [=====] - 0s 605us/step - loss: 7.9712
Epoch 50/400
160/160 [=====] - 0s 573us/step - loss: 7.9712
Epoch 51/400
160/160 [=====] - 0s 568us/step - loss: 7.9712
Epoch 52/400
160/160 [=====] - 0s 554us/step - loss: 7.9712
Epoch 53/400

160/160 [=====] - 0s 573us/step - loss: 7.9712
Epoch 54/400
160/160 [=====] - 0s 619us/step - loss: 7.9712
Epoch 55/400
160/160 [=====] - 0s 693us/step - loss: 7.9712
Epoch 56/400
160/160 [=====] - 0s 894us/step - loss: 7.9712
Epoch 57/400
160/160 [=====] - 0s 763us/step - loss: 7.9712
Epoch 58/400
160/160 [=====] - 0s 615us/step - loss: 7.9712
Epoch 59/400
160/160 [=====] - 0s 696us/step - loss: 7.9712
Epoch 60/400
160/160 [=====] - 0s 689us/step - loss: 7.9712
Epoch 61/400
160/160 [=====] - 0s 814us/step - loss: 7.9712
Epoch 62/400
160/160 [=====] - 0s 635us/step - loss: 7.9712
Epoch 63/400
160/160 [=====] - 0s 619us/step - loss: 7.9712
Epoch 64/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 65/400
160/160 [=====] - 0s 603us/step - loss: 7.9712
Epoch 66/400
160/160 [=====] - 0s 556us/step - loss: 7.9712
Epoch 67/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 68/400
160/160 [=====] - 0s 552us/step - loss: 7.9712
Epoch 69/400
160/160 [=====] - 0s 560us/step - loss: 7.9712
Epoch 70/400
160/160 [=====] - 0s 530us/step - loss: 7.9712
Epoch 71/400
160/160 [=====] - 0s 529us/step - loss: 7.9712
Epoch 72/400
160/160 [=====] - 0s 539us/step - loss: 7.9712
Epoch 73/400
160/160 [=====] - 0s 562us/step - loss: 7.9712
Epoch 74/400
160/160 [=====] - 0s 541us/step - loss: 7.9712
Epoch 75/400
160/160 [=====] - 0s 550us/step - loss: 7.9712
Epoch 76/400
160/160 [=====] - 0s 531us/step - loss: 7.9712
Epoch 77/400

160/160 [=====] - 0s 554us/step - loss: 7.9712
Epoch 78/400
160/160 [=====] - 0s 531us/step - loss: 7.9712
Epoch 79/400
160/160 [=====] - 0s 532us/step - loss: 7.9712
Epoch 80/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 81/400
160/160 [=====] - 0s 551us/step - loss: 7.9712
Epoch 82/400
160/160 [=====] - 0s 551us/step - loss: 7.9712
Epoch 83/400
160/160 [=====] - 0s 533us/step - loss: 7.9712
Epoch 84/400
160/160 [=====] - 0s 532us/step - loss: 7.9712
Epoch 85/400
160/160 [=====] - 0s 534us/step - loss: 7.9712
Epoch 86/400
160/160 [=====] - 0s 531us/step - loss: 7.9712
Epoch 87/400
160/160 [=====] - 0s 527us/step - loss: 7.9712
Epoch 88/400
160/160 [=====] - 0s 553us/step - loss: 7.9712
Epoch 89/400
160/160 [=====] - 0s 531us/step - loss: 7.9712
Epoch 90/400
160/160 [=====] - 0s 530us/step - loss: 7.9712
Epoch 91/400
160/160 [=====] - 0s 525us/step - loss: 7.9712
Epoch 92/400
160/160 [=====] - 0s 527us/step - loss: 7.9712
Epoch 93/400
160/160 [=====] - 0s 521us/step - loss: 7.9712
Epoch 94/400
160/160 [=====] - 0s 525us/step - loss: 7.9712
Epoch 95/400
160/160 [=====] - 0s 673us/step - loss: 7.9712
Epoch 96/400
160/160 [=====] - 0s 539us/step - loss: 7.9712
Epoch 97/400
160/160 [=====] - 0s 533us/step - loss: 7.9712
Epoch 98/400
160/160 [=====] - 0s 504us/step - loss: 7.9712
Epoch 99/400
160/160 [=====] - 0s 503us/step - loss: 7.9712
Epoch 100/400
160/160 [=====] - 0s 521us/step - loss: 7.9712
Epoch 101/400

160/160 [=====] - 0s 547us/step - loss: 7.9712
Epoch 102/400
160/160 [=====] - 0s 544us/step - loss: 7.9712
Epoch 103/400
160/160 [=====] - 0s 531us/step - loss: 7.9712
Epoch 104/400
160/160 [=====] - 0s 546us/step - loss: 7.9712
Epoch 105/400
160/160 [=====] - 0s 533us/step - loss: 7.9712
Epoch 106/400
160/160 [=====] - 0s 526us/step - loss: 7.9712
Epoch 107/400
160/160 [=====] - 0s 559us/step - loss: 7.9712
Epoch 108/400
160/160 [=====] - 0s 550us/step - loss: 7.9712
Epoch 109/400
160/160 [=====] - 0s 534us/step - loss: 7.9712
Epoch 110/400
160/160 [=====] - 0s 552us/step - loss: 7.9712
Epoch 111/400
160/160 [=====] - 0s 555us/step - loss: 7.9712
Epoch 112/400
160/160 [=====] - 0s 559us/step - loss: 7.9712
Epoch 113/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 114/400
160/160 [=====] - 0s 531us/step - loss: 7.9712
Epoch 115/400
160/160 [=====] - 0s 532us/step - loss: 7.9712
Epoch 116/400
160/160 [=====] - 0s 540us/step - loss: 7.9712
Epoch 117/400
160/160 [=====] - 0s 525us/step - loss: 7.9712
Epoch 118/400
160/160 [=====] - 0s 546us/step - loss: 7.9712
Epoch 119/400
160/160 [=====] - 0s 536us/step - loss: 7.9712
Epoch 120/400
160/160 [=====] - 0s 539us/step - loss: 7.9712
Epoch 121/400
160/160 [=====] - 0s 526us/step - loss: 7.9712
Epoch 122/400
160/160 [=====] - 0s 559us/step - loss: 7.9712
Epoch 123/400
160/160 [=====] - 0s 557us/step - loss: 7.9712
Epoch 124/400
160/160 [=====] - 0s 535us/step - loss: 7.9712
Epoch 125/400

160/160 [=====] - 0s 546us/step - loss: 7.9712
 Epoch 126/400
 160/160 [=====] - 0s 539us/step - loss: 7.9712
 Epoch 127/400
 160/160 [=====] - 0s 541us/step - loss: 7.9712
 Epoch 128/400
 160/160 [=====] - 0s 537us/step - loss: 7.9712
 Epoch 129/400
 160/160 [=====] - 0s 501us/step - loss: 7.9712
 Epoch 130/400
 160/160 [=====] - 0s 502us/step - loss: 7.9712
 Epoch 131/400
 160/160 [=====] - 0s 517us/step - loss: 7.9712
 Epoch 132/400
 160/160 [=====] - 0s 508us/step - loss: 7.9712
 Epoch 133/400
 160/160 [=====] - 0s 495us/step - loss: 7.9712
 Epoch 134/400
 160/160 [=====] - 0s 518us/step - loss: 7.9712
 Epoch 135/400
 160/160 [=====] - 0s 529us/step - loss: 7.9712
 Epoch 136/400
 160/160 [=====] - 0s 523us/step - loss: 7.9712
 Epoch 137/400
 160/160 [=====] - 0s 540us/step - loss: 7.9712
 Epoch 138/400
 160/160 [=====] - 0s 536us/step - loss: 7.9712
 Epoch 139/400
 160/160 [=====] - 0s 531us/step - loss: 7.9712
 Epoch 140/400
 160/160 [=====] - 0s 534us/step - loss: 7.9712
 Epoch 141/400
 160/160 [=====] - 0s 537us/step - loss: 7.9712
 Epoch 142/400
 160/160 [=====] - 0s 545us/step - loss: 7.9712
 Epoch 143/400
 160/160 [=====] - 0s 527us/step - loss: 7.9712
 Epoch 144/400
 160/160 [=====] - 0s 540us/step - loss: 7.9712
 Epoch 145/400
 160/160 [=====] - 0s 534us/step - loss: 7.9712
 Epoch 146/400
 160/160 [=====] - 0s 539us/step - loss: 7.9712
 Epoch 147/400
 160/160 [=====] - 0s 529us/step - loss: 7.9712
 Epoch 148/400
 160/160 [=====] - 0s 542us/step - loss: 7.9712
 Epoch 149/400

160/160 [=====] - 0s 531us/step - loss: 7.9712
Epoch 150/400
160/160 [=====] - 0s 539us/step - loss: 7.9712
Epoch 151/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 152/400
160/160 [=====] - 0s 536us/step - loss: 7.9712
Epoch 153/400
160/160 [=====] - 0s 535us/step - loss: 7.9712
Epoch 154/400
160/160 [=====] - 0s 533us/step - loss: 7.9712
Epoch 155/400
160/160 [=====] - 0s 522us/step - loss: 7.9712
Epoch 156/400
160/160 [=====] - 0s 542us/step - loss: 7.9712
Epoch 157/400
160/160 [=====] - 0s 511us/step - loss: 7.9712
Epoch 158/400
160/160 [=====] - 0s 508us/step - loss: 7.9712
Epoch 159/400
160/160 [=====] - 0s 509us/step - loss: 7.9712
Epoch 160/400
160/160 [=====] - 0s 614us/step - loss: 7.9712
Epoch 161/400
160/160 [=====] - 0s 505us/step - loss: 7.9712
Epoch 162/400
160/160 [=====] - 0s 499us/step - loss: 7.9712
Epoch 163/400
160/160 [=====] - 0s 514us/step - loss: 7.9712
Epoch 164/400
160/160 [=====] - 0s 519us/step - loss: 7.9712
Epoch 165/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 166/400
160/160 [=====] - 0s 552us/step - loss: 7.9712
Epoch 167/400
160/160 [=====] - 0s 533us/step - loss: 7.9712
Epoch 168/400
160/160 [=====] - 0s 535us/step - loss: 7.9712
Epoch 169/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 170/400
160/160 [=====] - 0s 540us/step - loss: 7.9712
Epoch 171/400
160/160 [=====] - 0s 537us/step - loss: 7.9712
Epoch 172/400
160/160 [=====] - 0s 536us/step - loss: 7.9712
Epoch 173/400

160/160 [=====] - 0s 527us/step - loss: 7.9712
Epoch 174/400
160/160 [=====] - 0s 535us/step - loss: 7.9712
Epoch 175/400
160/160 [=====] - 0s 533us/step - loss: 7.9712
Epoch 176/400
160/160 [=====] - 0s 532us/step - loss: 7.9712
Epoch 177/400
160/160 [=====] - 0s 533us/step - loss: 7.9712
Epoch 178/400
160/160 [=====] - 0s 546us/step - loss: 7.9712
Epoch 179/400
160/160 [=====] - 0s 535us/step - loss: 7.9712
Epoch 180/400
160/160 [=====] - 0s 572us/step - loss: 7.9712
Epoch 181/400
160/160 [=====] - 0s 741us/step - loss: 7.9712
Epoch 182/400
160/160 [=====] - 0s 542us/step - loss: 7.9712
Epoch 183/400
160/160 [=====] - 0s 571us/step - loss: 7.9712
Epoch 184/400
160/160 [=====] - 0s 577us/step - loss: 7.9712
Epoch 185/400
160/160 [=====] - 0s 580us/step - loss: 7.9712
Epoch 186/400
160/160 [=====] - 0s 597us/step - loss: 7.9712
Epoch 187/400
160/160 [=====] - 0s 589us/step - loss: 7.9712
Epoch 188/400
160/160 [=====] - 0s 610us/step - loss: 7.9712
Epoch 189/400
160/160 [=====] - 0s 602us/step - loss: 7.9712
Epoch 190/400
160/160 [=====] - 0s 604us/step - loss: 7.9712
Epoch 191/400
160/160 [=====] - 0s 624us/step - loss: 7.9712
Epoch 192/400
160/160 [=====] - 0s 629us/step - loss: 7.9712
Epoch 193/400
160/160 [=====] - 0s 614us/step - loss: 7.9712
Epoch 194/400
160/160 [=====] - 0s 626us/step - loss: 7.9712
Epoch 195/400
160/160 [=====] - 0s 602us/step - loss: 7.9712
Epoch 196/400
160/160 [=====] - 0s 573us/step - loss: 7.9712
Epoch 197/400

160/160 [=====] - 0s 534us/step - loss: 7.9712
Epoch 198/400
160/160 [=====] - 0s 573us/step - loss: 7.9712
Epoch 199/400
160/160 [=====] - 0s 568us/step - loss: 7.9712
Epoch 200/400
160/160 [=====] - 0s 558us/step - loss: 7.9712
Epoch 201/400
160/160 [=====] - 0s 586us/step - loss: 7.9712
Epoch 202/400
160/160 [=====] - 0s 568us/step - loss: 7.9712
Epoch 203/400
160/160 [=====] - 0s 532us/step - loss: 7.9712
Epoch 204/400
160/160 [=====] - 0s 548us/step - loss: 7.9712
Epoch 205/400
160/160 [=====] - 0s 544us/step - loss: 7.9712
Epoch 206/400
160/160 [=====] - 0s 559us/step - loss: 7.9712
Epoch 207/400
160/160 [=====] - 0s 547us/step - loss: 7.9712
Epoch 208/400
160/160 [=====] - 0s 634us/step - loss: 7.9712
Epoch 209/400
160/160 [=====] - 0s 553us/step - loss: 7.9712
Epoch 210/400
160/160 [=====] - 0s 565us/step - loss: 7.9712
Epoch 211/400
160/160 [=====] - 0s 581us/step - loss: 7.9712
Epoch 212/400
160/160 [=====] - 0s 554us/step - loss: 7.9712
Epoch 213/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 214/400
160/160 [=====] - 0s 563us/step - loss: 7.9712
Epoch 215/400
160/160 [=====] - 0s 596us/step - loss: 7.9712
Epoch 216/400
160/160 [=====] - 0s 583us/step - loss: 7.9712
Epoch 217/400
160/160 [=====] - 0s 532us/step - loss: 7.9712
Epoch 218/400
160/160 [=====] - 0s 560us/step - loss: 7.9712
Epoch 219/400
160/160 [=====] - 0s 544us/step - loss: 7.9712
Epoch 220/400
160/160 [=====] - 0s 555us/step - loss: 7.9712
Epoch 221/400

160/160 [=====] - 0s 534us/step - loss: 7.9712
Epoch 222/400
160/160 [=====] - 0s 551us/step - loss: 7.9712
Epoch 223/400
160/160 [=====] - 0s 579us/step - loss: 7.9712
Epoch 224/400
160/160 [=====] - 0s 577us/step - loss: 7.9712
Epoch 225/400
160/160 [=====] - 0s 597us/step - loss: 7.9712
Epoch 226/400
160/160 [=====] - 0s 590us/step - loss: 7.9712
Epoch 227/400
160/160 [=====] - 0s 593us/step - loss: 7.9712
Epoch 228/400
160/160 [=====] - 0s 593us/step - loss: 7.9712
Epoch 229/400
160/160 [=====] - 0s 648us/step - loss: 7.9712
Epoch 230/400
160/160 [=====] - 0s 595us/step - loss: 7.9712
Epoch 231/400
160/160 [=====] - 0s 628us/step - loss: 7.9712
Epoch 232/400
160/160 [=====] - 0s 603us/step - loss: 7.9712
Epoch 233/400
160/160 [=====] - 0s 596us/step - loss: 7.9712
Epoch 234/400
160/160 [=====] - 0s 621us/step - loss: 7.9712
Epoch 235/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 236/400
160/160 [=====] - 0s 601us/step - loss: 7.9712
Epoch 237/400
160/160 [=====] - 0s 686us/step - loss: 7.9712
Epoch 238/400
160/160 [=====] - 0s 550us/step - loss: 7.9712
Epoch 239/400
160/160 [=====] - 0s 567us/step - loss: 7.9712
Epoch 240/400
160/160 [=====] - 0s 550us/step - loss: 7.9712
Epoch 241/400
160/160 [=====] - 0s 588us/step - loss: 7.9712
Epoch 242/400
160/160 [=====] - 0s 522us/step - loss: 7.9712
Epoch 243/400
160/160 [=====] - 0s 552us/step - loss: 7.9712
Epoch 244/400
160/160 [=====] - 0s 593us/step - loss: 7.9712
Epoch 245/400

160/160 [=====] - 0s 559us/step - loss: 7.9712
Epoch 246/400
160/160 [=====] - 0s 553us/step - loss: 7.9712
Epoch 247/400
160/160 [=====] - 0s 573us/step - loss: 7.9712
Epoch 248/400
160/160 [=====] - 0s 596us/step - loss: 7.9712
Epoch 249/400
160/160 [=====] - 0s 597us/step - loss: 7.9712
Epoch 250/400
160/160 [=====] - 0s 532us/step - loss: 7.9712
Epoch 251/400
160/160 [=====] - 0s 546us/step - loss: 7.9712
Epoch 252/400
160/160 [=====] - 0s 545us/step - loss: 7.9712
Epoch 253/400
160/160 [=====] - 0s 640us/step - loss: 7.9712
Epoch 254/400
160/160 [=====] - 0s 736us/step - loss: 7.9712
Epoch 255/400
160/160 [=====] - 0s 548us/step - loss: 7.9712
Epoch 256/400
160/160 [=====] - 0s 589us/step - loss: 7.9712
Epoch 257/400
160/160 [=====] - 0s 612us/step - loss: 7.9712
Epoch 258/400
160/160 [=====] - 0s 566us/step - loss: 7.9712
Epoch 259/400
160/160 [=====] - 0s 622us/step - loss: 7.9712
Epoch 260/400
160/160 [=====] - 0s 618us/step - loss: 7.9712
Epoch 261/400
160/160 [=====] - 0s 616us/step - loss: 7.9712
Epoch 262/400
160/160 [=====] - 0s 613us/step - loss: 7.9712
Epoch 263/400
160/160 [=====] - 0s 601us/step - loss: 7.9712
Epoch 264/400
160/160 [=====] - 0s 566us/step - loss: 7.9712
Epoch 265/400
160/160 [=====] - 0s 536us/step - loss: 7.9712
Epoch 266/400
160/160 [=====] - 0s 531us/step - loss: 7.9712
Epoch 267/400
160/160 [=====] - 0s 543us/step - loss: 7.9712
Epoch 268/400
160/160 [=====] - 0s 536us/step - loss: 7.9712
Epoch 269/400

160/160 [=====] - 0s 545us/step - loss: 7.9712
Epoch 270/400
160/160 [=====] - 0s 552us/step - loss: 7.9712
Epoch 271/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 272/400
160/160 [=====] - 0s 551us/step - loss: 7.9712
Epoch 273/400
160/160 [=====] - 0s 589us/step - loss: 7.9712
Epoch 274/400
160/160 [=====] - 0s 549us/step - loss: 7.9712
Epoch 275/400
160/160 [=====] - 0s 597us/step - loss: 7.9712
Epoch 276/400
160/160 [=====] - 0s 620us/step - loss: 7.9712
Epoch 277/400
160/160 [=====] - 0s 620us/step - loss: 7.9712
Epoch 278/400
160/160 [=====] - 0s 600us/step - loss: 7.9712
Epoch 279/400
160/160 [=====] - 0s 594us/step - loss: 7.9712
Epoch 280/400
160/160 [=====] - 0s 661us/step - loss: 7.9712
Epoch 281/400
160/160 [=====] - 0s 633us/step - loss: 7.9712
Epoch 282/400
160/160 [=====] - 0s 611us/step - loss: 7.9712
Epoch 283/400
160/160 [=====] - 0s 650us/step - loss: 7.9712
Epoch 284/400
160/160 [=====] - 0s 595us/step - loss: 7.9712
Epoch 285/400
160/160 [=====] - 0s 583us/step - loss: 7.9712
Epoch 286/400
160/160 [=====] - 0s 601us/step - loss: 7.9712
Epoch 287/400
160/160 [=====] - 0s 554us/step - loss: 7.9712
Epoch 288/400
160/160 [=====] - 0s 539us/step - loss: 7.9712
Epoch 289/400
160/160 [=====] - 0s 573us/step - loss: 7.9712
Epoch 290/400
160/160 [=====] - 0s 541us/step - loss: 7.9712
Epoch 291/400
160/160 [=====] - 0s 535us/step - loss: 7.9712
Epoch 292/400
160/160 [=====] - 0s 535us/step - loss: 7.9712
Epoch 293/400

160/160 [=====] - 0s 567us/step - loss: 7.9712
Epoch 294/400
160/160 [=====] - 0s 553us/step - loss: 7.9712
Epoch 295/400
160/160 [=====] - 0s 518us/step - loss: 7.9712
Epoch 296/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 297/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 298/400
160/160 [=====] - 0s 556us/step - loss: 7.9712
Epoch 299/400
160/160 [=====] - 0s 496us/step - loss: 7.9712
Epoch 300/400
160/160 [=====] - 0s 612us/step - loss: 7.9712
Epoch 301/400
160/160 [=====] - 0s 621us/step - loss: 7.9712
Epoch 302/400
160/160 [=====] - 0s 566us/step - loss: 7.9712
Epoch 303/400
160/160 [=====] - 0s 554us/step - loss: 7.9712
Epoch 304/400
160/160 [=====] - 0s 589us/step - loss: 7.9712
Epoch 305/400
160/160 [=====] - 0s 548us/step - loss: 7.9712
Epoch 306/400
160/160 [=====] - 0s 615us/step - loss: 7.9712
Epoch 307/400
160/160 [=====] - 0s 577us/step - loss: 7.9712
Epoch 308/400
160/160 [=====] - 0s 551us/step - loss: 7.9712
Epoch 309/400
160/160 [=====] - 0s 561us/step - loss: 7.9712
Epoch 310/400
160/160 [=====] - 0s 603us/step - loss: 7.9712
Epoch 311/400
160/160 [=====] - 0s 582us/step - loss: 7.9712
Epoch 312/400
160/160 [=====] - 0s 557us/step - loss: 7.9712
Epoch 313/400
160/160 [=====] - 0s 618us/step - loss: 7.9712
Epoch 314/400
160/160 [=====] - 0s 547us/step - loss: 7.9712
Epoch 315/400
160/160 [=====] - 0s 549us/step - loss: 7.9712
Epoch 316/400
160/160 [=====] - 0s 563us/step - loss: 7.9712
Epoch 317/400

160/160 [=====] - 0s 619us/step - loss: 7.9712
Epoch 318/400
160/160 [=====] - 0s 647us/step - loss: 7.9712
Epoch 319/400
160/160 [=====] - 0s 638us/step - loss: 7.9712
Epoch 320/400
160/160 [=====] - 0s 631us/step - loss: 7.9712
Epoch 321/400
160/160 [=====] - 0s 634us/step - loss: 7.9712
Epoch 322/400
160/160 [=====] - 0s 714us/step - loss: 7.9712
Epoch 323/400
160/160 [=====] - 0s 674us/step - loss: 7.9712
Epoch 324/400
160/160 [=====] - 0s 555us/step - loss: 7.9712
Epoch 325/400
160/160 [=====] - 0s 622us/step - loss: 7.9712
Epoch 326/400
160/160 [=====] - 0s 731us/step - loss: 7.9712
Epoch 327/400
160/160 [=====] - 0s 720us/step - loss: 7.9712
Epoch 328/400
160/160 [=====] - 0s 599us/step - loss: 7.9712
Epoch 329/400
160/160 [=====] - 0s 608us/step - loss: 7.9712
Epoch 330/400
160/160 [=====] - 0s 579us/step - loss: 7.9712
Epoch 331/400
160/160 [=====] - 0s 623us/step - loss: 7.9712
Epoch 332/400
160/160 [=====] - 0s 630us/step - loss: 7.9712
Epoch 333/400
160/160 [=====] - 0s 646us/step - loss: 7.9712
Epoch 334/400
160/160 [=====] - 0s 562us/step - loss: 7.9712
Epoch 335/400
160/160 [=====] - 0s 572us/step - loss: 7.9712
Epoch 336/400
160/160 [=====] - 0s 525us/step - loss: 7.9712
Epoch 337/400
160/160 [=====] - 0s 554us/step - loss: 7.9712
Epoch 338/400
160/160 [=====] - 0s 562us/step - loss: 7.9712
Epoch 339/400
160/160 [=====] - 0s 547us/step - loss: 7.9712
Epoch 340/400
160/160 [=====] - 0s 541us/step - loss: 7.9712
Epoch 341/400

160/160 [=====] - 0s 591us/step - loss: 7.9712
Epoch 342/400
160/160 [=====] - 0s 523us/step - loss: 7.9712
Epoch 343/400
160/160 [=====] - 0s 682us/step - loss: 7.9712
Epoch 344/400
160/160 [=====] - 0s 618us/step - loss: 7.9712
Epoch 345/400
160/160 [=====] - 0s 564us/step - loss: 7.9712
Epoch 346/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 347/400
160/160 [=====] - 0s 561us/step - loss: 7.9712
Epoch 348/400
160/160 [=====] - 0s 554us/step - loss: 7.9712
Epoch 349/400
160/160 [=====] - 0s 540us/step - loss: 7.9712
Epoch 350/400
160/160 [=====] - 0s 562us/step - loss: 7.9712
Epoch 351/400
160/160 [=====] - 0s 564us/step - loss: 7.9712
Epoch 352/400
160/160 [=====] - 0s 547us/step - loss: 7.9712
Epoch 353/400
160/160 [=====] - 0s 536us/step - loss: 7.9712
Epoch 354/400
160/160 [=====] - 0s 622us/step - loss: 7.9712
Epoch 355/400
160/160 [=====] - 0s 556us/step - loss: 7.9712
Epoch 356/400
160/160 [=====] - 0s 544us/step - loss: 7.9712
Epoch 357/400
160/160 [=====] - 0s 608us/step - loss: 7.9712
Epoch 358/400
160/160 [=====] - 0s 643us/step - loss: 7.9712
Epoch 359/400
160/160 [=====] - 0s 582us/step - loss: 7.9712
Epoch 360/400
160/160 [=====] - 0s 610us/step - loss: 7.9712
Epoch 361/400
160/160 [=====] - 0s 596us/step - loss: 7.9712
Epoch 362/400
160/160 [=====] - 0s 559us/step - loss: 7.9712
Epoch 363/400
160/160 [=====] - 0s 605us/step - loss: 7.9712
Epoch 364/400
160/160 [=====] - 0s 553us/step - loss: 7.9712
Epoch 365/400

160/160 [=====] - 0s 591us/step - loss: 7.9712
Epoch 366/400
160/160 [=====] - 0s 529us/step - loss: 7.9712
Epoch 367/400
160/160 [=====] - 0s 538us/step - loss: 7.9712
Epoch 368/400
160/160 [=====] - 0s 535us/step - loss: 7.9712
Epoch 369/400
160/160 [=====] - 0s 560us/step - loss: 7.9712
Epoch 370/400
160/160 [=====] - 0s 558us/step - loss: 7.9712
Epoch 371/400
160/160 [=====] - 0s 577us/step - loss: 7.9712
Epoch 372/400
160/160 [=====] - 0s 590us/step - loss: 7.9712
Epoch 373/400
160/160 [=====] - 0s 541us/step - loss: 7.9712
Epoch 374/400
160/160 [=====] - 0s 593us/step - loss: 7.9712
Epoch 375/400
160/160 [=====] - 0s 553us/step - loss: 7.9712
Epoch 376/400
160/160 [=====] - 0s 572us/step - loss: 7.9712
Epoch 377/400
160/160 [=====] - 0s 593us/step - loss: 7.9712
Epoch 378/400
160/160 [=====] - 0s 607us/step - loss: 7.9712
Epoch 379/400
160/160 [=====] - 0s 648us/step - loss: 7.9712
Epoch 380/400
160/160 [=====] - 0s 576us/step - loss: 7.9712
Epoch 381/400
160/160 [=====] - 0s 721us/step - loss: 7.9712
Epoch 382/400
160/160 [=====] - 0s 608us/step - loss: 7.9712
Epoch 383/400
160/160 [=====] - 0s 541us/step - loss: 7.9712
Epoch 384/400
160/160 [=====] - 0s 559us/step - loss: 7.9712
Epoch 385/400
160/160 [=====] - 0s 535us/step - loss: 7.9712
Epoch 386/400
160/160 [=====] - 0s 541us/step - loss: 7.9712
Epoch 387/400
160/160 [=====] - 0s 552us/step - loss: 7.9712
Epoch 388/400
160/160 [=====] - 0s 559us/step - loss: 7.9712
Epoch 389/400

```

160/160 [=====] - 0s 564us/step - loss: 7.9712
Epoch 390/400
160/160 [=====] - 0s 573us/step - loss: 7.9712
Epoch 391/400
160/160 [=====] - 0s 543us/step - loss: 7.9712
Epoch 392/400
160/160 [=====] - 0s 530us/step - loss: 7.9712
Epoch 393/400
160/160 [=====] - 0s 558us/step - loss: 7.9712
Epoch 394/400
160/160 [=====] - 0s 642us/step - loss: 7.9712
Epoch 395/400
160/160 [=====] - 0s 618us/step - loss: 7.9712
Epoch 396/400
160/160 [=====] - 0s 573us/step - loss: 7.9712
Epoch 397/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 398/400
160/160 [=====] - 0s 626us/step - loss: 7.9712
Epoch 399/400
160/160 [=====] - 0s 537us/step - loss: 7.9712
Epoch 400/400
160/160 [=====] - 0s 528us/step - loss: 7.9712
[1.0729334 1.0927265 1.094656 1.0909879 1.1048992 1.1012673 1.0841979
 1.1037649 1.0667139 1.1014915 1.091201 1.0963261 1.0916545 1.0766597
 1.0771494 1.0910422 1.0617442 1.0981796 1.105368 1.0869217 1.118701
 1.1131775 1.0611961 1.0818119 1.107366 1.0641537 1.1175145 1.121986
 1.1131713 1.0857371 1.1011782 1.0738142 1.0752794 1.0856239 1.0979224
 1.1000125 1.0862451 1.074723 1.0833168 1.0716065 1.0391002 1.0156101
 1.0221587 1.016787 1.007023 1.0176795 1.0230104 1.0404656 1.0365477
 1.0191753 1.016852 1.0129021 1.0246956 1.039072 1.0308288 1.0263424
 1.040964 1.0213089 1.0066992 1.0409831 1.0148977 1.0029869 1.0416638
 1.0238519 1.0059078 1.0400844 1.0184623 1.0083982 1.0118381 1.0231243
 1.0328941 1.0310348 1.0297451 1.0229273 1.0249634 1.0104109 1.0233561
 1.0311043 1.0226738 1.0333773 1.0690508 1.0492713 1.0761108 1.0512714
 1.0545259 1.0798589 1.057728 1.1014984 1.0498946 1.0821043 1.0554633
 1.0540398 1.0751835 1.0735031 1.0619981 1.0264853 1.0475669 1.0800533
 1.0600696 1.0859146 1.1008265 1.0733342 1.0455035 1.0503656 1.0658183
 1.0561299 1.1021987 1.0991493 1.0901448 1.0622333 1.0941573 1.0419517
 1.0539818 1.0614403 1.0837882 1.0580077 1.0363106 1.0572457 1.0508554
 1.0557353 1.045983 1.0828204 1.0657184 1.0796437 1.0960411 1.072694
 1.0674024 1.0484228 1.0575647 1.0707216 1.0773876 1.0847663 1.0621465
 1.0452234 1.0563492 1.0910108 1.0568475 1.067281 1.0940745 1.0434978
 1.0826268 1.0987921 1.0584165 1.069954 1.0939205 1.0508233 1.0777011
 1.0927293 1.0840913 1.0657729 1.0549207 1.068464 1.0610039 1.0662619
 1.0626856 1.0875393 1.0823637 1.0579329 1.0712045 1.0564377]
160/160 [=====] - 0s 965us/step

```

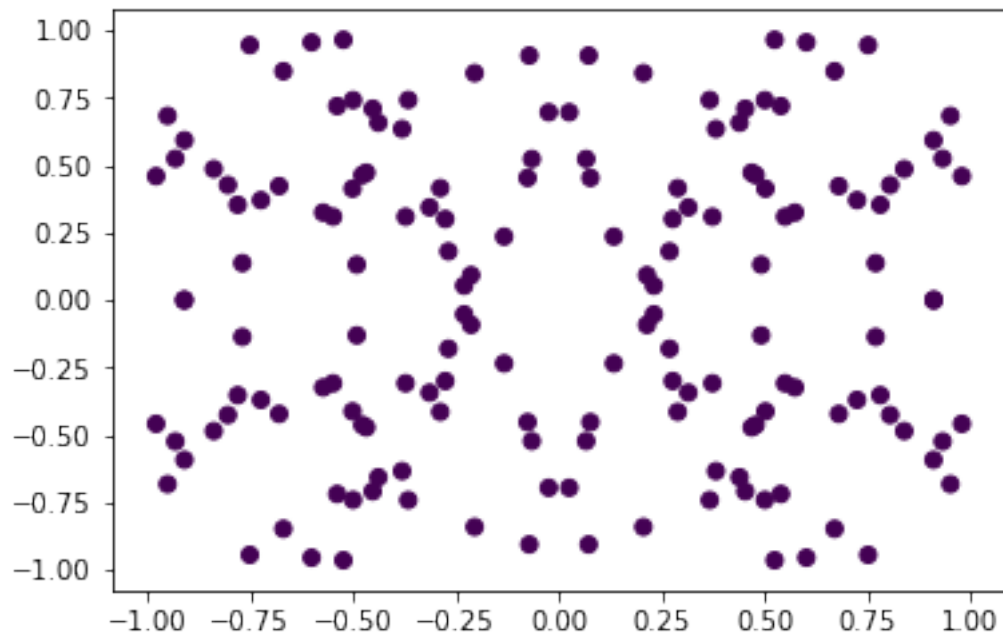
```
/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '
```

```
In [50]: scores, model.metrics_names
```

```
Out [50]: (7.971192407608049, ['loss'])
```

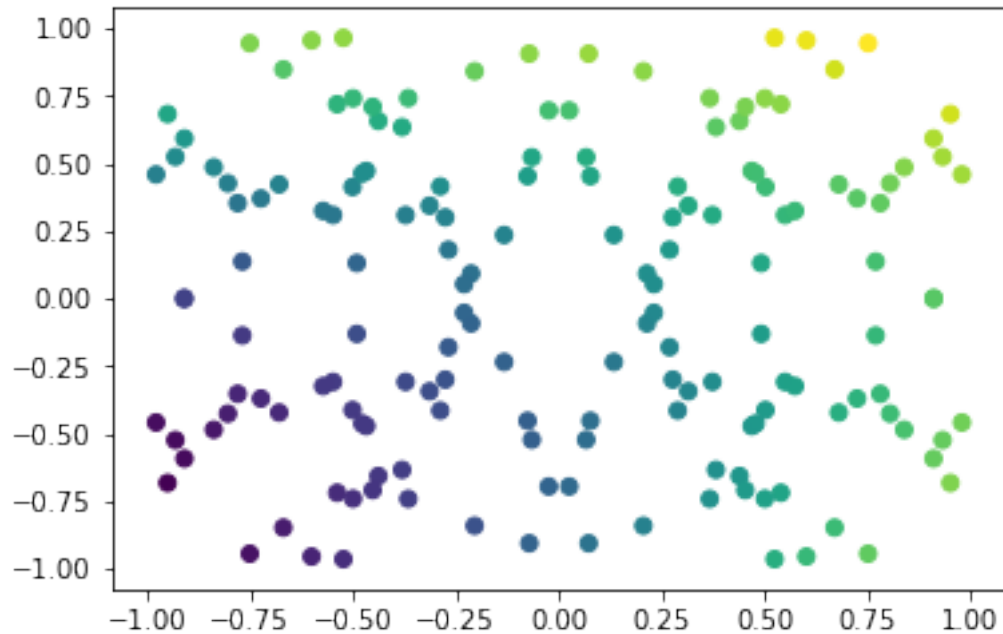
```
In [51]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out [51]: <matplotlib.collections.PathCollection at 0xb278ea588>
```



```
In [52]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out [52]: <matplotlib.collections.PathCollection at 0xb279c6940>
```



```
In [53]: # Softplus 3
model = Sequential()

model.add(Dense(2, input_dim=2, activation='softplus'))
model.add(Dense(2, activation='softplus'))
model.add(Dense(2, activation='softplus'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='softplus'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 4ms/step - loss: 0.6921
Epoch 2/400
160/160 [=====] - 0s 569us/step - loss: 0.6895
Epoch 3/400
160/160 [=====] - 0s 685us/step - loss: 0.6894
Epoch 4/400
160/160 [=====] - 0s 672us/step - loss: 0.6894
```

Epoch 5/400
160/160 [=====] - 0s 709us/step - loss: 0.6885
Epoch 6/400
160/160 [=====] - 0s 570us/step - loss: 0.6871
Epoch 7/400
160/160 [=====] - 0s 560us/step - loss: 0.6860
Epoch 8/400
160/160 [=====] - 0s 610us/step - loss: 0.6861
Epoch 9/400
160/160 [=====] - 0s 575us/step - loss: 0.6855
Epoch 10/400
160/160 [=====] - 0s 667us/step - loss: 0.6842
Epoch 11/400
160/160 [=====] - 0s 674us/step - loss: 0.6844
Epoch 12/400
160/160 [=====] - 0s 564us/step - loss: 0.6837
Epoch 13/400
160/160 [=====] - 0s 602us/step - loss: 0.6827
Epoch 14/400
160/160 [=====] - 0s 568us/step - loss: 0.6827
Epoch 15/400
160/160 [=====] - 0s 564us/step - loss: 0.6819
Epoch 16/400
160/160 [=====] - 0s 547us/step - loss: 0.6815
Epoch 17/400
160/160 [=====] - 0s 578us/step - loss: 0.6802
Epoch 18/400
160/160 [=====] - 0s 582us/step - loss: 0.6793
Epoch 19/400
160/160 [=====] - 0s 562us/step - loss: 0.6797
Epoch 20/400
160/160 [=====] - 0s 581us/step - loss: 0.6788
Epoch 21/400
160/160 [=====] - 0s 625us/step - loss: 0.6786
Epoch 22/400
160/160 [=====] - 0s 555us/step - loss: 0.6781
Epoch 23/400
160/160 [=====] - 0s 560us/step - loss: 0.6775
Epoch 24/400
160/160 [=====] - 0s 557us/step - loss: 0.6764
Epoch 25/400
160/160 [=====] - 0s 556us/step - loss: 0.6763
Epoch 26/400
160/160 [=====] - 0s 557us/step - loss: 0.6751
Epoch 27/400
160/160 [=====] - 0s 553us/step - loss: 0.6751
Epoch 28/400
160/160 [=====] - 0s 558us/step - loss: 0.6743

Epoch 29/400
160/160 [=====] - 0s 573us/step - loss: 0.6728
Epoch 30/400
160/160 [=====] - 0s 559us/step - loss: 0.6735
Epoch 31/400
160/160 [=====] - 0s 564us/step - loss: 0.6728
Epoch 32/400
160/160 [=====] - 0s 730us/step - loss: 0.6708
Epoch 33/400
160/160 [=====] - 0s 744us/step - loss: 0.6708
Epoch 34/400
160/160 [=====] - 0s 635us/step - loss: 0.6711
Epoch 35/400
160/160 [=====] - 0s 626us/step - loss: 0.6704
Epoch 36/400
160/160 [=====] - 0s 626us/step - loss: 0.6690
Epoch 37/400
160/160 [=====] - 0s 622us/step - loss: 0.6682
Epoch 38/400
160/160 [=====] - 0s 658us/step - loss: 0.6671
Epoch 39/400
160/160 [=====] - 0s 629us/step - loss: 0.6667
Epoch 40/400
160/160 [=====] - 0s 609us/step - loss: 0.6657
Epoch 41/400
160/160 [=====] - 0s 625us/step - loss: 0.6652
Epoch 42/400
160/160 [=====] - 0s 629us/step - loss: 0.6639
Epoch 43/400
160/160 [=====] - 0s 636us/step - loss: 0.6627
Epoch 44/400
160/160 [=====] - 0s 633us/step - loss: 0.6626
Epoch 45/400
160/160 [=====] - 0s 603us/step - loss: 0.6614
Epoch 46/400
160/160 [=====] - 0s 679us/step - loss: 0.6601
Epoch 47/400
160/160 [=====] - 0s 717us/step - loss: 0.6589
Epoch 48/400
160/160 [=====] - 0s 611us/step - loss: 0.6564
Epoch 49/400
160/160 [=====] - 0s 622us/step - loss: 0.6564
Epoch 50/400
160/160 [=====] - 0s 775us/step - loss: 0.6552
Epoch 51/400
160/160 [=====] - 0s 758us/step - loss: 0.6544
Epoch 52/400
160/160 [=====] - 0s 1ms/step - loss: 0.6508

Epoch 53/400
160/160 [=====] - 0s 618us/step - loss: 0.6506
Epoch 54/400
160/160 [=====] - 0s 842us/step - loss: 0.6480
Epoch 55/400
160/160 [=====] - 0s 742us/step - loss: 0.6468
Epoch 56/400
160/160 [=====] - 0s 714us/step - loss: 0.6460
Epoch 57/400
160/160 [=====] - 0s 751us/step - loss: 0.6432
Epoch 58/400
160/160 [=====] - 0s 745us/step - loss: 0.6424
Epoch 59/400
160/160 [=====] - 0s 947us/step - loss: 0.6389
Epoch 60/400
160/160 [=====] - 0s 680us/step - loss: 0.6359
Epoch 61/400
160/160 [=====] - 0s 639us/step - loss: 0.6335
Epoch 62/400
160/160 [=====] - 0s 670us/step - loss: 0.6314
Epoch 63/400
160/160 [=====] - 0s 639us/step - loss: 0.6266
Epoch 64/400
160/160 [=====] - 0s 680us/step - loss: 0.6279
Epoch 65/400
160/160 [=====] - 0s 744us/step - loss: 0.6229
Epoch 66/400
160/160 [=====] - 0s 647us/step - loss: 0.6222
Epoch 67/400
160/160 [=====] - 0s 597us/step - loss: 0.6158
Epoch 68/400
160/160 [=====] - 0s 822us/step - loss: 0.6115
Epoch 69/400
160/160 [=====] - 0s 877us/step - loss: 0.6062
Epoch 70/400
160/160 [=====] - 0s 844us/step - loss: 0.6039
Epoch 71/400
160/160 [=====] - 0s 853us/step - loss: 0.5981
Epoch 72/400
160/160 [=====] - 0s 812us/step - loss: 0.5935
Epoch 73/400
160/160 [=====] - 0s 873us/step - loss: 0.5851
Epoch 74/400
160/160 [=====] - 0s 843us/step - loss: 0.5820
Epoch 75/400
160/160 [=====] - 0s 834us/step - loss: 0.5737
Epoch 76/400
160/160 [=====] - 0s 958us/step - loss: 0.5682

Epoch 77/400
160/160 [=====] - 0s 964us/step - loss: 0.5594
Epoch 78/400
160/160 [=====] - 0s 897us/step - loss: 0.5527
Epoch 79/400
160/160 [=====] - 0s 753us/step - loss: 0.5451
Epoch 80/400
160/160 [=====] - 0s 849us/step - loss: 0.5306
Epoch 81/400
160/160 [=====] - 0s 864us/step - loss: 0.5159
Epoch 82/400
160/160 [=====] - 0s 862us/step - loss: 0.5120
Epoch 83/400
160/160 [=====] - 0s 846us/step - loss: 0.4985
Epoch 84/400
160/160 [=====] - 0s 830us/step - loss: 0.4793
Epoch 85/400
160/160 [=====] - 0s 841us/step - loss: 0.4732
Epoch 86/400
160/160 [=====] - 0s 807us/step - loss: 0.4578
Epoch 87/400
160/160 [=====] - 0s 711us/step - loss: 0.4430
Epoch 88/400
160/160 [=====] - 0s 695us/step - loss: 0.4335
Epoch 89/400
160/160 [=====] - 0s 644us/step - loss: 0.4370
Epoch 90/400
160/160 [=====] - 0s 665us/step - loss: 0.4222
Epoch 91/400
160/160 [=====] - 0s 791us/step - loss: 0.4084
Epoch 92/400
160/160 [=====] - 0s 893us/step - loss: 0.3880
Epoch 93/400
160/160 [=====] - 0s 664us/step - loss: 0.3779
Epoch 94/400
160/160 [=====] - 0s 681us/step - loss: 0.3799
Epoch 95/400
160/160 [=====] - 0s 643us/step - loss: 0.3993
Epoch 96/400
160/160 [=====] - 0s 626us/step - loss: 0.3865
Epoch 97/400
160/160 [=====] - 0s 807us/step - loss: 0.7646
Epoch 98/400
160/160 [=====] - 0s 753us/step - loss: 0.7209
Epoch 99/400
160/160 [=====] - 0s 623us/step - loss: 0.4451
Epoch 100/400
160/160 [=====] - 0s 630us/step - loss: 0.3760

Epoch 101/400
160/160 [=====] - 0s 594us/step - loss: 0.3837
Epoch 102/400
160/160 [=====] - 0s 635us/step - loss: 0.3680
Epoch 103/400
160/160 [=====] - 0s 779us/step - loss: 0.3627
Epoch 104/400
160/160 [=====] - 0s 1ms/step - loss: 0.4463
Epoch 105/400
160/160 [=====] - 0s 691us/step - loss: 0.3519
Epoch 106/400
160/160 [=====] - 0s 609us/step - loss: 0.3629
Epoch 107/400
160/160 [=====] - 0s 621us/step - loss: 0.3837
Epoch 108/400
160/160 [=====] - 0s 612us/step - loss: 0.3563
Epoch 109/400
160/160 [=====] - 0s 743us/step - loss: 0.3516
Epoch 110/400
160/160 [=====] - 0s 873us/step - loss: 0.3667
Epoch 111/400
160/160 [=====] - 0s 686us/step - loss: 0.3387
Epoch 112/400
160/160 [=====] - 0s 631us/step - loss: 0.3393
Epoch 113/400
160/160 [=====] - 0s 607us/step - loss: 0.3432
Epoch 114/400
160/160 [=====] - 0s 588us/step - loss: 0.4010
Epoch 115/400
160/160 [=====] - 0s 584us/step - loss: 0.3557
Epoch 116/400
160/160 [=====] - 0s 590us/step - loss: 0.3591
Epoch 117/400
160/160 [=====] - 0s 586us/step - loss: 0.3593
Epoch 118/400
160/160 [=====] - 0s 667us/step - loss: 0.3471
Epoch 119/400
160/160 [=====] - 0s 604us/step - loss: 0.5089
Epoch 120/400
160/160 [=====] - 0s 580us/step - loss: 8.0939
Epoch 121/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 122/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 123/400
160/160 [=====] - 0s 582us/step - loss: 8.0590
Epoch 124/400
160/160 [=====] - 0s 704us/step - loss: 8.0590

Epoch 125/400
160/160 [=====] - 0s 799us/step - loss: 8.0590
Epoch 126/400
160/160 [=====] - 0s 816us/step - loss: 8.0590
Epoch 127/400
160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 128/400
160/160 [=====] - 0s 796us/step - loss: 8.0590
Epoch 129/400
160/160 [=====] - 0s 750us/step - loss: 8.0590
Epoch 130/400
160/160 [=====] - 0s 737us/step - loss: 8.0590
Epoch 131/400
160/160 [=====] - 0s 916us/step - loss: 8.0590
Epoch 132/400
160/160 [=====] - 0s 858us/step - loss: 8.0590
Epoch 133/400
160/160 [=====] - 0s 711us/step - loss: 8.0590
Epoch 134/400
160/160 [=====] - 0s 756us/step - loss: 8.0590
Epoch 135/400
160/160 [=====] - 0s 845us/step - loss: 8.0590
Epoch 136/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 137/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 138/400
160/160 [=====] - 0s 826us/step - loss: 8.0590
Epoch 139/400
160/160 [=====] - 0s 838us/step - loss: 8.0590
Epoch 140/400
160/160 [=====] - 0s 700us/step - loss: 8.0590
Epoch 141/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 142/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 143/400
160/160 [=====] - 0s 718us/step - loss: 8.0590
Epoch 144/400
160/160 [=====] - 0s 733us/step - loss: 8.0590
Epoch 145/400
160/160 [=====] - 0s 600us/step - loss: 8.0590
Epoch 146/400
160/160 [=====] - 0s 639us/step - loss: 8.0590
Epoch 147/400
160/160 [=====] - 0s 731us/step - loss: 8.0590
Epoch 148/400
160/160 [=====] - 0s 625us/step - loss: 8.0590

Epoch 149/400
160/160 [=====] - 0s 584us/step - loss: 8.0590
Epoch 150/400
160/160 [=====] - 0s 647us/step - loss: 8.0590
Epoch 151/400
160/160 [=====] - 0s 622us/step - loss: 8.0590
Epoch 152/400
160/160 [=====] - 0s 595us/step - loss: 8.0590
Epoch 153/400
160/160 [=====] - 0s 711us/step - loss: 8.0590
Epoch 154/400
160/160 [=====] - 0s 608us/step - loss: 8.0590
Epoch 155/400
160/160 [=====] - 0s 610us/step - loss: 8.0590
Epoch 156/400
160/160 [=====] - 0s 656us/step - loss: 8.0590
Epoch 157/400
160/160 [=====] - 0s 614us/step - loss: 8.0590
Epoch 158/400
160/160 [=====] - 0s 602us/step - loss: 8.0590
Epoch 159/400
160/160 [=====] - 0s 743us/step - loss: 8.0590
Epoch 160/400
160/160 [=====] - 0s 841us/step - loss: 8.0590
Epoch 161/400
160/160 [=====] - 0s 602us/step - loss: 8.0590
Epoch 162/400
160/160 [=====] - 0s 670us/step - loss: 8.0590
Epoch 163/400
160/160 [=====] - 0s 616us/step - loss: 8.0590
Epoch 164/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 165/400
160/160 [=====] - 0s 831us/step - loss: 8.0590
Epoch 166/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 167/400
160/160 [=====] - 0s 735us/step - loss: 8.0590
Epoch 168/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 169/400
160/160 [=====] - 0s 743us/step - loss: 8.0590
Epoch 170/400
160/160 [=====] - 0s 844us/step - loss: 8.0590
Epoch 171/400
160/160 [=====] - 0s 760us/step - loss: 8.0590
Epoch 172/400
160/160 [=====] - 0s 598us/step - loss: 8.0590

Epoch 173/400
160/160 [=====] - 0s 573us/step - loss: 8.0590
Epoch 174/400
160/160 [=====] - 0s 583us/step - loss: 8.0590
Epoch 175/400
160/160 [=====] - 0s 804us/step - loss: 8.0590
Epoch 176/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 177/400
160/160 [=====] - 0s 622us/step - loss: 8.0590
Epoch 178/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 179/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 180/400
160/160 [=====] - 0s 605us/step - loss: 8.0590
Epoch 181/400
160/160 [=====] - 0s 589us/step - loss: 8.0590
Epoch 182/400
160/160 [=====] - 0s 580us/step - loss: 8.0590
Epoch 183/400
160/160 [=====] - 0s 710us/step - loss: 8.0590
Epoch 184/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 185/400
160/160 [=====] - 0s 634us/step - loss: 8.0590
Epoch 186/400
160/160 [=====] - 0s 643us/step - loss: 8.0590
Epoch 187/400
160/160 [=====] - 0s 640us/step - loss: 8.0590
Epoch 188/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 189/400
160/160 [=====] - 0s 608us/step - loss: 8.0590
Epoch 190/400
160/160 [=====] - 0s 674us/step - loss: 8.0590
Epoch 191/400
160/160 [=====] - 0s 622us/step - loss: 8.0590
Epoch 192/400
160/160 [=====] - 0s 837us/step - loss: 8.0590
Epoch 193/400
160/160 [=====] - 0s 969us/step - loss: 8.0590
Epoch 194/400
160/160 [=====] - 0s 986us/step - loss: 8.0590
Epoch 195/400
160/160 [=====] - 0s 985us/step - loss: 8.0590
Epoch 196/400
160/160 [=====] - 0s 959us/step - loss: 8.0590

Epoch 197/400
160/160 [=====] - 0s 955us/step - loss: 8.0590
Epoch 198/400
160/160 [=====] - 0s 929us/step - loss: 8.0590
Epoch 199/400
160/160 [=====] - 0s 625us/step - loss: 8.0590
Epoch 200/400
160/160 [=====] - 0s 658us/step - loss: 8.0590
Epoch 201/400
160/160 [=====] - 0s 583us/step - loss: 8.0590
Epoch 202/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 203/400
160/160 [=====] - 0s 647us/step - loss: 8.0590
Epoch 204/400
160/160 [=====] - 0s 750us/step - loss: 8.0590
Epoch 205/400
160/160 [=====] - 0s 867us/step - loss: 8.0590
Epoch 206/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 207/400
160/160 [=====] - 0s 634us/step - loss: 8.0590
Epoch 208/400
160/160 [=====] - 0s 611us/step - loss: 8.0590
Epoch 209/400
160/160 [=====] - 0s 639us/step - loss: 8.0590
Epoch 210/400
160/160 [=====] - 0s 623us/step - loss: 8.0590
Epoch 211/400
160/160 [=====] - 0s 618us/step - loss: 8.0590
Epoch 212/400
160/160 [=====] - 0s 641us/step - loss: 8.0590
Epoch 213/400
160/160 [=====] - 0s 628us/step - loss: 8.0590
Epoch 214/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 215/400
160/160 [=====] - 0s 618us/step - loss: 8.0590
Epoch 216/400
160/160 [=====] - 0s 587us/step - loss: 8.0590
Epoch 217/400
160/160 [=====] - 0s 608us/step - loss: 8.0590
Epoch 218/400
160/160 [=====] - 0s 600us/step - loss: 8.0590
Epoch 219/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 220/400
160/160 [=====] - 0s 618us/step - loss: 8.0590

Epoch 221/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 222/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 223/400
160/160 [=====] - 0s 630us/step - loss: 8.0590
Epoch 224/400
160/160 [=====] - 0s 660us/step - loss: 8.0590
Epoch 225/400
160/160 [=====] - 0s 691us/step - loss: 8.0590
Epoch 226/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 227/400
160/160 [=====] - 0s 683us/step - loss: 8.0590
Epoch 228/400
160/160 [=====] - 0s 704us/step - loss: 8.0590
Epoch 229/400
160/160 [=====] - 0s 686us/step - loss: 8.0590
Epoch 230/400
160/160 [=====] - 0s 661us/step - loss: 8.0590
Epoch 231/400
160/160 [=====] - 0s 647us/step - loss: 8.0590
Epoch 232/400
160/160 [=====] - 0s 643us/step - loss: 8.0590
Epoch 233/400
160/160 [=====] - 0s 621us/step - loss: 8.0590
Epoch 234/400
160/160 [=====] - 0s 574us/step - loss: 8.0590
Epoch 235/400
160/160 [=====] - 0s 570us/step - loss: 8.0590
Epoch 236/400
160/160 [=====] - 0s 562us/step - loss: 8.0590
Epoch 237/400
160/160 [=====] - 0s 547us/step - loss: 8.0590
Epoch 238/400
160/160 [=====] - 0s 587us/step - loss: 8.0590
Epoch 239/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 240/400
160/160 [=====] - 0s 715us/step - loss: 8.0590
Epoch 241/400
160/160 [=====] - 0s 624us/step - loss: 8.0590
Epoch 242/400
160/160 [=====] - 0s 609us/step - loss: 8.0590
Epoch 243/400
160/160 [=====] - 0s 625us/step - loss: 8.0590
Epoch 244/400
160/160 [=====] - 0s 626us/step - loss: 8.0590

Epoch 245/400
160/160 [=====] - 0s 647us/step - loss: 8.0590
Epoch 246/400
160/160 [=====] - 0s 621us/step - loss: 8.0590
Epoch 247/400
160/160 [=====] - 0s 639us/step - loss: 8.0590
Epoch 248/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 249/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 250/400
160/160 [=====] - 0s 628us/step - loss: 8.0590
Epoch 251/400
160/160 [=====] - 0s 612us/step - loss: 8.0590
Epoch 252/400
160/160 [=====] - 0s 680us/step - loss: 8.0590
Epoch 253/400
160/160 [=====] - 0s 633us/step - loss: 8.0590
Epoch 254/400
160/160 [=====] - 0s 602us/step - loss: 8.0590
Epoch 255/400
160/160 [=====] - 0s 599us/step - loss: 8.0590
Epoch 256/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 257/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 258/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 259/400
160/160 [=====] - 0s 589us/step - loss: 8.0590
Epoch 260/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 261/400
160/160 [=====] - 0s 842us/step - loss: 8.0590
Epoch 262/400
160/160 [=====] - 0s 787us/step - loss: 8.0590
Epoch 263/400
160/160 [=====] - 0s 811us/step - loss: 8.0590
Epoch 264/400
160/160 [=====] - 0s 792us/step - loss: 8.0590
Epoch 265/400
160/160 [=====] - 0s 811us/step - loss: 8.0590
Epoch 266/400
160/160 [=====] - 0s 864us/step - loss: 8.0590
Epoch 267/400
160/160 [=====] - 0s 835us/step - loss: 8.0590
Epoch 268/400
160/160 [=====] - 0s 811us/step - loss: 8.0590

Epoch 269/400
160/160 [=====] - 0s 803us/step - loss: 8.0590
Epoch 270/400
160/160 [=====] - 0s 826us/step - loss: 8.0590
Epoch 271/400
160/160 [=====] - 0s 827us/step - loss: 8.0590
Epoch 272/400
160/160 [=====] - 0s 831us/step - loss: 8.0590
Epoch 273/400
160/160 [=====] - 0s 786us/step - loss: 8.0590
Epoch 274/400
160/160 [=====] - 0s 759us/step - loss: 8.0590
Epoch 275/400
160/160 [=====] - 0s 647us/step - loss: 8.0590
Epoch 276/400
160/160 [=====] - 0s 575us/step - loss: 8.0590
Epoch 277/400
160/160 [=====] - 0s 589us/step - loss: 8.0590
Epoch 278/400
160/160 [=====] - 0s 579us/step - loss: 8.0590
Epoch 279/400
160/160 [=====] - 0s 590us/step - loss: 8.0590
Epoch 280/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 281/400
160/160 [=====] - 0s 592us/step - loss: 8.0590
Epoch 282/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 283/400
160/160 [=====] - 0s 787us/step - loss: 8.0590
Epoch 284/400
160/160 [=====] - 0s 802us/step - loss: 8.0590
Epoch 285/400
160/160 [=====] - 0s 587us/step - loss: 8.0590
Epoch 286/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 287/400
160/160 [=====] - 0s 595us/step - loss: 8.0590
Epoch 288/400
160/160 [=====] - 0s 584us/step - loss: 8.0590
Epoch 289/400
160/160 [=====] - 0s 599us/step - loss: 8.0590
Epoch 290/400
160/160 [=====] - 0s 588us/step - loss: 8.0590
Epoch 291/400
160/160 [=====] - 0s 593us/step - loss: 8.0590
Epoch 292/400
160/160 [=====] - 0s 582us/step - loss: 8.0590

Epoch 293/400
160/160 [=====] - 0s 583us/step - loss: 8.0590
Epoch 294/400
160/160 [=====] - 0s 584us/step - loss: 8.0590
Epoch 295/400
160/160 [=====] - 0s 588us/step - loss: 8.0590
Epoch 296/400
160/160 [=====] - 0s 585us/step - loss: 8.0590
Epoch 297/400
160/160 [=====] - 0s 583us/step - loss: 8.0590
Epoch 298/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 299/400
160/160 [=====] - 0s 750us/step - loss: 8.0590
Epoch 300/400
160/160 [=====] - 0s 822us/step - loss: 8.0590
Epoch 301/400
160/160 [=====] - 0s 608us/step - loss: 8.0590
Epoch 302/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 303/400
160/160 [=====] - 0s 583us/step - loss: 8.0590
Epoch 304/400
160/160 [=====] - 0s 585us/step - loss: 8.0590
Epoch 305/400
160/160 [=====] - 0s 591us/step - loss: 8.0590
Epoch 306/400
160/160 [=====] - 0s 663us/step - loss: 8.0590
Epoch 307/400
160/160 [=====] - 0s 643us/step - loss: 8.0590
Epoch 308/400
160/160 [=====] - 0s 617us/step - loss: 8.0590
Epoch 309/400
160/160 [=====] - 0s 619us/step - loss: 8.0590
Epoch 310/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 311/400
160/160 [=====] - 0s 837us/step - loss: 8.0590
Epoch 312/400
160/160 [=====] - 0s 965us/step - loss: 8.0590
Epoch 313/400
160/160 [=====] - 0s 948us/step - loss: 8.0590
Epoch 314/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 315/400
160/160 [=====] - 0s 900us/step - loss: 8.0590
Epoch 316/400
160/160 [=====] - 0s 881us/step - loss: 8.0590

Epoch 317/400
160/160 [=====] - 0s 921us/step - loss: 8.0590
Epoch 318/400
160/160 [=====] - 0s 929us/step - loss: 8.0590
Epoch 319/400
160/160 [=====] - 0s 934us/step - loss: 8.0590
Epoch 320/400
160/160 [=====] - 0s 880us/step - loss: 8.0590
Epoch 321/400
160/160 [=====] - 0s 917us/step - loss: 8.0590
Epoch 322/400
160/160 [=====] - 0s 930us/step - loss: 8.0590
Epoch 323/400
160/160 [=====] - 0s 949us/step - loss: 8.0590
Epoch 324/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 325/400
160/160 [=====] - 0s 832us/step - loss: 8.0590
Epoch 326/400
160/160 [=====] - 0s 753us/step - loss: 8.0590
Epoch 327/400
160/160 [=====] - 0s 585us/step - loss: 8.0590
Epoch 328/400
160/160 [=====] - 0s 619us/step - loss: 8.0590
Epoch 329/400
160/160 [=====] - 0s 588us/step - loss: 8.0590
Epoch 330/400
160/160 [=====] - 0s 601us/step - loss: 8.0590
Epoch 331/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 332/400
160/160 [=====] - 0s 832us/step - loss: 8.0590
Epoch 333/400
160/160 [=====] - 0s 780us/step - loss: 8.0590
Epoch 334/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 335/400
160/160 [=====] - 0s 605us/step - loss: 8.0590
Epoch 336/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 337/400
160/160 [=====] - 0s 616us/step - loss: 8.0590
Epoch 338/400
160/160 [=====] - 0s 637us/step - loss: 8.0590
Epoch 339/400
160/160 [=====] - 0s 618us/step - loss: 8.0590
Epoch 340/400
160/160 [=====] - 0s 830us/step - loss: 8.0590

Epoch 341/400
160/160 [=====] - 0s 664us/step - loss: 8.0590
Epoch 342/400
160/160 [=====] - 0s 645us/step - loss: 8.0590
Epoch 343/400
160/160 [=====] - 0s 795us/step - loss: 8.0590
Epoch 344/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 345/400
160/160 [=====] - 0s 825us/step - loss: 8.0590
Epoch 346/400
160/160 [=====] - 0s 754us/step - loss: 8.0590
Epoch 347/400
160/160 [=====] - 0s 638us/step - loss: 8.0590
Epoch 348/400
160/160 [=====] - 0s 674us/step - loss: 8.0590
Epoch 349/400
160/160 [=====] - 0s 608us/step - loss: 8.0590
Epoch 350/400
160/160 [=====] - 0s 592us/step - loss: 8.0590
Epoch 351/400
160/160 [=====] - 0s 832us/step - loss: 8.0590
Epoch 352/400
160/160 [=====] - 0s 886us/step - loss: 8.0590
Epoch 353/400
160/160 [=====] - 0s 670us/step - loss: 8.0590
Epoch 354/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 355/400
160/160 [=====] - 0s 612us/step - loss: 8.0590
Epoch 356/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 357/400
160/160 [=====] - 0s 919us/step - loss: 8.0590
Epoch 358/400
160/160 [=====] - 0s 860us/step - loss: 8.0590
Epoch 359/400
160/160 [=====] - 0s 693us/step - loss: 8.0590
Epoch 360/400
160/160 [=====] - 0s 891us/step - loss: 8.0590
Epoch 361/400
160/160 [=====] - 0s 785us/step - loss: 8.0590
Epoch 362/400
160/160 [=====] - 0s 688us/step - loss: 8.0590
Epoch 363/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 364/400
160/160 [=====] - 0s 604us/step - loss: 8.0590

Epoch 365/400
160/160 [=====] - 0s 611us/step - loss: 8.0590
Epoch 366/400
160/160 [=====] - 0s 882us/step - loss: 8.0590
Epoch 367/400
160/160 [=====] - 0s 893us/step - loss: 8.0590
Epoch 368/400
160/160 [=====] - 0s 833us/step - loss: 8.0590
Epoch 369/400
160/160 [=====] - 0s 914us/step - loss: 8.0590
Epoch 370/400
160/160 [=====] - 0s 858us/step - loss: 8.0590
Epoch 371/400
160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 372/400
160/160 [=====] - 0s 582us/step - loss: 8.0590
Epoch 373/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 374/400
160/160 [=====] - 0s 602us/step - loss: 8.0590
Epoch 375/400
160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 376/400
160/160 [=====] - 0s 840us/step - loss: 8.0590
Epoch 377/400
160/160 [=====] - 0s 792us/step - loss: 8.0590
Epoch 378/400
160/160 [=====] - 0s 812us/step - loss: 8.0590
Epoch 379/400
160/160 [=====] - 0s 833us/step - loss: 8.0590
Epoch 380/400
160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 381/400
160/160 [=====] - 0s 831us/step - loss: 8.0590
Epoch 382/400
160/160 [=====] - 0s 785us/step - loss: 8.0590
Epoch 383/400
160/160 [=====] - 0s 592us/step - loss: 8.0590
Epoch 384/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 385/400
160/160 [=====] - 0s 768us/step - loss: 8.0590
Epoch 386/400
160/160 [=====] - 0s 829us/step - loss: 8.0590
Epoch 387/400
160/160 [=====] - 0s 799us/step - loss: 8.0590
Epoch 388/400
160/160 [=====] - 0s 834us/step - loss: 8.0590

[illegible]

```

0.0000000e+00 0.0000000e+00 0.0000000e+00 0.0000000e+00 0.0000000e+00
0.0000000e+00 0.0000000e+00 2.9046877e-38 0.0000000e+00 0.0000000e+00
0.0000000e+00 0.0000000e+00 0.0000000e+00 0.0000000e+00 0.0000000e+00
0.0000000e+00 0.0000000e+00 0.0000000e+00 0.0000000e+00 0.0000000e+00
3.7549238e-35 1.7307802e-38 0.0000000e+00 0.0000000e+00 0.0000000e+00
0.0000000e+00 2.7365552e-35 8.1574498e-35 1.2487868e-36 0.0000000e+00
1.3001375e-38 0.0000000e+00 0.0000000e+00 0.0000000e+00 0.0000000e+00
0.0000000e+00 0.0000000e+00 0.0000000e+00 0.0000000e+00 0.0000000e+00]
160/160 [=====] - 0s 1ms/step

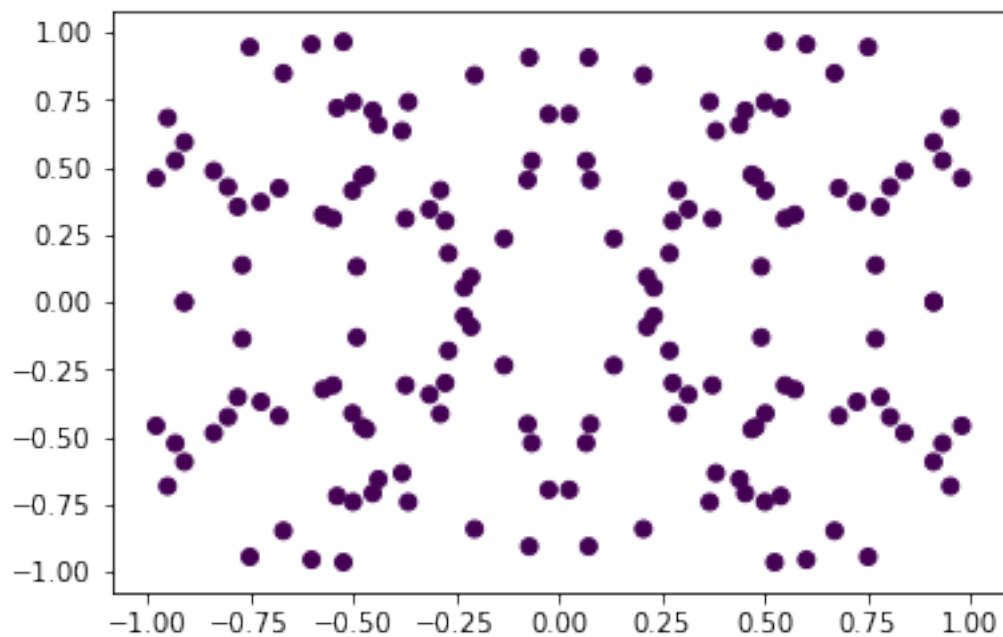
```

```
In [54]: scores, model.metrics_names
```

```
Out[54]: (8.059047738974616, ['loss'])
```

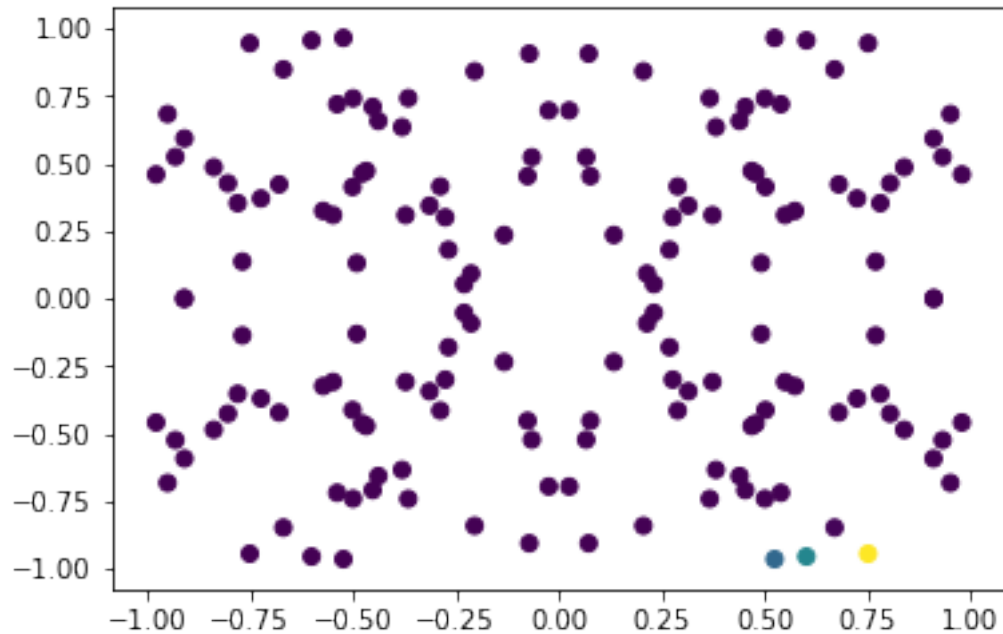
```
In [55]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[55]: <matplotlib.collections.PathCollection at 0xb27ecd400>
```



```
In [56]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[56]: <matplotlib.collections.PathCollection at 0xb27eef7b8>
```

```
In [57]: # Softplus 4
model = Sequential()

model.add(Dense(2, input_dim=2, activation='softplus'))
model.add(Dense(2, activation='softplus'))
model.add(Dense(2, activation='softplus'))
model.add(Dense(2, activation='softplus'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='softplus'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 5ms/step - loss: 0.7290
Epoch 2/400
160/160 [=====] - 0s 640us/step - loss: 0.6976
Epoch 3/400
160/160 [=====] - 0s 665us/step - loss: 0.6971
Epoch 4/400
```

160/160 [=====] - 0s 631us/step - loss: 0.6962
Epoch 5/400
160/160 [=====] - 0s 634us/step - loss: 0.6962
Epoch 6/400
160/160 [=====] - 0s 643us/step - loss: 0.6958
Epoch 7/400
160/160 [=====] - 0s 684us/step - loss: 0.6953
Epoch 8/400
160/160 [=====] - 0s 848us/step - loss: 0.6960
Epoch 9/400
160/160 [=====] - 0s 791us/step - loss: 0.6954
Epoch 10/400
160/160 [=====] - 0s 797us/step - loss: 0.6963
Epoch 11/400
160/160 [=====] - 0s 861us/step - loss: 0.6959
Epoch 12/400
160/160 [=====] - 0s 890us/step - loss: 0.6959
Epoch 13/400
160/160 [=====] - 0s 825us/step - loss: 0.6957
Epoch 14/400
160/160 [=====] - 0s 645us/step - loss: 0.6961
Epoch 15/400
160/160 [=====] - 0s 660us/step - loss: 0.6959
Epoch 16/400
160/160 [=====] - 0s 663us/step - loss: 0.6958
Epoch 17/400
160/160 [=====] - 0s 922us/step - loss: 0.6954
Epoch 18/400
160/160 [=====] - 0s 853us/step - loss: 0.6960
Epoch 19/400
160/160 [=====] - 0s 816us/step - loss: 0.6959
Epoch 20/400
160/160 [=====] - 0s 662us/step - loss: 0.6963
Epoch 21/400
160/160 [=====] - 0s 655us/step - loss: 0.6952
Epoch 22/400
160/160 [=====] - 0s 656us/step - loss: 0.6959
Epoch 23/400
160/160 [=====] - 0s 689us/step - loss: 0.6958
Epoch 24/400
160/160 [=====] - 0s 683us/step - loss: 0.6958
Epoch 25/400
160/160 [=====] - 0s 744us/step - loss: 0.6958
Epoch 26/400
160/160 [=====] - 0s 884us/step - loss: 0.6954
Epoch 27/400
160/160 [=====] - 0s 761us/step - loss: 0.6962
Epoch 28/400

160/160 [=====] - 0s 643us/step - loss: 0.6956
Epoch 29/400
160/160 [=====] - 0s 645us/step - loss: 0.6958
Epoch 30/400
160/160 [=====] - 0s 645us/step - loss: 0.6965
Epoch 31/400
160/160 [=====] - 0s 632us/step - loss: 0.6961
Epoch 32/400
160/160 [=====] - 0s 631us/step - loss: 0.6953
Epoch 33/400
160/160 [=====] - 0s 662us/step - loss: 0.6952
Epoch 34/400
160/160 [=====] - 0s 659us/step - loss: 0.6960
Epoch 35/400
160/160 [=====] - 0s 674us/step - loss: 0.6959
Epoch 36/400
160/160 [=====] - 0s 912us/step - loss: 0.6958
Epoch 37/400
160/160 [=====] - 0s 855us/step - loss: 0.6965
Epoch 38/400
160/160 [=====] - 0s 744us/step - loss: 0.6957
Epoch 39/400
160/160 [=====] - 0s 637us/step - loss: 0.6955
Epoch 40/400
160/160 [=====] - 0s 630us/step - loss: 0.6956
Epoch 41/400
160/160 [=====] - 0s 646us/step - loss: 0.6952
Epoch 42/400
160/160 [=====] - 0s 679us/step - loss: 0.6961
Epoch 43/400
160/160 [=====] - 0s 899us/step - loss: 0.6964
Epoch 44/400
160/160 [=====] - 0s 641us/step - loss: 0.6962
Epoch 45/400
160/160 [=====] - 0s 701us/step - loss: 0.6964
Epoch 46/400
160/160 [=====] - 0s 703us/step - loss: 0.6954
Epoch 47/400
160/160 [=====] - 0s 706us/step - loss: 0.6959
Epoch 48/400
160/160 [=====] - 0s 701us/step - loss: 0.6963
Epoch 49/400
160/160 [=====] - 0s 691us/step - loss: 0.6959
Epoch 50/400
160/160 [=====] - 0s 725us/step - loss: 0.6961
Epoch 51/400
160/160 [=====] - 0s 715us/step - loss: 0.6961
Epoch 52/400

160/160 [=====] - 0s 723us/step - loss: 0.6959
Epoch 53/400
160/160 [=====] - 0s 809us/step - loss: 0.6951
Epoch 54/400
160/160 [=====] - 0s 897us/step - loss: 0.6957
Epoch 55/400
160/160 [=====] - 0s 852us/step - loss: 0.6951
Epoch 56/400
160/160 [=====] - 0s 726us/step - loss: 0.6963
Epoch 57/400
160/160 [=====] - 0s 723us/step - loss: 0.6940
Epoch 58/400
160/160 [=====] - 0s 683us/step - loss: 0.6959
Epoch 59/400
160/160 [=====] - 0s 697us/step - loss: 0.6958
Epoch 60/400
160/160 [=====] - 0s 710us/step - loss: 0.6955
Epoch 61/400
160/160 [=====] - 0s 737us/step - loss: 0.6953
Epoch 62/400
160/160 [=====] - 0s 678us/step - loss: 0.6956
Epoch 63/400
160/160 [=====] - 0s 940us/step - loss: 0.6947
Epoch 64/400
160/160 [=====] - 0s 929us/step - loss: 0.6961
Epoch 65/400
160/160 [=====] - 0s 719us/step - loss: 0.6961
Epoch 66/400
160/160 [=====] - 0s 716us/step - loss: 0.6954
Epoch 67/400
160/160 [=====] - 0s 663us/step - loss: 0.6956
Epoch 68/400
160/160 [=====] - 0s 662us/step - loss: 0.6952
Epoch 69/400
160/160 [=====] - 0s 666us/step - loss: 0.6958
Epoch 70/400
160/160 [=====] - 0s 686us/step - loss: 0.6967
Epoch 71/400
160/160 [=====] - 0s 718us/step - loss: 0.6952
Epoch 72/400
160/160 [=====] - 0s 642us/step - loss: 0.6962
Epoch 73/400
160/160 [=====] - 0s 599us/step - loss: 0.6957
Epoch 74/400
160/160 [=====] - 0s 627us/step - loss: 0.6964
Epoch 75/400
160/160 [=====] - 0s 648us/step - loss: 0.6960
Epoch 76/400

```

160/160 [=====] - 0s 629us/step - loss: 0.6964
Epoch 77/400
160/160 [=====] - 0s 686us/step - loss: 0.6952
Epoch 78/400
160/160 [=====] - 0s 666us/step - loss: 0.6953
Epoch 79/400
160/160 [=====] - 0s 686us/step - loss: 0.6954
Epoch 80/400
160/160 [=====] - 0s 641us/step - loss: 0.6962
Epoch 81/400
160/160 [=====] - 0s 675us/step - loss: 0.6963
Epoch 82/400
160/160 [=====] - 0s 675us/step - loss: 0.6955
Epoch 83/400
160/160 [=====] - 0s 690us/step - loss: 0.6951
Epoch 84/400
160/160 [=====] - 0s 701us/step - loss: 0.6961
Epoch 85/400
160/160 [=====] - 0s 877us/step - loss: 0.6961
Epoch 86/400
160/160 [=====] - 0s 692us/step - loss: 0.6958
Epoch 87/400
160/160 [=====] - 0s 680us/step - loss: 0.6965
Epoch 88/400
160/160 [=====] - 0s 676us/step - loss: 0.6958
Epoch 89/400
160/160 [=====] - 0s 709us/step - loss: 0.6964
Epoch 90/400
160/160 [=====] - 0s 834us/step - loss: 0.6943
Epoch 91/400
160/160 [=====] - 0s 920us/step - loss: 0.6965 0s - loss: 0.69
Epoch 92/400
160/160 [=====] - 0s 834us/step - loss: 0.6960
Epoch 93/400
160/160 [=====] - 0s 727us/step - loss: 0.6960
Epoch 94/400
160/160 [=====] - 0s 719us/step - loss: 0.6963
Epoch 95/400
160/160 [=====] - 0s 756us/step - loss: 0.6955
Epoch 96/400
160/160 [=====] - 0s 928us/step - loss: 0.6959
Epoch 97/400
160/160 [=====] - 0s 931us/step - loss: 0.6954
Epoch 98/400
160/160 [=====] - 0s 996us/step - loss: 0.6961
Epoch 99/400
160/160 [=====] - 0s 819us/step - loss: 0.6957
Epoch 100/400

```

```

160/160 [=====] - 0s 686us/step - loss: 0.6968
Epoch 101/400
160/160 [=====] - 0s 698us/step - loss: 0.6935
Epoch 102/400
160/160 [=====] - 0s 884us/step - loss: 0.6961
Epoch 103/400
160/160 [=====] - 0s 868us/step - loss: 0.6961
Epoch 104/400
160/160 [=====] - 0s 803us/step - loss: 0.6959
Epoch 105/400
160/160 [=====] - 0s 708us/step - loss: 0.6952
Epoch 106/400
160/160 [=====] - 0s 672us/step - loss: 0.6948
Epoch 107/400
160/160 [=====] - 0s 734us/step - loss: 0.6946
Epoch 108/400
160/160 [=====] - 0s 651us/step - loss: 0.6957
Epoch 109/400
160/160 [=====] - 0s 657us/step - loss: 0.6951
Epoch 110/400
160/160 [=====] - 0s 726us/step - loss: 0.6958
Epoch 111/400
160/160 [=====] - 0s 638us/step - loss: 0.6955
Epoch 112/400
160/160 [=====] - 0s 723us/step - loss: 0.6962
Epoch 113/400
160/160 [=====] - 0s 943us/step - loss: 0.6960
Epoch 114/400
160/160 [=====] - 0s 849us/step - loss: 0.6961
Epoch 115/400
160/160 [=====] - 0s 687us/step - loss: 0.6960
Epoch 116/400
160/160 [=====] - 0s 670us/step - loss: 0.6961
Epoch 117/400
160/160 [=====] - 0s 642us/step - loss: 0.6958
Epoch 118/400
160/160 [=====] - 0s 621us/step - loss: 0.6947
Epoch 119/400
160/160 [=====] - 0s 649us/step - loss: 0.6957
Epoch 120/400
160/160 [=====] - 0s 857us/step - loss: 0.6955
Epoch 121/400
160/160 [=====] - 0s 842us/step - loss: 0.6952
Epoch 122/400
160/160 [=====] - 0s 736us/step - loss: 0.6947
Epoch 123/400
160/160 [=====] - 0s 670us/step - loss: 0.6959 0s - loss: 0.69
Epoch 124/400

```

160/160 [=====] - 0s 798us/step - loss: 0.6953
Epoch 125/400
160/160 [=====] - 0s 932us/step - loss: 0.6940
Epoch 126/400
160/160 [=====] - 0s 915us/step - loss: 0.6960
Epoch 127/400
160/160 [=====] - 0s 887us/step - loss: 0.6956
Epoch 128/400
160/160 [=====] - 0s 857us/step - loss: 0.6958
Epoch 129/400
160/160 [=====] - 0s 809us/step - loss: 0.6952
Epoch 130/400
160/160 [=====] - 0s 746us/step - loss: 0.6956
Epoch 131/400
160/160 [=====] - 0s 907us/step - loss: 0.6953
Epoch 132/400
160/160 [=====] - 0s 692us/step - loss: 0.6960
Epoch 133/400
160/160 [=====] - 0s 744us/step - loss: 0.6951
Epoch 134/400
160/160 [=====] - 0s 614us/step - loss: 0.6958
Epoch 135/400
160/160 [=====] - 0s 776us/step - loss: 0.6950
Epoch 136/400
160/160 [=====] - 0s 889us/step - loss: 0.6951
Epoch 137/400
160/160 [=====] - 0s 743us/step - loss: 0.6956
Epoch 138/400
160/160 [=====] - 0s 658us/step - loss: 0.6957
Epoch 139/400
160/160 [=====] - 0s 653us/step - loss: 0.6948
Epoch 140/400
160/160 [=====] - 0s 860us/step - loss: 0.6960
Epoch 141/400
160/160 [=====] - 0s 862us/step - loss: 0.6952
Epoch 142/400
160/160 [=====] - 0s 811us/step - loss: 0.6953
Epoch 143/400
160/160 [=====] - 0s 709us/step - loss: 0.6944
Epoch 144/400
160/160 [=====] - 0s 892us/step - loss: 0.6959
Epoch 145/400
160/160 [=====] - 0s 827us/step - loss: 0.6960
Epoch 146/400
160/160 [=====] - 0s 655us/step - loss: 0.6958
Epoch 147/400
160/160 [=====] - 0s 793us/step - loss: 0.6956
Epoch 148/400

160/160 [=====] - 0s 866us/step - loss: 0.6951
Epoch 149/400
160/160 [=====] - 0s 783us/step - loss: 0.6956
Epoch 150/400
160/160 [=====] - 0s 644us/step - loss: 0.6961
Epoch 151/400
160/160 [=====] - 0s 801us/step - loss: 0.6950
Epoch 152/400
160/160 [=====] - 0s 868us/step - loss: 0.6962
Epoch 153/400
160/160 [=====] - 0s 822us/step - loss: 0.6953
Epoch 154/400
160/160 [=====] - 0s 918us/step - loss: 0.6958
Epoch 155/400
160/160 [=====] - 0s 862us/step - loss: 0.6954
Epoch 156/400
160/160 [=====] - 0s 695us/step - loss: 0.6953
Epoch 157/400
160/160 [=====] - 0s 701us/step - loss: 0.6956
Epoch 158/400
160/160 [=====] - 0s 677us/step - loss: 0.6960
Epoch 159/400
160/160 [=====] - 0s 706us/step - loss: 0.6958
Epoch 160/400
160/160 [=====] - 0s 672us/step - loss: 0.6957
Epoch 161/400
160/160 [=====] - 0s 690us/step - loss: 0.6953
Epoch 162/400
160/160 [=====] - 0s 847us/step - loss: 0.6962
Epoch 163/400
160/160 [=====] - 0s 777us/step - loss: 0.6957
Epoch 164/400
160/160 [=====] - 0s 643us/step - loss: 0.6954
Epoch 165/400
160/160 [=====] - 0s 774us/step - loss: 0.6944
Epoch 166/400
160/160 [=====] - 0s 877us/step - loss: 0.6958
Epoch 167/400
160/160 [=====] - 0s 915us/step - loss: 0.6951
Epoch 168/400
160/160 [=====] - 0s 700us/step - loss: 0.6954
Epoch 169/400
160/160 [=====] - 0s 646us/step - loss: 0.6958
Epoch 170/400
160/160 [=====] - 0s 641us/step - loss: 0.6951
Epoch 171/400
160/160 [=====] - 0s 631us/step - loss: 0.6954
Epoch 172/400

160/160 [=====] - 0s 852us/step - loss: 0.6966
 Epoch 173/400
 160/160 [=====] - 0s 862us/step - loss: 0.6948
 Epoch 174/400
 160/160 [=====] - 0s 693us/step - loss: 0.6953
 Epoch 175/400
 160/160 [=====] - 0s 641us/step - loss: 0.6943
 Epoch 176/400
 160/160 [=====] - 0s 800us/step - loss: 0.6960
 Epoch 177/400
 160/160 [=====] - 0s 792us/step - loss: 0.6958
 Epoch 178/400
 160/160 [=====] - 0s 755us/step - loss: 0.6961
 Epoch 179/400
 160/160 [=====] - 0s 730us/step - loss: 0.6948
 Epoch 180/400
 160/160 [=====] - 0s 850us/step - loss: 0.6957
 Epoch 181/400
 160/160 [=====] - 0s 885us/step - loss: 0.6957
 Epoch 182/400
 160/160 [=====] - 0s 874us/step - loss: 0.6958
 Epoch 183/400
 160/160 [=====] - 0s 843us/step - loss: 0.6956
 Epoch 184/400
 160/160 [=====] - 0s 810us/step - loss: 0.6957
 Epoch 185/400
 160/160 [=====] - 0s 624us/step - loss: 0.6952
 Epoch 186/400
 160/160 [=====] - 0s 651us/step - loss: 0.6960
 Epoch 187/400
 160/160 [=====] - 0s 639us/step - loss: 0.6936
 Epoch 188/400
 160/160 [=====] - 0s 661us/step - loss: 0.6961
 Epoch 189/400
 160/160 [=====] - 0s 663us/step - loss: 0.6947
 Epoch 190/400
 160/160 [=====] - 0s 669us/step - loss: 0.6955
 Epoch 191/400
 160/160 [=====] - 0s 671us/step - loss: 0.6961
 Epoch 192/400
 160/160 [=====] - 0s 844us/step - loss: 0.6955
 Epoch 193/400
 160/160 [=====] - 0s 887us/step - loss: 0.6954
 Epoch 194/400
 160/160 [=====] - 0s 881us/step - loss: 0.6949
 Epoch 195/400
 160/160 [=====] - 0s 924us/step - loss: 0.6947
 Epoch 196/400

160/160 [=====] - 0s 717us/step - loss: 0.6959
 Epoch 197/400
 160/160 [=====] - 0s 659us/step - loss: 0.6953
 Epoch 198/400
 160/160 [=====] - 0s 648us/step - loss: 0.6955
 Epoch 199/400
 160/160 [=====] - 0s 631us/step - loss: 0.6962
 Epoch 200/400
 160/160 [=====] - 0s 637us/step - loss: 0.6962
 Epoch 201/400
 160/160 [=====] - 0s 706us/step - loss: 0.6953
 Epoch 202/400
 160/160 [=====] - 0s 639us/step - loss: 0.6949
 Epoch 203/400
 160/160 [=====] - 0s 630us/step - loss: 0.6953
 Epoch 204/400
 160/160 [=====] - 0s 624us/step - loss: 0.6958
 Epoch 205/400
 160/160 [=====] - 0s 602us/step - loss: 0.6959
 Epoch 206/400
 160/160 [=====] - 0s 625us/step - loss: 0.6946
 Epoch 207/400
 160/160 [=====] - 0s 688us/step - loss: 0.6950
 Epoch 208/400
 160/160 [=====] - 0s 916us/step - loss: 0.6944
 Epoch 209/400
 160/160 [=====] - 0s 837us/step - loss: 0.6959
 Epoch 210/400
 160/160 [=====] - 0s 904us/step - loss: 0.6958
 Epoch 211/400
 160/160 [=====] - 0s 657us/step - loss: 0.6956
 Epoch 212/400
 160/160 [=====] - 0s 659us/step - loss: 0.6951
 Epoch 213/400
 160/160 [=====] - 0s 672us/step - loss: 0.6962
 Epoch 214/400
 160/160 [=====] - 0s 889us/step - loss: 0.6956
 Epoch 215/400
 160/160 [=====] - 0s 937us/step - loss: 0.6961
 Epoch 216/400
 160/160 [=====] - 0s 736us/step - loss: 0.6952
 Epoch 217/400
 160/160 [=====] - 0s 741us/step - loss: 0.6958
 Epoch 218/400
 160/160 [=====] - 0s 933us/step - loss: 0.6956
 Epoch 219/400
 160/160 [=====] - 0s 881us/step - loss: 0.6951
 Epoch 220/400

160/160 [=====] - 0s 890us/step - loss: 0.6955
Epoch 221/400
160/160 [=====] - 0s 783us/step - loss: 0.6952
Epoch 222/400
160/160 [=====] - 0s 859us/step - loss: 0.6954
Epoch 223/400
160/160 [=====] - 0s 879us/step - loss: 0.6954
Epoch 224/400
160/160 [=====] - 0s 728us/step - loss: 0.6952
Epoch 225/400
160/160 [=====] - 0s 764us/step - loss: 0.6955
Epoch 226/400
160/160 [=====] - 0s 736us/step - loss: 0.6949
Epoch 227/400
160/160 [=====] - 0s 677us/step - loss: 0.6952
Epoch 228/400
160/160 [=====] - 0s 681us/step - loss: 0.6958
Epoch 229/400
160/160 [=====] - 0s 677us/step - loss: 0.6959
Epoch 230/400
160/160 [=====] - 0s 853us/step - loss: 0.6947
Epoch 231/400
160/160 [=====] - 0s 921us/step - loss: 0.6956
Epoch 232/400
160/160 [=====] - 0s 780us/step - loss: 0.6955
Epoch 233/400
160/160 [=====] - 0s 792us/step - loss: 0.6955
Epoch 234/400
160/160 [=====] - 0s 937us/step - loss: 0.6956
Epoch 235/400
160/160 [=====] - 0s 759us/step - loss: 0.6951
Epoch 236/400
160/160 [=====] - 0s 696us/step - loss: 0.6952
Epoch 237/400
160/160 [=====] - 0s 703us/step - loss: 0.6954
Epoch 238/400
160/160 [=====] - 0s 688us/step - loss: 0.6953
Epoch 239/400
160/160 [=====] - 0s 712us/step - loss: 0.6950
Epoch 240/400
160/160 [=====] - 0s 684us/step - loss: 0.6954
Epoch 241/400
160/160 [=====] - 0s 845us/step - loss: 0.6956
Epoch 242/400
160/160 [=====] - 0s 666us/step - loss: 0.6955
Epoch 243/400
160/160 [=====] - 0s 922us/step - loss: 0.6943
Epoch 244/400

```

160/160 [=====] - 0s 1ms/step - loss: 0.6956
Epoch 245/400
160/160 [=====] - 0s 809us/step - loss: 0.6955
Epoch 246/400
160/160 [=====] - 0s 906us/step - loss: 0.6956
Epoch 247/400
160/160 [=====] - 0s 739us/step - loss: 0.6949
Epoch 248/400
160/160 [=====] - 0s 766us/step - loss: 0.6945
Epoch 249/400
160/160 [=====] - 0s 709us/step - loss: 0.6962
Epoch 250/400
160/160 [=====] - 0s 682us/step - loss: 0.6956
Epoch 251/400
160/160 [=====] - 0s 761us/step - loss: 0.6955
Epoch 252/400
160/160 [=====] - 0s 681us/step - loss: 0.6957
Epoch 253/400
160/160 [=====] - 0s 771us/step - loss: 0.6949
Epoch 254/400
160/160 [=====] - 0s 924us/step - loss: 0.6949
Epoch 255/400
160/160 [=====] - 0s 937us/step - loss: 0.6950
Epoch 256/400
160/160 [=====] - 0s 1ms/step - loss: 0.6951
Epoch 257/400
160/160 [=====] - 0s 788us/step - loss: 0.6950
Epoch 258/400
160/160 [=====] - 0s 795us/step - loss: 0.6949
Epoch 259/400
160/160 [=====] - 0s 1ms/step - loss: 0.6954A: 0s - loss: 0.6
Epoch 260/400
160/160 [=====] - 0s 717us/step - loss: 0.6956
Epoch 261/400
160/160 [=====] - 0s 702us/step - loss: 0.6951
Epoch 262/400
160/160 [=====] - 0s 708us/step - loss: 0.6955
Epoch 263/400
160/160 [=====] - 0s 680us/step - loss: 0.6951
Epoch 264/400
160/160 [=====] - 0s 678us/step - loss: 0.6954
Epoch 265/400
160/160 [=====] - 0s 681us/step - loss: 0.6954
Epoch 266/400
160/160 [=====] - 0s 698us/step - loss: 0.6957
Epoch 267/400
160/160 [=====] - 0s 689us/step - loss: 0.6945
Epoch 268/400

```

```

160/160 [=====] - 0s 695us/step - loss: 0.6956
Epoch 269/400
160/160 [=====] - 0s 642us/step - loss: 0.6945
Epoch 270/400
160/160 [=====] - 0s 670us/step - loss: 0.6956
Epoch 271/400
160/160 [=====] - 0s 727us/step - loss: 0.6929
Epoch 272/400
160/160 [=====] - 0s 711us/step - loss: 0.6954
Epoch 273/400
160/160 [=====] - 0s 702us/step - loss: 0.6950
Epoch 274/400
160/160 [=====] - 0s 677us/step - loss: 0.6955
Epoch 275/400
160/160 [=====] - 0s 681us/step - loss: 0.6948
Epoch 276/400
160/160 [=====] - 0s 686us/step - loss: 0.6954
Epoch 277/400
160/160 [=====] - 0s 647us/step - loss: 0.6964
Epoch 278/400
160/160 [=====] - 0s 666us/step - loss: 0.6955
Epoch 279/400
160/160 [=====] - 0s 611us/step - loss: 0.6958
Epoch 280/400
160/160 [=====] - 0s 648us/step - loss: 0.6955
Epoch 281/400
160/160 [=====] - 0s 688us/step - loss: 0.6953
Epoch 282/400
160/160 [=====] - 0s 694us/step - loss: 0.6952
Epoch 283/400
160/160 [=====] - 0s 633us/step - loss: 0.6950
Epoch 284/400
160/160 [=====] - 0s 637us/step - loss: 0.6951
Epoch 285/400
160/160 [=====] - 0s 767us/step - loss: 0.6942
Epoch 286/400
160/160 [=====] - 0s 661us/step - loss: 0.6943
Epoch 287/400
160/160 [=====] - 0s 737us/step - loss: 0.6956
Epoch 288/400
160/160 [=====] - 0s 636us/step - loss: 0.6950
Epoch 289/400
160/160 [=====] - 0s 658us/step - loss: 0.6947
Epoch 290/400
160/160 [=====] - 0s 738us/step - loss: 0.6954
Epoch 291/400
160/160 [=====] - 0s 642us/step - loss: 0.6950
Epoch 292/400

```

160/160 [=====] - 0s 646us/step - loss: 0.6951
Epoch 293/400
160/160 [=====] - 0s 657us/step - loss: 0.6951
Epoch 294/400
160/160 [=====] - 0s 666us/step - loss: 0.6957
Epoch 295/400
160/160 [=====] - 0s 760us/step - loss: 0.6960
Epoch 296/400
160/160 [=====] - 0s 661us/step - loss: 0.6948
Epoch 297/400
160/160 [=====] - 0s 665us/step - loss: 0.6950
Epoch 298/400
160/160 [=====] - 0s 667us/step - loss: 0.6954
Epoch 299/400
160/160 [=====] - 0s 684us/step - loss: 0.6952
Epoch 300/400
160/160 [=====] - 0s 661us/step - loss: 0.6950
Epoch 301/400
160/160 [=====] - 0s 652us/step - loss: 0.6951
Epoch 302/400
160/160 [=====] - 0s 665us/step - loss: 0.6938
Epoch 303/400
160/160 [=====] - 0s 669us/step - loss: 0.6960
Epoch 304/400
160/160 [=====] - 0s 660us/step - loss: 0.6954
Epoch 305/400
160/160 [=====] - 0s 680us/step - loss: 0.6955
Epoch 306/400
160/160 [=====] - 0s 647us/step - loss: 0.6945
Epoch 307/400
160/160 [=====] - 0s 666us/step - loss: 0.6952
Epoch 308/400
160/160 [=====] - 0s 699us/step - loss: 0.6959
Epoch 309/400
160/160 [=====] - 0s 672us/step - loss: 0.6952
Epoch 310/400
160/160 [=====] - 0s 870us/step - loss: 0.6954
Epoch 311/400
160/160 [=====] - 0s 685us/step - loss: 0.6959
Epoch 312/400
160/160 [=====] - 0s 639us/step - loss: 0.6950
Epoch 313/400
160/160 [=====] - 0s 642us/step - loss: 0.6953
Epoch 314/400
160/160 [=====] - 0s 645us/step - loss: 0.6953
Epoch 315/400
160/160 [=====] - 0s 658us/step - loss: 0.6946
Epoch 316/400

160/160 [=====] - 0s 648us/step - loss: 0.6951
 Epoch 317/400
 160/160 [=====] - 0s 635us/step - loss: 0.6936
 Epoch 318/400
 160/160 [=====] - 0s 659us/step - loss: 0.6955
 Epoch 319/400
 160/160 [=====] - 0s 668us/step - loss: 0.6949
 Epoch 320/400
 160/160 [=====] - 0s 641us/step - loss: 0.6952
 Epoch 321/400
 160/160 [=====] - 0s 626us/step - loss: 0.6955
 Epoch 322/400
 160/160 [=====] - 0s 613us/step - loss: 0.6948
 Epoch 323/400
 160/160 [=====] - 0s 590us/step - loss: 0.6955
 Epoch 324/400
 160/160 [=====] - 0s 622us/step - loss: 0.6954
 Epoch 325/400
 160/160 [=====] - 0s 642us/step - loss: 0.6952
 Epoch 326/400
 160/160 [=====] - 0s 632us/step - loss: 0.6955
 Epoch 327/400
 160/160 [=====] - 0s 636us/step - loss: 0.6954
 Epoch 328/400
 160/160 [=====] - 0s 620us/step - loss: 0.6950
 Epoch 329/400
 160/160 [=====] - 0s 593us/step - loss: 0.6950
 Epoch 330/400
 160/160 [=====] - 0s 627us/step - loss: 0.6957
 Epoch 331/400
 160/160 [=====] - 0s 633us/step - loss: 0.6952
 Epoch 332/400
 160/160 [=====] - 0s 639us/step - loss: 0.6950
 Epoch 333/400
 160/160 [=====] - 0s 674us/step - loss: 0.6948
 Epoch 334/400
 160/160 [=====] - 0s 638us/step - loss: 0.6955
 Epoch 335/400
 160/160 [=====] - 0s 656us/step - loss: 0.6950
 Epoch 336/400
 160/160 [=====] - 0s 643us/step - loss: 0.6950
 Epoch 337/400
 160/160 [=====] - 0s 662us/step - loss: 0.6952
 Epoch 338/400
 160/160 [=====] - 0s 647us/step - loss: 0.6955
 Epoch 339/400
 160/160 [=====] - 0s 699us/step - loss: 0.6954
 Epoch 340/400

160/160 [=====] - 0s 781us/step - loss: 0.6955
Epoch 341/400
160/160 [=====] - 0s 647us/step - loss: 0.6951
Epoch 342/400
160/160 [=====] - 0s 657us/step - loss: 0.6948
Epoch 343/400
160/160 [=====] - 0s 640us/step - loss: 0.6951
Epoch 344/400
160/160 [=====] - 0s 662us/step - loss: 0.6946
Epoch 345/400
160/160 [=====] - 0s 664us/step - loss: 0.6959
Epoch 346/400
160/160 [=====] - 0s 645us/step - loss: 0.6954
Epoch 347/400
160/160 [=====] - 0s 677us/step - loss: 0.6955
Epoch 348/400
160/160 [=====] - 0s 646us/step - loss: 0.6950
Epoch 349/400
160/160 [=====] - 0s 675us/step - loss: 0.6952
Epoch 350/400
160/160 [=====] - 0s 666us/step - loss: 0.6951
Epoch 351/400
160/160 [=====] - 0s 644us/step - loss: 0.6951
Epoch 352/400
160/160 [=====] - 0s 640us/step - loss: 0.6949
Epoch 353/400
160/160 [=====] - 0s 644us/step - loss: 0.6953
Epoch 354/400
160/160 [=====] - 0s 715us/step - loss: 0.6945
Epoch 355/400
160/160 [=====] - 0s 646us/step - loss: 0.6953
Epoch 356/400
160/160 [=====] - 0s 656us/step - loss: 0.6949
Epoch 357/400
160/160 [=====] - 0s 650us/step - loss: 0.6949
Epoch 358/400
160/160 [=====] - 0s 653us/step - loss: 0.6951
Epoch 359/400
160/160 [=====] - 0s 639us/step - loss: 0.6949
Epoch 360/400
160/160 [=====] - 0s 691us/step - loss: 0.6948
Epoch 361/400
160/160 [=====] - 0s 641us/step - loss: 0.6945
Epoch 362/400
160/160 [=====] - 0s 664us/step - loss: 0.6946
Epoch 363/400
160/160 [=====] - 0s 643us/step - loss: 0.6951
Epoch 364/400

160/160 [=====] - 0s 643us/step - loss: 0.6952
Epoch 365/400
160/160 [=====] - 0s 666us/step - loss: 0.6951
Epoch 366/400
160/160 [=====] - 0s 641us/step - loss: 0.6952
Epoch 367/400
160/160 [=====] - 0s 649us/step - loss: 0.6954
Epoch 368/400
160/160 [=====] - 0s 733us/step - loss: 0.6954
Epoch 369/400
160/160 [=====] - 0s 822us/step - loss: 0.6951
Epoch 370/400
160/160 [=====] - 0s 877us/step - loss: 0.6953
Epoch 371/400
160/160 [=====] - 0s 764us/step - loss: 0.6945
Epoch 372/400
160/160 [=====] - 0s 751us/step - loss: 0.6950
Epoch 373/400
160/160 [=====] - 0s 638us/step - loss: 0.6949
Epoch 374/400
160/160 [=====] - 0s 700us/step - loss: 0.6946
Epoch 375/400
160/160 [=====] - 0s 784us/step - loss: 0.6946
Epoch 376/400
160/160 [=====] - 0s 695us/step - loss: 0.6950
Epoch 377/400
160/160 [=====] - 0s 625us/step - loss: 0.6951
Epoch 378/400
160/160 [=====] - 0s 643us/step - loss: 0.6951
Epoch 379/400
160/160 [=====] - 0s 643us/step - loss: 0.6946
Epoch 380/400
160/160 [=====] - 0s 786us/step - loss: 0.6949
Epoch 381/400
160/160 [=====] - 0s 825us/step - loss: 0.6940
Epoch 382/400
160/160 [=====] - 0s 736us/step - loss: 0.6947
Epoch 383/400
160/160 [=====] - 0s 745us/step - loss: 0.6946
Epoch 384/400
160/160 [=====] - 0s 688us/step - loss: 0.6952
Epoch 385/400
160/160 [=====] - 0s 677us/step - loss: 0.6951
Epoch 386/400
160/160 [=====] - 0s 762us/step - loss: 0.6946
Epoch 387/400
160/160 [=====] - 0s 743us/step - loss: 0.6947
Epoch 388/400

```

160/160 [=====] - 0s 647us/step - loss: 0.6952
Epoch 389/400
160/160 [=====] - 0s 820us/step - loss: 0.6943
Epoch 390/400
160/160 [=====] - 0s 783us/step - loss: 0.6941
Epoch 391/400
160/160 [=====] - 0s 673us/step - loss: 0.6947
Epoch 392/400
160/160 [=====] - 0s 645us/step - loss: 0.6952
Epoch 393/400
160/160 [=====] - 0s 656us/step - loss: 0.6950
Epoch 394/400
160/160 [=====] - 0s 640us/step - loss: 0.6945
Epoch 395/400
160/160 [=====] - 0s 643us/step - loss: 0.6945
Epoch 396/400
160/160 [=====] - 0s 789us/step - loss: 0.6952
Epoch 397/400
160/160 [=====] - 0s 777us/step - loss: 0.6950
Epoch 398/400
160/160 [=====] - 0s 851us/step - loss: 0.6954
Epoch 399/400
160/160 [=====] - 0s 867us/step - loss: 0.6944
Epoch 400/400
160/160 [=====] - 0s 795us/step - loss: 0.6947
[0.5138155 0.51258767 0.5149192 0.5128119 0.5129363 0.51523864
0.51340353 0.51592976 0.51216197 0.51537466 0.51323944 0.5130592
0.5148019 0.5141733 0.51357263 0.50972086 0.51166517 0.51520777
0.5135027 0.51497567 0.51652014 0.514565 0.51139957 0.5126659
0.5140209 0.51259524 0.5165608 0.51642144 0.5159176 0.51380676
0.51579225 0.51155394 0.51286864 0.513741 0.51538384 0.5134108
0.5110619 0.51313126 0.51273614 0.51289594 0.50868344 0.51019174
0.50814086 0.5100419 0.510007 0.50799835 0.50954306 0.50599176
0.51051795 0.50780755 0.5097377 0.50989115 0.50816214 0.5082426
0.50923604 0.5117348 0.5109544 0.5078851 0.5096508 0.50712013
0.5068979 0.5089791 0.51118046 0.51013106 0.5093088 0.51006234
0.5066733 0.50729525 0.50759786 0.5091843 0.50664985 0.510955
0.5099315 0.5092479 0.5075397 0.5096723 0.5111217 0.5096699
0.5100811 0.5098621 0.51377124 0.5129534 0.51428413 0.51303935
0.51316595 0.51434743 0.5133345 0.5157213 0.51240206 0.51447165
0.5132413 0.5131718 0.51427567 0.5141107 0.5134847 0.5117451
0.5119451 0.5144403 0.5133633 0.5149294 0.5148959 0.5137328
0.51174664 0.5129049 0.5135545 0.51267123 0.5150705 0.5145954
0.51450515 0.51358545 0.5152728 0.5121762 0.51297927 0.51354223
0.5146749 0.51332444 0.5122044 0.51315683 0.5129538 0.5129745
0.50841475 0.5075104 0.5063367 0.50753766 0.5062355 0.50570333
0.5077927 0.5056694 0.5098291 0.5056624 0.5072937 0.5069393
0.50661856 0.50799686 0.5082468 0.5096997 0.51049054 0.50597596

```

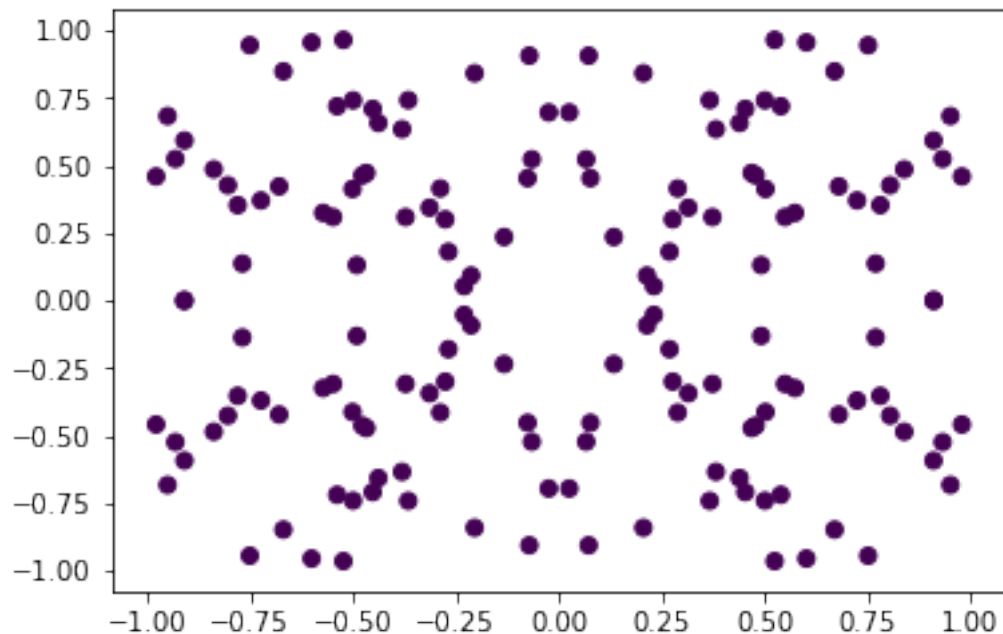
```
0.5059309 0.5070171 0.5041422 0.50486326 0.51071906 0.5083936
0.5055459 0.50969505 0.50427514 0.5038334 0.50459236 0.5074726
0.5057485 0.50975007 0.5087789 0.5075123 0.50597924 0.50644416
0.50907534 0.5086649 0.5082296 0.509024 ]
160/160 [=====] - 0s 1ms/step
```

```
In [58]: scores, model.metrics_names
```

```
Out[58]: (0.6923883199691773, ['loss'])
```

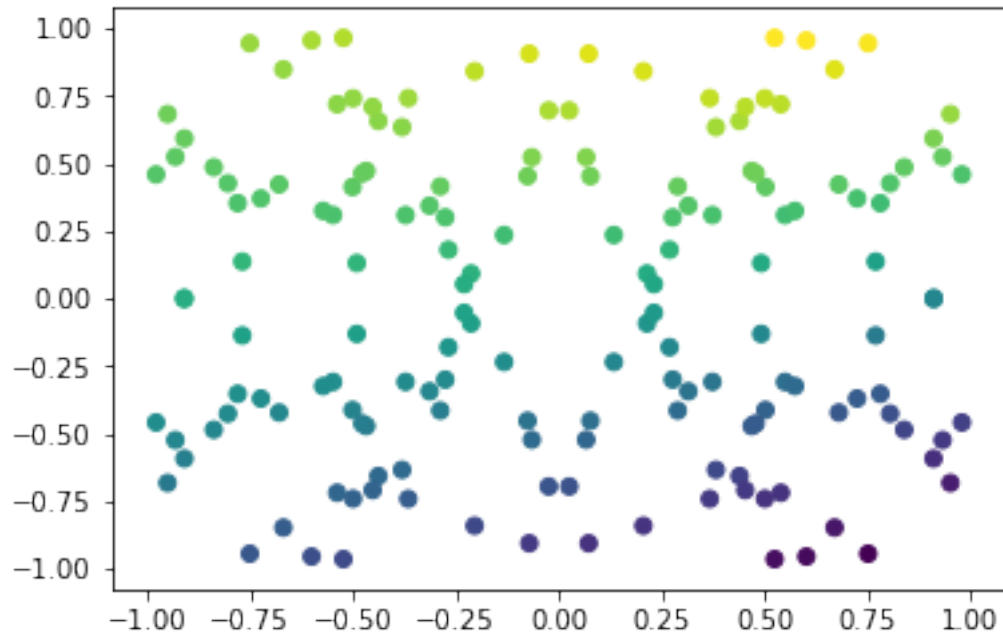
```
In [59]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[59]: <matplotlib.collections.PathCollection at 0xb28601e80>
```



```
In [60]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[60]: <matplotlib.collections.PathCollection at 0xb286e6278>
```



```
In [61]: # Softplus 5
model = Sequential()

model.add(Dense(2, input_dim=2, activation='softplus'))
model.add(Dense(2, activation='softplus'))
model.add(Dense(2, activation='softplus'))
model.add(Dense(2, activation='softplus'))
model.add(Dense(2, activation='softplus'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='softplus'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 6ms/step - loss: 1.1215
Epoch 2/400
160/160 [=====] - 0s 855us/step - loss: 0.7320
Epoch 3/400
160/160 [=====] - 0s 914us/step - loss: 0.6994
```

Epoch 4/400
160/160 [=====] - 0s 850us/step - loss: 0.6967
Epoch 5/400
160/160 [=====] - 0s 842us/step - loss: 0.6970
Epoch 6/400
160/160 [=====] - 0s 922us/step - loss: 0.6979
Epoch 7/400
160/160 [=====] - 0s 1ms/step - loss: 0.6967
Epoch 8/400
160/160 [=====] - 0s 909us/step - loss: 0.6956
Epoch 9/400
160/160 [=====] - 0s 963us/step - loss: 0.6964
Epoch 10/400
160/160 [=====] - 0s 912us/step - loss: 0.6963
Epoch 11/400
160/160 [=====] - 0s 975us/step - loss: 0.6961
Epoch 12/400
160/160 [=====] - 0s 959us/step - loss: 0.6942
Epoch 13/400
160/160 [=====] - 0s 936us/step - loss: 0.6979
Epoch 14/400
160/160 [=====] - 0s 981us/step - loss: 0.6938
Epoch 15/400
160/160 [=====] - 0s 882us/step - loss: 0.6980
Epoch 16/400
160/160 [=====] - 0s 866us/step - loss: 0.6947
Epoch 17/400
160/160 [=====] - 0s 854us/step - loss: 0.6969
Epoch 18/400
160/160 [=====] - 0s 832us/step - loss: 0.6973
Epoch 19/400
160/160 [=====] - 0s 931us/step - loss: 0.6954
Epoch 20/400
160/160 [=====] - 0s 732us/step - loss: 0.6963
Epoch 21/400
160/160 [=====] - 0s 724us/step - loss: 0.6966
Epoch 22/400
160/160 [=====] - 0s 820us/step - loss: 0.6966
Epoch 23/400
160/160 [=====] - 0s 910us/step - loss: 0.6954
Epoch 24/400
160/160 [=====] - 0s 922us/step - loss: 0.6968
Epoch 25/400
160/160 [=====] - 0s 886us/step - loss: 0.6961
Epoch 26/400
160/160 [=====] - 0s 943us/step - loss: 0.6962
Epoch 27/400
160/160 [=====] - 0s 951us/step - loss: 0.6967

Epoch 28/400
160/160 [=====] - 0s 903us/step - loss: 0.6972
Epoch 29/400
160/160 [=====] - 0s 761us/step - loss: 0.6958
Epoch 30/400
160/160 [=====] - 0s 756us/step - loss: 0.6964
Epoch 31/400
160/160 [=====] - 0s 863us/step - loss: 0.6967
Epoch 32/400
160/160 [=====] - 0s 884us/step - loss: 0.6951
Epoch 33/400
160/160 [=====] - 0s 745us/step - loss: 0.6968
Epoch 34/400
160/160 [=====] - 0s 772us/step - loss: 0.6961
Epoch 35/400
160/160 [=====] - 0s 790us/step - loss: 0.6959
Epoch 36/400
160/160 [=====] - 0s 774us/step - loss: 0.6960
Epoch 37/400
160/160 [=====] - 0s 686us/step - loss: 0.6960
Epoch 38/400
160/160 [=====] - 0s 664us/step - loss: 0.6962
Epoch 39/400
160/160 [=====] - 0s 678us/step - loss: 0.6966
Epoch 40/400
160/160 [=====] - 0s 681us/step - loss: 0.6965
Epoch 41/400
160/160 [=====] - 0s 839us/step - loss: 0.6968
Epoch 42/400
160/160 [=====] - 0s 717us/step - loss: 0.6959
Epoch 43/400
160/160 [=====] - 0s 719us/step - loss: 0.6960
Epoch 44/400
160/160 [=====] - 0s 907us/step - loss: 0.6963
Epoch 45/400
160/160 [=====] - 0s 905us/step - loss: 0.6966
Epoch 46/400
160/160 [=====] - 0s 915us/step - loss: 0.6948
Epoch 47/400
160/160 [=====] - 0s 881us/step - loss: 0.6951
Epoch 48/400
160/160 [=====] - 0s 894us/step - loss: 0.6970
Epoch 49/400
160/160 [=====] - 0s 902us/step - loss: 0.6963
Epoch 50/400
160/160 [=====] - 0s 902us/step - loss: 0.6970
Epoch 51/400
160/160 [=====] - 0s 882us/step - loss: 0.6954

Epoch 52/400
160/160 [=====] - 0s 716us/step - loss: 0.6963
Epoch 53/400
160/160 [=====] - 0s 859us/step - loss: 0.6964
Epoch 54/400
160/160 [=====] - 0s 953us/step - loss: 0.6964
Epoch 55/400
160/160 [=====] - 0s 913us/step - loss: 0.6950
Epoch 56/400
160/160 [=====] - 0s 899us/step - loss: 0.6973
Epoch 57/400
160/160 [=====] - 0s 935us/step - loss: 0.6965
Epoch 58/400
160/160 [=====] - 0s 847us/step - loss: 0.6962
Epoch 59/400
160/160 [=====] - 0s 744us/step - loss: 0.6968
Epoch 60/400
160/160 [=====] - 0s 867us/step - loss: 0.6963
Epoch 61/400
160/160 [=====] - 0s 716us/step - loss: 0.6955
Epoch 62/400
160/160 [=====] - 0s 685us/step - loss: 0.6959
Epoch 63/400
160/160 [=====] - 0s 736us/step - loss: 0.6963
Epoch 64/400
160/160 [=====] - 0s 748us/step - loss: 0.6961
Epoch 65/400
160/160 [=====] - 0s 741us/step - loss: 0.6968
Epoch 66/400
160/160 [=====] - 0s 690us/step - loss: 0.6967
Epoch 67/400
160/160 [=====] - 0s 734us/step - loss: 0.6965
Epoch 68/400
160/160 [=====] - 0s 836us/step - loss: 0.6953
Epoch 69/400
160/160 [=====] - 0s 805us/step - loss: 0.6973
Epoch 70/400
160/160 [=====] - 0s 909us/step - loss: 0.6961
Epoch 71/400
160/160 [=====] - 0s 895us/step - loss: 0.6955
Epoch 72/400
160/160 [=====] - 0s 921us/step - loss: 0.6964
Epoch 73/400
160/160 [=====] - 0s 919us/step - loss: 0.6956
Epoch 74/400
160/160 [=====] - 0s 878us/step - loss: 0.6960
Epoch 75/400
160/160 [=====] - 0s 823us/step - loss: 0.6953

Epoch 76/400
160/160 [=====] - 0s 916us/step - loss: 0.6963
Epoch 77/400
160/160 [=====] - 0s 909us/step - loss: 0.6963
Epoch 78/400
160/160 [=====] - 0s 922us/step - loss: 0.6963
Epoch 79/400
160/160 [=====] - 0s 956us/step - loss: 0.6953
Epoch 80/400
160/160 [=====] - 0s 915us/step - loss: 0.6967
Epoch 81/400
160/160 [=====] - 0s 914us/step - loss: 0.6967
Epoch 82/400
160/160 [=====] - 0s 816us/step - loss: 0.6969
Epoch 83/400
160/160 [=====] - 0s 744us/step - loss: 0.6969
Epoch 84/400
160/160 [=====] - 0s 704us/step - loss: 0.6965
Epoch 85/400
160/160 [=====] - 0s 697us/step - loss: 0.6966
Epoch 86/400
160/160 [=====] - 0s 674us/step - loss: 0.6967
Epoch 87/400
160/160 [=====] - 0s 673us/step - loss: 0.6960
Epoch 88/400
160/160 [=====] - 0s 662us/step - loss: 0.6960
Epoch 89/400
160/160 [=====] - 0s 704us/step - loss: 0.6967
Epoch 90/400
160/160 [=====] - 0s 712us/step - loss: 0.6965
Epoch 91/400
160/160 [=====] - 0s 723us/step - loss: 0.6965
Epoch 92/400
160/160 [=====] - 0s 747us/step - loss: 0.6944
Epoch 93/400
160/160 [=====] - 0s 695us/step - loss: 0.6952
Epoch 94/400
160/160 [=====] - 0s 879us/step - loss: 0.6974
Epoch 95/400
160/160 [=====] - 0s 975us/step - loss: 0.6955
Epoch 96/400
160/160 [=====] - 0s 894us/step - loss: 0.6954
Epoch 97/400
160/160 [=====] - 0s 956us/step - loss: 0.6952
Epoch 98/400
160/160 [=====] - 0s 950us/step - loss: 0.6969
Epoch 99/400
160/160 [=====] - 0s 1ms/step - loss: 0.6958

Epoch 100/400
160/160 [=====] - 0s 947us/step - loss: 0.6962
Epoch 101/400
160/160 [=====] - 0s 961us/step - loss: 0.6966
Epoch 102/400
160/160 [=====] - 0s 917us/step - loss: 0.6965
Epoch 103/400
160/160 [=====] - 0s 1ms/step - loss: 0.6967
Epoch 104/400
160/160 [=====] - 0s 743us/step - loss: 0.6959
Epoch 105/400
160/160 [=====] - 0s 757us/step - loss: 0.6969
Epoch 106/400
160/160 [=====] - 0s 769us/step - loss: 0.6964
Epoch 107/400
160/160 [=====] - 0s 938us/step - loss: 0.6956
Epoch 108/400
160/160 [=====] - 0s 900us/step - loss: 0.6966
Epoch 109/400
160/160 [=====] - 0s 936us/step - loss: 0.6956
Epoch 110/400
160/160 [=====] - 0s 1ms/step - loss: 0.6968
Epoch 111/400
160/160 [=====] - 0s 1ms/step - loss: 0.6960
Epoch 112/400
160/160 [=====] - 0s 1ms/step - loss: 0.6964
Epoch 113/400
160/160 [=====] - 0s 1ms/step - loss: 0.6958
Epoch 114/400
160/160 [=====] - 0s 980us/step - loss: 0.6959
Epoch 115/400
160/160 [=====] - 0s 988us/step - loss: 0.6955
Epoch 116/400
160/160 [=====] - 0s 942us/step - loss: 0.6960
Epoch 117/400
160/160 [=====] - 0s 952us/step - loss: 0.6963
Epoch 118/400
160/160 [=====] - 0s 925us/step - loss: 0.6960
Epoch 119/400
160/160 [=====] - 0s 926us/step - loss: 0.6966
Epoch 120/400
160/160 [=====] - 0s 914us/step - loss: 0.6964
Epoch 121/400
160/160 [=====] - 0s 914us/step - loss: 0.6960
Epoch 122/400
160/160 [=====] - 0s 806us/step - loss: 0.6958
Epoch 123/400
160/160 [=====] - 0s 750us/step - loss: 0.6938

Epoch 124/400
160/160 [=====] - 0s 743us/step - loss: 0.6955 0s - loss: 0.68
Epoch 125/400
160/160 [=====] - 0s 743us/step - loss: 0.6966
Epoch 126/400
160/160 [=====] - 0s 754us/step - loss: 0.6961
Epoch 127/400
160/160 [=====] - 0s 925us/step - loss: 0.6956
Epoch 128/400
160/160 [=====] - 0s 888us/step - loss: 0.6957
Epoch 129/400
160/160 [=====] - 0s 749us/step - loss: 0.6963
Epoch 130/400
160/160 [=====] - 0s 891us/step - loss: 0.6960
Epoch 131/400
160/160 [=====] - 0s 920us/step - loss: 0.6971
Epoch 132/400
160/160 [=====] - 0s 793us/step - loss: 0.6956
Epoch 133/400
160/160 [=====] - 0s 777us/step - loss: 0.6963
Epoch 134/400
160/160 [=====] - 0s 974us/step - loss: 0.6968
Epoch 135/400
160/160 [=====] - 0s 848us/step - loss: 0.6963
Epoch 136/400
160/160 [=====] - 0s 911us/step - loss: 0.6957
Epoch 137/400
160/160 [=====] - 0s 914us/step - loss: 0.6971
Epoch 138/400
160/160 [=====] - 0s 949us/step - loss: 0.6970
Epoch 139/400
160/160 [=====] - 0s 892us/step - loss: 0.6959
Epoch 140/400
160/160 [=====] - 0s 724us/step - loss: 0.6943
Epoch 141/400
160/160 [=====] - 0s 707us/step - loss: 0.6956
Epoch 142/400
160/160 [=====] - 0s 725us/step - loss: 0.6961
Epoch 143/400
160/160 [=====] - 0s 764us/step - loss: 0.6963
Epoch 144/400
160/160 [=====] - 0s 926us/step - loss: 0.6963
Epoch 145/400
160/160 [=====] - 0s 853us/step - loss: 0.6954
Epoch 146/400
160/160 [=====] - 0s 855us/step - loss: 0.6956
Epoch 147/400
160/160 [=====] - 0s 957us/step - loss: 0.6944

Epoch 148/400
160/160 [=====] - 0s 876us/step - loss: 0.6963
Epoch 149/400
160/160 [=====] - 0s 723us/step - loss: 0.6961
Epoch 150/400
160/160 [=====] - 0s 715us/step - loss: 0.6962
Epoch 151/400
160/160 [=====] - 0s 804us/step - loss: 0.6963
Epoch 152/400
160/160 [=====] - 0s 823us/step - loss: 0.6937
Epoch 153/400
160/160 [=====] - 0s 663us/step - loss: 0.6965
Epoch 154/400
160/160 [=====] - 0s 752us/step - loss: 0.6946
Epoch 155/400
160/160 [=====] - 0s 838us/step - loss: 0.6957
Epoch 156/400
160/160 [=====] - 0s 798us/step - loss: 0.6960
Epoch 157/400
160/160 [=====] - 0s 694us/step - loss: 0.6961
Epoch 158/400
160/160 [=====] - 0s 717us/step - loss: 0.6964
Epoch 159/400
160/160 [=====] - 0s 713us/step - loss: 0.6953
Epoch 160/400
160/160 [=====] - 0s 736us/step - loss: 0.6966
Epoch 161/400
160/160 [=====] - 0s 710us/step - loss: 0.6953
Epoch 162/400
160/160 [=====] - 0s 704us/step - loss: 0.6954
Epoch 163/400
160/160 [=====] - 0s 726us/step - loss: 0.6954
Epoch 164/400
160/160 [=====] - 0s 704us/step - loss: 0.6962
Epoch 165/400
160/160 [=====] - 0s 735us/step - loss: 0.6960
Epoch 166/400
160/160 [=====] - 0s 655us/step - loss: 0.6954
Epoch 167/400
160/160 [=====] - 0s 649us/step - loss: 0.6954
Epoch 168/400
160/160 [=====] - 0s 668us/step - loss: 0.6959
Epoch 169/400
160/160 [=====] - 0s 712us/step - loss: 0.6957
Epoch 170/400
160/160 [=====] - 0s 710us/step - loss: 0.6957
Epoch 171/400
160/160 [=====] - 0s 724us/step - loss: 0.6954

Epoch 172/400
160/160 [=====] - 0s 697us/step - loss: 0.6962
Epoch 173/400
160/160 [=====] - 0s 797us/step - loss: 0.6955
Epoch 174/400
160/160 [=====] - 0s 815us/step - loss: 0.6962
Epoch 175/400
160/160 [=====] - 0s 708us/step - loss: 0.6958
Epoch 176/400
160/160 [=====] - 0s 768us/step - loss: 0.6965
Epoch 177/400
160/160 [=====] - 0s 721us/step - loss: 0.6961
Epoch 178/400
160/160 [=====] - 0s 762us/step - loss: 0.6967
Epoch 179/400
160/160 [=====] - 0s 733us/step - loss: 0.6954
Epoch 180/400
160/160 [=====] - 0s 692us/step - loss: 0.6953
Epoch 181/400
160/160 [=====] - 0s 702us/step - loss: 0.6954
Epoch 182/400
160/160 [=====] - 0s 714us/step - loss: 0.6958
Epoch 183/400
160/160 [=====] - 0s 688us/step - loss: 0.6959
Epoch 184/400
160/160 [=====] - 0s 667us/step - loss: 0.6961
Epoch 185/400
160/160 [=====] - 0s 670us/step - loss: 0.6954
Epoch 186/400
160/160 [=====] - 0s 694us/step - loss: 0.6957
Epoch 187/400
160/160 [=====] - 0s 796us/step - loss: 0.6962
Epoch 188/400
160/160 [=====] - 0s 740us/step - loss: 0.6964
Epoch 189/400
160/160 [=====] - 0s 840us/step - loss: 0.6966
Epoch 190/400
160/160 [=====] - 0s 734us/step - loss: 0.6964
Epoch 191/400
160/160 [=====] - 0s 733us/step - loss: 0.6941
Epoch 192/400
160/160 [=====] - 0s 699us/step - loss: 0.6959
Epoch 193/400
160/160 [=====] - 0s 676us/step - loss: 0.6954
Epoch 194/400
160/160 [=====] - 0s 722us/step - loss: 0.6963
Epoch 195/400
160/160 [=====] - 0s 724us/step - loss: 0.6959

Epoch 196/400
160/160 [=====] - 0s 778us/step - loss: 0.6965
Epoch 197/400
160/160 [=====] - 0s 754us/step - loss: 0.6962
Epoch 198/400
160/160 [=====] - 0s 751us/step - loss: 0.6960
Epoch 199/400
160/160 [=====] - 0s 698us/step - loss: 0.6953
Epoch 200/400
160/160 [=====] - 0s 670us/step - loss: 0.6953
Epoch 201/400
160/160 [=====] - 0s 678us/step - loss: 0.6956
Epoch 202/400
160/160 [=====] - 0s 658us/step - loss: 0.6958
Epoch 203/400
160/160 [=====] - 0s 744us/step - loss: 0.6964
Epoch 204/400
160/160 [=====] - 0s 743us/step - loss: 0.6953
Epoch 205/400
160/160 [=====] - 0s 752us/step - loss: 0.6957
Epoch 206/400
160/160 [=====] - 0s 747us/step - loss: 0.6960
Epoch 207/400
160/160 [=====] - 0s 717us/step - loss: 0.6956
Epoch 208/400
160/160 [=====] - 0s 697us/step - loss: 0.6954
Epoch 209/400
160/160 [=====] - 0s 708us/step - loss: 0.6953
Epoch 210/400
160/160 [=====] - 0s 694us/step - loss: 0.6955
Epoch 211/400
160/160 [=====] - 0s 725us/step - loss: 0.6961
Epoch 212/400
160/160 [=====] - 0s 724us/step - loss: 0.6959
Epoch 213/400
160/160 [=====] - 0s 724us/step - loss: 0.6962
Epoch 214/400
160/160 [=====] - 0s 694us/step - loss: 0.6960
Epoch 215/400
160/160 [=====] - 0s 737us/step - loss: 0.6962
Epoch 216/400
160/160 [=====] - 0s 725us/step - loss: 0.6952
Epoch 217/400
160/160 [=====] - 0s 731us/step - loss: 0.6939
Epoch 218/400
160/160 [=====] - 0s 665us/step - loss: 0.6959
Epoch 219/400
160/160 [=====] - 0s 708us/step - loss: 0.6960

Epoch 220/400
160/160 [=====] - 0s 676us/step - loss: 0.6958
Epoch 221/400
160/160 [=====] - 0s 666us/step - loss: 0.6959
Epoch 222/400
160/160 [=====] - 0s 688us/step - loss: 0.6942
Epoch 223/400
160/160 [=====] - 0s 770us/step - loss: 0.6955
Epoch 224/400
160/160 [=====] - 0s 721us/step - loss: 0.6957
Epoch 225/400
160/160 [=====] - 0s 697us/step - loss: 0.6946
Epoch 226/400
160/160 [=====] - 0s 702us/step - loss: 0.6956
Epoch 227/400
160/160 [=====] - 0s 741us/step - loss: 0.6958
Epoch 228/400
160/160 [=====] - 0s 702us/step - loss: 0.6964
Epoch 229/400
160/160 [=====] - 0s 695us/step - loss: 0.6966
Epoch 230/400
160/160 [=====] - 0s 687us/step - loss: 0.6959
Epoch 231/400
160/160 [=====] - 0s 768us/step - loss: 0.6947
Epoch 232/400
160/160 [=====] - 0s 753us/step - loss: 0.6946
Epoch 233/400
160/160 [=====] - 0s 709us/step - loss: 0.6943
Epoch 234/400
160/160 [=====] - 0s 683us/step - loss: 0.6950
Epoch 235/400
160/160 [=====] - 0s 672us/step - loss: 0.6953
Epoch 236/400
160/160 [=====] - 0s 667us/step - loss: 0.6963
Epoch 237/400
160/160 [=====] - 0s 676us/step - loss: 0.6953
Epoch 238/400
160/160 [=====] - 0s 701us/step - loss: 0.6950
Epoch 239/400
160/160 [=====] - 0s 699us/step - loss: 0.6950
Epoch 240/400
160/160 [=====] - 0s 696us/step - loss: 0.6956
Epoch 241/400
160/160 [=====] - 0s 745us/step - loss: 0.6953
Epoch 242/400
160/160 [=====] - 0s 824us/step - loss: 0.6952
Epoch 243/400
160/160 [=====] - 0s 810us/step - loss: 0.6949

Epoch 244/400
160/160 [=====] - 0s 693us/step - loss: 0.6961
Epoch 245/400
160/160 [=====] - 0s 710us/step - loss: 0.6941
Epoch 246/400
160/160 [=====] - 0s 702us/step - loss: 0.6956
Epoch 247/400
160/160 [=====] - 0s 713us/step - loss: 0.6949
Epoch 248/400
160/160 [=====] - 0s 709us/step - loss: 0.6949
Epoch 249/400
160/160 [=====] - 0s 722us/step - loss: 0.6952
Epoch 250/400
160/160 [=====] - 0s 698us/step - loss: 0.6968
Epoch 251/400
160/160 [=====] - 0s 771us/step - loss: 0.6957
Epoch 252/400
160/160 [=====] - 0s 821us/step - loss: 0.6958
Epoch 253/400
160/160 [=====] - 0s 660us/step - loss: 0.6959
Epoch 254/400
160/160 [=====] - 0s 718us/step - loss: 0.6958
Epoch 255/400
160/160 [=====] - 0s 793us/step - loss: 0.6959
Epoch 256/400
160/160 [=====] - 0s 753us/step - loss: 0.6959
Epoch 257/400
160/160 [=====] - 0s 776us/step - loss: 0.6950
Epoch 258/400
160/160 [=====] - 0s 725us/step - loss: 0.6941
Epoch 259/400
160/160 [=====] - 0s 836us/step - loss: 0.6951
Epoch 260/400
160/160 [=====] - 0s 802us/step - loss: 0.6953
Epoch 261/400
160/160 [=====] - 0s 784us/step - loss: 0.6954
Epoch 262/400
160/160 [=====] - 0s 784us/step - loss: 0.6947
Epoch 263/400
160/160 [=====] - 0s 779us/step - loss: 0.6951
Epoch 264/400
160/160 [=====] - 0s 748us/step - loss: 0.6949
Epoch 265/400
160/160 [=====] - 0s 727us/step - loss: 0.6954
Epoch 266/400
160/160 [=====] - 0s 727us/step - loss: 0.6957
Epoch 267/400
160/160 [=====] - 0s 745us/step - loss: 0.6952

Epoch 268/400
160/160 [=====] - 0s 803us/step - loss: 0.6944
Epoch 269/400
160/160 [=====] - 0s 784us/step - loss: 0.6956
Epoch 270/400
160/160 [=====] - 0s 691us/step - loss: 0.6959
Epoch 271/400
160/160 [=====] - 0s 787us/step - loss: 0.6950
Epoch 272/400
160/160 [=====] - 0s 739us/step - loss: 0.6947
Epoch 273/400
160/160 [=====] - 0s 706us/step - loss: 0.6955
Epoch 274/400
160/160 [=====] - 0s 733us/step - loss: 0.6950
Epoch 275/400
160/160 [=====] - 0s 794us/step - loss: 0.6954
Epoch 276/400
160/160 [=====] - 0s 874us/step - loss: 0.6949
Epoch 277/400
160/160 [=====] - 0s 875us/step - loss: 0.6949
Epoch 278/400
160/160 [=====] - 0s 741us/step - loss: 0.6959
Epoch 279/400
160/160 [=====] - 0s 796us/step - loss: 0.6952
Epoch 280/400
160/160 [=====] - 0s 751us/step - loss: 0.6945
Epoch 281/400
160/160 [=====] - 0s 766us/step - loss: 0.6957
Epoch 282/400
160/160 [=====] - 0s 776us/step - loss: 0.6951
Epoch 283/400
160/160 [=====] - 0s 717us/step - loss: 0.6952
Epoch 284/400
160/160 [=====] - 0s 705us/step - loss: 0.6949
Epoch 285/400
160/160 [=====] - 0s 729us/step - loss: 0.6955
Epoch 286/400
160/160 [=====] - 0s 764us/step - loss: 0.6954
Epoch 287/400
160/160 [=====] - 0s 725us/step - loss: 0.6950
Epoch 288/400
160/160 [=====] - 0s 633us/step - loss: 0.6949
Epoch 289/400
160/160 [=====] - 0s 693us/step - loss: 0.6955
Epoch 290/400
160/160 [=====] - 0s 635us/step - loss: 0.6958
Epoch 291/400
160/160 [=====] - 0s 729us/step - loss: 0.6952

Epoch 292/400
160/160 [=====] - 0s 716us/step - loss: 0.6947
Epoch 293/400
160/160 [=====] - 0s 760us/step - loss: 0.6951
Epoch 294/400
160/160 [=====] - 0s 801us/step - loss: 0.6943
Epoch 295/400
160/160 [=====] - 0s 845us/step - loss: 0.6948
Epoch 296/400
160/160 [=====] - 0s 803us/step - loss: 0.6948
Epoch 297/400
160/160 [=====] - 0s 743us/step - loss: 0.6944
Epoch 298/400
160/160 [=====] - 0s 769us/step - loss: 0.6949
Epoch 299/400
160/160 [=====] - 0s 754us/step - loss: 0.6946
Epoch 300/400
160/160 [=====] - 0s 865us/step - loss: 0.6938
Epoch 301/400
160/160 [=====] - 0s 834us/step - loss: 0.6950
Epoch 302/400
160/160 [=====] - 0s 846us/step - loss: 0.6949
Epoch 303/400
160/160 [=====] - 0s 677us/step - loss: 0.6946
Epoch 304/400
160/160 [=====] - 0s 733us/step - loss: 0.6954
Epoch 305/400
160/160 [=====] - 0s 792us/step - loss: 0.6953
Epoch 306/400
160/160 [=====] - 0s 818us/step - loss: 0.6954
Epoch 307/400
160/160 [=====] - 0s 852us/step - loss: 0.6950
Epoch 308/400
160/160 [=====] - 0s 871us/step - loss: 0.6948
Epoch 309/400
160/160 [=====] - 0s 805us/step - loss: 0.6948
Epoch 310/400
160/160 [=====] - 0s 733us/step - loss: 0.6940
Epoch 311/400
160/160 [=====] - 0s 732us/step - loss: 0.6955
Epoch 312/400
160/160 [=====] - 0s 944us/step - loss: 0.6959
Epoch 313/400
160/160 [=====] - 0s 722us/step - loss: 0.6952
Epoch 314/400
160/160 [=====] - 0s 741us/step - loss: 0.6946
Epoch 315/400
160/160 [=====] - 0s 730us/step - loss: 0.6953

Epoch 316/400
160/160 [=====] - 0s 730us/step - loss: 0.6952
Epoch 317/400
160/160 [=====] - 0s 743us/step - loss: 0.6948
Epoch 318/400
160/160 [=====] - 0s 794us/step - loss: 0.6948
Epoch 319/400
160/160 [=====] - 0s 747us/step - loss: 0.6942
Epoch 320/400
160/160 [=====] - 0s 744us/step - loss: 0.6942
Epoch 321/400
160/160 [=====] - 0s 769us/step - loss: 0.6936
Epoch 322/400
160/160 [=====] - 0s 752us/step - loss: 0.6949
Epoch 323/400
160/160 [=====] - 0s 740us/step - loss: 0.6944
Epoch 324/400
160/160 [=====] - 0s 704us/step - loss: 0.6955
Epoch 325/400
160/160 [=====] - 0s 695us/step - loss: 0.6944
Epoch 326/400
160/160 [=====] - 0s 723us/step - loss: 0.6939
Epoch 327/400
160/160 [=====] - 0s 735us/step - loss: 0.6942
Epoch 328/400
160/160 [=====] - 0s 716us/step - loss: 0.6949
Epoch 329/400
160/160 [=====] - 0s 823us/step - loss: 0.6939
Epoch 330/400
160/160 [=====] - 0s 742us/step - loss: 0.6939
Epoch 331/400
160/160 [=====] - 0s 749us/step - loss: 0.6952
Epoch 332/400
160/160 [=====] - 0s 798us/step - loss: 0.6938
Epoch 333/400
160/160 [=====] - 0s 726us/step - loss: 0.6946
Epoch 334/400
160/160 [=====] - 0s 760us/step - loss: 0.6940
Epoch 335/400
160/160 [=====] - 0s 711us/step - loss: 0.6949
Epoch 336/400
160/160 [=====] - 0s 694us/step - loss: 0.6943
Epoch 337/400
160/160 [=====] - 0s 715us/step - loss: 0.6943
Epoch 338/400
160/160 [=====] - 0s 808us/step - loss: 0.6943
Epoch 339/400
160/160 [=====] - 0s 710us/step - loss: 0.6943

Epoch 340/400
160/160 [=====] - 0s 757us/step - loss: 0.6941
Epoch 341/400
160/160 [=====] - 0s 817us/step - loss: 0.6947
Epoch 342/400
160/160 [=====] - 0s 701us/step - loss: 0.6940
Epoch 343/400
160/160 [=====] - 0s 710us/step - loss: 0.6943
Epoch 344/400
160/160 [=====] - 0s 791us/step - loss: 0.6943
Epoch 345/400
160/160 [=====] - 0s 712us/step - loss: 0.6939
Epoch 346/400
160/160 [=====] - 0s 730us/step - loss: 0.6938
Epoch 347/400
160/160 [=====] - 0s 734us/step - loss: 0.6941
Epoch 348/400
160/160 [=====] - 0s 678us/step - loss: 0.6946
Epoch 349/400
160/160 [=====] - 0s 696us/step - loss: 0.6937
Epoch 350/400
160/160 [=====] - 0s 688us/step - loss: 0.6937
Epoch 351/400
160/160 [=====] - 0s 665us/step - loss: 0.6940
Epoch 352/400
160/160 [=====] - 0s 663us/step - loss: 0.6940
Epoch 353/400
160/160 [=====] - 0s 716us/step - loss: 0.6947
Epoch 354/400
160/160 [=====] - 0s 721us/step - loss: 0.6945
Epoch 355/400
160/160 [=====] - 0s 716us/step - loss: 0.6944
Epoch 356/400
160/160 [=====] - 0s 713us/step - loss: 0.6942
Epoch 357/400
160/160 [=====] - 0s 715us/step - loss: 0.6936
Epoch 358/400
160/160 [=====] - 0s 756us/step - loss: 0.6940
Epoch 359/400
160/160 [=====] - 0s 702us/step - loss: 0.6936
Epoch 360/400
160/160 [=====] - 0s 747us/step - loss: 0.6942
Epoch 361/400
160/160 [=====] - 0s 780us/step - loss: 0.6936
Epoch 362/400
160/160 [=====] - 0s 717us/step - loss: 0.6937
Epoch 363/400
160/160 [=====] - 0s 692us/step - loss: 0.6935

Epoch 364/400
160/160 [=====] - 0s 723us/step - loss: 0.6938
Epoch 365/400
160/160 [=====] - 0s 705us/step - loss: 0.6933
Epoch 366/400
160/160 [=====] - 0s 697us/step - loss: 0.6940
Epoch 367/400
160/160 [=====] - 0s 719us/step - loss: 0.6937
Epoch 368/400
160/160 [=====] - 0s 696us/step - loss: 0.6933
Epoch 369/400
160/160 [=====] - 0s 632us/step - loss: 0.6934
Epoch 370/400
160/160 [=====] - 0s 667us/step - loss: 0.6933
Epoch 371/400
160/160 [=====] - 0s 713us/step - loss: 0.6937
Epoch 372/400
160/160 [=====] - 0s 688us/step - loss: 0.6939
Epoch 373/400
160/160 [=====] - 0s 728us/step - loss: 0.6941
Epoch 374/400
160/160 [=====] - 0s 717us/step - loss: 0.6924
Epoch 375/400
160/160 [=====] - 0s 750us/step - loss: 0.6936
Epoch 376/400
160/160 [=====] - 0s 692us/step - loss: 0.6929
Epoch 377/400
160/160 [=====] - 0s 698us/step - loss: 0.6933
Epoch 378/400
160/160 [=====] - 0s 686us/step - loss: 0.6937
Epoch 379/400
160/160 [=====] - 0s 713us/step - loss: 0.6921
Epoch 380/400
160/160 [=====] - 0s 724us/step - loss: 0.6939
Epoch 381/400
160/160 [=====] - 0s 764us/step - loss: 0.6932
Epoch 382/400
160/160 [=====] - 0s 704us/step - loss: 0.6929
Epoch 383/400
160/160 [=====] - 0s 692us/step - loss: 0.6934
Epoch 384/400
160/160 [=====] - 0s 718us/step - loss: 0.6927
Epoch 385/400
160/160 [=====] - 0s 804us/step - loss: 0.6905
Epoch 386/400
160/160 [=====] - 0s 677us/step - loss: 0.6937
Epoch 387/400
160/160 [=====] - 0s 738us/step - loss: 0.6920

Epoch 388/400
160/160 [=====] - 0s 764us/step - loss: 0.6927
Epoch 389/400
160/160 [=====] - 0s 798us/step - loss: 0.6926
Epoch 390/400
160/160 [=====] - 0s 860us/step - loss: 0.6931
Epoch 391/400
160/160 [=====] - 0s 705us/step - loss: 0.6924
Epoch 392/400
160/160 [=====] - 0s 828us/step - loss: 0.6926
Epoch 393/400
160/160 [=====] - 0s 749us/step - loss: 0.6919
Epoch 394/400
160/160 [=====] - 0s 758us/step - loss: 0.6920
Epoch 395/400
160/160 [=====] - 0s 703us/step - loss: 0.6919
Epoch 396/400
160/160 [=====] - 0s 703us/step - loss: 0.6925
Epoch 397/400
160/160 [=====] - 0s 688us/step - loss: 0.6919
Epoch 398/400
160/160 [=====] - 0s 789us/step - loss: 0.6918
Epoch 399/400
160/160 [=====] - 0s 745us/step - loss: 0.6913
Epoch 400/400
160/160 [=====] - 0s 713us/step - loss: 0.6923
[0.51272905 0.5332543 0.52867043 0.53161263 0.54382896 0.53384846
0.52481884 0.5224121 0.5124674 0.5329952 0.5313343 0.5360995
0.5261179 0.513868 0.51801383 0.52891314 0.50927967 0.5304614
0.5437531 0.51632595 0.5424546 0.54891276 0.50896865 0.52390164
0.54475045 0.50995326 0.5397398 0.5480851 0.54223216 0.52512693
0.5251965 0.5179028 0.518227 0.52522784 0.5282394 0.53901327
0.5272827 0.51722246 0.5250981 0.515172 0.4952126 0.48854557
0.48910198 0.4888572 0.48659956 0.48785257 0.4904789 0.49063075
0.49560043 0.48799732 0.48883265 0.48787877 0.4898042 0.49455643
0.49278712 0.49010634 0.49752918 0.4886002 0.48649797 0.49322554
0.48602164 0.48557413 0.4977607 0.49090093 0.48624724 0.49699295
0.48643422 0.48527393 0.4862067 0.49030545 0.48981398 0.49319825
0.49283332 0.49029005 0.48909774 0.48727745 0.49025697 0.4931941
0.49053174 0.49413848 0.5088044 0.49468845 0.50422406 0.49560174
0.49346095 0.50320256 0.49946174 0.5180126 0.5002885 0.5043067
0.49681222 0.4951781 0.50504315 0.5103739 0.50343287 0.4901287
0.5000276 0.5047762 0.49464762 0.5149126 0.50568646 0.49611717
0.499181 0.4973568 0.49564764 0.5037564 0.50750697 0.50259376
0.50266975 0.5008672 0.51296616 0.4960604 0.50024587 0.5005628
0.5071813 0.49538893 0.4926505 0.5018273 0.49718642 0.50190634
0.497625 0.5160376 0.5015071 0.51396215 0.5199329 0.50265455
0.50708234 0.4923135 0.5056503 0.50148165 0.51160556 0.5151503

```

0.50068736 0.4965499 0.5021828 0.5288398 0.5059108 0.50098556
0.516918 0.493897 0.5002641 0.5140052 0.5070078 0.5102911
0.51472354 0.50180477 0.4986235 0.503668 0.50343233 0.5052147
0.49484515 0.5122807 0.5058379 0.5056064 0.49882635 0.5148912
0.52061135 0.50390047 0.51063555 0.5037788 ]
160/160 [=====] - 0s 1ms/step

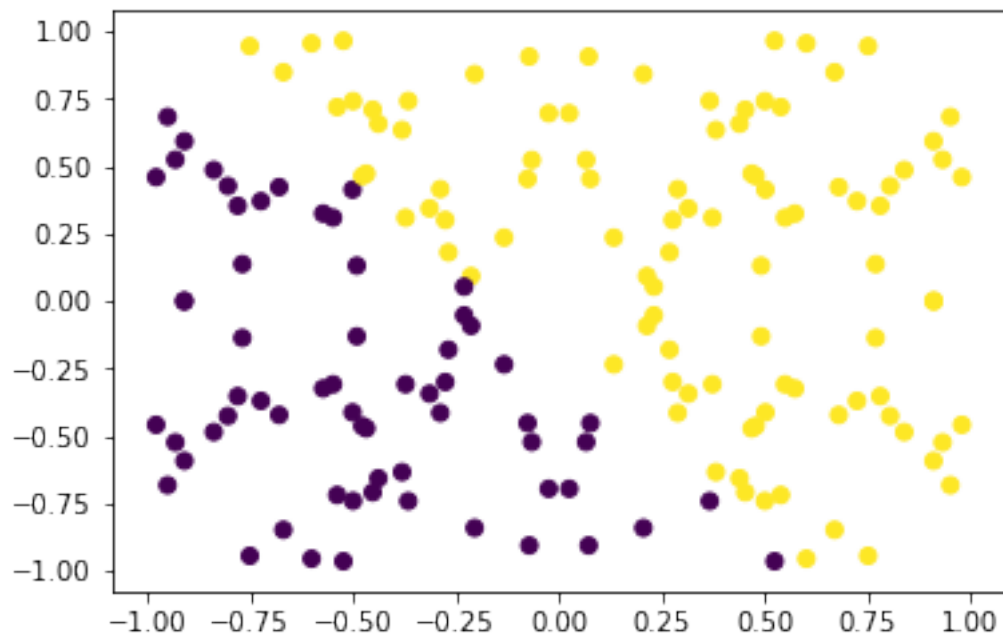
```

```
In [62]: scores, model.metrics_names
```

```
Out[62]: (0.6886902809143066, ['loss'])
```

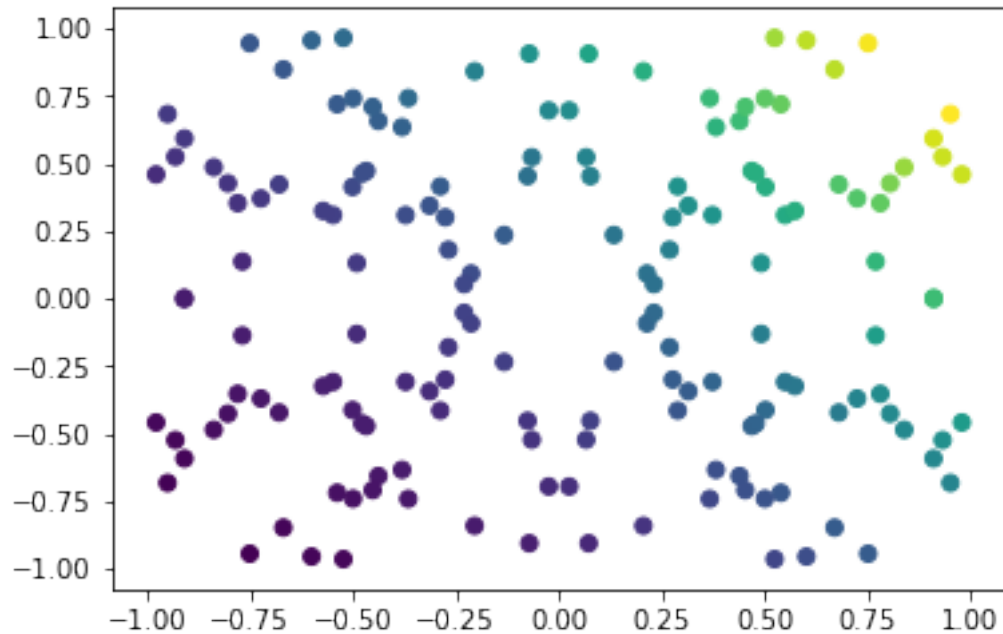
```
In [63]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[63]: <matplotlib.collections.PathCollection at 0xb28d7a6d8>
```



```
In [64]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[64]: <matplotlib.collections.PathCollection at 0xb28e55ac8>
```



```
In [65]: # relu 1
model = Sequential()

model.add(Dense(2, input_dim=2, activation='relu'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='relu'))

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))

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

Epoch 1/400
160/160 [=====] - 1s 4ms/step - loss: 8.0590
Epoch 2/400
160/160 [=====] - 0s 588us/step - loss: 8.0590
Epoch 3/400
160/160 [=====] - 0s 695us/step - loss: 8.0590
Epoch 4/400
160/160 [=====] - 0s 761us/step - loss: 8.0590
Epoch 5/400
160/160 [=====] - 0s 721us/step - loss: 8.0590

Epoch 6/400
160/160 [=====] - 0s 703us/step - loss: 8.0590
Epoch 7/400
160/160 [=====] - 0s 697us/step - loss: 8.0590
Epoch 8/400
160/160 [=====] - 0s 650us/step - loss: 8.0590
Epoch 9/400
160/160 [=====] - 0s 719us/step - loss: 8.0590
Epoch 10/400
160/160 [=====] - 0s 718us/step - loss: 8.0590
Epoch 11/400
160/160 [=====] - 0s 740us/step - loss: 8.0590
Epoch 12/400
160/160 [=====] - 0s 691us/step - loss: 8.0590
Epoch 13/400
160/160 [=====] - 0s 695us/step - loss: 8.0590
Epoch 14/400
160/160 [=====] - 0s 690us/step - loss: 8.0590
Epoch 15/400
160/160 [=====] - 0s 702us/step - loss: 8.0590
Epoch 16/400
160/160 [=====] - 0s 727us/step - loss: 8.0590
Epoch 17/400
160/160 [=====] - 0s 702us/step - loss: 8.0590
Epoch 18/400
160/160 [=====] - 0s 655us/step - loss: 8.0590
Epoch 19/400
160/160 [=====] - 0s 634us/step - loss: 8.0590
Epoch 20/400
160/160 [=====] - 0s 710us/step - loss: 8.0590
Epoch 21/400
160/160 [=====] - 0s 645us/step - loss: 8.0590
Epoch 22/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 23/400
160/160 [=====] - 0s 639us/step - loss: 8.0590
Epoch 24/400
160/160 [=====] - 0s 692us/step - loss: 8.0590
Epoch 25/400
160/160 [=====] - 0s 723us/step - loss: 8.0590
Epoch 26/400
160/160 [=====] - 0s 612us/step - loss: 8.0590
Epoch 27/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 28/400
160/160 [=====] - 0s 641us/step - loss: 8.0590
Epoch 29/400
160/160 [=====] - 0s 709us/step - loss: 8.0590

Epoch 30/400
160/160 [=====] - 0s 617us/step - loss: 8.0590
Epoch 31/400
160/160 [=====] - 0s 677us/step - loss: 8.0590
Epoch 32/400
160/160 [=====] - 0s 604us/step - loss: 8.0590
Epoch 33/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 34/400
160/160 [=====] - 0s 675us/step - loss: 8.0590
Epoch 35/400
160/160 [=====] - 0s 745us/step - loss: 8.0590
Epoch 36/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 37/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 38/400
160/160 [=====] - 0s 782us/step - loss: 8.0590
Epoch 39/400
160/160 [=====] - 0s 745us/step - loss: 8.0590
Epoch 40/400
160/160 [=====] - 0s 707us/step - loss: 8.0590
Epoch 41/400
160/160 [=====] - 0s 740us/step - loss: 8.0590
Epoch 42/400
160/160 [=====] - 0s 723us/step - loss: 8.0590
Epoch 43/400
160/160 [=====] - 0s 766us/step - loss: 8.0590
Epoch 44/400
160/160 [=====] - 0s 747us/step - loss: 8.0590
Epoch 45/400
160/160 [=====] - 0s 761us/step - loss: 8.0590
Epoch 46/400
160/160 [=====] - 0s 711us/step - loss: 8.0590
Epoch 47/400
160/160 [=====] - 0s 710us/step - loss: 8.0590
Epoch 48/400
160/160 [=====] - 0s 609us/step - loss: 8.0590
Epoch 49/400
160/160 [=====] - 0s 590us/step - loss: 8.0590
Epoch 50/400
160/160 [=====] - 0s 600us/step - loss: 8.0590
Epoch 51/400
160/160 [=====] - 0s 610us/step - loss: 8.0590
Epoch 52/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 53/400
160/160 [=====] - 0s 593us/step - loss: 8.0590

Epoch 54/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 55/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 56/400
160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 57/400
160/160 [=====] - 0s 718us/step - loss: 8.0590
Epoch 58/400
160/160 [=====] - 0s 749us/step - loss: 8.0590
Epoch 59/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 60/400
160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 61/400
160/160 [=====] - 0s 776us/step - loss: 8.0590
Epoch 62/400
160/160 [=====] - 0s 781us/step - loss: 8.0590
Epoch 63/400
160/160 [=====] - 0s 769us/step - loss: 8.0590
Epoch 64/400
160/160 [=====] - 0s 745us/step - loss: 8.0590
Epoch 65/400
160/160 [=====] - 0s 711us/step - loss: 8.0590
Epoch 66/400
160/160 [=====] - 0s 782us/step - loss: 8.0590
Epoch 67/400
160/160 [=====] - 0s 712us/step - loss: 8.0590
Epoch 68/400
160/160 [=====] - 0s 728us/step - loss: 8.0590
Epoch 69/400
160/160 [=====] - 0s 663us/step - loss: 8.0590
Epoch 70/400
160/160 [=====] - 0s 582us/step - loss: 8.0590
Epoch 71/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 72/400
160/160 [=====] - 0s 819us/step - loss: 8.0590
Epoch 73/400
160/160 [=====] - 0s 764us/step - loss: 8.0590
Epoch 74/400
160/160 [=====] - 0s 591us/step - loss: 8.0590
Epoch 75/400
160/160 [=====] - 0s 710us/step - loss: 8.0590
Epoch 76/400
160/160 [=====] - 0s 588us/step - loss: 8.0590
Epoch 77/400
160/160 [=====] - 0s 546us/step - loss: 8.0590

Epoch 78/400
160/160 [=====] - 0s 531us/step - loss: 8.0590
Epoch 79/400
160/160 [=====] - 0s 644us/step - loss: 8.0590
Epoch 80/400
160/160 [=====] - 0s 805us/step - loss: 8.0590
Epoch 81/400
160/160 [=====] - 0s 745us/step - loss: 8.0590
Epoch 82/400
160/160 [=====] - 0s 753us/step - loss: 8.0590
Epoch 83/400
160/160 [=====] - 0s 731us/step - loss: 8.0590
Epoch 84/400
160/160 [=====] - 0s 726us/step - loss: 8.0590
Epoch 85/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 86/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 87/400
160/160 [=====] - 0s 576us/step - loss: 8.0590
Epoch 88/400
160/160 [=====] - 0s 604us/step - loss: 8.0590
Epoch 89/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 90/400
160/160 [=====] - 0s 558us/step - loss: 8.0590
Epoch 91/400
160/160 [=====] - 0s 728us/step - loss: 8.0590
Epoch 92/400
160/160 [=====] - 0s 724us/step - loss: 8.0590
Epoch 93/400
160/160 [=====] - 0s 703us/step - loss: 8.0590
Epoch 94/400
160/160 [=====] - 0s 621us/step - loss: 8.0590
Epoch 95/400
160/160 [=====] - 0s 568us/step - loss: 8.0590
Epoch 96/400
160/160 [=====] - 0s 593us/step - loss: 8.0590
Epoch 97/400
160/160 [=====] - 0s 621us/step - loss: 8.0590
Epoch 98/400
160/160 [=====] - 0s 573us/step - loss: 8.0590
Epoch 99/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 100/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 101/400
160/160 [=====] - 0s 539us/step - loss: 8.0590

Epoch 102/400
160/160 [=====] - 0s 566us/step - loss: 8.0590
Epoch 103/400
160/160 [=====] - 0s 568us/step - loss: 8.0590
Epoch 104/400
160/160 [=====] - 0s 569us/step - loss: 8.0590
Epoch 105/400
160/160 [=====] - 0s 566us/step - loss: 8.0590
Epoch 106/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 107/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 108/400
160/160 [=====] - 0s 551us/step - loss: 8.0590
Epoch 109/400
160/160 [=====] - 0s 581us/step - loss: 8.0590
Epoch 110/400
160/160 [=====] - 0s 677us/step - loss: 8.0590
Epoch 111/400
160/160 [=====] - 0s 739us/step - loss: 8.0590
Epoch 112/400
160/160 [=====] - 0s 641us/step - loss: 8.0590
Epoch 113/400
160/160 [=====] - 0s 611us/step - loss: 8.0590
Epoch 114/400
160/160 [=====] - 0s 634us/step - loss: 8.0590
Epoch 115/400
160/160 [=====] - 0s 566us/step - loss: 8.0590
Epoch 116/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 117/400
160/160 [=====] - 0s 774us/step - loss: 8.0590
Epoch 118/400
160/160 [=====] - 0s 729us/step - loss: 8.0590
Epoch 119/400
160/160 [=====] - 0s 633us/step - loss: 8.0590
Epoch 120/400
160/160 [=====] - 0s 605us/step - loss: 8.0590
Epoch 121/400
160/160 [=====] - 0s 557us/step - loss: 8.0590
Epoch 122/400
160/160 [=====] - 0s 610us/step - loss: 8.0590
Epoch 123/400
160/160 [=====] - 0s 709us/step - loss: 8.0590
Epoch 124/400
160/160 [=====] - 0s 571us/step - loss: 8.0590
Epoch 125/400
160/160 [=====] - 0s 569us/step - loss: 8.0590

Epoch 126/400
160/160 [=====] - 0s 693us/step - loss: 8.0590
Epoch 127/400
160/160 [=====] - 0s 590us/step - loss: 8.0590
Epoch 128/400
160/160 [=====] - 0s 568us/step - loss: 8.0590
Epoch 129/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 130/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 131/400
160/160 [=====] - 0s 551us/step - loss: 8.0590
Epoch 132/400
160/160 [=====] - 0s 667us/step - loss: 8.0590
Epoch 133/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 134/400
160/160 [=====] - 0s 667us/step - loss: 8.0590
Epoch 135/400
160/160 [=====] - 0s 593us/step - loss: 8.0590
Epoch 136/400
160/160 [=====] - 0s 669us/step - loss: 8.0590
Epoch 137/400
160/160 [=====] - 0s 786us/step - loss: 8.0590
Epoch 138/400
160/160 [=====] - 0s 601us/step - loss: 8.0590
Epoch 139/400
160/160 [=====] - 0s 547us/step - loss: 8.0590
Epoch 140/400
160/160 [=====] - 0s 644us/step - loss: 8.0590
Epoch 141/400
160/160 [=====] - 0s 554us/step - loss: 8.0590
Epoch 142/400
160/160 [=====] - 0s 568us/step - loss: 8.0590
Epoch 143/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 144/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 145/400
160/160 [=====] - 0s 592us/step - loss: 8.0590
Epoch 146/400
160/160 [=====] - 0s 628us/step - loss: 8.0590
Epoch 147/400
160/160 [=====] - 0s 569us/step - loss: 8.0590
Epoch 148/400
160/160 [=====] - 0s 583us/step - loss: 8.0590
Epoch 149/400
160/160 [=====] - 0s 651us/step - loss: 8.0590

Epoch 150/400
160/160 [=====] - 0s 713us/step - loss: 8.0590
Epoch 151/400
160/160 [=====] - 0s 659us/step - loss: 8.0590
Epoch 152/400
160/160 [=====] - 0s 577us/step - loss: 8.0590
Epoch 153/400
160/160 [=====] - 0s 553us/step - loss: 8.0590
Epoch 154/400
160/160 [=====] - 0s 541us/step - loss: 8.0590
Epoch 155/400
160/160 [=====] - 0s 563us/step - loss: 8.0590
Epoch 156/400
160/160 [=====] - 0s 563us/step - loss: 8.0590
Epoch 157/400
160/160 [=====] - 0s 572us/step - loss: 8.0590
Epoch 158/400
160/160 [=====] - 0s 668us/step - loss: 8.0590
Epoch 159/400
160/160 [=====] - 0s 595us/step - loss: 8.0590
Epoch 160/400
160/160 [=====] - 0s 543us/step - loss: 8.0590
Epoch 161/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 162/400
160/160 [=====] - 0s 599us/step - loss: 8.0590
Epoch 163/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 164/400
160/160 [=====] - 0s 593us/step - loss: 8.0590
Epoch 165/400
160/160 [=====] - 0s 584us/step - loss: 8.0590
Epoch 166/400
160/160 [=====] - 0s 633us/step - loss: 8.0590
Epoch 167/400
160/160 [=====] - 0s 698us/step - loss: 8.0590
Epoch 168/400
160/160 [=====] - 0s 586us/step - loss: 8.0590
Epoch 169/400
160/160 [=====] - 0s 580us/step - loss: 8.0590
Epoch 170/400
160/160 [=====] - 0s 595us/step - loss: 8.0590
Epoch 171/400
160/160 [=====] - 0s 628us/step - loss: 8.0590
Epoch 172/400
160/160 [=====] - 0s 574us/step - loss: 8.0590
Epoch 173/400
160/160 [=====] - 0s 577us/step - loss: 8.0590

Epoch 174/400
160/160 [=====] - 0s 657us/step - loss: 8.0590
Epoch 175/400
160/160 [=====] - 0s 624us/step - loss: 8.0590
Epoch 176/400
160/160 [=====] - 0s 628us/step - loss: 8.0590
Epoch 177/400
160/160 [=====] - 0s 564us/step - loss: 8.0590
Epoch 178/400
160/160 [=====] - 0s 622us/step - loss: 8.0590
Epoch 179/400
160/160 [=====] - 0s 709us/step - loss: 8.0590
Epoch 180/400
160/160 [=====] - 0s 630us/step - loss: 8.0590
Epoch 181/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 182/400
160/160 [=====] - 0s 547us/step - loss: 8.0590
Epoch 183/400
160/160 [=====] - 0s 583us/step - loss: 8.0590
Epoch 184/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 185/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 186/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 187/400
160/160 [=====] - 0s 562us/step - loss: 8.0590
Epoch 188/400
160/160 [=====] - 0s 563us/step - loss: 8.0590
Epoch 189/400
160/160 [=====] - 0s 570us/step - loss: 8.0590
Epoch 190/400
160/160 [=====] - 0s 601us/step - loss: 8.0590
Epoch 191/400
160/160 [=====] - 0s 708us/step - loss: 8.0590
Epoch 192/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 193/400
160/160 [=====] - 0s 548us/step - loss: 8.0590
Epoch 194/400
160/160 [=====] - 0s 565us/step - loss: 8.0590
Epoch 195/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 196/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 197/400
160/160 [=====] - 0s 568us/step - loss: 8.0590

Epoch 198/400
160/160 [=====] - 0s 583us/step - loss: 8.0590
Epoch 199/400
160/160 [=====] - 0s 671us/step - loss: 8.0590
Epoch 200/400
160/160 [=====] - 0s 836us/step - loss: 8.0590
Epoch 201/400
160/160 [=====] - 0s 725us/step - loss: 8.0590
Epoch 202/400
160/160 [=====] - 0s 628us/step - loss: 8.0590
Epoch 203/400
160/160 [=====] - 0s 695us/step - loss: 8.0590
Epoch 204/400
160/160 [=====] - 0s 720us/step - loss: 8.0590
Epoch 205/400
160/160 [=====] - 0s 610us/step - loss: 8.0590
Epoch 206/400
160/160 [=====] - 0s 681us/step - loss: 8.0590
Epoch 207/400
160/160 [=====] - 0s 725us/step - loss: 8.0590
Epoch 208/400
160/160 [=====] - 0s 674us/step - loss: 8.0590
Epoch 209/400
160/160 [=====] - 0s 660us/step - loss: 8.0590
Epoch 210/400
160/160 [=====] - 0s 665us/step - loss: 8.0590
Epoch 211/400
160/160 [=====] - 0s 758us/step - loss: 8.0590
Epoch 212/400
160/160 [=====] - 0s 593us/step - loss: 8.0590
Epoch 213/400
160/160 [=====] - 0s 672us/step - loss: 8.0590
Epoch 214/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 215/400
160/160 [=====] - 0s 750us/step - loss: 8.0590
Epoch 216/400
160/160 [=====] - 0s 579us/step - loss: 8.0590
Epoch 217/400
160/160 [=====] - 0s 666us/step - loss: 8.0590
Epoch 218/400
160/160 [=====] - 0s 679us/step - loss: 8.0590
Epoch 219/400
160/160 [=====] - 0s 640us/step - loss: 8.0590
Epoch 220/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 221/400
160/160 [=====] - 0s 598us/step - loss: 8.0590

Epoch 222/400
160/160 [=====] - 0s 634us/step - loss: 8.0590
Epoch 223/400
160/160 [=====] - 0s 652us/step - loss: 8.0590
Epoch 224/400
160/160 [=====] - 0s 662us/step - loss: 8.0590
Epoch 225/400
160/160 [=====] - 0s 657us/step - loss: 8.0590
Epoch 226/400
160/160 [=====] - 0s 553us/step - loss: 8.0590
Epoch 227/400
160/160 [=====] - 0s 581us/step - loss: 8.0590
Epoch 228/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 229/400
160/160 [=====] - 0s 618us/step - loss: 8.0590
Epoch 230/400
160/160 [=====] - 0s 690us/step - loss: 8.0590
Epoch 231/400
160/160 [=====] - 0s 633us/step - loss: 8.0590
Epoch 232/400
160/160 [=====] - 0s 593us/step - loss: 8.0590
Epoch 233/400
160/160 [=====] - 0s 603us/step - loss: 8.0590
Epoch 234/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 235/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 236/400
160/160 [=====] - 0s 608us/step - loss: 8.0590
Epoch 237/400
160/160 [=====] - 0s 571us/step - loss: 8.0590
Epoch 238/400
160/160 [=====] - 0s 693us/step - loss: 8.0590
Epoch 239/400
160/160 [=====] - 0s 587us/step - loss: 8.0590
Epoch 240/400
160/160 [=====] - 0s 548us/step - loss: 8.0590
Epoch 241/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 242/400
160/160 [=====] - 0s 579us/step - loss: 8.0590
Epoch 243/400
160/160 [=====] - 0s 564us/step - loss: 8.0590
Epoch 244/400
160/160 [=====] - 0s 589us/step - loss: 8.0590
Epoch 245/400
160/160 [=====] - 0s 561us/step - loss: 8.0590

Epoch 246/400
160/160 [=====] - 0s 612us/step - loss: 8.0590
Epoch 247/400
160/160 [=====] - 0s 612us/step - loss: 8.0590
Epoch 248/400
160/160 [=====] - 0s 698us/step - loss: 8.0590
Epoch 249/400
160/160 [=====] - 0s 656us/step - loss: 8.0590
Epoch 250/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 251/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 252/400
160/160 [=====] - 0s 701us/step - loss: 8.0590
Epoch 253/400
160/160 [=====] - 0s 655us/step - loss: 8.0590
Epoch 254/400
160/160 [=====] - 0s 734us/step - loss: 8.0590
Epoch 255/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 256/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 257/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 258/400
160/160 [=====] - 0s 808us/step - loss: 8.0590
Epoch 259/400
160/160 [=====] - 0s 637us/step - loss: 8.0590
Epoch 260/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 261/400
160/160 [=====] - 0s 696us/step - loss: 8.0590
Epoch 262/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 263/400
160/160 [=====] - 0s 674us/step - loss: 8.0590
Epoch 264/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 265/400
160/160 [=====] - 0s 647us/step - loss: 8.0590
Epoch 266/400
160/160 [=====] - 0s 630us/step - loss: 8.0590
Epoch 267/400
160/160 [=====] - 0s 677us/step - loss: 8.0590
Epoch 268/400
160/160 [=====] - 0s 777us/step - loss: 8.0590
Epoch 269/400
160/160 [=====] - 0s 631us/step - loss: 8.0590

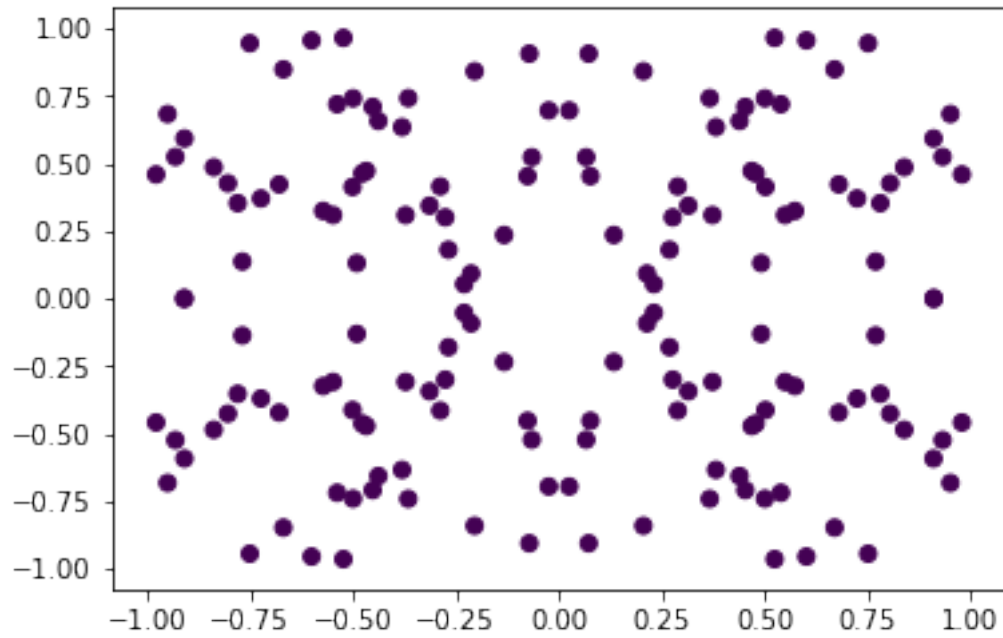
Epoch 270/400
160/160 [=====] - 0s 624us/step - loss: 8.0590
Epoch 271/400
160/160 [=====] - 0s 563us/step - loss: 8.0590
Epoch 272/400
160/160 [=====] - 0s 639us/step - loss: 8.0590
Epoch 273/400
160/160 [=====] - 0s 602us/step - loss: 8.0590
Epoch 274/400
160/160 [=====] - 0s 608us/step - loss: 8.0590
Epoch 275/400
160/160 [=====] - 0s 630us/step - loss: 8.0590
Epoch 276/400
160/160 [=====] - 0s 724us/step - loss: 8.0590
Epoch 277/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 278/400
160/160 [=====] - 0s 593us/step - loss: 8.0590
Epoch 279/400
160/160 [=====] - 0s 588us/step - loss: 8.0590
Epoch 280/400
160/160 [=====] - 0s 580us/step - loss: 8.0590
Epoch 281/400
160/160 [=====] - 0s 736us/step - loss: 8.0590
Epoch 282/400
160/160 [=====] - 0s 785us/step - loss: 8.0590
Epoch 283/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 284/400
160/160 [=====] - 0s 683us/step - loss: 8.0590
Epoch 285/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 286/400
160/160 [=====] - 0s 563us/step - loss: 8.0590
Epoch 287/400
160/160 [=====] - 0s 578us/step - loss: 8.0590
Epoch 288/400
160/160 [=====] - 0s 584us/step - loss: 8.0590
Epoch 289/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 290/400
160/160 [=====] - 0s 580us/step - loss: 8.0590
Epoch 291/400
160/160 [=====] - 0s 586us/step - loss: 8.0590
Epoch 292/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 293/400
160/160 [=====] - 0s 563us/step - loss: 8.0590

Epoch 294/400
160/160 [=====] - 0s 553us/step - loss: 8.0590
Epoch 295/400
160/160 [=====] - 0s 677us/step - loss: 8.0590
Epoch 296/400
160/160 [=====] - 0s 637us/step - loss: 8.0590
Epoch 297/400
160/160 [=====] - 0s 569us/step - loss: 8.0590
Epoch 298/400
160/160 [=====] - 0s 608us/step - loss: 8.0590
Epoch 299/400
160/160 [=====] - 0s 585us/step - loss: 8.0590
Epoch 300/400
160/160 [=====] - 0s 563us/step - loss: 8.0590
Epoch 301/400
160/160 [=====] - 0s 553us/step - loss: 8.0590
Epoch 302/400
160/160 [=====] - 0s 574us/step - loss: 8.0590
Epoch 303/400
160/160 [=====] - 0s 552us/step - loss: 8.0590
Epoch 304/400
160/160 [=====] - 0s 617us/step - loss: 8.0590
Epoch 305/400
160/160 [=====] - 0s 701us/step - loss: 8.0590
Epoch 306/400
160/160 [=====] - 0s 574us/step - loss: 8.0590
Epoch 307/400
160/160 [=====] - 0s 623us/step - loss: 8.0590
Epoch 308/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 309/400
160/160 [=====] - 0s 573us/step - loss: 8.0590
Epoch 310/400
160/160 [=====] - 0s 570us/step - loss: 8.0590
Epoch 311/400
160/160 [=====] - 0s 705us/step - loss: 8.0590
Epoch 312/400
160/160 [=====] - 0s 581us/step - loss: 8.0590
Epoch 313/400
160/160 [=====] - 0s 556us/step - loss: 8.0590
Epoch 314/400
160/160 [=====] - 0s 595us/step - loss: 8.0590
Epoch 315/400
160/160 [=====] - 0s 637us/step - loss: 8.0590
Epoch 316/400
160/160 [=====] - 0s 563us/step - loss: 8.0590
Epoch 317/400
160/160 [=====] - 0s 543us/step - loss: 8.0590

Epoch 318/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 319/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 320/400
160/160 [=====] - 0s 568us/step - loss: 8.0590
Epoch 321/400
160/160 [=====] - 0s 573us/step - loss: 8.0590
Epoch 322/400
160/160 [=====] - 0s 669us/step - loss: 8.0590
Epoch 323/400
160/160 [=====] - 0s 599us/step - loss: 8.0590
Epoch 324/400
160/160 [=====] - 0s 567us/step - loss: 8.0590
Epoch 325/400
160/160 [=====] - 0s 605us/step - loss: 8.0590
Epoch 326/400
160/160 [=====] - 0s 694us/step - loss: 8.0590
Epoch 327/400
160/160 [=====] - 0s 573us/step - loss: 8.0590
Epoch 328/400
160/160 [=====] - 0s 572us/step - loss: 8.0590
Epoch 329/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 330/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 331/400
160/160 [=====] - 0s 600us/step - loss: 8.0590
Epoch 332/400
160/160 [=====] - 0s 682us/step - loss: 8.0590
Epoch 333/400
160/160 [=====] - 0s 658us/step - loss: 8.0590
Epoch 334/400
160/160 [=====] - 0s 755us/step - loss: 8.0590
Epoch 335/400
160/160 [=====] - 0s 577us/step - loss: 8.0590
Epoch 336/400
160/160 [=====] - 0s 547us/step - loss: 8.0590
Epoch 337/400
160/160 [=====] - 0s 686us/step - loss: 8.0590
Epoch 338/400
160/160 [=====] - 0s 754us/step - loss: 8.0590
Epoch 339/400
160/160 [=====] - 0s 744us/step - loss: 8.0590
Epoch 340/400
160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 341/400
160/160 [=====] - 0s 563us/step - loss: 8.0590

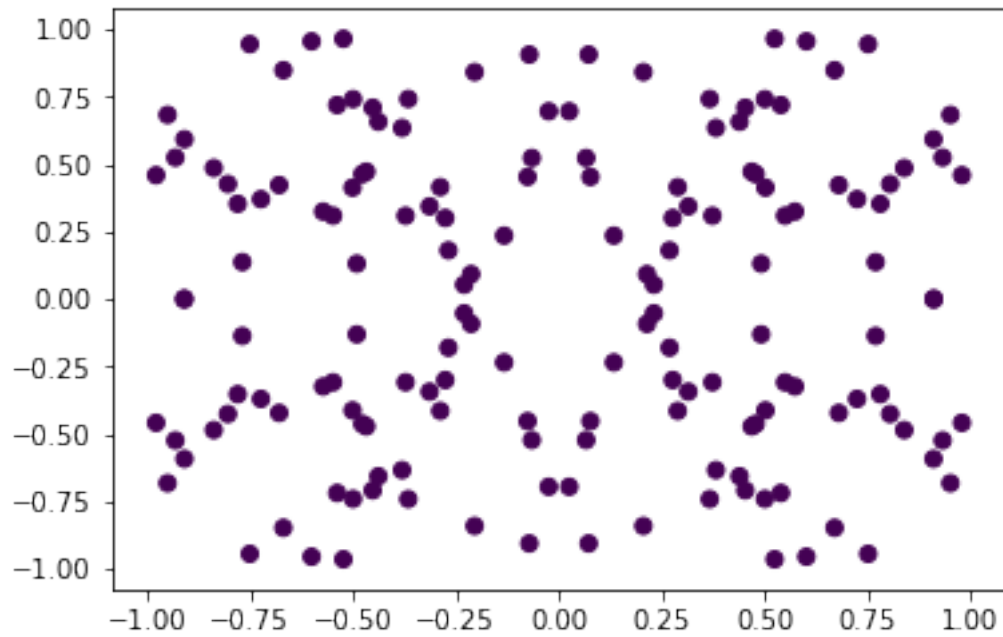
Epoch 342/400
160/160 [=====] - 0s 556us/step - loss: 8.0590
Epoch 343/400
160/160 [=====] - 0s 554us/step - loss: 8.0590
Epoch 344/400
160/160 [=====] - 0s 585us/step - loss: 8.0590
Epoch 345/400
160/160 [=====] - 0s 641us/step - loss: 8.0590
Epoch 346/400
160/160 [=====] - 0s 662us/step - loss: 8.0590
Epoch 347/400
160/160 [=====] - 0s 577us/step - loss: 8.0590
Epoch 348/400
160/160 [=====] - 0s 617us/step - loss: 8.0590
Epoch 349/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 350/400
160/160 [=====] - 0s 584us/step - loss: 8.0590
Epoch 351/400
160/160 [=====] - 0s 659us/step - loss: 8.0590
Epoch 352/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 353/400
160/160 [=====] - 0s 612us/step - loss: 8.0590
Epoch 354/400
160/160 [=====] - 0s 674us/step - loss: 8.0590
Epoch 355/400
160/160 [=====] - 0s 616us/step - loss: 8.0590
Epoch 356/400
160/160 [=====] - 0s 573us/step - loss: 8.0590
Epoch 357/400
160/160 [=====] - 0s 542us/step - loss: 8.0590
Epoch 358/400
160/160 [=====] - 0s 550us/step - loss: 8.0590
Epoch 359/400
160/160 [=====] - 0s 568us/step - loss: 8.0590
Epoch 360/400
160/160 [=====] - 0s 595us/step - loss: 8.0590
Epoch 361/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 362/400
160/160 [=====] - 0s 614us/step - loss: 8.0590
Epoch 363/400
160/160 [=====] - 0s 637us/step - loss: 8.0590
Epoch 364/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 365/400
160/160 [=====] - 0s 626us/step - loss: 8.0590

Epoch 366/400
160/160 [=====] - 0s 609us/step - loss: 8.0590
Epoch 367/400
160/160 [=====] - 0s 680us/step - loss: 8.0590
Epoch 368/400
160/160 [=====] - 0s 616us/step - loss: 8.0590
Epoch 369/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 370/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 371/400
160/160 [=====] - 0s 643us/step - loss: 8.0590
Epoch 372/400
160/160 [=====] - 0s 686us/step - loss: 8.0590
Epoch 373/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 374/400
160/160 [=====] - 0s 630us/step - loss: 8.0590
Epoch 375/400
160/160 [=====] - 0s 622us/step - loss: 8.0590
Epoch 376/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 377/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 378/400
160/160 [=====] - 0s 623us/step - loss: 8.0590
Epoch 379/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 380/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 381/400
160/160 [=====] - 0s 622us/step - loss: 8.0590
Epoch 382/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 383/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 384/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 385/400
160/160 [=====] - 0s 617us/step - loss: 8.0590
Epoch 386/400
160/160 [=====] - 0s 714us/step - loss: 8.0590
Epoch 387/400
160/160 [=====] - 0s 631us/step - loss: 8.0590
Epoch 388/400
160/160 [=====] - 0s 610us/step - loss: 8.0590
Epoch 389/400
160/160 [=====] - 0s 620us/step - loss: 8.0590



```
In [68]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[68]: <matplotlib.collections.PathCollection at 0xb293ac748>
```



```

In [69]: # relu 2
         model = Sequential()

         model.add(Dense(2, input_dim=2, activation='relu'))
         model.add(Dense(2, activation='relu'))

         # The output has 1 neuron for predicting whatever we are iterating
         model.add(Dense(1, activation='relu'))

         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))

         scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 5ms/step - loss: 8.0605
Epoch 2/400
160/160 [=====] - 0s 704us/step - loss: 8.0590
Epoch 3/400
160/160 [=====] - 0s 681us/step - loss: 8.0590
Epoch 4/400
160/160 [=====] - 0s 715us/step - loss: 8.0590
Epoch 5/400
160/160 [=====] - 0s 690us/step - loss: 8.0590
Epoch 6/400
160/160 [=====] - 0s 734us/step - loss: 8.0590
Epoch 7/400
160/160 [=====] - 0s 663us/step - loss: 8.0590
Epoch 8/400
160/160 [=====] - 0s 674us/step - loss: 8.0590
Epoch 9/400
160/160 [=====] - 0s 729us/step - loss: 8.0590
Epoch 10/400
160/160 [=====] - 0s 584us/step - loss: 8.0590
Epoch 11/400
160/160 [=====] - 0s 696us/step - loss: 8.0590
Epoch 12/400
160/160 [=====] - 0s 730us/step - loss: 8.0590
Epoch 13/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 14/400
160/160 [=====] - 0s 672us/step - loss: 8.0590
Epoch 15/400
160/160 [=====] - 0s 731us/step - loss: 8.0590
Epoch 16/400

```

160/160 [=====] - 0s 664us/step - loss: 8.0590
Epoch 17/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 18/400
160/160 [=====] - 0s 692us/step - loss: 8.0590
Epoch 19/400
160/160 [=====] - 0s 617us/step - loss: 8.0590
Epoch 20/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 21/400
160/160 [=====] - 0s 659us/step - loss: 8.0590
Epoch 22/400
160/160 [=====] - 0s 759us/step - loss: 8.0590
Epoch 23/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 24/400
160/160 [=====] - 0s 624us/step - loss: 8.0590
Epoch 25/400
160/160 [=====] - 0s 630us/step - loss: 8.0590
Epoch 26/400
160/160 [=====] - 0s 756us/step - loss: 8.0590
Epoch 27/400
160/160 [=====] - 0s 764us/step - loss: 8.0590
Epoch 28/400
160/160 [=====] - 0s 736us/step - loss: 8.0590
Epoch 29/400
160/160 [=====] - 0s 757us/step - loss: 8.0590
Epoch 30/400
160/160 [=====] - 0s 712us/step - loss: 8.0590
Epoch 31/400
160/160 [=====] - 0s 739us/step - loss: 8.0590
Epoch 32/400
160/160 [=====] - 0s 719us/step - loss: 8.0590
Epoch 33/400
160/160 [=====] - 0s 778us/step - loss: 8.0590
Epoch 34/400
160/160 [=====] - 0s 678us/step - loss: 8.0590
Epoch 35/400
160/160 [=====] - 0s 641us/step - loss: 8.0590
Epoch 36/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 37/400
160/160 [=====] - 0s 625us/step - loss: 8.0590
Epoch 38/400
160/160 [=====] - 0s 653us/step - loss: 8.0590
Epoch 39/400
160/160 [=====] - 0s 645us/step - loss: 8.0590
Epoch 40/400

160/160 [=====] - 0s 690us/step - loss: 8.0590
Epoch 41/400
160/160 [=====] - 0s 628us/step - loss: 8.0590
Epoch 42/400
160/160 [=====] - 0s 818us/step - loss: 8.0590
Epoch 43/400
160/160 [=====] - 0s 614us/step - loss: 8.0590
Epoch 44/400
160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 45/400
160/160 [=====] - 0s 674us/step - loss: 8.0590
Epoch 46/400
160/160 [=====] - 0s 625us/step - loss: 8.0590
Epoch 47/400
160/160 [=====] - 0s 954us/step - loss: 8.0590
Epoch 48/400
160/160 [=====] - 0s 656us/step - loss: 8.0590
Epoch 49/400
160/160 [=====] - 0s 706us/step - loss: 8.0590
Epoch 50/400
160/160 [=====] - 0s 814us/step - loss: 8.0590
Epoch 51/400
160/160 [=====] - 0s 776us/step - loss: 8.0590
Epoch 52/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 53/400
160/160 [=====] - 0s 773us/step - loss: 8.0590
Epoch 54/400
160/160 [=====] - 0s 749us/step - loss: 8.0590
Epoch 55/400
160/160 [=====] - 0s 636us/step - loss: 8.0590
Epoch 56/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 57/400
160/160 [=====] - 0s 637us/step - loss: 8.0590
Epoch 58/400
160/160 [=====] - 0s 631us/step - loss: 8.0590
Epoch 59/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 60/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 61/400
160/160 [=====] - 0s 662us/step - loss: 8.0590
Epoch 62/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 63/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 64/400

160/160 [=====] - 0s 646us/step - loss: 8.0590
Epoch 65/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 66/400
160/160 [=====] - 0s 591us/step - loss: 8.0590
Epoch 67/400
160/160 [=====] - 0s 601us/step - loss: 8.0590
Epoch 68/400
160/160 [=====] - 0s 564us/step - loss: 8.0590
Epoch 69/400
160/160 [=====] - 0s 532us/step - loss: 8.0590
Epoch 70/400
160/160 [=====] - 0s 560us/step - loss: 8.0590
Epoch 71/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 72/400
160/160 [=====] - 0s 561us/step - loss: 8.0590
Epoch 73/400
160/160 [=====] - 0s 573us/step - loss: 8.0590
Epoch 74/400
160/160 [=====] - 0s 585us/step - loss: 8.0590
Epoch 75/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 76/400
160/160 [=====] - 0s 636us/step - loss: 8.0590
Epoch 77/400
160/160 [=====] - 0s 747us/step - loss: 8.0590
Epoch 78/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 79/400
160/160 [=====] - 0s 640us/step - loss: 8.0590
Epoch 80/400
160/160 [=====] - 0s 633us/step - loss: 8.0590
Epoch 81/400
160/160 [=====] - 0s 683us/step - loss: 8.0590
Epoch 82/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 83/400
160/160 [=====] - 0s 599us/step - loss: 8.0590
Epoch 84/400
160/160 [=====] - 0s 799us/step - loss: 8.0590
Epoch 85/400
160/160 [=====] - 0s 642us/step - loss: 8.0590
Epoch 86/400
160/160 [=====] - 0s 727us/step - loss: 8.0590
Epoch 87/400
160/160 [=====] - 0s 766us/step - loss: 8.0590
Epoch 88/400

160/160 [=====] - 0s 754us/step - loss: 8.0590
Epoch 89/400
160/160 [=====] - 0s 761us/step - loss: 8.0590
Epoch 90/400
160/160 [=====] - 0s 749us/step - loss: 8.0590
Epoch 91/400
160/160 [=====] - 0s 728us/step - loss: 8.0590
Epoch 92/400
160/160 [=====] - 0s 769us/step - loss: 8.0590
Epoch 93/400
160/160 [=====] - 0s 783us/step - loss: 8.0590
Epoch 94/400
160/160 [=====] - 0s 755us/step - loss: 8.0590
Epoch 95/400
160/160 [=====] - 0s 735us/step - loss: 8.0590
Epoch 96/400
160/160 [=====] - 0s 797us/step - loss: 8.0590
Epoch 97/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 98/400
160/160 [=====] - 0s 683us/step - loss: 8.0590
Epoch 99/400
160/160 [=====] - 0s 618us/step - loss: 8.0590
Epoch 100/400
160/160 [=====] - 0s 614us/step - loss: 8.0590
Epoch 101/400
160/160 [=====] - 0s 634us/step - loss: 8.0590
Epoch 102/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 103/400
160/160 [=====] - 0s 730us/step - loss: 8.0590
Epoch 104/400
160/160 [=====] - 0s 658us/step - loss: 8.0590
Epoch 105/400
160/160 [=====] - 0s 619us/step - loss: 8.0590
Epoch 106/400
160/160 [=====] - 0s 705us/step - loss: 8.0590
Epoch 107/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 108/400
160/160 [=====] - 0s 574us/step - loss: 8.0590
Epoch 109/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 110/400
160/160 [=====] - 0s 692us/step - loss: 8.0590
Epoch 111/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 112/400

160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 113/400
160/160 [=====] - 0s 681us/step - loss: 8.0590
Epoch 114/400
160/160 [=====] - 0s 593us/step - loss: 8.0590
Epoch 115/400
160/160 [=====] - 0s 611us/step - loss: 8.0590
Epoch 116/400
160/160 [=====] - 0s 673us/step - loss: 8.0590
Epoch 117/400
160/160 [=====] - 0s 803us/step - loss: 8.0590
Epoch 118/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 119/400
160/160 [=====] - 0s 787us/step - loss: 8.0590
Epoch 120/400
160/160 [=====] - 0s 767us/step - loss: 8.0590
Epoch 121/400
160/160 [=====] - 0s 769us/step - loss: 8.0590
Epoch 122/400
160/160 [=====] - 0s 610us/step - loss: 8.0590
Epoch 123/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 124/400
160/160 [=====] - 0s 587us/step - loss: 8.0590
Epoch 125/400
160/160 [=====] - 0s 630us/step - loss: 8.0590
Epoch 126/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 127/400
160/160 [=====] - 0s 611us/step - loss: 8.0590
Epoch 128/400
160/160 [=====] - 0s 821us/step - loss: 8.0590
Epoch 129/400
160/160 [=====] - 0s 764us/step - loss: 8.0590
Epoch 130/400
160/160 [=====] - 0s 734us/step - loss: 8.0590
Epoch 131/400
160/160 [=====] - 0s 696us/step - loss: 8.0590
Epoch 132/400
160/160 [=====] - 0s 621us/step - loss: 8.0590
Epoch 133/400
160/160 [=====] - 0s 783us/step - loss: 8.0590
Epoch 134/400
160/160 [=====] - 0s 778us/step - loss: 8.0590
Epoch 135/400
160/160 [=====] - 0s 754us/step - loss: 8.0590
Epoch 136/400

160/160 [=====] - 0s 752us/step - loss: 8.0590
Epoch 137/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 138/400
160/160 [=====] - 0s 603us/step - loss: 8.0590
Epoch 139/400
160/160 [=====] - 0s 601us/step - loss: 8.0590
Epoch 140/400
160/160 [=====] - 0s 601us/step - loss: 8.0590
Epoch 141/400
160/160 [=====] - 0s 700us/step - loss: 8.0590
Epoch 142/400
160/160 [=====] - 0s 680us/step - loss: 8.0590
Epoch 143/400
160/160 [=====] - 0s 579us/step - loss: 8.0590
Epoch 144/400
160/160 [=====] - 0s 638us/step - loss: 8.0590
Epoch 145/400
160/160 [=====] - 0s 710us/step - loss: 8.0590
Epoch 146/400
160/160 [=====] - 0s 625us/step - loss: 8.0590
Epoch 147/400
160/160 [=====] - 0s 600us/step - loss: 8.0590
Epoch 148/400
160/160 [=====] - 0s 600us/step - loss: 8.0590
Epoch 149/400
160/160 [=====] - 0s 602us/step - loss: 8.0590
Epoch 150/400
160/160 [=====] - 0s 600us/step - loss: 8.0590
Epoch 151/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 152/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 153/400
160/160 [=====] - 0s 624us/step - loss: 8.0590
Epoch 154/400
160/160 [=====] - 0s 611us/step - loss: 8.0590
Epoch 155/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 156/400
160/160 [=====] - 0s 614us/step - loss: 8.0590
Epoch 157/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 158/400
160/160 [=====] - 0s 608us/step - loss: 8.0590
Epoch 159/400
160/160 [=====] - 0s 603us/step - loss: 8.0590
Epoch 160/400


```

160/160 [=====] - 0s 648us/step - loss: 8.0590
Epoch 161/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 162/400
160/160 [=====] - 0s 762us/step - loss: 8.0590
Epoch 163/400
160/160 [=====] - 0s 668us/step - loss: 8.0590
Epoch 164/400
160/160 [=====] - 0s 639us/step - loss: 8.0590
Epoch 165/400
160/160 [=====] - 0s 773us/step - loss: 8.0590
Epoch 166/400
160/160 [=====] - 0s 661us/step - loss: 8.0590
Epoch 167/400
160/160 [=====] - 0s 707us/step - loss: 8.0590
Epoch 168/400
160/160 [=====] - 0s 822us/step - loss: 8.0590
Epoch 169/400
160/160 [=====] - 0s 831us/step - loss: 8.0590
Epoch 170/400
160/160 [=====] - 0s 814us/step - loss: 8.0590
Epoch 171/400
160/160 [=====] - 0s 836us/step - loss: 8.0590
Epoch 172/400
160/160 [=====] - 0s 825us/step - loss: 8.0590
Epoch 173/400
160/160 [=====] - 0s 820us/step - loss: 8.0590
Epoch 174/400
160/160 [=====] - 0s 805us/step - loss: 8.0590
Epoch 175/400
160/160 [=====] - 0s 773us/step - loss: 8.0590
Epoch 176/400
160/160 [=====] - 0s 762us/step - loss: 8.0590
Epoch 177/400
160/160 [=====] - 0s 681us/step - loss: 8.0590
Epoch 178/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 179/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 180/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 181/400
160/160 [=====] - 0s 559us/step - loss: 8.0590
Epoch 182/400
160/160 [=====] - 0s 709us/step - loss: 8.0590
Epoch 183/400
160/160 [=====] - 0s 648us/step - loss: 8.0590
Epoch 184/400

```

160/160 [=====] - 0s 832us/step - loss: 8.0590
Epoch 185/400
160/160 [=====] - 0s 815us/step - loss: 8.0590
Epoch 186/400
160/160 [=====] - 0s 797us/step - loss: 8.0590
Epoch 187/400
160/160 [=====] - 0s 816us/step - loss: 8.0590
Epoch 188/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 189/400
160/160 [=====] - 0s 837us/step - loss: 8.0590
Epoch 190/400
160/160 [=====] - 0s 863us/step - loss: 8.0590
Epoch 191/400
160/160 [=====] - 0s 695us/step - loss: 8.0590
Epoch 192/400
160/160 [=====] - 0s 757us/step - loss: 8.0590
Epoch 193/400
160/160 [=====] - 0s 748us/step - loss: 8.0590
Epoch 194/400
160/160 [=====] - 0s 659us/step - loss: 8.0590
Epoch 195/400
160/160 [=====] - 0s 766us/step - loss: 8.0590
Epoch 196/400
160/160 [=====] - 0s 788us/step - loss: 8.0590
Epoch 197/400
160/160 [=====] - 0s 721us/step - loss: 8.0590
Epoch 198/400
160/160 [=====] - 0s 808us/step - loss: 8.0590
Epoch 199/400
160/160 [=====] - 0s 762us/step - loss: 8.0590
Epoch 200/400
160/160 [=====] - 0s 814us/step - loss: 8.0590
Epoch 201/400
160/160 [=====] - 0s 644us/step - loss: 8.0590
Epoch 202/400
160/160 [=====] - 0s 585us/step - loss: 8.0590
Epoch 203/400
160/160 [=====] - 0s 644us/step - loss: 8.0590
Epoch 204/400
160/160 [=====] - 0s 736us/step - loss: 8.0590
Epoch 205/400
160/160 [=====] - 0s 753us/step - loss: 8.0590
Epoch 206/400
160/160 [=====] - 0s 710us/step - loss: 8.0590
Epoch 207/400
160/160 [=====] - 0s 688us/step - loss: 8.0590
Epoch 208/400

160/160 [=====] - 0s 709us/step - loss: 8.0590
Epoch 209/400
160/160 [=====] - 0s 870us/step - loss: 8.0590
Epoch 210/400
160/160 [=====] - 0s 849us/step - loss: 8.0590
Epoch 211/400
160/160 [=====] - 0s 904us/step - loss: 8.0590
Epoch 212/400
160/160 [=====] - 0s 776us/step - loss: 8.0590
Epoch 213/400
160/160 [=====] - 0s 653us/step - loss: 8.0590
Epoch 214/400
160/160 [=====] - 0s 684us/step - loss: 8.0590
Epoch 215/400
160/160 [=====] - 0s 786us/step - loss: 8.0590
Epoch 216/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 217/400
160/160 [=====] - 0s 730us/step - loss: 8.0590
Epoch 218/400
160/160 [=====] - 0s 645us/step - loss: 8.0590
Epoch 219/400
160/160 [=====] - 0s 698us/step - loss: 8.0590
Epoch 220/400
160/160 [=====] - 0s 812us/step - loss: 8.0590
Epoch 221/400
160/160 [=====] - 0s 705us/step - loss: 8.0590
Epoch 222/400
160/160 [=====] - 0s 973us/step - loss: 8.0590
Epoch 223/400
160/160 [=====] - 0s 682us/step - loss: 8.0590
Epoch 224/400
160/160 [=====] - 0s 707us/step - loss: 8.0590
Epoch 225/400
160/160 [=====] - 0s 775us/step - loss: 8.0590
Epoch 226/400
160/160 [=====] - 0s 628us/step - loss: 8.0590
Epoch 227/400
160/160 [=====] - 0s 688us/step - loss: 8.0590
Epoch 228/400
160/160 [=====] - 0s 624us/step - loss: 8.0590
Epoch 229/400
160/160 [=====] - 0s 555us/step - loss: 8.0590
Epoch 230/400
160/160 [=====] - 0s 575us/step - loss: 8.0590
Epoch 231/400
160/160 [=====] - 0s 577us/step - loss: 8.0590
Epoch 232/400

160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 233/400
160/160 [=====] - 0s 723us/step - loss: 8.0590
Epoch 234/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 235/400
160/160 [=====] - 0s 597us/step - loss: 8.0590
Epoch 236/400
160/160 [=====] - 0s 742us/step - loss: 8.0590
Epoch 237/400
160/160 [=====] - 0s 694us/step - loss: 8.0590
Epoch 238/400
160/160 [=====] - 0s 671us/step - loss: 8.0590
Epoch 239/400
160/160 [=====] - 0s 609us/step - loss: 8.0590
Epoch 240/400
160/160 [=====] - 0s 701us/step - loss: 8.0590
Epoch 241/400
160/160 [=====] - 0s 752us/step - loss: 8.0590
Epoch 242/400
160/160 [=====] - 0s 826us/step - loss: 8.0590
Epoch 243/400
160/160 [=====] - 0s 735us/step - loss: 8.0590
Epoch 244/400
160/160 [=====] - 0s 738us/step - loss: 8.0590
Epoch 245/400
160/160 [=====] - 0s 706us/step - loss: 8.0590
Epoch 246/400
160/160 [=====] - 0s 631us/step - loss: 8.0590
Epoch 247/400
160/160 [=====] - 0s 650us/step - loss: 8.0590
Epoch 248/400
160/160 [=====] - 0s 609us/step - loss: 8.0590
Epoch 249/400
160/160 [=====] - 0s 691us/step - loss: 8.0590
Epoch 250/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 251/400
160/160 [=====] - 0s 810us/step - loss: 8.0590
Epoch 252/400
160/160 [=====] - 0s 801us/step - loss: 8.0590
Epoch 253/400
160/160 [=====] - 0s 742us/step - loss: 8.0590
Epoch 254/400
160/160 [=====] - 0s 722us/step - loss: 8.0590
Epoch 255/400
160/160 [=====] - 0s 568us/step - loss: 8.0590
Epoch 256/400

160/160 [=====] - 0s 579us/step - loss: 8.0590
Epoch 257/400
160/160 [=====] - 0s 667us/step - loss: 8.0590
Epoch 258/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 259/400
160/160 [=====] - 0s 644us/step - loss: 8.0590
Epoch 260/400
160/160 [=====] - 0s 758us/step - loss: 8.0590
Epoch 261/400
160/160 [=====] - 0s 744us/step - loss: 8.0590
Epoch 262/400
160/160 [=====] - 0s 752us/step - loss: 8.0590
Epoch 263/400
160/160 [=====] - 0s 671us/step - loss: 8.0590
Epoch 264/400
160/160 [=====] - 0s 621us/step - loss: 8.0590
Epoch 265/400
160/160 [=====] - 0s 595us/step - loss: 8.0590
Epoch 266/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 267/400
160/160 [=====] - 0s 636us/step - loss: 8.0590
Epoch 268/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 269/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 270/400
160/160 [=====] - 0s 695us/step - loss: 8.0590
Epoch 271/400
160/160 [=====] - 0s 637us/step - loss: 8.0590
Epoch 272/400
160/160 [=====] - 0s 609us/step - loss: 8.0590
Epoch 273/400
160/160 [=====] - 0s 610us/step - loss: 8.0590
Epoch 274/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 275/400
160/160 [=====] - 0s 676us/step - loss: 8.0590
Epoch 276/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 277/400
160/160 [=====] - 0s 603us/step - loss: 8.0590
Epoch 278/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 279/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 280/400

160/160 [=====] - 0s 667us/step - loss: 8.0590
Epoch 281/400
160/160 [=====] - 0s 622us/step - loss: 8.0590
Epoch 282/400
160/160 [=====] - 0s 717us/step - loss: 8.0590
Epoch 283/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 284/400
160/160 [=====] - 0s 629us/step - loss: 8.0590
Epoch 285/400
160/160 [=====] - 0s 554us/step - loss: 8.0590
Epoch 286/400
160/160 [=====] - 0s 556us/step - loss: 8.0590
Epoch 287/400
160/160 [=====] - 0s 589us/step - loss: 8.0590
Epoch 288/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 289/400
160/160 [=====] - 0s 698us/step - loss: 8.0590
Epoch 290/400
160/160 [=====] - 0s 615us/step - loss: 8.0590
Epoch 291/400
160/160 [=====] - 0s 720us/step - loss: 8.0590
Epoch 292/400
160/160 [=====] - 0s 640us/step - loss: 8.0590
Epoch 293/400
160/160 [=====] - 0s 696us/step - loss: 8.0590
Epoch 294/400
160/160 [=====] - 0s 640us/step - loss: 8.0590
Epoch 295/400
160/160 [=====] - 0s 718us/step - loss: 8.0590
Epoch 296/400
160/160 [=====] - 0s 752us/step - loss: 8.0590
Epoch 297/400
160/160 [=====] - 0s 755us/step - loss: 8.0590
Epoch 298/400
160/160 [=====] - 0s 650us/step - loss: 8.0590
Epoch 299/400
160/160 [=====] - 0s 619us/step - loss: 8.0590
Epoch 300/400
160/160 [=====] - 0s 603us/step - loss: 8.0590
Epoch 301/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 302/400
160/160 [=====] - 0s 620us/step - loss: 8.0590
Epoch 303/400
160/160 [=====] - 0s 599us/step - loss: 8.0590
Epoch 304/400

160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 305/400
160/160 [=====] - 0s 557us/step - loss: 8.0590
Epoch 306/400
160/160 [=====] - 0s 589us/step - loss: 8.0590
Epoch 307/400
160/160 [=====] - 0s 575us/step - loss: 8.0590
Epoch 308/400
160/160 [=====] - 0s 600us/step - loss: 8.0590
Epoch 309/400
160/160 [=====] - 0s 635us/step - loss: 8.0590
Epoch 310/400
160/160 [=====] - 0s 616us/step - loss: 8.0590
Epoch 311/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 312/400
160/160 [=====] - 0s 679us/step - loss: 8.0590
Epoch 313/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 314/400
160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 315/400
160/160 [=====] - 0s 758us/step - loss: 8.0590
Epoch 316/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 317/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 318/400
160/160 [=====] - 0s 623us/step - loss: 8.0590
Epoch 319/400
160/160 [=====] - 0s 634us/step - loss: 8.0590
Epoch 320/400
160/160 [=====] - 0s 633us/step - loss: 8.0590
Epoch 321/400
160/160 [=====] - 0s 792us/step - loss: 8.0590
Epoch 322/400
160/160 [=====] - 0s 600us/step - loss: 8.0590
Epoch 323/400
160/160 [=====] - 0s 666us/step - loss: 8.0590
Epoch 324/400
160/160 [=====] - 0s 617us/step - loss: 8.0590
Epoch 325/400
160/160 [=====] - 0s 573us/step - loss: 8.0590
Epoch 326/400
160/160 [=====] - 0s 588us/step - loss: 8.0590
Epoch 327/400
160/160 [=====] - 0s 738us/step - loss: 8.0590
Epoch 328/400

160/160 [=====] - 0s 721us/step - loss: 8.0590
Epoch 329/400
160/160 [=====] - 0s 692us/step - loss: 8.0590
Epoch 330/400
160/160 [=====] - 0s 753us/step - loss: 8.0590
Epoch 331/400
160/160 [=====] - 0s 726us/step - loss: 8.0590
Epoch 332/400
160/160 [=====] - 0s 621us/step - loss: 8.0590
Epoch 333/400
160/160 [=====] - 0s 673us/step - loss: 8.0590
Epoch 334/400
160/160 [=====] - 0s 645us/step - loss: 8.0590
Epoch 335/400
160/160 [=====] - 0s 789us/step - loss: 8.0590
Epoch 336/400
160/160 [=====] - 0s 605us/step - loss: 8.0590
Epoch 337/400
160/160 [=====] - 0s 684us/step - loss: 8.0590
Epoch 338/400
160/160 [=====] - 0s 765us/step - loss: 8.0590
Epoch 339/400
160/160 [=====] - 0s 720us/step - loss: 8.0590
Epoch 340/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 341/400
160/160 [=====] - 0s 789us/step - loss: 8.0590
Epoch 342/400
160/160 [=====] - 0s 756us/step - loss: 8.0590
Epoch 343/400
160/160 [=====] - 0s 778us/step - loss: 8.0590
Epoch 344/400
160/160 [=====] - 0s 651us/step - loss: 8.0590
Epoch 345/400
160/160 [=====] - 0s 592us/step - loss: 8.0590
Epoch 346/400
160/160 [=====] - 0s 683us/step - loss: 8.0590
Epoch 347/400
160/160 [=====] - 0s 634us/step - loss: 8.0590
Epoch 348/400
160/160 [=====] - 0s 738us/step - loss: 8.0590
Epoch 349/400
160/160 [=====] - 0s 672us/step - loss: 8.0590
Epoch 350/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 351/400
160/160 [=====] - 0s 611us/step - loss: 8.0590
Epoch 352/400

160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 353/400
160/160 [=====] - 0s 741us/step - loss: 8.0590
Epoch 354/400
160/160 [=====] - 0s 724us/step - loss: 8.0590
Epoch 355/400
160/160 [=====] - 0s 756us/step - loss: 8.0590
Epoch 356/400
160/160 [=====] - 0s 606us/step - loss: 8.0590
Epoch 357/400
160/160 [=====] - 0s 612us/step - loss: 8.0590
Epoch 358/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 359/400
160/160 [=====] - 0s 681us/step - loss: 8.0590
Epoch 360/400
160/160 [=====] - 0s 769us/step - loss: 8.0590
Epoch 361/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 362/400
160/160 [=====] - 0s 592us/step - loss: 8.0590
Epoch 363/400
160/160 [=====] - 0s 601us/step - loss: 8.0590
Epoch 364/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 365/400
160/160 [=====] - 0s 780us/step - loss: 8.0590
Epoch 366/400
160/160 [=====] - 0s 607us/step - loss: 8.0590
Epoch 367/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 368/400
160/160 [=====] - 0s 598us/step - loss: 8.0590
Epoch 369/400
160/160 [=====] - 0s 644us/step - loss: 8.0590
Epoch 370/400
160/160 [=====] - 0s 632us/step - loss: 8.0590
Epoch 371/400
160/160 [=====] - 0s 594us/step - loss: 8.0590
Epoch 372/400
160/160 [=====] - 0s 601us/step - loss: 8.0590
Epoch 373/400
160/160 [=====] - 0s 609us/step - loss: 8.0590
Epoch 374/400
160/160 [=====] - 0s 623us/step - loss: 8.0590
Epoch 375/400
160/160 [=====] - 0s 753us/step - loss: 8.0590
Epoch 376/400

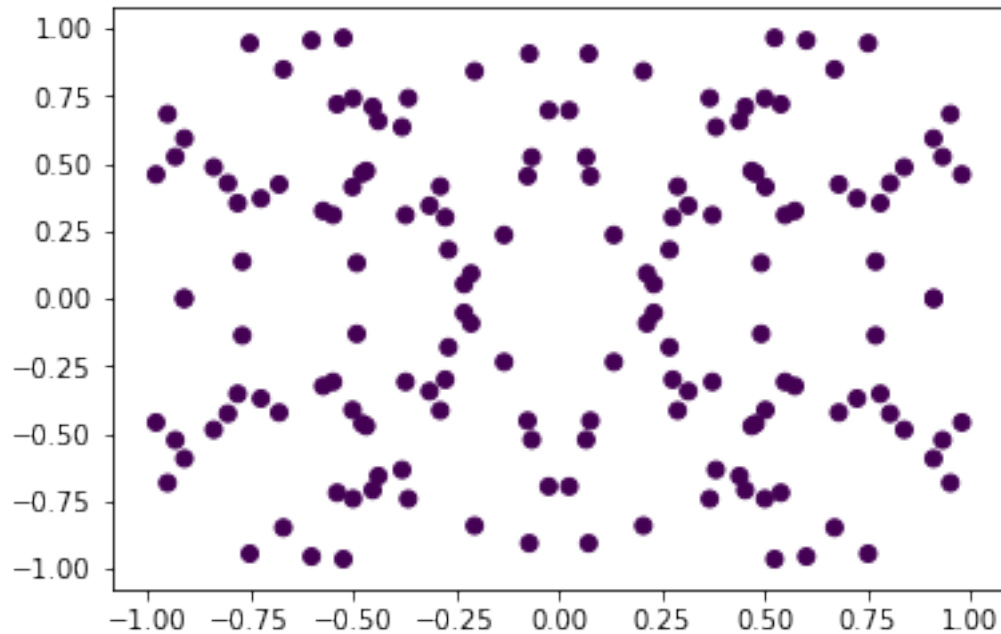
160/160 [=====] - 0s 747us/step - loss: 8.0590
Epoch 377/400
160/160 [=====] - 0s 755us/step - loss: 8.0590
Epoch 378/400
160/160 [=====] - 0s 727us/step - loss: 8.0590
Epoch 379/400
160/160 [=====] - 0s 677us/step - loss: 8.0590
Epoch 380/400
160/160 [=====] - 0s 587us/step - loss: 8.0590
Epoch 381/400
160/160 [=====] - 0s 717us/step - loss: 8.0590
Epoch 382/400
160/160 [=====] - 0s 630us/step - loss: 8.0590
Epoch 383/400
160/160 [=====] - 0s 697us/step - loss: 8.0590
Epoch 384/400
160/160 [=====] - 0s 700us/step - loss: 8.0590
Epoch 385/400
160/160 [=====] - 0s 596us/step - loss: 8.0590
Epoch 386/400
160/160 [=====] - 0s 663us/step - loss: 8.0590
Epoch 387/400
160/160 [=====] - 0s 669us/step - loss: 8.0590
Epoch 388/400
160/160 [=====] - 0s 613us/step - loss: 8.0590
Epoch 389/400
160/160 [=====] - 0s 658us/step - loss: 8.0590
Epoch 390/400
160/160 [=====] - 0s 670us/step - loss: 8.0590
Epoch 391/400
160/160 [=====] - 0s 682us/step - loss: 8.0590
Epoch 392/400
160/160 [=====] - 0s 626us/step - loss: 8.0590
Epoch 393/400
160/160 [=====] - 0s 611us/step - loss: 8.0590
Epoch 394/400
160/160 [=====] - 0s 667us/step - loss: 8.0590
Epoch 395/400
160/160 [=====] - 0s 814us/step - loss: 8.0590
Epoch 396/400
160/160 [=====] - 0s 767us/step - loss: 8.0590
Epoch 397/400
160/160 [=====] - 0s 602us/step - loss: 8.0590
Epoch 398/400
160/160 [=====] - 0s 572us/step - loss: 8.0590
Epoch 399/400
160/160 [=====] - 0s 578us/step - loss: 8.0590
Epoch 400/400

[illegible]

```
Out[70]: (8.059047738974616, ['loss'])
```

```
Out[71]: <matplotlib.collections.PathCollection at 0xb29a59588>
```

```
In [72]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```



```
In [73]: # relu 3
model = Sequential()

model.add(Dense(2, input_dim=2, activation='relu'))
model.add(Dense(2, activation='relu'))
model.add(Dense(2, activation='relu'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='relu'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 5ms/step - loss: 2.9637
Epoch 2/400
160/160 [=====] - 0s 692us/step - loss: 0.6050
Epoch 3/400
160/160 [=====] - 0s 694us/step - loss: 0.5914
Epoch 4/400
160/160 [=====] - 0s 681us/step - loss: 0.5904
```

Epoch 5/400
160/160 [=====] - 0s 690us/step - loss: 0.5933
Epoch 6/400
160/160 [=====] - 0s 696us/step - loss: 0.5871
Epoch 7/400
160/160 [=====] - 0s 679us/step - loss: 0.5914
Epoch 8/400
160/160 [=====] - 0s 677us/step - loss: 0.6056
Epoch 9/400
160/160 [=====] - 0s 663us/step - loss: 0.5846
Epoch 10/400
160/160 [=====] - 0s 784us/step - loss: 0.5988
Epoch 11/400
160/160 [=====] - 0s 727us/step - loss: 0.5715
Epoch 12/400
160/160 [=====] - 0s 684us/step - loss: 0.5598
Epoch 13/400
160/160 [=====] - 0s 696us/step - loss: 0.5577
Epoch 14/400
160/160 [=====] - 0s 801us/step - loss: 0.5541
Epoch 15/400
160/160 [=====] - 0s 804us/step - loss: 0.5438
Epoch 16/400
160/160 [=====] - 0s 684us/step - loss: 0.5875
Epoch 17/400
160/160 [=====] - 0s 702us/step - loss: 0.5476
Epoch 18/400
160/160 [=====] - 0s 757us/step - loss: 0.5296
Epoch 19/400
160/160 [=====] - 0s 689us/step - loss: 0.8693
Epoch 20/400
160/160 [=====] - 0s 865us/step - loss: 0.5360
Epoch 21/400
160/160 [=====] - 0s 701us/step - loss: 0.5032
Epoch 22/400
160/160 [=====] - 0s 674us/step - loss: 0.5030
Epoch 23/400
160/160 [=====] - 0s 742us/step - loss: 0.5065
Epoch 24/400
160/160 [=====] - 0s 856us/step - loss: 0.4770
Epoch 25/400
160/160 [=====] - 0s 771us/step - loss: 0.5497
Epoch 26/400
160/160 [=====] - 0s 604us/step - loss: 0.5599
Epoch 27/400
160/160 [=====] - 0s 647us/step - loss: 2.2557
Epoch 28/400
160/160 [=====] - 0s 649us/step - loss: 0.5020

Epoch 29/400
160/160 [=====] - 0s 680us/step - loss: 0.5556
Epoch 30/400
160/160 [=====] - 0s 714us/step - loss: 0.4682
Epoch 31/400
160/160 [=====] - 0s 694us/step - loss: 0.4839
Epoch 32/400
160/160 [=====] - 0s 792us/step - loss: 0.5722
Epoch 33/400
160/160 [=====] - 0s 797us/step - loss: 0.4608
Epoch 34/400
160/160 [=====] - 0s 669us/step - loss: 0.4626
Epoch 35/400
160/160 [=====] - 0s 685us/step - loss: 0.5287
Epoch 36/400
160/160 [=====] - 0s 690us/step - loss: 0.4376
Epoch 37/400
160/160 [=====] - 0s 768us/step - loss: 0.5446
Epoch 38/400
160/160 [=====] - 0s 742us/step - loss: 0.5285
Epoch 39/400
160/160 [=====] - 0s 747us/step - loss: 2.1809
Epoch 40/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 41/400
160/160 [=====] - 0s 670us/step - loss: 7.9712
Epoch 42/400
160/160 [=====] - 0s 750us/step - loss: 7.9712
Epoch 43/400
160/160 [=====] - 0s 686us/step - loss: 7.9712
Epoch 44/400
160/160 [=====] - 0s 634us/step - loss: 7.9712
Epoch 45/400
160/160 [=====] - 0s 665us/step - loss: 7.9712
Epoch 46/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 47/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 48/400
160/160 [=====] - 0s 696us/step - loss: 7.9712
Epoch 49/400
160/160 [=====] - 0s 726us/step - loss: 7.9712
Epoch 50/400
160/160 [=====] - 0s 724us/step - loss: 7.9712
Epoch 51/400
160/160 [=====] - 0s 671us/step - loss: 7.9712
Epoch 52/400
160/160 [=====] - 0s 726us/step - loss: 7.9712

Epoch 53/400
160/160 [=====] - 0s 705us/step - loss: 7.9712
Epoch 54/400
160/160 [=====] - 0s 693us/step - loss: 7.9712
Epoch 55/400
160/160 [=====] - 0s 735us/step - loss: 7.9712
Epoch 56/400
160/160 [=====] - 0s 697us/step - loss: 7.9712
Epoch 57/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 58/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 59/400
160/160 [=====] - 0s 758us/step - loss: 7.9712
Epoch 60/400
160/160 [=====] - 0s 775us/step - loss: 7.9712
Epoch 61/400
160/160 [=====] - 0s 721us/step - loss: 7.9712
Epoch 62/400
160/160 [=====] - 0s 768us/step - loss: 7.9712
Epoch 63/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 64/400
160/160 [=====] - 0s 645us/step - loss: 7.9712
Epoch 65/400
160/160 [=====] - 0s 629us/step - loss: 7.9712
Epoch 66/400
160/160 [=====] - 0s 627us/step - loss: 7.9712
Epoch 67/400
160/160 [=====] - 0s 634us/step - loss: 7.9712
Epoch 68/400
160/160 [=====] - 0s 780us/step - loss: 7.9712
Epoch 69/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 70/400
160/160 [=====] - 0s 644us/step - loss: 7.9712
Epoch 71/400
160/160 [=====] - 0s 672us/step - loss: 7.9712
Epoch 72/400
160/160 [=====] - 0s 790us/step - loss: 7.9712
Epoch 73/400
160/160 [=====] - 0s 692us/step - loss: 7.9712
Epoch 74/400
160/160 [=====] - 0s 648us/step - loss: 7.9712
Epoch 75/400
160/160 [=====] - 0s 669us/step - loss: 7.9712
Epoch 76/400
160/160 [=====] - 0s 811us/step - loss: 7.9712

Epoch 77/400
160/160 [=====] - 0s 833us/step - loss: 7.9712
Epoch 78/400
160/160 [=====] - 0s 819us/step - loss: 7.9712
Epoch 79/400
160/160 [=====] - 0s 823us/step - loss: 7.9712
Epoch 80/400
160/160 [=====] - 0s 671us/step - loss: 7.9712
Epoch 81/400
160/160 [=====] - 0s 675us/step - loss: 7.9712
Epoch 82/400
160/160 [=====] - 0s 875us/step - loss: 7.9712
Epoch 83/400
160/160 [=====] - 0s 811us/step - loss: 7.9712
Epoch 84/400
160/160 [=====] - 0s 809us/step - loss: 7.9712
Epoch 85/400
160/160 [=====] - 0s 841us/step - loss: 7.9712
Epoch 86/400
160/160 [=====] - 0s 756us/step - loss: 7.9712
Epoch 87/400
160/160 [=====] - 0s 655us/step - loss: 7.9712
Epoch 88/400
160/160 [=====] - 0s 780us/step - loss: 7.9712
Epoch 89/400
160/160 [=====] - 0s 814us/step - loss: 7.9712
Epoch 90/400
160/160 [=====] - 0s 750us/step - loss: 7.9712
Epoch 91/400
160/160 [=====] - 0s 861us/step - loss: 7.9712
Epoch 92/400
160/160 [=====] - 0s 819us/step - loss: 7.9712
Epoch 93/400
160/160 [=====] - 0s 771us/step - loss: 7.9712
Epoch 94/400
160/160 [=====] - 0s 771us/step - loss: 7.9712
Epoch 95/400
160/160 [=====] - 0s 615us/step - loss: 7.9712
Epoch 96/400
160/160 [=====] - 0s 615us/step - loss: 7.9712
Epoch 97/400
160/160 [=====] - 0s 736us/step - loss: 7.9712
Epoch 98/400
160/160 [=====] - 0s 720us/step - loss: 7.9712
Epoch 99/400
160/160 [=====] - 0s 692us/step - loss: 7.9712
Epoch 100/400
160/160 [=====] - 0s 636us/step - loss: 7.9712

Epoch 101/400
160/160 [=====] - 0s 646us/step - loss: 7.9712
Epoch 102/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 103/400
160/160 [=====] - 0s 739us/step - loss: 7.9712
Epoch 104/400
160/160 [=====] - 0s 665us/step - loss: 7.9712
Epoch 105/400
160/160 [=====] - 0s 646us/step - loss: 7.9712
Epoch 106/400
160/160 [=====] - 0s 659us/step - loss: 7.9712
Epoch 107/400
160/160 [=====] - 0s 764us/step - loss: 7.9712
Epoch 108/400
160/160 [=====] - 0s 751us/step - loss: 7.9712
Epoch 109/400
160/160 [=====] - 0s 668us/step - loss: 7.9712
Epoch 110/400
160/160 [=====] - 0s 719us/step - loss: 7.9712
Epoch 111/400
160/160 [=====] - 0s 789us/step - loss: 7.9712
Epoch 112/400
160/160 [=====] - 0s 611us/step - loss: 7.9712
Epoch 113/400
160/160 [=====] - 0s 608us/step - loss: 7.9712
Epoch 114/400
160/160 [=====] - 0s 632us/step - loss: 7.9712
Epoch 115/400
160/160 [=====] - 0s 713us/step - loss: 7.9712
Epoch 116/400
160/160 [=====] - 0s 653us/step - loss: 7.9712
Epoch 117/400
160/160 [=====] - 0s 672us/step - loss: 7.9712
Epoch 118/400
160/160 [=====] - 0s 734us/step - loss: 7.9712
Epoch 119/400
160/160 [=====] - 0s 793us/step - loss: 7.9712
Epoch 120/400
160/160 [=====] - 0s 669us/step - loss: 7.9712
Epoch 121/400
160/160 [=====] - 0s 797us/step - loss: 7.9712
Epoch 122/400
160/160 [=====] - 0s 686us/step - loss: 7.9712
Epoch 123/400
160/160 [=====] - 0s 837us/step - loss: 7.9712
Epoch 124/400
160/160 [=====] - 0s 811us/step - loss: 7.9712

Epoch 125/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 126/400
160/160 [=====] - 0s 786us/step - loss: 7.9712
Epoch 127/400
160/160 [=====] - 0s 847us/step - loss: 7.9712
Epoch 128/400
160/160 [=====] - 0s 795us/step - loss: 7.9712
Epoch 129/400
160/160 [=====] - 0s 823us/step - loss: 7.9712
Epoch 130/400
160/160 [=====] - 0s 728us/step - loss: 7.9712
Epoch 131/400
160/160 [=====] - 0s 694us/step - loss: 7.9712
Epoch 132/400
160/160 [=====] - 0s 677us/step - loss: 7.9712
Epoch 133/400
160/160 [=====] - 0s 830us/step - loss: 7.9712
Epoch 134/400
160/160 [=====] - 0s 787us/step - loss: 7.9712
Epoch 135/400
160/160 [=====] - 0s 853us/step - loss: 7.9712
Epoch 136/400
160/160 [=====] - 0s 691us/step - loss: 7.9712
Epoch 137/400
160/160 [=====] - 0s 758us/step - loss: 7.9712
Epoch 138/400
160/160 [=====] - 0s 818us/step - loss: 7.9712
Epoch 139/400
160/160 [=====] - 0s 780us/step - loss: 7.9712
Epoch 140/400
160/160 [=====] - 0s 806us/step - loss: 7.9712
Epoch 141/400
160/160 [=====] - 0s 813us/step - loss: 7.9712
Epoch 142/400
160/160 [=====] - 0s 872us/step - loss: 7.9712
Epoch 143/400
160/160 [=====] - 0s 801us/step - loss: 7.9712
Epoch 144/400
160/160 [=====] - 0s 653us/step - loss: 7.9712
Epoch 145/400
160/160 [=====] - 0s 597us/step - loss: 7.9712
Epoch 146/400
160/160 [=====] - 0s 705us/step - loss: 7.9712
Epoch 147/400
160/160 [=====] - 0s 629us/step - loss: 7.9712
Epoch 148/400
160/160 [=====] - 0s 710us/step - loss: 7.9712

Epoch 149/400
160/160 [=====] - 0s 763us/step - loss: 7.9712
Epoch 150/400
160/160 [=====] - 0s 634us/step - loss: 7.9712
Epoch 151/400
160/160 [=====] - 0s 767us/step - loss: 7.9712
Epoch 152/400
160/160 [=====] - 0s 775us/step - loss: 7.9712
Epoch 153/400
160/160 [=====] - 0s 784us/step - loss: 7.9712
Epoch 154/400
160/160 [=====] - 0s 790us/step - loss: 7.9712
Epoch 155/400
160/160 [=====] - 0s 708us/step - loss: 7.9712
Epoch 156/400
160/160 [=====] - 0s 799us/step - loss: 7.9712
Epoch 157/400
160/160 [=====] - 0s 799us/step - loss: 7.9712
Epoch 158/400
160/160 [=====] - 0s 806us/step - loss: 7.9712
Epoch 159/400
160/160 [=====] - 0s 659us/step - loss: 7.9712
Epoch 160/400
160/160 [=====] - 0s 693us/step - loss: 7.9712
Epoch 161/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 162/400
160/160 [=====] - 0s 617us/step - loss: 7.9712
Epoch 163/400
160/160 [=====] - 0s 622us/step - loss: 7.9712
Epoch 164/400
160/160 [=====] - 0s 636us/step - loss: 7.9712
Epoch 165/400
160/160 [=====] - 0s 668us/step - loss: 7.9712
Epoch 166/400
160/160 [=====] - 0s 767us/step - loss: 7.9712
Epoch 167/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 168/400
160/160 [=====] - 0s 686us/step - loss: 7.9712
Epoch 169/400
160/160 [=====] - 0s 687us/step - loss: 7.9712
Epoch 170/400
160/160 [=====] - 0s 811us/step - loss: 7.9712
Epoch 171/400
160/160 [=====] - 0s 693us/step - loss: 7.9712
Epoch 172/400
160/160 [=====] - 0s 704us/step - loss: 7.9712

Epoch 173/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 174/400
160/160 [=====] - 0s 738us/step - loss: 7.9712
Epoch 175/400
160/160 [=====] - 0s 688us/step - loss: 7.9712
Epoch 176/400
160/160 [=====] - 0s 640us/step - loss: 7.9712
Epoch 177/400
160/160 [=====] - 0s 732us/step - loss: 7.9712
Epoch 178/400
160/160 [=====] - 0s 649us/step - loss: 7.9712
Epoch 179/400
160/160 [=====] - 0s 632us/step - loss: 7.9712
Epoch 180/400
160/160 [=====] - 0s 635us/step - loss: 7.9712
Epoch 181/400
160/160 [=====] - 0s 758us/step - loss: 7.9712
Epoch 182/400
160/160 [=====] - 0s 652us/step - loss: 7.9712
Epoch 183/400
160/160 [=====] - 0s 688us/step - loss: 7.9712
Epoch 184/400
160/160 [=====] - 0s 851us/step - loss: 7.9712
Epoch 185/400
160/160 [=====] - 0s 800us/step - loss: 7.9712
Epoch 186/400
160/160 [=====] - 0s 843us/step - loss: 7.9712
Epoch 187/400
160/160 [=====] - 0s 865us/step - loss: 7.9712
Epoch 188/400
160/160 [=====] - 0s 787us/step - loss: 7.9712
Epoch 189/400
160/160 [=====] - 0s 752us/step - loss: 7.9712
Epoch 190/400
160/160 [=====] - 0s 757us/step - loss: 7.9712
Epoch 191/400
160/160 [=====] - 0s 667us/step - loss: 7.9712
Epoch 192/400
160/160 [=====] - 0s 697us/step - loss: 7.9712
Epoch 193/400
160/160 [=====] - 0s 737us/step - loss: 7.9712
Epoch 194/400
160/160 [=====] - 0s 725us/step - loss: 7.9712
Epoch 195/400
160/160 [=====] - 0s 826us/step - loss: 7.9712
Epoch 196/400
160/160 [=====] - 0s 700us/step - loss: 7.9712

Epoch 197/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 198/400
160/160 [=====] - 0s 609us/step - loss: 7.9712
Epoch 199/400
160/160 [=====] - 0s 753us/step - loss: 7.9712
Epoch 200/400
160/160 [=====] - 0s 725us/step - loss: 7.9712
Epoch 201/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 202/400
160/160 [=====] - 0s 844us/step - loss: 7.9712
Epoch 203/400
160/160 [=====] - 0s 805us/step - loss: 7.9712
Epoch 204/400
160/160 [=====] - 0s 781us/step - loss: 7.9712
Epoch 205/400
160/160 [=====] - 0s 760us/step - loss: 7.9712
Epoch 206/400
160/160 [=====] - 0s 805us/step - loss: 7.9712
Epoch 207/400
160/160 [=====] - 0s 809us/step - loss: 7.9712
Epoch 208/400
160/160 [=====] - 0s 645us/step - loss: 7.9712
Epoch 209/400
160/160 [=====] - 0s 745us/step - loss: 7.9712
Epoch 210/400
160/160 [=====] - 0s 819us/step - loss: 7.9712
Epoch 211/400
160/160 [=====] - 0s 850us/step - loss: 7.9712
Epoch 212/400
160/160 [=====] - 0s 809us/step - loss: 7.9712
Epoch 213/400
160/160 [=====] - 0s 721us/step - loss: 7.9712
Epoch 214/400
160/160 [=====] - 0s 806us/step - loss: 7.9712
Epoch 215/400
160/160 [=====] - 0s 796us/step - loss: 7.9712
Epoch 216/400
160/160 [=====] - 0s 852us/step - loss: 7.9712
Epoch 217/400
160/160 [=====] - 0s 785us/step - loss: 7.9712
Epoch 218/400
160/160 [=====] - 0s 748us/step - loss: 7.9712
Epoch 219/400
160/160 [=====] - 0s 774us/step - loss: 7.9712
Epoch 220/400
160/160 [=====] - 0s 768us/step - loss: 7.9712

Epoch 221/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 222/400
160/160 [=====] - 0s 788us/step - loss: 7.9712
Epoch 223/400
160/160 [=====] - 0s 767us/step - loss: 7.9712
Epoch 224/400
160/160 [=====] - 0s 773us/step - loss: 7.9712
Epoch 225/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 226/400
160/160 [=====] - 0s 776us/step - loss: 7.9712
Epoch 227/400
160/160 [=====] - 0s 811us/step - loss: 7.9712
Epoch 228/400
160/160 [=====] - 0s 800us/step - loss: 7.9712
Epoch 229/400
160/160 [=====] - 0s 783us/step - loss: 7.9712
Epoch 230/400
160/160 [=====] - 0s 813us/step - loss: 7.9712
Epoch 231/400
160/160 [=====] - 0s 844us/step - loss: 7.9712
Epoch 232/400
160/160 [=====] - 0s 790us/step - loss: 7.9712
Epoch 233/400
160/160 [=====] - 0s 824us/step - loss: 7.9712
Epoch 234/400
160/160 [=====] - 0s 736us/step - loss: 7.9712
Epoch 235/400
160/160 [=====] - 0s 734us/step - loss: 7.9712
Epoch 236/400
160/160 [=====] - 0s 762us/step - loss: 7.9712
Epoch 237/400
160/160 [=====] - 0s 718us/step - loss: 7.9712
Epoch 238/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 239/400
160/160 [=====] - 0s 748us/step - loss: 7.9712
Epoch 240/400
160/160 [=====] - 0s 679us/step - loss: 7.9712
Epoch 241/400
160/160 [=====] - 0s 678us/step - loss: 7.9712
Epoch 242/400
160/160 [=====] - 0s 830us/step - loss: 7.9712
Epoch 243/400
160/160 [=====] - 0s 736us/step - loss: 7.9712
Epoch 244/400
160/160 [=====] - 0s 784us/step - loss: 7.9712

Epoch 245/400
160/160 [=====] - 0s 826us/step - loss: 7.9712
Epoch 246/400
160/160 [=====] - 0s 725us/step - loss: 7.9712
Epoch 247/400
160/160 [=====] - 0s 754us/step - loss: 7.9712
Epoch 248/400
160/160 [=====] - 0s 769us/step - loss: 7.9712
Epoch 249/400
160/160 [=====] - 0s 790us/step - loss: 7.9712
Epoch 250/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 251/400
160/160 [=====] - 0s 856us/step - loss: 7.9712
Epoch 252/400
160/160 [=====] - 0s 812us/step - loss: 7.9712
Epoch 253/400
160/160 [=====] - 0s 829us/step - loss: 7.9712
Epoch 254/400
160/160 [=====] - 0s 825us/step - loss: 7.9712
Epoch 255/400
160/160 [=====] - 0s 809us/step - loss: 7.9712
Epoch 256/400
160/160 [=====] - 0s 797us/step - loss: 7.9712
Epoch 257/400
160/160 [=====] - 0s 790us/step - loss: 7.9712
Epoch 258/400
160/160 [=====] - 0s 793us/step - loss: 7.9712
Epoch 259/400
160/160 [=====] - 0s 820us/step - loss: 7.9712
Epoch 260/400
160/160 [=====] - 0s 817us/step - loss: 7.9712
Epoch 261/400
160/160 [=====] - 0s 849us/step - loss: 7.9712
Epoch 262/400
160/160 [=====] - 0s 739us/step - loss: 7.9712
Epoch 263/400
160/160 [=====] - 0s 722us/step - loss: 7.9712
Epoch 264/400
160/160 [=====] - 0s 692us/step - loss: 7.9712
Epoch 265/400
160/160 [=====] - 0s 823us/step - loss: 7.9712
Epoch 266/400
160/160 [=====] - 0s 796us/step - loss: 7.9712
Epoch 267/400
160/160 [=====] - 0s 825us/step - loss: 7.9712
Epoch 268/400
160/160 [=====] - 0s 833us/step - loss: 7.9712

Epoch 269/400
160/160 [=====] - 0s 827us/step - loss: 7.9712
Epoch 270/400
160/160 [=====] - 0s 811us/step - loss: 7.9712
Epoch 271/400
160/160 [=====] - 0s 805us/step - loss: 7.9712
Epoch 272/400
160/160 [=====] - 0s 835us/step - loss: 7.9712
Epoch 273/400
160/160 [=====] - 0s 786us/step - loss: 7.9712
Epoch 274/400
160/160 [=====] - 0s 863us/step - loss: 7.9712
Epoch 275/400
160/160 [=====] - 0s 788us/step - loss: 7.9712
Epoch 276/400
160/160 [=====] - 0s 841us/step - loss: 7.9712
Epoch 277/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 278/400
160/160 [=====] - 0s 823us/step - loss: 7.9712
Epoch 279/400
160/160 [=====] - 0s 798us/step - loss: 7.9712
Epoch 280/400
160/160 [=====] - 0s 746us/step - loss: 7.9712
Epoch 281/400
160/160 [=====] - 0s 805us/step - loss: 7.9712
Epoch 282/400
160/160 [=====] - 0s 795us/step - loss: 7.9712
Epoch 283/400
160/160 [=====] - 0s 862us/step - loss: 7.9712
Epoch 284/400
160/160 [=====] - 0s 785us/step - loss: 7.9712
Epoch 285/400
160/160 [=====] - 0s 789us/step - loss: 7.9712
Epoch 286/400
160/160 [=====] - 0s 854us/step - loss: 7.9712
Epoch 287/400
160/160 [=====] - 0s 823us/step - loss: 7.9712
Epoch 288/400
160/160 [=====] - 0s 817us/step - loss: 7.9712
Epoch 289/400
160/160 [=====] - 0s 824us/step - loss: 7.9712
Epoch 290/400
160/160 [=====] - 0s 846us/step - loss: 7.9712
Epoch 291/400
160/160 [=====] - 0s 823us/step - loss: 7.9712
Epoch 292/400
160/160 [=====] - 0s 798us/step - loss: 7.9712

Epoch 293/400
160/160 [=====] - 0s 758us/step - loss: 7.9712
Epoch 294/400
160/160 [=====] - 0s 787us/step - loss: 7.9712
Epoch 295/400
160/160 [=====] - 0s 867us/step - loss: 7.9712
Epoch 296/400
160/160 [=====] - 0s 845us/step - loss: 7.9712
Epoch 297/400
160/160 [=====] - 0s 809us/step - loss: 7.9712
Epoch 298/400
160/160 [=====] - 0s 800us/step - loss: 7.9712
Epoch 299/400
160/160 [=====] - 0s 812us/step - loss: 7.9712
Epoch 300/400
160/160 [=====] - 0s 837us/step - loss: 7.9712
Epoch 301/400
160/160 [=====] - 0s 852us/step - loss: 7.9712
Epoch 302/400
160/160 [=====] - 0s 822us/step - loss: 7.9712
Epoch 303/400
160/160 [=====] - 0s 838us/step - loss: 7.9712
Epoch 304/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 305/400
160/160 [=====] - 0s 769us/step - loss: 7.9712
Epoch 306/400
160/160 [=====] - 0s 659us/step - loss: 7.9712
Epoch 307/400
160/160 [=====] - 0s 819us/step - loss: 7.9712
Epoch 308/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 309/400
160/160 [=====] - 0s 791us/step - loss: 7.9712
Epoch 310/400
160/160 [=====] - 0s 841us/step - loss: 7.9712
Epoch 311/400
160/160 [=====] - 0s 830us/step - loss: 7.9712
Epoch 312/400
160/160 [=====] - 0s 842us/step - loss: 7.9712
Epoch 313/400
160/160 [=====] - 0s 832us/step - loss: 7.9712
Epoch 314/400
160/160 [=====] - 0s 865us/step - loss: 7.9712
Epoch 315/400
160/160 [=====] - 0s 811us/step - loss: 7.9712
Epoch 316/400
160/160 [=====] - 0s 801us/step - loss: 7.9712

Epoch 317/400
160/160 [=====] - 0s 753us/step - loss: 7.9712
Epoch 318/400
160/160 [=====] - 0s 799us/step - loss: 7.9712
Epoch 319/400
160/160 [=====] - 0s 845us/step - loss: 7.9712
Epoch 320/400
160/160 [=====] - 0s 800us/step - loss: 7.9712
Epoch 321/400
160/160 [=====] - 0s 837us/step - loss: 7.9712
Epoch 322/400
160/160 [=====] - 0s 883us/step - loss: 7.9712
Epoch 323/400
160/160 [=====] - 0s 804us/step - loss: 7.9712
Epoch 324/400
160/160 [=====] - 0s 791us/step - loss: 7.9712
Epoch 325/400
160/160 [=====] - 0s 811us/step - loss: 7.9712
Epoch 326/400
160/160 [=====] - 0s 802us/step - loss: 7.9712
Epoch 327/400
160/160 [=====] - 0s 760us/step - loss: 7.9712
Epoch 328/400
160/160 [=====] - 0s 787us/step - loss: 7.9712
Epoch 329/400
160/160 [=====] - 0s 781us/step - loss: 7.9712
Epoch 330/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 331/400
160/160 [=====] - 0s 746us/step - loss: 7.9712
Epoch 332/400
160/160 [=====] - 0s 735us/step - loss: 7.9712
Epoch 333/400
160/160 [=====] - 0s 786us/step - loss: 7.9712
Epoch 334/400
160/160 [=====] - 0s 822us/step - loss: 7.9712
Epoch 335/400
160/160 [=====] - 0s 816us/step - loss: 7.9712
Epoch 336/400
160/160 [=====] - 0s 746us/step - loss: 7.9712
Epoch 337/400
160/160 [=====] - 0s 710us/step - loss: 7.9712
Epoch 338/400
160/160 [=====] - 0s 790us/step - loss: 7.9712
Epoch 339/400
160/160 [=====] - 0s 822us/step - loss: 7.9712
Epoch 340/400
160/160 [=====] - 0s 829us/step - loss: 7.9712

Epoch 341/400
160/160 [=====] - 0s 808us/step - loss: 7.9712
Epoch 342/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 343/400
160/160 [=====] - 0s 831us/step - loss: 7.9712
Epoch 344/400
160/160 [=====] - 0s 832us/step - loss: 7.9712
Epoch 345/400
160/160 [=====] - 0s 824us/step - loss: 7.9712
Epoch 346/400
160/160 [=====] - 0s 875us/step - loss: 7.9712
Epoch 347/400
160/160 [=====] - 0s 963us/step - loss: 7.9712
Epoch 348/400
160/160 [=====] - 0s 823us/step - loss: 7.9712
Epoch 349/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 350/400
160/160 [=====] - 0s 930us/step - loss: 7.9712
Epoch 351/400
160/160 [=====] - 0s 916us/step - loss: 7.9712
Epoch 352/400
160/160 [=====] - 0s 661us/step - loss: 7.9712
Epoch 353/400
160/160 [=====] - 0s 695us/step - loss: 7.9712
Epoch 354/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 355/400
160/160 [=====] - 0s 743us/step - loss: 7.9712
Epoch 356/400
160/160 [=====] - 0s 927us/step - loss: 7.9712
Epoch 357/400
160/160 [=====] - 0s 901us/step - loss: 7.9712
Epoch 358/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 359/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 360/400
160/160 [=====] - 0s 687us/step - loss: 7.9712
Epoch 361/400
160/160 [=====] - 0s 685us/step - loss: 7.9712
Epoch 362/400
160/160 [=====] - 0s 635us/step - loss: 7.9712
Epoch 363/400
160/160 [=====] - 0s 676us/step - loss: 7.9712
Epoch 364/400
160/160 [=====] - 0s 699us/step - loss: 7.9712

Epoch 365/400
160/160 [=====] - 0s 710us/step - loss: 7.9712
Epoch 366/400
160/160 [=====] - 0s 688us/step - loss: 7.9712
Epoch 367/400
160/160 [=====] - 0s 689us/step - loss: 7.9712
Epoch 368/400
160/160 [=====] - 0s 700us/step - loss: 7.9712
Epoch 369/400
160/160 [=====] - 0s 629us/step - loss: 7.9712
Epoch 370/400
160/160 [=====] - 0s 620us/step - loss: 7.9712
Epoch 371/400
160/160 [=====] - 0s 680us/step - loss: 7.9712
Epoch 372/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 373/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 374/400
160/160 [=====] - 0s 857us/step - loss: 7.9712
Epoch 375/400
160/160 [=====] - 0s 922us/step - loss: 7.9712
Epoch 376/400
160/160 [=====] - 0s 841us/step - loss: 7.9712
Epoch 377/400
160/160 [=====] - 0s 883us/step - loss: 7.9712
Epoch 378/400
160/160 [=====] - 0s 880us/step - loss: 7.9712
Epoch 379/400
160/160 [=====] - 0s 867us/step - loss: 7.9712
Epoch 380/400
160/160 [=====] - 0s 818us/step - loss: 7.9712
Epoch 381/400
160/160 [=====] - 0s 869us/step - loss: 7.9712
Epoch 382/400
160/160 [=====] - 0s 811us/step - loss: 7.9712
Epoch 383/400
160/160 [=====] - 0s 829us/step - loss: 7.9712
Epoch 384/400
160/160 [=====] - 0s 760us/step - loss: 7.9712
Epoch 385/400
160/160 [=====] - 0s 734us/step - loss: 7.9712
Epoch 386/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 387/400
160/160 [=====] - 0s 722us/step - loss: 7.9712
Epoch 388/400
160/160 [=====] - 0s 822us/step - loss: 7.9712

```

Epoch 389/400
160/160 [=====] - 0s 865us/step - loss: 7.9712
Epoch 390/400
160/160 [=====] - 0s 872us/step - loss: 7.9712
Epoch 391/400
160/160 [=====] - 0s 878us/step - loss: 7.9712
Epoch 392/400
160/160 [=====] - 0s 872us/step - loss: 7.9712
Epoch 393/400
160/160 [=====] - 0s 886us/step - loss: 7.9712
Epoch 394/400
160/160 [=====] - 0s 867us/step - loss: 7.9712
Epoch 395/400
160/160 [=====] - 0s 757us/step - loss: 7.9712
Epoch 396/400
160/160 [=====] - 0s 825us/step - loss: 7.9712
Epoch 397/400
160/160 [=====] - 0s 834us/step - loss: 7.9712
Epoch 398/400
160/160 [=====] - 0s 914us/step - loss: 7.9712
Epoch 399/400
160/160 [=====] - 0s 882us/step - loss: 7.9712
Epoch 400/400
160/160 [=====] - 0s 919us/step - loss: 7.9712

```

```

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '

```

```

[1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765
 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765
 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765
 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765
 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 2.0623124 2.5411372
 2.7554429 2.5203316 2.928496 2.9114878 2.3898747 2.480461 1.7318329
 2.8797333 2.5763032 2.7019627 2.6736503 2.1843174 2.1916258 2.0025249
 1.5546765 2.8039181 3.0069456 2.2941842 3.1313722 3.323245 1.5546765
 2.2388098 3.1144452 1.7065196 3.046744 3.3007965 3.1450691 2.469897
 2.595903 1.8496658 2.0717106 2.461489 2.7229016 2.846066 2.1238317
 2.0818667 2.2909837 1.9647785 1.5546765 1.5546765 1.5546765 1.5546765
 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765
 1.5546765 1.5546765 1.5546765 1.5546765 1.9971553 1.5546765 1.5546765
 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765
 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765 1.5546765
 1.5546765 1.5546765 1.5546765 1.5546765 1.6087304 1.5546765 1.5546765
 1.5546765 1.9176947 1.5546765 1.7261983 1.5546765 1.4489791 1.6472723

```

```

1.5546765 2.311308 1.5546765 1.7061696 1.5546765 1.5294949 1.7793226
2.0593565 1.6455389 1.5546765 1.5546765 1.7424761 1.3774146 2.2357285
1.7214758 1.173504 1.5546765 1.5546765 1.2964876 1.5546765 1.8179389
1.5390747 1.5744402 1.5765096 2.114983 1.5546765 1.5546765 1.5567287
1.8639084 1.447016 1.5546765 1.5546765 1.5546765 1.5546765]
160/160 [=====] - 0s 2ms/step

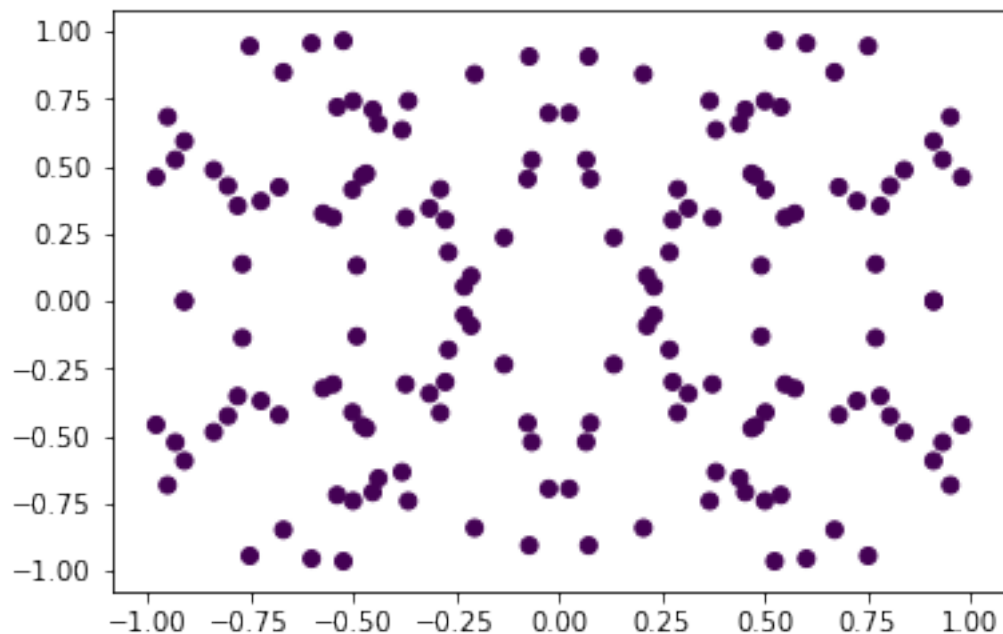
```

```
In [74]: scores, model.metrics_names
```

```
Out[74]: (7.971192407608049, ['loss'])
```

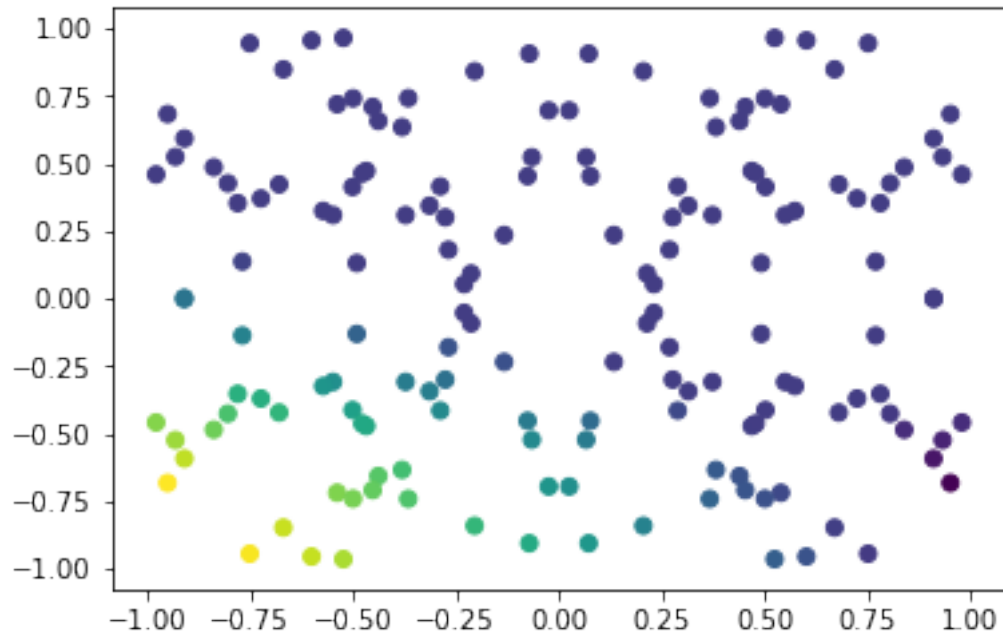
```
In [75]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[75]: <matplotlib.collections.PathCollection at 0xb29fff518>
```



```
In [76]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[76]: <matplotlib.collections.PathCollection at 0xb2a1dc8d0>
```



```
In [77]: # relu 4
model = Sequential()

model.add(Dense(2, input_dim=2, activation='relu'))
model.add(Dense(2, activation='relu'))
model.add(Dense(2, activation='relu'))
model.add(Dense(2, activation='relu'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='relu'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 6ms/step - loss: 8.0590
Epoch 2/400
160/160 [=====] - 0s 899us/step - loss: 8.0590
Epoch 3/400
160/160 [=====] - 0s 876us/step - loss: 8.0590
Epoch 4/400
```

160/160 [=====] - 0s 913us/step - loss: 8.0590
Epoch 5/400
160/160 [=====] - 0s 900us/step - loss: 8.0590
Epoch 6/400
160/160 [=====] - 0s 854us/step - loss: 8.0590
Epoch 7/400
160/160 [=====] - 0s 874us/step - loss: 8.0590
Epoch 8/400
160/160 [=====] - 0s 888us/step - loss: 8.0590
Epoch 9/400
160/160 [=====] - 0s 850us/step - loss: 8.0590
Epoch 10/400
160/160 [=====] - 0s 760us/step - loss: 8.0590
Epoch 11/400
160/160 [=====] - 0s 773us/step - loss: 8.0590
Epoch 12/400
160/160 [=====] - 0s 878us/step - loss: 8.0590
Epoch 13/400
160/160 [=====] - 0s 776us/step - loss: 8.0590
Epoch 14/400
160/160 [=====] - 0s 859us/step - loss: 8.0590
Epoch 15/400
160/160 [=====] - 0s 747us/step - loss: 8.0590
Epoch 16/400
160/160 [=====] - 0s 787us/step - loss: 8.0590
Epoch 17/400
160/160 [=====] - 0s 907us/step - loss: 8.0590
Epoch 18/400
160/160 [=====] - 0s 798us/step - loss: 8.0590
Epoch 19/400
160/160 [=====] - 0s 902us/step - loss: 8.0590
Epoch 20/400
160/160 [=====] - 0s 794us/step - loss: 8.0590
Epoch 21/400
160/160 [=====] - 0s 890us/step - loss: 8.0590
Epoch 22/400
160/160 [=====] - 0s 833us/step - loss: 8.0590
Epoch 23/400
160/160 [=====] - 0s 693us/step - loss: 8.0590
Epoch 24/400
160/160 [=====] - 0s 726us/step - loss: 8.0590
Epoch 25/400
160/160 [=====] - 0s 780us/step - loss: 8.0590
Epoch 26/400
160/160 [=====] - 0s 848us/step - loss: 8.0590
Epoch 27/400
160/160 [=====] - 0s 859us/step - loss: 8.0590
Epoch 28/400

160/160 [=====] - 0s 931us/step - loss: 8.0590
Epoch 29/400
160/160 [=====] - 0s 841us/step - loss: 8.0590
Epoch 30/400
160/160 [=====] - 0s 856us/step - loss: 8.0590
Epoch 31/400
160/160 [=====] - 0s 899us/step - loss: 8.0590
Epoch 32/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 33/400
160/160 [=====] - 0s 857us/step - loss: 8.0590
Epoch 34/400
160/160 [=====] - 0s 805us/step - loss: 8.0590
Epoch 35/400
160/160 [=====] - 0s 864us/step - loss: 8.0590
Epoch 36/400
160/160 [=====] - 0s 907us/step - loss: 8.0590
Epoch 37/400
160/160 [=====] - 0s 883us/step - loss: 8.0590
Epoch 38/400
160/160 [=====] - 0s 702us/step - loss: 8.0590
Epoch 39/400
160/160 [=====] - 0s 792us/step - loss: 8.0590
Epoch 40/400
160/160 [=====] - 0s 857us/step - loss: 8.0590
Epoch 41/400
160/160 [=====] - 0s 894us/step - loss: 8.0590
Epoch 42/400
160/160 [=====] - 0s 803us/step - loss: 8.0590
Epoch 43/400
160/160 [=====] - 0s 717us/step - loss: 8.0590
Epoch 44/400
160/160 [=====] - 0s 846us/step - loss: 8.0590
Epoch 45/400
160/160 [=====] - 0s 880us/step - loss: 8.0590
Epoch 46/400
160/160 [=====] - 0s 858us/step - loss: 8.0590
Epoch 47/400
160/160 [=====] - 0s 737us/step - loss: 8.0590
Epoch 48/400
160/160 [=====] - 0s 720us/step - loss: 8.0590
Epoch 49/400
160/160 [=====] - 0s 726us/step - loss: 8.0590
Epoch 50/400
160/160 [=====] - 0s 733us/step - loss: 8.0590
Epoch 51/400
160/160 [=====] - 0s 696us/step - loss: 8.0590
Epoch 52/400

160/160 [=====] - 0s 673us/step - loss: 8.0590
Epoch 53/400
160/160 [=====] - 0s 671us/step - loss: 8.0590
Epoch 54/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 55/400
160/160 [=====] - 0s 701us/step - loss: 8.0590
Epoch 56/400
160/160 [=====] - 0s 692us/step - loss: 8.0590
Epoch 57/400
160/160 [=====] - 0s 688us/step - loss: 8.0590
Epoch 58/400
160/160 [=====] - 0s 714us/step - loss: 8.0590
Epoch 59/400
160/160 [=====] - 0s 798us/step - loss: 8.0590
Epoch 60/400
160/160 [=====] - 0s 891us/step - loss: 8.0590
Epoch 61/400
160/160 [=====] - 0s 876us/step - loss: 8.0590
Epoch 62/400
160/160 [=====] - 0s 851us/step - loss: 8.0590
Epoch 63/400
160/160 [=====] - 0s 895us/step - loss: 8.0590
Epoch 64/400
160/160 [=====] - 0s 871us/step - loss: 8.0590
Epoch 65/400
160/160 [=====] - 0s 838us/step - loss: 8.0590
Epoch 66/400
160/160 [=====] - 0s 859us/step - loss: 8.0590
Epoch 67/400
160/160 [=====] - 0s 863us/step - loss: 8.0590
Epoch 68/400
160/160 [=====] - 0s 837us/step - loss: 8.0590
Epoch 69/400
160/160 [=====] - 0s 860us/step - loss: 8.0590
Epoch 70/400
160/160 [=====] - 0s 874us/step - loss: 8.0590
Epoch 71/400
160/160 [=====] - 0s 845us/step - loss: 8.0590
Epoch 72/400
160/160 [=====] - 0s 845us/step - loss: 8.0590
Epoch 73/400
160/160 [=====] - 0s 855us/step - loss: 8.0590
Epoch 74/400
160/160 [=====] - 0s 871us/step - loss: 8.0590
Epoch 75/400
160/160 [=====] - 0s 850us/step - loss: 8.0590
Epoch 76/400

160/160 [=====] - 0s 865us/step - loss: 8.0590
Epoch 77/400
160/160 [=====] - 0s 845us/step - loss: 8.0590
Epoch 78/400
160/160 [=====] - 0s 848us/step - loss: 8.0590
Epoch 79/400
160/160 [=====] - 0s 902us/step - loss: 8.0590
Epoch 80/400
160/160 [=====] - 0s 876us/step - loss: 8.0590
Epoch 81/400
160/160 [=====] - 0s 856us/step - loss: 8.0590
Epoch 82/400
160/160 [=====] - 0s 792us/step - loss: 8.0590
Epoch 83/400
160/160 [=====] - 0s 860us/step - loss: 8.0590
Epoch 84/400
160/160 [=====] - 0s 856us/step - loss: 8.0590
Epoch 85/400
160/160 [=====] - 0s 859us/step - loss: 8.0590
Epoch 86/400
160/160 [=====] - 0s 838us/step - loss: 8.0590
Epoch 87/400
160/160 [=====] - 0s 908us/step - loss: 8.0590
Epoch 88/400
160/160 [=====] - 0s 909us/step - loss: 8.0590
Epoch 89/400
160/160 [=====] - 0s 901us/step - loss: 8.0590
Epoch 90/400
160/160 [=====] - 0s 843us/step - loss: 8.0590
Epoch 91/400
160/160 [=====] - 0s 762us/step - loss: 8.0590
Epoch 92/400
160/160 [=====] - 0s 842us/step - loss: 8.0590
Epoch 93/400
160/160 [=====] - 0s 790us/step - loss: 8.0590
Epoch 94/400
160/160 [=====] - 0s 848us/step - loss: 8.0590
Epoch 95/400
160/160 [=====] - 0s 780us/step - loss: 8.0590
Epoch 96/400
160/160 [=====] - 0s 684us/step - loss: 8.0590
Epoch 97/400
160/160 [=====] - 0s 647us/step - loss: 8.0590
Epoch 98/400
160/160 [=====] - 0s 779us/step - loss: 8.0590
Epoch 99/400
160/160 [=====] - 0s 884us/step - loss: 8.0590
Epoch 100/400

160/160 [=====] - 0s 810us/step - loss: 8.0590
Epoch 101/400
160/160 [=====] - 0s 819us/step - loss: 8.0590
Epoch 102/400
160/160 [=====] - 0s 817us/step - loss: 8.0590
Epoch 103/400
160/160 [=====] - 0s 830us/step - loss: 8.0590
Epoch 104/400
160/160 [=====] - 0s 841us/step - loss: 8.0590
Epoch 105/400
160/160 [=====] - 0s 925us/step - loss: 8.0590
Epoch 106/400
160/160 [=====] - 0s 873us/step - loss: 8.0590
Epoch 107/400
160/160 [=====] - 0s 857us/step - loss: 8.0590
Epoch 108/400
160/160 [=====] - 0s 885us/step - loss: 8.0590
Epoch 109/400
160/160 [=====] - 0s 880us/step - loss: 8.0590
Epoch 110/400
160/160 [=====] - 0s 872us/step - loss: 8.0590
Epoch 111/400
160/160 [=====] - 0s 845us/step - loss: 8.0590
Epoch 112/400
160/160 [=====] - 0s 846us/step - loss: 8.0590
Epoch 113/400
160/160 [=====] - 0s 844us/step - loss: 8.0590
Epoch 114/400
160/160 [=====] - 0s 831us/step - loss: 8.0590
Epoch 115/400
160/160 [=====] - 0s 791us/step - loss: 8.0590
Epoch 116/400
160/160 [=====] - 0s 795us/step - loss: 8.0590
Epoch 117/400
160/160 [=====] - 0s 762us/step - loss: 8.0590
Epoch 118/400
160/160 [=====] - 0s 892us/step - loss: 8.0590
Epoch 119/400
160/160 [=====] - 0s 867us/step - loss: 8.0590
Epoch 120/400
160/160 [=====] - 0s 859us/step - loss: 8.0590
Epoch 121/400
160/160 [=====] - 0s 889us/step - loss: 8.0590
Epoch 122/400
160/160 [=====] - 0s 744us/step - loss: 8.0590
Epoch 123/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 124/400

160/160 [=====] - 0s 802us/step - loss: 8.0590
Epoch 125/400
160/160 [=====] - 0s 734us/step - loss: 8.0590
Epoch 126/400
160/160 [=====] - 0s 699us/step - loss: 8.0590
Epoch 127/400
160/160 [=====] - 0s 824us/step - loss: 8.0590
Epoch 128/400
160/160 [=====] - 0s 680us/step - loss: 8.0590
Epoch 129/400
160/160 [=====] - 0s 695us/step - loss: 8.0590
Epoch 130/400
160/160 [=====] - 0s 695us/step - loss: 8.0590
Epoch 131/400
160/160 [=====] - 0s 786us/step - loss: 8.0590
Epoch 132/400
160/160 [=====] - 0s 710us/step - loss: 8.0590
Epoch 133/400
160/160 [=====] - 0s 774us/step - loss: 8.0590
Epoch 134/400
160/160 [=====] - 0s 836us/step - loss: 8.0590
Epoch 135/400
160/160 [=====] - 0s 744us/step - loss: 8.0590
Epoch 136/400
160/160 [=====] - 0s 815us/step - loss: 8.0590
Epoch 137/400
160/160 [=====] - 0s 835us/step - loss: 8.0590
Epoch 138/400
160/160 [=====] - 0s 818us/step - loss: 8.0590
Epoch 139/400
160/160 [=====] - 0s 844us/step - loss: 8.0590
Epoch 140/400
160/160 [=====] - 0s 769us/step - loss: 8.0590
Epoch 141/400
160/160 [=====] - 0s 778us/step - loss: 8.0590
Epoch 142/400
160/160 [=====] - 0s 696us/step - loss: 8.0590
Epoch 143/400
160/160 [=====] - 0s 712us/step - loss: 8.0590
Epoch 144/400
160/160 [=====] - 0s 813us/step - loss: 8.0590
Epoch 145/400
160/160 [=====] - 0s 740us/step - loss: 8.0590
Epoch 146/400
160/160 [=====] - 0s 731us/step - loss: 8.0590
Epoch 147/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 148/400

160/160 [=====] - 0s 760us/step - loss: 8.0590
Epoch 149/400
160/160 [=====] - 0s 707us/step - loss: 8.0590
Epoch 150/400
160/160 [=====] - 0s 762us/step - loss: 8.0590
Epoch 151/400
160/160 [=====] - 0s 849us/step - loss: 8.0590
Epoch 152/400
160/160 [=====] - 0s 841us/step - loss: 8.0590
Epoch 153/400
160/160 [=====] - 0s 876us/step - loss: 8.0590
Epoch 154/400
160/160 [=====] - 0s 820us/step - loss: 8.0590
Epoch 155/400
160/160 [=====] - 0s 708us/step - loss: 8.0590
Epoch 156/400
160/160 [=====] - 0s 751us/step - loss: 8.0590
Epoch 157/400
160/160 [=====] - 0s 738us/step - loss: 8.0590
Epoch 158/400
160/160 [=====] - 0s 693us/step - loss: 8.0590
Epoch 159/400
160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 160/400
160/160 [=====] - 0s 694us/step - loss: 8.0590
Epoch 161/400
160/160 [=====] - 0s 731us/step - loss: 8.0590
Epoch 162/400
160/160 [=====] - 0s 745us/step - loss: 8.0590
Epoch 163/400
160/160 [=====] - 0s 692us/step - loss: 8.0590
Epoch 164/400
160/160 [=====] - 0s 746us/step - loss: 8.0590
Epoch 165/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 166/400
160/160 [=====] - 0s 680us/step - loss: 8.0590
Epoch 167/400
160/160 [=====] - 0s 757us/step - loss: 8.0590
Epoch 168/400
160/160 [=====] - 0s 756us/step - loss: 8.0590
Epoch 169/400
160/160 [=====] - 0s 677us/step - loss: 8.0590
Epoch 170/400
160/160 [=====] - 0s 709us/step - loss: 8.0590
Epoch 171/400
160/160 [=====] - 0s 686us/step - loss: 8.0590
Epoch 172/400

160/160 [=====] - 0s 688us/step - loss: 8.0590
Epoch 173/400
160/160 [=====] - 0s 711us/step - loss: 8.0590
Epoch 174/400
160/160 [=====] - 0s 749us/step - loss: 8.0590
Epoch 175/400
160/160 [=====] - 0s 779us/step - loss: 8.0590
Epoch 176/400
160/160 [=====] - 0s 704us/step - loss: 8.0590
Epoch 177/400
160/160 [=====] - 0s 724us/step - loss: 8.0590
Epoch 178/400
160/160 [=====] - 0s 675us/step - loss: 8.0590
Epoch 179/400
160/160 [=====] - 0s 660us/step - loss: 8.0590
Epoch 180/400
160/160 [=====] - 0s 763us/step - loss: 8.0590
Epoch 181/400
160/160 [=====] - 0s 740us/step - loss: 8.0590
Epoch 182/400
160/160 [=====] - 0s 701us/step - loss: 8.0590
Epoch 183/400
160/160 [=====] - 0s 694us/step - loss: 8.0590
Epoch 184/400
160/160 [=====] - 0s 741us/step - loss: 8.0590
Epoch 185/400
160/160 [=====] - 0s 698us/step - loss: 8.0590
Epoch 186/400
160/160 [=====] - 0s 732us/step - loss: 8.0590
Epoch 187/400
160/160 [=====] - 0s 759us/step - loss: 8.0590
Epoch 188/400
160/160 [=====] - 0s 757us/step - loss: 8.0590
Epoch 189/400
160/160 [=====] - 0s 687us/step - loss: 8.0590
Epoch 190/400
160/160 [=====] - 0s 707us/step - loss: 8.0590
Epoch 191/400
160/160 [=====] - 0s 775us/step - loss: 8.0590
Epoch 192/400
160/160 [=====] - 0s 757us/step - loss: 8.0590
Epoch 193/400
160/160 [=====] - 0s 752us/step - loss: 8.0590
Epoch 194/400
160/160 [=====] - 0s 764us/step - loss: 8.0590
Epoch 195/400
160/160 [=====] - 0s 679us/step - loss: 8.0590
Epoch 196/400

160/160 [=====] - 0s 817us/step - loss: 8.0590
Epoch 197/400
160/160 [=====] - 0s 759us/step - loss: 8.0590
Epoch 198/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 199/400
160/160 [=====] - 0s 733us/step - loss: 8.0590
Epoch 200/400
160/160 [=====] - 0s 940us/step - loss: 8.0590
Epoch 201/400
160/160 [=====] - 0s 886us/step - loss: 8.0590
Epoch 202/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 203/400
160/160 [=====] - 0s 686us/step - loss: 8.0590
Epoch 204/400
160/160 [=====] - 0s 750us/step - loss: 8.0590
Epoch 205/400
160/160 [=====] - 0s 826us/step - loss: 8.0590
Epoch 206/400
160/160 [=====] - 0s 679us/step - loss: 8.0590
Epoch 207/400
160/160 [=====] - 0s 790us/step - loss: 8.0590
Epoch 208/400
160/160 [=====] - 0s 739us/step - loss: 8.0590
Epoch 209/400
160/160 [=====] - 0s 759us/step - loss: 8.0590
Epoch 210/400
160/160 [=====] - 0s 720us/step - loss: 8.0590
Epoch 211/400
160/160 [=====] - 0s 779us/step - loss: 8.0590
Epoch 212/400
160/160 [=====] - 0s 718us/step - loss: 8.0590
Epoch 213/400
160/160 [=====] - 0s 685us/step - loss: 8.0590
Epoch 214/400
160/160 [=====] - 0s 799us/step - loss: 8.0590
Epoch 215/400
160/160 [=====] - 0s 794us/step - loss: 8.0590
Epoch 216/400
160/160 [=====] - 0s 856us/step - loss: 8.0590
Epoch 217/400
160/160 [=====] - 0s 890us/step - loss: 8.0590
Epoch 218/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 219/400
160/160 [=====] - 0s 928us/step - loss: 8.0590
Epoch 220/400

160/160 [=====] - 0s 943us/step - loss: 8.0590
Epoch 221/400
160/160 [=====] - 0s 740us/step - loss: 8.0590
Epoch 222/400
160/160 [=====] - 0s 925us/step - loss: 8.0590
Epoch 223/400
160/160 [=====] - 0s 731us/step - loss: 8.0590
Epoch 224/400
160/160 [=====] - 0s 804us/step - loss: 8.0590
Epoch 225/400
160/160 [=====] - 0s 860us/step - loss: 8.0590
Epoch 226/400
160/160 [=====] - 0s 848us/step - loss: 8.0590
Epoch 227/400
160/160 [=====] - 0s 790us/step - loss: 8.0590
Epoch 228/400
160/160 [=====] - 0s 662us/step - loss: 8.0590
Epoch 229/400
160/160 [=====] - 0s 818us/step - loss: 8.0590
Epoch 230/400
160/160 [=====] - 0s 897us/step - loss: 8.0590
Epoch 231/400
160/160 [=====] - 0s 934us/step - loss: 8.0590
Epoch 232/400
160/160 [=====] - 0s 854us/step - loss: 8.0590
Epoch 233/400
160/160 [=====] - 0s 879us/step - loss: 8.0590
Epoch 234/400
160/160 [=====] - 0s 883us/step - loss: 8.0590
Epoch 235/400
160/160 [=====] - 0s 841us/step - loss: 8.0590
Epoch 236/400
160/160 [=====] - 0s 793us/step - loss: 8.0590
Epoch 237/400
160/160 [=====] - 0s 890us/step - loss: 8.0590
Epoch 238/400
160/160 [=====] - 0s 779us/step - loss: 8.0590
Epoch 239/400
160/160 [=====] - 0s 735us/step - loss: 8.0590
Epoch 240/400
160/160 [=====] - 0s 763us/step - loss: 8.0590
Epoch 241/400
160/160 [=====] - 0s 755us/step - loss: 8.0590
Epoch 242/400
160/160 [=====] - 0s 758us/step - loss: 8.0590
Epoch 243/400
160/160 [=====] - 0s 865us/step - loss: 8.0590
Epoch 244/400

160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 245/400
160/160 [=====] - 0s 734us/step - loss: 8.0590
Epoch 246/400
160/160 [=====] - 0s 723us/step - loss: 8.0590
Epoch 247/400
160/160 [=====] - 0s 874us/step - loss: 8.0590
Epoch 248/400
160/160 [=====] - 0s 817us/step - loss: 8.0590
Epoch 249/400
160/160 [=====] - 0s 841us/step - loss: 8.0590
Epoch 250/400
160/160 [=====] - 0s 869us/step - loss: 8.0590
Epoch 251/400
160/160 [=====] - 0s 860us/step - loss: 8.0590
Epoch 252/400
160/160 [=====] - 0s 870us/step - loss: 8.0590
Epoch 253/400
160/160 [=====] - 0s 854us/step - loss: 8.0590
Epoch 254/400
160/160 [=====] - 0s 839us/step - loss: 8.0590
Epoch 255/400
160/160 [=====] - 0s 723us/step - loss: 8.0590
Epoch 256/400
160/160 [=====] - 0s 751us/step - loss: 8.0590
Epoch 257/400
160/160 [=====] - 0s 833us/step - loss: 8.0590
Epoch 258/400
160/160 [=====] - 0s 919us/step - loss: 8.0590
Epoch 259/400
160/160 [=====] - 0s 818us/step - loss: 8.0590
Epoch 260/400
160/160 [=====] - 0s 789us/step - loss: 8.0590
Epoch 261/400
160/160 [=====] - 0s 878us/step - loss: 8.0590
Epoch 262/400
160/160 [=====] - 0s 870us/step - loss: 8.0590
Epoch 263/400
160/160 [=====] - 0s 828us/step - loss: 8.0590
Epoch 264/400
160/160 [=====] - 0s 880us/step - loss: 8.0590
Epoch 265/400
160/160 [=====] - 0s 825us/step - loss: 8.0590
Epoch 266/400
160/160 [=====] - 0s 869us/step - loss: 8.0590
Epoch 267/400
160/160 [=====] - 0s 855us/step - loss: 8.0590
Epoch 268/400

160/160 [=====] - 0s 877us/step - loss: 8.0590
Epoch 269/400
160/160 [=====] - 0s 885us/step - loss: 8.0590
Epoch 270/400
160/160 [=====] - 0s 822us/step - loss: 8.0590
Epoch 271/400
160/160 [=====] - 0s 798us/step - loss: 8.0590
Epoch 272/400
160/160 [=====] - 0s 853us/step - loss: 8.0590
Epoch 273/400
160/160 [=====] - 0s 822us/step - loss: 8.0590
Epoch 274/400
160/160 [=====] - 0s 827us/step - loss: 8.0590
Epoch 275/400
160/160 [=====] - 0s 880us/step - loss: 8.0590
Epoch 276/400
160/160 [=====] - 0s 847us/step - loss: 8.0590
Epoch 277/400
160/160 [=====] - 0s 830us/step - loss: 8.0590
Epoch 278/400
160/160 [=====] - 0s 786us/step - loss: 8.0590
Epoch 279/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 280/400
160/160 [=====] - 0s 730us/step - loss: 8.0590
Epoch 281/400
160/160 [=====] - 0s 763us/step - loss: 8.0590
Epoch 282/400
160/160 [=====] - 0s 709us/step - loss: 8.0590
Epoch 283/400
160/160 [=====] - 0s 754us/step - loss: 8.0590
Epoch 284/400
160/160 [=====] - 0s 893us/step - loss: 8.0590
Epoch 285/400
160/160 [=====] - 0s 762us/step - loss: 8.0590
Epoch 286/400
160/160 [=====] - 0s 642us/step - loss: 8.0590
Epoch 287/400
160/160 [=====] - 0s 616us/step - loss: 8.0590
Epoch 288/400
160/160 [=====] - 0s 661us/step - loss: 8.0590
Epoch 289/400
160/160 [=====] - 0s 627us/step - loss: 8.0590
Epoch 290/400
160/160 [=====] - 0s 678us/step - loss: 8.0590
Epoch 291/400
160/160 [=====] - 0s 767us/step - loss: 8.0590
Epoch 292/400

160/160 [=====] - 0s 810us/step - loss: 8.0590
Epoch 293/400
160/160 [=====] - 0s 699us/step - loss: 8.0590
Epoch 294/400
160/160 [=====] - 0s 786us/step - loss: 8.0590
Epoch 295/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 296/400
160/160 [=====] - 0s 830us/step - loss: 8.0590
Epoch 297/400
160/160 [=====] - 0s 857us/step - loss: 8.0590
Epoch 298/400
160/160 [=====] - 0s 752us/step - loss: 8.0590
Epoch 299/400
160/160 [=====] - 0s 775us/step - loss: 8.0590
Epoch 300/400
160/160 [=====] - 0s 636us/step - loss: 8.0590
Epoch 301/400
160/160 [=====] - 0s 865us/step - loss: 8.0590
Epoch 302/400
160/160 [=====] - 0s 819us/step - loss: 8.0590
Epoch 303/400
160/160 [=====] - 0s 757us/step - loss: 8.0590
Epoch 304/400
160/160 [=====] - 0s 848us/step - loss: 8.0590
Epoch 305/400
160/160 [=====] - 0s 813us/step - loss: 8.0590
Epoch 306/400
160/160 [=====] - 0s 712us/step - loss: 8.0590
Epoch 307/400
160/160 [=====] - 0s 696us/step - loss: 8.0590
Epoch 308/400
160/160 [=====] - 0s 725us/step - loss: 8.0590
Epoch 309/400
160/160 [=====] - 0s 699us/step - loss: 8.0590
Epoch 310/400
160/160 [=====] - 0s 733us/step - loss: 8.0590
Epoch 311/400
160/160 [=====] - 0s 674us/step - loss: 8.0590
Epoch 312/400
160/160 [=====] - 0s 689us/step - loss: 8.0590
Epoch 313/400
160/160 [=====] - 0s 779us/step - loss: 8.0590
Epoch 314/400
160/160 [=====] - 0s 811us/step - loss: 8.0590
Epoch 315/400
160/160 [=====] - 0s 695us/step - loss: 8.0590
Epoch 316/400

160/160 [=====] - 0s 748us/step - loss: 8.0590
Epoch 317/400
160/160 [=====] - 0s 839us/step - loss: 8.0590
Epoch 318/400
160/160 [=====] - 0s 736us/step - loss: 8.0590
Epoch 319/400
160/160 [=====] - 0s 680us/step - loss: 8.0590
Epoch 320/400
160/160 [=====] - 0s 723us/step - loss: 8.0590
Epoch 321/400
160/160 [=====] - 0s 890us/step - loss: 8.0590
Epoch 322/400
160/160 [=====] - 0s 889us/step - loss: 8.0590
Epoch 323/400
160/160 [=====] - 0s 845us/step - loss: 8.0590
Epoch 324/400
160/160 [=====] - 0s 830us/step - loss: 8.0590
Epoch 325/400
160/160 [=====] - 0s 702us/step - loss: 8.0590
Epoch 326/400
160/160 [=====] - 0s 724us/step - loss: 8.0590
Epoch 327/400
160/160 [=====] - 0s 747us/step - loss: 8.0590
Epoch 328/400
160/160 [=====] - 0s 833us/step - loss: 8.0590
Epoch 329/400
160/160 [=====] - 0s 791us/step - loss: 8.0590
Epoch 330/400
160/160 [=====] - 0s 785us/step - loss: 8.0590
Epoch 331/400
160/160 [=====] - 0s 802us/step - loss: 8.0590
Epoch 332/400
160/160 [=====] - 0s 745us/step - loss: 8.0590
Epoch 333/400
160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 334/400
160/160 [=====] - 0s 904us/step - loss: 8.0590
Epoch 335/400
160/160 [=====] - 0s 725us/step - loss: 8.0590
Epoch 336/400
160/160 [=====] - 0s 688us/step - loss: 8.0590
Epoch 337/400
160/160 [=====] - 0s 865us/step - loss: 8.0590
Epoch 338/400
160/160 [=====] - 0s 743us/step - loss: 8.0590
Epoch 339/400
160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 340/400

160/160 [=====] - 0s 869us/step - loss: 8.0590
Epoch 341/400
160/160 [=====] - 0s 805us/step - loss: 8.0590
Epoch 342/400
160/160 [=====] - 0s 817us/step - loss: 8.0590
Epoch 343/400
160/160 [=====] - 0s 694us/step - loss: 8.0590
Epoch 344/400
160/160 [=====] - 0s 782us/step - loss: 8.0590
Epoch 345/400
160/160 [=====] - 0s 786us/step - loss: 8.0590
Epoch 346/400
160/160 [=====] - 0s 830us/step - loss: 8.0590
Epoch 347/400
160/160 [=====] - 0s 732us/step - loss: 8.0590
Epoch 348/400
160/160 [=====] - 0s 664us/step - loss: 8.0590
Epoch 349/400
160/160 [=====] - 0s 666us/step - loss: 8.0590
Epoch 350/400
160/160 [=====] - 0s 642us/step - loss: 8.0590
Epoch 351/400
160/160 [=====] - 0s 636us/step - loss: 8.0590
Epoch 352/400
160/160 [=====] - 0s 647us/step - loss: 8.0590
Epoch 353/400
160/160 [=====] - 0s 787us/step - loss: 8.0590
Epoch 354/400
160/160 [=====] - 0s 704us/step - loss: 8.0590
Epoch 355/400
160/160 [=====] - 0s 702us/step - loss: 8.0590
Epoch 356/400
160/160 [=====] - 0s 736us/step - loss: 8.0590
Epoch 357/400
160/160 [=====] - 0s 870us/step - loss: 8.0590
Epoch 358/400
160/160 [=====] - 0s 702us/step - loss: 8.0590
Epoch 359/400
160/160 [=====] - 0s 876us/step - loss: 8.0590
Epoch 360/400
160/160 [=====] - 0s 868us/step - loss: 8.0590
Epoch 361/400
160/160 [=====] - 0s 857us/step - loss: 8.0590
Epoch 362/400
160/160 [=====] - 0s 860us/step - loss: 8.0590
Epoch 363/400
160/160 [=====] - 0s 893us/step - loss: 8.0590
Epoch 364/400

160/160 [=====] - 0s 868us/step - loss: 8.0590
Epoch 365/400
160/160 [=====] - 0s 827us/step - loss: 8.0590
Epoch 366/400
160/160 [=====] - 0s 674us/step - loss: 8.0590
Epoch 367/400
160/160 [=====] - 0s 689us/step - loss: 8.0590
Epoch 368/400
160/160 [=====] - 0s 766us/step - loss: 8.0590
Epoch 369/400
160/160 [=====] - 0s 770us/step - loss: 8.0590
Epoch 370/400
160/160 [=====] - 0s 695us/step - loss: 8.0590
Epoch 371/400
160/160 [=====] - 0s 827us/step - loss: 8.0590
Epoch 372/400
160/160 [=====] - 0s 790us/step - loss: 8.0590
Epoch 373/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 374/400
160/160 [=====] - 0s 762us/step - loss: 8.0590
Epoch 375/400
160/160 [=====] - 0s 698us/step - loss: 8.0590
Epoch 376/400
160/160 [=====] - 0s 859us/step - loss: 8.0590
Epoch 377/400
160/160 [=====] - 0s 924us/step - loss: 8.0590
Epoch 378/400
160/160 [=====] - 0s 914us/step - loss: 8.0590
Epoch 379/400
160/160 [=====] - 0s 899us/step - loss: 8.0590
Epoch 380/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 381/400
160/160 [=====] - 0s 700us/step - loss: 8.0590
Epoch 382/400
160/160 [=====] - 0s 750us/step - loss: 8.0590
Epoch 383/400
160/160 [=====] - 0s 774us/step - loss: 8.0590
Epoch 384/400
160/160 [=====] - 0s 681us/step - loss: 8.0590
Epoch 385/400
160/160 [=====] - 0s 697us/step - loss: 8.0590
Epoch 386/400
160/160 [=====] - 0s 693us/step - loss: 8.0590
Epoch 387/400
160/160 [=====] - 0s 718us/step - loss: 8.0590
Epoch 388/400

```

160/160 [=====] - 0s 702us/step - loss: 8.0590
Epoch 389/400
160/160 [=====] - 0s 720us/step - loss: 8.0590
Epoch 390/400
160/160 [=====] - 0s 735us/step - loss: 8.0590
Epoch 391/400
160/160 [=====] - 0s 782us/step - loss: 8.0590
Epoch 392/400
160/160 [=====] - 0s 711us/step - loss: 8.0590
Epoch 393/400
160/160 [=====] - 0s 728us/step - loss: 8.0590
Epoch 394/400
160/160 [=====] - 0s 861us/step - loss: 8.0590
Epoch 395/400
160/160 [=====] - 0s 871us/step - loss: 8.0590
Epoch 396/400
160/160 [=====] - 0s 787us/step - loss: 8.0590
Epoch 397/400
160/160 [=====] - 0s 696us/step - loss: 8.0590
Epoch 398/400
160/160 [=====] - 0s 694us/step - loss: 8.0590
Epoch 399/400
160/160 [=====] - 0s 690us/step - loss: 8.0590
Epoch 400/400
160/160 [=====] - 0s 791us/step - loss: 8.0590
[0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.
 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.]
160/160 [=====] - 0s 2ms/step

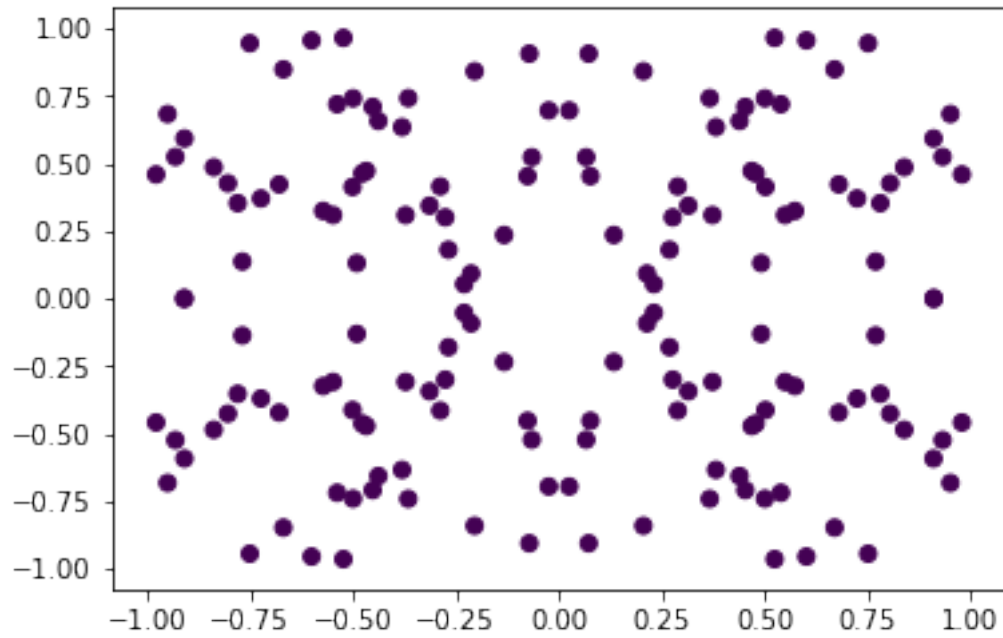
```

```
In [78]: scores, model.metrics_names
```

```
Out[78]: (8.059047738974616, ['loss'])
```

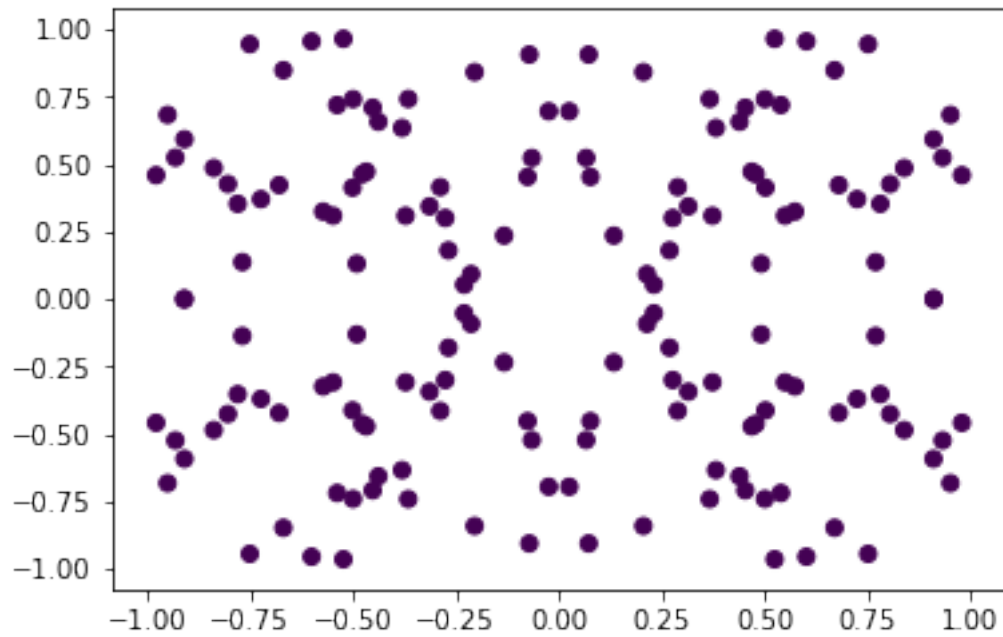
```
In [79]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[79]: <matplotlib.collections.PathCollection at 0xb2a9f3048>
```

```
In [80]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[80]: <matplotlib.collections.PathCollection at 0xb2aa14400>
```



```

In [81]: # relu 5
         model = Sequential()

         model.add(Dense(2, input_dim=2, activation='relu'))
         model.add(Dense(2, activation='relu'))
         model.add(Dense(2, activation='relu'))
         model.add(Dense(2, activation='relu'))
         model.add(Dense(2, activation='relu'))

         # The output has 1 neuron for predicting whatever we are iterating
         model.add(Dense(1, activation='relu'))

         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))

         scores = model.evaluate(X, y)

```

```

Epoch 1/400
160/160 [=====] - 1s 6ms/step - loss: 0.7470
Epoch 2/400
160/160 [=====] - 0s 939us/step - loss: 0.6989
Epoch 3/400
160/160 [=====] - 0s 951us/step - loss: 0.6927
Epoch 4/400
160/160 [=====] - 0s 787us/step - loss: 0.6824
Epoch 5/400
160/160 [=====] - 0s 757us/step - loss: 0.6773
Epoch 6/400
160/160 [=====] - 0s 773us/step - loss: 0.6790
Epoch 7/400
160/160 [=====] - 0s 870us/step - loss: 0.6677
Epoch 8/400
160/160 [=====] - 0s 760us/step - loss: 0.6564
Epoch 9/400
160/160 [=====] - 0s 824us/step - loss: 0.6381
Epoch 10/400
160/160 [=====] - 0s 927us/step - loss: 0.6072
Epoch 11/400
160/160 [=====] - 0s 790us/step - loss: 0.6113
Epoch 12/400
160/160 [=====] - 0s 767us/step - loss: 0.5975
Epoch 13/400
160/160 [=====] - 0s 799us/step - loss: 0.5915
Epoch 14/400
160/160 [=====] - 0s 836us/step - loss: 0.5856

```

Epoch 15/400
160/160 [=====] - 0s 902us/step - loss: 0.6703
Epoch 16/400
160/160 [=====] - 0s 945us/step - loss: 0.5863
Epoch 17/400
160/160 [=====] - 0s 911us/step - loss: 0.5869
Epoch 18/400
160/160 [=====] - 0s 910us/step - loss: 0.5926
Epoch 19/400
160/160 [=====] - 0s 933us/step - loss: 0.5847
Epoch 20/400
160/160 [=====] - 0s 958us/step - loss: 0.7569
Epoch 21/400
160/160 [=====] - 0s 1ms/step - loss: 0.7572
Epoch 22/400
160/160 [=====] - 0s 934us/step - loss: 4.4176
Epoch 23/400
160/160 [=====] - 0s 898us/step - loss: 8.0590
Epoch 24/400
160/160 [=====] - 0s 900us/step - loss: 8.0590
Epoch 25/400
160/160 [=====] - 0s 890us/step - loss: 8.0590
Epoch 26/400
160/160 [=====] - 0s 892us/step - loss: 8.0590
Epoch 27/400
160/160 [=====] - 0s 944us/step - loss: 8.0590
Epoch 28/400
160/160 [=====] - 0s 919us/step - loss: 8.0590
Epoch 29/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 30/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 31/400
160/160 [=====] - 0s 956us/step - loss: 8.0590
Epoch 32/400
160/160 [=====] - 0s 963us/step - loss: 8.0590
Epoch 33/400
160/160 [=====] - 0s 932us/step - loss: 8.0590
Epoch 34/400
160/160 [=====] - 0s 883us/step - loss: 8.0590
Epoch 35/400
160/160 [=====] - 0s 924us/step - loss: 8.0590
Epoch 36/400
160/160 [=====] - 0s 893us/step - loss: 8.0590
Epoch 37/400
160/160 [=====] - 0s 894us/step - loss: 8.0590
Epoch 38/400
160/160 [=====] - 0s 794us/step - loss: 8.0590

Epoch 39/400
160/160 [=====] - 0s 827us/step - loss: 8.0590
Epoch 40/400
160/160 [=====] - 0s 853us/step - loss: 8.0590
Epoch 41/400
160/160 [=====] - 0s 923us/step - loss: 8.0590
Epoch 42/400
160/160 [=====] - 0s 915us/step - loss: 8.0590
Epoch 43/400
160/160 [=====] - 0s 902us/step - loss: 8.0590
Epoch 44/400
160/160 [=====] - 0s 893us/step - loss: 8.0590
Epoch 45/400
160/160 [=====] - 0s 911us/step - loss: 8.0590
Epoch 46/400
160/160 [=====] - 0s 909us/step - loss: 8.0590
Epoch 47/400
160/160 [=====] - 0s 902us/step - loss: 8.0590
Epoch 48/400
160/160 [=====] - 0s 910us/step - loss: 8.0590
Epoch 49/400
160/160 [=====] - 0s 743us/step - loss: 8.0590
Epoch 50/400
160/160 [=====] - 0s 758us/step - loss: 8.0590
Epoch 51/400
160/160 [=====] - 0s 773us/step - loss: 8.0590
Epoch 52/400
160/160 [=====] - 0s 945us/step - loss: 8.0590
Epoch 53/400
160/160 [=====] - 0s 937us/step - loss: 8.0590
Epoch 54/400
160/160 [=====] - 0s 935us/step - loss: 8.0590
Epoch 55/400
160/160 [=====] - 0s 945us/step - loss: 8.0590
Epoch 56/400
160/160 [=====] - 0s 928us/step - loss: 8.0590
Epoch 57/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 58/400
160/160 [=====] - 0s 764us/step - loss: 8.0590
Epoch 59/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 60/400
160/160 [=====] - 0s 979us/step - loss: 8.0590
Epoch 61/400
160/160 [=====] - 0s 957us/step - loss: 8.0590
Epoch 62/400
160/160 [=====] - 0s 995us/step - loss: 8.0590

```

Epoch 63/400
160/160 [=====] - 0s 987us/step - loss: 8.0590
Epoch 64/400
160/160 [=====] - 0s 969us/step - loss: 8.0590
Epoch 65/400
160/160 [=====] - 0s 869us/step - loss: 8.0590
Epoch 66/400
160/160 [=====] - 0s 838us/step - loss: 8.0590
Epoch 67/400
160/160 [=====] - 0s 982us/step - loss: 8.0590
Epoch 68/400
160/160 [=====] - 0s 858us/step - loss: 8.0590
Epoch 69/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 70/400
160/160 [=====] - 0s 911us/step - loss: 8.0590
Epoch 71/400
160/160 [=====] - 0s 905us/step - loss: 8.0590
Epoch 72/400
160/160 [=====] - 0s 903us/step - loss: 8.0590
Epoch 73/400
160/160 [=====] - 0s 934us/step - loss: 8.0590
Epoch 74/400
160/160 [=====] - 0s 878us/step - loss: 8.0590
Epoch 75/400
160/160 [=====] - 0s 863us/step - loss: 8.0590
Epoch 76/400
160/160 [=====] - 0s 894us/step - loss: 8.0590
Epoch 77/400
160/160 [=====] - 0s 919us/step - loss: 8.0590
Epoch 78/400
160/160 [=====] - 0s 898us/step - loss: 8.0590
Epoch 79/400
160/160 [=====] - 0s 956us/step - loss: 8.0590
Epoch 80/400
160/160 [=====] - 0s 925us/step - loss: 8.0590
Epoch 81/400
160/160 [=====] - 0s 958us/step - loss: 8.0590
Epoch 82/400
160/160 [=====] - 0s 970us/step - loss: 8.0590
Epoch 83/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 84/400
160/160 [=====] - 0s 974us/step - loss: 8.0590
Epoch 85/400
160/160 [=====] - 0s 932us/step - loss: 8.0590
Epoch 86/400
160/160 [=====] - 0s 979us/step - loss: 8.0590

```

Epoch 87/400
160/160 [=====] - 0s 886us/step - loss: 8.0590
Epoch 88/400
160/160 [=====] - 0s 874us/step - loss: 8.0590
Epoch 89/400
160/160 [=====] - 0s 967us/step - loss: 8.0590
Epoch 90/400
160/160 [=====] - 0s 959us/step - loss: 8.0590
Epoch 91/400
160/160 [=====] - 0s 922us/step - loss: 8.0590
Epoch 92/400
160/160 [=====] - 0s 947us/step - loss: 8.0590
Epoch 93/400
160/160 [=====] - 0s 920us/step - loss: 8.0590
Epoch 94/400
160/160 [=====] - 0s 804us/step - loss: 8.0590
Epoch 95/400
160/160 [=====] - 0s 848us/step - loss: 8.0590
Epoch 96/400
160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 97/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 98/400
160/160 [=====] - 0s 906us/step - loss: 8.0590
Epoch 99/400
160/160 [=====] - 0s 819us/step - loss: 8.0590
Epoch 100/400
160/160 [=====] - 0s 826us/step - loss: 8.0590
Epoch 101/400
160/160 [=====] - 0s 814us/step - loss: 8.0590
Epoch 102/400
160/160 [=====] - 0s 871us/step - loss: 8.0590
Epoch 103/400
160/160 [=====] - 0s 761us/step - loss: 8.0590
Epoch 104/400
160/160 [=====] - 0s 782us/step - loss: 8.0590
Epoch 105/400
160/160 [=====] - 0s 803us/step - loss: 8.0590
Epoch 106/400
160/160 [=====] - 0s 801us/step - loss: 8.0590
Epoch 107/400
160/160 [=====] - 0s 861us/step - loss: 8.0590
Epoch 108/400
160/160 [=====] - 0s 925us/step - loss: 8.0590
Epoch 109/400
160/160 [=====] - 0s 820us/step - loss: 8.0590
Epoch 110/400
160/160 [=====] - 0s 787us/step - loss: 8.0590

Epoch 111/400
160/160 [=====] - 0s 785us/step - loss: 8.0590
Epoch 112/400
160/160 [=====] - 0s 924us/step - loss: 8.0590
Epoch 113/400
160/160 [=====] - 0s 813us/step - loss: 8.0590
Epoch 114/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 115/400
160/160 [=====] - 0s 974us/step - loss: 8.0590
Epoch 116/400
160/160 [=====] - 0s 937us/step - loss: 8.0590
Epoch 117/400
160/160 [=====] - 0s 877us/step - loss: 8.0590
Epoch 118/400
160/160 [=====] - 0s 733us/step - loss: 8.0590
Epoch 119/400
160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 120/400
160/160 [=====] - 0s 817us/step - loss: 8.0590
Epoch 121/400
160/160 [=====] - 0s 910us/step - loss: 8.0590
Epoch 122/400
160/160 [=====] - 0s 756us/step - loss: 8.0590
Epoch 123/400
160/160 [=====] - 0s 756us/step - loss: 8.0590
Epoch 124/400
160/160 [=====] - 0s 760us/step - loss: 8.0590
Epoch 125/400
160/160 [=====] - 0s 756us/step - loss: 8.0590
Epoch 126/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 127/400
160/160 [=====] - 0s 772us/step - loss: 8.0590
Epoch 128/400
160/160 [=====] - 0s 761us/step - loss: 8.0590
Epoch 129/400
160/160 [=====] - 0s 795us/step - loss: 8.0590
Epoch 130/400
160/160 [=====] - 0s 746us/step - loss: 8.0590
Epoch 131/400
160/160 [=====] - 0s 899us/step - loss: 8.0590
Epoch 132/400
160/160 [=====] - 0s 895us/step - loss: 8.0590
Epoch 133/400
160/160 [=====] - 0s 960us/step - loss: 8.0590
Epoch 134/400
160/160 [=====] - 0s 866us/step - loss: 8.0590

Epoch 135/400
160/160 [=====] - 0s 896us/step - loss: 8.0590
Epoch 136/400
160/160 [=====] - 0s 911us/step - loss: 8.0590
Epoch 137/400
160/160 [=====] - 0s 862us/step - loss: 8.0590
Epoch 138/400
160/160 [=====] - 0s 947us/step - loss: 8.0590
Epoch 139/400
160/160 [=====] - 0s 981us/step - loss: 8.0590
Epoch 140/400
160/160 [=====] - 0s 915us/step - loss: 8.0590
Epoch 141/400
160/160 [=====] - 0s 918us/step - loss: 8.0590
Epoch 142/400
160/160 [=====] - 0s 912us/step - loss: 8.0590
Epoch 143/400
160/160 [=====] - 0s 936us/step - loss: 8.0590
Epoch 144/400
160/160 [=====] - 0s 915us/step - loss: 8.0590
Epoch 145/400
160/160 [=====] - 0s 927us/step - loss: 8.0590
Epoch 146/400
160/160 [=====] - 0s 878us/step - loss: 8.0590
Epoch 147/400
160/160 [=====] - 0s 875us/step - loss: 8.0590
Epoch 148/400
160/160 [=====] - 0s 742us/step - loss: 8.0590
Epoch 149/400
160/160 [=====] - 0s 861us/step - loss: 8.0590
Epoch 150/400
160/160 [=====] - 0s 805us/step - loss: 8.0590
Epoch 151/400
160/160 [=====] - 0s 762us/step - loss: 8.0590
Epoch 152/400
160/160 [=====] - 0s 883us/step - loss: 8.0590
Epoch 153/400
160/160 [=====] - 0s 706us/step - loss: 8.0590
Epoch 154/400
160/160 [=====] - 0s 729us/step - loss: 8.0590
Epoch 155/400
160/160 [=====] - 0s 842us/step - loss: 8.0590
Epoch 156/400
160/160 [=====] - 0s 821us/step - loss: 8.0590
Epoch 157/400
160/160 [=====] - 0s 875us/step - loss: 8.0590
Epoch 158/400
160/160 [=====] - 0s 839us/step - loss: 8.0590

Epoch 159/400
160/160 [=====] - 0s 778us/step - loss: 8.0590
Epoch 160/400
160/160 [=====] - 0s 744us/step - loss: 8.0590
Epoch 161/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 162/400
160/160 [=====] - 0s 799us/step - loss: 8.0590
Epoch 163/400
160/160 [=====] - 0s 752us/step - loss: 8.0590
Epoch 164/400
160/160 [=====] - 0s 739us/step - loss: 8.0590
Epoch 165/400
160/160 [=====] - 0s 818us/step - loss: 8.0590
Epoch 166/400
160/160 [=====] - 0s 769us/step - loss: 8.0590
Epoch 167/400
160/160 [=====] - 0s 789us/step - loss: 8.0590
Epoch 168/400
160/160 [=====] - 0s 807us/step - loss: 8.0590
Epoch 169/400
160/160 [=====] - 0s 905us/step - loss: 8.0590
Epoch 170/400
160/160 [=====] - 0s 740us/step - loss: 8.0590
Epoch 171/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 172/400
160/160 [=====] - 0s 909us/step - loss: 8.0590
Epoch 173/400
160/160 [=====] - 0s 900us/step - loss: 8.0590
Epoch 174/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 175/400
160/160 [=====] - 0s 765us/step - loss: 8.0590
Epoch 176/400
160/160 [=====] - 0s 716us/step - loss: 8.0590
Epoch 177/400
160/160 [=====] - 0s 792us/step - loss: 8.0590
Epoch 178/400
160/160 [=====] - 0s 746us/step - loss: 8.0590
Epoch 179/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 180/400
160/160 [=====] - 0s 820us/step - loss: 8.0590
Epoch 181/400
160/160 [=====] - 0s 835us/step - loss: 8.0590
Epoch 182/400
160/160 [=====] - 0s 725us/step - loss: 8.0590

Epoch 183/400
160/160 [=====] - 0s 913us/step - loss: 8.0590
Epoch 184/400
160/160 [=====] - 0s 852us/step - loss: 8.0590
Epoch 185/400
160/160 [=====] - 0s 890us/step - loss: 8.0590
Epoch 186/400
160/160 [=====] - 0s 921us/step - loss: 8.0590
Epoch 187/400
160/160 [=====] - 0s 914us/step - loss: 8.0590
Epoch 188/400
160/160 [=====] - 0s 957us/step - loss: 8.0590
Epoch 189/400
160/160 [=====] - 0s 792us/step - loss: 8.0590
Epoch 190/400
160/160 [=====] - 0s 949us/step - loss: 8.0590
Epoch 191/400
160/160 [=====] - 0s 929us/step - loss: 8.0590
Epoch 192/400
160/160 [=====] - 0s 944us/step - loss: 8.0590
Epoch 193/400
160/160 [=====] - 0s 886us/step - loss: 8.0590
Epoch 194/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 195/400
160/160 [=====] - 0s 926us/step - loss: 8.0590
Epoch 196/400
160/160 [=====] - 0s 947us/step - loss: 8.0590
Epoch 197/400
160/160 [=====] - 0s 946us/step - loss: 8.0590
Epoch 198/400
160/160 [=====] - 0s 767us/step - loss: 8.0590
Epoch 199/400
160/160 [=====] - 0s 740us/step - loss: 8.0590
Epoch 200/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 201/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 202/400
160/160 [=====] - 0s 890us/step - loss: 8.0590
Epoch 203/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 204/400
160/160 [=====] - 0s 884us/step - loss: 8.0590
Epoch 205/400
160/160 [=====] - 0s 941us/step - loss: 8.0590
Epoch 206/400
160/160 [=====] - 0s 848us/step - loss: 8.0590

Epoch 207/400
160/160 [=====] - 0s 933us/step - loss: 8.0590
Epoch 208/400
160/160 [=====] - 0s 883us/step - loss: 8.0590
Epoch 209/400
160/160 [=====] - 0s 942us/step - loss: 8.0590
Epoch 210/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 211/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 212/400
160/160 [=====] - 0s 867us/step - loss: 8.0590
Epoch 213/400
160/160 [=====] - 0s 925us/step - loss: 8.0590
Epoch 214/400
160/160 [=====] - 0s 972us/step - loss: 8.0590
Epoch 215/400
160/160 [=====] - 0s 924us/step - loss: 8.0590
Epoch 216/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 217/400
160/160 [=====] - 0s 963us/step - loss: 8.0590
Epoch 218/400
160/160 [=====] - 0s 908us/step - loss: 8.0590
Epoch 219/400
160/160 [=====] - 0s 931us/step - loss: 8.0590
Epoch 220/400
160/160 [=====] - 0s 983us/step - loss: 8.0590
Epoch 221/400
160/160 [=====] - 0s 919us/step - loss: 8.0590
Epoch 222/400
160/160 [=====] - 0s 919us/step - loss: 8.0590
Epoch 223/400
160/160 [=====] - 0s 921us/step - loss: 8.0590
Epoch 224/400
160/160 [=====] - 0s 926us/step - loss: 8.0590
Epoch 225/400
160/160 [=====] - 0s 915us/step - loss: 8.0590
Epoch 226/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 227/400
160/160 [=====] - 0s 948us/step - loss: 8.0590
Epoch 228/400
160/160 [=====] - 0s 840us/step - loss: 8.0590
Epoch 229/400
160/160 [=====] - 0s 747us/step - loss: 8.0590
Epoch 230/400
160/160 [=====] - 0s 827us/step - loss: 8.0590

Epoch 231/400
160/160 [=====] - 0s 903us/step - loss: 8.0590
Epoch 232/400
160/160 [=====] - 0s 796us/step - loss: 8.0590
Epoch 233/400
160/160 [=====] - 0s 756us/step - loss: 8.0590
Epoch 234/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 235/400
160/160 [=====] - 0s 932us/step - loss: 8.0590
Epoch 236/400
160/160 [=====] - 0s 790us/step - loss: 8.0590
Epoch 237/400
160/160 [=====] - 0s 682us/step - loss: 8.0590
Epoch 238/400
160/160 [=====] - 0s 893us/step - loss: 8.0590
Epoch 239/400
160/160 [=====] - 0s 847us/step - loss: 8.0590
Epoch 240/400
160/160 [=====] - 0s 929us/step - loss: 8.0590
Epoch 241/400
160/160 [=====] - 0s 928us/step - loss: 8.0590
Epoch 242/400
160/160 [=====] - 0s 824us/step - loss: 8.0590
Epoch 243/400
160/160 [=====] - 0s 768us/step - loss: 8.0590
Epoch 244/400
160/160 [=====] - 0s 937us/step - loss: 8.0590
Epoch 245/400
160/160 [=====] - 0s 913us/step - loss: 8.0590
Epoch 246/400
160/160 [=====] - 0s 866us/step - loss: 8.0590
Epoch 247/400
160/160 [=====] - 0s 699us/step - loss: 8.0590
Epoch 248/400
160/160 [=====] - 0s 930us/step - loss: 8.0590
Epoch 249/400
160/160 [=====] - 0s 739us/step - loss: 8.0590
Epoch 250/400
160/160 [=====] - 0s 755us/step - loss: 8.0590
Epoch 251/400
160/160 [=====] - 0s 839us/step - loss: 8.0590
Epoch 252/400
160/160 [=====] - 0s 811us/step - loss: 8.0590
Epoch 253/400
160/160 [=====] - 0s 785us/step - loss: 8.0590
Epoch 254/400
160/160 [=====] - 0s 820us/step - loss: 8.0590

Epoch 255/400
160/160 [=====] - 0s 915us/step - loss: 8.0590
Epoch 256/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 257/400
160/160 [=====] - 0s 794us/step - loss: 8.0590
Epoch 258/400
160/160 [=====] - 0s 924us/step - loss: 8.0590
Epoch 259/400
160/160 [=====] - 0s 932us/step - loss: 8.0590
Epoch 260/400
160/160 [=====] - 0s 956us/step - loss: 8.0590
Epoch 261/400
160/160 [=====] - 0s 939us/step - loss: 8.0590
Epoch 262/400
160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 263/400
160/160 [=====] - 0s 774us/step - loss: 8.0590
Epoch 264/400
160/160 [=====] - 0s 923us/step - loss: 8.0590
Epoch 265/400
160/160 [=====] - 0s 867us/step - loss: 8.0590
Epoch 266/400
160/160 [=====] - 0s 891us/step - loss: 8.0590
Epoch 267/400
160/160 [=====] - 0s 796us/step - loss: 8.0590
Epoch 268/400
160/160 [=====] - 0s 794us/step - loss: 8.0590
Epoch 269/400
160/160 [=====] - 0s 785us/step - loss: 8.0590
Epoch 270/400
160/160 [=====] - 0s 866us/step - loss: 8.0590
Epoch 271/400
160/160 [=====] - 0s 737us/step - loss: 8.0590
Epoch 272/400
160/160 [=====] - 0s 785us/step - loss: 8.0590
Epoch 273/400
160/160 [=====] - 0s 976us/step - loss: 8.0590
Epoch 274/400
160/160 [=====] - 0s 941us/step - loss: 8.0590
Epoch 275/400
160/160 [=====] - 0s 918us/step - loss: 8.0590
Epoch 276/400
160/160 [=====] - 0s 815us/step - loss: 8.0590
Epoch 277/400
160/160 [=====] - 0s 789us/step - loss: 8.0590
Epoch 278/400
160/160 [=====] - 0s 851us/step - loss: 8.0590

Epoch 279/400
160/160 [=====] - 0s 943us/step - loss: 8.0590
Epoch 280/400
160/160 [=====] - 0s 945us/step - loss: 8.0590
Epoch 281/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 282/400
160/160 [=====] - 0s 883us/step - loss: 8.0590
Epoch 283/400
160/160 [=====] - 0s 765us/step - loss: 8.0590
Epoch 284/400
160/160 [=====] - 0s 963us/step - loss: 8.0590
Epoch 285/400
160/160 [=====] - 0s 892us/step - loss: 8.0590
Epoch 286/400
160/160 [=====] - 0s 930us/step - loss: 8.0590
Epoch 287/400
160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 288/400
160/160 [=====] - 0s 807us/step - loss: 8.0590
Epoch 289/400
160/160 [=====] - 0s 980us/step - loss: 8.0590
Epoch 290/400
160/160 [=====] - 0s 943us/step - loss: 8.0590
Epoch 291/400
160/160 [=====] - 0s 791us/step - loss: 8.0590
Epoch 292/400
160/160 [=====] - 0s 903us/step - loss: 8.0590
Epoch 293/400
160/160 [=====] - 0s 801us/step - loss: 8.0590
Epoch 294/400
160/160 [=====] - 0s 934us/step - loss: 8.0590
Epoch 295/400
160/160 [=====] - 0s 749us/step - loss: 8.0590
Epoch 296/400
160/160 [=====] - 0s 903us/step - loss: 8.0590
Epoch 297/400
160/160 [=====] - 0s 946us/step - loss: 8.0590
Epoch 298/400
160/160 [=====] - 0s 951us/step - loss: 8.0590
Epoch 299/400
160/160 [=====] - 0s 846us/step - loss: 8.0590
Epoch 300/400
160/160 [=====] - 0s 810us/step - loss: 8.0590
Epoch 301/400
160/160 [=====] - 0s 890us/step - loss: 8.0590
Epoch 302/400
160/160 [=====] - 0s 764us/step - loss: 8.0590

Epoch 303/400
160/160 [=====] - 0s 816us/step - loss: 8.0590
Epoch 304/400
160/160 [=====] - 0s 789us/step - loss: 8.0590
Epoch 305/400
160/160 [=====] - 0s 720us/step - loss: 8.0590
Epoch 306/400
160/160 [=====] - 0s 836us/step - loss: 8.0590
Epoch 307/400
160/160 [=====] - 0s 908us/step - loss: 8.0590
Epoch 308/400
160/160 [=====] - 0s 772us/step - loss: 8.0590
Epoch 309/400
160/160 [=====] - 0s 771us/step - loss: 8.0590
Epoch 310/400
160/160 [=====] - 0s 953us/step - loss: 8.0590
Epoch 311/400
160/160 [=====] - 0s 932us/step - loss: 8.0590
Epoch 312/400
160/160 [=====] - 0s 946us/step - loss: 8.0590
Epoch 313/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 314/400
160/160 [=====] - 0s 899us/step - loss: 8.0590
Epoch 315/400
160/160 [=====] - 0s 873us/step - loss: 8.0590
Epoch 316/400
160/160 [=====] - 0s 770us/step - loss: 8.0590
Epoch 317/400
160/160 [=====] - 0s 714us/step - loss: 8.0590
Epoch 318/400
160/160 [=====] - 0s 849us/step - loss: 8.0590
Epoch 319/400
160/160 [=====] - 0s 810us/step - loss: 8.0590
Epoch 320/400
160/160 [=====] - 0s 851us/step - loss: 8.0590
Epoch 321/400
160/160 [=====] - 0s 765us/step - loss: 8.0590
Epoch 322/400
160/160 [=====] - 0s 936us/step - loss: 8.0590
Epoch 323/400
160/160 [=====] - 0s 907us/step - loss: 8.0590
Epoch 324/400
160/160 [=====] - 0s 905us/step - loss: 8.0590
Epoch 325/400
160/160 [=====] - 0s 813us/step - loss: 8.0590
Epoch 326/400
160/160 [=====] - 0s 740us/step - loss: 8.0590

Epoch 327/400
160/160 [=====] - 0s 741us/step - loss: 8.0590
Epoch 328/400
160/160 [=====] - 0s 985us/step - loss: 8.0590
Epoch 329/400
160/160 [=====] - 0s 938us/step - loss: 8.0590
Epoch 330/400
160/160 [=====] - 0s 766us/step - loss: 8.0590
Epoch 331/400
160/160 [=====] - 0s 883us/step - loss: 8.0590
Epoch 332/400
160/160 [=====] - 0s 875us/step - loss: 8.0590
Epoch 333/400
160/160 [=====] - 0s 709us/step - loss: 8.0590
Epoch 334/400
160/160 [=====] - 0s 779us/step - loss: 8.0590
Epoch 335/400
160/160 [=====] - 0s 913us/step - loss: 8.0590
Epoch 336/400
160/160 [=====] - 0s 798us/step - loss: 8.0590
Epoch 337/400
160/160 [=====] - 0s 774us/step - loss: 8.0590
Epoch 338/400
160/160 [=====] - 0s 750us/step - loss: 8.0590
Epoch 339/400
160/160 [=====] - 0s 893us/step - loss: 8.0590
Epoch 340/400
160/160 [=====] - 0s 911us/step - loss: 8.0590
Epoch 341/400
160/160 [=====] - 0s 886us/step - loss: 8.0590
Epoch 342/400
160/160 [=====] - 0s 787us/step - loss: 8.0590
Epoch 343/400
160/160 [=====] - 0s 884us/step - loss: 8.0590
Epoch 344/400
160/160 [=====] - 0s 932us/step - loss: 8.0590
Epoch 345/400
160/160 [=====] - 0s 921us/step - loss: 8.0590
Epoch 346/400
160/160 [=====] - 0s 909us/step - loss: 8.0590
Epoch 347/400
160/160 [=====] - 0s 857us/step - loss: 8.0590
Epoch 348/400
160/160 [=====] - 0s 702us/step - loss: 8.0590
Epoch 349/400
160/160 [=====] - 0s 767us/step - loss: 8.0590
Epoch 350/400
160/160 [=====] - 0s 892us/step - loss: 8.0590

Epoch 351/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 352/400
160/160 [=====] - 0s 751us/step - loss: 8.0590
Epoch 353/400
160/160 [=====] - 0s 811us/step - loss: 8.0590
Epoch 354/400
160/160 [=====] - 0s 772us/step - loss: 8.0590
Epoch 355/400
160/160 [=====] - 0s 802us/step - loss: 8.0590
Epoch 356/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 357/400
160/160 [=====] - 0s 909us/step - loss: 8.0590
Epoch 358/400
160/160 [=====] - 0s 769us/step - loss: 8.0590
Epoch 359/400
160/160 [=====] - 0s 747us/step - loss: 8.0590
Epoch 360/400
160/160 [=====] - 0s 955us/step - loss: 8.0590
Epoch 361/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 362/400
160/160 [=====] - 0s 729us/step - loss: 8.0590
Epoch 363/400
160/160 [=====] - 0s 797us/step - loss: 8.0590
Epoch 364/400
160/160 [=====] - 0s 827us/step - loss: 8.0590
Epoch 365/400
160/160 [=====] - 0s 765us/step - loss: 8.0590
Epoch 366/400
160/160 [=====] - 0s 829us/step - loss: 8.0590
Epoch 367/400
160/160 [=====] - 0s 888us/step - loss: 8.0590
Epoch 368/400
160/160 [=====] - 0s 759us/step - loss: 8.0590
Epoch 369/400
160/160 [=====] - 0s 841us/step - loss: 8.0590
Epoch 370/400
160/160 [=====] - 0s 763us/step - loss: 8.0590
Epoch 371/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 372/400
160/160 [=====] - 0s 954us/step - loss: 8.0590
Epoch 373/400
160/160 [=====] - 0s 939us/step - loss: 8.0590
Epoch 374/400
160/160 [=====] - 0s 762us/step - loss: 8.0590

Epoch 375/400
160/160 [=====] - 0s 905us/step - loss: 8.0590
Epoch 376/400
160/160 [=====] - 0s 915us/step - loss: 8.0590
Epoch 377/400
160/160 [=====] - 0s 733us/step - loss: 8.0590
Epoch 378/400
160/160 [=====] - 0s 831us/step - loss: 8.0590
Epoch 379/400
160/160 [=====] - 0s 868us/step - loss: 8.0590
Epoch 380/400
160/160 [=====] - 0s 780us/step - loss: 8.0590
Epoch 381/400
160/160 [=====] - 0s 814us/step - loss: 8.0590
Epoch 382/400
160/160 [=====] - 0s 866us/step - loss: 8.0590
Epoch 383/400
160/160 [=====] - 0s 798us/step - loss: 8.0590
Epoch 384/400
160/160 [=====] - 0s 808us/step - loss: 8.0590
Epoch 385/400
160/160 [=====] - 0s 776us/step - loss: 8.0590
Epoch 386/400
160/160 [=====] - 0s 953us/step - loss: 8.0590
Epoch 387/400
160/160 [=====] - 0s 966us/step - loss: 8.0590
Epoch 388/400
160/160 [=====] - 0s 898us/step - loss: 8.0590
Epoch 389/400
160/160 [=====] - 0s 928us/step - loss: 8.0590
Epoch 390/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 391/400
160/160 [=====] - 0s 807us/step - loss: 8.0590
Epoch 392/400
160/160 [=====] - 0s 718us/step - loss: 8.0590
Epoch 393/400
160/160 [=====] - 0s 827us/step - loss: 8.0590
Epoch 394/400
160/160 [=====] - 0s 855us/step - loss: 8.0590
Epoch 395/400
160/160 [=====] - 0s 788us/step - loss: 8.0590
Epoch 396/400
160/160 [=====] - 0s 872us/step - loss: 8.0590
Epoch 397/400
160/160 [=====] - 0s 908us/step - loss: 8.0590
Epoch 398/400
160/160 [=====] - 0s 816us/step - loss: 8.0590

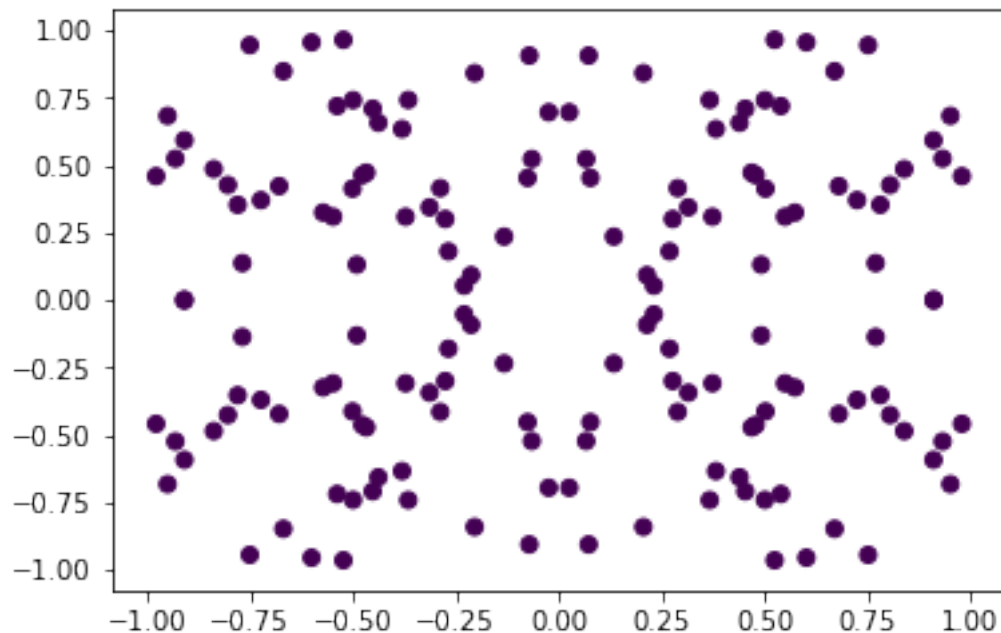
[illegible]

```
In [82]: scores, model.metrics_names
```

```
Out[82]: (8.059047738974616, ['loss'])
```

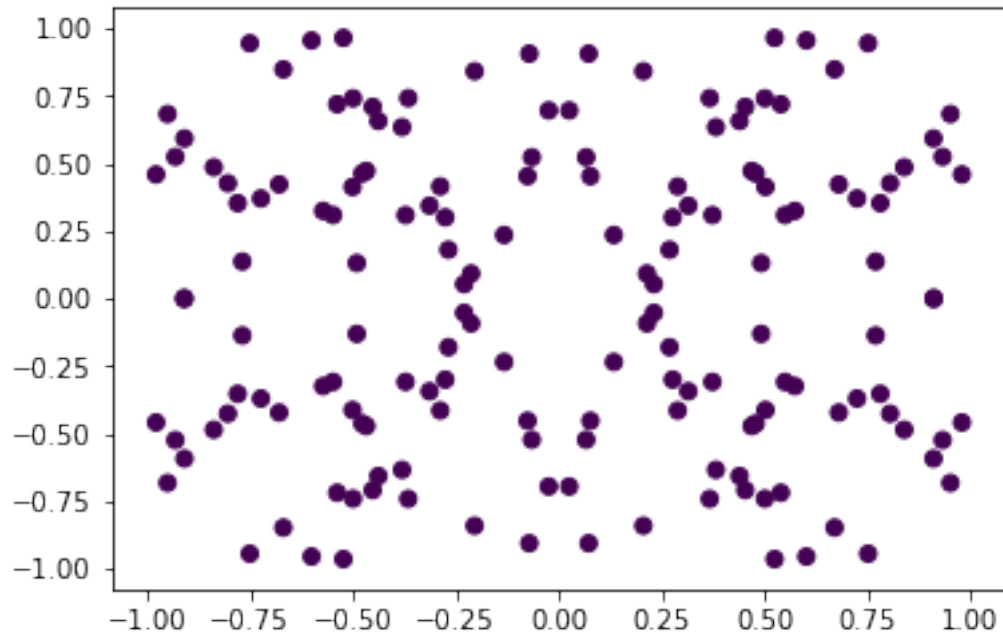
```
In [83]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[83]: <matplotlib.collections.PathCollection at 0xb2b2147f0>
```



```
In [84]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[84]: <matplotlib.collections.PathCollection at 0xb2b238cc0>
```



```
In [85]: # Using tanh for 3 neuron
model = Sequential()

model.add(Dense(3, input_dim=2, activation='tanh'))
model.add(Dense(3, activation='tanh'))
model.add(Dense(3, activation='tanh'))
model.add(Dense(3, activation='tanh'))
model.add(Dense(3, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 5ms/step - loss: 4.2818
Epoch 2/400
160/160 [=====] - 0s 712us/step - loss: 4.2527
Epoch 3/400
160/160 [=====] - 0s 684us/step - loss: 4.2336
```

Epoch 4/400
160/160 [=====] - 0s 610us/step - loss: 4.2288
Epoch 5/400
160/160 [=====] - 0s 630us/step - loss: 4.2162
Epoch 6/400
160/160 [=====] - 0s 669us/step - loss: 4.2089
Epoch 7/400
160/160 [=====] - 0s 639us/step - loss: 4.2049
Epoch 8/400
160/160 [=====] - 0s 756us/step - loss: 4.2031
Epoch 9/400
160/160 [=====] - 0s 722us/step - loss: 4.2002
Epoch 10/400
160/160 [=====] - 0s 739us/step - loss: 4.1934
Epoch 11/400
160/160 [=====] - 0s 726us/step - loss: 4.2069
Epoch 12/400
160/160 [=====] - 0s 733us/step - loss: 4.1938
Epoch 13/400
160/160 [=====] - 0s 761us/step - loss: 4.1926
Epoch 14/400
160/160 [=====] - 0s 774us/step - loss: 4.0935
Epoch 15/400
160/160 [=====] - 0s 737us/step - loss: 3.6919
Epoch 16/400
160/160 [=====] - 0s 728us/step - loss: 1.1271
Epoch 17/400
160/160 [=====] - 0s 745us/step - loss: 0.7386
Epoch 18/400
160/160 [=====] - 0s 746us/step - loss: 0.7182
Epoch 19/400
160/160 [=====] - 0s 773us/step - loss: 0.7123
Epoch 20/400
160/160 [=====] - 0s 747us/step - loss: 0.7048
Epoch 21/400
160/160 [=====] - 0s 739us/step - loss: 0.7044
Epoch 22/400
160/160 [=====] - 0s 722us/step - loss: 0.7004
Epoch 23/400
160/160 [=====] - 0s 724us/step - loss: 0.6919
Epoch 24/400
160/160 [=====] - 0s 753us/step - loss: 0.6945
Epoch 25/400
160/160 [=====] - 0s 738us/step - loss: 0.6914
Epoch 26/400
160/160 [=====] - 0s 751us/step - loss: 0.6856
Epoch 27/400
160/160 [=====] - 0s 735us/step - loss: 0.6866

Epoch 28/400
160/160 [=====] - 0s 765us/step - loss: 0.6809
Epoch 29/400
160/160 [=====] - 0s 719us/step - loss: 0.6745
Epoch 30/400
160/160 [=====] - 0s 749us/step - loss: 0.6713
Epoch 31/400
160/160 [=====] - 0s 757us/step - loss: 0.6665
Epoch 32/400
160/160 [=====] - 0s 740us/step - loss: 0.6610
Epoch 33/400
160/160 [=====] - 0s 743us/step - loss: 0.6545
Epoch 34/400
160/160 [=====] - 0s 749us/step - loss: 0.6507
Epoch 35/400
160/160 [=====] - 0s 778us/step - loss: 0.6470
Epoch 36/400
160/160 [=====] - 0s 724us/step - loss: 0.6394
Epoch 37/400
160/160 [=====] - 0s 743us/step - loss: 0.6266
Epoch 38/400
160/160 [=====] - 0s 747us/step - loss: 0.6256
Epoch 39/400
160/160 [=====] - 0s 743us/step - loss: 0.6289
Epoch 40/400
160/160 [=====] - 0s 776us/step - loss: 0.6215
Epoch 41/400
160/160 [=====] - 0s 773us/step - loss: 0.6112
Epoch 42/400
160/160 [=====] - 0s 674us/step - loss: 0.6066
Epoch 43/400
160/160 [=====] - 0s 746us/step - loss: 0.6004
Epoch 44/400
160/160 [=====] - 0s 627us/step - loss: 0.5963
Epoch 45/400
160/160 [=====] - 0s 706us/step - loss: 0.6002
Epoch 46/400
160/160 [=====] - 0s 667us/step - loss: 0.5900
Epoch 47/400
160/160 [=====] - 0s 591us/step - loss: 0.5786
Epoch 48/400
160/160 [=====] - 0s 730us/step - loss: 0.5894
Epoch 49/400
160/160 [=====] - 0s 769us/step - loss: 0.5858
Epoch 50/400
160/160 [=====] - 0s 735us/step - loss: 0.5819
Epoch 51/400
160/160 [=====] - 0s 745us/step - loss: 0.5747

Epoch 52/400
160/160 [=====] - 0s 740us/step - loss: 0.5755
Epoch 53/400
160/160 [=====] - 0s 755us/step - loss: 0.5763
Epoch 54/400
160/160 [=====] - 0s 758us/step - loss: 0.5781
Epoch 55/400
160/160 [=====] - 0s 784us/step - loss: 0.5682
Epoch 56/400
160/160 [=====] - 0s 782us/step - loss: 0.5547
Epoch 57/400
160/160 [=====] - 0s 754us/step - loss: 0.5662
Epoch 58/400
160/160 [=====] - 0s 708us/step - loss: 0.5596
Epoch 59/400
160/160 [=====] - 0s 619us/step - loss: 0.5534
Epoch 60/400
160/160 [=====] - 0s 783us/step - loss: 0.5541
Epoch 61/400
160/160 [=====] - 0s 741us/step - loss: 0.5564
Epoch 62/400
160/160 [=====] - 0s 739us/step - loss: 0.5492
Epoch 63/400
160/160 [=====] - 0s 723us/step - loss: 0.5465
Epoch 64/400
160/160 [=====] - 0s 787us/step - loss: 0.5523
Epoch 65/400
160/160 [=====] - 0s 622us/step - loss: 0.5463
Epoch 66/400
160/160 [=====] - 0s 710us/step - loss: 0.5396
Epoch 67/400
160/160 [=====] - 0s 761us/step - loss: 0.5441
Epoch 68/400
160/160 [=====] - 0s 737us/step - loss: 0.5400
Epoch 69/400
160/160 [=====] - 0s 722us/step - loss: 0.5388
Epoch 70/400
160/160 [=====] - 0s 696us/step - loss: 0.5375
Epoch 71/400
160/160 [=====] - 0s 682us/step - loss: 0.5292
Epoch 72/400
160/160 [=====] - 0s 695us/step - loss: 0.6278
Epoch 73/400
160/160 [=====] - 0s 712us/step - loss: 0.5324
Epoch 74/400
160/160 [=====] - 0s 622us/step - loss: 0.5285
Epoch 75/400
160/160 [=====] - 0s 640us/step - loss: 0.5282

Epoch 76/400
160/160 [=====] - 0s 742us/step - loss: 0.5256
Epoch 77/400
160/160 [=====] - 0s 730us/step - loss: 0.5269
Epoch 78/400
160/160 [=====] - 0s 588us/step - loss: 0.5277
Epoch 79/400
160/160 [=====] - 0s 562us/step - loss: 0.5255
Epoch 80/400
160/160 [=====] - 0s 618us/step - loss: 0.5177
Epoch 81/400
160/160 [=====] - 0s 780us/step - loss: 0.5235
Epoch 82/400
160/160 [=====] - 0s 818us/step - loss: 0.5176
Epoch 83/400
160/160 [=====] - 0s 677us/step - loss: 0.5174
Epoch 84/400
160/160 [=====] - 0s 615us/step - loss: 0.5156
Epoch 85/400
160/160 [=====] - 0s 712us/step - loss: 0.5174
Epoch 86/400
160/160 [=====] - 0s 779us/step - loss: 0.5080
Epoch 87/400
160/160 [=====] - 0s 668us/step - loss: 0.5160
Epoch 88/400
160/160 [=====] - 0s 632us/step - loss: 0.5085
Epoch 89/400
160/160 [=====] - 0s 590us/step - loss: 0.5132
Epoch 90/400
160/160 [=====] - 0s 589us/step - loss: 0.5071
Epoch 91/400
160/160 [=====] - 0s 594us/step - loss: 0.5099
Epoch 92/400
160/160 [=====] - 0s 603us/step - loss: 0.5079
Epoch 93/400
160/160 [=====] - 0s 636us/step - loss: 0.5031
Epoch 94/400
160/160 [=====] - 0s 796us/step - loss: 0.5031
Epoch 95/400
160/160 [=====] - 0s 761us/step - loss: 0.5047
Epoch 96/400
160/160 [=====] - 0s 709us/step - loss: 0.4990
Epoch 97/400
160/160 [=====] - 0s 677us/step - loss: 0.5029
Epoch 98/400
160/160 [=====] - 0s 662us/step - loss: 0.4989
Epoch 99/400
160/160 [=====] - 0s 749us/step - loss: 0.4951

Epoch 100/400
160/160 [=====] - 0s 680us/step - loss: 0.4987
Epoch 101/400
160/160 [=====] - 0s 689us/step - loss: 0.4942
Epoch 102/400
160/160 [=====] - 0s 705us/step - loss: 0.4922
Epoch 103/400
160/160 [=====] - 0s 592us/step - loss: 0.4978
Epoch 104/400
160/160 [=====] - 0s 629us/step - loss: 0.4960
Epoch 105/400
160/160 [=====] - 0s 584us/step - loss: 0.4891
Epoch 106/400
160/160 [=====] - 0s 709us/step - loss: 0.4916
Epoch 107/400
160/160 [=====] - 0s 658us/step - loss: 0.4886
Epoch 108/400
160/160 [=====] - 0s 613us/step - loss: 0.4976
Epoch 109/400
160/160 [=====] - 0s 711us/step - loss: 0.4852
Epoch 110/400
160/160 [=====] - 0s 674us/step - loss: 0.4922
Epoch 111/400
160/160 [=====] - 0s 602us/step - loss: 0.4886
Epoch 112/400
160/160 [=====] - 0s 719us/step - loss: 0.4857
Epoch 113/400
160/160 [=====] - 0s 745us/step - loss: 0.4887
Epoch 114/400
160/160 [=====] - 0s 790us/step - loss: 0.4846
Epoch 115/400
160/160 [=====] - 0s 628us/step - loss: 0.4846
Epoch 116/400
160/160 [=====] - 0s 575us/step - loss: 0.4806
Epoch 117/400
160/160 [=====] - 0s 749us/step - loss: 0.4808
Epoch 118/400
160/160 [=====] - 0s 732us/step - loss: 0.4835
Epoch 119/400
160/160 [=====] - 0s 701us/step - loss: 0.4842
Epoch 120/400
160/160 [=====] - 0s 735us/step - loss: 0.4808
Epoch 121/400
160/160 [=====] - 0s 696us/step - loss: 0.4826
Epoch 122/400
160/160 [=====] - 0s 742us/step - loss: 0.4810
Epoch 123/400
160/160 [=====] - 0s 753us/step - loss: 0.4808

Epoch 124/400
160/160 [=====] - 0s 777us/step - loss: 0.4803
Epoch 125/400
160/160 [=====] - 0s 778us/step - loss: 0.4747
Epoch 126/400
160/160 [=====] - 0s 738us/step - loss: 0.4765
Epoch 127/400
160/160 [=====] - 0s 749us/step - loss: 0.4737
Epoch 128/400
160/160 [=====] - 0s 707us/step - loss: 0.4741
Epoch 129/400
160/160 [=====] - 0s 717us/step - loss: 0.4759
Epoch 130/400
160/160 [=====] - 0s 675us/step - loss: 0.4760
Epoch 131/400
160/160 [=====] - 0s 693us/step - loss: 0.4754
Epoch 132/400
160/160 [=====] - 0s 733us/step - loss: 0.4700
Epoch 133/400
160/160 [=====] - 0s 784us/step - loss: 0.4717
Epoch 134/400
160/160 [=====] - 0s 701us/step - loss: 0.4698
Epoch 135/400
160/160 [=====] - 0s 747us/step - loss: 0.4742
Epoch 136/400
160/160 [=====] - 0s 753us/step - loss: 0.4660
Epoch 137/400
160/160 [=====] - 0s 743us/step - loss: 0.4692
Epoch 138/400
160/160 [=====] - 0s 731us/step - loss: 0.4711
Epoch 139/400
160/160 [=====] - 0s 762us/step - loss: 0.4681
Epoch 140/400
160/160 [=====] - 0s 723us/step - loss: 0.4673
Epoch 141/400
160/160 [=====] - 0s 642us/step - loss: 0.4699
Epoch 142/400
160/160 [=====] - 0s 658us/step - loss: 0.4677
Epoch 143/400
160/160 [=====] - 0s 724us/step - loss: 0.4631
Epoch 144/400
160/160 [=====] - 0s 730us/step - loss: 0.4662
Epoch 145/400
160/160 [=====] - 0s 682us/step - loss: 0.4623
Epoch 146/400
160/160 [=====] - 0s 756us/step - loss: 0.4589
Epoch 147/400
160/160 [=====] - 0s 737us/step - loss: 0.4660

Epoch 148/400
160/160 [=====] - 0s 718us/step - loss: 0.4618
Epoch 149/400
160/160 [=====] - 0s 566us/step - loss: 0.4624
Epoch 150/400
160/160 [=====] - 0s 642us/step - loss: 0.4594
Epoch 151/400
160/160 [=====] - 0s 768us/step - loss: 0.4595
Epoch 152/400
160/160 [=====] - 0s 762us/step - loss: 0.4603
Epoch 153/400
160/160 [=====] - 0s 735us/step - loss: 0.4558
Epoch 154/400
160/160 [=====] - 0s 730us/step - loss: 0.4518
Epoch 155/400
160/160 [=====] - 0s 732us/step - loss: 0.4565
Epoch 156/400
160/160 [=====] - 0s 741us/step - loss: 0.4566
Epoch 157/400
160/160 [=====] - 0s 714us/step - loss: 0.4507
Epoch 158/400
160/160 [=====] - 0s 690us/step - loss: 0.4505
Epoch 159/400
160/160 [=====] - 0s 799us/step - loss: 0.4474
Epoch 160/400
160/160 [=====] - 0s 758us/step - loss: 0.4523
Epoch 161/400
160/160 [=====] - 0s 599us/step - loss: 0.4476
Epoch 162/400
160/160 [=====] - 0s 619us/step - loss: 0.4470
Epoch 163/400
160/160 [=====] - 0s 771us/step - loss: 0.4410
Epoch 164/400
160/160 [=====] - 0s 758us/step - loss: 0.4403
Epoch 165/400
160/160 [=====] - 0s 742us/step - loss: 0.4301
Epoch 166/400
160/160 [=====] - 0s 772us/step - loss: 0.4326
Epoch 167/400
160/160 [=====] - 0s 606us/step - loss: 0.4273
Epoch 168/400
160/160 [=====] - 0s 641us/step - loss: 0.4141
Epoch 169/400
160/160 [=====] - 0s 782us/step - loss: 0.4063
Epoch 170/400
160/160 [=====] - 0s 758us/step - loss: 0.3900
Epoch 171/400
160/160 [=====] - 0s 788us/step - loss: 0.3766

Epoch 172/400
160/160 [=====] - 0s 778us/step - loss: 0.3535
Epoch 173/400
160/160 [=====] - 0s 605us/step - loss: 0.3249
Epoch 174/400
160/160 [=====] - 0s 593us/step - loss: 0.3006
Epoch 175/400
160/160 [=====] - 0s 635us/step - loss: 0.2796
Epoch 176/400
160/160 [=====] - 0s 781us/step - loss: 0.2602
Epoch 177/400
160/160 [=====] - 0s 769us/step - loss: 0.2425
Epoch 178/400
160/160 [=====] - 0s 757us/step - loss: 0.2301
Epoch 179/400
160/160 [=====] - 0s 802us/step - loss: 0.2172
Epoch 180/400
160/160 [=====] - 0s 821us/step - loss: 0.2103
Epoch 181/400
160/160 [=====] - 0s 774us/step - loss: 0.2021
Epoch 182/400
160/160 [=====] - 0s 1ms/step - loss: 0.1975
Epoch 183/400
160/160 [=====] - 0s 791us/step - loss: 0.1909
Epoch 184/400
160/160 [=====] - 0s 782us/step - loss: 0.1860
Epoch 185/400
160/160 [=====] - 0s 1ms/step - loss: 0.1841
Epoch 186/400
160/160 [=====] - 0s 869us/step - loss: 0.1786
Epoch 187/400
160/160 [=====] - 0s 625us/step - loss: 0.1780
Epoch 188/400
160/160 [=====] - 0s 667us/step - loss: 0.1762
Epoch 189/400
160/160 [=====] - 0s 808us/step - loss: 0.1723
Epoch 190/400
160/160 [=====] - 0s 848us/step - loss: 0.1706
Epoch 191/400
160/160 [=====] - 0s 836us/step - loss: 0.1700
Epoch 192/400
160/160 [=====] - 0s 888us/step - loss: 0.1691
Epoch 193/400
160/160 [=====] - 0s 849us/step - loss: 0.1656
Epoch 194/400
160/160 [=====] - 0s 710us/step - loss: 0.1648
Epoch 195/400
160/160 [=====] - 0s 644us/step - loss: 0.1628

Epoch 196/400
160/160 [=====] - 0s 776us/step - loss: 0.1624
Epoch 197/400
160/160 [=====] - 0s 808us/step - loss: 0.1613
Epoch 198/400
160/160 [=====] - 0s 767us/step - loss: 0.1578
Epoch 199/400
160/160 [=====] - 0s 780us/step - loss: 0.1612
Epoch 200/400
160/160 [=====] - 0s 616us/step - loss: 0.1571
Epoch 201/400
160/160 [=====] - 0s 632us/step - loss: 0.1551
Epoch 202/400
160/160 [=====] - 0s 698us/step - loss: 0.1557
Epoch 203/400
160/160 [=====] - 0s 687us/step - loss: 0.1549
Epoch 204/400
160/160 [=====] - 0s 616us/step - loss: 0.1527
Epoch 205/400
160/160 [=====] - 0s 627us/step - loss: 0.1546
Epoch 206/400
160/160 [=====] - 0s 688us/step - loss: 0.1544
Epoch 207/400
160/160 [=====] - 0s 640us/step - loss: 0.1524
Epoch 208/400
160/160 [=====] - 0s 627us/step - loss: 0.1498
Epoch 209/400
160/160 [=====] - 0s 650us/step - loss: 0.1486
Epoch 210/400
160/160 [=====] - 0s 892us/step - loss: 0.1477
Epoch 211/400
160/160 [=====] - 0s 689us/step - loss: 0.1486
Epoch 212/400
160/160 [=====] - 0s 633us/step - loss: 0.1461
Epoch 213/400
160/160 [=====] - 0s 860us/step - loss: 0.1463
Epoch 214/400
160/160 [=====] - 0s 827us/step - loss: 0.1476
Epoch 215/400
160/160 [=====] - 0s 766us/step - loss: 0.1466
Epoch 216/400
160/160 [=====] - 0s 599us/step - loss: 0.1468
Epoch 217/400
160/160 [=====] - 0s 611us/step - loss: 0.1454
Epoch 218/400
160/160 [=====] - 0s 581us/step - loss: 0.1462
Epoch 219/400
160/160 [=====] - 0s 657us/step - loss: 0.1445

Epoch 220/400
160/160 [=====] - 0s 830us/step - loss: 0.1448
Epoch 221/400
160/160 [=====] - 0s 613us/step - loss: 0.1420
Epoch 222/400
160/160 [=====] - 0s 622us/step - loss: 0.1426
Epoch 223/400
160/160 [=====] - 0s 722us/step - loss: 0.1415
Epoch 224/400
160/160 [=====] - 0s 788us/step - loss: 0.1419
Epoch 225/400
160/160 [=====] - 0s 807us/step - loss: 0.1424
Epoch 226/400
160/160 [=====] - 0s 687us/step - loss: 0.1406
Epoch 227/400
160/160 [=====] - 0s 700us/step - loss: 0.1403
Epoch 228/400
160/160 [=====] - 0s 811us/step - loss: 0.1383
Epoch 229/400
160/160 [=====] - 0s 842us/step - loss: 0.1366
Epoch 230/400
160/160 [=====] - 0s 896us/step - loss: 0.1392
Epoch 231/400
160/160 [=====] - 0s 926us/step - loss: 0.1423
Epoch 232/400
160/160 [=====] - 0s 840us/step - loss: 0.1362
Epoch 233/400
160/160 [=====] - 0s 728us/step - loss: 0.1393
Epoch 234/400
160/160 [=====] - 0s 623us/step - loss: 0.1375
Epoch 235/400
160/160 [=====] - 0s 664us/step - loss: 0.1337
Epoch 236/400
160/160 [=====] - 0s 735us/step - loss: 0.1388
Epoch 237/400
160/160 [=====] - 0s 710us/step - loss: 0.1387
Epoch 238/400
160/160 [=====] - 0s 643us/step - loss: 0.1346
Epoch 239/400
160/160 [=====] - 0s 742us/step - loss: 0.1349
Epoch 240/400
160/160 [=====] - 0s 816us/step - loss: 0.1365
Epoch 241/400
160/160 [=====] - 0s 747us/step - loss: 0.1370
Epoch 242/400
160/160 [=====] - 0s 667us/step - loss: 0.1357
Epoch 243/400
160/160 [=====] - 0s 681us/step - loss: 0.1341

Epoch 244/400
160/160 [=====] - 0s 822us/step - loss: 0.1328
Epoch 245/400
160/160 [=====] - 0s 822us/step - loss: 0.1268
Epoch 246/400
160/160 [=====] - 0s 766us/step - loss: 0.1330
Epoch 247/400
160/160 [=====] - 0s 727us/step - loss: 0.1329
Epoch 248/400
160/160 [=====] - 0s 630us/step - loss: 0.1289
Epoch 249/400
160/160 [=====] - 0s 669us/step - loss: 0.1320
Epoch 250/400
160/160 [=====] - 0s 834us/step - loss: 0.1301
Epoch 251/400
160/160 [=====] - 0s 845us/step - loss: 0.1281
Epoch 252/400
160/160 [=====] - 0s 815us/step - loss: 0.1326
Epoch 253/400
160/160 [=====] - 0s 750us/step - loss: 0.1276
Epoch 254/400
160/160 [=====] - 0s 815us/step - loss: 0.1333
Epoch 255/400
160/160 [=====] - 0s 729us/step - loss: 0.1277
Epoch 256/400
160/160 [=====] - 0s 809us/step - loss: 0.1322
Epoch 257/400
160/160 [=====] - 0s 720us/step - loss: 0.1321
Epoch 258/400
160/160 [=====] - 0s 782us/step - loss: 0.1305
Epoch 259/400
160/160 [=====] - 0s 733us/step - loss: 0.1293
Epoch 260/400
160/160 [=====] - 0s 602us/step - loss: 0.1318
Epoch 261/400
160/160 [=====] - 0s 619us/step - loss: 0.1275
Epoch 262/400
160/160 [=====] - 0s 688us/step - loss: 0.1313
Epoch 263/400
160/160 [=====] - 0s 760us/step - loss: 0.1297
Epoch 264/400
160/160 [=====] - 0s 649us/step - loss: 0.1311
Epoch 265/400
160/160 [=====] - 0s 769us/step - loss: 0.1297
Epoch 266/400
160/160 [=====] - 0s 781us/step - loss: 0.1280
Epoch 267/400
160/160 [=====] - 0s 804us/step - loss: 0.1260

Epoch 268/400
160/160 [=====] - 0s 710us/step - loss: 0.1266
Epoch 269/400
160/160 [=====] - 0s 743us/step - loss: 0.1262
Epoch 270/400
160/160 [=====] - 0s 751us/step - loss: 0.1240
Epoch 271/400
160/160 [=====] - 0s 760us/step - loss: 0.1272
Epoch 272/400
160/160 [=====] - 0s 743us/step - loss: 0.1260
Epoch 273/400
160/160 [=====] - 0s 766us/step - loss: 0.1264
Epoch 274/400
160/160 [=====] - 0s 663us/step - loss: 0.1266
Epoch 275/400
160/160 [=====] - 0s 596us/step - loss: 0.1254
Epoch 276/400
160/160 [=====] - 0s 641us/step - loss: 0.1259
Epoch 277/400
160/160 [=====] - 0s 737us/step - loss: 0.1227
Epoch 278/400
160/160 [=====] - 0s 751us/step - loss: 0.1272
Epoch 279/400
160/160 [=====] - 0s 612us/step - loss: 0.1246
Epoch 280/400
160/160 [=====] - 0s 712us/step - loss: 0.1229
Epoch 281/400
160/160 [=====] - 0s 619us/step - loss: 0.1227
Epoch 282/400
160/160 [=====] - 0s 633us/step - loss: 0.1255
Epoch 283/400
160/160 [=====] - 0s 586us/step - loss: 0.1244
Epoch 284/400
160/160 [=====] - 0s 574us/step - loss: 0.1253
Epoch 285/400
160/160 [=====] - 0s 631us/step - loss: 0.1207
Epoch 286/400
160/160 [=====] - 0s 575us/step - loss: 0.1259
Epoch 287/400
160/160 [=====] - 0s 596us/step - loss: 0.1239
Epoch 288/400
160/160 [=====] - 0s 607us/step - loss: 0.1214
Epoch 289/400
160/160 [=====] - 0s 731us/step - loss: 0.1250
Epoch 290/400
160/160 [=====] - 0s 682us/step - loss: 0.1229
Epoch 291/400
160/160 [=====] - 0s 619us/step - loss: 0.1244

Epoch 292/400
160/160 [=====] - 0s 781us/step - loss: 0.1224
Epoch 293/400
160/160 [=====] - 0s 761us/step - loss: 0.1227
Epoch 294/400
160/160 [=====] - 0s 762us/step - loss: 0.1231
Epoch 295/400
160/160 [=====] - 0s 791us/step - loss: 0.1245
Epoch 296/400
160/160 [=====] - 0s 814us/step - loss: 0.1182
Epoch 297/400
160/160 [=====] - 0s 757us/step - loss: 0.1226
Epoch 298/400
160/160 [=====] - 0s 629us/step - loss: 0.1226
Epoch 299/400
160/160 [=====] - 0s 599us/step - loss: 0.1206
Epoch 300/400
160/160 [=====] - 0s 761us/step - loss: 0.1224
Epoch 301/400
160/160 [=====] - 0s 598us/step - loss: 0.1218
Epoch 302/400
160/160 [=====] - 0s 599us/step - loss: 0.1209
Epoch 303/400
160/160 [=====] - 0s 646us/step - loss: 0.1217
Epoch 304/400
160/160 [=====] - 0s 685us/step - loss: 0.1189
Epoch 305/400
160/160 [=====] - 0s 608us/step - loss: 0.1223
Epoch 306/400
160/160 [=====] - 0s 699us/step - loss: 0.1181
Epoch 307/400
160/160 [=====] - 0s 726us/step - loss: 0.1200
Epoch 308/400
160/160 [=====] - 0s 605us/step - loss: 0.1195
Epoch 309/400
160/160 [=====] - 0s 694us/step - loss: 0.1195
Epoch 310/400
160/160 [=====] - 0s 767us/step - loss: 0.1185
Epoch 311/400
160/160 [=====] - 0s 755us/step - loss: 0.1169
Epoch 312/400
160/160 [=====] - 0s 776us/step - loss: 0.1195
Epoch 313/400
160/160 [=====] - 0s 739us/step - loss: 0.1142
Epoch 314/400
160/160 [=====] - 0s 787us/step - loss: 0.1190
Epoch 315/400
160/160 [=====] - 0s 753us/step - loss: 0.1171

Epoch 316/400
160/160 [=====] - 0s 609us/step - loss: 0.1170
Epoch 317/400
160/160 [=====] - 0s 731us/step - loss: 0.1178
Epoch 318/400
160/160 [=====] - 0s 623us/step - loss: 0.1180
Epoch 319/400
160/160 [=====] - 0s 839us/step - loss: 0.1191
Epoch 320/400
160/160 [=====] - 0s 849us/step - loss: 0.1176
Epoch 321/400
160/160 [=====] - 0s 712us/step - loss: 0.1179
Epoch 322/400
160/160 [=====] - 0s 634us/step - loss: 0.1190
Epoch 323/400
160/160 [=====] - 0s 835us/step - loss: 0.1152
Epoch 324/400
160/160 [=====] - 0s 713us/step - loss: 0.1203
Epoch 325/400
160/160 [=====] - 0s 606us/step - loss: 0.1175
Epoch 326/400
160/160 [=====] - 0s 736us/step - loss: 0.1141
Epoch 327/400
160/160 [=====] - 0s 748us/step - loss: 0.1187
Epoch 328/400
160/160 [=====] - 0s 751us/step - loss: 0.1171
Epoch 329/400
160/160 [=====] - 0s 748us/step - loss: 0.1144
Epoch 330/400
160/160 [=====] - 0s 785us/step - loss: 0.1188
Epoch 331/400
160/160 [=====] - 0s 786us/step - loss: 0.1145
Epoch 332/400
160/160 [=====] - 0s 842us/step - loss: 0.1147
Epoch 333/400
160/160 [=====] - 0s 837us/step - loss: 0.1160
Epoch 334/400
160/160 [=====] - 0s 715us/step - loss: 0.1165
Epoch 335/400
160/160 [=====] - 0s 602us/step - loss: 0.1156
Epoch 336/400
160/160 [=====] - 0s 668us/step - loss: 0.1146
Epoch 337/400
160/160 [=====] - 0s 689us/step - loss: 0.1160
Epoch 338/400
160/160 [=====] - 0s 686us/step - loss: 0.1180
Epoch 339/400
160/160 [=====] - 0s 595us/step - loss: 0.1156

Epoch 340/400
160/160 [=====] - 0s 601us/step - loss: 0.1076
Epoch 341/400
160/160 [=====] - 0s 634us/step - loss: 0.1143
Epoch 342/400
160/160 [=====] - 0s 707us/step - loss: 0.1152
Epoch 343/400
160/160 [=====] - 0s 795us/step - loss: 0.1155
Epoch 344/400
160/160 [=====] - 0s 606us/step - loss: 0.1081
Epoch 345/400
160/160 [=====] - 0s 618us/step - loss: 0.1166
Epoch 346/400
160/160 [=====] - 0s 803us/step - loss: 0.1143
Epoch 347/400
160/160 [=====] - 0s 732us/step - loss: 0.1144
Epoch 348/400
160/160 [=====] - 0s 777us/step - loss: 0.1133
Epoch 349/400
160/160 [=====] - 0s 723us/step - loss: 0.1158
Epoch 350/400
160/160 [=====] - 0s 622us/step - loss: 0.1140
Epoch 351/400
160/160 [=====] - 0s 717us/step - loss: 0.1151
Epoch 352/400
160/160 [=====] - 0s 618us/step - loss: 0.1140
Epoch 353/400
160/160 [=====] - 0s 597us/step - loss: 0.1138
Epoch 354/400
160/160 [=====] - 0s 617us/step - loss: 0.1136
Epoch 355/400
160/160 [=====] - 0s 685us/step - loss: 0.1090
Epoch 356/400
160/160 [=====] - 0s 642us/step - loss: 0.1125
Epoch 357/400
160/160 [=====] - 0s 594us/step - loss: 0.1112
Epoch 358/400
160/160 [=====] - 0s 597us/step - loss: 0.1129
Epoch 359/400
160/160 [=====] - 0s 661us/step - loss: 0.1129
Epoch 360/400
160/160 [=====] - 0s 731us/step - loss: 0.1146
Epoch 361/400
160/160 [=====] - 0s 644us/step - loss: 0.1139
Epoch 362/400
160/160 [=====] - 0s 605us/step - loss: 0.1110
Epoch 363/400
160/160 [=====] - 0s 599us/step - loss: 0.1128

Epoch 364/400
160/160 [=====] - 0s 742us/step - loss: 0.1101
Epoch 365/400
160/160 [=====] - 0s 766us/step - loss: 0.1136
Epoch 366/400
160/160 [=====] - 0s 740us/step - loss: 0.1099
Epoch 367/400
160/160 [=====] - 0s 751us/step - loss: 0.1098
Epoch 368/400
160/160 [=====] - 0s 784us/step - loss: 0.1151
Epoch 369/400
160/160 [=====] - 0s 743us/step - loss: 0.1114
Epoch 370/400
160/160 [=====] - 0s 723us/step - loss: 0.1112
Epoch 371/400
160/160 [=====] - 0s 741us/step - loss: 0.1110
Epoch 372/400
160/160 [=====] - 0s 620us/step - loss: 0.1133
Epoch 373/400
160/160 [=====] - 0s 592us/step - loss: 0.1088
Epoch 374/400
160/160 [=====] - 0s 681us/step - loss: 0.1102
Epoch 375/400
160/160 [=====] - 0s 683us/step - loss: 0.1121
Epoch 376/400
160/160 [=====] - 0s 588us/step - loss: 0.1094
Epoch 377/400
160/160 [=====] - 0s 683us/step - loss: 0.1087
Epoch 378/400
160/160 [=====] - 0s 749us/step - loss: 0.1104
Epoch 379/400
160/160 [=====] - 0s 612us/step - loss: 0.1117
Epoch 380/400
160/160 [=====] - 0s 679us/step - loss: 0.1102
Epoch 381/400
160/160 [=====] - 0s 766us/step - loss: 0.1101
Epoch 382/400
160/160 [=====] - 0s 733us/step - loss: 0.1105
Epoch 383/400
160/160 [=====] - 0s 779us/step - loss: 0.1134
Epoch 384/400
160/160 [=====] - 0s 645us/step - loss: 0.1121
Epoch 385/400
160/160 [=====] - 0s 589us/step - loss: 0.1109
Epoch 386/400
160/160 [=====] - 0s 760us/step - loss: 0.1093
Epoch 387/400
160/160 [=====] - 0s 733us/step - loss: 0.1101

```

Epoch 388/400
160/160 [=====] - 0s 614us/step - loss: 0.1087
Epoch 389/400
160/160 [=====] - 0s 630us/step - loss: 0.1100
Epoch 390/400
160/160 [=====] - 0s 647us/step - loss: 0.1093
Epoch 391/400
160/160 [=====] - 0s 663us/step - loss: 0.1090
Epoch 392/400
160/160 [=====] - 0s 605us/step - loss: 0.1102
Epoch 393/400
160/160 [=====] - 0s 564us/step - loss: 0.1101
Epoch 394/400
160/160 [=====] - 0s 601us/step - loss: 0.1105
Epoch 395/400
160/160 [=====] - 0s 726us/step - loss: 0.1093
Epoch 396/400
160/160 [=====] - 0s 749us/step - loss: 0.1096
Epoch 397/400
160/160 [=====] - 0s 618us/step - loss: 0.1102
Epoch 398/400
160/160 [=====] - 0s 640us/step - loss: 0.1091
Epoch 399/400
160/160 [=====] - 0s 795us/step - loss: 0.1097
Epoch 400/400
160/160 [=====] - 0s 747us/step - loss: 0.1078

```

```

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '

```

```

[ 0.6248695  0.99790406  0.99980605  0.99910206  0.98896885  0.9999382
  0.99942404  0.97264665  0.8412463  0.9999281  0.99963474  0.9989112
  0.9995071  0.68116325  0.9834387  0.38830855  0.5489998  0.9998748
  0.99796236  0.75734216  0.9999748  0.99959666  0.5108399  0.99880356
  0.9993759  0.5299677  0.99996877  0.9999752  0.9999702  0.9995074
  0.9972305  0.9805922  0.99044555  0.9995236  0.9996944  0.9991785
  0.95668185  0.9808113  0.9990882  0.94524086  0.8367714  0.99217314
  0.9968429  0.99171615  0.99824744  0.9985129  0.98599297  0.6301999
  0.72061837  0.99836874  0.99382913  0.99619085  0.9950424  0.8542017
  0.9589387  0.8631392  0.47633153  0.997667  0.9986873  0.72106814
  0.99924594  0.99940556  0.4047926  0.9695584  0.999049  0.6666288
  0.99883556  0.99954414  0.9993529  0.9903042  0.975132  0.8085411
  0.93363404  0.98996806  0.99631333  0.9978229  0.93363845  0.93513083
  0.9763673  0.88785076  0.05579298 -0.02924776 -0.369237 -0.09812601
 -0.08063794 -0.40431148 -0.24899256 0.68602437 -0.02997311 -0.4000734
 -0.19700964 -0.13806598 -0.34221745 0.15300128 -0.24201952 0.859711

```

```

0.0896612 -0.3812555 -0.20525712 0.5674035 -0.4412107 -0.34874383
0.17185967 -0.1025622 -0.2889297 -0.06290179 -0.4121652 -0.46088395
-0.44209427 -0.30063394 0.03095067 0.21089342 -0.16977164 -0.29360446
-0.33129367 -0.20217453 0.47604367 -0.205308 -0.11357044 -0.16576357
0.22761086 -0.6323444 -0.99097306 -0.7780004 -0.21967584 -0.9894476
-0.9692623 -0.5871386 -0.23410623 -0.99073815 -0.8953672 -0.6601491
-0.9871432 0.26912618 -0.8682295 0.3786805 0.10983559 -0.99129546
-0.2916132 0.39733133 -0.9720402 -0.03109906 0.22834444 -0.8804279
-0.3195317 0.01401309 -0.9817508 -0.8329497 -0.95411867 -0.9819445
-0.9257869 0.03671759 -0.84492636 -0.98072314 -0.9868558 -0.5978189
0.0819382 -0.8242003 -0.8907939 -0.6486744 ]
160/160 [=====] - 0s 2ms/step

```

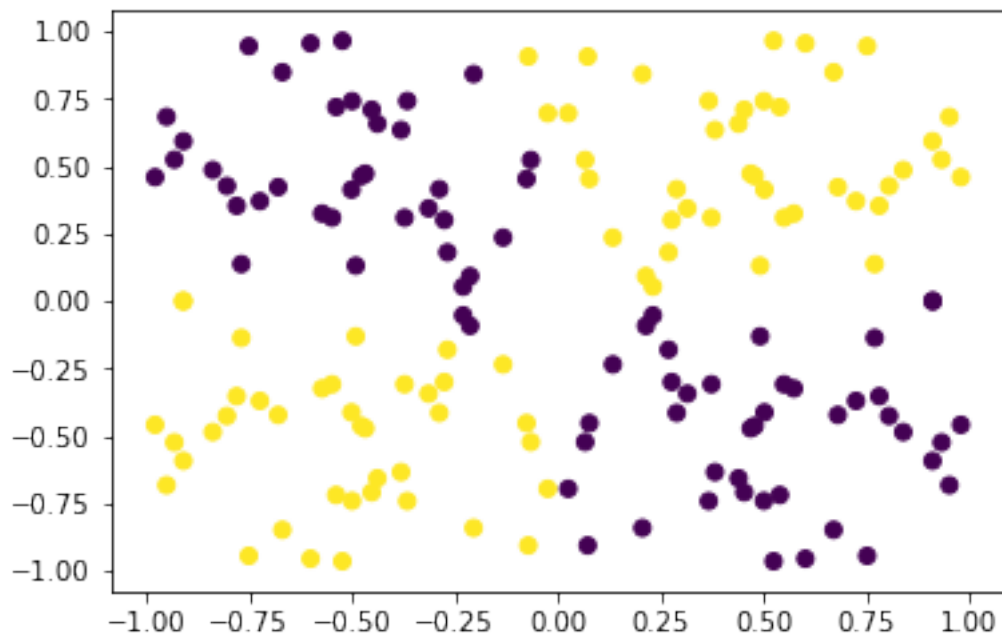
```
In [86]: scores, model.metrics_names
```

```
Out[86]: (0.10138571858406067, ['loss'])
```

```
In [87]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

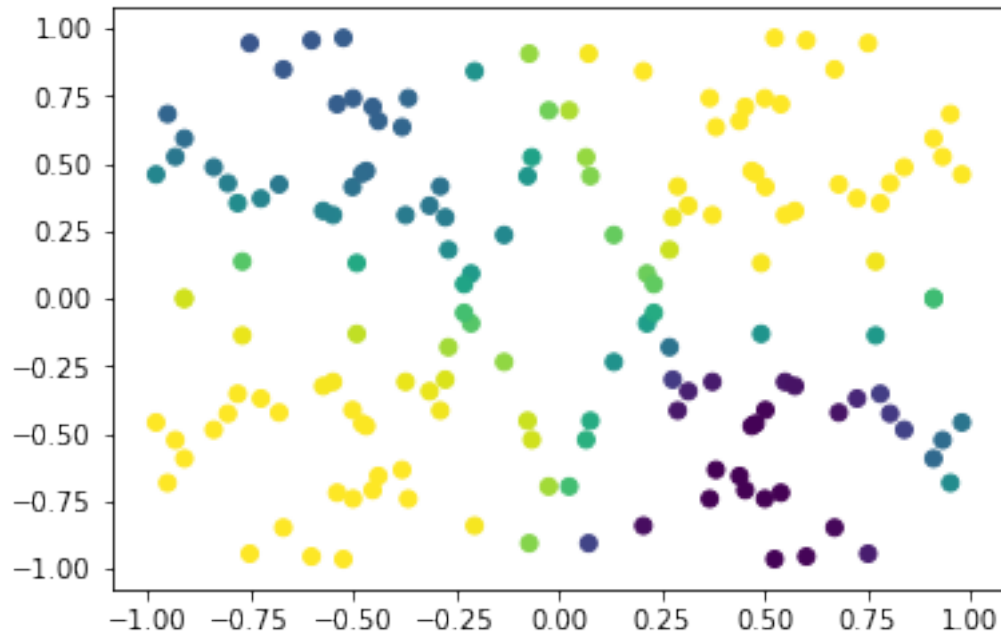
```
# Finally something nice!
```

```
Out[87]: <matplotlib.collections.PathCollection at 0xb2b6e07b8>
```



```
In [88]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[88]: <matplotlib.collections.PathCollection at 0xb27927e10>
```



```
In [89]: # Using tanh for 3 neuron
model = Sequential()

model.add(Dense(3, input_dim=2, activation='tanh'))
model.add(Dense(3, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 6ms/step - loss: 1.0999
Epoch 2/400
160/160 [=====] - 0s 708us/step - loss: 0.7469
Epoch 3/400
160/160 [=====] - 0s 812us/step - loss: 0.7044
Epoch 4/400
160/160 [=====] - 0s 850us/step - loss: 0.6523
Epoch 5/400
```

160/160 [=====] - 0s 717us/step - loss: 0.6407
Epoch 6/400
160/160 [=====] - 0s 772us/step - loss: 0.6016
Epoch 7/400
160/160 [=====] - 0s 789us/step - loss: 0.5629
Epoch 8/400
160/160 [=====] - 0s 791us/step - loss: 0.5297
Epoch 9/400
160/160 [=====] - 0s 647us/step - loss: 0.4931
Epoch 10/400
160/160 [=====] - 0s 705us/step - loss: 0.4568
Epoch 11/400
160/160 [=====] - 0s 839us/step - loss: 0.4220
Epoch 12/400
160/160 [=====] - 0s 825us/step - loss: 0.3880
Epoch 13/400
160/160 [=====] - 0s 835us/step - loss: 0.5720
Epoch 14/400
160/160 [=====] - 0s 810us/step - loss: 0.3446
Epoch 15/400
160/160 [=====] - 0s 679us/step - loss: 0.3278
Epoch 16/400
160/160 [=====] - 0s 647us/step - loss: 0.2975
Epoch 17/400
160/160 [=====] - 0s 718us/step - loss: 0.2806
Epoch 18/400
160/160 [=====] - 0s 899us/step - loss: 0.2763
Epoch 19/400
160/160 [=====] - 0s 738us/step - loss: 0.2528
Epoch 20/400
160/160 [=====] - 0s 804us/step - loss: 0.2444
Epoch 21/400
160/160 [=====] - 0s 878us/step - loss: 0.2418
Epoch 22/400
160/160 [=====] - 0s 736us/step - loss: 0.2274
Epoch 23/400
160/160 [=====] - 0s 735us/step - loss: 0.2150
Epoch 24/400
160/160 [=====] - 0s 730us/step - loss: 0.2283
Epoch 25/400
160/160 [=====] - 0s 752us/step - loss: 0.2118
Epoch 26/400
160/160 [=====] - 0s 849us/step - loss: 0.2193
Epoch 27/400
160/160 [=====] - 0s 784us/step - loss: 0.2105
Epoch 28/400
160/160 [=====] - 0s 729us/step - loss: 0.2112
Epoch 29/400

160/160 [=====] - 0s 882us/step - loss: 0.1952
Epoch 30/400
160/160 [=====] - 0s 809us/step - loss: 0.1972
Epoch 31/400
160/160 [=====] - 0s 825us/step - loss: 0.2033
Epoch 32/400
160/160 [=====] - 0s 754us/step - loss: 0.1879
Epoch 33/400
160/160 [=====] - 0s 766us/step - loss: 0.1850
Epoch 34/400
160/160 [=====] - 0s 779us/step - loss: 0.2800
Epoch 35/400
160/160 [=====] - 0s 833us/step - loss: 0.1762
Epoch 36/400
160/160 [=====] - 0s 842us/step - loss: 0.1975
Epoch 37/400
160/160 [=====] - 0s 842us/step - loss: 0.2645
Epoch 38/400
160/160 [=====] - 0s 855us/step - loss: 0.1947
Epoch 39/400
160/160 [=====] - 0s 717us/step - loss: 0.1733
Epoch 40/400
160/160 [=====] - 0s 629us/step - loss: 0.1735
Epoch 41/400
160/160 [=====] - 0s 697us/step - loss: 0.1940
Epoch 42/400
160/160 [=====] - 0s 722us/step - loss: 0.1996
Epoch 43/400
160/160 [=====] - 0s 654us/step - loss: 0.1675
Epoch 44/400
160/160 [=====] - 0s 659us/step - loss: 0.1685
Epoch 45/400
160/160 [=====] - 0s 820us/step - loss: 0.2521
Epoch 46/400
160/160 [=====] - 0s 691us/step - loss: 0.2413
Epoch 47/400
160/160 [=====] - 0s 696us/step - loss: 0.1669
Epoch 48/400
160/160 [=====] - 0s 693us/step - loss: 0.3536
Epoch 49/400
160/160 [=====] - 0s 630us/step - loss: 0.1703
Epoch 50/400
160/160 [=====] - 0s 837us/step - loss: 0.1718
Epoch 51/400
160/160 [=====] - 0s 805us/step - loss: 0.1567
Epoch 52/400
160/160 [=====] - 0s 678us/step - loss: 0.1452
Epoch 53/400

160/160 [=====] - 0s 670us/step - loss: 0.1584
Epoch 54/400
160/160 [=====] - 0s 703us/step - loss: 0.1626
Epoch 55/400
160/160 [=====] - 0s 676us/step - loss: 0.1423
Epoch 56/400
160/160 [=====] - 0s 854us/step - loss: 0.1766
Epoch 57/400
160/160 [=====] - 0s 647us/step - loss: 0.1561
Epoch 58/400
160/160 [=====] - 0s 696us/step - loss: 0.1415
Epoch 59/400
160/160 [=====] - 0s 782us/step - loss: 0.1479
Epoch 60/400
160/160 [=====] - 0s 697us/step - loss: 0.1767
Epoch 61/400
160/160 [=====] - 0s 721us/step - loss: 0.2376
Epoch 62/400
160/160 [=====] - 0s 737us/step - loss: 0.3067
Epoch 63/400
160/160 [=====] - 0s 740us/step - loss: 0.2903
Epoch 64/400
160/160 [=====] - 0s 715us/step - loss: 0.1624
Epoch 65/400
160/160 [=====] - 0s 680us/step - loss: 0.1502
Epoch 66/400
160/160 [=====] - 0s 702us/step - loss: 0.1386
Epoch 67/400
160/160 [=====] - 0s 731us/step - loss: 0.1453
Epoch 68/400
160/160 [=====] - 0s 712us/step - loss: 0.1421
Epoch 69/400
160/160 [=====] - 0s 762us/step - loss: 0.1403
Epoch 70/400
160/160 [=====] - 0s 676us/step - loss: 0.1343
Epoch 71/400
160/160 [=====] - 0s 673us/step - loss: 0.1403
Epoch 72/400
160/160 [=====] - 0s 877us/step - loss: 0.1300
Epoch 73/400
160/160 [=====] - 0s 1000us/step - loss: 0.1447
Epoch 74/400
160/160 [=====] - 0s 906us/step - loss: 0.1380
Epoch 75/400
160/160 [=====] - 0s 960us/step - loss: 0.1242
Epoch 76/400
160/160 [=====] - 0s 1ms/step - loss: 0.2212
Epoch 77/400

160/160 [=====] - 0s 819us/step - loss: 0.2120
Epoch 78/400
160/160 [=====] - 0s 720us/step - loss: 0.3362
Epoch 79/400
160/160 [=====] - 0s 782us/step - loss: 0.2308
Epoch 80/400
160/160 [=====] - 0s 818us/step - loss: 0.1489
Epoch 81/400
160/160 [=====] - 0s 731us/step - loss: 0.1260
Epoch 82/400
160/160 [=====] - 0s 811us/step - loss: 0.1188
Epoch 83/400
160/160 [=====] - 0s 755us/step - loss: 0.1230
Epoch 84/400
160/160 [=====] - 0s 741us/step - loss: 0.1199
Epoch 85/400
160/160 [=====] - 0s 745us/step - loss: 0.1384
Epoch 86/400
160/160 [=====] - 0s 744us/step - loss: 0.1607
Epoch 87/400
160/160 [=====] - 0s 854us/step - loss: 0.1417
Epoch 88/400
160/160 [=====] - 0s 700us/step - loss: 0.1185
Epoch 89/400
160/160 [=====] - 0s 738us/step - loss: 0.1119
Epoch 90/400
160/160 [=====] - 0s 882us/step - loss: 0.1217
Epoch 91/400
160/160 [=====] - 0s 801us/step - loss: 0.1142
Epoch 92/400
160/160 [=====] - 0s 877us/step - loss: 0.1123
Epoch 93/400
160/160 [=====] - 0s 840us/step - loss: 0.1230
Epoch 94/400
160/160 [=====] - 0s 756us/step - loss: 0.1101
Epoch 95/400
160/160 [=====] - 0s 683us/step - loss: 0.1007
Epoch 96/400
160/160 [=====] - 0s 846us/step - loss: 0.1121
Epoch 97/400
160/160 [=====] - 0s 863us/step - loss: 0.1007
Epoch 98/400
160/160 [=====] - 0s 781us/step - loss: 0.1005
Epoch 99/400
160/160 [=====] - 0s 852us/step - loss: 0.0953
Epoch 100/400
160/160 [=====] - 0s 900us/step - loss: 0.1109
Epoch 101/400

160/160 [=====] - 0s 833us/step - loss: 0.0989
 Epoch 102/400
 160/160 [=====] - 0s 806us/step - loss: 0.0926
 Epoch 103/400
 160/160 [=====] - 0s 710us/step - loss: 0.0894
 Epoch 104/400
 160/160 [=====] - 0s 766us/step - loss: 0.1887
 Epoch 105/400
 160/160 [=====] - 0s 780us/step - loss: 0.1202
 Epoch 106/400
 160/160 [=====] - 0s 695us/step - loss: 0.0948
 Epoch 107/400
 160/160 [=====] - 0s 686us/step - loss: 0.0996
 Epoch 108/400
 160/160 [=====] - 0s 735us/step - loss: 0.0911
 Epoch 109/400
 160/160 [=====] - 0s 688us/step - loss: 0.1032
 Epoch 110/400
 160/160 [=====] - 0s 781us/step - loss: 0.0961
 Epoch 111/400
 160/160 [=====] - 0s 776us/step - loss: 0.0932
 Epoch 112/400
 160/160 [=====] - 0s 751us/step - loss: 0.0868
 Epoch 113/400
 160/160 [=====] - 0s 822us/step - loss: 0.0888
 Epoch 114/400
 160/160 [=====] - 0s 885us/step - loss: 0.1603
 Epoch 115/400
 160/160 [=====] - 0s 878us/step - loss: 0.0899
 Epoch 116/400
 160/160 [=====] - 0s 864us/step - loss: 0.0814
 Epoch 117/400
 160/160 [=====] - 0s 859us/step - loss: 0.0776
 Epoch 118/400
 160/160 [=====] - 0s 890us/step - loss: 0.0873
 Epoch 119/400
 160/160 [=====] - 0s 738us/step - loss: 0.0757
 Epoch 120/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0936
 Epoch 121/400
 160/160 [=====] - 0s 943us/step - loss: 0.0745
 Epoch 122/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0759
 Epoch 123/400
 160/160 [=====] - 0s 940us/step - loss: 0.0920
 Epoch 124/400
 160/160 [=====] - 0s 833us/step - loss: 0.0778
 Epoch 125/400

160/160 [=====] - 0s 895us/step - loss: 0.0760
Epoch 126/400
160/160 [=====] - 0s 2ms/step - loss: 0.0853
Epoch 127/400
160/160 [=====] - 0s 3ms/step - loss: 0.0779
Epoch 128/400
160/160 [=====] - 0s 2ms/step - loss: 0.0783
Epoch 129/400
160/160 [=====] - 0s 2ms/step - loss: 0.0777
Epoch 130/400
160/160 [=====] - 0s 1ms/step - loss: 0.0769
Epoch 131/400
160/160 [=====] - 0s 849us/step - loss: 0.0732
Epoch 132/400
160/160 [=====] - 0s 709us/step - loss: 0.0676
Epoch 133/400
160/160 [=====] - 0s 972us/step - loss: 0.0808
Epoch 134/400
160/160 [=====] - 0s 767us/step - loss: 0.0754
Epoch 135/400
160/160 [=====] - 0s 742us/step - loss: 0.0669
Epoch 136/400
160/160 [=====] - 0s 920us/step - loss: 0.0648
Epoch 137/400
160/160 [=====] - 0s 962us/step - loss: 0.0712
Epoch 138/400
160/160 [=====] - 0s 841us/step - loss: 0.0716
Epoch 139/400
160/160 [=====] - 0s 802us/step - loss: 0.0641
Epoch 140/400
160/160 [=====] - 0s 883us/step - loss: 0.0728
Epoch 141/400
160/160 [=====] - 0s 849us/step - loss: 0.0751
Epoch 142/400
160/160 [=====] - 0s 1ms/step - loss: 0.0648
Epoch 143/400
160/160 [=====] - 0s 967us/step - loss: 0.0633
Epoch 144/400
160/160 [=====] - 0s 1ms/step - loss: 0.0617
Epoch 145/400
160/160 [=====] - 0s 894us/step - loss: 0.0688
Epoch 146/400
160/160 [=====] - 0s 899us/step - loss: 0.0667
Epoch 147/400
160/160 [=====] - 0s 1ms/step - loss: 0.0662
Epoch 148/400
160/160 [=====] - 0s 972us/step - loss: 0.0626
Epoch 149/400

160/160 [=====] - 0s 994us/step - loss: 0.0652
 Epoch 150/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0644
 Epoch 151/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0609
 Epoch 152/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0675
 Epoch 153/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0632
 Epoch 154/400
 160/160 [=====] - 0s 742us/step - loss: 0.0596
 Epoch 155/400
 160/160 [=====] - 0s 665us/step - loss: 0.0679
 Epoch 156/400
 160/160 [=====] - 0s 668us/step - loss: 0.0602
 Epoch 157/400
 160/160 [=====] - 0s 666us/step - loss: 0.0611
 Epoch 158/400
 160/160 [=====] - 0s 638us/step - loss: 0.0598
 Epoch 159/400
 160/160 [=====] - 0s 637us/step - loss: 0.0829
 Epoch 160/400
 160/160 [=====] - 0s 624us/step - loss: 0.0745
 Epoch 161/400
 160/160 [=====] - 0s 604us/step - loss: 0.0571
 Epoch 162/400
 160/160 [=====] - 0s 613us/step - loss: 0.0584
 Epoch 163/400
 160/160 [=====] - 0s 633us/step - loss: 0.0586
 Epoch 164/400
 160/160 [=====] - 0s 769us/step - loss: 0.0575
 Epoch 165/400
 160/160 [=====] - 0s 712us/step - loss: 0.0603
 Epoch 166/400
 160/160 [=====] - 0s 591us/step - loss: 0.0607
 Epoch 167/400
 160/160 [=====] - 0s 605us/step - loss: 0.0525
 Epoch 168/400
 160/160 [=====] - 0s 845us/step - loss: 0.0613
 Epoch 169/400
 160/160 [=====] - 0s 682us/step - loss: 0.0543
 Epoch 170/400
 160/160 [=====] - 0s 625us/step - loss: 0.0550
 Epoch 171/400
 160/160 [=====] - 0s 601us/step - loss: 0.0454
 Epoch 172/400
 160/160 [=====] - 0s 600us/step - loss: 0.0581
 Epoch 173/400

160/160 [=====] - 0s 755us/step - loss: 0.0573
Epoch 174/400
160/160 [=====] - 0s 609us/step - loss: 0.0621
Epoch 175/400
160/160 [=====] - 0s 709us/step - loss: 0.0581
Epoch 176/400
160/160 [=====] - 0s 838us/step - loss: 0.0590
Epoch 177/400
160/160 [=====] - 0s 757us/step - loss: 0.0492
Epoch 178/400
160/160 [=====] - 0s 708us/step - loss: 0.0725
Epoch 179/400
160/160 [=====] - 0s 728us/step - loss: 0.0536
Epoch 180/400
160/160 [=====] - 0s 904us/step - loss: 0.0536
Epoch 181/400
160/160 [=====] - 0s 849us/step - loss: 0.0519
Epoch 182/400
160/160 [=====] - 0s 744us/step - loss: 0.0535
Epoch 183/400
160/160 [=====] - 0s 898us/step - loss: 0.0507
Epoch 184/400
160/160 [=====] - 0s 874us/step - loss: 0.0548
Epoch 185/400
160/160 [=====] - 0s 985us/step - loss: 0.0518
Epoch 186/400
160/160 [=====] - 0s 800us/step - loss: 0.2161
Epoch 187/400
160/160 [=====] - 0s 744us/step - loss: 0.1033
Epoch 188/400
160/160 [=====] - 0s 606us/step - loss: 0.0612
Epoch 189/400
160/160 [=====] - 0s 614us/step - loss: 0.0519
Epoch 190/400
160/160 [=====] - 0s 663us/step - loss: 0.0542
Epoch 191/400
160/160 [=====] - 0s 866us/step - loss: 0.0487
Epoch 192/400
160/160 [=====] - 0s 841us/step - loss: 0.0496
Epoch 193/400
160/160 [=====] - 0s 959us/step - loss: 0.0497
Epoch 194/400
160/160 [=====] - 0s 711us/step - loss: 0.0535
Epoch 195/400
160/160 [=====] - 0s 623us/step - loss: 0.0446
Epoch 196/400
160/160 [=====] - 0s 800us/step - loss: 0.0485
Epoch 197/400

160/160 [=====] - 0s 728us/step - loss: 0.0482
Epoch 198/400
160/160 [=====] - 0s 879us/step - loss: 0.0522
Epoch 199/400
160/160 [=====] - 0s 774us/step - loss: 0.0483
Epoch 200/400
160/160 [=====] - 0s 634us/step - loss: 0.0458
Epoch 201/400
160/160 [=====] - 0s 857us/step - loss: 0.0503
Epoch 202/400
160/160 [=====] - 0s 713us/step - loss: 0.0539
Epoch 203/400
160/160 [=====] - 0s 639us/step - loss: 0.0658
Epoch 204/400
160/160 [=====] - 0s 624us/step - loss: 0.0441
Epoch 205/400
160/160 [=====] - 0s 672us/step - loss: 0.0441
Epoch 206/400
160/160 [=====] - 0s 822us/step - loss: 0.0513
Epoch 207/400
160/160 [=====] - 0s 939us/step - loss: 0.0441
Epoch 208/400
160/160 [=====] - 0s 777us/step - loss: 0.0461
Epoch 209/400
160/160 [=====] - 0s 709us/step - loss: 0.0546
Epoch 210/400
160/160 [=====] - 0s 728us/step - loss: 0.0545
Epoch 211/400
160/160 [=====] - 0s 694us/step - loss: 0.0462
Epoch 212/400
160/160 [=====] - 0s 699us/step - loss: 0.0457
Epoch 213/400
160/160 [=====] - 0s 708us/step - loss: 0.0456
Epoch 214/400
160/160 [=====] - 0s 638us/step - loss: 0.0462
Epoch 215/400
160/160 [=====] - 0s 625us/step - loss: 0.0496
Epoch 216/400
160/160 [=====] - 0s 604us/step - loss: 0.0437
Epoch 217/400
160/160 [=====] - 0s 611us/step - loss: 0.0453
Epoch 218/400
160/160 [=====] - 0s 615us/step - loss: 0.0377
Epoch 219/400
160/160 [=====] - 0s 599us/step - loss: 0.0451
Epoch 220/400
160/160 [=====] - 0s 595us/step - loss: 0.0466
Epoch 221/400

160/160 [=====] - 0s 600us/step - loss: 0.0492
 Epoch 222/400
 160/160 [=====] - 0s 609us/step - loss: 0.0502
 Epoch 223/400
 160/160 [=====] - 0s 609us/step - loss: 0.0461
 Epoch 224/400
 160/160 [=====] - 0s 592us/step - loss: 0.0450
 Epoch 225/400
 160/160 [=====] - 0s 618us/step - loss: 0.0437
 Epoch 226/400
 160/160 [=====] - 0s 616us/step - loss: 0.0442
 Epoch 227/400
 160/160 [=====] - 0s 606us/step - loss: 0.0416
 Epoch 228/400
 160/160 [=====] - 0s 616us/step - loss: 0.0427
 Epoch 229/400
 160/160 [=====] - 0s 604us/step - loss: 0.0456
 Epoch 230/400
 160/160 [=====] - 0s 597us/step - loss: 0.0378
 Epoch 231/400
 160/160 [=====] - 0s 604us/step - loss: 0.0867
 Epoch 232/400
 160/160 [=====] - 0s 598us/step - loss: 0.1316
 Epoch 233/400
 160/160 [=====] - 0s 602us/step - loss: 0.0508
 Epoch 234/400
 160/160 [=====] - 0s 615us/step - loss: 0.0469
 Epoch 235/400
 160/160 [=====] - 0s 589us/step - loss: 0.0457
 Epoch 236/400
 160/160 [=====] - 0s 586us/step - loss: 0.0448
 Epoch 237/400
 160/160 [=====] - 0s 606us/step - loss: 0.0451
 Epoch 238/400
 160/160 [=====] - 0s 678us/step - loss: 0.0428
 Epoch 239/400
 160/160 [=====] - 0s 682us/step - loss: 0.0434
 Epoch 240/400
 160/160 [=====] - 0s 676us/step - loss: 0.0412
 Epoch 241/400
 160/160 [=====] - 0s 606us/step - loss: 0.0413
 Epoch 242/400
 160/160 [=====] - 0s 611us/step - loss: 0.0410
 Epoch 243/400
 160/160 [=====] - 0s 715us/step - loss: 0.0444
 Epoch 244/400
 160/160 [=====] - 0s 729us/step - loss: 0.0437
 Epoch 245/400

160/160 [=====] - 0s 770us/step - loss: 0.0419
 Epoch 246/400
 160/160 [=====] - 0s 700us/step - loss: 0.0419
 Epoch 247/400
 160/160 [=====] - 0s 719us/step - loss: 0.0379
 Epoch 248/400
 160/160 [=====] - 0s 626us/step - loss: 0.0491
 Epoch 249/400
 160/160 [=====] - 0s 652us/step - loss: 0.0360
 Epoch 250/400
 160/160 [=====] - 0s 657us/step - loss: 0.0434
 Epoch 251/400
 160/160 [=====] - 0s 673us/step - loss: 0.0412
 Epoch 252/400
 160/160 [=====] - 0s 676us/step - loss: 0.0416
 Epoch 253/400
 160/160 [=====] - 0s 698us/step - loss: 0.0386
 Epoch 254/400
 160/160 [=====] - 0s 678us/step - loss: 0.0398
 Epoch 255/400
 160/160 [=====] - 0s 645us/step - loss: 0.0386
 Epoch 256/400
 160/160 [=====] - 0s 638us/step - loss: 0.0554
 Epoch 257/400
 160/160 [=====] - 0s 649us/step - loss: 0.0591
 Epoch 258/400
 160/160 [=====] - 0s 623us/step - loss: 0.0388
 Epoch 259/400
 160/160 [=====] - 0s 627us/step - loss: 0.0411
 Epoch 260/400
 160/160 [=====] - 0s 597us/step - loss: 0.0443
 Epoch 261/400
 160/160 [=====] - 0s 610us/step - loss: 0.0414
 Epoch 262/400
 160/160 [=====] - 0s 665us/step - loss: 0.0391
 Epoch 263/400
 160/160 [=====] - 0s 764us/step - loss: 0.0401
 Epoch 264/400
 160/160 [=====] - 0s 746us/step - loss: 0.0400
 Epoch 265/400
 160/160 [=====] - 0s 770us/step - loss: 0.0382
 Epoch 266/400
 160/160 [=====] - 0s 681us/step - loss: 0.0431
 Epoch 267/400
 160/160 [=====] - 0s 618us/step - loss: 0.0400
 Epoch 268/400
 160/160 [=====] - 0s 610us/step - loss: 0.0428
 Epoch 269/400

160/160 [=====] - 0s 614us/step - loss: 0.0377
Epoch 270/400
160/160 [=====] - 0s 717us/step - loss: 0.0375
Epoch 271/400
160/160 [=====] - 0s 860us/step - loss: 0.0430
Epoch 272/400
160/160 [=====] - 0s 687us/step - loss: 0.0449
Epoch 273/400
160/160 [=====] - 0s 656us/step - loss: 0.0691
Epoch 274/400
160/160 [=====] - 0s 707us/step - loss: 0.0443
Epoch 275/400
160/160 [=====] - 0s 1ms/step - loss: 0.0395
Epoch 276/400
160/160 [=====] - 0s 1ms/step - loss: 0.0378
Epoch 277/400
160/160 [=====] - 0s 696us/step - loss: 0.0425
Epoch 278/400
160/160 [=====] - 0s 671us/step - loss: 0.0473
Epoch 279/400
160/160 [=====] - 0s 1ms/step - loss: 0.0360
Epoch 280/400
160/160 [=====] - 0s 693us/step - loss: 0.0384
Epoch 281/400
160/160 [=====] - 0s 715us/step - loss: 0.0588
Epoch 282/400
160/160 [=====] - 0s 841us/step - loss: 0.0412
Epoch 283/400
160/160 [=====] - 0s 713us/step - loss: 0.0405
Epoch 284/400
160/160 [=====] - 0s 1ms/step - loss: 0.0398
Epoch 285/400
160/160 [=====] - 0s 823us/step - loss: 0.0383
Epoch 286/400
160/160 [=====] - 0s 799us/step - loss: 0.0401
Epoch 287/400
160/160 [=====] - 0s 881us/step - loss: 0.0366
Epoch 288/400
160/160 [=====] - 0s 879us/step - loss: 0.0386
Epoch 289/400
160/160 [=====] - 0s 847us/step - loss: 0.0401
Epoch 290/400
160/160 [=====] - 0s 823us/step - loss: 0.0483
Epoch 291/400
160/160 [=====] - 0s 777us/step - loss: 0.0380
Epoch 292/400
160/160 [=====] - 0s 661us/step - loss: 0.0409
Epoch 293/400

160/160 [=====] - 0s 744us/step - loss: 0.0359
Epoch 294/400
160/160 [=====] - 0s 801us/step - loss: 1.3277
Epoch 295/400
160/160 [=====] - 0s 665us/step - loss: 1.9149
Epoch 296/400
160/160 [=====] - 0s 846us/step - loss: 1.2487
Epoch 297/400
160/160 [=====] - 0s 737us/step - loss: 0.6978
Epoch 298/400
160/160 [=====] - 0s 641us/step - loss: 0.5572
Epoch 299/400
160/160 [=====] - 0s 836us/step - loss: 0.4995
Epoch 300/400
160/160 [=====] - 0s 1ms/step - loss: 0.4642
Epoch 301/400
160/160 [=====] - 0s 1ms/step - loss: 0.4599
Epoch 302/400
160/160 [=====] - 0s 910us/step - loss: 0.4488
Epoch 303/400
160/160 [=====] - 0s 765us/step - loss: 0.4527
Epoch 304/400
160/160 [=====] - 0s 735us/step - loss: 0.4518
Epoch 305/400
160/160 [=====] - 0s 845us/step - loss: 0.4506
Epoch 306/400
160/160 [=====] - 0s 764us/step - loss: 0.4512
Epoch 307/400
160/160 [=====] - 0s 813us/step - loss: 0.4473
Epoch 308/400
160/160 [=====] - 0s 684us/step - loss: 0.4465
Epoch 309/400
160/160 [=====] - 0s 720us/step - loss: 0.4458
Epoch 310/400
160/160 [=====] - 0s 746us/step - loss: 0.4412
Epoch 311/400
160/160 [=====] - 0s 806us/step - loss: 0.4409
Epoch 312/400
160/160 [=====] - 0s 716us/step - loss: 0.4405
Epoch 313/400
160/160 [=====] - 0s 816us/step - loss: 0.4298
Epoch 314/400
160/160 [=====] - 0s 675us/step - loss: 0.4274
Epoch 315/400
160/160 [=====] - 0s 781us/step - loss: 0.4348
Epoch 316/400
160/160 [=====] - 0s 855us/step - loss: 0.4324
Epoch 317/400

160/160 [=====] - 0s 871us/step - loss: 0.4287
Epoch 318/400
160/160 [=====] - 0s 782us/step - loss: 0.4191
Epoch 319/400
160/160 [=====] - 0s 677us/step - loss: 0.4328
Epoch 320/400
160/160 [=====] - 0s 641us/step - loss: 0.4243
Epoch 321/400
160/160 [=====] - 0s 793us/step - loss: 0.4264
Epoch 322/400
160/160 [=====] - 0s 880us/step - loss: 0.4212
Epoch 323/400
160/160 [=====] - 0s 858us/step - loss: 0.4278
Epoch 324/400
160/160 [=====] - 0s 793us/step - loss: 0.4265
Epoch 325/400
160/160 [=====] - 0s 925us/step - loss: 0.4218
Epoch 326/400
160/160 [=====] - 0s 764us/step - loss: 0.4192
Epoch 327/400
160/160 [=====] - 0s 997us/step - loss: 0.4222
Epoch 328/400
160/160 [=====] - 0s 750us/step - loss: 0.4196
Epoch 329/400
160/160 [=====] - 0s 641us/step - loss: 0.4216
Epoch 330/400
160/160 [=====] - 0s 832us/step - loss: 0.4214
Epoch 331/400
160/160 [=====] - 0s 802us/step - loss: 0.4173
Epoch 332/400
160/160 [=====] - 0s 641us/step - loss: 0.4177
Epoch 333/400
160/160 [=====] - 0s 835us/step - loss: 0.4203
Epoch 334/400
160/160 [=====] - 0s 873us/step - loss: 0.4145
Epoch 335/400
160/160 [=====] - 0s 879us/step - loss: 0.4157
Epoch 336/400
160/160 [=====] - 0s 753us/step - loss: 0.4166
Epoch 337/400
160/160 [=====] - 0s 627us/step - loss: 0.4181
Epoch 338/400
160/160 [=====] - 0s 627us/step - loss: 0.4162
Epoch 339/400
160/160 [=====] - 0s 808us/step - loss: 0.4198
Epoch 340/400
160/160 [=====] - 0s 820us/step - loss: 0.4154
Epoch 341/400

160/160 [=====] - 0s 835us/step - loss: 0.4181
 Epoch 342/400
 160/160 [=====] - 0s 804us/step - loss: 0.4144
 Epoch 343/400
 160/160 [=====] - 0s 801us/step - loss: 0.4118
 Epoch 344/400
 160/160 [=====] - 0s 750us/step - loss: 0.4159
 Epoch 345/400
 160/160 [=====] - 0s 640us/step - loss: 0.4087
 Epoch 346/400
 160/160 [=====] - 0s 778us/step - loss: 0.4132
 Epoch 347/400
 160/160 [=====] - 0s 815us/step - loss: 0.4110
 Epoch 348/400
 160/160 [=====] - 0s 711us/step - loss: 0.4100
 Epoch 349/400
 160/160 [=====] - 0s 837us/step - loss: 0.4160
 Epoch 350/400
 160/160 [=====] - 0s 661us/step - loss: 0.4133
 Epoch 351/400
 160/160 [=====] - 0s 771us/step - loss: 0.4093
 Epoch 352/400
 160/160 [=====] - 0s 958us/step - loss: 0.4101
 Epoch 353/400
 160/160 [=====] - 0s 1ms/step - loss: 0.4156
 Epoch 354/400
 160/160 [=====] - 0s 693us/step - loss: 0.4095
 Epoch 355/400
 160/160 [=====] - 0s 649us/step - loss: 0.4097
 Epoch 356/400
 160/160 [=====] - 0s 799us/step - loss: 0.4068
 Epoch 357/400
 160/160 [=====] - 0s 944us/step - loss: 0.4109
 Epoch 358/400
 160/160 [=====] - 0s 899us/step - loss: 0.4097
 Epoch 359/400
 160/160 [=====] - 0s 734us/step - loss: 0.4103
 Epoch 360/400
 160/160 [=====] - 0s 683us/step - loss: 0.4082
 Epoch 361/400
 160/160 [=====] - 0s 783us/step - loss: 0.4115
 Epoch 362/400
 160/160 [=====] - 0s 803us/step - loss: 0.4085
 Epoch 363/400
 160/160 [=====] - 0s 805us/step - loss: 0.4097
 Epoch 364/400
 160/160 [=====] - 0s 728us/step - loss: 0.4035
 Epoch 365/400

160/160 [=====] - 0s 647us/step - loss: 0.4074
 Epoch 366/400
 160/160 [=====] - 0s 795us/step - loss: 0.4042
 Epoch 367/400
 160/160 [=====] - 0s 828us/step - loss: 0.4052
 Epoch 368/400
 160/160 [=====] - 0s 795us/step - loss: 0.4075
 Epoch 369/400
 160/160 [=====] - 0s 775us/step - loss: 0.4035
 Epoch 370/400
 160/160 [=====] - 0s 782us/step - loss: 0.4096
 Epoch 371/400
 160/160 [=====] - 0s 809us/step - loss: 0.4081
 Epoch 372/400
 160/160 [=====] - 0s 817us/step - loss: 0.4073
 Epoch 373/400
 160/160 [=====] - 0s 804us/step - loss: 0.4051
 Epoch 374/400
 160/160 [=====] - 0s 826us/step - loss: 0.4062
 Epoch 375/400
 160/160 [=====] - 0s 903us/step - loss: 0.4061
 Epoch 376/400
 160/160 [=====] - 0s 858us/step - loss: 0.4063
 Epoch 377/400
 160/160 [=====] - 0s 990us/step - loss: 0.4091
 Epoch 378/400
 160/160 [=====] - 0s 761us/step - loss: 0.4042
 Epoch 379/400
 160/160 [=====] - 0s 762us/step - loss: 0.4016
 Epoch 380/400
 160/160 [=====] - 0s 1ms/step - loss: 0.4061
 Epoch 381/400
 160/160 [=====] - 0s 884us/step - loss: 0.4037
 Epoch 382/400
 160/160 [=====] - 0s 828us/step - loss: 0.4035
 Epoch 383/400
 160/160 [=====] - 0s 726us/step - loss: 0.4043
 Epoch 384/400
 160/160 [=====] - 0s 1ms/step - loss: 0.4014
 Epoch 385/400
 160/160 [=====] - 0s 866us/step - loss: 0.3984
 Epoch 386/400
 160/160 [=====] - 0s 842us/step - loss: 0.4013
 Epoch 387/400
 160/160 [=====] - 0s 878us/step - loss: 0.3989
 Epoch 388/400
 160/160 [=====] - 0s 812us/step - loss: 0.4000
 Epoch 389/400

```

160/160 [=====] - 0s 632us/step - loss: 0.4052
Epoch 390/400
160/160 [=====] - 0s 646us/step - loss: 0.3990
Epoch 391/400
160/160 [=====] - 0s 672us/step - loss: 0.4036
Epoch 392/400
160/160 [=====] - 0s 675us/step - loss: 0.4024
Epoch 393/400
160/160 [=====] - 0s 801us/step - loss: 0.4002
Epoch 394/400
160/160 [=====] - 0s 747us/step - loss: 0.4030
Epoch 395/400
160/160 [=====] - 0s 775us/step - loss: 0.4006
Epoch 396/400
160/160 [=====] - 0s 834us/step - loss: 0.3974
Epoch 397/400
160/160 [=====] - 0s 626us/step - loss: 0.4023
Epoch 398/400
160/160 [=====] - 0s 625us/step - loss: 0.3980
Epoch 399/400
160/160 [=====] - 0s 740us/step - loss: 0.3993
Epoch 400/400
160/160 [=====] - 0s 693us/step - loss: 0.3925

```

```

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '

```

```

[ 0.58174133  0.5554923  0.5594186  0.5556766  0.55520046  0.55742824
 0.5576133  0.5476169  0.56588453  0.5581339  0.55588984  0.5554455
 0.56131434  0.57581776  0.56529003  0.555261  0.5708654  0.55916923
 0.5552488  0.49730575  0.55688703  0.55524254  0.56922436  0.5568633
 0.555282  0.58135015  0.5580723  0.55576575  0.5561726  0.558319
 0.5759425  0.5575553  0.5606802  0.55810755  0.5623998  0.5553822
 0.5555015  0.56342876  0.55661625  0.56564426  0.7634081  0.9648479
 0.998908  0.96584445  0.9788849  0.9985083  0.9869256  0.8372182
 0.9413281  0.99900717  0.977644  0.97893125  0.9984631  0.75384563
 0.9846263  0.717538  0.84592044  0.999144  0.98050034  0.7208213
 0.9974804  0.978275  0.76816446  0.9463622  0.9811969  0.82990795
 0.9988734  0.99000156  0.99482405  0.9943931  0.978678  0.73421085
 0.9827663  0.9934593  0.99894685  0.98286635  0.79060125  0.98447645
 0.9500519  0.9726912 -0.09572862 -0.47795758 -0.9499792 -0.62197214
-0.25357303 -0.9164177 -0.8982033 -0.8040826 -0.9007133 -0.9302299
-0.7466205 -0.572822 -0.96791 -0.09104758 -0.98339236 0.7125817
-0.17214373 -0.9458771 -0.5088082 0.18895015 -0.9059315 -0.6976496
0.07381524 -0.8032553 -0.64902747 -0.20762816 -0.92465353 -0.8758686
-0.8857531 -0.92828256 -0.99168855 -0.5936296 -0.95208097 -0.9220369

```



```

-0.97138095 -0.60908556  0.12043028 -0.9750198  -0.7868729  -0.9735577
 0.6219807   0.55584866  0.56716317  0.55619943  0.5554465   0.56435215
 0.5595437   0.6700722   0.5676378   0.5667323   0.5567737   0.5559373
 0.56996655  0.63123703  0.5705872   0.55526114  0.57224894  0.56813824
 0.55570066  0.67185146  0.5698774   0.5562021   0.56988364  0.5576967
 0.5560149   0.59071034  0.5746072   0.563393    0.56329167  0.5613775
 0.6041486   0.5578504   0.5626705   0.560906    0.5753761   0.5559651
 0.55558187  0.5667233   0.55743504  0.5689748 ]
160/160 [=====] - 0s 2ms/step

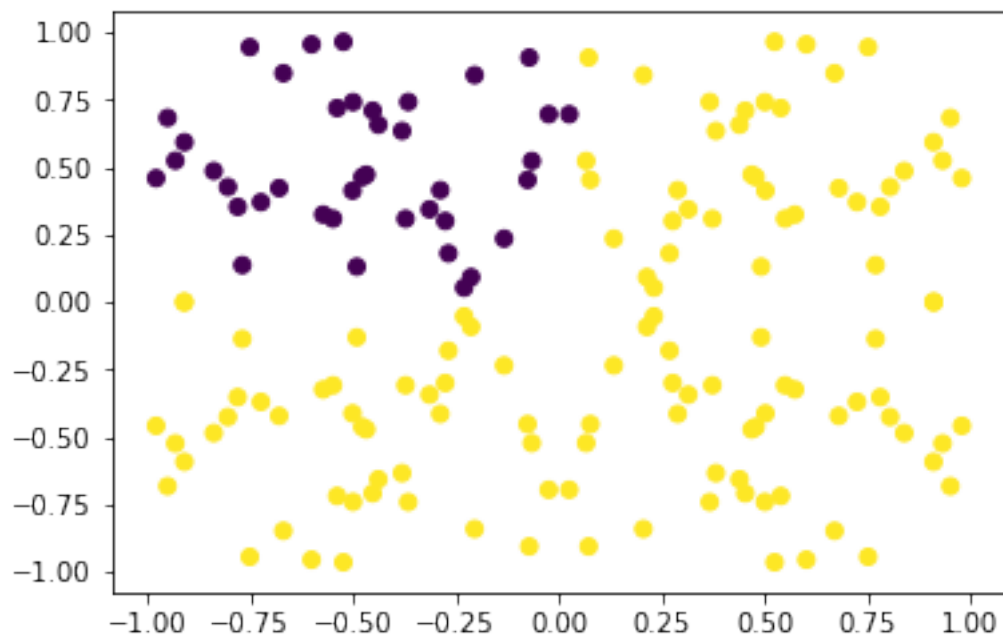
```

```
In [90]: scores, model.metrics_names
```

```
Out[90]: (0.3884660929441452, ['loss'])
```

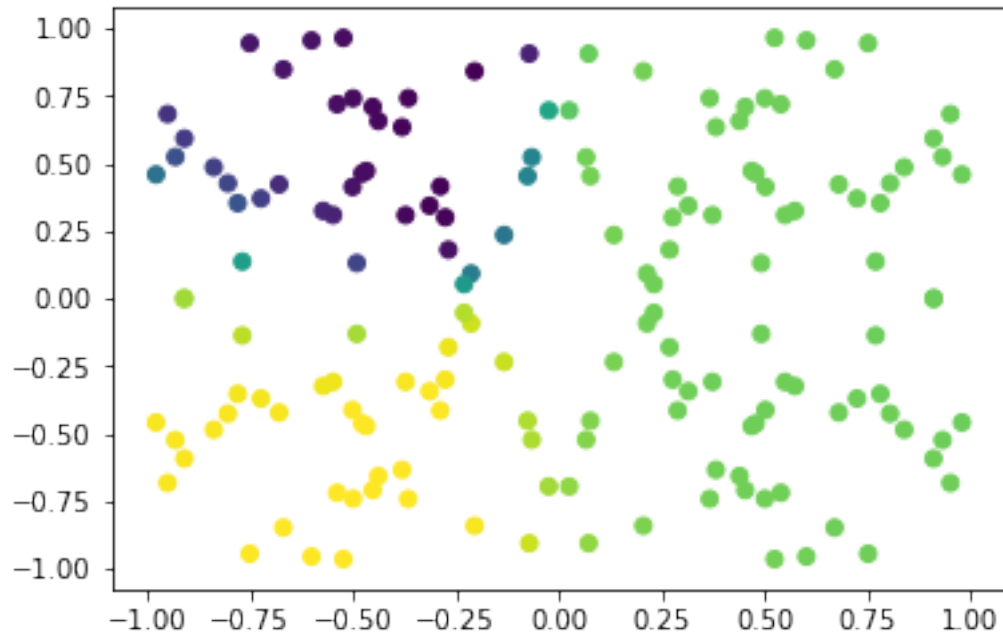
```
In [91]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[91]: <matplotlib.collections.PathCollection at 0xb2bea49e8>
```



```
In [92]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[92]: <matplotlib.collections.PathCollection at 0x107433da0>
```



```
In [93]: # Using tanh for 3 neuron
model = Sequential()

model.add(Dense(3, input_dim=2, activation='tanh'))
model.add(Dense(3, activation='tanh'))
model.add(Dense(3, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 7ms/step - loss: 2.3988
Epoch 2/400
160/160 [=====] - 0s 860us/step - loss: 0.7055
Epoch 3/400
160/160 [=====] - 0s 831us/step - loss: 0.6699
Epoch 4/400
160/160 [=====] - 0s 842us/step - loss: 0.6280
```

Epoch 5/400
160/160 [=====] - 0s 790us/step - loss: 0.5745
Epoch 6/400
160/160 [=====] - 0s 835us/step - loss: 0.5114
Epoch 7/400
160/160 [=====] - 0s 787us/step - loss: 0.4571
Epoch 8/400
160/160 [=====] - 0s 818us/step - loss: 0.3946
Epoch 9/400
160/160 [=====] - 0s 800us/step - loss: 0.4896
Epoch 10/400
160/160 [=====] - 0s 760us/step - loss: 0.4966
Epoch 11/400
160/160 [=====] - 0s 904us/step - loss: 0.3384
Epoch 12/400
160/160 [=====] - 0s 794us/step - loss: 0.5490
Epoch 13/400
160/160 [=====] - 0s 750us/step - loss: 0.2840
Epoch 14/400
160/160 [=====] - 0s 756us/step - loss: 0.2688
Epoch 15/400
160/160 [=====] - 0s 761us/step - loss: 0.2522
Epoch 16/400
160/160 [=====] - 0s 793us/step - loss: 0.2240
Epoch 17/400
160/160 [=====] - 0s 790us/step - loss: 1.0310
Epoch 18/400
160/160 [=====] - 0s 798us/step - loss: 0.6616
Epoch 19/400
160/160 [=====] - 0s 796us/step - loss: 0.3615
Epoch 20/400
160/160 [=====] - 0s 704us/step - loss: 0.2803
Epoch 21/400
160/160 [=====] - 0s 746us/step - loss: 0.2107
Epoch 22/400
160/160 [=====] - 0s 710us/step - loss: 0.1994
Epoch 23/400
160/160 [=====] - 0s 704us/step - loss: 0.1964
Epoch 24/400
160/160 [=====] - 0s 721us/step - loss: 0.1953
Epoch 25/400
160/160 [=====] - 0s 809us/step - loss: 0.1903
Epoch 26/400
160/160 [=====] - 0s 758us/step - loss: 0.1967
Epoch 27/400
160/160 [=====] - 0s 752us/step - loss: 0.1799
Epoch 28/400
160/160 [=====] - 0s 785us/step - loss: 0.1807

Epoch 29/400
160/160 [=====] - 0s 799us/step - loss: 0.1759
Epoch 30/400
160/160 [=====] - 0s 772us/step - loss: 0.1557
Epoch 31/400
160/160 [=====] - 0s 787us/step - loss: 0.2619
Epoch 32/400
160/160 [=====] - 0s 797us/step - loss: 0.2704
Epoch 33/400
160/160 [=====] - 0s 783us/step - loss: 0.2512
Epoch 34/400
160/160 [=====] - 0s 849us/step - loss: 0.7847
Epoch 35/400
160/160 [=====] - 0s 779us/step - loss: 0.5407
Epoch 36/400
160/160 [=====] - 0s 877us/step - loss: 2.0678
Epoch 37/400
160/160 [=====] - 0s 825us/step - loss: 7.9712
Epoch 38/400
160/160 [=====] - 0s 752us/step - loss: 7.9712
Epoch 39/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 40/400
160/160 [=====] - 0s 684us/step - loss: 7.9712
Epoch 41/400
160/160 [=====] - 0s 773us/step - loss: 7.9712
Epoch 42/400
160/160 [=====] - 0s 772us/step - loss: 7.9712
Epoch 43/400
160/160 [=====] - 0s 758us/step - loss: 7.9712
Epoch 44/400
160/160 [=====] - 0s 770us/step - loss: 7.9712
Epoch 45/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 46/400
160/160 [=====] - 0s 696us/step - loss: 7.9712
Epoch 47/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 48/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 49/400
160/160 [=====] - 0s 808us/step - loss: 7.9712
Epoch 50/400
160/160 [=====] - 0s 829us/step - loss: 7.9712
Epoch 51/400
160/160 [=====] - 0s 720us/step - loss: 7.9712
Epoch 52/400
160/160 [=====] - 0s 727us/step - loss: 7.9712

Epoch 53/400
160/160 [=====] - 0s 750us/step - loss: 7.9712
Epoch 54/400
160/160 [=====] - 0s 875us/step - loss: 7.9712
Epoch 55/400
160/160 [=====] - 0s 795us/step - loss: 7.9712
Epoch 56/400
160/160 [=====] - 0s 665us/step - loss: 7.9712
Epoch 57/400
160/160 [=====] - 0s 831us/step - loss: 7.9712
Epoch 58/400
160/160 [=====] - 0s 885us/step - loss: 7.9712
Epoch 59/400
160/160 [=====] - 0s 832us/step - loss: 7.9712
Epoch 60/400
160/160 [=====] - 0s 833us/step - loss: 7.9712
Epoch 61/400
160/160 [=====] - 0s 815us/step - loss: 7.9712
Epoch 62/400
160/160 [=====] - 0s 776us/step - loss: 7.9712
Epoch 63/400
160/160 [=====] - 0s 785us/step - loss: 7.9712
Epoch 64/400
160/160 [=====] - 0s 774us/step - loss: 7.9712
Epoch 65/400
160/160 [=====] - 0s 805us/step - loss: 7.9712
Epoch 66/400
160/160 [=====] - 0s 814us/step - loss: 7.9712
Epoch 67/400
160/160 [=====] - 0s 906us/step - loss: 7.9712
Epoch 68/400
160/160 [=====] - 0s 877us/step - loss: 7.9712
Epoch 69/400
160/160 [=====] - 0s 895us/step - loss: 7.9712
Epoch 70/400
160/160 [=====] - 0s 661us/step - loss: 7.9712
Epoch 71/400
160/160 [=====] - 0s 706us/step - loss: 7.9712
Epoch 72/400
160/160 [=====] - 0s 880us/step - loss: 7.9712
Epoch 73/400
160/160 [=====] - 0s 868us/step - loss: 7.9712
Epoch 74/400
160/160 [=====] - 0s 868us/step - loss: 7.9712
Epoch 75/400
160/160 [=====] - 0s 866us/step - loss: 7.9712
Epoch 76/400
160/160 [=====] - 0s 871us/step - loss: 7.9712

Epoch 77/400
160/160 [=====] - 0s 889us/step - loss: 7.9712
Epoch 78/400
160/160 [=====] - 0s 854us/step - loss: 7.9712
Epoch 79/400
160/160 [=====] - 0s 960us/step - loss: 7.9712
Epoch 80/400
160/160 [=====] - 0s 974us/step - loss: 7.9712
Epoch 81/400
160/160 [=====] - 0s 927us/step - loss: 7.9712
Epoch 82/400
160/160 [=====] - 0s 960us/step - loss: 7.9712
Epoch 83/400
160/160 [=====] - 0s 887us/step - loss: 7.9712
Epoch 84/400
160/160 [=====] - 0s 808us/step - loss: 7.9712
Epoch 85/400
160/160 [=====] - 0s 841us/step - loss: 7.9712
Epoch 86/400
160/160 [=====] - 0s 860us/step - loss: 7.9712
Epoch 87/400
160/160 [=====] - 0s 851us/step - loss: 7.9712
Epoch 88/400
160/160 [=====] - 0s 876us/step - loss: 7.9712
Epoch 89/400
160/160 [=====] - 0s 864us/step - loss: 7.9712
Epoch 90/400
160/160 [=====] - 0s 889us/step - loss: 7.9712
Epoch 91/400
160/160 [=====] - 0s 929us/step - loss: 7.9712
Epoch 92/400
160/160 [=====] - 0s 863us/step - loss: 7.9712
Epoch 93/400
160/160 [=====] - 0s 835us/step - loss: 7.9712
Epoch 94/400
160/160 [=====] - 0s 762us/step - loss: 7.9712
Epoch 95/400
160/160 [=====] - 0s 880us/step - loss: 7.9712
Epoch 96/400
160/160 [=====] - 0s 876us/step - loss: 7.9712
Epoch 97/400
160/160 [=====] - 0s 771us/step - loss: 7.9712
Epoch 98/400
160/160 [=====] - 0s 795us/step - loss: 7.9712
Epoch 99/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 100/400
160/160 [=====] - 0s 674us/step - loss: 7.9712

Epoch 101/400
160/160 [=====] - 0s 683us/step - loss: 7.9712
Epoch 102/400
160/160 [=====] - 0s 731us/step - loss: 7.9712
Epoch 103/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 104/400
160/160 [=====] - 0s 723us/step - loss: 7.9712
Epoch 105/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 106/400
160/160 [=====] - 0s 719us/step - loss: 7.9712
Epoch 107/400
160/160 [=====] - 0s 700us/step - loss: 7.9712
Epoch 108/400
160/160 [=====] - 0s 707us/step - loss: 7.9712
Epoch 109/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 110/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 111/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 112/400
160/160 [=====] - 0s 718us/step - loss: 7.9712
Epoch 113/400
160/160 [=====] - 0s 710us/step - loss: 7.9712
Epoch 114/400
160/160 [=====] - 0s 720us/step - loss: 7.9712
Epoch 115/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 116/400
160/160 [=====] - 0s 673us/step - loss: 7.9712
Epoch 117/400
160/160 [=====] - 0s 647us/step - loss: 7.9712
Epoch 118/400
160/160 [=====] - 0s 672us/step - loss: 7.9712
Epoch 119/400
160/160 [=====] - 0s 694us/step - loss: 7.9712
Epoch 120/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 121/400
160/160 [=====] - 0s 695us/step - loss: 7.9712
Epoch 122/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 123/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 124/400
160/160 [=====] - 0s 720us/step - loss: 7.9712

Epoch 125/400
160/160 [=====] - 0s 729us/step - loss: 7.9712
Epoch 126/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 127/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 128/400
160/160 [=====] - 0s 709us/step - loss: 7.9712
Epoch 129/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 130/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 131/400
160/160 [=====] - 0s 693us/step - loss: 7.9712
Epoch 132/400
160/160 [=====] - 0s 726us/step - loss: 7.9712
Epoch 133/400
160/160 [=====] - 0s 699us/step - loss: 7.9712
Epoch 134/400
160/160 [=====] - 0s 665us/step - loss: 7.9712
Epoch 135/400
160/160 [=====] - 0s 676us/step - loss: 7.9712
Epoch 136/400
160/160 [=====] - 0s 671us/step - loss: 7.9712
Epoch 137/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 138/400
160/160 [=====] - 0s 700us/step - loss: 7.9712
Epoch 139/400
160/160 [=====] - 0s 691us/step - loss: 7.9712
Epoch 140/400
160/160 [=====] - 0s 708us/step - loss: 7.9712
Epoch 141/400
160/160 [=====] - 0s 705us/step - loss: 7.9712
Epoch 142/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 143/400
160/160 [=====] - 0s 738us/step - loss: 7.9712
Epoch 144/400
160/160 [=====] - 0s 773us/step - loss: 7.9712
Epoch 145/400
160/160 [=====] - 0s 688us/step - loss: 7.9712
Epoch 146/400
160/160 [=====] - 0s 709us/step - loss: 7.9712
Epoch 147/400
160/160 [=====] - 0s 745us/step - loss: 7.9712
Epoch 148/400
160/160 [=====] - 0s 675us/step - loss: 7.9712

Epoch 149/400
160/160 [=====] - 0s 675us/step - loss: 7.9712
Epoch 150/400
160/160 [=====] - 0s 707us/step - loss: 7.9712
Epoch 151/400
160/160 [=====] - 0s 729us/step - loss: 7.9712
Epoch 152/400
160/160 [=====] - 0s 709us/step - loss: 7.9712
Epoch 153/400
160/160 [=====] - 0s 667us/step - loss: 7.9712
Epoch 154/400
160/160 [=====] - 0s 695us/step - loss: 7.9712
Epoch 155/400
160/160 [=====] - 0s 722us/step - loss: 7.9712
Epoch 156/400
160/160 [=====] - 0s 706us/step - loss: 7.9712
Epoch 157/400
160/160 [=====] - 0s 696us/step - loss: 7.9712
Epoch 158/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 159/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 160/400
160/160 [=====] - 0s 726us/step - loss: 7.9712
Epoch 161/400
160/160 [=====] - 0s 705us/step - loss: 7.9712
Epoch 162/400
160/160 [=====] - 0s 723us/step - loss: 7.9712
Epoch 163/400
160/160 [=====] - 0s 708us/step - loss: 7.9712
Epoch 164/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 165/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 166/400
160/160 [=====] - 0s 718us/step - loss: 7.9712
Epoch 167/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 168/400
160/160 [=====] - 0s 707us/step - loss: 7.9712
Epoch 169/400
160/160 [=====] - 0s 689us/step - loss: 7.9712
Epoch 170/400
160/160 [=====] - 0s 667us/step - loss: 7.9712
Epoch 171/400
160/160 [=====] - 0s 682us/step - loss: 7.9712
Epoch 172/400
160/160 [=====] - 0s 705us/step - loss: 7.9712

Epoch 173/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 174/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 175/400
160/160 [=====] - 0s 706us/step - loss: 7.9712
Epoch 176/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 177/400
160/160 [=====] - 0s 707us/step - loss: 7.9712
Epoch 178/400
160/160 [=====] - 0s 697us/step - loss: 7.9712
Epoch 179/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 180/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 181/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 182/400
160/160 [=====] - 0s 684us/step - loss: 7.9712
Epoch 183/400
160/160 [=====] - 0s 680us/step - loss: 7.9712
Epoch 184/400
160/160 [=====] - 0s 727us/step - loss: 7.9712
Epoch 185/400
160/160 [=====] - 0s 698us/step - loss: 7.9712
Epoch 186/400
160/160 [=====] - 0s 726us/step - loss: 7.9712
Epoch 187/400
160/160 [=====] - 0s 664us/step - loss: 7.9712
Epoch 188/400
160/160 [=====] - 0s 670us/step - loss: 7.9712
Epoch 189/400
160/160 [=====] - 0s 690us/step - loss: 7.9712
Epoch 190/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 191/400
160/160 [=====] - 0s 707us/step - loss: 7.9712
Epoch 192/400
160/160 [=====] - 0s 743us/step - loss: 7.9712
Epoch 193/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 194/400
160/160 [=====] - 0s 731us/step - loss: 7.9712
Epoch 195/400
160/160 [=====] - 0s 706us/step - loss: 7.9712
Epoch 196/400
160/160 [=====] - 0s 716us/step - loss: 7.9712

Epoch 197/400
160/160 [=====] - 0s 719us/step - loss: 7.9712
Epoch 198/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 199/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 200/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 201/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 202/400
160/160 [=====] - 0s 709us/step - loss: 7.9712
Epoch 203/400
160/160 [=====] - 0s 713us/step - loss: 7.9712
Epoch 204/400
160/160 [=====] - 0s 685us/step - loss: 7.9712
Epoch 205/400
160/160 [=====] - 0s 667us/step - loss: 7.9712
Epoch 206/400
160/160 [=====] - 0s 675us/step - loss: 7.9712
Epoch 207/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 208/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 209/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 210/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 211/400
160/160 [=====] - 0s 708us/step - loss: 7.9712
Epoch 212/400
160/160 [=====] - 0s 713us/step - loss: 7.9712
Epoch 213/400
160/160 [=====] - 0s 713us/step - loss: 7.9712
Epoch 214/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 215/400
160/160 [=====] - 0s 725us/step - loss: 7.9712
Epoch 216/400
160/160 [=====] - 0s 714us/step - loss: 7.9712
Epoch 217/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 218/400
160/160 [=====] - 0s 723us/step - loss: 7.9712
Epoch 219/400
160/160 [=====] - 0s 709us/step - loss: 7.9712
Epoch 220/400
160/160 [=====] - 0s 698us/step - loss: 7.9712

Epoch 221/400
160/160 [=====] - 0s 718us/step - loss: 7.9712
Epoch 222/400
160/160 [=====] - 0s 654us/step - loss: 7.9712
Epoch 223/400
160/160 [=====] - 0s 664us/step - loss: 7.9712
Epoch 224/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 225/400
160/160 [=====] - 0s 708us/step - loss: 7.9712
Epoch 226/400
160/160 [=====] - 0s 698us/step - loss: 7.9712
Epoch 227/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 228/400
160/160 [=====] - 0s 705us/step - loss: 7.9712
Epoch 229/400
160/160 [=====] - 0s 694us/step - loss: 7.9712
Epoch 230/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 231/400
160/160 [=====] - 0s 720us/step - loss: 7.9712
Epoch 232/400
160/160 [=====] - 0s 688us/step - loss: 7.9712
Epoch 233/400
160/160 [=====] - 0s 734us/step - loss: 7.9712
Epoch 234/400
160/160 [=====] - 0s 729us/step - loss: 7.9712
Epoch 235/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 236/400
160/160 [=====] - 0s 699us/step - loss: 7.9712
Epoch 237/400
160/160 [=====] - 0s 733us/step - loss: 7.9712
Epoch 238/400
160/160 [=====] - 0s 700us/step - loss: 7.9712
Epoch 239/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 240/400
160/160 [=====] - 0s 656us/step - loss: 7.9712
Epoch 241/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 242/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 243/400
160/160 [=====] - 0s 693us/step - loss: 7.9712
Epoch 244/400
160/160 [=====] - 0s 722us/step - loss: 7.9712

Epoch 245/400
160/160 [=====] - 0s 759us/step - loss: 7.9712
Epoch 246/400
160/160 [=====] - 0s 729us/step - loss: 7.9712
Epoch 247/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 248/400
160/160 [=====] - 0s 760us/step - loss: 7.9712
Epoch 249/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 250/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 251/400
160/160 [=====] - 0s 720us/step - loss: 7.9712
Epoch 252/400
160/160 [=====] - 0s 697us/step - loss: 7.9712
Epoch 253/400
160/160 [=====] - 0s 700us/step - loss: 7.9712
Epoch 254/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 255/400
160/160 [=====] - 0s 706us/step - loss: 7.9712
Epoch 256/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 257/400
160/160 [=====] - 0s 648us/step - loss: 7.9712
Epoch 258/400
160/160 [=====] - 0s 672us/step - loss: 7.9712
Epoch 259/400
160/160 [=====] - 0s 680us/step - loss: 7.9712
Epoch 260/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 261/400
160/160 [=====] - 0s 719us/step - loss: 7.9712
Epoch 262/400
160/160 [=====] - 0s 705us/step - loss: 7.9712
Epoch 263/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 264/400
160/160 [=====] - 0s 707us/step - loss: 7.9712
Epoch 265/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 266/400
160/160 [=====] - 0s 697us/step - loss: 7.9712
Epoch 267/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 268/400
160/160 [=====] - 0s 698us/step - loss: 7.9712

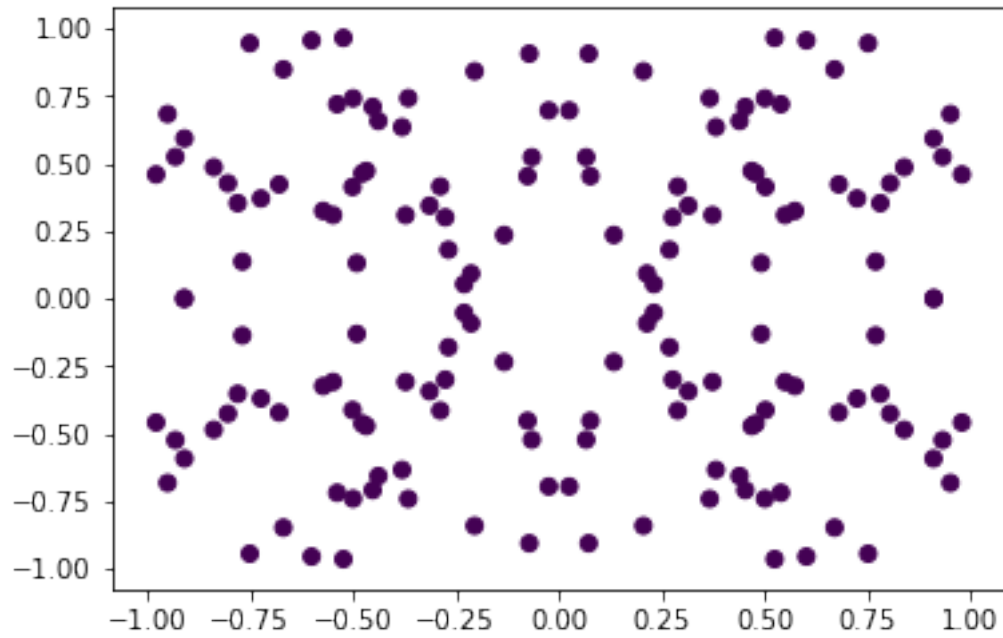
Epoch 269/400
160/160 [=====] - 0s 697us/step - loss: 7.9712
Epoch 270/400
160/160 [=====] - 0s 684us/step - loss: 7.9712
Epoch 271/400
160/160 [=====] - 0s 693us/step - loss: 7.9712
Epoch 272/400
160/160 [=====] - 0s 691us/step - loss: 7.9712
Epoch 273/400
160/160 [=====] - 0s 693us/step - loss: 7.9712
Epoch 274/400
160/160 [=====] - 0s 698us/step - loss: 7.9712
Epoch 275/400
160/160 [=====] - 0s 690us/step - loss: 7.9712
Epoch 276/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 277/400
160/160 [=====] - 0s 689us/step - loss: 7.9712
Epoch 278/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 279/400
160/160 [=====] - 0s 710us/step - loss: 7.9712
Epoch 280/400
160/160 [=====] - 0s 721us/step - loss: 7.9712
Epoch 281/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 282/400
160/160 [=====] - 0s 714us/step - loss: 7.9712
Epoch 283/400
160/160 [=====] - 0s 692us/step - loss: 7.9712
Epoch 284/400
160/160 [=====] - 0s 700us/step - loss: 7.9712
Epoch 285/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 286/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 287/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 288/400
160/160 [=====] - 0s 724us/step - loss: 7.9712
Epoch 289/400
160/160 [=====] - 0s 750us/step - loss: 7.9712
Epoch 290/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 291/400
160/160 [=====] - 0s 722us/step - loss: 7.9712
Epoch 292/400
160/160 [=====] - 0s 682us/step - loss: 7.9712

Epoch 293/400
160/160 [=====] - 0s 640us/step - loss: 7.9712
Epoch 294/400
160/160 [=====] - 0s 641us/step - loss: 7.9712
Epoch 295/400
160/160 [=====] - 0s 681us/step - loss: 7.9712
Epoch 296/400
160/160 [=====] - 0s 718us/step - loss: 7.9712
Epoch 297/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 298/400
160/160 [=====] - 0s 725us/step - loss: 7.9712
Epoch 299/400
160/160 [=====] - 0s 718us/step - loss: 7.9712
Epoch 300/400
160/160 [=====] - 0s 724us/step - loss: 7.9712
Epoch 301/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 302/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 303/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 304/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 305/400
160/160 [=====] - 0s 706us/step - loss: 7.9712
Epoch 306/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 307/400
160/160 [=====] - 0s 714us/step - loss: 7.9712
Epoch 308/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 309/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 310/400
160/160 [=====] - 0s 661us/step - loss: 7.9712
Epoch 311/400
160/160 [=====] - 0s 660us/step - loss: 7.9712
Epoch 312/400
160/160 [=====] - 0s 743us/step - loss: 7.9712
Epoch 313/400
160/160 [=====] - 0s 709us/step - loss: 7.9712
Epoch 314/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 315/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 316/400
160/160 [=====] - 0s 726us/step - loss: 7.9712

Epoch 317/400
160/160 [=====] - 0s 711us/step - loss: 7.9712
Epoch 318/400
160/160 [=====] - 0s 686us/step - loss: 7.9712
Epoch 319/400
160/160 [=====] - 0s 677us/step - loss: 7.9712
Epoch 320/400
160/160 [=====] - 0s 686us/step - loss: 7.9712
Epoch 321/400
160/160 [=====] - 0s 729us/step - loss: 7.9712
Epoch 322/400
160/160 [=====] - 0s 723us/step - loss: 7.9712
Epoch 323/400
160/160 [=====] - 0s 715us/step - loss: 7.9712
Epoch 324/400
160/160 [=====] - 0s 710us/step - loss: 7.9712
Epoch 325/400
160/160 [=====] - 0s 682us/step - loss: 7.9712
Epoch 326/400
160/160 [=====] - 0s 695us/step - loss: 7.9712
Epoch 327/400
160/160 [=====] - 0s 699us/step - loss: 7.9712
Epoch 328/400
160/160 [=====] - 0s 684us/step - loss: 7.9712
Epoch 329/400
160/160 [=====] - 0s 665us/step - loss: 7.9712
Epoch 330/400
160/160 [=====] - 0s 699us/step - loss: 7.9712
Epoch 331/400
160/160 [=====] - 0s 705us/step - loss: 7.9712
Epoch 332/400
160/160 [=====] - 0s 707us/step - loss: 7.9712
Epoch 333/400
160/160 [=====] - 0s 698us/step - loss: 7.9712
Epoch 334/400
160/160 [=====] - 0s 710us/step - loss: 7.9712
Epoch 335/400
160/160 [=====] - 0s 700us/step - loss: 7.9712
Epoch 336/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 337/400
160/160 [=====] - 0s 714us/step - loss: 7.9712
Epoch 338/400
160/160 [=====] - 0s 708us/step - loss: 7.9712
Epoch 339/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 340/400
160/160 [=====] - 0s 704us/step - loss: 7.9712

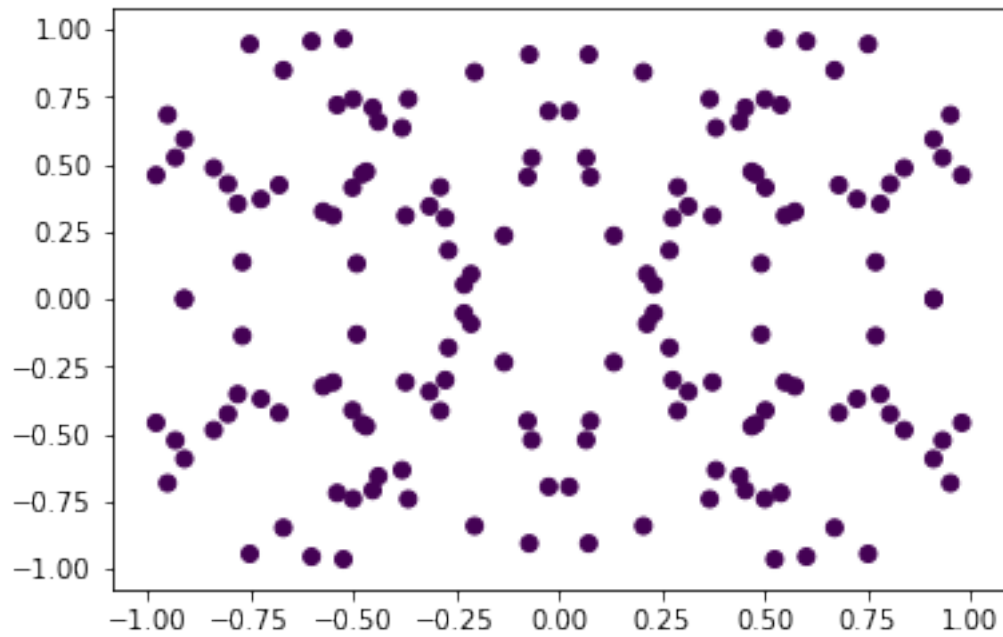
Epoch 341/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 342/400
160/160 [=====] - 0s 709us/step - loss: 7.9712
Epoch 343/400
160/160 [=====] - 0s 722us/step - loss: 7.9712
Epoch 344/400
160/160 [=====] - 0s 675us/step - loss: 7.9712
Epoch 345/400
160/160 [=====] - 0s 638us/step - loss: 7.9712
Epoch 346/400
160/160 [=====] - 0s 635us/step - loss: 7.9712
Epoch 347/400
160/160 [=====] - 0s 663us/step - loss: 7.9712
Epoch 348/400
160/160 [=====] - 0s 693us/step - loss: 7.9712
Epoch 349/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 350/400
160/160 [=====] - 0s 717us/step - loss: 7.9712
Epoch 351/400
160/160 [=====] - 0s 733us/step - loss: 7.9712
Epoch 352/400
160/160 [=====] - 0s 710us/step - loss: 7.9712
Epoch 353/400
160/160 [=====] - 0s 759us/step - loss: 7.9712
Epoch 354/400
160/160 [=====] - 0s 697us/step - loss: 7.9712
Epoch 355/400
160/160 [=====] - 0s 712us/step - loss: 7.9712
Epoch 356/400
160/160 [=====] - 0s 723us/step - loss: 7.9712
Epoch 357/400
160/160 [=====] - 0s 697us/step - loss: 7.9712
Epoch 358/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 359/400
160/160 [=====] - 0s 731us/step - loss: 7.9712
Epoch 360/400
160/160 [=====] - 0s 707us/step - loss: 7.9712
Epoch 361/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 362/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 363/400
160/160 [=====] - 0s 667us/step - loss: 7.9712
Epoch 364/400
160/160 [=====] - 0s 668us/step - loss: 7.9712

Epoch 365/400
160/160 [=====] - 0s 664us/step - loss: 7.9712
Epoch 366/400
160/160 [=====] - 0s 724us/step - loss: 7.9712
Epoch 367/400
160/160 [=====] - 0s 741us/step - loss: 7.9712
Epoch 368/400
160/160 [=====] - 0s 912us/step - loss: 7.9712
Epoch 369/400
160/160 [=====] - 0s 868us/step - loss: 7.9712
Epoch 370/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 371/400
160/160 [=====] - 0s 841us/step - loss: 7.9712
Epoch 372/400
160/160 [=====] - 0s 696us/step - loss: 7.9712
Epoch 373/400
160/160 [=====] - 0s 727us/step - loss: 7.9712
Epoch 374/400
160/160 [=====] - 0s 921us/step - loss: 7.9712
Epoch 375/400
160/160 [=====] - 0s 902us/step - loss: 7.9712
Epoch 376/400
160/160 [=====] - 0s 876us/step - loss: 7.9712
Epoch 377/400
160/160 [=====] - 0s 884us/step - loss: 7.9712
Epoch 378/400
160/160 [=====] - 0s 860us/step - loss: 7.9712
Epoch 379/400
160/160 [=====] - 0s 855us/step - loss: 7.9712
Epoch 380/400
160/160 [=====] - 0s 889us/step - loss: 7.9712
Epoch 381/400
160/160 [=====] - 0s 898us/step - loss: 7.9712
Epoch 382/400
160/160 [=====] - 0s 884us/step - loss: 7.9712
Epoch 383/400
160/160 [=====] - 0s 885us/step - loss: 7.9712
Epoch 384/400
160/160 [=====] - 0s 886us/step - loss: 7.9712
Epoch 385/400
160/160 [=====] - 0s 866us/step - loss: 7.9712
Epoch 386/400
160/160 [=====] - 0s 873us/step - loss: 7.9712
Epoch 387/400
160/160 [=====] - 0s 842us/step - loss: 7.9712
Epoch 388/400
160/160 [=====] - 0s 718us/step - loss: 7.9712



```
In [96]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[96]: <matplotlib.collections.PathCollection at 0xb2850ab00>
```



```

In [97]: # Using tanh for 3 neuron
         model = Sequential()

         model.add(Dense(3, input_dim=2, activation='tanh'))
         model.add(Dense(3, activation='tanh'))
         model.add(Dense(3, activation='tanh'))
         model.add(Dense(3, activation='tanh'))

         # The output has 1 neuron for predicting whatever we are iterating
         model.add(Dense(1, activation='tanh'))

         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))

         scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 6ms/step - loss: 1.2784
Epoch 2/400
160/160 [=====] - 0s 724us/step - loss: 0.6493
Epoch 3/400
160/160 [=====] - 0s 759us/step - loss: 0.6120
Epoch 4/400
160/160 [=====] - 0s 709us/step - loss: 0.5997
Epoch 5/400
160/160 [=====] - 0s 726us/step - loss: 0.5780
Epoch 6/400
160/160 [=====] - 0s 698us/step - loss: 0.5580
Epoch 7/400
160/160 [=====] - 0s 660us/step - loss: 0.5336
Epoch 8/400
160/160 [=====] - 0s 664us/step - loss: 0.5036
Epoch 9/400
160/160 [=====] - 0s 700us/step - loss: 0.4679
Epoch 10/400
160/160 [=====] - 0s 785us/step - loss: 0.5106
Epoch 11/400
160/160 [=====] - 0s 764us/step - loss: 0.4502
Epoch 12/400
160/160 [=====] - 0s 823us/step - loss: 0.3972
Epoch 13/400
160/160 [=====] - 0s 889us/step - loss: 0.4481
Epoch 14/400
160/160 [=====] - 0s 896us/step - loss: 0.4474
Epoch 15/400

```

```

160/160 [=====] - 0s 895us/step - loss: 0.3671
Epoch 16/400
160/160 [=====] - 0s 896us/step - loss: 0.3694
Epoch 17/400
160/160 [=====] - 0s 917us/step - loss: 0.5044
Epoch 18/400
160/160 [=====] - 0s 802us/step - loss: 0.4882
Epoch 19/400
160/160 [=====] - 0s 938us/step - loss: 0.3561
Epoch 20/400
160/160 [=====] - 0s 917us/step - loss: 0.3843
Epoch 21/400
160/160 [=====] - 0s 900us/step - loss: 0.3523
Epoch 22/400
160/160 [=====] - 0s 887us/step - loss: 0.3344
Epoch 23/400
160/160 [=====] - 0s 919us/step - loss: 0.4722
Epoch 24/400
160/160 [=====] - 0s 954us/step - loss: 0.4575
Epoch 25/400
160/160 [=====] - 0s 892us/step - loss: 0.3864
Epoch 26/400
160/160 [=====] - 0s 795us/step - loss: 0.4202
Epoch 27/400
160/160 [=====] - 0s 818us/step - loss: 0.4934
Epoch 28/400
160/160 [=====] - 0s 768us/step - loss: 0.4932
Epoch 29/400
160/160 [=====] - 0s 756us/step - loss: 0.4348
Epoch 30/400
160/160 [=====] - 0s 737us/step - loss: 0.3619
Epoch 31/400
160/160 [=====] - 0s 766us/step - loss: 0.4925
Epoch 32/400
160/160 [=====] - 0s 775us/step - loss: 1.7793
Epoch 33/400
160/160 [=====] - 0s 930us/step - loss: 0.9421
Epoch 34/400
160/160 [=====] - 0s 860us/step - loss: 0.6837
Epoch 35/400
160/160 [=====] - 0s 937us/step - loss: 0.6733
Epoch 36/400
160/160 [=====] - 0s 917us/step - loss: 0.6676
Epoch 37/400
160/160 [=====] - 0s 874us/step - loss: 0.6488
Epoch 38/400
160/160 [=====] - 0s 890us/step - loss: 0.6338
Epoch 39/400

```

160/160 [=====] - 0s 923us/step - loss: 0.6070
Epoch 40/400
160/160 [=====] - 0s 904us/step - loss: 0.6115
Epoch 41/400
160/160 [=====] - 0s 913us/step - loss: 0.5909
Epoch 42/400
160/160 [=====] - 0s 899us/step - loss: 0.5979
Epoch 43/400
160/160 [=====] - 0s 909us/step - loss: 0.5938
Epoch 44/400
160/160 [=====] - 0s 912us/step - loss: 0.6770
Epoch 45/400
160/160 [=====] - 0s 839us/step - loss: 0.5898
Epoch 46/400
160/160 [=====] - 0s 843us/step - loss: 0.5974
Epoch 47/400
160/160 [=====] - 0s 768us/step - loss: 0.5780
Epoch 48/400
160/160 [=====] - 0s 832us/step - loss: 0.5908
Epoch 49/400
160/160 [=====] - 0s 1ms/step - loss: 0.5764
Epoch 50/400
160/160 [=====] - 0s 872us/step - loss: 0.6483
Epoch 51/400
160/160 [=====] - 0s 715us/step - loss: 0.7994
Epoch 52/400
160/160 [=====] - 0s 722us/step - loss: 0.6078
Epoch 53/400
160/160 [=====] - 0s 770us/step - loss: 0.5629
Epoch 54/400
160/160 [=====] - 0s 754us/step - loss: 0.5380
Epoch 55/400
160/160 [=====] - 0s 893us/step - loss: 0.5456
Epoch 56/400
160/160 [=====] - 0s 894us/step - loss: 0.5207
Epoch 57/400
160/160 [=====] - 0s 906us/step - loss: 0.5090
Epoch 58/400
160/160 [=====] - 0s 865us/step - loss: 0.4929
Epoch 59/400
160/160 [=====] - 0s 949us/step - loss: 0.4944
Epoch 60/400
160/160 [=====] - 0s 919us/step - loss: 0.4851
Epoch 61/400
160/160 [=====] - 0s 946us/step - loss: 0.4910
Epoch 62/400
160/160 [=====] - 0s 921us/step - loss: 0.4715
Epoch 63/400

160/160 [=====] - 0s 832us/step - loss: 0.4562
Epoch 64/400
160/160 [=====] - 0s 837us/step - loss: 0.4548
Epoch 65/400
160/160 [=====] - 0s 791us/step - loss: 0.4430
Epoch 66/400
160/160 [=====] - 0s 710us/step - loss: 0.4231
Epoch 67/400
160/160 [=====] - 0s 674us/step - loss: 0.4003
Epoch 68/400
160/160 [=====] - 0s 766us/step - loss: 0.3407
Epoch 69/400
160/160 [=====] - 0s 732us/step - loss: 0.2667
Epoch 70/400
160/160 [=====] - 0s 734us/step - loss: 0.2162
Epoch 71/400
160/160 [=====] - 0s 767us/step - loss: 0.1808
Epoch 72/400
160/160 [=====] - 0s 747us/step - loss: 0.1555
Epoch 73/400
160/160 [=====] - 0s 789us/step - loss: 0.1406
Epoch 74/400
160/160 [=====] - 0s 744us/step - loss: 0.1477
Epoch 75/400
160/160 [=====] - 0s 735us/step - loss: 0.1218
Epoch 76/400
160/160 [=====] - 0s 745us/step - loss: 0.1512
Epoch 77/400
160/160 [=====] - 0s 750us/step - loss: 0.1163
Epoch 78/400
160/160 [=====] - 0s 734us/step - loss: 0.1174
Epoch 79/400
160/160 [=====] - 0s 740us/step - loss: 0.0982
Epoch 80/400
160/160 [=====] - 0s 731us/step - loss: 0.0950
Epoch 81/400
160/160 [=====] - 0s 808us/step - loss: 0.1970
Epoch 82/400
160/160 [=====] - 0s 930us/step - loss: 0.0924
Epoch 83/400
160/160 [=====] - 0s 978us/step - loss: 0.0872
Epoch 84/400
160/160 [=====] - 0s 918us/step - loss: 0.0987
Epoch 85/400
160/160 [=====] - 0s 911us/step - loss: 0.1451
Epoch 86/400
160/160 [=====] - 0s 950us/step - loss: 0.1058
Epoch 87/400

160/160 [=====] - 0s 967us/step - loss: 0.1079
Epoch 88/400
160/160 [=====] - 0s 964us/step - loss: 0.0867
Epoch 89/400
160/160 [=====] - 0s 919us/step - loss: 0.2557
Epoch 90/400
160/160 [=====] - 0s 783us/step - loss: 1.6071
Epoch 91/400
160/160 [=====] - 0s 746us/step - loss: 0.6564
Epoch 92/400
160/160 [=====] - 0s 767us/step - loss: 0.5521
Epoch 93/400
160/160 [=====] - 0s 731us/step - loss: 0.6407
Epoch 94/400
160/160 [=====] - 0s 881us/step - loss: 0.5596
Epoch 95/400
160/160 [=====] - 0s 923us/step - loss: 0.4774
Epoch 96/400
160/160 [=====] - 0s 787us/step - loss: 0.4606
Epoch 97/400
160/160 [=====] - 0s 767us/step - loss: 1.0041
Epoch 98/400
160/160 [=====] - 0s 714us/step - loss: 1.1757
Epoch 99/400
160/160 [=====] - 0s 724us/step - loss: 0.8280
Epoch 100/400
160/160 [=====] - 0s 779us/step - loss: 0.7308
Epoch 101/400
160/160 [=====] - 0s 973us/step - loss: 0.7024
Epoch 102/400
160/160 [=====] - 0s 907us/step - loss: 0.6576
Epoch 103/400
160/160 [=====] - 0s 767us/step - loss: 0.5573
Epoch 104/400
160/160 [=====] - 0s 773us/step - loss: 0.5096
Epoch 105/400
160/160 [=====] - 0s 774us/step - loss: 0.4973
Epoch 106/400
160/160 [=====] - 0s 748us/step - loss: 0.4862
Epoch 107/400
160/160 [=====] - 0s 752us/step - loss: 0.4764
Epoch 108/400
160/160 [=====] - 0s 727us/step - loss: 0.4658
Epoch 109/400
160/160 [=====] - 0s 748us/step - loss: 0.4565
Epoch 110/400
160/160 [=====] - 0s 757us/step - loss: 0.4551
Epoch 111/400

160/160 [=====] - 0s 761us/step - loss: 0.4424
 Epoch 112/400
 160/160 [=====] - 0s 677us/step - loss: 0.4378
 Epoch 113/400
 160/160 [=====] - 0s 688us/step - loss: 0.4397
 Epoch 114/400
 160/160 [=====] - 0s 681us/step - loss: 0.4292
 Epoch 115/400
 160/160 [=====] - 0s 729us/step - loss: 0.4199
 Epoch 116/400
 160/160 [=====] - 0s 748us/step - loss: 0.4213
 Epoch 117/400
 160/160 [=====] - 0s 735us/step - loss: 0.4349
 Epoch 118/400
 160/160 [=====] - 0s 733us/step - loss: 0.4220
 Epoch 119/400
 160/160 [=====] - 0s 744us/step - loss: 0.4216
 Epoch 120/400
 160/160 [=====] - 0s 746us/step - loss: 0.4159
 Epoch 121/400
 160/160 [=====] - 0s 720us/step - loss: 0.4143
 Epoch 122/400
 160/160 [=====] - 0s 739us/step - loss: 0.4177
 Epoch 123/400
 160/160 [=====] - 0s 752us/step - loss: 0.4111
 Epoch 124/400
 160/160 [=====] - 0s 737us/step - loss: 0.4116
 Epoch 125/400
 160/160 [=====] - 0s 732us/step - loss: 0.4082
 Epoch 126/400
 160/160 [=====] - 0s 744us/step - loss: 0.4047
 Epoch 127/400
 160/160 [=====] - 0s 733us/step - loss: 0.4084
 Epoch 128/400
 160/160 [=====] - 0s 735us/step - loss: 0.4036
 Epoch 129/400
 160/160 [=====] - 0s 690us/step - loss: 0.4058
 Epoch 130/400
 160/160 [=====] - 0s 711us/step - loss: 0.4014
 Epoch 131/400
 160/160 [=====] - 0s 679us/step - loss: 0.4008
 Epoch 132/400
 160/160 [=====] - 0s 728us/step - loss: 0.3962
 Epoch 133/400
 160/160 [=====] - 0s 749us/step - loss: 0.3979
 Epoch 134/400
 160/160 [=====] - 0s 734us/step - loss: 0.4107
 Epoch 135/400

160/160 [=====] - 0s 743us/step - loss: 0.3996
Epoch 136/400
160/160 [=====] - 0s 729us/step - loss: 0.3939
Epoch 137/400
160/160 [=====] - 0s 766us/step - loss: 0.3943
Epoch 138/400
160/160 [=====] - 0s 720us/step - loss: 0.4038
Epoch 139/400
160/160 [=====] - 0s 737us/step - loss: 0.3867
Epoch 140/400
160/160 [=====] - 0s 766us/step - loss: 0.3968
Epoch 141/400
160/160 [=====] - 0s 743us/step - loss: 0.3884
Epoch 142/400
160/160 [=====] - 0s 748us/step - loss: 0.3928
Epoch 143/400
160/160 [=====] - 0s 728us/step - loss: 0.4839
Epoch 144/400
160/160 [=====] - 0s 750us/step - loss: 0.3953
Epoch 145/400
160/160 [=====] - 0s 740us/step - loss: 0.3927
Epoch 146/400
160/160 [=====] - 0s 695us/step - loss: 0.3848
Epoch 147/400
160/160 [=====] - 0s 708us/step - loss: 0.3885
Epoch 148/400
160/160 [=====] - 0s 693us/step - loss: 0.3892
Epoch 149/400
160/160 [=====] - 0s 671us/step - loss: 0.3881
Epoch 150/400
160/160 [=====] - 0s 705us/step - loss: 0.3981
Epoch 151/400
160/160 [=====] - 0s 702us/step - loss: 0.3889
Epoch 152/400
160/160 [=====] - 0s 719us/step - loss: 0.3829
Epoch 153/400
160/160 [=====] - 0s 753us/step - loss: 0.3847
Epoch 154/400
160/160 [=====] - 0s 720us/step - loss: 0.3831
Epoch 155/400
160/160 [=====] - 0s 770us/step - loss: 0.3895
Epoch 156/400
160/160 [=====] - 0s 736us/step - loss: 0.3798
Epoch 157/400
160/160 [=====] - 0s 726us/step - loss: 0.3816
Epoch 158/400
160/160 [=====] - 0s 778us/step - loss: 0.3783
Epoch 159/400

160/160 [=====] - 0s 915us/step - loss: 0.3819
Epoch 160/400
160/160 [=====] - 0s 790us/step - loss: 0.3853
Epoch 161/400
160/160 [=====] - 0s 734us/step - loss: 0.3788
Epoch 162/400
160/160 [=====] - 0s 735us/step - loss: 0.3872
Epoch 163/400
160/160 [=====] - 0s 688us/step - loss: 0.3833
Epoch 164/400
160/160 [=====] - 0s 703us/step - loss: 0.3767
Epoch 165/400
160/160 [=====] - 0s 706us/step - loss: 0.3818
Epoch 166/400
160/160 [=====] - 0s 738us/step - loss: 0.3838
Epoch 167/400
160/160 [=====] - 0s 738us/step - loss: 0.3845
Epoch 168/400
160/160 [=====] - 0s 741us/step - loss: 0.3844
Epoch 169/400
160/160 [=====] - 0s 748us/step - loss: 0.3877
Epoch 170/400
160/160 [=====] - 0s 755us/step - loss: 0.3853
Epoch 171/400
160/160 [=====] - 0s 728us/step - loss: 0.3750
Epoch 172/400
160/160 [=====] - 0s 733us/step - loss: 0.3885
Epoch 173/400
160/160 [=====] - 0s 756us/step - loss: 0.3799
Epoch 174/400
160/160 [=====] - 0s 740us/step - loss: 0.3755
Epoch 175/400
160/160 [=====] - 0s 738us/step - loss: 0.3814
Epoch 176/400
160/160 [=====] - 0s 760us/step - loss: 0.3787
Epoch 177/400
160/160 [=====] - 0s 734us/step - loss: 0.3846
Epoch 178/400
160/160 [=====] - 0s 743us/step - loss: 0.3757
Epoch 179/400
160/160 [=====] - 0s 717us/step - loss: 0.3768
Epoch 180/400
160/160 [=====] - 0s 693us/step - loss: 0.3690
Epoch 181/400
160/160 [=====] - 0s 729us/step - loss: 0.3781
Epoch 182/400
160/160 [=====] - 0s 704us/step - loss: 0.3802
Epoch 183/400

160/160 [=====] - 0s 737us/step - loss: 0.3748
Epoch 184/400
160/160 [=====] - 0s 754us/step - loss: 0.3619
Epoch 185/400
160/160 [=====] - 0s 882us/step - loss: 0.3760
Epoch 186/400
160/160 [=====] - 0s 988us/step - loss: 0.3799
Epoch 187/400
160/160 [=====] - 0s 819us/step - loss: 0.3822
Epoch 188/400
160/160 [=====] - 0s 771us/step - loss: 0.3736
Epoch 189/400
160/160 [=====] - 0s 733us/step - loss: 0.3968
Epoch 190/400
160/160 [=====] - 0s 749us/step - loss: 0.3753
Epoch 191/400
160/160 [=====] - 0s 830us/step - loss: 0.3724
Epoch 192/400
160/160 [=====] - 0s 1ms/step - loss: 0.3707
Epoch 193/400
160/160 [=====] - 0s 992us/step - loss: 0.3720
Epoch 194/400
160/160 [=====] - 0s 991us/step - loss: 0.3905
Epoch 195/400
160/160 [=====] - 0s 890us/step - loss: 0.3729
Epoch 196/400
160/160 [=====] - 0s 920us/step - loss: 0.3698
Epoch 197/400
160/160 [=====] - 0s 911us/step - loss: 0.3926
Epoch 198/400
160/160 [=====] - 0s 1ms/step - loss: 0.3663
Epoch 199/400
160/160 [=====] - 0s 948us/step - loss: 0.3734
Epoch 200/400
160/160 [=====] - 0s 946us/step - loss: 0.4006
Epoch 201/400
160/160 [=====] - 0s 921us/step - loss: 0.3761
Epoch 202/400
160/160 [=====] - 0s 973us/step - loss: 0.3647
Epoch 203/400
160/160 [=====] - 0s 871us/step - loss: 0.3989
Epoch 204/400
160/160 [=====] - 0s 886us/step - loss: 0.3754
Epoch 205/400
160/160 [=====] - 0s 766us/step - loss: 0.3705
Epoch 206/400
160/160 [=====] - 0s 744us/step - loss: 0.3670
Epoch 207/400

160/160 [=====] - 0s 741us/step - loss: 0.3743
Epoch 208/400
160/160 [=====] - 0s 735us/step - loss: 0.3712
Epoch 209/400
160/160 [=====] - 0s 725us/step - loss: 0.3710
Epoch 210/400
160/160 [=====] - 0s 705us/step - loss: 0.3834
Epoch 211/400
160/160 [=====] - 0s 894us/step - loss: 0.3722
Epoch 212/400
160/160 [=====] - 0s 876us/step - loss: 0.3950
Epoch 213/400
160/160 [=====] - 0s 864us/step - loss: 0.3737
Epoch 214/400
160/160 [=====] - 0s 824us/step - loss: 0.3781
Epoch 215/400
160/160 [=====] - 0s 877us/step - loss: 0.3690
Epoch 216/400
160/160 [=====] - 0s 887us/step - loss: 0.3795
Epoch 217/400
160/160 [=====] - 0s 809us/step - loss: 1.0019
Epoch 218/400
160/160 [=====] - 0s 762us/step - loss: 1.2871
Epoch 219/400
160/160 [=====] - 0s 755us/step - loss: 0.8366
Epoch 220/400
160/160 [=====] - 0s 742us/step - loss: 0.7225
Epoch 221/400
160/160 [=====] - 0s 926us/step - loss: 0.7110
Epoch 222/400
160/160 [=====] - 0s 769us/step - loss: 0.7215
Epoch 223/400
160/160 [=====] - 0s 727us/step - loss: 0.7105
Epoch 224/400
160/160 [=====] - 0s 724us/step - loss: 0.7116
Epoch 225/400
160/160 [=====] - 0s 859us/step - loss: 0.7015
Epoch 226/400
160/160 [=====] - 0s 728us/step - loss: 0.6962
Epoch 227/400
160/160 [=====] - 0s 758us/step - loss: 0.7015
Epoch 228/400
160/160 [=====] - 0s 901us/step - loss: 0.6947
Epoch 229/400
160/160 [=====] - 0s 941us/step - loss: 0.6928
Epoch 230/400
160/160 [=====] - 0s 924us/step - loss: 0.6993
Epoch 231/400

```

160/160 [=====] - 0s 864us/step - loss: 0.6989
Epoch 232/400
160/160 [=====] - 0s 752us/step - loss: 0.6926
Epoch 233/400
160/160 [=====] - 0s 911us/step - loss: 0.6888
Epoch 234/400
160/160 [=====] - 0s 926us/step - loss: 0.6979
Epoch 235/400
160/160 [=====] - 0s 947us/step - loss: 0.6942
Epoch 236/400
160/160 [=====] - 0s 938us/step - loss: 0.6891
Epoch 237/400
160/160 [=====] - 0s 939us/step - loss: 0.6846
Epoch 238/400
160/160 [=====] - 0s 936us/step - loss: 0.6906
Epoch 239/400
160/160 [=====] - 0s 941us/step - loss: 0.6860
Epoch 240/400
160/160 [=====] - 0s 904us/step - loss: 0.6932
Epoch 241/400
160/160 [=====] - 0s 861us/step - loss: 0.6737
Epoch 242/400
160/160 [=====] - 0s 814us/step - loss: 0.6868
Epoch 243/400
160/160 [=====] - 0s 846us/step - loss: 0.6837
Epoch 244/400
160/160 [=====] - 0s 914us/step - loss: 0.6837
Epoch 245/400
160/160 [=====] - 0s 872us/step - loss: 0.6809
Epoch 246/400
160/160 [=====] - 0s 1ms/step - loss: 0.6753
Epoch 247/400
160/160 [=====] - 0s 930us/step - loss: 0.6764
Epoch 248/400
160/160 [=====] - 0s 910us/step - loss: 0.6834
Epoch 249/400
160/160 [=====] - 0s 959us/step - loss: 0.6836
Epoch 250/400
160/160 [=====] - 0s 871us/step - loss: 0.6822
Epoch 251/400
160/160 [=====] - 0s 830us/step - loss: 0.6747
Epoch 252/400
160/160 [=====] - 0s 794us/step - loss: 0.6785
Epoch 253/400
160/160 [=====] - 0s 859us/step - loss: 2.7265
Epoch 254/400
160/160 [=====] - 0s 854us/step - loss: 6.8552
Epoch 255/400

```

160/160 [=====] - 0s 831us/step - loss: 4.2804
 Epoch 256/400
 160/160 [=====] - 0s 923us/step - loss: 4.5419
 Epoch 257/400
 160/160 [=====] - 0s 849us/step - loss: 2.7587
 Epoch 258/400
 160/160 [=====] - 0s 824us/step - loss: 0.7162
 Epoch 259/400
 160/160 [=====] - 0s 907us/step - loss: 0.6526
 Epoch 260/400
 160/160 [=====] - 0s 1ms/step - loss: 0.6484
 Epoch 261/400
 160/160 [=====] - 0s 804us/step - loss: 0.6497
 Epoch 262/400
 160/160 [=====] - 0s 767us/step - loss: 0.6327
 Epoch 263/400
 160/160 [=====] - 0s 825us/step - loss: 0.6129
 Epoch 264/400
 160/160 [=====] - 0s 944us/step - loss: 0.6150
 Epoch 265/400
 160/160 [=====] - 0s 893us/step - loss: 0.6230
 Epoch 266/400
 160/160 [=====] - 0s 960us/step - loss: 0.5987
 Epoch 267/400
 160/160 [=====] - 0s 886us/step - loss: 0.5989
 Epoch 268/400
 160/160 [=====] - 0s 917us/step - loss: 0.5993
 Epoch 269/400
 160/160 [=====] - 0s 925us/step - loss: 0.5864
 Epoch 270/400
 160/160 [=====] - 0s 898us/step - loss: 0.5979
 Epoch 271/400
 160/160 [=====] - 0s 940us/step - loss: 0.6046
 Epoch 272/400
 160/160 [=====] - 0s 960us/step - loss: 0.6108
 Epoch 273/400
 160/160 [=====] - 0s 879us/step - loss: 0.5820
 Epoch 274/400
 160/160 [=====] - 0s 904us/step - loss: 0.5981
 Epoch 275/400
 160/160 [=====] - 0s 938us/step - loss: 0.5944
 Epoch 276/400
 160/160 [=====] - 0s 927us/step - loss: 0.5856
 Epoch 277/400
 160/160 [=====] - 0s 875us/step - loss: 0.5927
 Epoch 278/400
 160/160 [=====] - 0s 921us/step - loss: 0.5924
 Epoch 279/400

160/160 [=====] - 0s 854us/step - loss: 0.5877
 Epoch 280/400
 160/160 [=====] - 0s 888us/step - loss: 0.5953
 Epoch 281/400
 160/160 [=====] - 0s 891us/step - loss: 0.5637
 Epoch 282/400
 160/160 [=====] - 0s 937us/step - loss: 0.5995
 Epoch 283/400
 160/160 [=====] - 0s 939us/step - loss: 0.5924
 Epoch 284/400
 160/160 [=====] - 0s 905us/step - loss: 0.5893
 Epoch 285/400
 160/160 [=====] - 0s 937us/step - loss: 0.5884
 Epoch 286/400
 160/160 [=====] - 0s 890us/step - loss: 0.5826
 Epoch 287/400
 160/160 [=====] - 0s 948us/step - loss: 0.5899
 Epoch 288/400
 160/160 [=====] - 0s 936us/step - loss: 0.5859
 Epoch 289/400
 160/160 [=====] - 0s 954us/step - loss: 0.5912
 Epoch 290/400
 160/160 [=====] - 0s 938us/step - loss: 0.5888
 Epoch 291/400
 160/160 [=====] - 0s 981us/step - loss: 0.6004
 Epoch 292/400
 160/160 [=====] - 0s 815us/step - loss: 0.5787
 Epoch 293/400
 160/160 [=====] - 0s 945us/step - loss: 0.5994
 Epoch 294/400
 160/160 [=====] - 0s 861us/step - loss: 0.5920
 Epoch 295/400
 160/160 [=====] - 0s 700us/step - loss: 0.5893
 Epoch 296/400
 160/160 [=====] - 0s 743us/step - loss: 0.5912
 Epoch 297/400
 160/160 [=====] - 0s 767us/step - loss: 0.5841
 Epoch 298/400
 160/160 [=====] - 0s 764us/step - loss: 0.5827
 Epoch 299/400
 160/160 [=====] - 0s 727us/step - loss: 0.5861
 Epoch 300/400
 160/160 [=====] - 0s 762us/step - loss: 0.5917
 Epoch 301/400
 160/160 [=====] - 0s 785us/step - loss: 0.5870
 Epoch 302/400
 160/160 [=====] - 0s 710us/step - loss: 0.5882
 Epoch 303/400

160/160 [=====] - 0s 744us/step - loss: 0.5871
 Epoch 304/400
 160/160 [=====] - 0s 729us/step - loss: 0.5685
 Epoch 305/400
 160/160 [=====] - 0s 739us/step - loss: 0.5858
 Epoch 306/400
 160/160 [=====] - 0s 884us/step - loss: 0.5754
 Epoch 307/400
 160/160 [=====] - 0s 776us/step - loss: 0.5736
 Epoch 308/400
 160/160 [=====] - 0s 775us/step - loss: 0.5891
 Epoch 309/400
 160/160 [=====] - 0s 843us/step - loss: 0.5790
 Epoch 310/400
 160/160 [=====] - 0s 706us/step - loss: 0.5831
 Epoch 311/400
 160/160 [=====] - 0s 724us/step - loss: 0.5917
 Epoch 312/400
 160/160 [=====] - 0s 768us/step - loss: 0.5865
 Epoch 313/400
 160/160 [=====] - 0s 810us/step - loss: 0.5880
 Epoch 314/400
 160/160 [=====] - 0s 912us/step - loss: 0.5582
 Epoch 315/400
 160/160 [=====] - 0s 763us/step - loss: 0.5676
 Epoch 316/400
 160/160 [=====] - 0s 794us/step - loss: 0.5837
 Epoch 317/400
 160/160 [=====] - 0s 874us/step - loss: 0.5819
 Epoch 318/400
 160/160 [=====] - 0s 754us/step - loss: 0.5857
 Epoch 319/400
 160/160 [=====] - 0s 825us/step - loss: 0.5534
 Epoch 320/400
 160/160 [=====] - 0s 733us/step - loss: 0.5757
 Epoch 321/400
 160/160 [=====] - 0s 890us/step - loss: 0.5823
 Epoch 322/400
 160/160 [=====] - 0s 817us/step - loss: 0.5926
 Epoch 323/400
 160/160 [=====] - 0s 745us/step - loss: 0.5737
 Epoch 324/400
 160/160 [=====] - 0s 783us/step - loss: 0.5736
 Epoch 325/400
 160/160 [=====] - 0s 794us/step - loss: 0.5801
 Epoch 326/400
 160/160 [=====] - 0s 929us/step - loss: 0.5845
 Epoch 327/400

160/160 [=====] - 0s 912us/step - loss: 0.5773
Epoch 328/400
160/160 [=====] - 0s 914us/step - loss: 0.5747
Epoch 329/400
160/160 [=====] - 0s 888us/step - loss: 0.5709
Epoch 330/400
160/160 [=====] - 0s 949us/step - loss: 0.5714
Epoch 331/400
160/160 [=====] - 0s 968us/step - loss: 0.5851
Epoch 332/400
160/160 [=====] - 0s 1ms/step - loss: 0.5792
Epoch 333/400
160/160 [=====] - 0s 907us/step - loss: 0.5784
Epoch 334/400
160/160 [=====] - 0s 900us/step - loss: 0.5701
Epoch 335/400
160/160 [=====] - 0s 981us/step - loss: 0.5831
Epoch 336/400
160/160 [=====] - 0s 951us/step - loss: 0.5760
Epoch 337/400
160/160 [=====] - 0s 964us/step - loss: 0.5559
Epoch 338/400
160/160 [=====] - 0s 922us/step - loss: 0.5800
Epoch 339/400
160/160 [=====] - 0s 972us/step - loss: 0.5760
Epoch 340/400
160/160 [=====] - 0s 946us/step - loss: 0.5811
Epoch 341/400
160/160 [=====] - 0s 914us/step - loss: 0.5752
Epoch 342/400
160/160 [=====] - 0s 828us/step - loss: 0.5800
Epoch 343/400
160/160 [=====] - 0s 744us/step - loss: 0.5799
Epoch 344/400
160/160 [=====] - 0s 671us/step - loss: 0.5789
Epoch 345/400
160/160 [=====] - 0s 688us/step - loss: 0.5761
Epoch 346/400
160/160 [=====] - 0s 696us/step - loss: 0.5741
Epoch 347/400
160/160 [=====] - 0s 725us/step - loss: 0.5750
Epoch 348/400
160/160 [=====] - 0s 728us/step - loss: 0.5862
Epoch 349/400
160/160 [=====] - 0s 765us/step - loss: 0.5713
Epoch 350/400
160/160 [=====] - 0s 912us/step - loss: 0.5773
Epoch 351/400

160/160 [=====] - 0s 928us/step - loss: 0.5749
 Epoch 352/400
 160/160 [=====] - 0s 1ms/step - loss: 0.5754
 Epoch 353/400
 160/160 [=====] - 0s 923us/step - loss: 0.5733
 Epoch 354/400
 160/160 [=====] - 0s 943us/step - loss: 0.5762
 Epoch 355/400
 160/160 [=====] - 0s 946us/step - loss: 0.5702
 Epoch 356/400
 160/160 [=====] - 0s 852us/step - loss: 0.5692
 Epoch 357/400
 160/160 [=====] - 0s 883us/step - loss: 0.5747
 Epoch 358/400
 160/160 [=====] - 0s 900us/step - loss: 0.5808
 Epoch 359/400
 160/160 [=====] - 0s 925us/step - loss: 0.5765
 Epoch 360/400
 160/160 [=====] - 0s 904us/step - loss: 0.5665
 Epoch 361/400
 160/160 [=====] - 0s 928us/step - loss: 0.5786
 Epoch 362/400
 160/160 [=====] - 0s 899us/step - loss: 0.5764
 Epoch 363/400
 160/160 [=====] - 0s 935us/step - loss: 0.5704
 Epoch 364/400
 160/160 [=====] - 0s 884us/step - loss: 0.5780
 Epoch 365/400
 160/160 [=====] - 0s 982us/step - loss: 0.5984
 Epoch 366/400
 160/160 [=====] - 0s 955us/step - loss: 0.5722
 Epoch 367/400
 160/160 [=====] - 0s 914us/step - loss: 0.5789
 Epoch 368/400
 160/160 [=====] - 0s 867us/step - loss: 0.5733
 Epoch 369/400
 160/160 [=====] - 0s 862us/step - loss: 0.5715
 Epoch 370/400
 160/160 [=====] - 0s 946us/step - loss: 0.5637
 Epoch 371/400
 160/160 [=====] - 0s 838us/step - loss: 0.5681
 Epoch 372/400
 160/160 [=====] - 0s 847us/step - loss: 0.5846
 Epoch 373/400
 160/160 [=====] - 0s 881us/step - loss: 0.5716
 Epoch 374/400
 160/160 [=====] - 0s 861us/step - loss: 0.5753
 Epoch 375/400

```

160/160 [=====] - 0s 909us/step - loss: 0.5757
Epoch 376/400
160/160 [=====] - 0s 932us/step - loss: 0.5759
Epoch 377/400
160/160 [=====] - 0s 916us/step - loss: 0.5772
Epoch 378/400
160/160 [=====] - 0s 957us/step - loss: 0.5710
Epoch 379/400
160/160 [=====] - 0s 970us/step - loss: 0.5703
Epoch 380/400
160/160 [=====] - 0s 914us/step - loss: 0.5776
Epoch 381/400
160/160 [=====] - 0s 909us/step - loss: 0.5730
Epoch 382/400
160/160 [=====] - 0s 914us/step - loss: 0.5707
Epoch 383/400
160/160 [=====] - 0s 936us/step - loss: 0.5760
Epoch 384/400
160/160 [=====] - 0s 901us/step - loss: 0.5725
Epoch 385/400
160/160 [=====] - 0s 914us/step - loss: 0.5658
Epoch 386/400
160/160 [=====] - 0s 953us/step - loss: 0.5690
Epoch 387/400
160/160 [=====] - 0s 916us/step - loss: 0.5655
Epoch 388/400
160/160 [=====] - 0s 935us/step - loss: 0.5758
Epoch 389/400
160/160 [=====] - 0s 885us/step - loss: 0.5757
Epoch 390/400
160/160 [=====] - 0s 912us/step - loss: 0.5820
Epoch 391/400
160/160 [=====] - 0s 955us/step - loss: 0.5632
Epoch 392/400
160/160 [=====] - 0s 922us/step - loss: 0.5595
Epoch 393/400
160/160 [=====] - 0s 924us/step - loss: 0.5486
Epoch 394/400
160/160 [=====] - 0s 923us/step - loss: 0.5656
Epoch 395/400
160/160 [=====] - 0s 903us/step - loss: 0.5784
Epoch 396/400
160/160 [=====] - 0s 916us/step - loss: 0.5681
Epoch 397/400
160/160 [=====] - 0s 916us/step - loss: 0.5641
Epoch 398/400
160/160 [=====] - 0s 916us/step - loss: 0.5522
Epoch 399/400

```

```

160/160 [=====] - 0s 947us/step - loss: 0.5691
Epoch 400/400
160/160 [=====] - 0s 905us/step - loss: 0.5617
[0.3113155  0.31130603 0.31130648 0.31130692 0.31130692 0.31130734
 0.31130692 0.3113129  0.3113099  0.31130648 0.31130603 0.31130603
 0.31130692 0.3113155  0.3113086  0.31130692 0.3113129  0.31130648
 0.31130648 0.3113168  0.31130603 0.3113056  0.31131336 0.31130692
 0.31130648 0.31131378 0.31130734 0.31130773 0.31130603 0.31130648
 0.31131035 0.3113082  0.31130734 0.31130648 0.31130734 0.31130773
 0.3113056  0.3113086  0.31130603 0.31130946 0.3493148  1.
 1.          1.          1.          1.          1.          0.9999998
 0.31707177 1.          1.          1.          1.          0.39610347
 0.9963667  0.4638045  0.31214204 1.          1.          0.569459
 1.          1.          0.31191915 1.          1.          0.31403404
 1.          1.          1.          1.          1.          0.34641352
 0.8636631  1.          1.          1.          0.99988955 0.75802386
 1.          0.37991515 0.31133014 0.3122359  0.31149334 0.3120603
 0.31231079 0.31158635 0.3116208  0.31132412 0.3114559  0.31154284
 0.31189328 0.31209904 0.31144774 0.3113276  0.31140724 0.44997296
 0.31145716 0.31150153 0.31212273 0.31132108 0.31162596 0.31201035
 0.3115308  0.31179643 0.31202972 0.31135553 0.3115463  0.31178525
 0.31171203 0.31155708 0.31134954 0.31219283 0.31150582 0.31157085
 0.31142834 0.31205642 0.315164  0.31143692 0.31182396 0.31141797
 0.3168161  0.31133014 0.3139752  0.31134266 0.31135255 0.31395453
 0.31147742 0.47011548 0.3113383  0.31462836 0.31139302 0.31136245
 0.31428203 0.32459718 0.31190878 0.31130692 0.31132627 0.31469238
 0.3114391  0.41178313 0.31596905 0.31204438 0.31131983 0.31134006
 0.31163716 0.311483  0.31700742 0.3148638  0.31451792 0.31173792
 0.33407462 0.31131208 0.31139088 0.3116742  0.31697828 0.31141716
 0.3113082  0.31150198 0.31134266 0.31144813]
160/160 [=====] - 0s 2ms/step

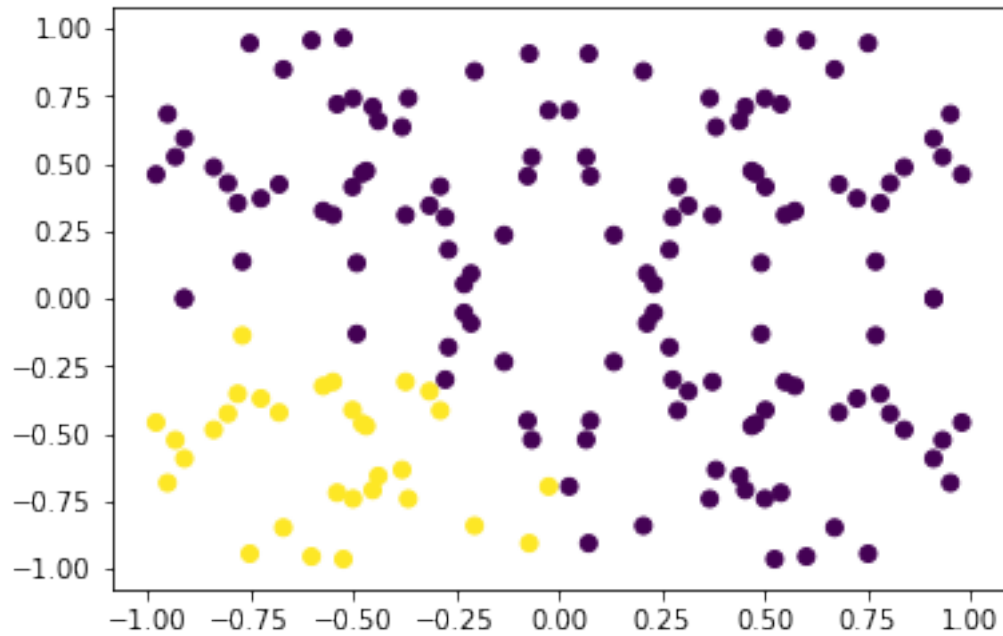
```

```
In [98]: scores, model.metrics_names
```

```
Out[98]: (0.5481760561466217, ['loss'])
```

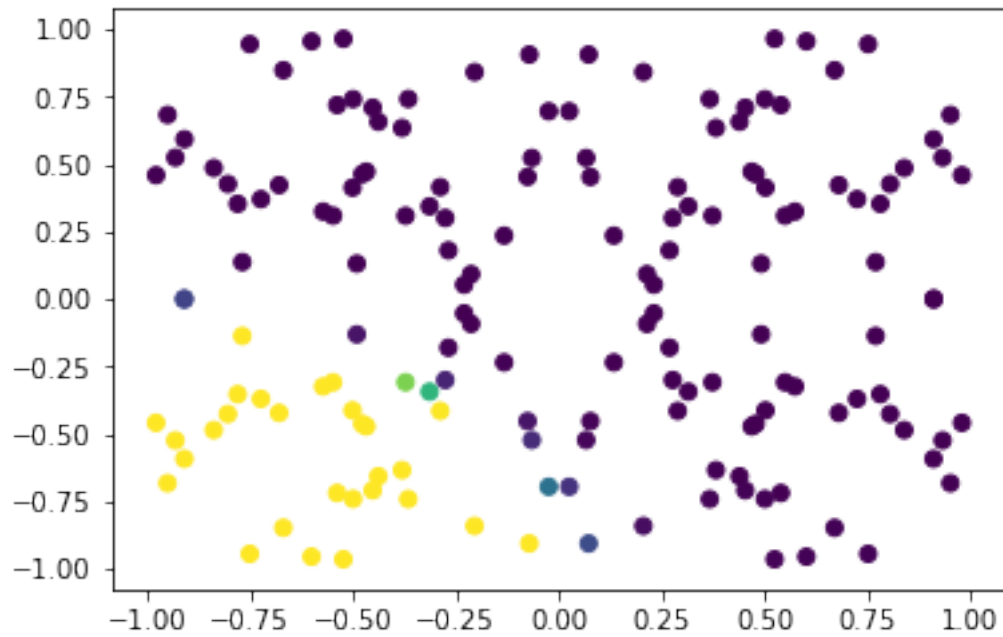
```
In [99]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[99]: <matplotlib.collections.PathCollection at 0xb2cc212e8>
```



```
In [100]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[100]: <matplotlib.collections.PathCollection at 0xb292186a0>
```



```

In [101]: # Using tanh for 3 neuron
          model = Sequential()

          model.add(Dense(3, input_dim=2, activation='tanh'))
          model.add(Dense(3, activation='tanh'))
          model.add(Dense(3, activation='tanh'))
          model.add(Dense(3, activation='tanh'))
          model.add(Dense(3, activation='tanh'))

          # The output has 1 neuron for predicting whatever we are iterating
          model.add(Dense(1, activation='tanh'))

          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))

          scores = model.evaluate(X, y)

```

```

Epoch 1/400
160/160 [=====] - 1s 7ms/step - loss: 0.7435
Epoch 2/400
160/160 [=====] - 0s 933us/step - loss: 0.6722
Epoch 3/400
160/160 [=====] - 0s 834us/step - loss: 0.6508
Epoch 4/400
160/160 [=====] - 0s 837us/step - loss: 0.6238
Epoch 5/400
160/160 [=====] - 0s 790us/step - loss: 0.6051
Epoch 6/400
160/160 [=====] - 0s 758us/step - loss: 0.5950
Epoch 7/400
160/160 [=====] - 0s 769us/step - loss: 0.5982
Epoch 8/400
160/160 [=====] - 0s 959us/step - loss: 0.5935
Epoch 9/400
160/160 [=====] - 0s 1ms/step - loss: 0.5853
Epoch 10/400
160/160 [=====] - 0s 837us/step - loss: 0.5823
Epoch 11/400
160/160 [=====] - 0s 844us/step - loss: 0.6448
Epoch 12/400
160/160 [=====] - 0s 809us/step - loss: 0.7254
Epoch 13/400
160/160 [=====] - 0s 801us/step - loss: 0.7030
Epoch 14/400
160/160 [=====] - 0s 845us/step - loss: 0.7032

```


Epoch 15/400
160/160 [=====] - 0s 844us/step - loss: 0.6954
Epoch 16/400
160/160 [=====] - 0s 810us/step - loss: 0.6979
Epoch 17/400
160/160 [=====] - 0s 815us/step - loss: 0.7017
Epoch 18/400
160/160 [=====] - 0s 825us/step - loss: 0.6983
Epoch 19/400
160/160 [=====] - 0s 827us/step - loss: 0.6988
Epoch 20/400
160/160 [=====] - 0s 781us/step - loss: 0.6950
Epoch 21/400
160/160 [=====] - 0s 795us/step - loss: 0.6974
Epoch 22/400
160/160 [=====] - 0s 805us/step - loss: 0.6949
Epoch 23/400
160/160 [=====] - 0s 819us/step - loss: 0.6918
Epoch 24/400
160/160 [=====] - 0s 808us/step - loss: 0.6947
Epoch 25/400
160/160 [=====] - 0s 811us/step - loss: 0.6865
Epoch 26/400
160/160 [=====] - 0s 820us/step - loss: 0.6794
Epoch 27/400
160/160 [=====] - 0s 799us/step - loss: 0.6852
Epoch 28/400
160/160 [=====] - 0s 808us/step - loss: 0.6758
Epoch 29/400
160/160 [=====] - 0s 818us/step - loss: 0.6679
Epoch 30/400
160/160 [=====] - 0s 816us/step - loss: 0.6375
Epoch 31/400
160/160 [=====] - 0s 804us/step - loss: 0.6106
Epoch 32/400
160/160 [=====] - 0s 824us/step - loss: 0.6002
Epoch 33/400
160/160 [=====] - 0s 820us/step - loss: 0.5903
Epoch 34/400
160/160 [=====] - 0s 839us/step - loss: 0.5851
Epoch 35/400
160/160 [=====] - 0s 813us/step - loss: 0.5896
Epoch 36/400
160/160 [=====] - 0s 749us/step - loss: 0.5848
Epoch 37/400
160/160 [=====] - 0s 763us/step - loss: 0.5922
Epoch 38/400
160/160 [=====] - 0s 835us/step - loss: 0.5831

Epoch 39/400
160/160 [=====] - 0s 803us/step - loss: 0.6139
Epoch 40/400
160/160 [=====] - 0s 809us/step - loss: 0.7024
Epoch 41/400
160/160 [=====] - 0s 815us/step - loss: 0.6459
Epoch 42/400
160/160 [=====] - 0s 827us/step - loss: 0.6152
Epoch 43/400
160/160 [=====] - 0s 810us/step - loss: 0.5925
Epoch 44/400
160/160 [=====] - 0s 788us/step - loss: 0.5901
Epoch 45/400
160/160 [=====] - 0s 805us/step - loss: 0.5811
Epoch 46/400
160/160 [=====] - 0s 840us/step - loss: 0.5918
Epoch 47/400
160/160 [=====] - 0s 853us/step - loss: 0.5814
Epoch 48/400
160/160 [=====] - 0s 859us/step - loss: 0.6652
Epoch 49/400
160/160 [=====] - 0s 843us/step - loss: 0.5930
Epoch 50/400
160/160 [=====] - 0s 839us/step - loss: 0.6004
Epoch 51/400
160/160 [=====] - 0s 835us/step - loss: 0.5883
Epoch 52/400
160/160 [=====] - 0s 809us/step - loss: 0.5715
Epoch 53/400
160/160 [=====] - 0s 889us/step - loss: 0.5877
Epoch 54/400
160/160 [=====] - 0s 838us/step - loss: 0.5994
Epoch 55/400
160/160 [=====] - 0s 864us/step - loss: 0.5916
Epoch 56/400
160/160 [=====] - 0s 861us/step - loss: 0.5790
Epoch 57/400
160/160 [=====] - 0s 918us/step - loss: 0.5782
Epoch 58/400
160/160 [=====] - 0s 922us/step - loss: 0.5807
Epoch 59/400
160/160 [=====] - 0s 956us/step - loss: 0.5873
Epoch 60/400
160/160 [=====] - 0s 879us/step - loss: 0.5894
Epoch 61/400
160/160 [=====] - 0s 848us/step - loss: 0.5763
Epoch 62/400
160/160 [=====] - 0s 955us/step - loss: 0.5790

Epoch 63/400
160/160 [=====] - 0s 983us/step - loss: 0.5773
Epoch 64/400
160/160 [=====] - 0s 877us/step - loss: 0.5857
Epoch 65/400
160/160 [=====] - 0s 840us/step - loss: 0.5828
Epoch 66/400
160/160 [=====] - 0s 949us/step - loss: 0.5729
Epoch 67/400
160/160 [=====] - 0s 811us/step - loss: 0.5765
Epoch 68/400
160/160 [=====] - 0s 820us/step - loss: 0.5817
Epoch 69/400
160/160 [=====] - 0s 933us/step - loss: 0.5840
Epoch 70/400
160/160 [=====] - 0s 804us/step - loss: 0.5777
Epoch 71/400
160/160 [=====] - 0s 936us/step - loss: 0.5745
Epoch 72/400
160/160 [=====] - 0s 1ms/step - loss: 0.5749
Epoch 73/400
160/160 [=====] - 0s 1ms/step - loss: 0.5711
Epoch 74/400
160/160 [=====] - 0s 1ms/step - loss: 0.5774
Epoch 75/400
160/160 [=====] - 0s 1000us/step - loss: 0.5680
Epoch 76/400
160/160 [=====] - 0s 1ms/step - loss: 0.5924
Epoch 77/400
160/160 [=====] - 0s 942us/step - loss: 0.5755
Epoch 78/400
160/160 [=====] - 0s 829us/step - loss: 0.5794
Epoch 79/400
160/160 [=====] - 0s 962us/step - loss: 0.5572
Epoch 80/400
160/160 [=====] - 0s 987us/step - loss: 0.5545
Epoch 81/400
160/160 [=====] - 0s 992us/step - loss: 0.5488
Epoch 82/400
160/160 [=====] - 0s 1ms/step - loss: 0.5299
Epoch 83/400
160/160 [=====] - 0s 1ms/step - loss: 0.5129
Epoch 84/400
160/160 [=====] - 0s 1ms/step - loss: 0.5611
Epoch 85/400
160/160 [=====] - 0s 968us/step - loss: 0.4694
Epoch 86/400
160/160 [=====] - 0s 973us/step - loss: 0.5186

Epoch 87/400
160/160 [=====] - 0s 822us/step - loss: 0.5219
Epoch 88/400
160/160 [=====] - 0s 891us/step - loss: 0.4091
Epoch 89/400
160/160 [=====] - 0s 1ms/step - loss: 0.4749
Epoch 90/400
160/160 [=====] - 0s 788us/step - loss: 0.3967
Epoch 91/400
160/160 [=====] - 0s 753us/step - loss: 0.6496
Epoch 92/400
160/160 [=====] - 0s 812us/step - loss: 0.5181
Epoch 93/400
160/160 [=====] - 0s 1ms/step - loss: 0.9158
Epoch 94/400
160/160 [=====] - 0s 967us/step - loss: 0.5797
Epoch 95/400
160/160 [=====] - 0s 973us/step - loss: 0.4162
Epoch 96/400
160/160 [=====] - 0s 954us/step - loss: 0.4155
Epoch 97/400
160/160 [=====] - 0s 1ms/step - loss: 0.3617
Epoch 98/400
160/160 [=====] - 0s 962us/step - loss: 0.7161
Epoch 99/400
160/160 [=====] - 0s 862us/step - loss: 0.6197
Epoch 100/400
160/160 [=====] - 0s 1ms/step - loss: 0.4937
Epoch 101/400
160/160 [=====] - 0s 1ms/step - loss: 0.4644
Epoch 102/400
160/160 [=====] - 0s 1ms/step - loss: 0.4037
Epoch 103/400
160/160 [=====] - 0s 1ms/step - loss: 0.3372
Epoch 104/400
160/160 [=====] - 0s 939us/step - loss: 0.2586
Epoch 105/400
160/160 [=====] - 0s 1ms/step - loss: 0.3047
Epoch 106/400
160/160 [=====] - 0s 1ms/step - loss: 0.3012
Epoch 107/400
160/160 [=====] - 0s 1ms/step - loss: 0.2252
Epoch 108/400
160/160 [=====] - 0s 969us/step - loss: 0.4105
Epoch 109/400
160/160 [=====] - 0s 937us/step - loss: 0.4378
Epoch 110/400
160/160 [=====] - 0s 1ms/step - loss: 0.6631

Epoch 111/400
160/160 [=====] - 0s 1ms/step - loss: 0.3207
Epoch 112/400
160/160 [=====] - 0s 1ms/step - loss: 0.2156
Epoch 113/400
160/160 [=====] - 0s 973us/step - loss: 0.1803
Epoch 114/400
160/160 [=====] - 0s 1ms/step - loss: 0.1616
Epoch 115/400
160/160 [=====] - 0s 1ms/step - loss: 0.1414
Epoch 116/400
160/160 [=====] - 0s 965us/step - loss: 0.2255
Epoch 117/400
160/160 [=====] - 0s 913us/step - loss: 0.6948
Epoch 118/400
160/160 [=====] - 0s 882us/step - loss: 0.7629
Epoch 119/400
160/160 [=====] - 0s 906us/step - loss: 0.5291
Epoch 120/400
160/160 [=====] - 0s 989us/step - loss: 0.5073
Epoch 121/400
160/160 [=====] - 0s 1ms/step - loss: 0.5039
Epoch 122/400
160/160 [=====] - 0s 1ms/step - loss: 0.5038
Epoch 123/400
160/160 [=====] - 0s 965us/step - loss: 0.5021
Epoch 124/400
160/160 [=====] - 0s 1ms/step - loss: 0.4905
Epoch 125/400
160/160 [=====] - 0s 1ms/step - loss: 0.4852
Epoch 126/400
160/160 [=====] - 0s 988us/step - loss: 0.4621
Epoch 127/400
160/160 [=====] - 0s 1ms/step - loss: 0.4135
Epoch 128/400
160/160 [=====] - 0s 1ms/step - loss: 0.3232
Epoch 129/400
160/160 [=====] - 0s 964us/step - loss: 0.2419
Epoch 130/400
160/160 [=====] - 0s 1ms/step - loss: 0.1992
Epoch 131/400
160/160 [=====] - 0s 965us/step - loss: 0.1599
Epoch 132/400
160/160 [=====] - 0s 917us/step - loss: 0.1335
Epoch 133/400
160/160 [=====] - 0s 780us/step - loss: 0.1232
Epoch 134/400
160/160 [=====] - 0s 861us/step - loss: 0.1084

Epoch 135/400
160/160 [=====] - 0s 938us/step - loss: 0.1080
Epoch 136/400
160/160 [=====] - 0s 975us/step - loss: 0.0990
Epoch 137/400
160/160 [=====] - 0s 1ms/step - loss: 0.0933
Epoch 138/400
160/160 [=====] - 0s 973us/step - loss: 0.0852
Epoch 139/400
160/160 [=====] - 0s 880us/step - loss: 0.0861
Epoch 140/400
160/160 [=====] - 0s 916us/step - loss: 0.0733
Epoch 141/400
160/160 [=====] - 0s 943us/step - loss: 0.1010
Epoch 142/400
160/160 [=====] - 0s 977us/step - loss: 0.0849
Epoch 143/400
160/160 [=====] - 0s 1ms/step - loss: 0.0694
Epoch 144/400
160/160 [=====] - 0s 1ms/step - loss: 0.0799
Epoch 145/400
160/160 [=====] - 0s 1ms/step - loss: 0.0622
Epoch 146/400
160/160 [=====] - 0s 956us/step - loss: 0.0679
Epoch 147/400
160/160 [=====] - 0s 1ms/step - loss: 0.0580
Epoch 148/400
160/160 [=====] - 0s 1ms/step - loss: 0.0707
Epoch 149/400
160/160 [=====] - 0s 931us/step - loss: 0.0639
Epoch 150/400
160/160 [=====] - 0s 854us/step - loss: 0.0614
Epoch 151/400
160/160 [=====] - 0s 906us/step - loss: 0.0573
Epoch 152/400
160/160 [=====] - 0s 786us/step - loss: 0.0618
Epoch 153/400
160/160 [=====] - 0s 781us/step - loss: 0.0478
Epoch 154/400
160/160 [=====] - 0s 953us/step - loss: 0.0575
Epoch 155/400
160/160 [=====] - 0s 1ms/step - loss: 0.0509
Epoch 156/400
160/160 [=====] - 0s 1ms/step - loss: 0.0539
Epoch 157/400
160/160 [=====] - 0s 962us/step - loss: 0.0574
Epoch 158/400
160/160 [=====] - 0s 901us/step - loss: 0.0459

Epoch 159/400
160/160 [=====] - 0s 878us/step - loss: 0.0688
Epoch 160/400
160/160 [=====] - 0s 855us/step - loss: 0.0421
Epoch 161/400
160/160 [=====] - 0s 904us/step - loss: 0.0828
Epoch 162/400
160/160 [=====] - 0s 779us/step - loss: 0.0495
Epoch 163/400
160/160 [=====] - 0s 842us/step - loss: 0.0450
Epoch 164/400
160/160 [=====] - 0s 1ms/step - loss: 0.0505
Epoch 165/400
160/160 [=====] - 0s 745us/step - loss: 0.0784
Epoch 166/400
160/160 [=====] - 0s 682us/step - loss: 0.0591
Epoch 167/400
160/160 [=====] - 0s 834us/step - loss: 0.0452
Epoch 168/400
160/160 [=====] - 0s 1ms/step - loss: 0.0439
Epoch 169/400
160/160 [=====] - 0s 836us/step - loss: 0.0606
Epoch 170/400
160/160 [=====] - 0s 782us/step - loss: 0.0537
Epoch 171/400
160/160 [=====] - 0s 736us/step - loss: 0.0389
Epoch 172/400
160/160 [=====] - 0s 749us/step - loss: 0.0492
Epoch 173/400
160/160 [=====] - 0s 712us/step - loss: 0.0440
Epoch 174/400
160/160 [=====] - 0s 736us/step - loss: 0.0572
Epoch 175/400
160/160 [=====] - 0s 797us/step - loss: 0.0626
Epoch 176/400
160/160 [=====] - 0s 784us/step - loss: 0.0465
Epoch 177/400
160/160 [=====] - 0s 808us/step - loss: 0.0617
Epoch 178/400
160/160 [=====] - 0s 800us/step - loss: 0.0824
Epoch 179/400
160/160 [=====] - 0s 810us/step - loss: 0.0532
Epoch 180/400
160/160 [=====] - 0s 799us/step - loss: 0.0485
Epoch 181/400
160/160 [=====] - 0s 789us/step - loss: 0.0524
Epoch 182/400
160/160 [=====] - 0s 708us/step - loss: 0.0505

Epoch 183/400
160/160 [=====] - 0s 705us/step - loss: 0.0519
Epoch 184/400
160/160 [=====] - 0s 817us/step - loss: 0.0553
Epoch 185/400
160/160 [=====] - 0s 958us/step - loss: 0.0800
Epoch 186/400
160/160 [=====] - 0s 972us/step - loss: 0.0547
Epoch 187/400
160/160 [=====] - 0s 858us/step - loss: 0.0413
Epoch 188/400
160/160 [=====] - 0s 784us/step - loss: 0.0660
Epoch 189/400
160/160 [=====] - 0s 809us/step - loss: 0.0453
Epoch 190/400
160/160 [=====] - 0s 789us/step - loss: 0.0386
Epoch 191/400
160/160 [=====] - 0s 780us/step - loss: 0.0478
Epoch 192/400
160/160 [=====] - 0s 785us/step - loss: 0.0455
Epoch 193/400
160/160 [=====] - 0s 967us/step - loss: 0.0529
Epoch 194/400
160/160 [=====] - 0s 1ms/step - loss: 0.0521
Epoch 195/400
160/160 [=====] - 0s 864us/step - loss: 0.0408
Epoch 196/400
160/160 [=====] - 0s 789us/step - loss: 0.0594
Epoch 197/400
160/160 [=====] - 0s 786us/step - loss: 0.4626
Epoch 198/400
160/160 [=====] - 0s 803us/step - loss: 0.1417
Epoch 199/400
160/160 [=====] - 0s 757us/step - loss: 0.4358
Epoch 200/400
160/160 [=====] - 0s 737us/step - loss: 0.2452
Epoch 201/400
160/160 [=====] - 0s 749us/step - loss: 0.0595
Epoch 202/400
160/160 [=====] - 0s 907us/step - loss: 0.0454
Epoch 203/400
160/160 [=====] - 0s 753us/step - loss: 0.0435
Epoch 204/400
160/160 [=====] - 0s 762us/step - loss: 0.0502
Epoch 205/400
160/160 [=====] - 0s 877us/step - loss: 0.0557
Epoch 206/400
160/160 [=====] - 0s 1ms/step - loss: 0.0375

Epoch 207/400
160/160 [=====] - 0s 841us/step - loss: 0.0453
Epoch 208/400
160/160 [=====] - 0s 810us/step - loss: 0.0354
Epoch 209/400
160/160 [=====] - 0s 781us/step - loss: 0.0446
Epoch 210/400
160/160 [=====] - 0s 797us/step - loss: 0.0463
Epoch 211/400
160/160 [=====] - 0s 796us/step - loss: 0.0442
Epoch 212/400
160/160 [=====] - 0s 952us/step - loss: 0.1559
Epoch 213/400
160/160 [=====] - 0s 1ms/step - loss: 0.0537
Epoch 214/400
160/160 [=====] - 0s 832us/step - loss: 0.0390
Epoch 215/400
160/160 [=====] - 0s 732us/step - loss: 0.0433
Epoch 216/400
160/160 [=====] - 0s 714us/step - loss: 0.1529
Epoch 217/400
160/160 [=====] - 0s 779us/step - loss: 0.0703
Epoch 218/400
160/160 [=====] - 0s 1ms/step - loss: 0.0399
Epoch 219/400
160/160 [=====] - 0s 966us/step - loss: 0.0407
Epoch 220/400
160/160 [=====] - 0s 815us/step - loss: 0.0394
Epoch 221/400
160/160 [=====] - 0s 840us/step - loss: 0.0505
Epoch 222/400
160/160 [=====] - 0s 1ms/step - loss: 0.0353
Epoch 223/400
160/160 [=====] - 0s 969us/step - loss: 0.0436
Epoch 224/400
160/160 [=====] - 0s 864us/step - loss: 0.0417
Epoch 225/400
160/160 [=====] - 0s 814us/step - loss: 0.0409
Epoch 226/400
160/160 [=====] - 0s 784us/step - loss: 0.0390
Epoch 227/400
160/160 [=====] - 0s 838us/step - loss: 0.0355
Epoch 228/400
160/160 [=====] - 0s 1ms/step - loss: 0.0472
Epoch 229/400
160/160 [=====] - 0s 999us/step - loss: 0.0382
Epoch 230/400
160/160 [=====] - 0s 827us/step - loss: 0.0323

Epoch 231/400
160/160 [=====] - 0s 780us/step - loss: 0.0487
Epoch 232/400
160/160 [=====] - 0s 797us/step - loss: 0.0442
Epoch 233/400
160/160 [=====] - 0s 939us/step - loss: 0.0456
Epoch 234/400
160/160 [=====] - 0s 1ms/step - loss: 0.0407
Epoch 235/400
160/160 [=====] - 0s 895us/step - loss: 0.0478
Epoch 236/400
160/160 [=====] - 0s 786us/step - loss: 0.0505
Epoch 237/400
160/160 [=====] - 0s 780us/step - loss: 0.0438
Epoch 238/400
160/160 [=====] - 0s 867us/step - loss: 0.0577
Epoch 239/400
160/160 [=====] - 0s 1ms/step - loss: 0.0614
Epoch 240/400
160/160 [=====] - 0s 933us/step - loss: 0.0637
Epoch 241/400
160/160 [=====] - 0s 773us/step - loss: 0.0583
Epoch 242/400
160/160 [=====] - 0s 780us/step - loss: 0.0362
Epoch 243/400
160/160 [=====] - 0s 748us/step - loss: 0.0406
Epoch 244/400
160/160 [=====] - 0s 910us/step - loss: 0.0444
Epoch 245/400
160/160 [=====] - 0s 994us/step - loss: 2.8838
Epoch 246/400
160/160 [=====] - 0s 907us/step - loss: 5.7964
Epoch 247/400
160/160 [=====] - 0s 804us/step - loss: 5.3916
Epoch 248/400
160/160 [=====] - 0s 784us/step - loss: 4.5458
Epoch 249/400
160/160 [=====] - 0s 786us/step - loss: 4.3080
Epoch 250/400
160/160 [=====] - 0s 785us/step - loss: 4.2208
Epoch 251/400
160/160 [=====] - 0s 800us/step - loss: 4.1800
Epoch 252/400
160/160 [=====] - 0s 803us/step - loss: 4.1650
Epoch 253/400
160/160 [=====] - 0s 755us/step - loss: 4.1391
Epoch 254/400
160/160 [=====] - 0s 821us/step - loss: 4.1349

Epoch 255/400
160/160 [=====] - 0s 1ms/step - loss: 4.2273
Epoch 256/400
160/160 [=====] - 0s 809us/step - loss: 4.4128
Epoch 257/400
160/160 [=====] - 0s 779us/step - loss: 4.4200
Epoch 258/400
160/160 [=====] - 0s 760us/step - loss: 4.4141
Epoch 259/400
160/160 [=====] - 0s 735us/step - loss: 4.4103
Epoch 260/400
160/160 [=====] - 0s 764us/step - loss: 4.4057
Epoch 261/400
160/160 [=====] - 0s 791us/step - loss: 4.4071
Epoch 262/400
160/160 [=====] - 0s 795us/step - loss: 4.4046
Epoch 263/400
160/160 [=====] - 0s 761us/step - loss: 4.3989
Epoch 264/400
160/160 [=====] - 0s 810us/step - loss: 4.4176
Epoch 265/400
160/160 [=====] - 0s 771us/step - loss: 4.4010
Epoch 266/400
160/160 [=====] - 0s 787us/step - loss: 4.4003
Epoch 267/400
160/160 [=====] - 0s 806us/step - loss: 4.3975
Epoch 268/400
160/160 [=====] - 0s 765us/step - loss: 4.3945
Epoch 269/400
160/160 [=====] - 0s 796us/step - loss: 4.3992
Epoch 270/400
160/160 [=====] - 0s 995us/step - loss: 4.3976
Epoch 271/400
160/160 [=====] - 0s 924us/step - loss: 4.4020
Epoch 272/400
160/160 [=====] - 0s 1ms/step - loss: 4.3980
Epoch 273/400
160/160 [=====] - 0s 962us/step - loss: 4.3954
Epoch 274/400
160/160 [=====] - 0s 912us/step - loss: 4.3954
Epoch 275/400
160/160 [=====] - 0s 940us/step - loss: 4.3964
Epoch 276/400
160/160 [=====] - 0s 988us/step - loss: 4.3973
Epoch 277/400
160/160 [=====] - 0s 1ms/step - loss: 4.3958
Epoch 278/400
160/160 [=====] - 0s 1ms/step - loss: 4.3972

Epoch 279/400
160/160 [=====] - 0s 1ms/step - loss: 4.3962
Epoch 280/400
160/160 [=====] - 0s 984us/step - loss: 4.4030
Epoch 281/400
160/160 [=====] - 0s 1ms/step - loss: 4.4021
Epoch 282/400
160/160 [=====] - 0s 839us/step - loss: 4.3967
Epoch 283/400
160/160 [=====] - 0s 755us/step - loss: 4.3999
Epoch 284/400
160/160 [=====] - 0s 761us/step - loss: 4.3964
Epoch 285/400
160/160 [=====] - 0s 820us/step - loss: 4.3986
Epoch 286/400
160/160 [=====] - 0s 747us/step - loss: 4.3951
Epoch 287/400
160/160 [=====] - 0s 834us/step - loss: 4.3966
Epoch 288/400
160/160 [=====] - 0s 1ms/step - loss: 4.3979
Epoch 289/400
160/160 [=====] - 0s 987us/step - loss: 4.3972
Epoch 290/400
160/160 [=====] - 0s 1ms/step - loss: 4.4010
Epoch 291/400
160/160 [=====] - 0s 1ms/step - loss: 4.3131
Epoch 292/400
160/160 [=====] - 0s 944us/step - loss: 4.1178
Epoch 293/400
160/160 [=====] - 0s 809us/step - loss: 4.2323
Epoch 294/400
160/160 [=====] - 0s 747us/step - loss: 4.3987
Epoch 295/400
160/160 [=====] - 0s 783us/step - loss: 4.3974
Epoch 296/400
160/160 [=====] - 0s 797us/step - loss: 4.3971
Epoch 297/400
160/160 [=====] - 0s 814us/step - loss: 4.3967
Epoch 298/400
160/160 [=====] - 0s 785us/step - loss: 4.3960
Epoch 299/400
160/160 [=====] - 0s 821us/step - loss: 4.3953
Epoch 300/400
160/160 [=====] - 0s 757us/step - loss: 4.3951
Epoch 301/400
160/160 [=====] - 0s 946us/step - loss: 4.3980
Epoch 302/400
160/160 [=====] - 0s 1ms/step - loss: 4.3965

Epoch 303/400
160/160 [=====] - 0s 1ms/step - loss: 4.3950
Epoch 304/400
160/160 [=====] - 0s 1ms/step - loss: 4.3973
Epoch 305/400
160/160 [=====] - 0s 1ms/step - loss: 4.3971
Epoch 306/400
160/160 [=====] - 0s 1ms/step - loss: 4.3948
Epoch 307/400
160/160 [=====] - 0s 1ms/step - loss: 4.3949
Epoch 308/400
160/160 [=====] - 0s 855us/step - loss: 4.3978
Epoch 309/400
160/160 [=====] - 0s 926us/step - loss: 4.3955
Epoch 310/400
160/160 [=====] - 0s 1ms/step - loss: 4.3974
Epoch 311/400
160/160 [=====] - 0s 852us/step - loss: 4.3949
Epoch 312/400
160/160 [=====] - 0s 800us/step - loss: 4.3946
Epoch 313/400
160/160 [=====] - 0s 781us/step - loss: 4.3973
Epoch 314/400
160/160 [=====] - 0s 729us/step - loss: 4.3943
Epoch 315/400
160/160 [=====] - 0s 718us/step - loss: 4.3957
Epoch 316/400
160/160 [=====] - 0s 758us/step - loss: 4.3965
Epoch 317/400
160/160 [=====] - 0s 777us/step - loss: 4.3965
Epoch 318/400
160/160 [=====] - 0s 776us/step - loss: 4.3965
Epoch 319/400
160/160 [=====] - 0s 786us/step - loss: 4.3974
Epoch 320/400
160/160 [=====] - 0s 967us/step - loss: 4.3978
Epoch 321/400
160/160 [=====] - 0s 992us/step - loss: 4.3971
Epoch 322/400
160/160 [=====] - 0s 849us/step - loss: 4.3972
Epoch 323/400
160/160 [=====] - 0s 795us/step - loss: 4.3949
Epoch 324/400
160/160 [=====] - 0s 821us/step - loss: 4.3954
Epoch 325/400
160/160 [=====] - 0s 1ms/step - loss: 4.3956
Epoch 326/400
160/160 [=====] - 0s 893us/step - loss: 4.3972

Epoch 327/400
160/160 [=====] - 0s 802us/step - loss: 4.3968
Epoch 328/400
160/160 [=====] - 0s 772us/step - loss: 4.3975
Epoch 329/400
160/160 [=====] - 0s 1ms/step - loss: 4.3968
Epoch 330/400
160/160 [=====] - 0s 988us/step - loss: 4.3970
Epoch 331/400
160/160 [=====] - 0s 799us/step - loss: 4.3975
Epoch 332/400
160/160 [=====] - 0s 778us/step - loss: 4.3939
Epoch 333/400
160/160 [=====] - 0s 782us/step - loss: 4.3955
Epoch 334/400
160/160 [=====] - 0s 775us/step - loss: 4.3964
Epoch 335/400
160/160 [=====] - 0s 880us/step - loss: 4.3948
Epoch 336/400
160/160 [=====] - 0s 1ms/step - loss: 4.3978
Epoch 337/400
160/160 [=====] - 0s 1ms/step - loss: 4.3967
Epoch 338/400
160/160 [=====] - 0s 975us/step - loss: 4.3969
Epoch 339/400
160/160 [=====] - 0s 824us/step - loss: 4.3966
Epoch 340/400
160/160 [=====] - 0s 807us/step - loss: 4.3950
Epoch 341/400
160/160 [=====] - 0s 984us/step - loss: 4.3963
Epoch 342/400
160/160 [=====] - 0s 1ms/step - loss: 4.3941
Epoch 343/400
160/160 [=====] - 0s 764us/step - loss: 4.3962
Epoch 344/400
160/160 [=====] - 0s 759us/step - loss: 4.3965
Epoch 345/400
160/160 [=====] - 0s 769us/step - loss: 4.3974
Epoch 346/400
160/160 [=====] - 0s 918us/step - loss: 4.3945
Epoch 347/400
160/160 [=====] - 0s 1ms/step - loss: 4.3961
Epoch 348/400
160/160 [=====] - 0s 873us/step - loss: 4.3950
Epoch 349/400
160/160 [=====] - 0s 786us/step - loss: 4.3962
Epoch 350/400
160/160 [=====] - 0s 775us/step - loss: 4.3943

Epoch 351/400
160/160 [=====] - 0s 803us/step - loss: 4.3961
Epoch 352/400
160/160 [=====] - 0s 851us/step - loss: 4.3955
Epoch 353/400
160/160 [=====] - 0s 1ms/step - loss: 4.3992
Epoch 354/400
160/160 [=====] - 0s 1ms/step - loss: 4.3954
Epoch 355/400
160/160 [=====] - 0s 810us/step - loss: 4.3973
Epoch 356/400
160/160 [=====] - 0s 794us/step - loss: 4.3966
Epoch 357/400
160/160 [=====] - 0s 733us/step - loss: 4.3968
Epoch 358/400
160/160 [=====] - 0s 736us/step - loss: 4.3943
Epoch 359/400
160/160 [=====] - 0s 789us/step - loss: 4.3964
Epoch 360/400
160/160 [=====] - 0s 1ms/step - loss: 4.3941
Epoch 361/400
160/160 [=====] - 0s 932us/step - loss: 4.3963
Epoch 362/400
160/160 [=====] - 0s 794us/step - loss: 4.3967
Epoch 363/400
160/160 [=====] - 0s 781us/step - loss: 4.3967
Epoch 364/400
160/160 [=====] - 0s 787us/step - loss: 4.3969
Epoch 365/400
160/160 [=====] - 0s 790us/step - loss: 4.3965
Epoch 366/400
160/160 [=====] - 0s 931us/step - loss: 4.3966
Epoch 367/400
160/160 [=====] - 0s 908us/step - loss: 4.3966
Epoch 368/400
160/160 [=====] - 0s 841us/step - loss: 4.3943
Epoch 369/400
160/160 [=====] - 0s 875us/step - loss: 4.3955
Epoch 370/400
160/160 [=====] - 0s 961us/step - loss: 4.3973
Epoch 371/400
160/160 [=====] - 0s 1ms/step - loss: 4.3944
Epoch 372/400
160/160 [=====] - 0s 951us/step - loss: 4.3962
Epoch 373/400
160/160 [=====] - 0s 963us/step - loss: 4.3942
Epoch 374/400
160/160 [=====] - 0s 1ms/step - loss: 4.3949

Epoch 375/400
160/160 [=====] - 0s 1ms/step - loss: 4.3974
Epoch 376/400
160/160 [=====] - 0s 889us/step - loss: 4.3963
Epoch 377/400
160/160 [=====] - 0s 818us/step - loss: 4.3959
Epoch 378/400
160/160 [=====] - 0s 784us/step - loss: 4.3953
Epoch 379/400
160/160 [=====] - 0s 820us/step - loss: 4.3940
Epoch 380/400
160/160 [=====] - 0s 1ms/step - loss: 4.3978
Epoch 381/400
160/160 [=====] - 0s 944us/step - loss: 4.3947
Epoch 382/400
160/160 [=====] - 0s 793us/step - loss: 4.3967
Epoch 383/400
160/160 [=====] - 0s 816us/step - loss: 4.3946
Epoch 384/400
160/160 [=====] - 0s 804us/step - loss: 4.3954
Epoch 385/400
160/160 [=====] - 0s 730us/step - loss: 4.3964
Epoch 386/400
160/160 [=====] - 0s 846us/step - loss: 4.3968
Epoch 387/400
160/160 [=====] - 0s 1ms/step - loss: 4.3965
Epoch 388/400
160/160 [=====] - 0s 1ms/step - loss: 4.3947
Epoch 389/400
160/160 [=====] - 0s 800us/step - loss: 4.3970
Epoch 390/400
160/160 [=====] - 0s 795us/step - loss: 4.3938
Epoch 391/400
160/160 [=====] - 0s 952us/step - loss: 4.3969
Epoch 392/400
160/160 [=====] - 0s 1ms/step - loss: 4.3941
Epoch 393/400
160/160 [=====] - 0s 848us/step - loss: 4.3955
Epoch 394/400
160/160 [=====] - 0s 848us/step - loss: 4.3961
Epoch 395/400
160/160 [=====] - 0s 783us/step - loss: 4.3957
Epoch 396/400
160/160 [=====] - 0s 810us/step - loss: 4.3904
Epoch 397/400
160/160 [=====] - 0s 1ms/step - loss: 4.3947
Epoch 398/400
160/160 [=====] - 0s 965us/step - loss: 4.3957


```
Epoch 399/400
160/160 [=====] - 0s 932us/step - loss: 4.3959
Epoch 400/400
160/160 [=====] - 0s 897us/step - loss: 4.3970
```

```
/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '
```

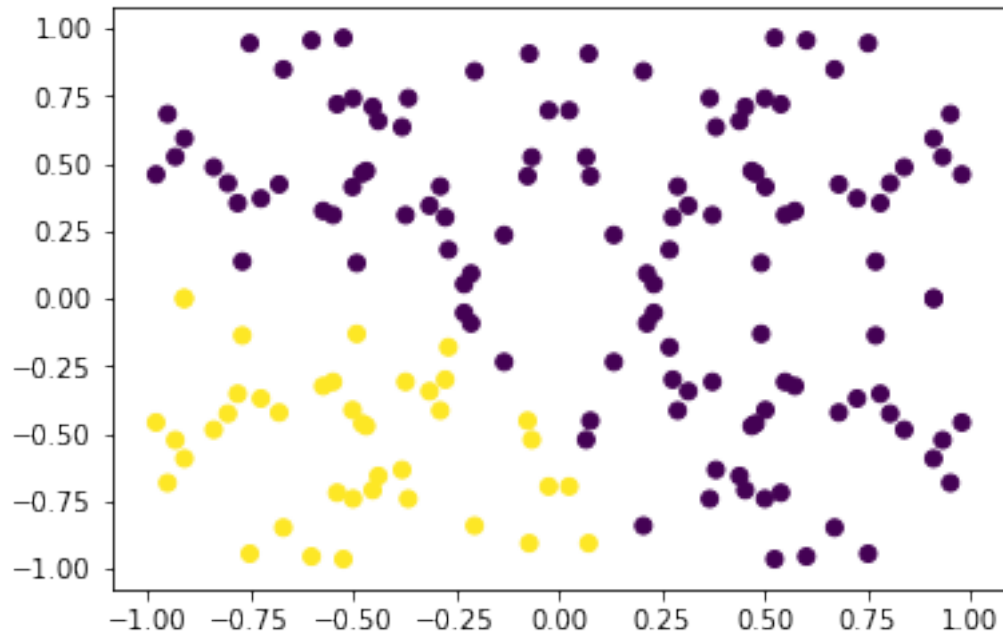
```
[-0.5558566 -0.55555654 -0.55596066 -0.5555906 -0.55577785 -0.5559958
-0.5556629 -0.5560773 -0.5552809 -0.55600375 -0.555694 -0.5557111
-0.555945 -0.55595237 -0.5556697 -0.5565358 -0.5557637 -0.55598927
-0.5558642 -0.55608696 -0.55605286 -0.5559896 -0.5562755 -0.55543256
-0.55593026 -0.5553937 -0.5560531 -0.5560534 -0.55603784 -0.5557668
-0.5560409 -0.55531085 -0.5554276 -0.5557522 -0.55600303 -0.55580974
-0.55525076 -0.5555135 -0.55547154 -0.55542207 0.94040954 0.942803
0.94365233 0.942892 0.9433779 0.9436677 0.9431343 0.9441791
0.94371253 0.9436832 0.94315183 0.9432134 0.9436801 0.94459826
0.9437462 0.766972 -0.52994025 0.9436779 0.9435097 0.9448898
0.94374555 0.94368064 -0.5342357 0.94230795 0.94360083 -0.55085593
0.94374645 0.9437509 0.9437251 0.94336855 0.94392693 0.9333598
0.94287544 0.9433343 0.9437368 0.94340795 0.93496513 0.9434617
0.9424701 0.9437897 -0.55626494 -0.06377152 -0.56477416 -0.06317945
-0.0650853 -0.5791016 -0.7862467 -0.5561731 -0.5587689 -0.56814575
-0.0606507 -0.06449386 -0.56117594 -0.5562428 -0.55986965 0.7490839
-0.55755806 -0.5641287 -0.0653909 -0.5561496 -0.56953824 -0.06532107
-0.5573827 -0.03808172 -0.06528866 -0.55648947 -0.5615904 -0.79172534
-0.6510862 -0.5992328 -0.5565354 -0.00283744 -0.5723307 -0.6176867
-0.5589767 -0.06486738 -0.03383018 -0.56204367 -0.04785167 -0.55994284
-0.57042897 -0.5634689 -0.56444573 -0.5635837 -0.5637993 -0.56436735
-0.56388944 0.94480723 -0.5622411 -0.56446373 -0.5638033 -0.5637615
-0.5645568 -0.58103496 -0.56418157 -0.55659384 -0.56029606 -0.56451726
-0.56393963 0.9448841 -0.56462294 -0.56409514 -0.5590364 -0.5633423
-0.56403196 -0.56347364 -0.5650661 -0.5643538 -0.5643511 -0.5640754
-0.510379 -0.56066966 -0.56353456 -0.56404537 -0.5651602 -0.5638978
-0.56042 -0.5638271 -0.5634283 -0.5636362 ]
160/160 [=====] - 0s 2ms/step
```

```
In [102]: scores, model.metrics_names
```

```
Out[102]: (4.391482047736645, ['loss'])
```

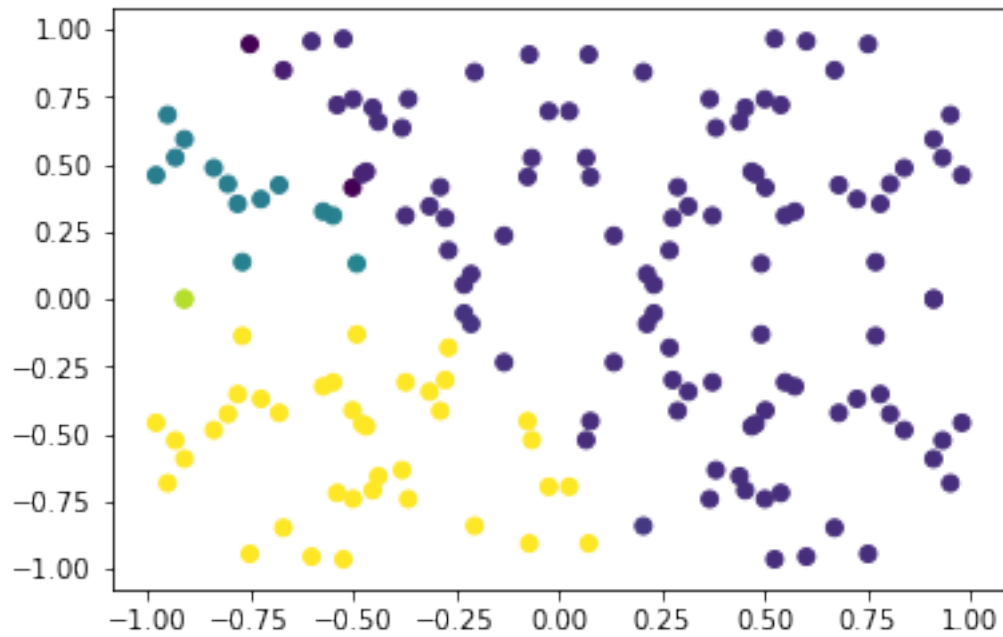
```
In [103]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[103]: <matplotlib.collections.PathCollection at 0xb2d180a90>
```



```
In [104]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[104]: <matplotlib.collections.PathCollection at 0xb2d162f60>
```



```
In [105]: # Using tanh for 4 neuron
model = Sequential()

model.add(Dense(4, input_dim=2, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

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

```
Epoch 1/400
160/160 [=====] - 1s 7ms/step - loss: 1.8844
Epoch 2/400
160/160 [=====] - 0s 677us/step - loss: 0.6129
Epoch 3/400
160/160 [=====] - 0s 687us/step - loss: 0.5679
Epoch 4/400
160/160 [=====] - 0s 647us/step - loss: 0.5462
Epoch 5/400
160/160 [=====] - 0s 645us/step - loss: 0.5156
Epoch 6/400
160/160 [=====] - 0s 785us/step - loss: 0.4947
Epoch 7/400
160/160 [=====] - 0s 801us/step - loss: 0.4663
Epoch 8/400
160/160 [=====] - 0s 820us/step - loss: 0.4415
Epoch 9/400
160/160 [=====] - 0s 637us/step - loss: 0.4304
Epoch 10/400
160/160 [=====] - 0s 642us/step - loss: 0.4127
Epoch 11/400
160/160 [=====] - 0s 635us/step - loss: 0.4015
Epoch 12/400
160/160 [=====] - 0s 677us/step - loss: 0.3913
Epoch 13/400
160/160 [=====] - 0s 813us/step - loss: 0.3726
Epoch 14/400
160/160 [=====] - 0s 828us/step - loss: 0.3751
Epoch 15/400
160/160 [=====] - 0s 710us/step - loss: 0.3645
Epoch 16/400
160/160 [=====] - 0s 653us/step - loss: 0.3618
```

Epoch 17/400
160/160 [=====] - 0s 659us/step - loss: 0.3570
Epoch 18/400
160/160 [=====] - 0s 642us/step - loss: 0.3530
Epoch 19/400
160/160 [=====] - 0s 638us/step - loss: 0.3532
Epoch 20/400
160/160 [=====] - 0s 669us/step - loss: 0.3496
Epoch 21/400
160/160 [=====] - 0s 662us/step - loss: 0.3473
Epoch 22/400
160/160 [=====] - 0s 831us/step - loss: 0.3421
Epoch 23/400
160/160 [=====] - 0s 788us/step - loss: 0.3492
Epoch 24/400
160/160 [=====] - 0s 790us/step - loss: 0.4450
Epoch 25/400
160/160 [=====] - 0s 772us/step - loss: 0.3445
Epoch 26/400
160/160 [=====] - 0s 807us/step - loss: 0.3369
Epoch 27/400
160/160 [=====] - 0s 791us/step - loss: 0.3424
Epoch 28/400
160/160 [=====] - 0s 797us/step - loss: 0.3310
Epoch 29/400
160/160 [=====] - 0s 810us/step - loss: 0.3428
Epoch 30/400
160/160 [=====] - 0s 794us/step - loss: 0.3331
Epoch 31/400
160/160 [=====] - 0s 770us/step - loss: 0.3387
Epoch 32/400
160/160 [=====] - 0s 793us/step - loss: 0.6921
Epoch 33/400
160/160 [=====] - 0s 766us/step - loss: 0.4807
Epoch 34/400
160/160 [=====] - 0s 730us/step - loss: 0.4321
Epoch 35/400
160/160 [=====] - 0s 755us/step - loss: 0.4306
Epoch 36/400
160/160 [=====] - 0s 765us/step - loss: 0.3369
Epoch 37/400
160/160 [=====] - 0s 819us/step - loss: 0.4181
Epoch 38/400
160/160 [=====] - 0s 733us/step - loss: 0.3465
Epoch 39/400
160/160 [=====] - 0s 647us/step - loss: 0.3432
Epoch 40/400
160/160 [=====] - 0s 641us/step - loss: 0.3331

Epoch 41/400
160/160 [=====] - 0s 601us/step - loss: 0.7997
Epoch 42/400
160/160 [=====] - 0s 608us/step - loss: 0.4934
Epoch 43/400
160/160 [=====] - 0s 623us/step - loss: 0.3761
Epoch 44/400
160/160 [=====] - 0s 659us/step - loss: 0.3517
Epoch 45/400
160/160 [=====] - 0s 630us/step - loss: 0.3428
Epoch 46/400
160/160 [=====] - 0s 648us/step - loss: 0.3409
Epoch 47/400
160/160 [=====] - 0s 685us/step - loss: 0.3433
Epoch 48/400
160/160 [=====] - 0s 639us/step - loss: 0.3475
Epoch 49/400
160/160 [=====] - 0s 639us/step - loss: 0.3327
Epoch 50/400
160/160 [=====] - 0s 629us/step - loss: 0.3590
Epoch 51/400
160/160 [=====] - 0s 625us/step - loss: 0.3330
Epoch 52/400
160/160 [=====] - 0s 634us/step - loss: 0.3372
Epoch 53/400
160/160 [=====] - 0s 639us/step - loss: 0.9792
Epoch 54/400
160/160 [=====] - 0s 637us/step - loss: 2.7258
Epoch 55/400
160/160 [=====] - 0s 668us/step - loss: 2.0841
Epoch 56/400
160/160 [=====] - 0s 629us/step - loss: 1.4297
Epoch 57/400
160/160 [=====] - 0s 646us/step - loss: 1.1501
Epoch 58/400
160/160 [=====] - 0s 628us/step - loss: 0.8150
Epoch 59/400
160/160 [=====] - 0s 647us/step - loss: 0.6347
Epoch 60/400
160/160 [=====] - 0s 614us/step - loss: 0.6109
Epoch 61/400
160/160 [=====] - 0s 608us/step - loss: 0.5563
Epoch 62/400
160/160 [=====] - 0s 616us/step - loss: 0.4796
Epoch 63/400
160/160 [=====] - 0s 658us/step - loss: 0.4602
Epoch 64/400
160/160 [=====] - 0s 644us/step - loss: 0.4412

Epoch 65/400
160/160 [=====] - 0s 640us/step - loss: 0.4166
Epoch 66/400
160/160 [=====] - 0s 687us/step - loss: 0.4952
Epoch 67/400
160/160 [=====] - 0s 827us/step - loss: 0.6175
Epoch 68/400
160/160 [=====] - 0s 806us/step - loss: 0.4231
Epoch 69/400
160/160 [=====] - 0s 801us/step - loss: 0.3807
Epoch 70/400
160/160 [=====] - 0s 666us/step - loss: 0.3703
Epoch 71/400
160/160 [=====] - 0s 672us/step - loss: 0.3442
Epoch 72/400
160/160 [=====] - 0s 640us/step - loss: 0.3286
Epoch 73/400
160/160 [=====] - 0s 693us/step - loss: 0.3200
Epoch 74/400
160/160 [=====] - 0s 627us/step - loss: 0.4363
Epoch 75/400
160/160 [=====] - 0s 659us/step - loss: 0.3464
Epoch 76/400
160/160 [=====] - 0s 816us/step - loss: 0.3098
Epoch 77/400
160/160 [=====] - 0s 819us/step - loss: 0.2955
Epoch 78/400
160/160 [=====] - 0s 683us/step - loss: 0.2933
Epoch 79/400
160/160 [=====] - 0s 625us/step - loss: 0.2851
Epoch 80/400
160/160 [=====] - 0s 598us/step - loss: 0.2757
Epoch 81/400
160/160 [=====] - 0s 601us/step - loss: 0.2766
Epoch 82/400
160/160 [=====] - 0s 604us/step - loss: 0.2661
Epoch 83/400
160/160 [=====] - 0s 761us/step - loss: 0.2605
Epoch 84/400
160/160 [=====] - 0s 837us/step - loss: 0.2582
Epoch 85/400
160/160 [=====] - 0s 743us/step - loss: 0.2663
Epoch 86/400
160/160 [=====] - 0s 673us/step - loss: 0.2645
Epoch 87/400
160/160 [=====] - 0s 652us/step - loss: 0.2494
Epoch 88/400
160/160 [=====] - 0s 607us/step - loss: 0.2478

Epoch 89/400
160/160 [=====] - 0s 619us/step - loss: 0.2388
Epoch 90/400
160/160 [=====] - 0s 633us/step - loss: 0.2385
Epoch 91/400
160/160 [=====] - 0s 650us/step - loss: 0.2353
Epoch 92/400
160/160 [=====] - 0s 642us/step - loss: 0.2330
Epoch 93/400
160/160 [=====] - 0s 617us/step - loss: 0.2248
Epoch 94/400
160/160 [=====] - 0s 641us/step - loss: 0.2283
Epoch 95/400
160/160 [=====] - 0s 632us/step - loss: 0.2255
Epoch 96/400
160/160 [=====] - 0s 640us/step - loss: 0.2133
Epoch 97/400
160/160 [=====] - 0s 615us/step - loss: 0.2250
Epoch 98/400
160/160 [=====] - 0s 601us/step - loss: 0.3518
Epoch 99/400
160/160 [=====] - 0s 590us/step - loss: 0.2196
Epoch 100/400
160/160 [=====] - 0s 629us/step - loss: 0.2106
Epoch 101/400
160/160 [=====] - 0s 642us/step - loss: 0.2159
Epoch 102/400
160/160 [=====] - 0s 637us/step - loss: 0.2060
Epoch 103/400
160/160 [=====] - 0s 630us/step - loss: 0.1979
Epoch 104/400
160/160 [=====] - 0s 618us/step - loss: 0.2017
Epoch 105/400
160/160 [=====] - 0s 625us/step - loss: 0.1921
Epoch 106/400
160/160 [=====] - 0s 628us/step - loss: 0.2798
Epoch 107/400
160/160 [=====] - 0s 639us/step - loss: 0.1967
Epoch 108/400
160/160 [=====] - 0s 628us/step - loss: 0.1923
Epoch 109/400
160/160 [=====] - 0s 640us/step - loss: 0.1851
Epoch 110/400
160/160 [=====] - 0s 656us/step - loss: 0.1857
Epoch 111/400
160/160 [=====] - 0s 642us/step - loss: 0.1794
Epoch 112/400
160/160 [=====] - 0s 622us/step - loss: 0.1902

Epoch 113/400
160/160 [=====] - 0s 645us/step - loss: 0.1886
Epoch 114/400
160/160 [=====] - 0s 677us/step - loss: 0.1777
Epoch 115/400
160/160 [=====] - 0s 846us/step - loss: 0.1744
Epoch 116/400
160/160 [=====] - 0s 892us/step - loss: 0.1723
Epoch 117/400
160/160 [=====] - 0s 776us/step - loss: 0.1712
Epoch 118/400
160/160 [=====] - 0s 619us/step - loss: 0.1705
Epoch 119/400
160/160 [=====] - 0s 645us/step - loss: 0.1720
Epoch 120/400
160/160 [=====] - 0s 624us/step - loss: 0.1635
Epoch 121/400
160/160 [=====] - 0s 644us/step - loss: 0.1686
Epoch 122/400
160/160 [=====] - 0s 646us/step - loss: 0.1627
Epoch 123/400
160/160 [=====] - 0s 630us/step - loss: 0.1630
Epoch 124/400
160/160 [=====] - 0s 644us/step - loss: 0.1666
Epoch 125/400
160/160 [=====] - 0s 618us/step - loss: 0.1618
Epoch 126/400
160/160 [=====] - 0s 613us/step - loss: 0.1606
Epoch 127/400
160/160 [=====] - 0s 618us/step - loss: 0.1594
Epoch 128/400
160/160 [=====] - 0s 647us/step - loss: 0.1574
Epoch 129/400
160/160 [=====] - 0s 675us/step - loss: 0.1589
Epoch 130/400
160/160 [=====] - 0s 871us/step - loss: 0.1535
Epoch 131/400
160/160 [=====] - 0s 768us/step - loss: 0.1578
Epoch 132/400
160/160 [=====] - 0s 698us/step - loss: 0.1569
Epoch 133/400
160/160 [=====] - 0s 646us/step - loss: 0.1589
Epoch 134/400
160/160 [=====] - 0s 607us/step - loss: 0.1580
Epoch 135/400
160/160 [=====] - 0s 610us/step - loss: 0.1552
Epoch 136/400
160/160 [=====] - 0s 762us/step - loss: 0.1563

Epoch 137/400
160/160 [=====] - 0s 811us/step - loss: 0.1549
Epoch 138/400
160/160 [=====] - 0s 747us/step - loss: 0.1549
Epoch 139/400
160/160 [=====] - 0s 641us/step - loss: 0.1545
Epoch 140/400
160/160 [=====] - 0s 681us/step - loss: 0.1552
Epoch 141/400
160/160 [=====] - 0s 644us/step - loss: 0.1487
Epoch 142/400
160/160 [=====] - 0s 841us/step - loss: 0.1597
Epoch 143/400
160/160 [=====] - 0s 866us/step - loss: 0.1521
Epoch 144/400
160/160 [=====] - 0s 737us/step - loss: 0.1525
Epoch 145/400
160/160 [=====] - 0s 727us/step - loss: 0.1516
Epoch 146/400
160/160 [=====] - 0s 861us/step - loss: 0.1533
Epoch 147/400
160/160 [=====] - 0s 785us/step - loss: 0.1476
Epoch 148/400
160/160 [=====] - 0s 642us/step - loss: 0.1539
Epoch 149/400
160/160 [=====] - 0s 773us/step - loss: 0.1516
Epoch 150/400
160/160 [=====] - 0s 816us/step - loss: 0.1529
Epoch 151/400
160/160 [=====] - 0s 839us/step - loss: 0.1513
Epoch 152/400
160/160 [=====] - 0s 758us/step - loss: 0.1501
Epoch 153/400
160/160 [=====] - 0s 805us/step - loss: 0.1497
Epoch 154/400
160/160 [=====] - 0s 815us/step - loss: 0.1469
Epoch 155/400
160/160 [=====] - 0s 773us/step - loss: 0.1487
Epoch 156/400
160/160 [=====] - 0s 799us/step - loss: 0.1478
Epoch 157/400
160/160 [=====] - 0s 821us/step - loss: 0.1472
Epoch 158/400
160/160 [=====] - 0s 793us/step - loss: 0.1462
Epoch 159/400
160/160 [=====] - 0s 819us/step - loss: 0.1485
Epoch 160/400
160/160 [=====] - 0s 809us/step - loss: 0.1463

Epoch 161/400
160/160 [=====] - 0s 808us/step - loss: 0.1480
Epoch 162/400
160/160 [=====] - 0s 801us/step - loss: 0.1448
Epoch 163/400
160/160 [=====] - 0s 817us/step - loss: 0.1466
Epoch 164/400
160/160 [=====] - 0s 826us/step - loss: 0.1467
Epoch 165/400
160/160 [=====] - 0s 822us/step - loss: 0.1424
Epoch 166/400
160/160 [=====] - 0s 912us/step - loss: 0.1441
Epoch 167/400
160/160 [=====] - 0s 866us/step - loss: 0.1462
Epoch 168/400
160/160 [=====] - 0s 700us/step - loss: 0.1487
Epoch 169/400
160/160 [=====] - 0s 774us/step - loss: 0.1460
Epoch 170/400
160/160 [=====] - 0s 835us/step - loss: 0.1408
Epoch 171/400
160/160 [=====] - 0s 796us/step - loss: 0.1436
Epoch 172/400
160/160 [=====] - 0s 808us/step - loss: 0.1437
Epoch 173/400
160/160 [=====] - 0s 793us/step - loss: 0.1421
Epoch 174/400
160/160 [=====] - 0s 783us/step - loss: 0.1458
Epoch 175/400
160/160 [=====] - 0s 818us/step - loss: 0.1387
Epoch 176/400
160/160 [=====] - 0s 803us/step - loss: 0.1319
Epoch 177/400
160/160 [=====] - 0s 804us/step - loss: 0.1387
Epoch 178/400
160/160 [=====] - 0s 778us/step - loss: 0.1464
Epoch 179/400
160/160 [=====] - 0s 806us/step - loss: 0.1406
Epoch 180/400
160/160 [=====] - 0s 802us/step - loss: 0.1420
Epoch 181/400
160/160 [=====] - 0s 836us/step - loss: 0.1436
Epoch 182/400
160/160 [=====] - 0s 811us/step - loss: 0.1425
Epoch 183/400
160/160 [=====] - 0s 782us/step - loss: 0.1393
Epoch 184/400
160/160 [=====] - 0s 813us/step - loss: 0.1426

Epoch 185/400
160/160 [=====] - 0s 818us/step - loss: 0.1422
Epoch 186/400
160/160 [=====] - 0s 821us/step - loss: 0.1456
Epoch 187/400
160/160 [=====] - 0s 837us/step - loss: 0.1397
Epoch 188/400
160/160 [=====] - 0s 788us/step - loss: 0.1373
Epoch 189/400
160/160 [=====] - 0s 808us/step - loss: 0.1429
Epoch 190/400
160/160 [=====] - 0s 785us/step - loss: 0.1402
Epoch 191/400
160/160 [=====] - 0s 827us/step - loss: 0.1368
Epoch 192/400
160/160 [=====] - 0s 801us/step - loss: 0.1398
Epoch 193/400
160/160 [=====] - 0s 832us/step - loss: 0.1343
Epoch 194/400
160/160 [=====] - 0s 761us/step - loss: 0.1361
Epoch 195/400
160/160 [=====] - 0s 630us/step - loss: 0.1407
Epoch 196/400
160/160 [=====] - 0s 699us/step - loss: 0.1365
Epoch 197/400
160/160 [=====] - 0s 865us/step - loss: 0.1428
Epoch 198/400
160/160 [=====] - 0s 835us/step - loss: 0.1339
Epoch 199/400
160/160 [=====] - 0s 856us/step - loss: 0.1395
Epoch 200/400
160/160 [=====] - 0s 801us/step - loss: 0.1369
Epoch 201/400
160/160 [=====] - 0s 818us/step - loss: 0.1354
Epoch 202/400
160/160 [=====] - 0s 748us/step - loss: 0.1414
Epoch 203/400
160/160 [=====] - 0s 634us/step - loss: 0.1371
Epoch 204/400
160/160 [=====] - 0s 653us/step - loss: 0.1370
Epoch 205/400
160/160 [=====] - 0s 858us/step - loss: 0.1389
Epoch 206/400
160/160 [=====] - 0s 839us/step - loss: 0.1334
Epoch 207/400
160/160 [=====] - 0s 857us/step - loss: 0.1372
Epoch 208/400
160/160 [=====] - 0s 831us/step - loss: 0.1349

Epoch 209/400
160/160 [=====] - 0s 842us/step - loss: 0.1372
Epoch 210/400
160/160 [=====] - 0s 837us/step - loss: 0.1360
Epoch 211/400
160/160 [=====] - 0s 808us/step - loss: 0.1252
Epoch 212/400
160/160 [=====] - 0s 807us/step - loss: 0.1335
Epoch 213/400
160/160 [=====] - 0s 846us/step - loss: 0.1427
Epoch 214/400
160/160 [=====] - 0s 825us/step - loss: 0.1342
Epoch 215/400
160/160 [=====] - 0s 809us/step - loss: 0.1321
Epoch 216/400
160/160 [=====] - 0s 669us/step - loss: 0.1355
Epoch 217/400
160/160 [=====] - 0s 638us/step - loss: 0.1338
Epoch 218/400
160/160 [=====] - 0s 642us/step - loss: 0.1351
Epoch 219/400
160/160 [=====] - 0s 614us/step - loss: 0.1354
Epoch 220/400
160/160 [=====] - 0s 645us/step - loss: 0.1277
Epoch 221/400
160/160 [=====] - 0s 621us/step - loss: 0.1213
Epoch 222/400
160/160 [=====] - 0s 633us/step - loss: 0.1380
Epoch 223/400
160/160 [=====] - 0s 631us/step - loss: 0.1364
Epoch 224/400
160/160 [=====] - 0s 667us/step - loss: 0.1319
Epoch 225/400
160/160 [=====] - 0s 664us/step - loss: 0.1289
Epoch 226/400
160/160 [=====] - 0s 645us/step - loss: 0.1330
Epoch 227/400
160/160 [=====] - 0s 624us/step - loss: 0.1349
Epoch 228/400
160/160 [=====] - 0s 642us/step - loss: 0.1302
Epoch 229/400
160/160 [=====] - 0s 627us/step - loss: 0.1284
Epoch 230/400
160/160 [=====] - 0s 657us/step - loss: 0.1257
Epoch 231/400
160/160 [=====] - 0s 623us/step - loss: 0.1340
Epoch 232/400
160/160 [=====] - 0s 786us/step - loss: 0.1339

Epoch 233/400
160/160 [=====] - 0s 820us/step - loss: 0.1314
Epoch 234/400
160/160 [=====] - 0s 793us/step - loss: 0.1316
Epoch 235/400
160/160 [=====] - 0s 821us/step - loss: 0.1298
Epoch 236/400
160/160 [=====] - 0s 810us/step - loss: 0.1268
Epoch 237/400
160/160 [=====] - 0s 812us/step - loss: 0.1343
Epoch 238/400
160/160 [=====] - 0s 759us/step - loss: 0.1281
Epoch 239/400
160/160 [=====] - 0s 858us/step - loss: 0.1311
Epoch 240/400
160/160 [=====] - 0s 837us/step - loss: 0.1288
Epoch 241/400
160/160 [=====] - 0s 795us/step - loss: 0.1239
Epoch 242/400
160/160 [=====] - 0s 739us/step - loss: 0.1282
Epoch 243/400
160/160 [=====] - 0s 775us/step - loss: 0.1304
Epoch 244/400
160/160 [=====] - 0s 805us/step - loss: 0.1309
Epoch 245/400
160/160 [=====] - 0s 816us/step - loss: 0.1241
Epoch 246/400
160/160 [=====] - 0s 729us/step - loss: 0.2126
Epoch 247/400
160/160 [=====] - 0s 729us/step - loss: 0.1275
Epoch 248/400
160/160 [=====] - 0s 673us/step - loss: 0.1322
Epoch 249/400
160/160 [=====] - 0s 610us/step - loss: 0.1333
Epoch 250/400
160/160 [=====] - 0s 642us/step - loss: 0.1297
Epoch 251/400
160/160 [=====] - 0s 639us/step - loss: 0.1282
Epoch 252/400
160/160 [=====] - 0s 638us/step - loss: 0.1264
Epoch 253/400
160/160 [=====] - 0s 622us/step - loss: 0.1262
Epoch 254/400
160/160 [=====] - 0s 648us/step - loss: 0.1256
Epoch 255/400
160/160 [=====] - 0s 629us/step - loss: 0.1209
Epoch 256/400
160/160 [=====] - 0s 639us/step - loss: 0.1274

Epoch 257/400
160/160 [=====] - 0s 633us/step - loss: 0.1231
Epoch 258/400
160/160 [=====] - 0s 643us/step - loss: 0.1261
Epoch 259/400
160/160 [=====] - 0s 726us/step - loss: 0.1271
Epoch 260/400
160/160 [=====] - 0s 791us/step - loss: 0.1304
Epoch 261/400
160/160 [=====] - 0s 829us/step - loss: 0.1221
Epoch 262/400
160/160 [=====] - 0s 827us/step - loss: 0.1286
Epoch 263/400
160/160 [=====] - 0s 800us/step - loss: 0.1297
Epoch 264/400
160/160 [=====] - 0s 763us/step - loss: 0.1270
Epoch 265/400
160/160 [=====] - 0s 807us/step - loss: 0.1242
Epoch 266/400
160/160 [=====] - 0s 837us/step - loss: 0.1297
Epoch 267/400
160/160 [=====] - 0s 777us/step - loss: 0.1240
Epoch 268/400
160/160 [=====] - 0s 706us/step - loss: 0.1227
Epoch 269/400
160/160 [=====] - 0s 832us/step - loss: 0.1158
Epoch 270/400
160/160 [=====] - 0s 801us/step - loss: 0.1181
Epoch 271/400
160/160 [=====] - 0s 694us/step - loss: 0.1274
Epoch 272/400
160/160 [=====] - 0s 833us/step - loss: 0.1227
Epoch 273/400
160/160 [=====] - 0s 822us/step - loss: 0.1298
Epoch 274/400
160/160 [=====] - 0s 877us/step - loss: 0.1205
Epoch 275/400
160/160 [=====] - 0s 807us/step - loss: 0.1288
Epoch 276/400
160/160 [=====] - 0s 829us/step - loss: 0.1204
Epoch 277/400
160/160 [=====] - 0s 845us/step - loss: 0.1277
Epoch 278/400
160/160 [=====] - 0s 825us/step - loss: 0.1223
Epoch 279/400
160/160 [=====] - 0s 763us/step - loss: 0.1226
Epoch 280/400
160/160 [=====] - 0s 851us/step - loss: 0.1198

Epoch 281/400
160/160 [=====] - 0s 817us/step - loss: 0.1224
Epoch 282/400
160/160 [=====] - 0s 797us/step - loss: 0.1167
Epoch 283/400
160/160 [=====] - 0s 774us/step - loss: 0.1205
Epoch 284/400
160/160 [=====] - 0s 804us/step - loss: 0.1172
Epoch 285/400
160/160 [=====] - 0s 690us/step - loss: 0.1115
Epoch 286/400
160/160 [=====] - 0s 636us/step - loss: 0.1237
Epoch 287/400
160/160 [=====] - 0s 629us/step - loss: 0.1192
Epoch 288/400
160/160 [=====] - 0s 624us/step - loss: 0.1271
Epoch 289/400
160/160 [=====] - 0s 613us/step - loss: 0.1197
Epoch 290/400
160/160 [=====] - 0s 661us/step - loss: 0.1204
Epoch 291/400
160/160 [=====] - 0s 680us/step - loss: 0.1206
Epoch 292/400
160/160 [=====] - 0s 649us/step - loss: 0.1241
Epoch 293/400
160/160 [=====] - 0s 642us/step - loss: 0.1220
Epoch 294/400
160/160 [=====] - 0s 631us/step - loss: 0.1278
Epoch 295/400
160/160 [=====] - 0s 633us/step - loss: 0.1190
Epoch 296/400
160/160 [=====] - 0s 623us/step - loss: 0.1214
Epoch 297/400
160/160 [=====] - 0s 640us/step - loss: 0.1206
Epoch 298/400
160/160 [=====] - 0s 620us/step - loss: 0.1221
Epoch 299/400
160/160 [=====] - 0s 595us/step - loss: 0.1146
Epoch 300/400
160/160 [=====] - 0s 602us/step - loss: 0.1208
Epoch 301/400
160/160 [=====] - 0s 606us/step - loss: 0.1214
Epoch 302/400
160/160 [=====] - 0s 629us/step - loss: 0.1207
Epoch 303/400
160/160 [=====] - 0s 635us/step - loss: 0.1203
Epoch 304/400
160/160 [=====] - 0s 654us/step - loss: 0.1233

Epoch 305/400
160/160 [=====] - 0s 654us/step - loss: 0.1221
Epoch 306/400
160/160 [=====] - 0s 635us/step - loss: 0.1129
Epoch 307/400
160/160 [=====] - 0s 637us/step - loss: 0.1161
Epoch 308/400
160/160 [=====] - 0s 628us/step - loss: 0.1228
Epoch 309/400
160/160 [=====] - 0s 634us/step - loss: 0.1157
Epoch 310/400
160/160 [=====] - 0s 623us/step - loss: 0.1224
Epoch 311/400
160/160 [=====] - 0s 644us/step - loss: 0.1181
Epoch 312/400
160/160 [=====] - 0s 631us/step - loss: 0.1193
Epoch 313/400
160/160 [=====] - 0s 639us/step - loss: 0.1167
Epoch 314/400
160/160 [=====] - 0s 633us/step - loss: 0.1217
Epoch 315/400
160/160 [=====] - 0s 636us/step - loss: 0.1200
Epoch 316/400
160/160 [=====] - 0s 630us/step - loss: 0.1200
Epoch 317/400
160/160 [=====] - 0s 662us/step - loss: 0.1181
Epoch 318/400
160/160 [=====] - 0s 604us/step - loss: 0.1188
Epoch 319/400
160/160 [=====] - 0s 602us/step - loss: 0.1172
Epoch 320/400
160/160 [=====] - 0s 584us/step - loss: 0.1222
Epoch 321/400
160/160 [=====] - 0s 595us/step - loss: 0.1198
Epoch 322/400
160/160 [=====] - 0s 636us/step - loss: 0.1193
Epoch 323/400
160/160 [=====] - 0s 634us/step - loss: 0.1067
Epoch 324/400
160/160 [=====] - 0s 644us/step - loss: 0.1118
Epoch 325/400
160/160 [=====] - 0s 771us/step - loss: 0.1218
Epoch 326/400
160/160 [=====] - 0s 811us/step - loss: 0.1186
Epoch 327/400
160/160 [=====] - 0s 770us/step - loss: 0.1124
Epoch 328/400
160/160 [=====] - 0s 661us/step - loss: 0.1187

Epoch 329/400
160/160 [=====] - 0s 717us/step - loss: 0.1207
Epoch 330/400
160/160 [=====] - 0s 643us/step - loss: 0.1145
Epoch 331/400
160/160 [=====] - 0s 623us/step - loss: 0.1117
Epoch 332/400
160/160 [=====] - 0s 635us/step - loss: 0.1193
Epoch 333/400
160/160 [=====] - 0s 662us/step - loss: 0.1202
Epoch 334/400
160/160 [=====] - 0s 641us/step - loss: 0.1214
Epoch 335/400
160/160 [=====] - 0s 793us/step - loss: 0.1160
Epoch 336/400
160/160 [=====] - 0s 749us/step - loss: 0.3551
Epoch 337/400
160/160 [=====] - 0s 611us/step - loss: 0.2986
Epoch 338/400
160/160 [=====] - 0s 753us/step - loss: 0.2626
Epoch 339/400
160/160 [=====] - 0s 619us/step - loss: 0.1553
Epoch 340/400
160/160 [=====] - 0s 647us/step - loss: 0.1349
Epoch 341/400
160/160 [=====] - 0s 781us/step - loss: 0.1300
Epoch 342/400
160/160 [=====] - 0s 825us/step - loss: 0.1214
Epoch 343/400
160/160 [=====] - 0s 770us/step - loss: 0.1242
Epoch 344/400
160/160 [=====] - 0s 734us/step - loss: 0.1214
Epoch 345/400
160/160 [=====] - 0s 732us/step - loss: 0.1197
Epoch 346/400
160/160 [=====] - 0s 788us/step - loss: 0.1199
Epoch 347/400
160/160 [=====] - 0s 861us/step - loss: 0.1134
Epoch 348/400
160/160 [=====] - 0s 813us/step - loss: 0.1154
Epoch 349/400
160/160 [=====] - 0s 785us/step - loss: 0.1140
Epoch 350/400
160/160 [=====] - 0s 788us/step - loss: 0.1158
Epoch 351/400
160/160 [=====] - 0s 627us/step - loss: 0.1069
Epoch 352/400
160/160 [=====] - 0s 627us/step - loss: 0.1321

Epoch 353/400
160/160 [=====] - 0s 840us/step - loss: 0.1224
Epoch 354/400
160/160 [=====] - 0s 722us/step - loss: 0.1259
Epoch 355/400
160/160 [=====] - 0s 887us/step - loss: 0.1121
Epoch 356/400
160/160 [=====] - 0s 829us/step - loss: 0.1162
Epoch 357/400
160/160 [=====] - 0s 839us/step - loss: 0.1102
Epoch 358/400
160/160 [=====] - 0s 826us/step - loss: 0.1170
Epoch 359/400
160/160 [=====] - 0s 809us/step - loss: 0.1168
Epoch 360/400
160/160 [=====] - 0s 789us/step - loss: 0.1165
Epoch 361/400
160/160 [=====] - 0s 625us/step - loss: 0.1150
Epoch 362/400
160/160 [=====] - 0s 762us/step - loss: 0.1145
Epoch 363/400
160/160 [=====] - 0s 833us/step - loss: 0.1089
Epoch 364/400
160/160 [=====] - 0s 777us/step - loss: 0.1956
Epoch 365/400
160/160 [=====] - 0s 738us/step - loss: 0.2602
Epoch 366/400
160/160 [=====] - 0s 800us/step - loss: 0.8483
Epoch 367/400
160/160 [=====] - 0s 808us/step - loss: 0.3352
Epoch 368/400
160/160 [=====] - 0s 774us/step - loss: 0.1330
Epoch 369/400
160/160 [=====] - 0s 603us/step - loss: 0.1337
Epoch 370/400
160/160 [=====] - 0s 594us/step - loss: 0.1141
Epoch 371/400
160/160 [=====] - 0s 596us/step - loss: 0.1427
Epoch 372/400
160/160 [=====] - 0s 611us/step - loss: 0.3437
Epoch 373/400
160/160 [=====] - 0s 632us/step - loss: 0.1341
Epoch 374/400
160/160 [=====] - 0s 645us/step - loss: 0.1169
Epoch 375/400
160/160 [=====] - 0s 625us/step - loss: 0.1233
Epoch 376/400
160/160 [=====] - 0s 641us/step - loss: 0.1192

Epoch 377/400
160/160 [=====] - 0s 632us/step - loss: 0.1162
Epoch 378/400
160/160 [=====] - 0s 643us/step - loss: 0.1162
Epoch 379/400
160/160 [=====] - 0s 627us/step - loss: 0.1179
Epoch 380/400
160/160 [=====] - 0s 628us/step - loss: 0.1201
Epoch 381/400
160/160 [=====] - 0s 660us/step - loss: 0.1173
Epoch 382/400
160/160 [=====] - 0s 665us/step - loss: 0.1156
Epoch 383/400
160/160 [=====] - 0s 642us/step - loss: 0.1166
Epoch 384/400
160/160 [=====] - 0s 639us/step - loss: 0.1094
Epoch 385/400
160/160 [=====] - 0s 630us/step - loss: 0.1161
Epoch 386/400
160/160 [=====] - 0s 682us/step - loss: 0.1129
Epoch 387/400
160/160 [=====] - 0s 639us/step - loss: 0.1225
Epoch 388/400
160/160 [=====] - 0s 626us/step - loss: 0.1185
Epoch 389/400
160/160 [=====] - 0s 595us/step - loss: 0.1163
Epoch 390/400
160/160 [=====] - 0s 599us/step - loss: 0.1137
Epoch 391/400
160/160 [=====] - 0s 605us/step - loss: 0.1150
Epoch 392/400
160/160 [=====] - 0s 637us/step - loss: 0.1143
Epoch 393/400
160/160 [=====] - 0s 634us/step - loss: 0.1127
Epoch 394/400
160/160 [=====] - 0s 642us/step - loss: 0.1073
Epoch 395/400
160/160 [=====] - 0s 638us/step - loss: 0.1133
Epoch 396/400
160/160 [=====] - 0s 645us/step - loss: 0.1156
Epoch 397/400
160/160 [=====] - 0s 634us/step - loss: 0.1151
Epoch 398/400
160/160 [=====] - 0s 662us/step - loss: 0.1123
Epoch 399/400
160/160 [=====] - 0s 636us/step - loss: 0.1163
Epoch 400/400
160/160 [=====] - 0s 642us/step - loss: 0.1052

```
/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '
```

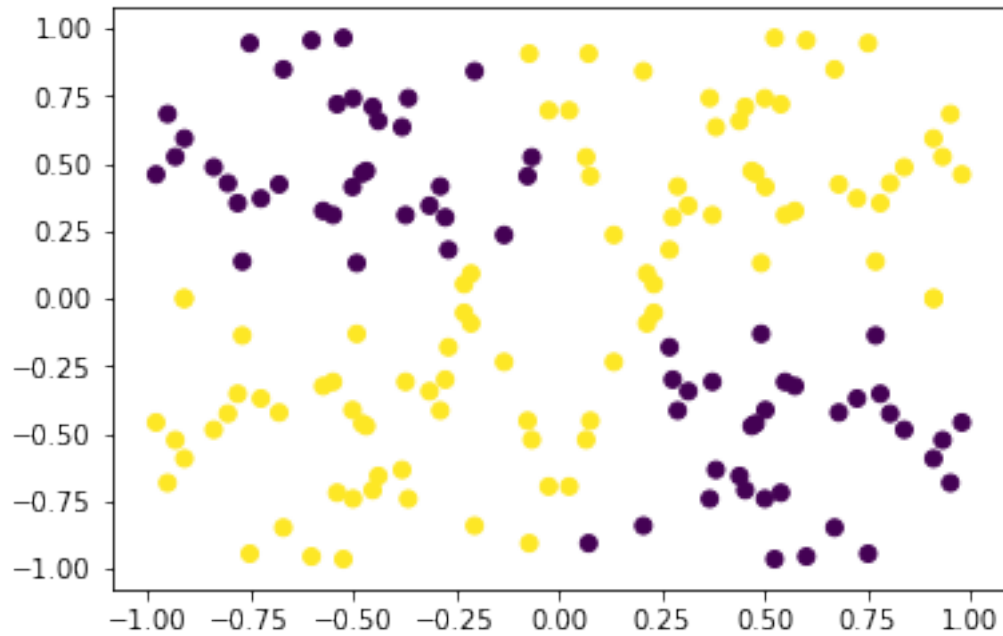
```
[ 0.73803806  0.98378104  0.9998845   0.9930122   0.9309923   0.99995
 0.99915606  0.9908382   0.92628163  0.99995446  0.99774516  0.988741
 0.99975115  0.7619081   0.99244916  0.78804964  0.8158314   0.9999286
 0.96644443  0.80368584  0.99998444  0.9792415   0.7935535   0.9967125
 0.9830082   0.7820302   0.9999863   0.99993664  0.9999577   0.9995083
 0.9991224   0.9605534   0.9934999   0.9994809   0.99986815  0.9887224
 0.89095914  0.9903108   0.99702173  0.97459126  0.9147267   0.95889676
 0.9837068   0.96228653  0.9741662   0.98734117  0.96773607  0.62959087
 0.88980573  0.987223    0.9701404   0.9706767   0.98103696  0.9045534
 0.96032053  0.6593439   0.81966305  0.98548746  0.98007345  0.7522988
 0.99137914  0.9879222   0.7777642   0.94870985  0.9842605   0.89677
 0.9900844   0.992425    0.99091804  0.97380626  0.9512377   0.8607922
 0.9453749   0.97308916  0.98280525  0.97702366  0.8610623   0.9504662
 0.9526689   0.93790716 -0.06090846 -0.558747   -0.89987123 -0.59715945
-0.79259294 -0.9400859   -0.65137565  0.7151278   0.22457965 -0.94010395
-0.70653063 -0.7280056   -0.8680543   -0.02861142 -0.52992105  0.6530855
 0.5137243   -0.9223323   -0.86427015  0.5209655   -0.9761278   -0.9495315
 0.6001878   -0.3775807   -0.9120402   0.19149898 -0.96839505 -0.98208994
-0.97199357 -0.74752086 -0.57645136  0.31998137 -0.30349937 -0.7361835
-0.90016955 -0.8191677   0.25276962 -0.37096968 -0.4356396   -0.19919258
 0.63965034 -0.6951353   -0.99759924 -0.87509316  0.18506017 -0.9990849
-0.98237485 -0.6903829   0.23915547 -0.9991253   -0.9610967   -0.7800167
-0.99402183  0.59423697 -0.7487371   0.78558195  0.61870193 -0.9985602
-0.39886507  0.5014724   -0.99969465 -0.7432366   0.66002727 -0.9330429
-0.7242903   0.6403396   -0.9997083   -0.99916476 -0.99930316 -0.98937607
-0.97133785 -0.2291163   -0.792255    -0.9889829   -0.9969041   -0.78174907
 0.14055054 -0.6833596   -0.9430848   -0.30907074]
160/160 [=====] - 0s 2ms/step
```

```
In [106]: scores, model.metrics_names
```

```
Out[106]: (0.11897641271352768, ['loss'])
```

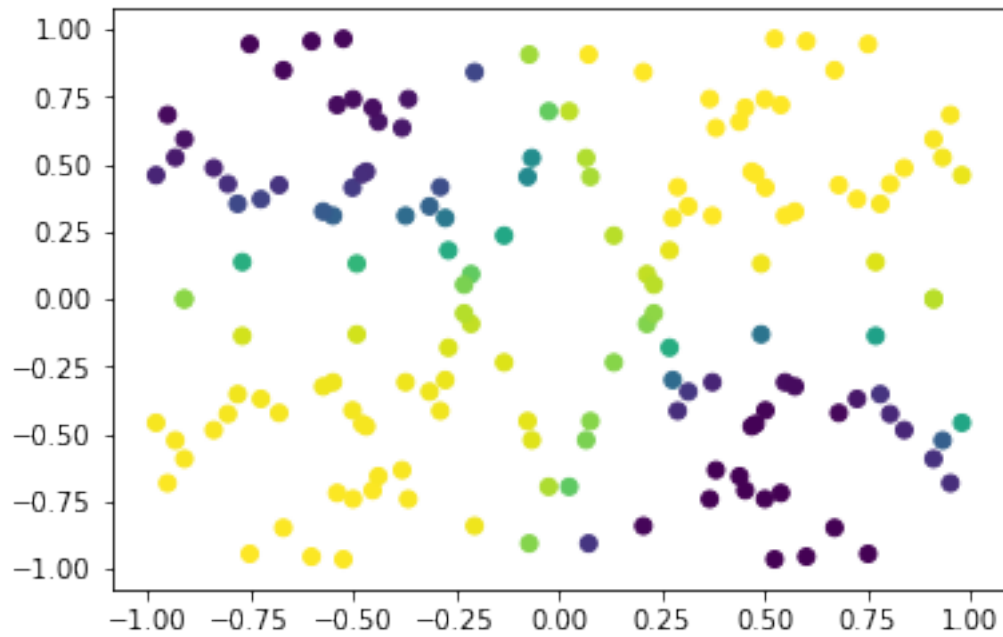
```
In [107]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[107]: <matplotlib.collections.PathCollection at 0xb2d75d0f0>
```



```
In [108]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[108]: <matplotlib.collections.PathCollection at 0xb2d7394a8>
```



```

In [109]: # Using tanh for 4 neuron
          model = Sequential()

          model.add(Dense(4, input_dim=2, activation='tanh'))
          model.add(Dense(4, activation='tanh'))

          # The output has 1 neuron for predicting whatever we are iterating
          model.add(Dense(1, activation='tanh'))

          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))

          scores = model.evaluate(X, y)

```

```

Epoch 1/400
160/160 [=====] - 1s 7ms/step - loss: 1.1712
Epoch 2/400
160/160 [=====] - 0s 886us/step - loss: 0.6487
Epoch 3/400
160/160 [=====] - 0s 830us/step - loss: 0.5922
Epoch 4/400
160/160 [=====] - 0s 788us/step - loss: 0.5467
Epoch 5/400
160/160 [=====] - 0s 746us/step - loss: 0.5096
Epoch 6/400
160/160 [=====] - 0s 857us/step - loss: 0.4892
Epoch 7/400
160/160 [=====] - 0s 748us/step - loss: 0.4452
Epoch 8/400
160/160 [=====] - 0s 686us/step - loss: 0.4069
Epoch 9/400
160/160 [=====] - 0s 691us/step - loss: 0.3771
Epoch 10/400
160/160 [=====] - 0s 702us/step - loss: 0.3441
Epoch 11/400
160/160 [=====] - 0s 709us/step - loss: 0.3078
Epoch 12/400
160/160 [=====] - 0s 693us/step - loss: 0.2984
Epoch 13/400
160/160 [=====] - 0s 708us/step - loss: 0.2709
Epoch 14/400
160/160 [=====] - 0s 706us/step - loss: 0.2495
Epoch 15/400
160/160 [=====] - 0s 696us/step - loss: 0.2333
Epoch 16/400

```

160/160 [=====] - 0s 696us/step - loss: 0.2262
Epoch 17/400
160/160 [=====] - 0s 695us/step - loss: 0.2132
Epoch 18/400
160/160 [=====] - 0s 694us/step - loss: 0.2040
Epoch 19/400
160/160 [=====] - 0s 699us/step - loss: 0.2012
Epoch 20/400
160/160 [=====] - 0s 707us/step - loss: 0.1904
Epoch 21/400
160/160 [=====] - 0s 702us/step - loss: 0.1854
Epoch 22/400
160/160 [=====] - 0s 698us/step - loss: 0.1807
Epoch 23/400
160/160 [=====] - 0s 673us/step - loss: 0.1765
Epoch 24/400
160/160 [=====] - 0s 641us/step - loss: 0.1689
Epoch 25/400
160/160 [=====] - 0s 658us/step - loss: 0.1702
Epoch 26/400
160/160 [=====] - 0s 695us/step - loss: 0.1554
Epoch 27/400
160/160 [=====] - 0s 703us/step - loss: 0.1514
Epoch 28/400
160/160 [=====] - 0s 703us/step - loss: 0.1610
Epoch 29/400
160/160 [=====] - 0s 715us/step - loss: 0.1605
Epoch 30/400
160/160 [=====] - 0s 693us/step - loss: 0.1468
Epoch 31/400
160/160 [=====] - 0s 710us/step - loss: 0.1402
Epoch 32/400
160/160 [=====] - 0s 856us/step - loss: 0.1355
Epoch 33/400
160/160 [=====] - 0s 685us/step - loss: 0.1322
Epoch 34/400
160/160 [=====] - 0s 700us/step - loss: 0.1328
Epoch 35/400
160/160 [=====] - 0s 716us/step - loss: 0.1288
Epoch 36/400
160/160 [=====] - 0s 838us/step - loss: 0.1294
Epoch 37/400
160/160 [=====] - 0s 738us/step - loss: 0.1242
Epoch 38/400
160/160 [=====] - 0s 740us/step - loss: 0.1216
Epoch 39/400
160/160 [=====] - 0s 777us/step - loss: 0.1163
Epoch 40/400

```

160/160 [=====] - 0s 735us/step - loss: 0.1186
Epoch 41/400
160/160 [=====] - 0s 648us/step - loss: 0.1170
Epoch 42/400
160/160 [=====] - 0s 784us/step - loss: 0.1094
Epoch 43/400
160/160 [=====] - 0s 638us/step - loss: 0.1119
Epoch 44/400
160/160 [=====] - 0s 662us/step - loss: 0.1123
Epoch 45/400
160/160 [=====] - 0s 837us/step - loss: 0.1012
Epoch 46/400
160/160 [=====] - 0s 725us/step - loss: 0.1092
Epoch 47/400
160/160 [=====] - 0s 693us/step - loss: 0.1055
Epoch 48/400
160/160 [=====] - 0s 801us/step - loss: 0.1038
Epoch 49/400
160/160 [=====] - 0s 787us/step - loss: 0.0955
Epoch 50/400
160/160 [=====] - 0s 680us/step - loss: 0.1043
Epoch 51/400
160/160 [=====] - 0s 700us/step - loss: 0.0974
Epoch 52/400
160/160 [=====] - 0s 694us/step - loss: 0.0988
Epoch 53/400
160/160 [=====] - 0s 741us/step - loss: 0.0987
Epoch 54/400
160/160 [=====] - 0s 886us/step - loss: 0.0957
Epoch 55/400
160/160 [=====] - 0s 892us/step - loss: 0.0917
Epoch 56/400
160/160 [=====] - 0s 725us/step - loss: 0.0917
Epoch 57/400
160/160 [=====] - 0s 696us/step - loss: 0.0929
Epoch 58/400
160/160 [=====] - 0s 724us/step - loss: 0.0880
Epoch 59/400
160/160 [=====] - 0s 704us/step - loss: 0.0893
Epoch 60/400
160/160 [=====] - 0s 696us/step - loss: 0.0883
Epoch 61/400
160/160 [=====] - 0s 686us/step - loss: 0.0880
Epoch 62/400
160/160 [=====] - 0s 683us/step - loss: 0.0792
Epoch 63/400
160/160 [=====] - 0s 691us/step - loss: 0.0909
Epoch 64/400

```


160/160 [=====] - 0s 770us/step - loss: 0.0847
Epoch 65/400
160/160 [=====] - 0s 769us/step - loss: 0.0822
Epoch 66/400
160/160 [=====] - 0s 697us/step - loss: 0.0778
Epoch 67/400
160/160 [=====] - 0s 906us/step - loss: 0.0815
Epoch 68/400
160/160 [=====] - 0s 828us/step - loss: 0.0799
Epoch 69/400
160/160 [=====] - 0s 849us/step - loss: 0.0767
Epoch 70/400
160/160 [=====] - 0s 887us/step - loss: 0.0799
Epoch 71/400
160/160 [=====] - 0s 897us/step - loss: 0.0786
Epoch 72/400
160/160 [=====] - 0s 875us/step - loss: 0.0801
Epoch 73/400
160/160 [=====] - 0s 913us/step - loss: 0.0747
Epoch 74/400
160/160 [=====] - 0s 877us/step - loss: 0.0694
Epoch 75/400
160/160 [=====] - 0s 871us/step - loss: 0.0742
Epoch 76/400
160/160 [=====] - 0s 868us/step - loss: 0.0742
Epoch 77/400
160/160 [=====] - 0s 861us/step - loss: 0.0729
Epoch 78/400
160/160 [=====] - 0s 835us/step - loss: 0.0711
Epoch 79/400
160/160 [=====] - 0s 851us/step - loss: 0.0718
Epoch 80/400
160/160 [=====] - 0s 829us/step - loss: 0.0698
Epoch 81/400
160/160 [=====] - 0s 854us/step - loss: 0.0710
Epoch 82/400
160/160 [=====] - 0s 805us/step - loss: 0.0693
Epoch 83/400
160/160 [=====] - 0s 847us/step - loss: 0.0656
Epoch 84/400
160/160 [=====] - 0s 703us/step - loss: 0.0698
Epoch 85/400
160/160 [=====] - 0s 727us/step - loss: 0.0629
Epoch 86/400
160/160 [=====] - 0s 700us/step - loss: 0.0624
Epoch 87/400
160/160 [=====] - 0s 690us/step - loss: 0.0671
Epoch 88/400

```

160/160 [=====] - 0s 899us/step - loss: 0.0637
Epoch 89/400
160/160 [=====] - 0s 879us/step - loss: 0.0608
Epoch 90/400
160/160 [=====] - 0s 875us/step - loss: 0.0607
Epoch 91/400
160/160 [=====] - 0s 865us/step - loss: 0.0653
Epoch 92/400
160/160 [=====] - 0s 883us/step - loss: 0.0611
Epoch 93/400
160/160 [=====] - 0s 946us/step - loss: 0.0603
Epoch 94/400
160/160 [=====] - 0s 882us/step - loss: 0.0611
Epoch 95/400
160/160 [=====] - 0s 866us/step - loss: 0.0621
Epoch 96/400
160/160 [=====] - 0s 887us/step - loss: 0.0612
Epoch 97/400
160/160 [=====] - 0s 868us/step - loss: 0.0621
Epoch 98/400
160/160 [=====] - 0s 913us/step - loss: 0.0600
Epoch 99/400
160/160 [=====] - 0s 717us/step - loss: 0.0605
Epoch 100/400
160/160 [=====] - 0s 712us/step - loss: 0.0570
Epoch 101/400
160/160 [=====] - 0s 881us/step - loss: 0.0565
Epoch 102/400
160/160 [=====] - 0s 719us/step - loss: 0.0572
Epoch 103/400
160/160 [=====] - 0s 764us/step - loss: 0.0596
Epoch 104/400
160/160 [=====] - 0s 940us/step - loss: 0.0542
Epoch 105/400
160/160 [=====] - 0s 913us/step - loss: 0.0578
Epoch 106/400
160/160 [=====] - 0s 885us/step - loss: 0.0558
Epoch 107/400
160/160 [=====] - 0s 801us/step - loss: 0.0553
Epoch 108/400
160/160 [=====] - 0s 919us/step - loss: 0.0526
Epoch 109/400
160/160 [=====] - 0s 807us/step - loss: 0.0548
Epoch 110/400
160/160 [=====] - 0s 687us/step - loss: 0.0525
Epoch 111/400
160/160 [=====] - 0s 715us/step - loss: 0.0544
Epoch 112/400

```

160/160 [=====] - 0s 725us/step - loss: 0.0536
 Epoch 113/400
 160/160 [=====] - 0s 701us/step - loss: 0.0524
 Epoch 114/400
 160/160 [=====] - 0s 847us/step - loss: 0.0540
 Epoch 115/400
 160/160 [=====] - 0s 910us/step - loss: 0.0533
 Epoch 116/400
 160/160 [=====] - 0s 928us/step - loss: 0.0517
 Epoch 117/400
 160/160 [=====] - 0s 932us/step - loss: 0.0520
 Epoch 118/400
 160/160 [=====] - 0s 833us/step - loss: 0.0501
 Epoch 119/400
 160/160 [=====] - 0s 899us/step - loss: 0.0551
 Epoch 120/400
 160/160 [=====] - 0s 847us/step - loss: 0.0520
 Epoch 121/400
 160/160 [=====] - 0s 917us/step - loss: 0.0496
 Epoch 122/400
 160/160 [=====] - 0s 827us/step - loss: 0.0486
 Epoch 123/400
 160/160 [=====] - 0s 712us/step - loss: 0.0513
 Epoch 124/400
 160/160 [=====] - 0s 706us/step - loss: 0.0492
 Epoch 125/400
 160/160 [=====] - 0s 710us/step - loss: 0.0512
 Epoch 126/400
 160/160 [=====] - 0s 681us/step - loss: 0.0501
 Epoch 127/400
 160/160 [=====] - 0s 872us/step - loss: 0.0497
 Epoch 128/400
 160/160 [=====] - 0s 834us/step - loss: 0.0476
 Epoch 129/400
 160/160 [=====] - 0s 730us/step - loss: 0.0500
 Epoch 130/400
 160/160 [=====] - 0s 675us/step - loss: 0.0457
 Epoch 131/400
 160/160 [=====] - 0s 886us/step - loss: 0.0496
 Epoch 132/400
 160/160 [=====] - 0s 902us/step - loss: 0.0484
 Epoch 133/400
 160/160 [=====] - 0s 809us/step - loss: 0.0487
 Epoch 134/400
 160/160 [=====] - 0s 824us/step - loss: 0.0467
 Epoch 135/400
 160/160 [=====] - 0s 937us/step - loss: 0.0499
 Epoch 136/400

160/160 [=====] - 0s 782us/step - loss: 0.0492
Epoch 137/400
160/160 [=====] - 0s 700us/step - loss: 0.0470
Epoch 138/400
160/160 [=====] - 0s 708us/step - loss: 0.0429
Epoch 139/400
160/160 [=====] - 0s 675us/step - loss: 0.0468
Epoch 140/400
160/160 [=====] - 0s 732us/step - loss: 0.0448
Epoch 141/400
160/160 [=====] - 0s 926us/step - loss: 0.0457
Epoch 142/400
160/160 [=====] - 0s 893us/step - loss: 0.0450
Epoch 143/400
160/160 [=====] - 0s 699us/step - loss: 0.0450
Epoch 144/400
160/160 [=====] - 0s 680us/step - loss: 0.0468
Epoch 145/400
160/160 [=====] - 0s 702us/step - loss: 0.0464
Epoch 146/400
160/160 [=====] - 0s 708us/step - loss: 0.0446
Epoch 147/400
160/160 [=====] - 0s 853us/step - loss: 0.0460
Epoch 148/400
160/160 [=====] - 0s 733us/step - loss: 0.0460
Epoch 149/400
160/160 [=====] - 0s 808us/step - loss: 0.0439
Epoch 150/400
160/160 [=====] - 0s 846us/step - loss: 0.0463
Epoch 151/400
160/160 [=====] - 0s 685us/step - loss: 0.0429
Epoch 152/400
160/160 [=====] - 0s 698us/step - loss: 0.0436
Epoch 153/400
160/160 [=====] - 0s 685us/step - loss: 0.0416
Epoch 154/400
160/160 [=====] - 0s 732us/step - loss: 0.0456
Epoch 155/400
160/160 [=====] - 0s 855us/step - loss: 0.0449
Epoch 156/400
160/160 [=====] - 0s 689us/step - loss: 0.0451
Epoch 157/400
160/160 [=====] - 0s 692us/step - loss: 0.0443
Epoch 158/400
160/160 [=====] - 0s 705us/step - loss: 0.0389
Epoch 159/400
160/160 [=====] - 0s 696us/step - loss: 0.0415
Epoch 160/400

160/160 [=====] - 0s 761us/step - loss: 0.0409
 Epoch 161/400
 160/160 [=====] - 0s 745us/step - loss: 0.0439
 Epoch 162/400
 160/160 [=====] - 0s 688us/step - loss: 0.0433
 Epoch 163/400
 160/160 [=====] - 0s 692us/step - loss: 0.0423
 Epoch 164/400
 160/160 [=====] - 0s 670us/step - loss: 0.0420
 Epoch 165/400
 160/160 [=====] - 0s 687us/step - loss: 0.0412
 Epoch 166/400
 160/160 [=====] - 0s 642us/step - loss: 0.0428
 Epoch 167/400
 160/160 [=====] - 0s 611us/step - loss: 0.0431
 Epoch 168/400
 160/160 [=====] - 0s 631us/step - loss: 0.0406
 Epoch 169/400
 160/160 [=====] - 0s 726us/step - loss: 0.0423
 Epoch 170/400
 160/160 [=====] - 0s 779us/step - loss: 0.0432
 Epoch 171/400
 160/160 [=====] - 0s 692us/step - loss: 0.0418
 Epoch 172/400
 160/160 [=====] - 0s 732us/step - loss: 0.0426
 Epoch 173/400
 160/160 [=====] - 0s 923us/step - loss: 0.0404
 Epoch 174/400
 160/160 [=====] - 0s 800us/step - loss: 0.0443
 Epoch 175/400
 160/160 [=====] - 0s 695us/step - loss: 0.0382
 Epoch 176/400
 160/160 [=====] - 0s 736us/step - loss: 0.0400
 Epoch 177/400
 160/160 [=====] - 0s 707us/step - loss: 0.0397
 Epoch 178/400
 160/160 [=====] - 0s 687us/step - loss: 0.0416
 Epoch 179/400
 160/160 [=====] - 0s 767us/step - loss: 0.0395
 Epoch 180/400
 160/160 [=====] - 0s 799us/step - loss: 0.0412
 Epoch 181/400
 160/160 [=====] - 0s 734us/step - loss: 0.0371
 Epoch 182/400
 160/160 [=====] - 0s 747us/step - loss: 0.0415
 Epoch 183/400
 160/160 [=====] - 0s 844us/step - loss: 0.0406
 Epoch 184/400

160/160 [=====] - 0s 846us/step - loss: 0.0405
 Epoch 185/400
 160/160 [=====] - 0s 692us/step - loss: 0.0387
 Epoch 186/400
 160/160 [=====] - 0s 716us/step - loss: 0.0400
 Epoch 187/400
 160/160 [=====] - 0s 699us/step - loss: 0.0386
 Epoch 188/400
 160/160 [=====] - 0s 846us/step - loss: 0.0391
 Epoch 189/400
 160/160 [=====] - 0s 859us/step - loss: 0.0393
 Epoch 190/400
 160/160 [=====] - 0s 797us/step - loss: 0.0373
 Epoch 191/400
 160/160 [=====] - 0s 854us/step - loss: 0.0396
 Epoch 192/400
 160/160 [=====] - 0s 885us/step - loss: 0.0379
 Epoch 193/400
 160/160 [=====] - 0s 824us/step - loss: 0.0401
 Epoch 194/400
 160/160 [=====] - 0s 875us/step - loss: 0.0367
 Epoch 195/400
 160/160 [=====] - 0s 843us/step - loss: 0.0365
 Epoch 196/400
 160/160 [=====] - 0s 860us/step - loss: 0.0396
 Epoch 197/400
 160/160 [=====] - 0s 889us/step - loss: 0.0352
 Epoch 198/400
 160/160 [=====] - 0s 801us/step - loss: 0.0388
 Epoch 199/400
 160/160 [=====] - 0s 758us/step - loss: 0.0395
 Epoch 200/400
 160/160 [=====] - 0s 932us/step - loss: 0.0397ETA: 0s - loss: 0.0583
 Epoch 201/400
 160/160 [=====] - 0s 822us/step - loss: 0.0372
 Epoch 202/400
 160/160 [=====] - 0s 916us/step - loss: 0.0389
 Epoch 203/400
 160/160 [=====] - 0s 900us/step - loss: 0.0379
 Epoch 204/400
 160/160 [=====] - 0s 887us/step - loss: 0.0392
 Epoch 205/400
 160/160 [=====] - 0s 803us/step - loss: 0.0374
 Epoch 206/400
 160/160 [=====] - 0s 864us/step - loss: 0.0376
 Epoch 207/400
 160/160 [=====] - 0s 906us/step - loss: 0.0398
 Epoch 208/400

160/160 [=====] - 0s 901us/step - loss: 0.0382
 Epoch 209/400
 160/160 [=====] - 0s 999us/step - loss: 0.0375
 Epoch 210/400
 160/160 [=====] - 0s 896us/step - loss: 0.0349
 Epoch 211/400
 160/160 [=====] - 0s 843us/step - loss: 0.0380
 Epoch 212/400
 160/160 [=====] - 0s 798us/step - loss: 0.0377
 Epoch 213/400
 160/160 [=====] - 0s 802us/step - loss: 0.0376
 Epoch 214/400
 160/160 [=====] - 0s 867us/step - loss: 0.0360
 Epoch 215/400
 160/160 [=====] - 0s 848us/step - loss: 0.0366
 Epoch 216/400
 160/160 [=====] - 0s 852us/step - loss: 0.0356
 Epoch 217/400
 160/160 [=====] - 0s 793us/step - loss: 0.0374
 Epoch 218/400
 160/160 [=====] - 0s 892us/step - loss: 0.0340
 Epoch 219/400
 160/160 [=====] - 0s 881us/step - loss: 0.0372
 Epoch 220/400
 160/160 [=====] - 0s 889us/step - loss: 0.0348
 Epoch 221/400
 160/160 [=====] - 0s 828us/step - loss: 0.0387
 Epoch 222/400
 160/160 [=====] - 0s 879us/step - loss: 0.0378
 Epoch 223/400
 160/160 [=====] - 0s 877us/step - loss: 0.0339
 Epoch 224/400
 160/160 [=====] - 0s 864us/step - loss: 0.0359
 Epoch 225/400
 160/160 [=====] - 0s 872us/step - loss: 0.0358
 Epoch 226/400
 160/160 [=====] - 0s 807us/step - loss: 0.0357
 Epoch 227/400
 160/160 [=====] - 0s 904us/step - loss: 0.0360
 Epoch 228/400
 160/160 [=====] - 0s 890us/step - loss: 0.0362
 Epoch 229/400
 160/160 [=====] - 0s 899us/step - loss: 0.0361
 Epoch 230/400
 160/160 [=====] - 0s 889us/step - loss: 0.0339
 Epoch 231/400
 160/160 [=====] - 0s 838us/step - loss: 0.0369
 Epoch 232/400

160/160 [=====] - 0s 844us/step - loss: 0.0347
 Epoch 233/400
 160/160 [=====] - 0s 907us/step - loss: 0.0351
 Epoch 234/400
 160/160 [=====] - 0s 872us/step - loss: 0.0353
 Epoch 235/400
 160/160 [=====] - 0s 845us/step - loss: 0.0344
 Epoch 236/400
 160/160 [=====] - 0s 688us/step - loss: 0.0340
 Epoch 237/400
 160/160 [=====] - 0s 674us/step - loss: 0.0358
 Epoch 238/400
 160/160 [=====] - 0s 696us/step - loss: 0.0333
 Epoch 239/400
 160/160 [=====] - 0s 710us/step - loss: 0.0334
 Epoch 240/400
 160/160 [=====] - 0s 848us/step - loss: 0.0352
 Epoch 241/400
 160/160 [=====] - 0s 692us/step - loss: 0.0355
 Epoch 242/400
 160/160 [=====] - 0s 685us/step - loss: 0.0342
 Epoch 243/400
 160/160 [=====] - 0s 776us/step - loss: 0.0354
 Epoch 244/400
 160/160 [=====] - 0s 679us/step - loss: 0.0350
 Epoch 245/400
 160/160 [=====] - 0s 678us/step - loss: 0.0334
 Epoch 246/400
 160/160 [=====] - 0s 686us/step - loss: 0.0308
 Epoch 247/400
 160/160 [=====] - 0s 684us/step - loss: 0.0348
 Epoch 248/400
 160/160 [=====] - 0s 702us/step - loss: 0.0342
 Epoch 249/400
 160/160 [=====] - 0s 701us/step - loss: 0.0346
 Epoch 250/400
 160/160 [=====] - 0s 683us/step - loss: 0.0338
 Epoch 251/400
 160/160 [=====] - 0s 685us/step - loss: 0.0352
 Epoch 252/400
 160/160 [=====] - 0s 689us/step - loss: 0.0351
 Epoch 253/400
 160/160 [=====] - 0s 668us/step - loss: 0.0296
 Epoch 254/400
 160/160 [=====] - 0s 703us/step - loss: 0.0330
 Epoch 255/400
 160/160 [=====] - 0s 854us/step - loss: 0.0341
 Epoch 256/400

160/160 [=====] - 0s 870us/step - loss: 0.0339
Epoch 257/400
160/160 [=====] - 0s 736us/step - loss: 0.0302
Epoch 258/400
160/160 [=====] - 0s 708us/step - loss: 0.0338
Epoch 259/400
160/160 [=====] - 0s 700us/step - loss: 0.0331
Epoch 260/400
160/160 [=====] - 0s 660us/step - loss: 0.0334
Epoch 261/400
160/160 [=====] - 0s 637us/step - loss: 0.0336
Epoch 262/400
160/160 [=====] - 0s 640us/step - loss: 0.0330
Epoch 263/400
160/160 [=====] - 0s 698us/step - loss: 0.0329
Epoch 264/400
160/160 [=====] - 0s 875us/step - loss: 0.0333
Epoch 265/400
160/160 [=====] - 0s 750us/step - loss: 0.0322
Epoch 266/400
160/160 [=====] - 0s 733us/step - loss: 0.0335
Epoch 267/400
160/160 [=====] - 0s 715us/step - loss: 0.0306
Epoch 268/400
160/160 [=====] - 0s 690us/step - loss: 0.0349
Epoch 269/400
160/160 [=====] - 0s 688us/step - loss: 0.0312
Epoch 270/400
160/160 [=====] - 0s 710us/step - loss: 0.0339
Epoch 271/400
160/160 [=====] - 0s 684us/step - loss: 0.0311
Epoch 272/400
160/160 [=====] - 0s 705us/step - loss: 0.0330
Epoch 273/400
160/160 [=====] - 0s 673us/step - loss: 0.0326
Epoch 274/400
160/160 [=====] - 0s 746us/step - loss: 0.0317
Epoch 275/400
160/160 [=====] - 0s 689us/step - loss: 0.0337
Epoch 276/400
160/160 [=====] - 0s 748us/step - loss: 0.0299
Epoch 277/400
160/160 [=====] - 0s 875us/step - loss: 0.0309
Epoch 278/400
160/160 [=====] - 0s 889us/step - loss: 0.0300
Epoch 279/400
160/160 [=====] - 0s 875us/step - loss: 0.0311
Epoch 280/400

```

160/160 [=====] - 0s 893us/step - loss: 0.0299
Epoch 281/400
160/160 [=====] - 0s 865us/step - loss: 0.0338
Epoch 282/400
160/160 [=====] - 0s 919us/step - loss: 0.0313
Epoch 283/400
160/160 [=====] - 0s 868us/step - loss: 0.0308
Epoch 284/400
160/160 [=====] - 0s 889us/step - loss: 0.0323
Epoch 285/400
160/160 [=====] - 0s 741us/step - loss: 0.0322
Epoch 286/400
160/160 [=====] - 0s 681us/step - loss: 0.0334
Epoch 287/400
160/160 [=====] - 0s 725us/step - loss: 0.0314
Epoch 288/400
160/160 [=====] - 0s 669us/step - loss: 0.0296
Epoch 289/400
160/160 [=====] - 0s 706us/step - loss: 0.0306
Epoch 290/400
160/160 [=====] - 0s 738us/step - loss: 0.0319
Epoch 291/400
160/160 [=====] - 0s 1ms/step - loss: 0.0288
Epoch 292/400
160/160 [=====] - 0s 779us/step - loss: 0.0323
Epoch 293/400
160/160 [=====] - 0s 686us/step - loss: 0.0307
Epoch 294/400
160/160 [=====] - 0s 916us/step - loss: 0.0290
Epoch 295/400
160/160 [=====] - 0s 925us/step - loss: 0.0313
Epoch 296/400
160/160 [=====] - 0s 820us/step - loss: 0.0319
Epoch 297/400
160/160 [=====] - 0s 700us/step - loss: 0.0291
Epoch 298/400
160/160 [=====] - 0s 700us/step - loss: 0.0299
Epoch 299/400
160/160 [=====] - 0s 703us/step - loss: 0.0322
Epoch 300/400
160/160 [=====] - 0s 684us/step - loss: 0.0294
Epoch 301/400
160/160 [=====] - 0s 670us/step - loss: 0.0314
Epoch 302/400
160/160 [=====] - 0s 681us/step - loss: 0.0290
Epoch 303/400
160/160 [=====] - 0s 688us/step - loss: 0.0316
Epoch 304/400

```

160/160 [=====] - 0s 811us/step - loss: 0.0278
 Epoch 305/400
 160/160 [=====] - 0s 759us/step - loss: 0.0298
 Epoch 306/400
 160/160 [=====] - 0s 799us/step - loss: 0.0316
 Epoch 307/400
 160/160 [=====] - 0s 704us/step - loss: 0.0314
 Epoch 308/400
 160/160 [=====] - 0s 743us/step - loss: 0.0300
 Epoch 309/400
 160/160 [=====] - 0s 933us/step - loss: 0.0285
 Epoch 310/400
 160/160 [=====] - 0s 728us/step - loss: 0.0283
 Epoch 311/400
 160/160 [=====] - 0s 683us/step - loss: 0.0306
 Epoch 312/400
 160/160 [=====] - 0s 795us/step - loss: 0.0327
 Epoch 313/400
 160/160 [=====] - 0s 787us/step - loss: 0.0276
 Epoch 314/400
 160/160 [=====] - 0s 828us/step - loss: 0.0283
 Epoch 315/400
 160/160 [=====] - 0s 880us/step - loss: 0.0305
 Epoch 316/400
 160/160 [=====] - 0s 888us/step - loss: 0.0299
 Epoch 317/400
 160/160 [=====] - 0s 909us/step - loss: 0.0268
 Epoch 318/400
 160/160 [=====] - 0s 878us/step - loss: 0.0293
 Epoch 319/400
 160/160 [=====] - 0s 889us/step - loss: 0.0271
 Epoch 320/400
 160/160 [=====] - 0s 845us/step - loss: 0.0306
 Epoch 321/400
 160/160 [=====] - 0s 862us/step - loss: 0.0268
 Epoch 322/400
 160/160 [=====] - 0s 861us/step - loss: 0.0302
 Epoch 323/400
 160/160 [=====] - 0s 891us/step - loss: 0.0271
 Epoch 324/400
 160/160 [=====] - 0s 832us/step - loss: 0.0322
 Epoch 325/400
 160/160 [=====] - 0s 920us/step - loss: 0.0285
 Epoch 326/400
 160/160 [=====] - 0s 861us/step - loss: 0.0288
 Epoch 327/400
 160/160 [=====] - 0s 899us/step - loss: 0.0277
 Epoch 328/400

160/160 [=====] - 0s 887us/step - loss: 0.0294
Epoch 329/400
160/160 [=====] - 0s 899us/step - loss: 0.0292
Epoch 330/400
160/160 [=====] - 0s 766us/step - loss: 0.0298
Epoch 331/400
160/160 [=====] - 0s 702us/step - loss: 0.0274
Epoch 332/400
160/160 [=====] - 0s 697us/step - loss: 0.0293
Epoch 333/400
160/160 [=====] - 0s 837us/step - loss: 0.0279
Epoch 334/400
160/160 [=====] - 0s 692us/step - loss: 0.0292
Epoch 335/400
160/160 [=====] - 0s 732us/step - loss: 0.0267
Epoch 336/400
160/160 [=====] - 0s 806us/step - loss: 0.0267
Epoch 337/400
160/160 [=====] - 0s 697us/step - loss: 0.0317
Epoch 338/400
160/160 [=====] - 0s 881us/step - loss: 0.0281
Epoch 339/400
160/160 [=====] - 0s 802us/step - loss: 0.0287
Epoch 340/400
160/160 [=====] - 0s 819us/step - loss: 0.0272
Epoch 341/400
160/160 [=====] - 0s 663us/step - loss: 0.0296
Epoch 342/400
160/160 [=====] - 0s 720us/step - loss: 0.0288
Epoch 343/400
160/160 [=====] - 0s 808us/step - loss: 0.0286
Epoch 344/400
160/160 [=====] - 0s 719us/step - loss: 0.0283
Epoch 345/400
160/160 [=====] - 0s 819us/step - loss: 0.0307
Epoch 346/400
160/160 [=====] - 0s 737us/step - loss: 0.0261
Epoch 347/400
160/160 [=====] - 0s 661us/step - loss: 0.0298
Epoch 348/400
160/160 [=====] - 0s 712us/step - loss: 0.0289
Epoch 349/400
160/160 [=====] - 0s 684us/step - loss: 0.0285
Epoch 350/400
160/160 [=====] - 0s 687us/step - loss: 0.0290
Epoch 351/400
160/160 [=====] - 0s 700us/step - loss: 0.0282
Epoch 352/400

160/160 [=====] - 0s 692us/step - loss: 0.0267
 Epoch 353/400
 160/160 [=====] - 0s 701us/step - loss: 0.0277
 Epoch 354/400
 160/160 [=====] - 0s 703us/step - loss: 0.0293
 Epoch 355/400
 160/160 [=====] - 0s 674us/step - loss: 0.0276
 Epoch 356/400
 160/160 [=====] - 0s 668us/step - loss: 0.0269
 Epoch 357/400
 160/160 [=====] - 0s 855us/step - loss: 0.0261
 Epoch 358/400
 160/160 [=====] - 0s 801us/step - loss: 0.0287
 Epoch 359/400
 160/160 [=====] - 0s 784us/step - loss: 0.0294
 Epoch 360/400
 160/160 [=====] - 0s 890us/step - loss: 0.0281
 Epoch 361/400
 160/160 [=====] - 0s 895us/step - loss: 0.0262
 Epoch 362/400
 160/160 [=====] - 0s 793us/step - loss: 0.0266
 Epoch 363/400
 160/160 [=====] - 0s 804us/step - loss: 0.0283
 Epoch 364/400
 160/160 [=====] - 0s 805us/step - loss: 0.0280
 Epoch 365/400
 160/160 [=====] - 0s 691us/step - loss: 0.0298
 Epoch 366/400
 160/160 [=====] - 0s 810us/step - loss: 0.0271
 Epoch 367/400
 160/160 [=====] - 0s 704us/step - loss: 0.0257
 Epoch 368/400
 160/160 [=====] - 0s 754us/step - loss: 0.0265
 Epoch 369/400
 160/160 [=====] - 0s 700us/step - loss: 0.0272
 Epoch 370/400
 160/160 [=====] - 0s 765us/step - loss: 0.0254
 Epoch 371/400
 160/160 [=====] - 0s 687us/step - loss: 0.0280
 Epoch 372/400
 160/160 [=====] - 0s 748us/step - loss: 0.0264
 Epoch 373/400
 160/160 [=====] - 0s 644us/step - loss: 0.0283
 Epoch 374/400
 160/160 [=====] - 0s 757us/step - loss: 0.0252
 Epoch 375/400
 160/160 [=====] - 0s 745us/step - loss: 0.0290
 Epoch 376/400

```

160/160 [=====] - 0s 779us/step - loss: 0.0267
Epoch 377/400
160/160 [=====] - 0s 755us/step - loss: 0.0260
Epoch 378/400
160/160 [=====] - 0s 770us/step - loss: 0.0270
Epoch 379/400
160/160 [=====] - 0s 813us/step - loss: 0.0259
Epoch 380/400
160/160 [=====] - 0s 674us/step - loss: 0.0237
Epoch 381/400
160/160 [=====] - 0s 689us/step - loss: 0.0294
Epoch 382/400
160/160 [=====] - 0s 718us/step - loss: 0.0265
Epoch 383/400
160/160 [=====] - 0s 702us/step - loss: 0.0280
Epoch 384/400
160/160 [=====] - 0s 713us/step - loss: 0.0268
Epoch 385/400
160/160 [=====] - 0s 677us/step - loss: 0.0259
Epoch 386/400
160/160 [=====] - 0s 757us/step - loss: 0.0266
Epoch 387/400
160/160 [=====] - 0s 716us/step - loss: 0.0275
Epoch 388/400
160/160 [=====] - 0s 671us/step - loss: 0.0247
Epoch 389/400
160/160 [=====] - 0s 656us/step - loss: 0.0278
Epoch 390/400
160/160 [=====] - 0s 638us/step - loss: 0.0274
Epoch 391/400
160/160 [=====] - 0s 635us/step - loss: 0.0261
Epoch 392/400
160/160 [=====] - 0s 668us/step - loss: 0.0265
Epoch 393/400
160/160 [=====] - 0s 688us/step - loss: 0.0256
Epoch 394/400
160/160 [=====] - 0s 687us/step - loss: 0.0274
Epoch 395/400
160/160 [=====] - 0s 683us/step - loss: 0.0253
Epoch 396/400
160/160 [=====] - 0s 705us/step - loss: 0.0248
Epoch 397/400
160/160 [=====] - 0s 793us/step - loss: 0.0276
Epoch 398/400
160/160 [=====] - 0s 681us/step - loss: 0.0261
Epoch 399/400
160/160 [=====] - 0s 691us/step - loss: 0.0276
Epoch 400/400

```

```
160/160 [=====] - 0s 701us/step - loss: 0.0263
```

```
/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '
```

```
[ 0.9964936  0.9995489  0.99997944 0.99970776 0.999837  0.9999788
 0.999929  0.9396367  0.9994582  0.99997973 0.9998733  0.99983317
 0.99997956 0.99002796 0.99996996 0.6494449  0.99466217 0.9999799
 0.9999208  0.71180844 0.9999797  0.999967  0.9738201  0.99959785
 0.99995214 0.9994842  0.99997956 0.9999793  0.99997896 0.9999621
 0.9998238  0.9795222  0.99988985 0.99995816 0.9999784  0.99990565
 0.9625241  0.9999503  0.99965435 0.9999331  0.9948564  0.9984795
 0.9999277  0.9990905  0.9992185  0.99992955 0.99976003 0.99587905
 0.9964039  0.9999339  0.9995976  0.999397  0.9999272  0.9923769
 0.999839  0.5136357  0.9640021  0.999933  0.99967873 0.92589265
 0.99994344 0.99988115 0.8811334  0.99901265 0.99982125 0.99611044
 0.9999454  0.9999399  0.9999361  0.9998565  0.9998915  0.97390246
 0.99954855 0.9998446  0.99993736 0.99964756 0.92723274 0.99972606
 0.9991185  0.9995525 -0.8659193 -0.91012317 -0.9975105 -0.9610779
-0.84255993 -0.9974618 -0.9959344 -0.8974715 -0.9717852 -0.9974931
-0.98689234 -0.95530677 -0.9973848 -0.8336497 -0.9964324  0.50400776
-0.660762  -0.9974896 -0.94592375 -0.4032172 -0.9973672 -0.98267645
-0.3250933  -0.9855352 -0.9766762 -0.88100046 -0.9973882 -0.99688196
-0.99714667 -0.99708956 -0.9924806 -0.8150535 -0.99480253 -0.9969492
-0.99714386 -0.96784085 -0.16203776 -0.9957913 -0.9851708 -0.99378407
-0.9033917  -0.9506616 -0.99536383 -0.9643468 -0.97498894 -0.99512357
-0.98721164 -0.63359916 -0.9504362 -0.9953472 -0.98023176 -0.97536236
-0.99568176 -0.8549654  -0.99481654 0.63699114 -0.5263957 -0.99545705
-0.98604417 0.03441276 -0.9954312 -0.9933983  0.02877779 -0.9598862
-0.99079585 -0.92187124 -0.9951762 -0.9956896 -0.99542373 -0.99195045
-0.9884829  -0.6339506 -0.9841311 -0.99129736 -0.9956915 -0.9839122
-0.3391663  -0.99158126 -0.9629735 -0.99004126]
```

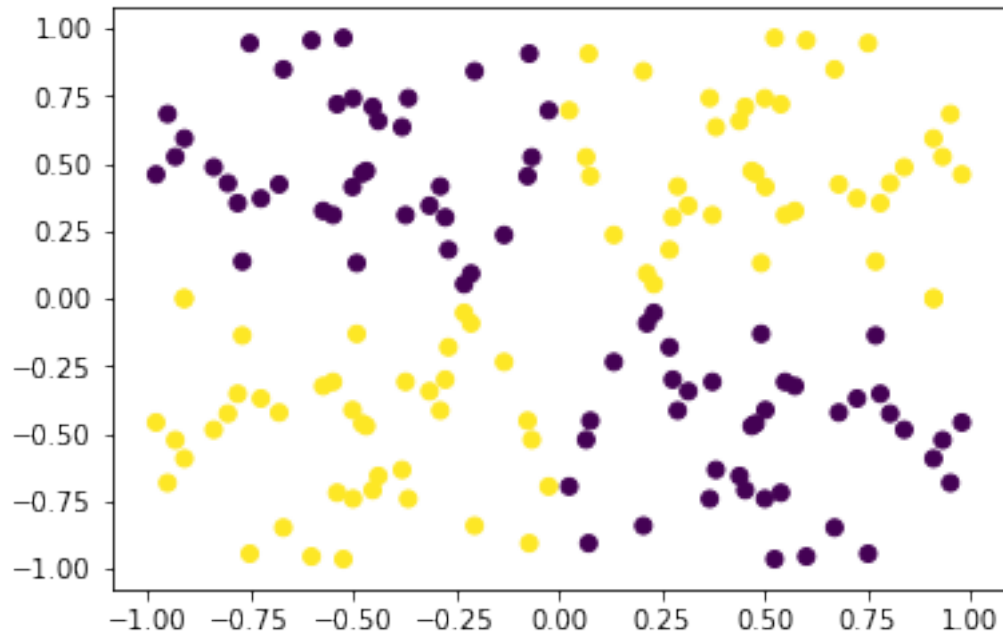
```
160/160 [=====] - 0s 2ms/step
```

```
In [110]: scores, model.metrics_names
```

```
Out[110]: (0.02352197233106921, ['loss'])
```

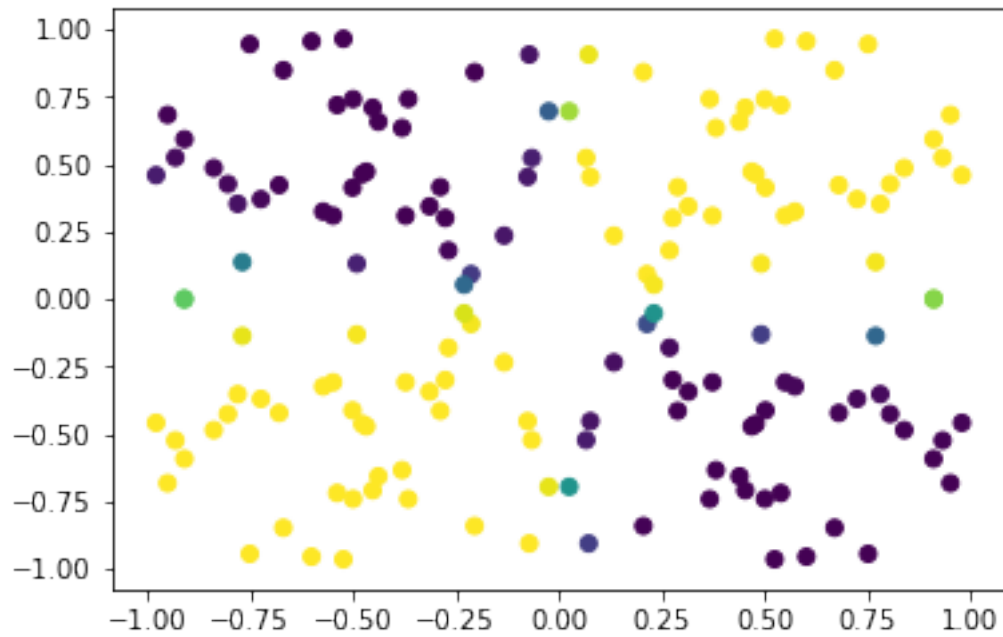
```
In [111]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[111]: <matplotlib.collections.PathCollection at 0xb2db152e8>
```



```
In [112]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[112]: <matplotlib.collections.PathCollection at 0xb2db39828>
```




```

In [113]: # Using tanh for 4 neuron
          model = Sequential()

          model.add(Dense(4, input_dim=2, activation='tanh'))
          model.add(Dense(4, activation='tanh'))
          model.add(Dense(4, activation='tanh'))

          # The output has 1 neuron for predicting whatever we are iterating
          model.add(Dense(1, activation='tanh'))

          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))

          scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 7ms/step - loss: 1.3949
Epoch 2/400
160/160 [=====] - 0s 728us/step - loss: 0.6515
Epoch 3/400
160/160 [=====] - 0s 764us/step - loss: 0.6356
Epoch 4/400
160/160 [=====] - 0s 776us/step - loss: 0.6081
Epoch 5/400
160/160 [=====] - 0s 789us/step - loss: 0.5693
Epoch 6/400
160/160 [=====] - 0s 766us/step - loss: 0.5347
Epoch 7/400
160/160 [=====] - 0s 936us/step - loss: 0.4961
Epoch 8/400
160/160 [=====] - 0s 927us/step - loss: 0.4578
Epoch 9/400
160/160 [=====] - 0s 882us/step - loss: 0.4231
Epoch 10/400
160/160 [=====] - 0s 774us/step - loss: 0.4503
Epoch 11/400
160/160 [=====] - 0s 906us/step - loss: 0.4720
Epoch 12/400
160/160 [=====] - 0s 884us/step - loss: 0.3507
Epoch 13/400
160/160 [=====] - 0s 900us/step - loss: 0.4029
Epoch 14/400
160/160 [=====] - 0s 899us/step - loss: 0.4883
Epoch 15/400
160/160 [=====] - 0s 903us/step - loss: 0.3630

```

Epoch 16/400
160/160 [=====] - 0s 826us/step - loss: 0.5089
Epoch 17/400
160/160 [=====] - 0s 945us/step - loss: 0.3231
Epoch 18/400
160/160 [=====] - 0s 950us/step - loss: 3.4050
Epoch 19/400
160/160 [=====] - 0s 919us/step - loss: 7.9712
Epoch 20/400
160/160 [=====] - 0s 963us/step - loss: 7.9712
Epoch 21/400
160/160 [=====] - 0s 870us/step - loss: 7.9712
Epoch 22/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 23/400
160/160 [=====] - 0s 944us/step - loss: 7.9712
Epoch 24/400
160/160 [=====] - 0s 832us/step - loss: 7.9712
Epoch 25/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 26/400
160/160 [=====] - 0s 959us/step - loss: 7.9712
Epoch 27/400
160/160 [=====] - 0s 880us/step - loss: 7.9712
Epoch 28/400
160/160 [=====] - 0s 952us/step - loss: 7.9712
Epoch 29/400
160/160 [=====] - 0s 744us/step - loss: 7.9712
Epoch 30/400
160/160 [=====] - 0s 698us/step - loss: 7.9712
Epoch 31/400
160/160 [=====] - 0s 769us/step - loss: 7.9712
Epoch 32/400
160/160 [=====] - 0s 986us/step - loss: 7.9712
Epoch 33/400
160/160 [=====] - 0s 809us/step - loss: 7.9712
Epoch 34/400
160/160 [=====] - 0s 774us/step - loss: 7.9712
Epoch 35/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 36/400
160/160 [=====] - 0s 744us/step - loss: 7.9712
Epoch 37/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 38/400
160/160 [=====] - 0s 759us/step - loss: 7.9712
Epoch 39/400
160/160 [=====] - 0s 731us/step - loss: 7.9712

Epoch 40/400
160/160 [=====] - 0s 851us/step - loss: 7.9712
Epoch 41/400
160/160 [=====] - 0s 977us/step - loss: 7.9712
Epoch 42/400
160/160 [=====] - 0s 905us/step - loss: 7.9712
Epoch 43/400
160/160 [=====] - 0s 914us/step - loss: 7.9712
Epoch 44/400
160/160 [=====] - 0s 689us/step - loss: 7.9712
Epoch 45/400
160/160 [=====] - 0s 704us/step - loss: 7.9712
Epoch 46/400
160/160 [=====] - 0s 709us/step - loss: 7.9712
Epoch 47/400
160/160 [=====] - 0s 765us/step - loss: 7.9712
Epoch 48/400
160/160 [=====] - 0s 744us/step - loss: 7.9712
Epoch 49/400
160/160 [=====] - 0s 723us/step - loss: 7.9712
Epoch 50/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 51/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 52/400
160/160 [=====] - 0s 743us/step - loss: 7.9712
Epoch 53/400
160/160 [=====] - 0s 760us/step - loss: 7.9712
Epoch 54/400
160/160 [=====] - 0s 952us/step - loss: 7.9712
Epoch 55/400
160/160 [=====] - 0s 943us/step - loss: 7.9712
Epoch 56/400
160/160 [=====] - 0s 910us/step - loss: 7.9712
Epoch 57/400
160/160 [=====] - 0s 920us/step - loss: 7.9712
Epoch 58/400
160/160 [=====] - 0s 921us/step - loss: 7.9712
Epoch 59/400
160/160 [=====] - 0s 839us/step - loss: 7.9712
Epoch 60/400
160/160 [=====] - 0s 672us/step - loss: 7.9712
Epoch 61/400
160/160 [=====] - 0s 695us/step - loss: 7.9712
Epoch 62/400
160/160 [=====] - 0s 750us/step - loss: 7.9712
Epoch 63/400
160/160 [=====] - 0s 948us/step - loss: 7.9712

Epoch 64/400
160/160 [=====] - 0s 955us/step - loss: 7.9712
Epoch 65/400
160/160 [=====] - 0s 812us/step - loss: 7.9712
Epoch 66/400
160/160 [=====] - 0s 716us/step - loss: 7.9712
Epoch 67/400
160/160 [=====] - 0s 847us/step - loss: 7.9712
Epoch 68/400
160/160 [=====] - 0s 899us/step - loss: 7.9712
Epoch 69/400
160/160 [=====] - 0s 962us/step - loss: 7.9712
Epoch 70/400
160/160 [=====] - 0s 945us/step - loss: 7.9712
Epoch 71/400
160/160 [=====] - 0s 964us/step - loss: 7.9712
Epoch 72/400
160/160 [=====] - 0s 938us/step - loss: 7.9712
Epoch 73/400
160/160 [=====] - 0s 945us/step - loss: 7.9712
Epoch 74/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 75/400
160/160 [=====] - 0s 726us/step - loss: 7.9712
Epoch 76/400
160/160 [=====] - 0s 883us/step - loss: 7.9712
Epoch 77/400
160/160 [=====] - 0s 775us/step - loss: 7.9712
Epoch 78/400
160/160 [=====] - 0s 786us/step - loss: 7.9712
Epoch 79/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 80/400
160/160 [=====] - 0s 761us/step - loss: 7.9712
Epoch 81/400
160/160 [=====] - 0s 796us/step - loss: 7.9712
Epoch 82/400
160/160 [=====] - 0s 827us/step - loss: 7.9712
Epoch 83/400
160/160 [=====] - 0s 916us/step - loss: 7.9712
Epoch 84/400
160/160 [=====] - 0s 738us/step - loss: 7.9712
Epoch 85/400
160/160 [=====] - 0s 857us/step - loss: 7.9712
Epoch 86/400
160/160 [=====] - 0s 824us/step - loss: 7.9712
Epoch 87/400
160/160 [=====] - 0s 751us/step - loss: 7.9712

Epoch 88/400
160/160 [=====] - 0s 762us/step - loss: 7.9712
Epoch 89/400
160/160 [=====] - 0s 797us/step - loss: 7.9712
Epoch 90/400
160/160 [=====] - 0s 854us/step - loss: 7.9712
Epoch 91/400
160/160 [=====] - 0s 694us/step - loss: 7.9712
Epoch 92/400
160/160 [=====] - 0s 889us/step - loss: 7.9712
Epoch 93/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 94/400
160/160 [=====] - 0s 751us/step - loss: 7.9712
Epoch 95/400
160/160 [=====] - 0s 772us/step - loss: 7.9712
Epoch 96/400
160/160 [=====] - 0s 784us/step - loss: 7.9712
Epoch 97/400
160/160 [=====] - 0s 916us/step - loss: 7.9712
Epoch 98/400
160/160 [=====] - 0s 738us/step - loss: 7.9712
Epoch 99/400
160/160 [=====] - 0s 863us/step - loss: 7.9712
Epoch 100/400
160/160 [=====] - 0s 975us/step - loss: 7.9712
Epoch 101/400
160/160 [=====] - 0s 959us/step - loss: 7.9712
Epoch 102/400
160/160 [=====] - 0s 941us/step - loss: 7.9712
Epoch 103/400
160/160 [=====] - 0s 798us/step - loss: 7.9712
Epoch 104/400
160/160 [=====] - 0s 756us/step - loss: 7.9712
Epoch 105/400
160/160 [=====] - 0s 945us/step - loss: 7.9712
Epoch 106/400
160/160 [=====] - 0s 935us/step - loss: 7.9712
Epoch 107/400
160/160 [=====] - 0s 875us/step - loss: 7.9712
Epoch 108/400
160/160 [=====] - 0s 879us/step - loss: 7.9712
Epoch 109/400
160/160 [=====] - 0s 899us/step - loss: 7.9712
Epoch 110/400
160/160 [=====] - 0s 896us/step - loss: 7.9712
Epoch 111/400
160/160 [=====] - 0s 902us/step - loss: 7.9712

Epoch 112/400
160/160 [=====] - 0s 943us/step - loss: 7.9712
Epoch 113/400
160/160 [=====] - 0s 880us/step - loss: 7.9712
Epoch 114/400
160/160 [=====] - 0s 842us/step - loss: 7.9712
Epoch 115/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 116/400
160/160 [=====] - 0s 928us/step - loss: 7.9712
Epoch 117/400
160/160 [=====] - 0s 735us/step - loss: 7.9712
Epoch 118/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 119/400
160/160 [=====] - 0s 781us/step - loss: 7.9712
Epoch 120/400
160/160 [=====] - 0s 951us/step - loss: 7.9712
Epoch 121/400
160/160 [=====] - 0s 945us/step - loss: 7.9712
Epoch 122/400
160/160 [=====] - 0s 832us/step - loss: 7.9712
Epoch 123/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 124/400
160/160 [=====] - 0s 820us/step - loss: 7.9712
Epoch 125/400
160/160 [=====] - 0s 947us/step - loss: 7.9712
Epoch 126/400
160/160 [=====] - 0s 939us/step - loss: 7.9712
Epoch 127/400
160/160 [=====] - 0s 851us/step - loss: 7.9712
Epoch 128/400
160/160 [=====] - 0s 743us/step - loss: 7.9712
Epoch 129/400
160/160 [=====] - 0s 765us/step - loss: 7.9712
Epoch 130/400
160/160 [=====] - 0s 741us/step - loss: 7.9712
Epoch 131/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 132/400
160/160 [=====] - 0s 953us/step - loss: 7.9712
Epoch 133/400
160/160 [=====] - 0s 936us/step - loss: 7.9712
Epoch 134/400
160/160 [=====] - 0s 939us/step - loss: 7.9712
Epoch 135/400
160/160 [=====] - 0s 864us/step - loss: 7.9712

Epoch 136/400
160/160 [=====] - 0s 759us/step - loss: 7.9712
Epoch 137/400
160/160 [=====] - 0s 797us/step - loss: 7.9712
Epoch 138/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 139/400
160/160 [=====] - 0s 949us/step - loss: 7.9712
Epoch 140/400
160/160 [=====] - 0s 903us/step - loss: 7.9712
Epoch 141/400
160/160 [=====] - 0s 754us/step - loss: 7.9712
Epoch 142/400
160/160 [=====] - 0s 735us/step - loss: 7.9712
Epoch 143/400
160/160 [=====] - 0s 760us/step - loss: 7.9712
Epoch 144/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 145/400
160/160 [=====] - 0s 767us/step - loss: 7.9712
Epoch 146/400
160/160 [=====] - 0s 725us/step - loss: 7.9712
Epoch 147/400
160/160 [=====] - 0s 728us/step - loss: 7.9712
Epoch 148/400
160/160 [=====] - 0s 729us/step - loss: 7.9712
Epoch 149/400
160/160 [=====] - 0s 671us/step - loss: 7.9712
Epoch 150/400
160/160 [=====] - 0s 705us/step - loss: 7.9712
Epoch 151/400
160/160 [=====] - 0s 724us/step - loss: 7.9712
Epoch 152/400
160/160 [=====] - 0s 932us/step - loss: 7.9712
Epoch 153/400
160/160 [=====] - 0s 898us/step - loss: 7.9712
Epoch 154/400
160/160 [=====] - 0s 960us/step - loss: 7.9712
Epoch 155/400
160/160 [=====] - 0s 936us/step - loss: 7.9712
Epoch 156/400
160/160 [=====] - 0s 995us/step - loss: 7.9712
Epoch 157/400
160/160 [=====] - 0s 951us/step - loss: 7.9712
Epoch 158/400
160/160 [=====] - 0s 965us/step - loss: 7.9712
Epoch 159/400
160/160 [=====] - 0s 940us/step - loss: 7.9712

Epoch 160/400
160/160 [=====] - 0s 941us/step - loss: 7.9712
Epoch 161/400
160/160 [=====] - 0s 945us/step - loss: 7.9712
Epoch 162/400
160/160 [=====] - 0s 920us/step - loss: 7.9712
Epoch 163/400
160/160 [=====] - 0s 944us/step - loss: 7.9712
Epoch 164/400
160/160 [=====] - 0s 858us/step - loss: 7.9712
Epoch 165/400
160/160 [=====] - 0s 790us/step - loss: 7.9712
Epoch 166/400
160/160 [=====] - 0s 867us/step - loss: 7.9712
Epoch 167/400
160/160 [=====] - 0s 908us/step - loss: 7.9712
Epoch 168/400
160/160 [=====] - 0s 890us/step - loss: 7.9712
Epoch 169/400
160/160 [=====] - 0s 723us/step - loss: 7.9712
Epoch 170/400
160/160 [=====] - 0s 779us/step - loss: 7.9712
Epoch 171/400
160/160 [=====] - 0s 732us/step - loss: 7.9712
Epoch 172/400
160/160 [=====] - 0s 821us/step - loss: 7.9712
Epoch 173/400
160/160 [=====] - 0s 750us/step - loss: 7.9712
Epoch 174/400
160/160 [=====] - 0s 783us/step - loss: 7.9712
Epoch 175/400
160/160 [=====] - 0s 733us/step - loss: 7.9712
Epoch 176/400
160/160 [=====] - 0s 780us/step - loss: 7.9712
Epoch 177/400
160/160 [=====] - 0s 877us/step - loss: 7.9712
Epoch 178/400
160/160 [=====] - 0s 787us/step - loss: 7.9712
Epoch 179/400
160/160 [=====] - 0s 685us/step - loss: 7.9712
Epoch 180/400
160/160 [=====] - 0s 855us/step - loss: 7.9712
Epoch 181/400
160/160 [=====] - 0s 858us/step - loss: 7.9712
Epoch 182/400
160/160 [=====] - 0s 866us/step - loss: 7.9712
Epoch 183/400
160/160 [=====] - 0s 784us/step - loss: 7.9712

Epoch 184/400
160/160 [=====] - 0s 777us/step - loss: 7.9712
Epoch 185/400
160/160 [=====] - 0s 859us/step - loss: 7.9712
Epoch 186/400
160/160 [=====] - 0s 754us/step - loss: 7.9712
Epoch 187/400
160/160 [=====] - 0s 864us/step - loss: 7.9712
Epoch 188/400
160/160 [=====] - 0s 906us/step - loss: 7.9712
Epoch 189/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 190/400
160/160 [=====] - 0s 778us/step - loss: 7.9712
Epoch 191/400
160/160 [=====] - 0s 946us/step - loss: 7.9712
Epoch 192/400
160/160 [=====] - 0s 907us/step - loss: 7.9712
Epoch 193/400
160/160 [=====] - 0s 874us/step - loss: 7.9712
Epoch 194/400
160/160 [=====] - 0s 887us/step - loss: 7.9712
Epoch 195/400
160/160 [=====] - 0s 888us/step - loss: 7.9712
Epoch 196/400
160/160 [=====] - 0s 872us/step - loss: 7.9712
Epoch 197/400
160/160 [=====] - 0s 816us/step - loss: 7.9712
Epoch 198/400
160/160 [=====] - 0s 788us/step - loss: 7.9712
Epoch 199/400
160/160 [=====] - 0s 766us/step - loss: 7.9712
Epoch 200/400
160/160 [=====] - 0s 930us/step - loss: 7.9712
Epoch 201/400
160/160 [=====] - 0s 940us/step - loss: 7.9712
Epoch 202/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 203/400
160/160 [=====] - 0s 958us/step - loss: 7.9712
Epoch 204/400
160/160 [=====] - 0s 944us/step - loss: 7.9712
Epoch 205/400
160/160 [=====] - 0s 941us/step - loss: 7.9712
Epoch 206/400
160/160 [=====] - 0s 929us/step - loss: 7.9712
Epoch 207/400
160/160 [=====] - 0s 756us/step - loss: 7.9712

Epoch 208/400
160/160 [=====] - 0s 940us/step - loss: 7.9712
Epoch 209/400
160/160 [=====] - 0s 952us/step - loss: 7.9712
Epoch 210/400
160/160 [=====] - 0s 840us/step - loss: 7.9712
Epoch 211/400
160/160 [=====] - 0s 953us/step - loss: 7.9712
Epoch 212/400
160/160 [=====] - 0s 940us/step - loss: 7.9712
Epoch 213/400
160/160 [=====] - 0s 961us/step - loss: 7.9712
Epoch 214/400
160/160 [=====] - 0s 949us/step - loss: 7.9712
Epoch 215/400
160/160 [=====] - 0s 897us/step - loss: 7.9712
Epoch 216/400
160/160 [=====] - 0s 855us/step - loss: 7.9712
Epoch 217/400
160/160 [=====] - 0s 732us/step - loss: 7.9712
Epoch 218/400
160/160 [=====] - 0s 755us/step - loss: 7.9712
Epoch 219/400
160/160 [=====] - 0s 898us/step - loss: 7.9712
Epoch 220/400
160/160 [=====] - 0s 817us/step - loss: 7.9712
Epoch 221/400
160/160 [=====] - 0s 702us/step - loss: 7.9712
Epoch 222/400
160/160 [=====] - 0s 857us/step - loss: 7.9712
Epoch 223/400
160/160 [=====] - 0s 755us/step - loss: 7.9712
Epoch 224/400
160/160 [=====] - 0s 778us/step - loss: 7.9712
Epoch 225/400
160/160 [=====] - 0s 922us/step - loss: 7.9712
Epoch 226/400
160/160 [=====] - 0s 865us/step - loss: 7.9712
Epoch 227/400
160/160 [=====] - 0s 869us/step - loss: 7.9712
Epoch 228/400
160/160 [=====] - 0s 852us/step - loss: 7.9712
Epoch 229/400
160/160 [=====] - 0s 794us/step - loss: 7.9712
Epoch 230/400
160/160 [=====] - 0s 761us/step - loss: 7.9712
Epoch 231/400
160/160 [=====] - 0s 751us/step - loss: 7.9712

Epoch 232/400
160/160 [=====] - 0s 740us/step - loss: 7.9712
Epoch 233/400
160/160 [=====] - 0s 769us/step - loss: 7.9712
Epoch 234/400
160/160 [=====] - 0s 987us/step - loss: 7.9712
Epoch 235/400
160/160 [=====] - 0s 918us/step - loss: 7.9712
Epoch 236/400
160/160 [=====] - 0s 828us/step - loss: 7.9712
Epoch 237/400
160/160 [=====] - 0s 870us/step - loss: 7.9712
Epoch 238/400
160/160 [=====] - 0s 888us/step - loss: 7.9712
Epoch 239/400
160/160 [=====] - 0s 805us/step - loss: 7.9712
Epoch 240/400
160/160 [=====] - 0s 766us/step - loss: 7.9712
Epoch 241/400
160/160 [=====] - 0s 760us/step - loss: 7.9712
Epoch 242/400
160/160 [=====] - 0s 907us/step - loss: 7.9712
Epoch 243/400
160/160 [=====] - 0s 834us/step - loss: 7.9712
Epoch 244/400
160/160 [=====] - 0s 954us/step - loss: 7.9712
Epoch 245/400
160/160 [=====] - 0s 761us/step - loss: 7.9712
Epoch 246/400
160/160 [=====] - 0s 902us/step - loss: 7.9712
Epoch 247/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 248/400
160/160 [=====] - 0s 925us/step - loss: 7.9712
Epoch 249/400
160/160 [=====] - 0s 962us/step - loss: 7.9712
Epoch 250/400
160/160 [=====] - 0s 871us/step - loss: 7.9712
Epoch 251/400
160/160 [=====] - 0s 703us/step - loss: 7.9712
Epoch 252/400
160/160 [=====] - 0s 713us/step - loss: 7.9712
Epoch 253/400
160/160 [=====] - 0s 963us/step - loss: 7.9712
Epoch 254/400
160/160 [=====] - 0s 924us/step - loss: 7.9712
Epoch 255/400
160/160 [=====] - 0s 904us/step - loss: 7.9712

Epoch 256/400
160/160 [=====] - 0s 741us/step - loss: 7.9712
Epoch 257/400
160/160 [=====] - 0s 774us/step - loss: 7.9712
Epoch 258/400
160/160 [=====] - 0s 875us/step - loss: 7.9712
Epoch 259/400
160/160 [=====] - 0s 957us/step - loss: 7.9712
Epoch 260/400
160/160 [=====] - 0s 935us/step - loss: 7.9712
Epoch 261/400
160/160 [=====] - 0s 756us/step - loss: 7.9712
Epoch 262/400
160/160 [=====] - 0s 931us/step - loss: 7.9712
Epoch 263/400
160/160 [=====] - 0s 941us/step - loss: 7.9712
Epoch 264/400
160/160 [=====] - 0s 885us/step - loss: 7.9712
Epoch 265/400
160/160 [=====] - 0s 701us/step - loss: 7.9712
Epoch 266/400
160/160 [=====] - 0s 842us/step - loss: 7.9712
Epoch 267/400
160/160 [=====] - 0s 911us/step - loss: 7.9712
Epoch 268/400
160/160 [=====] - 0s 894us/step - loss: 7.9712
Epoch 269/400
160/160 [=====] - 0s 877us/step - loss: 7.9712
Epoch 270/400
160/160 [=====] - 0s 764us/step - loss: 7.9712
Epoch 271/400
160/160 [=====] - 0s 738us/step - loss: 7.9712
Epoch 272/400
160/160 [=====] - 0s 856us/step - loss: 7.9712
Epoch 273/400
160/160 [=====] - 0s 888us/step - loss: 7.9712
Epoch 274/400
160/160 [=====] - 0s 727us/step - loss: 7.9712
Epoch 275/400
160/160 [=====] - 0s 743us/step - loss: 7.9712
Epoch 276/400
160/160 [=====] - 0s 779us/step - loss: 7.9712
Epoch 277/400
160/160 [=====] - 0s 765us/step - loss: 7.9712
Epoch 278/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 279/400
160/160 [=====] - 0s 813us/step - loss: 7.9712

Epoch 280/400
160/160 [=====] - 0s 788us/step - loss: 7.9712
Epoch 281/400
160/160 [=====] - 0s 714us/step - loss: 7.9712
Epoch 282/400
160/160 [=====] - 0s 673us/step - loss: 7.9712
Epoch 283/400
160/160 [=====] - 0s 765us/step - loss: 7.9712
Epoch 284/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 285/400
160/160 [=====] - 0s 729us/step - loss: 7.9712
Epoch 286/400
160/160 [=====] - 0s 725us/step - loss: 7.9712
Epoch 287/400
160/160 [=====] - 0s 747us/step - loss: 7.9712
Epoch 288/400
160/160 [=====] - 0s 751us/step - loss: 7.9712
Epoch 289/400
160/160 [=====] - 0s 806us/step - loss: 7.9712
Epoch 290/400
160/160 [=====] - 0s 773us/step - loss: 7.9712
Epoch 291/400
160/160 [=====] - 0s 878us/step - loss: 7.9712
Epoch 292/400
160/160 [=====] - 0s 844us/step - loss: 7.9712
Epoch 293/400
160/160 [=====] - 0s 779us/step - loss: 7.9712
Epoch 294/400
160/160 [=====] - 0s 726us/step - loss: 7.9712
Epoch 295/400
160/160 [=====] - 0s 732us/step - loss: 7.9712
Epoch 296/400
160/160 [=====] - 0s 726us/step - loss: 7.9712
Epoch 297/400
160/160 [=====] - 0s 681us/step - loss: 7.9712
Epoch 298/400
160/160 [=====] - 0s 755us/step - loss: 7.9712
Epoch 299/400
160/160 [=====] - 0s 714us/step - loss: 7.9712
Epoch 300/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 301/400
160/160 [=====] - 0s 765us/step - loss: 7.9712
Epoch 302/400
160/160 [=====] - 0s 767us/step - loss: 7.9712
Epoch 303/400
160/160 [=====] - 0s 854us/step - loss: 7.9712

Epoch 304/400
160/160 [=====] - 0s 825us/step - loss: 7.9712
Epoch 305/400
160/160 [=====] - 0s 773us/step - loss: 7.9712
Epoch 306/400
160/160 [=====] - 0s 809us/step - loss: 7.9712
Epoch 307/400
160/160 [=====] - 0s 866us/step - loss: 7.9712
Epoch 308/400
160/160 [=====] - 0s 907us/step - loss: 7.9712
Epoch 309/400
160/160 [=====] - 0s 782us/step - loss: 7.9712
Epoch 310/400
160/160 [=====] - 0s 728us/step - loss: 7.9712
Epoch 311/400
160/160 [=====] - 0s 853us/step - loss: 7.9712
Epoch 312/400
160/160 [=====] - 0s 804us/step - loss: 7.9712
Epoch 313/400
160/160 [=====] - 0s 799us/step - loss: 7.9712
Epoch 314/400
160/160 [=====] - 0s 780us/step - loss: 7.9712
Epoch 315/400
160/160 [=====] - 0s 870us/step - loss: 7.9712
Epoch 316/400
160/160 [=====] - 0s 885us/step - loss: 7.9712
Epoch 317/400
160/160 [=====] - 0s 735us/step - loss: 7.9712
Epoch 318/400
160/160 [=====] - 0s 796us/step - loss: 7.9712
Epoch 319/400
160/160 [=====] - 0s 733us/step - loss: 7.9712
Epoch 320/400
160/160 [=====] - 0s 734us/step - loss: 7.9712
Epoch 321/400
160/160 [=====] - 0s 761us/step - loss: 7.9712
Epoch 322/400
160/160 [=====] - 0s 752us/step - loss: 7.9712
Epoch 323/400
160/160 [=====] - 0s 714us/step - loss: 7.9712
Epoch 324/400
160/160 [=====] - 0s 772us/step - loss: 7.9712
Epoch 325/400
160/160 [=====] - 0s 832us/step - loss: 7.9712
Epoch 326/400
160/160 [=====] - 0s 838us/step - loss: 7.9712
Epoch 327/400
160/160 [=====] - 0s 728us/step - loss: 7.9712

Epoch 328/400
160/160 [=====] - 0s 694us/step - loss: 7.9712
Epoch 329/400
160/160 [=====] - 0s 674us/step - loss: 7.9712
Epoch 330/400
160/160 [=====] - 0s 695us/step - loss: 7.9712
Epoch 331/400
160/160 [=====] - 0s 796us/step - loss: 7.9712
Epoch 332/400
160/160 [=====] - 0s 767us/step - loss: 7.9712
Epoch 333/400
160/160 [=====] - 0s 755us/step - loss: 7.9712
Epoch 334/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 335/400
160/160 [=====] - 0s 799us/step - loss: 7.9712
Epoch 336/400
160/160 [=====] - 0s 808us/step - loss: 7.9712
Epoch 337/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 338/400
160/160 [=====] - 0s 813us/step - loss: 7.9712
Epoch 339/400
160/160 [=====] - 0s 842us/step - loss: 7.9712
Epoch 340/400
160/160 [=====] - 0s 816us/step - loss: 7.9712
Epoch 341/400
160/160 [=====] - 0s 817us/step - loss: 7.9712
Epoch 342/400
160/160 [=====] - 0s 803us/step - loss: 7.9712
Epoch 343/400
160/160 [=====] - 0s 786us/step - loss: 7.9712
Epoch 344/400
160/160 [=====] - 0s 721us/step - loss: 7.9712
Epoch 345/400
160/160 [=====] - 0s 781us/step - loss: 7.9712
Epoch 346/400
160/160 [=====] - 0s 896us/step - loss: 7.9712
Epoch 347/400
160/160 [=====] - 0s 825us/step - loss: 7.9712
Epoch 348/400
160/160 [=====] - 0s 835us/step - loss: 7.9712
Epoch 349/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 350/400
160/160 [=====] - 0s 738us/step - loss: 7.9712
Epoch 351/400
160/160 [=====] - 0s 791us/step - loss: 7.9712

Epoch 352/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 353/400
160/160 [=====] - 0s 875us/step - loss: 7.9712
Epoch 354/400
160/160 [=====] - 0s 935us/step - loss: 7.9712
Epoch 355/400
160/160 [=====] - 0s 877us/step - loss: 7.9712
Epoch 356/400
160/160 [=====] - 0s 738us/step - loss: 7.9712
Epoch 357/400
160/160 [=====] - 0s 811us/step - loss: 7.9712
Epoch 358/400
160/160 [=====] - 0s 793us/step - loss: 7.9712
Epoch 359/400
160/160 [=====] - 0s 815us/step - loss: 7.9712
Epoch 360/400
160/160 [=====] - 0s 745us/step - loss: 7.9712
Epoch 361/400
160/160 [=====] - 0s 687us/step - loss: 7.9712
Epoch 362/400
160/160 [=====] - 0s 772us/step - loss: 7.9712
Epoch 363/400
160/160 [=====] - 0s 750us/step - loss: 7.9712
Epoch 364/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 365/400
160/160 [=====] - 0s 726us/step - loss: 7.9712
Epoch 366/400
160/160 [=====] - 0s 743us/step - loss: 7.9712
Epoch 367/400
160/160 [=====] - 0s 825us/step - loss: 7.9712
Epoch 368/400
160/160 [=====] - 0s 816us/step - loss: 7.9712
Epoch 369/400
160/160 [=====] - 0s 814us/step - loss: 7.9712
Epoch 370/400
160/160 [=====] - 0s 829us/step - loss: 7.9712
Epoch 371/400
160/160 [=====] - 0s 762us/step - loss: 7.9712
Epoch 372/400
160/160 [=====] - 0s 724us/step - loss: 7.9712
Epoch 373/400
160/160 [=====] - 0s 770us/step - loss: 7.9712
Epoch 374/400
160/160 [=====] - 0s 733us/step - loss: 7.9712
Epoch 375/400
160/160 [=====] - 0s 740us/step - loss: 7.9712

Epoch 376/400
160/160 [=====] - 0s 685us/step - loss: 7.9712
Epoch 377/400
160/160 [=====] - 0s 801us/step - loss: 7.9712
Epoch 378/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 379/400
160/160 [=====] - 0s 823us/step - loss: 7.9712
Epoch 380/400
160/160 [=====] - 0s 733us/step - loss: 7.9712
Epoch 381/400
160/160 [=====] - 0s 714us/step - loss: 7.9712
Epoch 382/400
160/160 [=====] - 0s 802us/step - loss: 7.9712
Epoch 383/400
160/160 [=====] - 0s 734us/step - loss: 7.9712
Epoch 384/400
160/160 [=====] - 0s 710us/step - loss: 7.9712
Epoch 385/400
160/160 [=====] - 0s 821us/step - loss: 7.9712
Epoch 386/400
160/160 [=====] - 0s 828us/step - loss: 7.9712
Epoch 387/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 388/400
160/160 [=====] - 0s 887us/step - loss: 7.9712
Epoch 389/400
160/160 [=====] - 0s 768us/step - loss: 7.9712
Epoch 390/400
160/160 [=====] - 0s 724us/step - loss: 7.9712
Epoch 391/400
160/160 [=====] - 0s 733us/step - loss: 7.9712
Epoch 392/400
160/160 [=====] - 0s 699us/step - loss: 7.9712
Epoch 393/400
160/160 [=====] - 0s 758us/step - loss: 7.9712
Epoch 394/400
160/160 [=====] - 0s 790us/step - loss: 7.9712
Epoch 395/400
160/160 [=====] - 0s 804us/step - loss: 7.9712
Epoch 396/400
160/160 [=====] - 0s 792us/step - loss: 7.9712
Epoch 397/400
160/160 [=====] - 0s 848us/step - loss: 7.9712
Epoch 398/400
160/160 [=====] - 0s 871us/step - loss: 7.9712
Epoch 399/400
160/160 [=====] - 0s 895us/step - loss: 7.9712

Epoch 400/400

160/160 [=====] - 0s 944us/step - loss: 7.9712

```
[1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.]
```

160/160 [=====] - 0s 2ms/step

In [114]: *# I noticed that at certain iterations, loss increases significantly all of a sudden*

```
# 160/160 [=====] - 0s 945us/step - loss: 0.3231
```

```
# Epoch 18/400
```

```
# 160/160 [=====] - 0s 950us/step - loss: 3.4050
```

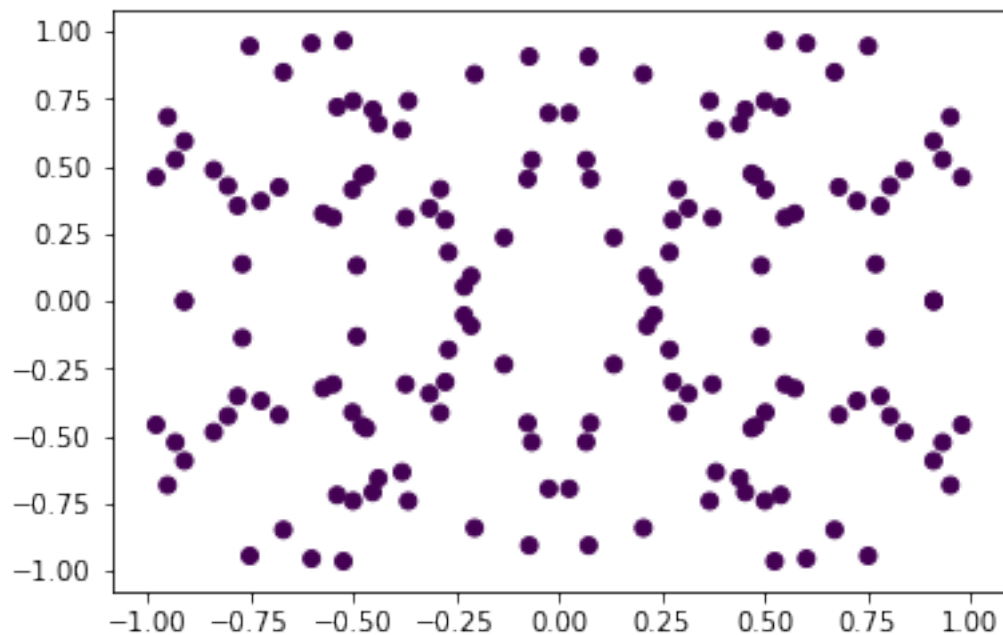
```
# Epoch 19/400
```

```
scores, model.metrics_names
```

Out[114]: (7.971192407608049, ['loss'])

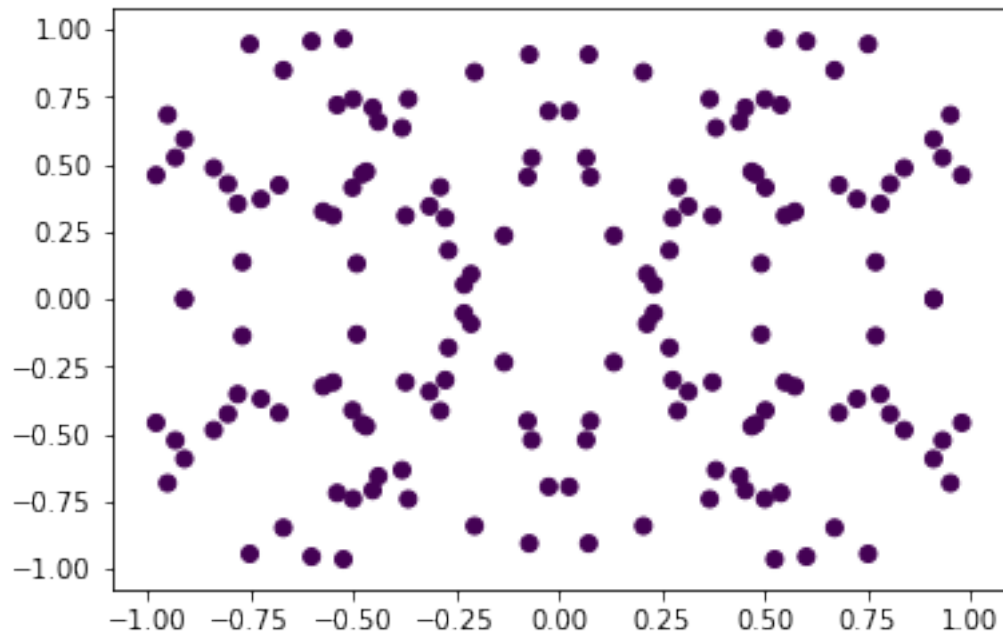
In [115]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())

Out[115]: <matplotlib.collections.PathCollection at 0xb2e3b4fd0>



```
In [116]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[116]: <matplotlib.collections.PathCollection at 0xb2e3573c8>
```



```
In [117]: # Using tanh for 4 neuron
model = Sequential()

model.add(Dense(4, input_dim=2, activation='tanh'))
model.add(Dense(4, activation='tanh'))
model.add(Dense(4, activation='tanh'))
model.add(Dense(4, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

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

Epoch 1/400

160/160 [=====] - 1s 7ms/step - loss: 1.0708

Epoch 2/400

```

160/160 [=====] - 0s 844us/step - loss: 0.7147
Epoch 3/400
160/160 [=====] - 0s 859us/step - loss: 0.7032
Epoch 4/400
160/160 [=====] - 0s 1ms/step - loss: 0.6914
Epoch 5/400
160/160 [=====] - 0s 975us/step - loss: 0.6797
Epoch 6/400
160/160 [=====] - 0s 1ms/step - loss: 0.6656
Epoch 7/400
160/160 [=====] - 0s 1ms/step - loss: 0.6443
Epoch 8/400
160/160 [=====] - 0s 911us/step - loss: 0.6238
Epoch 9/400
160/160 [=====] - 0s 867us/step - loss: 0.6018
Epoch 10/400
160/160 [=====] - 0s 913us/step - loss: 0.5778
Epoch 11/400
160/160 [=====] - 0s 844us/step - loss: 0.5362
Epoch 12/400
160/160 [=====] - 0s 823us/step - loss: 0.5055
Epoch 13/400
160/160 [=====] - 0s 975us/step - loss: 0.4761
Epoch 14/400
160/160 [=====] - 0s 1ms/step - loss: 0.5024
Epoch 15/400
160/160 [=====] - 0s 998us/step - loss: 0.5557
Epoch 16/400
160/160 [=====] - 0s 1ms/step - loss: 0.6952
Epoch 17/400
160/160 [=====] - 0s 965us/step - loss: 0.3896
Epoch 18/400
160/160 [=====] - 0s 786us/step - loss: 0.3222
Epoch 19/400
160/160 [=====] - 0s 900us/step - loss: 0.3033
Epoch 20/400
160/160 [=====] - 0s 1ms/step - loss: 0.3577
Epoch 21/400
160/160 [=====] - 0s 981us/step - loss: 0.2746
Epoch 22/400
160/160 [=====] - 0s 1ms/step - loss: 0.5712
Epoch 23/400
160/160 [=====] - 0s 1ms/step - loss: 0.2677
Epoch 24/400
160/160 [=====] - 0s 826us/step - loss: 0.2420
Epoch 25/400
160/160 [=====] - 0s 805us/step - loss: 0.3244
Epoch 26/400

```

```

160/160 [=====] - 0s 960us/step - loss: 0.4138
Epoch 27/400
160/160 [=====] - 0s 951us/step - loss: 0.2948
Epoch 28/400
160/160 [=====] - 0s 914us/step - loss: 0.3914
Epoch 29/400
160/160 [=====] - 0s 858us/step - loss: 0.2806
Epoch 30/400
160/160 [=====] - 0s 806us/step - loss: 0.2003
Epoch 31/400
160/160 [=====] - 0s 1ms/step - loss: 0.2029
Epoch 32/400
160/160 [=====] - 0s 1ms/step - loss: 0.1725
Epoch 33/400
160/160 [=====] - 0s 1ms/step - loss: 0.1731
Epoch 34/400
160/160 [=====] - 0s 777us/step - loss: 0.1563
Epoch 35/400
160/160 [=====] - 0s 780us/step - loss: 0.1545
Epoch 36/400
160/160 [=====] - 0s 797us/step - loss: 0.1317
Epoch 37/400
160/160 [=====] - 0s 994us/step - loss: 0.1477
Epoch 38/400
160/160 [=====] - 0s 870us/step - loss: 0.1467
Epoch 39/400
160/160 [=====] - 0s 973us/step - loss: 0.1325
Epoch 40/400
160/160 [=====] - 0s 825us/step - loss: 0.1029
Epoch 41/400
160/160 [=====] - 0s 783us/step - loss: 0.1388
Epoch 42/400
160/160 [=====] - 0s 905us/step - loss: 0.1090
Epoch 43/400
160/160 [=====] - 0s 840us/step - loss: 0.1122
Epoch 44/400
160/160 [=====] - 0s 770us/step - loss: 0.1072
Epoch 45/400
160/160 [=====] - 0s 881us/step - loss: 0.1080
Epoch 46/400
160/160 [=====] - 0s 972us/step - loss: 0.0896
Epoch 47/400
160/160 [=====] - 0s 875us/step - loss: 0.0861
Epoch 48/400
160/160 [=====] - 0s 765us/step - loss: 0.0957
Epoch 49/400
160/160 [=====] - 0s 912us/step - loss: 0.1022
Epoch 50/400

```

160/160 [=====] - 0s 816us/step - loss: 0.0896
Epoch 51/400
160/160 [=====] - 0s 863us/step - loss: 0.0735
Epoch 52/400
160/160 [=====] - 0s 880us/step - loss: 0.0698
Epoch 53/400
160/160 [=====] - 0s 845us/step - loss: 0.0739
Epoch 54/400
160/160 [=====] - 0s 938us/step - loss: 0.0809
Epoch 55/400
160/160 [=====] - 0s 765us/step - loss: 0.0726
Epoch 56/400
160/160 [=====] - 0s 786us/step - loss: 0.0733
Epoch 57/400
160/160 [=====] - 0s 798us/step - loss: 0.0726
Epoch 58/400
160/160 [=====] - 0s 751us/step - loss: 0.0757
Epoch 59/400
160/160 [=====] - 0s 754us/step - loss: 0.0605
Epoch 60/400
160/160 [=====] - 0s 742us/step - loss: 0.0712
Epoch 61/400
160/160 [=====] - 0s 864us/step - loss: 0.0640
Epoch 62/400
160/160 [=====] - 0s 881us/step - loss: 0.0533
Epoch 63/400
160/160 [=====] - 0s 780us/step - loss: 0.0620
Epoch 64/400
160/160 [=====] - 0s 923us/step - loss: 0.0587
Epoch 65/400
160/160 [=====] - 0s 784us/step - loss: 0.0520
Epoch 66/400
160/160 [=====] - 0s 814us/step - loss: 0.8407
Epoch 67/400
160/160 [=====] - 0s 952us/step - loss: 0.6239
Epoch 68/400
160/160 [=====] - 0s 794us/step - loss: 0.1364
Epoch 69/400
160/160 [=====] - 0s 782us/step - loss: 0.0891
Epoch 70/400
160/160 [=====] - 0s 786us/step - loss: 0.0753
Epoch 71/400
160/160 [=====] - 0s 949us/step - loss: 0.0675
Epoch 72/400
160/160 [=====] - 0s 763us/step - loss: 0.0589
Epoch 73/400
160/160 [=====] - 0s 751us/step - loss: 0.0611
Epoch 74/400

160/160 [=====] - 0s 917us/step - loss: 0.0581
Epoch 75/400
160/160 [=====] - 0s 773us/step - loss: 0.0553
Epoch 76/400
160/160 [=====] - 0s 786us/step - loss: 0.0600
Epoch 77/400
160/160 [=====] - 0s 762us/step - loss: 0.0539
Epoch 78/400
160/160 [=====] - 0s 915us/step - loss: 0.0772
Epoch 79/400
160/160 [=====] - 0s 788us/step - loss: 0.0654
Epoch 80/400
160/160 [=====] - 0s 783us/step - loss: 0.0508
Epoch 81/400
160/160 [=====] - 0s 778us/step - loss: 0.0533
Epoch 82/400
160/160 [=====] - 0s 850us/step - loss: 0.0393
Epoch 83/400
160/160 [=====] - 0s 783us/step - loss: 0.0452
Epoch 84/400
160/160 [=====] - 0s 763us/step - loss: 0.0419
Epoch 85/400
160/160 [=====] - 0s 757us/step - loss: 0.0560
Epoch 86/400
160/160 [=====] - 0s 777us/step - loss: 0.0472
Epoch 87/400
160/160 [=====] - 0s 746us/step - loss: 0.0451
Epoch 88/400
160/160 [=====] - 0s 794us/step - loss: 0.0487
Epoch 89/400
160/160 [=====] - 0s 751us/step - loss: 0.0427
Epoch 90/400
160/160 [=====] - 0s 724us/step - loss: 0.0424
Epoch 91/400
160/160 [=====] - 0s 756us/step - loss: 0.0536
Epoch 92/400
160/160 [=====] - 0s 782us/step - loss: 0.0473
Epoch 93/400
160/160 [=====] - 0s 768us/step - loss: 0.0472
Epoch 94/400
160/160 [=====] - 0s 787us/step - loss: 0.0408
Epoch 95/400
160/160 [=====] - 0s 771us/step - loss: 0.0470
Epoch 96/400
160/160 [=====] - 0s 814us/step - loss: 0.0492
Epoch 97/400
160/160 [=====] - 0s 783us/step - loss: 0.0583
Epoch 98/400

160/160 [=====] - 0s 930us/step - loss: 0.0473
 Epoch 99/400
 160/160 [=====] - 0s 961us/step - loss: 0.0495
 Epoch 100/400
 160/160 [=====] - 0s 918us/step - loss: 0.0396
 Epoch 101/400
 160/160 [=====] - 0s 792us/step - loss: 0.0545
 Epoch 102/400
 160/160 [=====] - 0s 961us/step - loss: 0.0412
 Epoch 103/400
 160/160 [=====] - 0s 792us/step - loss: 0.0448
 Epoch 104/400
 160/160 [=====] - 0s 748us/step - loss: 0.0438
 Epoch 105/400
 160/160 [=====] - 0s 799us/step - loss: 0.0418
 Epoch 106/400
 160/160 [=====] - 0s 796us/step - loss: 0.0504
 Epoch 107/400
 160/160 [=====] - 0s 904us/step - loss: 0.0419
 Epoch 108/400
 160/160 [=====] - 0s 796us/step - loss: 0.0493
 Epoch 109/400
 160/160 [=====] - 0s 775us/step - loss: 0.0440
 Epoch 110/400
 160/160 [=====] - 0s 798us/step - loss: 0.0432
 Epoch 111/400
 160/160 [=====] - 0s 793us/step - loss: 0.0421
 Epoch 112/400
 160/160 [=====] - 0s 776us/step - loss: 0.0426
 Epoch 113/400
 160/160 [=====] - 0s 782us/step - loss: 0.0437
 Epoch 114/400
 160/160 [=====] - 0s 800us/step - loss: 0.0443
 Epoch 115/400
 160/160 [=====] - 0s 797us/step - loss: 0.0376
 Epoch 116/400
 160/160 [=====] - 0s 791us/step - loss: 0.0430
 Epoch 117/400
 160/160 [=====] - 0s 776us/step - loss: 0.0429
 Epoch 118/400
 160/160 [=====] - 0s 788us/step - loss: 0.0404
 Epoch 119/400
 160/160 [=====] - 0s 818us/step - loss: 0.0431
 Epoch 120/400
 160/160 [=====] - 0s 731us/step - loss: 0.0566
 Epoch 121/400
 160/160 [=====] - 0s 715us/step - loss: 0.0500
 Epoch 122/400

160/160 [=====] - 0s 768us/step - loss: 0.0401
Epoch 123/400
160/160 [=====] - 0s 803us/step - loss: 0.0379
Epoch 124/400
160/160 [=====] - 0s 793us/step - loss: 0.0417
Epoch 125/400
160/160 [=====] - 0s 771us/step - loss: 0.0459
Epoch 126/400
160/160 [=====] - 0s 787us/step - loss: 0.0379
Epoch 127/400
160/160 [=====] - 0s 809us/step - loss: 0.0418
Epoch 128/400
160/160 [=====] - 0s 817us/step - loss: 0.0487
Epoch 129/400
160/160 [=====] - 0s 779us/step - loss: 0.0377
Epoch 130/400
160/160 [=====] - 0s 875us/step - loss: 0.0445
Epoch 131/400
160/160 [=====] - 0s 787us/step - loss: 0.0438
Epoch 132/400
160/160 [=====] - 0s 943us/step - loss: 0.0454
Epoch 133/400
160/160 [=====] - 0s 927us/step - loss: 0.0387
Epoch 134/400
160/160 [=====] - 0s 784us/step - loss: 0.0372
Epoch 135/400
160/160 [=====] - 0s 801us/step - loss: 0.0446
Epoch 136/400
160/160 [=====] - 0s 954us/step - loss: 0.0399
Epoch 137/400
160/160 [=====] - 0s 774us/step - loss: 0.0468
Epoch 138/400
160/160 [=====] - 0s 935us/step - loss: 0.0474
Epoch 139/400
160/160 [=====] - 0s 796us/step - loss: 0.0419
Epoch 140/400
160/160 [=====] - 0s 782us/step - loss: 0.0405
Epoch 141/400
160/160 [=====] - 0s 784us/step - loss: 0.0468
Epoch 142/400
160/160 [=====] - 0s 783us/step - loss: 0.0480
Epoch 143/400
160/160 [=====] - 0s 968us/step - loss: 0.0434
Epoch 144/400
160/160 [=====] - 0s 978us/step - loss: 0.0437
Epoch 145/400
160/160 [=====] - 0s 1ms/step - loss: 0.0437
Epoch 146/400

```

160/160 [=====] - 0s 817us/step - loss: 0.0400
Epoch 147/400
160/160 [=====] - 0s 789us/step - loss: 0.0407
Epoch 148/400
160/160 [=====] - 0s 958us/step - loss: 0.0364
Epoch 149/400
160/160 [=====] - 0s 874us/step - loss: 0.0444
Epoch 150/400
160/160 [=====] - 0s 779us/step - loss: 0.0398
Epoch 151/400
160/160 [=====] - 0s 848us/step - loss: 0.0439
Epoch 152/400
160/160 [=====] - 0s 781us/step - loss: 0.0386
Epoch 153/400
160/160 [=====] - 0s 878us/step - loss: 0.0435
Epoch 154/400
160/160 [=====] - 0s 954us/step - loss: 0.0465
Epoch 155/400
160/160 [=====] - 0s 1ms/step - loss: 0.0390
Epoch 156/400
160/160 [=====] - 0s 814us/step - loss: 0.0432
Epoch 157/400
160/160 [=====] - 0s 831us/step - loss: 0.0369
Epoch 158/400
160/160 [=====] - 0s 1ms/step - loss: 0.0426
Epoch 159/400
160/160 [=====] - 0s 1ms/step - loss: 0.0337
Epoch 160/400
160/160 [=====] - 0s 956us/step - loss: 0.0406
Epoch 161/400
160/160 [=====] - 0s 810us/step - loss: 0.0423
Epoch 162/400
160/160 [=====] - 0s 807us/step - loss: 0.0435
Epoch 163/400
160/160 [=====] - 0s 800us/step - loss: 0.0397
Epoch 164/400
160/160 [=====] - 0s 898us/step - loss: 0.0362
Epoch 165/400
160/160 [=====] - 0s 802us/step - loss: 0.0418
Epoch 166/400
160/160 [=====] - 0s 792us/step - loss: 0.0417
Epoch 167/400
160/160 [=====] - 0s 803us/step - loss: 0.0414
Epoch 168/400
160/160 [=====] - 0s 856us/step - loss: 0.0349
Epoch 169/400
160/160 [=====] - 0s 908us/step - loss: 0.0384
Epoch 170/400

```

160/160 [=====] - 0s 884us/step - loss: 0.0397
Epoch 171/400
160/160 [=====] - 0s 784us/step - loss: 0.0401
Epoch 172/400
160/160 [=====] - 0s 799us/step - loss: 0.0372
Epoch 173/400
160/160 [=====] - 0s 972us/step - loss: 0.0464
Epoch 174/400
160/160 [=====] - 0s 888us/step - loss: 0.0383
Epoch 175/400
160/160 [=====] - 0s 788us/step - loss: 0.0383
Epoch 176/400
160/160 [=====] - 0s 864us/step - loss: 0.0358
Epoch 177/400
160/160 [=====] - 0s 874us/step - loss: 0.0431
Epoch 178/400
160/160 [=====] - 0s 788us/step - loss: 0.0405
Epoch 179/400
160/160 [=====] - 0s 766us/step - loss: 0.0327
Epoch 180/400
160/160 [=====] - 0s 882us/step - loss: 0.0373
Epoch 181/400
160/160 [=====] - 0s 803us/step - loss: 0.0379
Epoch 182/400
160/160 [=====] - 0s 794us/step - loss: 0.0419
Epoch 183/400
160/160 [=====] - 0s 894us/step - loss: 0.0368
Epoch 184/400
160/160 [=====] - 0s 853us/step - loss: 0.0349
Epoch 185/400
160/160 [=====] - 0s 962us/step - loss: 0.0398
Epoch 186/400
160/160 [=====] - 0s 858us/step - loss: 0.0414
Epoch 187/400
160/160 [=====] - 0s 716us/step - loss: 0.0343
Epoch 188/400
160/160 [=====] - 0s 843us/step - loss: 0.0352
Epoch 189/400
160/160 [=====] - 0s 1ms/step - loss: 0.0348
Epoch 190/400
160/160 [=====] - 0s 1ms/step - loss: 0.0384
Epoch 191/400
160/160 [=====] - 0s 947us/step - loss: 0.0389
Epoch 192/400
160/160 [=====] - 0s 795us/step - loss: 0.0423
Epoch 193/400
160/160 [=====] - 0s 948us/step - loss: 0.0354
Epoch 194/400

160/160 [=====] - 0s 957us/step - loss: 0.0466
 Epoch 195/400
 160/160 [=====] - 0s 966us/step - loss: 0.0414
 Epoch 196/400
 160/160 [=====] - 0s 797us/step - loss: 0.0396
 Epoch 197/400
 160/160 [=====] - 0s 895us/step - loss: 0.0427
 Epoch 198/400
 160/160 [=====] - 0s 792us/step - loss: 0.0383
 Epoch 199/400
 160/160 [=====] - 0s 932us/step - loss: 0.0360
 Epoch 200/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0356
 Epoch 201/400
 160/160 [=====] - 0s 804us/step - loss: 0.0388
 Epoch 202/400
 160/160 [=====] - 0s 841us/step - loss: 0.0449
 Epoch 203/400
 160/160 [=====] - 0s 954us/step - loss: 0.0341
 Epoch 204/400
 160/160 [=====] - 0s 795us/step - loss: 0.0348
 Epoch 205/400
 160/160 [=====] - 0s 864us/step - loss: 0.0417
 Epoch 206/400
 160/160 [=====] - 0s 839us/step - loss: 0.0424
 Epoch 207/400
 160/160 [=====] - 0s 892us/step - loss: 0.0375
 Epoch 208/400
 160/160 [=====] - 0s 783us/step - loss: 0.0363
 Epoch 209/400
 160/160 [=====] - 0s 787us/step - loss: 0.0376
 Epoch 210/400
 160/160 [=====] - 0s 831us/step - loss: 0.0345
 Epoch 211/400
 160/160 [=====] - 0s 793us/step - loss: 0.0347
 Epoch 212/400
 160/160 [=====] - 0s 947us/step - loss: 0.0386
 Epoch 213/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0484
 Epoch 214/400
 160/160 [=====] - 0s 963us/step - loss: 0.0403
 Epoch 215/400
 160/160 [=====] - 0s 905us/step - loss: 0.0311
 Epoch 216/400
 160/160 [=====] - 0s 779us/step - loss: 0.0365
 Epoch 217/400
 160/160 [=====] - 0s 957us/step - loss: 0.0333
 Epoch 218/400

```

160/160 [=====] - 0s 946us/step - loss: 0.0376
Epoch 219/400
160/160 [=====] - 0s 948us/step - loss: 0.0357
Epoch 220/400
160/160 [=====] - 0s 1ms/step - loss: 0.0373
Epoch 221/400
160/160 [=====] - 0s 758us/step - loss: 0.0354
Epoch 222/400
160/160 [=====] - 0s 777us/step - loss: 0.0339
Epoch 223/400
160/160 [=====] - 0s 885us/step - loss: 0.0332
Epoch 224/400
160/160 [=====] - 0s 824us/step - loss: 0.0318
Epoch 225/400
160/160 [=====] - 0s 769us/step - loss: 0.0352
Epoch 226/400
160/160 [=====] - 0s 814us/step - loss: 0.0347
Epoch 227/400
160/160 [=====] - 0s 811us/step - loss: 0.0319
Epoch 228/400
160/160 [=====] - 0s 1ms/step - loss: 0.0406
Epoch 229/400
160/160 [=====] - 0s 1ms/step - loss: 0.0316
Epoch 230/400
160/160 [=====] - 0s 959us/step - loss: 0.0400
Epoch 231/400
160/160 [=====] - 0s 809us/step - loss: 0.0339
Epoch 232/400
160/160 [=====] - 0s 925us/step - loss: 0.0367
Epoch 233/400
160/160 [=====] - 0s 802us/step - loss: 0.0360
Epoch 234/400
160/160 [=====] - 0s 848us/step - loss: 0.0329
Epoch 235/400
160/160 [=====] - 0s 888us/step - loss: 0.0326
Epoch 236/400
160/160 [=====] - 0s 894us/step - loss: 0.0340
Epoch 237/400
160/160 [=====] - 0s 916us/step - loss: 0.0355
Epoch 238/400
160/160 [=====] - 0s 942us/step - loss: 0.0346
Epoch 239/400
160/160 [=====] - 0s 810us/step - loss: 0.0318
Epoch 240/400
160/160 [=====] - 0s 863us/step - loss: 0.0345
Epoch 241/400
160/160 [=====] - 0s 837us/step - loss: 0.0352
Epoch 242/400

```

160/160 [=====] - 0s 853us/step - loss: 0.0329
 Epoch 243/400
 160/160 [=====] - 0s 795us/step - loss: 0.0349
 Epoch 244/400
 160/160 [=====] - 0s 840us/step - loss: 0.0378
 Epoch 245/400
 160/160 [=====] - 0s 845us/step - loss: 0.0417
 Epoch 246/400
 160/160 [=====] - 0s 800us/step - loss: 0.0333
 Epoch 247/400
 160/160 [=====] - 0s 827us/step - loss: 0.0373
 Epoch 248/400
 160/160 [=====] - 0s 777us/step - loss: 0.0326
 Epoch 249/400
 160/160 [=====] - 0s 865us/step - loss: 0.0313
 Epoch 250/400
 160/160 [=====] - 0s 837us/step - loss: 0.0286
 Epoch 251/400
 160/160 [=====] - 0s 815us/step - loss: 0.0329
 Epoch 252/400
 160/160 [=====] - 0s 808us/step - loss: 0.0309
 Epoch 253/400
 160/160 [=====] - 0s 777us/step - loss: 0.0333
 Epoch 254/400
 160/160 [=====] - 0s 973us/step - loss: 0.0346
 Epoch 255/400
 160/160 [=====] - 0s 925us/step - loss: 0.0372
 Epoch 256/400
 160/160 [=====] - 0s 910us/step - loss: 0.0370
 Epoch 257/400
 160/160 [=====] - 0s 797us/step - loss: 0.0366
 Epoch 258/400
 160/160 [=====] - 0s 927us/step - loss: 0.0321
 Epoch 259/400
 160/160 [=====] - 0s 817us/step - loss: 0.0363
 Epoch 260/400
 160/160 [=====] - 0s 817us/step - loss: 0.0375
 Epoch 261/400
 160/160 [=====] - 0s 863us/step - loss: 0.0295
 Epoch 262/400
 160/160 [=====] - 0s 848us/step - loss: 0.0359
 Epoch 263/400
 160/160 [=====] - 0s 904us/step - loss: 0.0322
 Epoch 264/400
 160/160 [=====] - 0s 890us/step - loss: 0.0330
 Epoch 265/400
 160/160 [=====] - 0s 757us/step - loss: 0.0343
 Epoch 266/400

160/160 [=====] - 0s 855us/step - loss: 0.0348
Epoch 267/400
160/160 [=====] - 0s 896us/step - loss: 0.0273
Epoch 268/400
160/160 [=====] - 0s 935us/step - loss: 0.0342
Epoch 269/400
160/160 [=====] - 0s 975us/step - loss: 0.0332
Epoch 270/400
160/160 [=====] - 0s 827us/step - loss: 0.0354
Epoch 271/400
160/160 [=====] - 0s 807us/step - loss: 0.0320
Epoch 272/400
160/160 [=====] - 0s 895us/step - loss: 0.0331
Epoch 273/400
160/160 [=====] - 0s 1ms/step - loss: 0.0353
Epoch 274/400
160/160 [=====] - 0s 913us/step - loss: 0.0356
Epoch 275/400
160/160 [=====] - 0s 858us/step - loss: 0.0323
Epoch 276/400
160/160 [=====] - 0s 903us/step - loss: 0.0301
Epoch 277/400
160/160 [=====] - 0s 965us/step - loss: 0.0363
Epoch 278/400
160/160 [=====] - 0s 763us/step - loss: 0.0276
Epoch 279/400
160/160 [=====] - 0s 785us/step - loss: 0.0334
Epoch 280/400
160/160 [=====] - 0s 815us/step - loss: 0.0340
Epoch 281/400
160/160 [=====] - 0s 899us/step - loss: 0.0280
Epoch 282/400
160/160 [=====] - 0s 793us/step - loss: 0.0335
Epoch 283/400
160/160 [=====] - 0s 864us/step - loss: 0.0341
Epoch 284/400
160/160 [=====] - 0s 868us/step - loss: 0.0331
Epoch 285/400
160/160 [=====] - 0s 768us/step - loss: 0.0295
Epoch 286/400
160/160 [=====] - 0s 889us/step - loss: 0.0322
Epoch 287/400
160/160 [=====] - 0s 1ms/step - loss: 0.0340
Epoch 288/400
160/160 [=====] - 0s 948us/step - loss: 0.0286
Epoch 289/400
160/160 [=====] - 0s 836us/step - loss: 0.0301
Epoch 290/400

160/160 [=====] - 0s 899us/step - loss: 0.0305
Epoch 291/400
160/160 [=====] - 0s 800us/step - loss: 0.0315
Epoch 292/400
160/160 [=====] - 0s 832us/step - loss: 0.0313
Epoch 293/400
160/160 [=====] - 0s 843us/step - loss: 0.0433
Epoch 294/400
160/160 [=====] - 0s 908us/step - loss: 0.0305
Epoch 295/400
160/160 [=====] - 0s 837us/step - loss: 0.0294
Epoch 296/400
160/160 [=====] - 0s 830us/step - loss: 0.0285
Epoch 297/400
160/160 [=====] - 0s 870us/step - loss: 0.0335
Epoch 298/400
160/160 [=====] - 0s 929us/step - loss: 0.0307
Epoch 299/400
160/160 [=====] - 0s 923us/step - loss: 0.0357
Epoch 300/400
160/160 [=====] - 0s 907us/step - loss: 0.0336
Epoch 301/400
160/160 [=====] - 0s 782us/step - loss: 0.0311
Epoch 302/400
160/160 [=====] - 0s 917us/step - loss: 0.0339
Epoch 303/400
160/160 [=====] - 0s 797us/step - loss: 0.0366
Epoch 304/400
160/160 [=====] - 0s 811us/step - loss: 0.0292
Epoch 305/400
160/160 [=====] - 0s 825us/step - loss: 0.0326
Epoch 306/400
160/160 [=====] - 0s 767us/step - loss: 0.0261
Epoch 307/400
160/160 [=====] - 0s 725us/step - loss: 0.0267
Epoch 308/400
160/160 [=====] - 0s 734us/step - loss: 0.0298
Epoch 309/400
160/160 [=====] - 0s 764us/step - loss: 0.0314
Epoch 310/400
160/160 [=====] - 0s 785us/step - loss: 0.0313
Epoch 311/400
160/160 [=====] - 0s 783us/step - loss: 0.0332
Epoch 312/400
160/160 [=====] - 0s 861us/step - loss: 0.0330
Epoch 313/400
160/160 [=====] - 0s 886us/step - loss: 0.0340
Epoch 314/400

160/160 [=====] - 0s 839us/step - loss: 0.0355
 Epoch 315/400
 160/160 [=====] - 0s 920us/step - loss: 0.0296
 Epoch 316/400
 160/160 [=====] - 0s 819us/step - loss: 0.0291
 Epoch 317/400
 160/160 [=====] - 0s 764us/step - loss: 0.0307
 Epoch 318/400
 160/160 [=====] - 0s 767us/step - loss: 0.0306
 Epoch 319/400
 160/160 [=====] - 0s 796us/step - loss: 0.0310
 Epoch 320/400
 160/160 [=====] - 0s 786us/step - loss: 0.0310
 Epoch 321/400
 160/160 [=====] - 0s 782us/step - loss: 0.0317
 Epoch 322/400
 160/160 [=====] - 0s 739us/step - loss: 0.0297
 Epoch 323/400
 160/160 [=====] - 0s 741us/step - loss: 0.0286
 Epoch 324/400
 160/160 [=====] - 0s 768us/step - loss: 0.0326
 Epoch 325/400
 160/160 [=====] - 0s 781us/step - loss: 0.0288
 Epoch 326/400
 160/160 [=====] - 0s 781us/step - loss: 0.0273
 Epoch 327/400
 160/160 [=====] - 0s 806us/step - loss: 0.0314
 Epoch 328/400
 160/160 [=====] - 0s 802us/step - loss: 0.0309
 Epoch 329/400
 160/160 [=====] - 0s 779us/step - loss: 0.0247
 Epoch 330/400
 160/160 [=====] - 0s 780us/step - loss: 0.0299
 Epoch 331/400
 160/160 [=====] - 0s 792us/step - loss: 0.0287
 Epoch 332/400
 160/160 [=====] - 0s 797us/step - loss: 0.0339
 Epoch 333/400
 160/160 [=====] - 0s 775us/step - loss: 0.0329
 Epoch 334/400
 160/160 [=====] - 0s 887us/step - loss: 0.0295
 Epoch 335/400
 160/160 [=====] - 0s 893us/step - loss: 0.0288
 Epoch 336/400
 160/160 [=====] - 0s 826us/step - loss: 0.0319
 Epoch 337/400
 160/160 [=====] - 0s 796us/step - loss: 0.0264
 Epoch 338/400

160/160 [=====] - 0s 700us/step - loss: 0.0276
Epoch 339/400
160/160 [=====] - 0s 834us/step - loss: 0.0321
Epoch 340/400
160/160 [=====] - 0s 898us/step - loss: 0.0320
Epoch 341/400
160/160 [=====] - 0s 871us/step - loss: 0.0321
Epoch 342/400
160/160 [=====] - 0s 824us/step - loss: 0.0272
Epoch 343/400
160/160 [=====] - 0s 797us/step - loss: 0.0290
Epoch 344/400
160/160 [=====] - 0s 923us/step - loss: 0.0287
Epoch 345/400
160/160 [=====] - 0s 953us/step - loss: 0.0327
Epoch 346/400
160/160 [=====] - 0s 893us/step - loss: 0.0313
Epoch 347/400
160/160 [=====] - 0s 932us/step - loss: 0.0300
Epoch 348/400
160/160 [=====] - 0s 890us/step - loss: 0.0294
Epoch 349/400
160/160 [=====] - 0s 812us/step - loss: 0.0281
Epoch 350/400
160/160 [=====] - 0s 1ms/step - loss: 0.0275
Epoch 351/400
160/160 [=====] - 0s 858us/step - loss: 0.0286
Epoch 352/400
160/160 [=====] - 0s 893us/step - loss: 0.0329
Epoch 353/400
160/160 [=====] - 0s 1ms/step - loss: 0.0314
Epoch 354/400
160/160 [=====] - 0s 1ms/step - loss: 0.0274
Epoch 355/400
160/160 [=====] - 0s 1ms/step - loss: 0.0284
Epoch 356/400
160/160 [=====] - 0s 831us/step - loss: 0.0284
Epoch 357/400
160/160 [=====] - 0s 796us/step - loss: 0.0281
Epoch 358/400
160/160 [=====] - 0s 881us/step - loss: 0.0289
Epoch 359/400
160/160 [=====] - 0s 885us/step - loss: 0.0275
Epoch 360/400
160/160 [=====] - 0s 920us/step - loss: 0.0290
Epoch 361/400
160/160 [=====] - 0s 1ms/step - loss: 0.0277
Epoch 362/400

160/160 [=====] - 0s 941us/step - loss: 0.0295
Epoch 363/400
160/160 [=====] - 0s 863us/step - loss: 0.0245
Epoch 364/400
160/160 [=====] - 0s 904us/step - loss: 0.0293
Epoch 365/400
160/160 [=====] - 0s 920us/step - loss: 0.0275
Epoch 366/400
160/160 [=====] - 0s 1ms/step - loss: 0.0261
Epoch 367/400
160/160 [=====] - 0s 1ms/step - loss: 0.0318
Epoch 368/400
160/160 [=====] - 0s 856us/step - loss: 0.0317
Epoch 369/400
160/160 [=====] - 0s 930us/step - loss: 0.0302
Epoch 370/400
160/160 [=====] - 0s 753us/step - loss: 0.0272
Epoch 371/400
160/160 [=====] - 0s 877us/step - loss: 0.0274
Epoch 372/400
160/160 [=====] - 0s 1ms/step - loss: 0.0310
Epoch 373/400
160/160 [=====] - 0s 962us/step - loss: 0.0275
Epoch 374/400
160/160 [=====] - 0s 975us/step - loss: 0.0303
Epoch 375/400
160/160 [=====] - 0s 818us/step - loss: 0.0281
Epoch 376/400
160/160 [=====] - 0s 945us/step - loss: 0.0278
Epoch 377/400
160/160 [=====] - 0s 954us/step - loss: 0.0291
Epoch 378/400
160/160 [=====] - 0s 1ms/step - loss: 0.0300
Epoch 379/400
160/160 [=====] - 0s 890us/step - loss: 0.0311
Epoch 380/400
160/160 [=====] - 0s 802us/step - loss: 0.0314
Epoch 381/400
160/160 [=====] - 0s 811us/step - loss: 0.0288
Epoch 382/400
160/160 [=====] - 0s 808us/step - loss: 0.0274
Epoch 383/400
160/160 [=====] - 0s 795us/step - loss: 0.0286
Epoch 384/400
160/160 [=====] - 0s 928us/step - loss: 0.0255
Epoch 385/400
160/160 [=====] - 0s 1ms/step - loss: 0.0278
Epoch 386/400

```

160/160 [=====] - 0s 985us/step - loss: 0.0256
Epoch 387/400
160/160 [=====] - 0s 926us/step - loss: 0.0307
Epoch 388/400
160/160 [=====] - 0s 816us/step - loss: 0.0285
Epoch 389/400
160/160 [=====] - 0s 943us/step - loss: 0.0259
Epoch 390/400
160/160 [=====] - 0s 1ms/step - loss: 0.0266
Epoch 391/400
160/160 [=====] - 0s 1ms/step - loss: 0.0286
Epoch 392/400
160/160 [=====] - 0s 812us/step - loss: 0.0284
Epoch 393/400
160/160 [=====] - 0s 751us/step - loss: 0.0264
Epoch 394/400
160/160 [=====] - 0s 943us/step - loss: 0.0274
Epoch 395/400
160/160 [=====] - 0s 1ms/step - loss: 0.0287
Epoch 396/400
160/160 [=====] - 0s 1ms/step - loss: 0.0263
Epoch 397/400
160/160 [=====] - 0s 797us/step - loss: 0.0292
Epoch 398/400
160/160 [=====] - 0s 824us/step - loss: 0.0282
Epoch 399/400
160/160 [=====] - 0s 792us/step - loss: 0.0278
Epoch 400/400
160/160 [=====] - 0s 802us/step - loss: 0.0250

```

```

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '

```

```

[ 0.9992842  0.9973824  0.999471  0.9979615  0.9974437  0.99938387
 0.99910307 0.9994135  0.99858934 0.9994346  0.9985656  0.9980645
 0.9995257 0.9986773  0.9995535 0.37875664 0.99183875 0.99947363
 0.9981356 0.8796136  0.9994097 0.99864537 0.91239506 0.99826175
 0.9984996 0.99969965 0.9994721 0.99927384 0.9993048 0.9992967
 0.9996675 0.97696185 0.9991522 0.99926376 0.99956137 0.9982983
 0.96063167 0.9994318  0.99830174 0.99944913 0.99921685 0.9982823
 0.99934465 0.9984939  0.9984438 0.9992755  0.9990542  0.99923307
 0.99837875 0.99931425 0.99877816 0.99859494 0.99939275 0.99885875
 0.99941397 0.5062458  0.9926456 0.9993463  0.99867797 0.970129
 0.9992928 0.9988929  0.9418257 0.9984999  0.9988224  0.9995523
 0.99934  0.99920523 0.9992223 0.99920034 0.9995232  0.98462296
 0.99903995 0.9991751  0.9994237 0.9987144  0.98395735 0.9992893

```

```

0.99854887 0.99929297 -0.30907604 -0.356954 -0.36017 -0.35777786
-0.35932702 -0.36075205 -0.3587598 -0.28912103 -0.32798085 -0.36062574
-0.35912922 -0.3590586 -0.359589 -0.29954904 -0.35599265 0.47990918
-0.19942138 -0.36033803 -0.3602238 -0.16627276 -0.360997 -0.36100304
-0.04777403 -0.35538962 -0.3607011 -0.31166643 -0.36075583 -0.3611953
-0.36110476 -0.35942832 -0.35285845 -0.30564424 -0.3543002 -0.35937697
-0.35951498 -0.35992396 -0.2894378 -0.35469434 -0.35620224 -0.35092264
-0.39018592 -0.42824972 -0.42915592 -0.4284825 -0.42909005 -0.42933217
-0.42871916 -0.35910606 -0.41658342 -0.42929947 -0.42888322 -0.4289266
-0.42898524 -0.37405404 -0.42790154 0.35415274 -0.34795287 -0.42921284
-0.4292879 -0.1040176 -0.42944288 -0.42947817 -0.22473483 -0.4274999
-0.42939427 -0.41200128 -0.42937732 -0.42951035 -0.4294626 -0.42892298
-0.4263828 -0.39098024 -0.42727175 -0.42890772 -0.4289855 -0.42917714
-0.37859565 -0.4275186 -0.42782745 -0.4263553 ]
160/160 [=====] - 0s 2ms/step

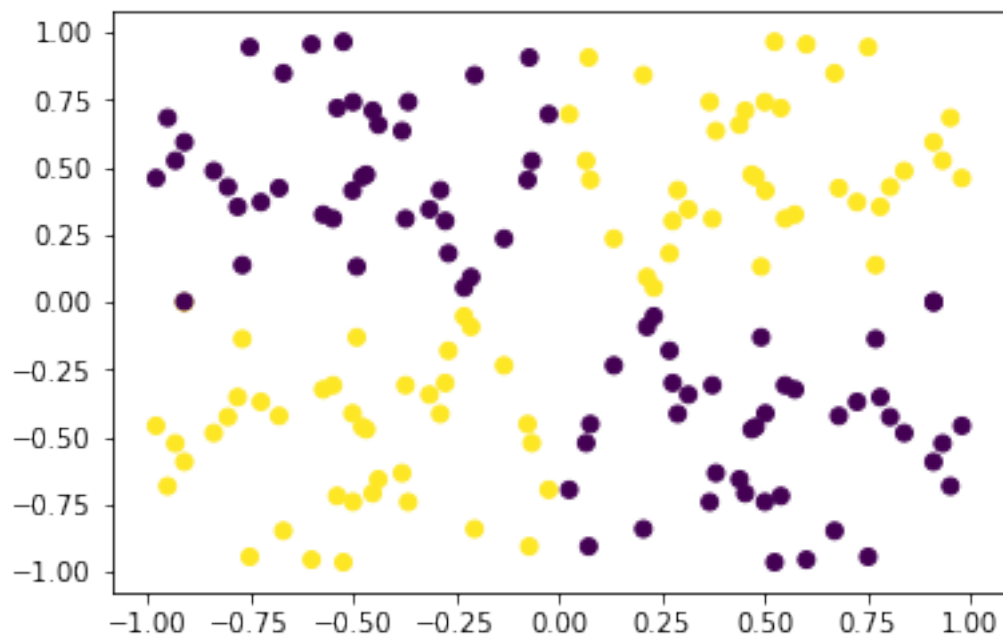
```

```
In [118]: scores, model.metrics_names
```

```
Out[118]: (0.020199596206508373, ['loss'])
```

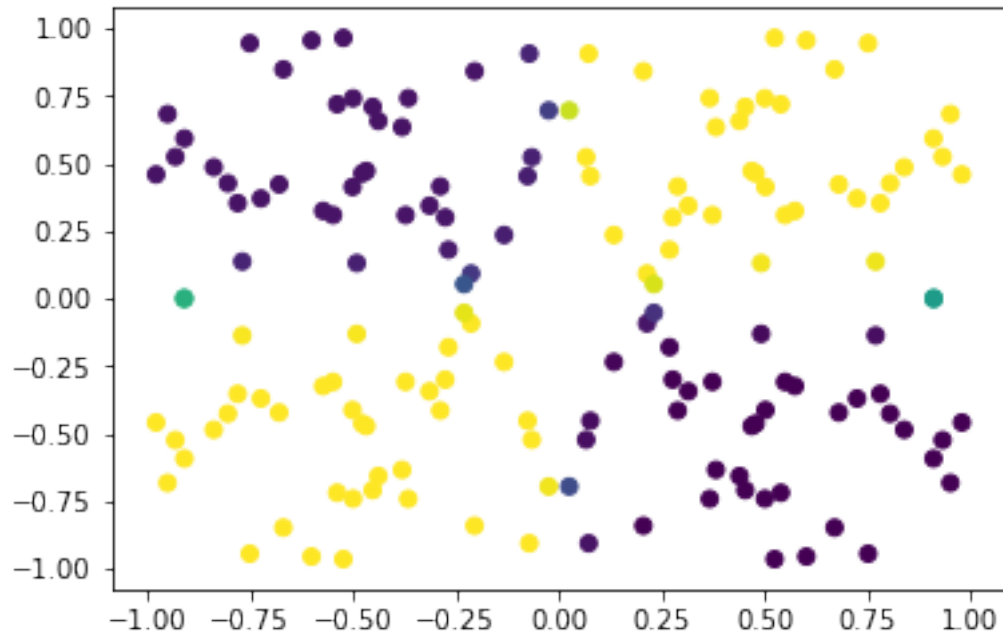
```
In [119]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[119]: <matplotlib.collections.PathCollection at 0xb2ea18b00>
```



```
In [120]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

Out[120]: <matplotlib.collections.PathCollection at 0xb2e9eeeb8>



```
In [121]: # Using tanh for 4 neuron
model = Sequential()

model.add(Dense(4, input_dim=2, activation='tanh'))
model.add(Dense(4, activation='tanh'))
model.add(Dense(4, activation='tanh'))
model.add(Dense(4, activation='tanh'))
model.add(Dense(4, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

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))

scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 1s 8ms/step - loss: 0.9070
Epoch 2/400
160/160 [=====] - 0s 876us/step - loss: 0.6655
```

Epoch 3/400
160/160 [=====] - 0s 780us/step - loss: 0.6198
Epoch 4/400
160/160 [=====] - 0s 796us/step - loss: 0.5514
Epoch 5/400
160/160 [=====] - 0s 810us/step - loss: 0.4957
Epoch 6/400
160/160 [=====] - 0s 832us/step - loss: 0.4466
Epoch 7/400
160/160 [=====] - 0s 825us/step - loss: 0.3917
Epoch 8/400
160/160 [=====] - 0s 846us/step - loss: 0.3413
Epoch 9/400
160/160 [=====] - 0s 847us/step - loss: 0.3131
Epoch 10/400
160/160 [=====] - 0s 863us/step - loss: 0.3521
Epoch 11/400
160/160 [=====] - 0s 1ms/step - loss: 0.2293
Epoch 12/400
160/160 [=====] - 0s 947us/step - loss: 0.2178
Epoch 13/400
160/160 [=====] - 0s 1ms/step - loss: 0.1801
Epoch 14/400
160/160 [=====] - 0s 1ms/step - loss: 0.1762
Epoch 15/400
160/160 [=====] - 0s 879us/step - loss: 0.1563
Epoch 16/400
160/160 [=====] - 0s 862us/step - loss: 0.1410
Epoch 17/400
160/160 [=====] - 0s 832us/step - loss: 0.1405
Epoch 18/400
160/160 [=====] - 0s 797us/step - loss: 0.1441
Epoch 19/400
160/160 [=====] - 0s 861us/step - loss: 0.2047
Epoch 20/400
160/160 [=====] - 0s 1ms/step - loss: 0.1984
Epoch 21/400
160/160 [=====] - 0s 1ms/step - loss: 0.1031
Epoch 22/400
160/160 [=====] - 0s 1ms/step - loss: 0.1187
Epoch 23/400
160/160 [=====] - 0s 1ms/step - loss: 0.0962
Epoch 24/400
160/160 [=====] - 0s 1ms/step - loss: 0.1028
Epoch 25/400
160/160 [=====] - 0s 865us/step - loss: 0.0888
Epoch 26/400
160/160 [=====] - 0s 863us/step - loss: 0.0813

Epoch 27/400
160/160 [=====] - 0s 854us/step - loss: 0.0713
Epoch 28/400
160/160 [=====] - 0s 857us/step - loss: 0.0723
Epoch 29/400
160/160 [=====] - 0s 868us/step - loss: 0.0831
Epoch 30/400
160/160 [=====] - 0s 819us/step - loss: 0.0735
Epoch 31/400
160/160 [=====] - 0s 773us/step - loss: 0.2186
Epoch 32/400
160/160 [=====] - 0s 785us/step - loss: 0.1023
Epoch 33/400
160/160 [=====] - 0s 856us/step - loss: 0.0739
Epoch 34/400
160/160 [=====] - 0s 859us/step - loss: 0.0720
Epoch 35/400
160/160 [=====] - 0s 870us/step - loss: 0.0762
Epoch 36/400
160/160 [=====] - 0s 877us/step - loss: 0.0737
Epoch 37/400
160/160 [=====] - 0s 840us/step - loss: 0.0687
Epoch 38/400
160/160 [=====] - 0s 859us/step - loss: 0.1098
Epoch 39/400
160/160 [=====] - 0s 1ms/step - loss: 0.0744
Epoch 40/400
160/160 [=====] - 0s 981us/step - loss: 0.0598
Epoch 41/400
160/160 [=====] - 0s 1ms/step - loss: 0.0628
Epoch 42/400
160/160 [=====] - 0s 876us/step - loss: 0.1289
Epoch 43/400
160/160 [=====] - 0s 866us/step - loss: 0.0756
Epoch 44/400
160/160 [=====] - 0s 816us/step - loss: 0.0973
Epoch 45/400
160/160 [=====] - 0s 772us/step - loss: 0.0658
Epoch 46/400
160/160 [=====] - 0s 1ms/step - loss: 0.0603
Epoch 47/400
160/160 [=====] - 0s 924us/step - loss: 0.0665
Epoch 48/400
160/160 [=====] - 0s 848us/step - loss: 0.0728
Epoch 49/400
160/160 [=====] - 0s 852us/step - loss: 0.0925
Epoch 50/400
160/160 [=====] - 0s 976us/step - loss: 1.0960

Epoch 51/400
160/160 [=====] - 0s 932us/step - loss: 0.9092
Epoch 52/400
160/160 [=====] - 0s 863us/step - loss: 0.9543
Epoch 53/400
160/160 [=====] - 0s 829us/step - loss: 0.9071
Epoch 54/400
160/160 [=====] - 0s 857us/step - loss: 0.6030
Epoch 55/400
160/160 [=====] - 0s 838us/step - loss: 0.7160
Epoch 56/400
160/160 [=====] - 0s 856us/step - loss: 0.5993
Epoch 57/400
160/160 [=====] - 0s 885us/step - loss: 0.6037
Epoch 58/400
160/160 [=====] - 0s 1ms/step - loss: 0.5192
Epoch 59/400
160/160 [=====] - 0s 1ms/step - loss: 0.6025
Epoch 60/400
160/160 [=====] - 0s 902us/step - loss: 0.5098
Epoch 61/400
160/160 [=====] - 0s 849us/step - loss: 0.4962
Epoch 62/400
160/160 [=====] - 0s 851us/step - loss: 0.4868
Epoch 63/400
160/160 [=====] - 0s 830us/step - loss: 0.4710
Epoch 64/400
160/160 [=====] - 0s 927us/step - loss: 0.4718
Epoch 65/400
160/160 [=====] - 0s 912us/step - loss: 0.4610
Epoch 66/400
160/160 [=====] - 0s 1ms/step - loss: 0.4676
Epoch 67/400
160/160 [=====] - 0s 963us/step - loss: 0.4526
Epoch 68/400
160/160 [=====] - 0s 827us/step - loss: 0.4491
Epoch 69/400
160/160 [=====] - 0s 828us/step - loss: 0.4524
Epoch 70/400
160/160 [=====] - 0s 803us/step - loss: 0.4419
Epoch 71/400
160/160 [=====] - 0s 875us/step - loss: 0.4455
Epoch 72/400
160/160 [=====] - 0s 793us/step - loss: 0.4395
Epoch 73/400
160/160 [=====] - 0s 778us/step - loss: 0.4404
Epoch 74/400
160/160 [=====] - 0s 962us/step - loss: 0.4407

Epoch 75/400
160/160 [=====] - 0s 1ms/step - loss: 0.4321
Epoch 76/400
160/160 [=====] - 0s 882us/step - loss: 0.4399
Epoch 77/400
160/160 [=====] - 0s 840us/step - loss: 0.4270
Epoch 78/400
160/160 [=====] - 0s 841us/step - loss: 0.4212
Epoch 79/400
160/160 [=====] - 0s 858us/step - loss: 0.4309
Epoch 80/400
160/160 [=====] - 0s 829us/step - loss: 0.4208
Epoch 81/400
160/160 [=====] - 0s 817us/step - loss: 0.4259
Epoch 82/400
160/160 [=====] - 0s 899us/step - loss: 0.5114
Epoch 83/400
160/160 [=====] - 0s 862us/step - loss: 0.4207
Epoch 84/400
160/160 [=====] - 0s 994us/step - loss: 0.4202
Epoch 85/400
160/160 [=====] - 0s 1ms/step - loss: 0.4248
Epoch 86/400
160/160 [=====] - 0s 1ms/step - loss: 0.4123
Epoch 87/400
160/160 [=====] - 0s 1ms/step - loss: 0.4134
Epoch 88/400
160/160 [=====] - 0s 1ms/step - loss: 0.4156
Epoch 89/400
160/160 [=====] - 0s 1ms/step - loss: 0.4106
Epoch 90/400
160/160 [=====] - 0s 957us/step - loss: 0.4168
Epoch 91/400
160/160 [=====] - 0s 1ms/step - loss: 0.4087
Epoch 92/400
160/160 [=====] - 0s 1ms/step - loss: 0.4040
Epoch 93/400
160/160 [=====] - 0s 963us/step - loss: 0.4013
Epoch 94/400
160/160 [=====] - 0s 1ms/step - loss: 0.4027
Epoch 95/400
160/160 [=====] - 0s 1ms/step - loss: 0.4001
Epoch 96/400
160/160 [=====] - 0s 1ms/step - loss: 0.4011
Epoch 97/400
160/160 [=====] - 0s 931us/step - loss: 0.3976
Epoch 98/400
160/160 [=====] - 0s 989us/step - loss: 0.4019

Epoch 99/400
160/160 [=====] - 0s 1ms/step - loss: 0.4077
Epoch 100/400
160/160 [=====] - 0s 1ms/step - loss: 0.3960
Epoch 101/400
160/160 [=====] - 0s 1ms/step - loss: 0.3984
Epoch 102/400
160/160 [=====] - 0s 1ms/step - loss: 0.4018
Epoch 103/400
160/160 [=====] - 0s 1ms/step - loss: 0.3910
Epoch 104/400
160/160 [=====] - 0s 1ms/step - loss: 0.3880
Epoch 105/400
160/160 [=====] - 0s 968us/step - loss: 0.3950
Epoch 106/400
160/160 [=====] - 0s 828us/step - loss: 0.3813
Epoch 107/400
160/160 [=====] - 0s 1ms/step - loss: 0.3935
Epoch 108/400
160/160 [=====] - 0s 1ms/step - loss: 0.3885
Epoch 109/400
160/160 [=====] - 0s 1ms/step - loss: 0.3918
Epoch 110/400
160/160 [=====] - 0s 1ms/step - loss: 0.3929
Epoch 111/400
160/160 [=====] - 0s 1ms/step - loss: 0.3915
Epoch 112/400
160/160 [=====] - 0s 1ms/step - loss: 0.8854
Epoch 113/400
160/160 [=====] - 0s 1ms/step - loss: 0.9111
Epoch 114/400
160/160 [=====] - 0s 1ms/step - loss: 0.6556
Epoch 115/400
160/160 [=====] - 0s 1ms/step - loss: 0.5973
Epoch 116/400
160/160 [=====] - 0s 1ms/step - loss: 0.5000
Epoch 117/400
160/160 [=====] - 0s 1ms/step - loss: 0.4314
Epoch 118/400
160/160 [=====] - 0s 1ms/step - loss: 0.3518
Epoch 119/400
160/160 [=====] - 0s 1ms/step - loss: 0.3335
Epoch 120/400
160/160 [=====] - 0s 1ms/step - loss: 0.3332
Epoch 121/400
160/160 [=====] - 0s 1ms/step - loss: 0.3467
Epoch 122/400
160/160 [=====] - 0s 1ms/step - loss: 0.3876

Epoch 123/400
160/160 [=====] - 0s 1ms/step - loss: 0.5608
Epoch 124/400
160/160 [=====] - 0s 879us/step - loss: 0.2156
Epoch 125/400
160/160 [=====] - 0s 827us/step - loss: 0.2780
Epoch 126/400
160/160 [=====] - 0s 788us/step - loss: 0.4910
Epoch 127/400
160/160 [=====] - 0s 795us/step - loss: 0.4272
Epoch 128/400
160/160 [=====] - 0s 832us/step - loss: 0.3138
Epoch 129/400
160/160 [=====] - 0s 827us/step - loss: 0.1515
Epoch 130/400
160/160 [=====] - 0s 827us/step - loss: 0.1931
Epoch 131/400
160/160 [=====] - 0s 910us/step - loss: 0.2788
Epoch 132/400
160/160 [=====] - 0s 1ms/step - loss: 0.1961
Epoch 133/400
160/160 [=====] - 0s 833us/step - loss: 0.2105
Epoch 134/400
160/160 [=====] - 0s 859us/step - loss: 0.1648
Epoch 135/400
160/160 [=====] - 0s 793us/step - loss: 0.1285
Epoch 136/400
160/160 [=====] - 0s 929us/step - loss: 0.1339
Epoch 137/400
160/160 [=====] - 0s 1ms/step - loss: 0.0866
Epoch 138/400
160/160 [=====] - 0s 1ms/step - loss: 0.0939
Epoch 139/400
160/160 [=====] - 0s 1ms/step - loss: 0.1861
Epoch 140/400
160/160 [=====] - 0s 1ms/step - loss: 0.2677
Epoch 141/400
160/160 [=====] - 0s 1ms/step - loss: 2.0468
Epoch 142/400
160/160 [=====] - 0s 1ms/step - loss: 0.8248
Epoch 143/400
160/160 [=====] - 0s 1ms/step - loss: 0.5909
Epoch 144/400
160/160 [=====] - 0s 981us/step - loss: 0.5537
Epoch 145/400
160/160 [=====] - 0s 1ms/step - loss: 0.5372
Epoch 146/400
160/160 [=====] - 0s 852us/step - loss: 0.5310

Epoch 147/400
160/160 [=====] - 0s 820us/step - loss: 0.5182
Epoch 148/400
160/160 [=====] - 0s 780us/step - loss: 0.5188
Epoch 149/400
160/160 [=====] - 0s 1ms/step - loss: 0.5203
Epoch 150/400
160/160 [=====] - 0s 1ms/step - loss: 0.5143
Epoch 151/400
160/160 [=====] - 0s 1ms/step - loss: 0.5014
Epoch 152/400
160/160 [=====] - 0s 959us/step - loss: 0.4984
Epoch 153/400
160/160 [=====] - 0s 1ms/step - loss: 0.4939
Epoch 154/400
160/160 [=====] - 0s 1ms/step - loss: 0.4881
Epoch 155/400
160/160 [=====] - 0s 1ms/step - loss: 0.4680
Epoch 156/400
160/160 [=====] - 0s 836us/step - loss: 0.4688
Epoch 157/400
160/160 [=====] - 0s 824us/step - loss: 0.4625
Epoch 158/400
160/160 [=====] - 0s 858us/step - loss: 0.4481
Epoch 159/400
160/160 [=====] - 0s 819us/step - loss: 0.4469
Epoch 160/400
160/160 [=====] - 0s 829us/step - loss: 0.4469
Epoch 161/400
160/160 [=====] - 0s 780us/step - loss: 0.4326
Epoch 162/400
160/160 [=====] - 0s 795us/step - loss: 0.4354
Epoch 163/400
160/160 [=====] - 0s 825us/step - loss: 0.4365
Epoch 164/400
160/160 [=====] - 0s 866us/step - loss: 0.4287
Epoch 165/400
160/160 [=====] - 0s 826us/step - loss: 0.4186
Epoch 166/400
160/160 [=====] - 0s 1ms/step - loss: 0.4231
Epoch 167/400
160/160 [=====] - 0s 1ms/step - loss: 0.4228
Epoch 168/400
160/160 [=====] - 0s 1ms/step - loss: 0.4128
Epoch 169/400
160/160 [=====] - 0s 1ms/step - loss: 0.4067
Epoch 170/400
160/160 [=====] - 0s 975us/step - loss: 0.5037

Epoch 171/400
160/160 [=====] - 0s 827us/step - loss: 0.4108
Epoch 172/400
160/160 [=====] - 0s 804us/step - loss: 0.4037
Epoch 173/400
160/160 [=====] - 0s 843us/step - loss: 0.4081
Epoch 174/400
160/160 [=====] - 0s 792us/step - loss: 0.4081
Epoch 175/400
160/160 [=====] - 0s 792us/step - loss: 0.4057
Epoch 176/400
160/160 [=====] - 0s 783us/step - loss: 0.4038
Epoch 177/400
160/160 [=====] - 0s 841us/step - loss: 0.3977
Epoch 178/400
160/160 [=====] - 0s 813us/step - loss: 0.3983
Epoch 179/400
160/160 [=====] - 0s 827us/step - loss: 0.3958
Epoch 180/400
160/160 [=====] - 0s 843us/step - loss: 0.3879
Epoch 181/400
160/160 [=====] - 0s 1ms/step - loss: 0.6407
Epoch 182/400
160/160 [=====] - 0s 1ms/step - loss: 0.6304
Epoch 183/400
160/160 [=====] - 0s 1ms/step - loss: 0.6163
Epoch 184/400
160/160 [=====] - 0s 964us/step - loss: 0.5885
Epoch 185/400
160/160 [=====] - 0s 940us/step - loss: 0.5990
Epoch 186/400
160/160 [=====] - 0s 941us/step - loss: 0.5740
Epoch 187/400
160/160 [=====] - 0s 1ms/step - loss: 0.8535
Epoch 188/400
160/160 [=====] - 0s 1ms/step - loss: 0.5780
Epoch 189/400
160/160 [=====] - 0s 1ms/step - loss: 0.5656
Epoch 190/400
160/160 [=====] - 0s 1ms/step - loss: 0.5769
Epoch 191/400
160/160 [=====] - 0s 1ms/step - loss: 0.5728
Epoch 192/400
160/160 [=====] - 0s 1ms/step - loss: 0.5677
Epoch 193/400
160/160 [=====] - 0s 1ms/step - loss: 0.5409
Epoch 194/400
160/160 [=====] - 0s 1ms/step - loss: 0.5491

Epoch 195/400
160/160 [=====] - 0s 1ms/step - loss: 0.5712
Epoch 196/400
160/160 [=====] - 0s 1ms/step - loss: 0.4370
Epoch 197/400
160/160 [=====] - 0s 1ms/step - loss: 0.3760
Epoch 198/400
160/160 [=====] - 0s 1ms/step - loss: 0.3362
Epoch 199/400
160/160 [=====] - 0s 1ms/step - loss: 0.2826
Epoch 200/400
160/160 [=====] - 0s 1ms/step - loss: 0.2381
Epoch 201/400
160/160 [=====] - 0s 1ms/step - loss: 0.2094
Epoch 202/400
160/160 [=====] - 0s 859us/step - loss: 0.1808
Epoch 203/400
160/160 [=====] - 0s 1ms/step - loss: 0.1745
Epoch 204/400
160/160 [=====] - 0s 1ms/step - loss: 0.1468
Epoch 205/400
160/160 [=====] - 0s 1ms/step - loss: 0.1284
Epoch 206/400
160/160 [=====] - 0s 1ms/step - loss: 0.1212
Epoch 207/400
160/160 [=====] - 0s 1ms/step - loss: 0.1020
Epoch 208/400
160/160 [=====] - 0s 1ms/step - loss: 0.0874
Epoch 209/400
160/160 [=====] - 0s 988us/step - loss: 0.0858
Epoch 210/400
160/160 [=====] - 0s 969us/step - loss: 1.1431
Epoch 211/400
160/160 [=====] - 0s 998us/step - loss: 0.2584
Epoch 212/400
160/160 [=====] - 0s 1ms/step - loss: 0.1587
Epoch 213/400
160/160 [=====] - 0s 1ms/step - loss: 0.1117
Epoch 214/400
160/160 [=====] - 0s 931us/step - loss: 0.0945
Epoch 215/400
160/160 [=====] - 0s 952us/step - loss: 0.0896
Epoch 216/400
160/160 [=====] - 0s 1ms/step - loss: 0.0925
Epoch 217/400
160/160 [=====] - 0s 1ms/step - loss: 0.0781
Epoch 218/400
160/160 [=====] - 0s 837us/step - loss: 0.0786

Epoch 219/400
160/160 [=====] - 0s 864us/step - loss: 0.0874
Epoch 220/400
160/160 [=====] - 0s 831us/step - loss: 0.0820
Epoch 221/400
160/160 [=====] - 0s 1ms/step - loss: 0.1827
Epoch 222/400
160/160 [=====] - 0s 884us/step - loss: 0.0758
Epoch 223/400
160/160 [=====] - 0s 879us/step - loss: 0.1752
Epoch 224/400
160/160 [=====] - 0s 868us/step - loss: 0.6658
Epoch 225/400
160/160 [=====] - 0s 756us/step - loss: 0.5726
Epoch 226/400
160/160 [=====] - 0s 1ms/step - loss: 0.5690
Epoch 227/400
160/160 [=====] - 0s 877us/step - loss: 0.5825
Epoch 228/400
160/160 [=====] - 0s 1ms/step - loss: 0.5470
Epoch 229/400
160/160 [=====] - 0s 1ms/step - loss: 0.5845
Epoch 230/400
160/160 [=====] - 0s 1ms/step - loss: 0.5622
Epoch 231/400
160/160 [=====] - 0s 1ms/step - loss: 0.5597
Epoch 232/400
160/160 [=====] - 0s 1ms/step - loss: 0.5680
Epoch 233/400
160/160 [=====] - 0s 871us/step - loss: 0.5362
Epoch 234/400
160/160 [=====] - 0s 1ms/step - loss: 0.5810
Epoch 235/400
160/160 [=====] - 0s 855us/step - loss: 0.5655
Epoch 236/400
160/160 [=====] - 0s 1ms/step - loss: 0.5630
Epoch 237/400
160/160 [=====] - 0s 1ms/step - loss: 0.5544
Epoch 238/400
160/160 [=====] - 0s 1ms/step - loss: 0.7750
Epoch 239/400
160/160 [=====] - 0s 1ms/step - loss: 0.9366
Epoch 240/400
160/160 [=====] - 0s 1ms/step - loss: 0.5515
Epoch 241/400
160/160 [=====] - 0s 956us/step - loss: 0.5790
Epoch 242/400
160/160 [=====] - 0s 814us/step - loss: 0.5482

Epoch 243/400
160/160 [=====] - 0s 959us/step - loss: 0.5638
Epoch 244/400
160/160 [=====] - 0s 996us/step - loss: 0.5324
Epoch 245/400
160/160 [=====] - 0s 854us/step - loss: 0.5330
Epoch 246/400
160/160 [=====] - 0s 1ms/step - loss: 0.5378
Epoch 247/400
160/160 [=====] - 0s 943us/step - loss: 0.5446
Epoch 248/400
160/160 [=====] - 0s 841us/step - loss: 0.5554
Epoch 249/400
160/160 [=====] - 0s 949us/step - loss: 0.5447
Epoch 250/400
160/160 [=====] - 0s 1ms/step - loss: 0.5485
Epoch 251/400
160/160 [=====] - 0s 1ms/step - loss: 0.5562
Epoch 252/400
160/160 [=====] - 0s 1ms/step - loss: 0.5333
Epoch 253/400
160/160 [=====] - 0s 1ms/step - loss: 0.5224
Epoch 254/400
160/160 [=====] - 0s 855us/step - loss: 0.5716
Epoch 255/400
160/160 [=====] - 0s 1ms/step - loss: 0.5601
Epoch 256/400
160/160 [=====] - 0s 927us/step - loss: 0.5332
Epoch 257/400
160/160 [=====] - 0s 923us/step - loss: 0.5525
Epoch 258/400
160/160 [=====] - 0s 839us/step - loss: 0.5646
Epoch 259/400
160/160 [=====] - 0s 1ms/step - loss: 0.5440
Epoch 260/400
160/160 [=====] - 0s 959us/step - loss: 0.5402
Epoch 261/400
160/160 [=====] - 0s 893us/step - loss: 0.5324
Epoch 262/400
160/160 [=====] - 0s 1ms/step - loss: 0.5504
Epoch 263/400
160/160 [=====] - 0s 874us/step - loss: 0.5274
Epoch 264/400
160/160 [=====] - 0s 801us/step - loss: 0.5523
Epoch 265/400
160/160 [=====] - 0s 957us/step - loss: 0.5449
Epoch 266/400
160/160 [=====] - 0s 866us/step - loss: 0.5371

Epoch 267/400
160/160 [=====] - 0s 868us/step - loss: 0.5334
Epoch 268/400
160/160 [=====] - 0s 886us/step - loss: 0.5468
Epoch 269/400
160/160 [=====] - 0s 918us/step - loss: 1.1436
Epoch 270/400
160/160 [=====] - 0s 829us/step - loss: 0.5412
Epoch 271/400
160/160 [=====] - 0s 844us/step - loss: 0.5355
Epoch 272/400
160/160 [=====] - 0s 902us/step - loss: 0.5355
Epoch 273/400
160/160 [=====] - 0s 839us/step - loss: 0.5322
Epoch 274/400
160/160 [=====] - 0s 862us/step - loss: 0.5568
Epoch 275/400
160/160 [=====] - 0s 975us/step - loss: 0.5360
Epoch 276/400
160/160 [=====] - 0s 995us/step - loss: 0.5300
Epoch 277/400
160/160 [=====] - 0s 770us/step - loss: 0.5465
Epoch 278/400
160/160 [=====] - 0s 822us/step - loss: 0.5128
Epoch 279/400
160/160 [=====] - 0s 923us/step - loss: 0.5403
Epoch 280/400
160/160 [=====] - 0s 890us/step - loss: 0.5323
Epoch 281/400
160/160 [=====] - 0s 837us/step - loss: 0.5406
Epoch 282/400
160/160 [=====] - 0s 1ms/step - loss: 0.5317
Epoch 283/400
160/160 [=====] - 0s 1ms/step - loss: 0.5168
Epoch 284/400
160/160 [=====] - 0s 1ms/step - loss: 0.5188
Epoch 285/400
160/160 [=====] - 0s 913us/step - loss: 0.5188
Epoch 286/400
160/160 [=====] - 0s 929us/step - loss: 0.5159
Epoch 287/400
160/160 [=====] - 0s 861us/step - loss: 0.5285
Epoch 288/400
160/160 [=====] - 0s 955us/step - loss: 0.5186
Epoch 289/400
160/160 [=====] - 0s 882us/step - loss: 0.5221
Epoch 290/400
160/160 [=====] - 0s 755us/step - loss: 0.5204

Epoch 291/400
160/160 [=====] - 0s 814us/step - loss: 0.5707
Epoch 292/400
160/160 [=====] - 0s 772us/step - loss: 0.5236
Epoch 293/400
160/160 [=====] - 0s 990us/step - loss: 0.5096
Epoch 294/400
160/160 [=====] - 0s 825us/step - loss: 0.5193
Epoch 295/400
160/160 [=====] - 0s 1ms/step - loss: 0.5252
Epoch 296/400
160/160 [=====] - 0s 1ms/step - loss: 0.5438
Epoch 297/400
160/160 [=====] - 0s 986us/step - loss: 0.5255
Epoch 298/400
160/160 [=====] - 0s 858us/step - loss: 0.5231
Epoch 299/400
160/160 [=====] - 0s 952us/step - loss: 0.5234
Epoch 300/400
160/160 [=====] - 0s 909us/step - loss: 0.5304
Epoch 301/400
160/160 [=====] - 0s 922us/step - loss: 0.5208
Epoch 302/400
160/160 [=====] - 0s 824us/step - loss: 0.5244
Epoch 303/400
160/160 [=====] - 0s 905us/step - loss: 0.5105
Epoch 304/400
160/160 [=====] - 0s 908us/step - loss: 0.5223
Epoch 305/400
160/160 [=====] - 0s 803us/step - loss: 0.5447
Epoch 306/400
160/160 [=====] - 0s 880us/step - loss: 0.5167
Epoch 307/400
160/160 [=====] - 0s 906us/step - loss: 0.5281
Epoch 308/400
160/160 [=====] - 0s 1ms/step - loss: 0.5192
Epoch 309/400
160/160 [=====] - 0s 1ms/step - loss: 0.5158
Epoch 310/400
160/160 [=====] - 0s 1ms/step - loss: 0.5150
Epoch 311/400
160/160 [=====] - 0s 906us/step - loss: 0.5367
Epoch 312/400
160/160 [=====] - 0s 841us/step - loss: 0.5453
Epoch 313/400
160/160 [=====] - 0s 1ms/step - loss: 0.5125
Epoch 314/400
160/160 [=====] - 0s 1ms/step - loss: 0.5177

Epoch 315/400
160/160 [=====] - 0s 1ms/step - loss: 0.5325
Epoch 316/400
160/160 [=====] - 0s 1ms/step - loss: 0.5211
Epoch 317/400
160/160 [=====] - 0s 810us/step - loss: 0.5343
Epoch 318/400
160/160 [=====] - 0s 955us/step - loss: 0.5332
Epoch 319/400
160/160 [=====] - 0s 1ms/step - loss: 0.5069
Epoch 320/400
160/160 [=====] - 0s 838us/step - loss: 0.5104
Epoch 321/400
160/160 [=====] - 0s 1ms/step - loss: 0.5293
Epoch 322/400
160/160 [=====] - 0s 983us/step - loss: 0.5304
Epoch 323/400
160/160 [=====] - 0s 835us/step - loss: 0.5220
Epoch 324/400
160/160 [=====] - 0s 974us/step - loss: 0.5228
Epoch 325/400
160/160 [=====] - 0s 833us/step - loss: 0.5124
Epoch 326/400
160/160 [=====] - 0s 1ms/step - loss: 0.5172
Epoch 327/400
160/160 [=====] - 0s 1ms/step - loss: 0.5141
Epoch 328/400
160/160 [=====] - 0s 1ms/step - loss: 0.5304
Epoch 329/400
160/160 [=====] - 0s 1ms/step - loss: 0.5195
Epoch 330/400
160/160 [=====] - 0s 1ms/step - loss: 0.5196
Epoch 331/400
160/160 [=====] - 0s 1ms/step - loss: 0.5025
Epoch 332/400
160/160 [=====] - 0s 1ms/step - loss: 0.5114
Epoch 333/400
160/160 [=====] - 0s 1ms/step - loss: 0.5176
Epoch 334/400
160/160 [=====] - 0s 1ms/step - loss: 0.5293
Epoch 335/400
160/160 [=====] - 0s 1ms/step - loss: 0.5263
Epoch 336/400
160/160 [=====] - 0s 1ms/step - loss: 0.5071
Epoch 337/400
160/160 [=====] - 0s 856us/step - loss: 0.5167
Epoch 338/400
160/160 [=====] - 0s 841us/step - loss: 0.5273

Epoch 339/400
160/160 [=====] - 0s 822us/step - loss: 0.5125
Epoch 340/400
160/160 [=====] - 0s 881us/step - loss: 0.5086
Epoch 341/400
160/160 [=====] - 0s 842us/step - loss: 0.5092
Epoch 342/400
160/160 [=====] - 0s 942us/step - loss: 0.5011
Epoch 343/400
160/160 [=====] - 0s 790us/step - loss: 0.5028
Epoch 344/400
160/160 [=====] - 0s 1ms/step - loss: 0.5157
Epoch 345/400
160/160 [=====] - 0s 1ms/step - loss: 0.5006
Epoch 346/400
160/160 [=====] - 0s 1ms/step - loss: 0.5103
Epoch 347/400
160/160 [=====] - 0s 1ms/step - loss: 0.5019
Epoch 348/400
160/160 [=====] - 0s 1ms/step - loss: 0.5060
Epoch 349/400
160/160 [=====] - 0s 963us/step - loss: 0.5107
Epoch 350/400
160/160 [=====] - 0s 716us/step - loss: 0.5098
Epoch 351/400
160/160 [=====] - 0s 705us/step - loss: 0.5074
Epoch 352/400
160/160 [=====] - 0s 1ms/step - loss: 0.5211
Epoch 353/400
160/160 [=====] - 0s 1ms/step - loss: 0.5089
Epoch 354/400
160/160 [=====] - 0s 1ms/step - loss: 0.4937
Epoch 355/400
160/160 [=====] - 0s 1ms/step - loss: 0.5093
Epoch 356/400
160/160 [=====] - 0s 1ms/step - loss: 0.5185
Epoch 357/400
160/160 [=====] - 0s 1ms/step - loss: 0.5140
Epoch 358/400
160/160 [=====] - 0s 1ms/step - loss: 0.5120
Epoch 359/400
160/160 [=====] - 0s 1ms/step - loss: 0.5237
Epoch 360/400
160/160 [=====] - 0s 1ms/step - loss: 0.5187
Epoch 361/400
160/160 [=====] - 0s 1ms/step - loss: 0.5023
Epoch 362/400
160/160 [=====] - 0s 1ms/step - loss: 0.5022

Epoch 363/400
160/160 [=====] - 0s 1ms/step - loss: 0.5118
Epoch 364/400
160/160 [=====] - 0s 967us/step - loss: 0.4978
Epoch 365/400
160/160 [=====] - 0s 953us/step - loss: 0.5090
Epoch 366/400
160/160 [=====] - 0s 1ms/step - loss: 0.5085
Epoch 367/400
160/160 [=====] - 0s 1ms/step - loss: 0.5051
Epoch 368/400
160/160 [=====] - 0s 1ms/step - loss: 0.5177
Epoch 369/400
160/160 [=====] - 0s 1ms/step - loss: 0.5090
Epoch 370/400
160/160 [=====] - 0s 1ms/step - loss: 0.5016
Epoch 371/400
160/160 [=====] - 0s 1ms/step - loss: 6.5380
Epoch 372/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 373/400
160/160 [=====] - 0s 921us/step - loss: 7.9712
Epoch 374/400
160/160 [=====] - 0s 868us/step - loss: 7.9712
Epoch 375/400
160/160 [=====] - 0s 854us/step - loss: 7.9712
Epoch 376/400
160/160 [=====] - 0s 807us/step - loss: 7.9712
Epoch 377/400
160/160 [=====] - 0s 842us/step - loss: 7.9712
Epoch 378/400
160/160 [=====] - 0s 852us/step - loss: 7.9712
Epoch 379/400
160/160 [=====] - 0s 803us/step - loss: 7.9712
Epoch 380/400
160/160 [=====] - 0s 775us/step - loss: 7.9712
Epoch 381/400
160/160 [=====] - 0s 787us/step - loss: 7.9712
Epoch 382/400
160/160 [=====] - 0s 813us/step - loss: 7.9712
Epoch 383/400
160/160 [=====] - 0s 823us/step - loss: 7.9712
Epoch 384/400
160/160 [=====] - 0s 796us/step - loss: 7.9712
Epoch 385/400
160/160 [=====] - 0s 789us/step - loss: 7.9712
Epoch 386/400
160/160 [=====] - 0s 879us/step - loss: 7.9712

```

Epoch 387/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 388/400
160/160 [=====] - 0s 838us/step - loss: 7.9712
Epoch 389/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 390/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 391/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 392/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 393/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 394/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 395/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 396/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 397/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 398/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 399/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 400/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
[1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.]
160/160 [=====] - 0s 3ms/step

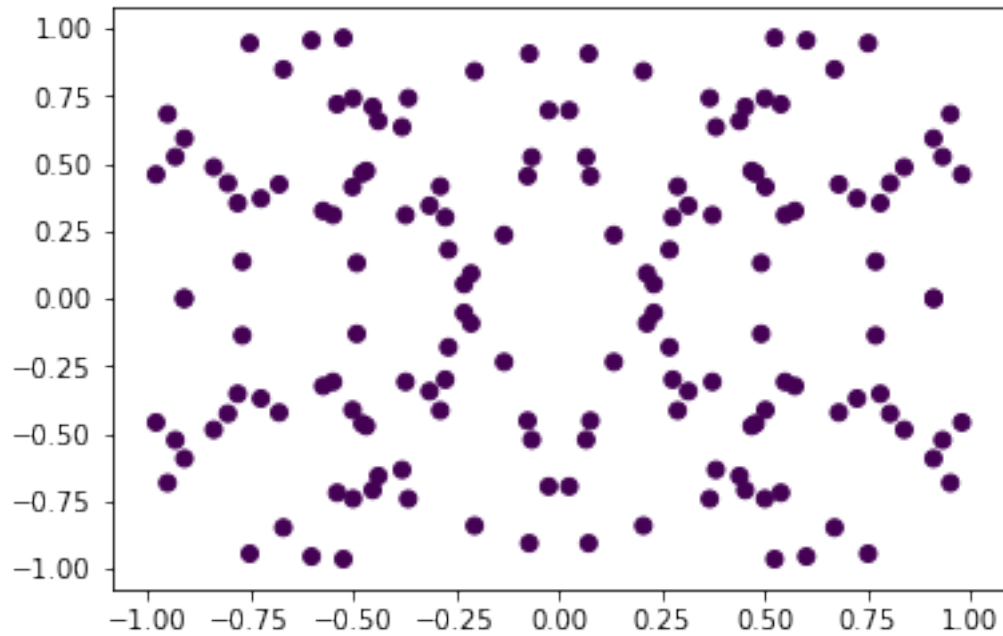
```

```
In [122]: scores, model.metrics_names
```

```
Out[122]: (7.971192407608049, ['loss'])
```

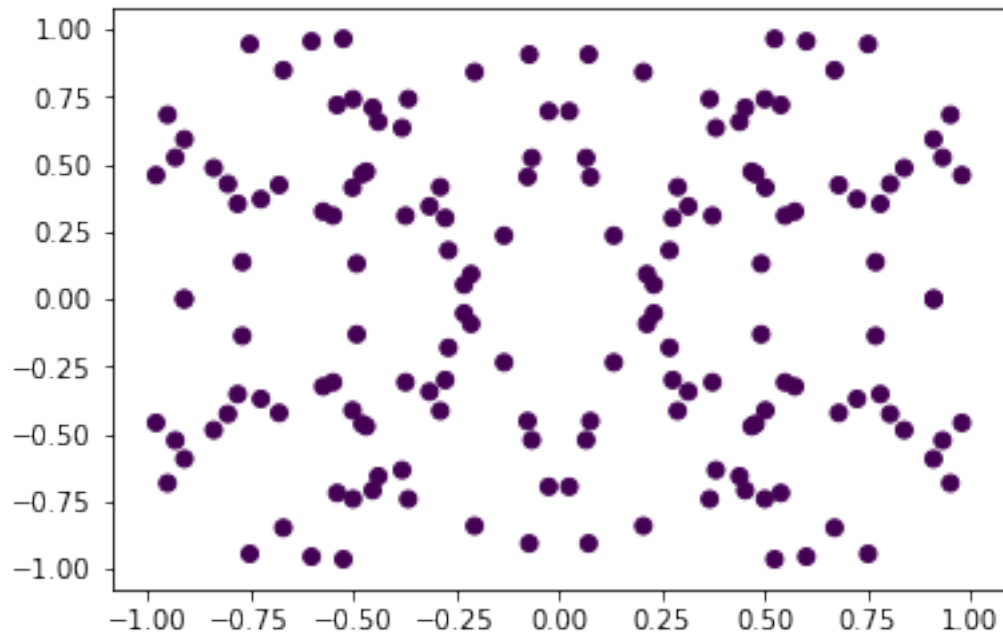
```
In [123]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[123]: <matplotlib.collections.PathCollection at 0xb2f36a2e8>
```



```
In [124]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[124]: <matplotlib.collections.PathCollection at 0xb2f33b7b8>
```




```

In [125]: # At (0.020199596206508373, ['loss']), this model came out best.
          # So, I am comparing it with other activation models
          model = Sequential()

          model.add(Dense(4, input_dim=2, activation='sigmoid'))
          model.add(Dense(4, activation='sigmoid'))
          model.add(Dense(4, activation='sigmoid'))
          model.add(Dense(4, activation='sigmoid'))

          # The output has 1 neuron for predicting whatever we are iterating
          model.add(Dense(1, 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))

          scores = model.evaluate(X, y)

```

```

Epoch 1/400
160/160 [=====] - 1s 8ms/step - loss: 0.6953
Epoch 2/400
160/160 [=====] - 0s 1ms/step - loss: 0.6948
Epoch 3/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 4/400
160/160 [=====] - 0s 951us/step - loss: 0.6947
Epoch 5/400
160/160 [=====] - 0s 972us/step - loss: 0.6943
Epoch 6/400
160/160 [=====] - 0s 955us/step - loss: 0.6945
Epoch 7/400
160/160 [=====] - 0s 888us/step - loss: 0.6945
Epoch 8/400
160/160 [=====] - 0s 912us/step - loss: 0.6946
Epoch 9/400
160/160 [=====] - 0s 913us/step - loss: 0.6943
Epoch 10/400
160/160 [=====] - 0s 947us/step - loss: 0.6945
Epoch 11/400
160/160 [=====] - 0s 895us/step - loss: 0.6944
Epoch 12/400
160/160 [=====] - 0s 887us/step - loss: 0.6945
Epoch 13/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 14/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945

```

Epoch 15/400
160/160 [=====] - 0s 937us/step - loss: 0.6944
Epoch 16/400
160/160 [=====] - 0s 916us/step - loss: 0.6945
Epoch 17/400
160/160 [=====] - 0s 880us/step - loss: 0.6947
Epoch 18/400
160/160 [=====] - 0s 895us/step - loss: 0.6948
Epoch 19/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 20/400
160/160 [=====] - 0s 948us/step - loss: 0.6944
Epoch 21/400
160/160 [=====] - 0s 902us/step - loss: 0.6946
Epoch 22/400
160/160 [=====] - 0s 863us/step - loss: 0.6942
Epoch 23/400
160/160 [=====] - 0s 939us/step - loss: 0.6944
Epoch 24/400
160/160 [=====] - 0s 864us/step - loss: 0.6945
Epoch 25/400
160/160 [=====] - 0s 830us/step - loss: 0.6946
Epoch 26/400
160/160 [=====] - 0s 892us/step - loss: 0.6946
Epoch 27/400
160/160 [=====] - 0s 900us/step - loss: 0.6946
Epoch 28/400
160/160 [=====] - 0s 848us/step - loss: 0.6945
Epoch 29/400
160/160 [=====] - 0s 871us/step - loss: 0.6946
Epoch 30/400
160/160 [=====] - 0s 868us/step - loss: 0.6945
Epoch 31/400
160/160 [=====] - 0s 985us/step - loss: 0.6947
Epoch 32/400
160/160 [=====] - 0s 828us/step - loss: 0.6943
Epoch 33/400
160/160 [=====] - 0s 839us/step - loss: 0.6939
Epoch 34/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 35/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 36/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 37/400
160/160 [=====] - 0s 904us/step - loss: 0.6942
Epoch 38/400
160/160 [=====] - 0s 1ms/step - loss: 0.6948

Epoch 39/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 40/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 41/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 42/400
160/160 [=====] - 0s 940us/step - loss: 0.6945
Epoch 43/400
160/160 [=====] - 0s 880us/step - loss: 0.6943
Epoch 44/400
160/160 [=====] - 0s 966us/step - loss: 0.6946
Epoch 45/400
160/160 [=====] - 0s 888us/step - loss: 0.6943
Epoch 46/400
160/160 [=====] - 0s 903us/step - loss: 0.6943
Epoch 47/400
160/160 [=====] - 0s 859us/step - loss: 0.6944
Epoch 48/400
160/160 [=====] - 0s 955us/step - loss: 0.6945
Epoch 49/400
160/160 [=====] - 0s 803us/step - loss: 0.6947
Epoch 50/400
160/160 [=====] - 0s 825us/step - loss: 0.6942
Epoch 51/400
160/160 [=====] - 0s 840us/step - loss: 0.6944
Epoch 52/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 53/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 54/400
160/160 [=====] - 0s 1ms/step - loss: 0.6947
Epoch 55/400
160/160 [=====] - 0s 863us/step - loss: 0.6946
Epoch 56/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 57/400
160/160 [=====] - 0s 901us/step - loss: 0.6944
Epoch 58/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 59/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 60/400
160/160 [=====] - 0s 892us/step - loss: 0.6943
Epoch 61/400
160/160 [=====] - 0s 990us/step - loss: 0.6944
Epoch 62/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942

Epoch 63/400
160/160 [=====] - 0s 950us/step - loss: 0.6945
Epoch 64/400
160/160 [=====] - 0s 932us/step - loss: 0.6944
Epoch 65/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 66/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 67/400
160/160 [=====] - 0s 1ms/step - loss: 0.6947
Epoch 68/400
160/160 [=====] - 0s 1ms/step - loss: 0.6947
Epoch 69/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 70/400
160/160 [=====] - 0s 855us/step - loss: 0.6945
Epoch 71/400
160/160 [=====] - 0s 961us/step - loss: 0.6944
Epoch 72/400
160/160 [=====] - 0s 1ms/step - loss: 0.6947
Epoch 73/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 74/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 75/400
160/160 [=====] - 0s 974us/step - loss: 0.6946
Epoch 76/400
160/160 [=====] - 0s 938us/step - loss: 0.6948
Epoch 77/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 78/400
160/160 [=====] - 0s 842us/step - loss: 0.6941
Epoch 79/400
160/160 [=====] - 0s 920us/step - loss: 0.6943
Epoch 80/400
160/160 [=====] - 0s 880us/step - loss: 0.6941
Epoch 81/400
160/160 [=====] - 0s 953us/step - loss: 0.6939
Epoch 82/400
160/160 [=====] - 0s 917us/step - loss: 0.6945
Epoch 83/400
160/160 [=====] - 0s 993us/step - loss: 0.6946
Epoch 84/400
160/160 [=====] - 0s 935us/step - loss: 0.6944
Epoch 85/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 86/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945

Epoch 87/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 88/400
160/160 [=====] - 0s 987us/step - loss: 0.6947
Epoch 89/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 90/400
160/160 [=====] - 0s 960us/step - loss: 0.6944
Epoch 91/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 92/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 93/400
160/160 [=====] - 0s 998us/step - loss: 0.6945
Epoch 94/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 95/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 96/400
160/160 [=====] - 0s 933us/step - loss: 0.6945
Epoch 97/400
160/160 [=====] - 0s 1ms/step - loss: 0.6949
Epoch 98/400
160/160 [=====] - 0s 988us/step - loss: 0.6943
Epoch 99/400
160/160 [=====] - 0s 892us/step - loss: 0.6942
Epoch 100/400
160/160 [=====] - 0s 901us/step - loss: 0.6946
Epoch 101/400
160/160 [=====] - 0s 920us/step - loss: 0.6946
Epoch 102/400
160/160 [=====] - 0s 823us/step - loss: 0.6946
Epoch 103/400
160/160 [=====] - 0s 819us/step - loss: 0.6947
Epoch 104/400
160/160 [=====] - 0s 855us/step - loss: 0.6944
Epoch 105/400
160/160 [=====] - 0s 845us/step - loss: 0.6945
Epoch 106/400
160/160 [=====] - 0s 822us/step - loss: 0.6946
Epoch 107/400
160/160 [=====] - 0s 864us/step - loss: 0.6947
Epoch 108/400
160/160 [=====] - 0s 870us/step - loss: 0.6941
Epoch 109/400
160/160 [=====] - 0s 869us/step - loss: 0.6945
Epoch 110/400
160/160 [=====] - 0s 860us/step - loss: 0.6946

Epoch 111/400
160/160 [=====] - 0s 807us/step - loss: 0.6947
Epoch 112/400
160/160 [=====] - 0s 858us/step - loss: 0.6946
Epoch 113/400
160/160 [=====] - 0s 888us/step - loss: 0.6945
Epoch 114/400
160/160 [=====] - 0s 861us/step - loss: 0.6945
Epoch 115/400
160/160 [=====] - 0s 849us/step - loss: 0.6944
Epoch 116/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 117/400
160/160 [=====] - 0s 839us/step - loss: 0.6944
Epoch 118/400
160/160 [=====] - 0s 853us/step - loss: 0.6944
Epoch 119/400
160/160 [=====] - 0s 856us/step - loss: 0.6942
Epoch 120/400
160/160 [=====] - 0s 765us/step - loss: 0.6945
Epoch 121/400
160/160 [=====] - 0s 816us/step - loss: 0.6945
Epoch 122/400
160/160 [=====] - 0s 767us/step - loss: 0.6945
Epoch 123/400
160/160 [=====] - 0s 770us/step - loss: 0.6943
Epoch 124/400
160/160 [=====] - 0s 838us/step - loss: 0.6946
Epoch 125/400
160/160 [=====] - 0s 793us/step - loss: 0.6945
Epoch 126/400
160/160 [=====] - 0s 763us/step - loss: 0.6942
Epoch 127/400
160/160 [=====] - 0s 792us/step - loss: 0.6943
Epoch 128/400
160/160 [=====] - 0s 757us/step - loss: 0.6944
Epoch 129/400
160/160 [=====] - 0s 776us/step - loss: 0.6945
Epoch 130/400
160/160 [=====] - 0s 774us/step - loss: 0.6942
Epoch 131/400
160/160 [=====] - 0s 759us/step - loss: 0.6946
Epoch 132/400
160/160 [=====] - 0s 772us/step - loss: 0.6943
Epoch 133/400
160/160 [=====] - 0s 847us/step - loss: 0.6945
Epoch 134/400
160/160 [=====] - 0s 848us/step - loss: 0.6946

Epoch 135/400
160/160 [=====] - 0s 834us/step - loss: 0.6944
Epoch 136/400
160/160 [=====] - 0s 813us/step - loss: 0.6946
Epoch 137/400
160/160 [=====] - 0s 804us/step - loss: 0.6944
Epoch 138/400
160/160 [=====] - 0s 806us/step - loss: 0.6946
Epoch 139/400
160/160 [=====] - 0s 791us/step - loss: 0.6944
Epoch 140/400
160/160 [=====] - 0s 849us/step - loss: 0.6944
Epoch 141/400
160/160 [=====] - 0s 854us/step - loss: 0.6946
Epoch 142/400
160/160 [=====] - 0s 881us/step - loss: 0.6948
Epoch 143/400
160/160 [=====] - 0s 862us/step - loss: 0.6945
Epoch 144/400
160/160 [=====] - 0s 857us/step - loss: 0.6946
Epoch 145/400
160/160 [=====] - 0s 829us/step - loss: 0.6947
Epoch 146/400
160/160 [=====] - 0s 880us/step - loss: 0.6944
Epoch 147/400
160/160 [=====] - 0s 856us/step - loss: 0.6944
Epoch 148/400
160/160 [=====] - 0s 800us/step - loss: 0.6946
Epoch 149/400
160/160 [=====] - 0s 798us/step - loss: 0.6945
Epoch 150/400
160/160 [=====] - 0s 839us/step - loss: 0.6945
Epoch 151/400
160/160 [=====] - 0s 834us/step - loss: 0.6942
Epoch 152/400
160/160 [=====] - 0s 843us/step - loss: 0.6948
Epoch 153/400
160/160 [=====] - 0s 863us/step - loss: 0.6943
Epoch 154/400
160/160 [=====] - 0s 837us/step - loss: 0.6945
Epoch 155/400
160/160 [=====] - 0s 851us/step - loss: 0.6944
Epoch 156/400
160/160 [=====] - 0s 830us/step - loss: 0.6944
Epoch 157/400
160/160 [=====] - 0s 852us/step - loss: 0.6947
Epoch 158/400
160/160 [=====] - 0s 808us/step - loss: 0.6945

Epoch 159/400
160/160 [=====] - 0s 860us/step - loss: 0.6947
Epoch 160/400
160/160 [=====] - 0s 851us/step - loss: 0.6947
Epoch 161/400
160/160 [=====] - 0s 839us/step - loss: 0.6943
Epoch 162/400
160/160 [=====] - 0s 804us/step - loss: 0.6948
Epoch 163/400
160/160 [=====] - 0s 846us/step - loss: 0.6946
Epoch 164/400
160/160 [=====] - 0s 812us/step - loss: 0.6949
Epoch 165/400
160/160 [=====] - 0s 838us/step - loss: 0.6945
Epoch 166/400
160/160 [=====] - 0s 862us/step - loss: 0.6944
Epoch 167/400
160/160 [=====] - 0s 769us/step - loss: 0.6947
Epoch 168/400
160/160 [=====] - 0s 840us/step - loss: 0.6945
Epoch 169/400
160/160 [=====] - 0s 851us/step - loss: 0.6947
Epoch 170/400
160/160 [=====] - 0s 828us/step - loss: 0.6947
Epoch 171/400
160/160 [=====] - 0s 839us/step - loss: 0.6940
Epoch 172/400
160/160 [=====] - 0s 881us/step - loss: 0.6947
Epoch 173/400
160/160 [=====] - 0s 848us/step - loss: 0.6946
Epoch 174/400
160/160 [=====] - 0s 814us/step - loss: 0.6945
Epoch 175/400
160/160 [=====] - 0s 1ms/step - loss: 0.6948
Epoch 176/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 177/400
160/160 [=====] - 0s 982us/step - loss: 0.6946
Epoch 178/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 179/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 180/400
160/160 [=====] - 0s 832us/step - loss: 0.6945
Epoch 181/400
160/160 [=====] - 0s 770us/step - loss: 0.6944
Epoch 182/400
160/160 [=====] - 0s 773us/step - loss: 0.6945

Epoch 183/400
160/160 [=====] - 0s 767us/step - loss: 0.6946
Epoch 184/400
160/160 [=====] - 0s 773us/step - loss: 0.6943
Epoch 185/400
160/160 [=====] - 0s 776us/step - loss: 0.6943
Epoch 186/400
160/160 [=====] - 0s 883us/step - loss: 0.6945
Epoch 187/400
160/160 [=====] - 0s 856us/step - loss: 0.6941
Epoch 188/400
160/160 [=====] - 0s 971us/step - loss: 0.6945
Epoch 189/400
160/160 [=====] - 0s 895us/step - loss: 0.6943
Epoch 190/400
160/160 [=====] - 0s 883us/step - loss: 0.6942
Epoch 191/400
160/160 [=====] - 0s 860us/step - loss: 0.6942
Epoch 192/400
160/160 [=====] - 0s 928us/step - loss: 0.6943
Epoch 193/400
160/160 [=====] - 0s 874us/step - loss: 0.6944
Epoch 194/400
160/160 [=====] - 0s 804us/step - loss: 0.6947
Epoch 195/400
160/160 [=====] - 0s 857us/step - loss: 0.6944
Epoch 196/400
160/160 [=====] - 0s 814us/step - loss: 0.6941
Epoch 197/400
160/160 [=====] - 0s 893us/step - loss: 0.6946
Epoch 198/400
160/160 [=====] - 0s 773us/step - loss: 0.6944
Epoch 199/400
160/160 [=====] - 0s 797us/step - loss: 0.6944
Epoch 200/400
160/160 [=====] - 0s 746us/step - loss: 0.6944
Epoch 201/400
160/160 [=====] - 0s 794us/step - loss: 0.6949
Epoch 202/400
160/160 [=====] - 0s 853us/step - loss: 0.6942
Epoch 203/400
160/160 [=====] - 0s 908us/step - loss: 0.6946
Epoch 204/400
160/160 [=====] - 0s 861us/step - loss: 0.6945
Epoch 205/400
160/160 [=====] - 0s 881us/step - loss: 0.6944
Epoch 206/400
160/160 [=====] - 0s 893us/step - loss: 0.6942

Epoch 207/400
160/160 [=====] - 0s 821us/step - loss: 0.6945
Epoch 208/400
160/160 [=====] - 0s 784us/step - loss: 0.6944
Epoch 209/400
160/160 [=====] - 0s 822us/step - loss: 0.6944
Epoch 210/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 211/400
160/160 [=====] - 0s 929us/step - loss: 0.6945
Epoch 212/400
160/160 [=====] - 0s 918us/step - loss: 0.6944
Epoch 213/400
160/160 [=====] - 0s 874us/step - loss: 0.6947
Epoch 214/400
160/160 [=====] - 0s 987us/step - loss: 0.6945
Epoch 215/400
160/160 [=====] - 0s 899us/step - loss: 0.6945
Epoch 216/400
160/160 [=====] - 0s 803us/step - loss: 0.6944
Epoch 217/400
160/160 [=====] - 0s 767us/step - loss: 0.6946
Epoch 218/400
160/160 [=====] - 0s 787us/step - loss: 0.6940
Epoch 219/400
160/160 [=====] - 0s 773us/step - loss: 0.6946
Epoch 220/400
160/160 [=====] - 0s 892us/step - loss: 0.6946
Epoch 221/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 222/400
160/160 [=====] - 0s 841us/step - loss: 0.6945
Epoch 223/400
160/160 [=====] - 0s 787us/step - loss: 0.6942
Epoch 224/400
160/160 [=====] - 0s 831us/step - loss: 0.6943
Epoch 225/400
160/160 [=====] - 0s 939us/step - loss: 0.6944
Epoch 226/400
160/160 [=====] - 0s 810us/step - loss: 0.6947
Epoch 227/400
160/160 [=====] - 0s 945us/step - loss: 0.6944
Epoch 228/400
160/160 [=====] - 0s 759us/step - loss: 0.6944
Epoch 229/400
160/160 [=====] - 0s 803us/step - loss: 0.6945
Epoch 230/400
160/160 [=====] - 0s 933us/step - loss: 0.6947

Epoch 231/400
160/160 [=====] - 0s 784us/step - loss: 0.6947
Epoch 232/400
160/160 [=====] - 0s 868us/step - loss: 0.6943
Epoch 233/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 234/400
160/160 [=====] - 0s 882us/step - loss: 0.6945
Epoch 235/400
160/160 [=====] - 0s 803us/step - loss: 0.6943
Epoch 236/400
160/160 [=====] - 0s 933us/step - loss: 0.6944
Epoch 237/400
160/160 [=====] - 0s 751us/step - loss: 0.6944
Epoch 238/400
160/160 [=====] - 0s 735us/step - loss: 0.6946
Epoch 239/400
160/160 [=====] - 0s 757us/step - loss: 0.6943
Epoch 240/400
160/160 [=====] - 0s 743us/step - loss: 0.6945
Epoch 241/400
160/160 [=====] - 0s 763us/step - loss: 0.6945
Epoch 242/400
160/160 [=====] - 0s 766us/step - loss: 0.6944
Epoch 243/400
160/160 [=====] - 0s 932us/step - loss: 0.6945
Epoch 244/400
160/160 [=====] - 0s 882us/step - loss: 0.6943
Epoch 245/400
160/160 [=====] - 0s 843us/step - loss: 0.6943
Epoch 246/400
160/160 [=====] - 0s 962us/step - loss: 0.6943
Epoch 247/400
160/160 [=====] - 0s 811us/step - loss: 0.6947
Epoch 248/400
160/160 [=====] - 0s 826us/step - loss: 0.6945
Epoch 249/400
160/160 [=====] - 0s 785us/step - loss: 0.6943
Epoch 250/400
160/160 [=====] - 0s 900us/step - loss: 0.6944
Epoch 251/400
160/160 [=====] - 0s 885us/step - loss: 0.6944
Epoch 252/400
160/160 [=====] - 0s 882us/step - loss: 0.6946
Epoch 253/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 254/400
160/160 [=====] - 0s 939us/step - loss: 0.6947

Epoch 255/400
160/160 [=====] - 0s 923us/step - loss: 0.6945
Epoch 256/400
160/160 [=====] - 0s 882us/step - loss: 0.6946
Epoch 257/400
160/160 [=====] - 0s 950us/step - loss: 0.6946
Epoch 258/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 259/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 260/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 261/400
160/160 [=====] - 0s 865us/step - loss: 0.6945
Epoch 262/400
160/160 [=====] - 0s 855us/step - loss: 0.6945
Epoch 263/400
160/160 [=====] - 0s 904us/step - loss: 0.6942
Epoch 264/400
160/160 [=====] - 0s 1ms/step - loss: 0.6947
Epoch 265/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 266/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 267/400
160/160 [=====] - 0s 941us/step - loss: 0.6942
Epoch 268/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 269/400
160/160 [=====] - 0s 813us/step - loss: 0.6944
Epoch 270/400
160/160 [=====] - 0s 895us/step - loss: 0.6945
Epoch 271/400
160/160 [=====] - 0s 971us/step - loss: 0.6945
Epoch 272/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 273/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 274/400
160/160 [=====] - 0s 835us/step - loss: 0.6945
Epoch 275/400
160/160 [=====] - 0s 993us/step - loss: 0.6946
Epoch 276/400
160/160 [=====] - 0s 886us/step - loss: 0.6945
Epoch 277/400
160/160 [=====] - 0s 899us/step - loss: 0.6946
Epoch 278/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944

Epoch 279/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 280/400
160/160 [=====] - 0s 804us/step - loss: 0.6943
Epoch 281/400
160/160 [=====] - 0s 834us/step - loss: 0.6944
Epoch 282/400
160/160 [=====] - 0s 963us/step - loss: 0.6945
Epoch 283/400
160/160 [=====] - 0s 917us/step - loss: 0.6944
Epoch 284/400
160/160 [=====] - 0s 889us/step - loss: 0.6946
Epoch 285/400
160/160 [=====] - 0s 862us/step - loss: 0.6948
Epoch 286/400
160/160 [=====] - 0s 880us/step - loss: 0.6940
Epoch 287/400
160/160 [=====] - 0s 874us/step - loss: 0.6944
Epoch 288/400
160/160 [=====] - 0s 869us/step - loss: 0.6948
Epoch 289/400
160/160 [=====] - 0s 885us/step - loss: 0.6941
Epoch 290/400
160/160 [=====] - 0s 850us/step - loss: 0.6943
Epoch 291/400
160/160 [=====] - 0s 881us/step - loss: 0.6943
Epoch 292/400
160/160 [=====] - 0s 862us/step - loss: 0.6944
Epoch 293/400
160/160 [=====] - 0s 870us/step - loss: 0.6944
Epoch 294/400
160/160 [=====] - 0s 868us/step - loss: 0.6946
Epoch 295/400
160/160 [=====] - 0s 860us/step - loss: 0.6943
Epoch 296/400
160/160 [=====] - 0s 861us/step - loss: 0.6940
Epoch 297/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 298/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 299/400
160/160 [=====] - 0s 999us/step - loss: 0.6946
Epoch 300/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 301/400
160/160 [=====] - 0s 883us/step - loss: 0.6943
Epoch 302/400
160/160 [=====] - 0s 921us/step - loss: 0.6945

Epoch 303/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 304/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 305/400
160/160 [=====] - 0s 932us/step - loss: 0.6946
Epoch 306/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 307/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 308/400
160/160 [=====] - 0s 920us/step - loss: 0.6944
Epoch 309/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 310/400
160/160 [=====] - 0s 959us/step - loss: 0.6944
Epoch 311/400
160/160 [=====] - 0s 929us/step - loss: 0.6943
Epoch 312/400
160/160 [=====] - 0s 962us/step - loss: 0.6946
Epoch 313/400
160/160 [=====] - 0s 915us/step - loss: 0.6945
Epoch 314/400
160/160 [=====] - 0s 833us/step - loss: 0.6946
Epoch 315/400
160/160 [=====] - 0s 957us/step - loss: 0.6944
Epoch 316/400
160/160 [=====] - 0s 866us/step - loss: 0.6946
Epoch 317/400
160/160 [=====] - 0s 851us/step - loss: 0.6942
Epoch 318/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 319/400
160/160 [=====] - 0s 904us/step - loss: 0.6944
Epoch 320/400
160/160 [=====] - 0s 946us/step - loss: 0.6946
Epoch 321/400
160/160 [=====] - 0s 960us/step - loss: 0.6944
Epoch 322/400
160/160 [=====] - 0s 906us/step - loss: 0.6943
Epoch 323/400
160/160 [=====] - 0s 802us/step - loss: 0.6941
Epoch 324/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 325/400
160/160 [=====] - 0s 891us/step - loss: 0.6946
Epoch 326/400
160/160 [=====] - 0s 942us/step - loss: 0.6943

Epoch 327/400
160/160 [=====] - 0s 811us/step - loss: 0.6943
Epoch 328/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 329/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 330/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 331/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 332/400
160/160 [=====] - 0s 887us/step - loss: 0.6945
Epoch 333/400
160/160 [=====] - 0s 973us/step - loss: 0.6941
Epoch 334/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 335/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 336/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 337/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 338/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 339/400
160/160 [=====] - 0s 893us/step - loss: 0.6941
Epoch 340/400
160/160 [=====] - 0s 873us/step - loss: 0.6943
Epoch 341/400
160/160 [=====] - 0s 817us/step - loss: 0.6942
Epoch 342/400
160/160 [=====] - 0s 826us/step - loss: 0.6946
Epoch 343/400
160/160 [=====] - 0s 817us/step - loss: 0.6946
Epoch 344/400
160/160 [=====] - 0s 802us/step - loss: 0.6945
Epoch 345/400
160/160 [=====] - 0s 829us/step - loss: 0.6944
Epoch 346/400
160/160 [=====] - 0s 832us/step - loss: 0.6947
Epoch 347/400
160/160 [=====] - 0s 956us/step - loss: 0.6945
Epoch 348/400
160/160 [=====] - 0s 809us/step - loss: 0.6944
Epoch 349/400
160/160 [=====] - 0s 951us/step - loss: 0.6945
Epoch 350/400
160/160 [=====] - 0s 965us/step - loss: 0.6944

Epoch 351/400
160/160 [=====] - 0s 821us/step - loss: 0.6943
Epoch 352/400
160/160 [=====] - 0s 889us/step - loss: 0.6945
Epoch 353/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 354/400
160/160 [=====] - 0s 1ms/step - loss: 0.6948
Epoch 355/400
160/160 [=====] - 0s 1ms/step - loss: 0.6948
Epoch 356/400
160/160 [=====] - 0s 965us/step - loss: 0.6944
Epoch 357/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 358/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
Epoch 359/400
160/160 [=====] - 0s 844us/step - loss: 0.6946
Epoch 360/400
160/160 [=====] - 0s 891us/step - loss: 0.6945
Epoch 361/400
160/160 [=====] - 0s 872us/step - loss: 0.6943
Epoch 362/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 363/400
160/160 [=====] - 0s 943us/step - loss: 0.6945
Epoch 364/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 365/400
160/160 [=====] - 0s 873us/step - loss: 0.6942
Epoch 366/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 367/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 368/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945
Epoch 369/400
160/160 [=====] - 0s 906us/step - loss: 0.6944
Epoch 370/400
160/160 [=====] - 0s 877us/step - loss: 0.6943
Epoch 371/400
160/160 [=====] - 0s 1ms/step - loss: 0.6947
Epoch 372/400
160/160 [=====] - 0s 991us/step - loss: 0.6945
Epoch 373/400
160/160 [=====] - 0s 922us/step - loss: 0.6945
Epoch 374/400
160/160 [=====] - 0s 924us/step - loss: 0.6946

Epoch 375/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 376/400
160/160 [=====] - 0s 1ms/step - loss: 0.6947
Epoch 377/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 378/400
160/160 [=====] - 0s 974us/step - loss: 0.6945
Epoch 379/400
160/160 [=====] - 0s 879us/step - loss: 0.6945
Epoch 380/400
160/160 [=====] - 0s 876us/step - loss: 0.6944
Epoch 381/400
160/160 [=====] - 0s 895us/step - loss: 0.6944
Epoch 382/400
160/160 [=====] - 0s 906us/step - loss: 0.6947
Epoch 383/400
160/160 [=====] - 0s 805us/step - loss: 0.6945
Epoch 384/400
160/160 [=====] - 0s 814us/step - loss: 0.6946
Epoch 385/400
160/160 [=====] - 0s 851us/step - loss: 0.6941
Epoch 386/400
160/160 [=====] - 0s 750us/step - loss: 0.6944
Epoch 387/400
160/160 [=====] - 0s 887us/step - loss: 0.6942
Epoch 388/400
160/160 [=====] - 0s 835us/step - loss: 0.6944
Epoch 389/400
160/160 [=====] - 0s 790us/step - loss: 0.6944
Epoch 390/400
160/160 [=====] - 0s 858us/step - loss: 0.6943
Epoch 391/400
160/160 [=====] - 0s 898us/step - loss: 0.6946
Epoch 392/400
160/160 [=====] - 0s 834us/step - loss: 0.6947
Epoch 393/400
160/160 [=====] - 0s 766us/step - loss: 0.6945
Epoch 394/400
160/160 [=====] - 0s 751us/step - loss: 0.6942
Epoch 395/400
160/160 [=====] - 0s 1ms/step - loss: 0.6942
Epoch 396/400
160/160 [=====] - 0s 1ms/step - loss: 0.6943
Epoch 397/400
160/160 [=====] - 0s 1ms/step - loss: 0.6944
Epoch 398/400
160/160 [=====] - 0s 1ms/step - loss: 0.6945

```

Epoch 399/400
160/160 [=====] - 0s 841us/step - loss: 0.6947
Epoch 400/400
160/160 [=====] - 0s 1ms/step - loss: 0.6946
[0.5006556 0.50074065 0.5007277 0.50073504 0.50077796 0.5007478
 0.50070983 0.50070286 0.5006519 0.5007448 0.50073487 0.5007518
 0.5007174 0.50066185 0.50068086 0.50071883 0.50063425 0.50073504
 0.5007789 0.50067466 0.50078 0.50079805 0.50063217 0.50070477
 0.5007834 0.50063926 0.50077057 0.50079876 0.50077844 0.5007118
 0.5007147 0.500677 0.5006807 0.5007121 0.5007267 0.5007627
 0.5007152 0.5006765 0.5007098 0.50066644 0.5005321 0.5004457
 0.50045925 0.50045145 0.5004076 0.50043887 0.50047725 0.5004846
 0.5005358 0.50044197 0.50045174 0.5004344 0.5004697 0.5005259
 0.50050664 0.5004675 0.5005535 0.50045186 0.5004067 0.50051296
 0.50040627 0.50038725 0.5005555 0.5004823 0.5004023 0.50054854
 0.50041586 0.50038695 0.5004077 0.5004753 0.50047255 0.50051033
 0.50050676 0.500475 0.5004604 0.5004233 0.50047135 0.500511
 0.50047725 0.5005211 0.5006342 0.50052476 0.5006054 0.5005345
 0.50050914 0.50059783 0.5005702 0.50068265 0.50057673 0.5006056
 0.50054634 0.50052947 0.50061107 0.5006434 0.5006003 0.5004678
 0.50057447 0.500609 0.50052255 0.5006677 0.5006131 0.50053674
 0.5005677 0.500552 0.5005329 0.50060195 0.50062484 0.500591
 0.5005928 0.5005813 0.50065744 0.5005401 0.5005766 0.500579
 0.5006245 0.50053126 0.50050217 0.5005887 0.5005503 0.5005892
 0.50055355 0.50066227 0.5005822 0.5006527 0.5006774 0.5005897
 0.50061744 0.5005049 0.500611 0.50058204 0.5006409 0.50065744
 0.5005767 0.5005444 0.5005875 0.5007185 0.50061333 0.50057864
 0.5006642 0.50052 0.5005744 0.50065005 0.5006201 0.5006355
 0.5006539 0.500586 0.5005627 0.5005963 0.5005946 0.50060624
 0.50053024 0.5006474 0.5006111 0.5006086 0.5005632 0.50065565
 0.5006847 0.5005991 0.5006371 0.5005986 ]
160/160 [=====] - 1s 3ms/step

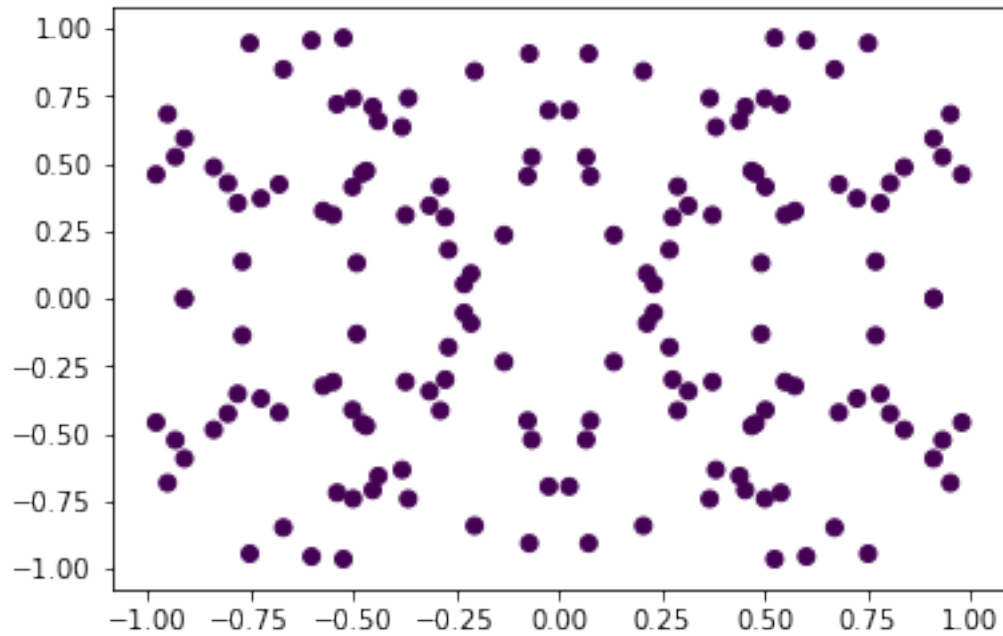
```

```
In [126]: scores, model.metrics_names
```

```
Out[126]: (0.6931481838226319, ['loss'])
```

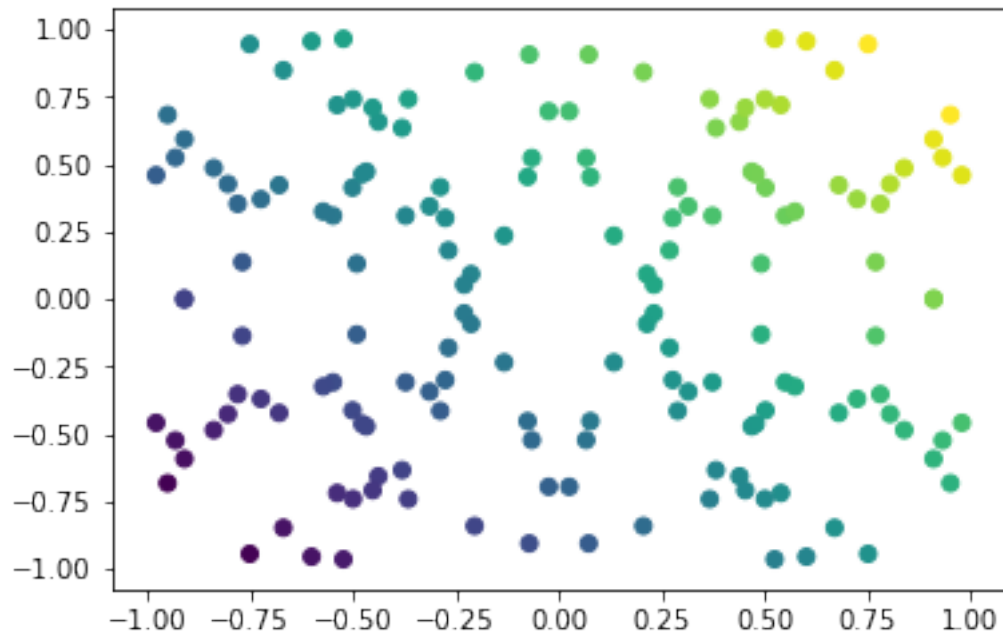
```
In [127]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[127]: <matplotlib.collections.PathCollection at 0xb2fc17080>
```



```
In [128]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[128]: <matplotlib.collections.PathCollection at 0xb2fbe5438>
```



```

In [129]: model = Sequential()

model.add(Dense(4, input_dim=2, activation='softplus'))
model.add(Dense(4, activation='softplus'))
model.add(Dense(4, activation='softplus'))
model.add(Dense(4, activation='softplus'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='softplus'))

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))

scores = model.evaluate(X, y)

```

```

Epoch 1/400
160/160 [=====] - 2s 11ms/step - loss: 7.9712
Epoch 2/400
160/160 [=====] - 0s 954us/step - loss: 7.9712
Epoch 3/400
160/160 [=====] - 0s 867us/step - loss: 7.9712
Epoch 4/400
160/160 [=====] - 0s 820us/step - loss: 7.9712
Epoch 5/400
160/160 [=====] - 0s 776us/step - loss: 7.9712
Epoch 6/400
160/160 [=====] - 0s 778us/step - loss: 7.9712
Epoch 7/400
160/160 [=====] - 0s 789us/step - loss: 7.9712
Epoch 8/400
160/160 [=====] - 0s 743us/step - loss: 7.9712
Epoch 9/400
160/160 [=====] - 0s 795us/step - loss: 7.9712
Epoch 10/400
160/160 [=====] - 0s 739us/step - loss: 7.9712
Epoch 11/400
160/160 [=====] - 0s 817us/step - loss: 7.9712
Epoch 12/400
160/160 [=====] - 0s 828us/step - loss: 7.9712
Epoch 13/400
160/160 [=====] - 0s 815us/step - loss: 7.9712
Epoch 14/400
160/160 [=====] - 0s 796us/step - loss: 7.9712
Epoch 15/400
160/160 [=====] - 0s 921us/step - loss: 7.9712

```

Epoch 16/400
160/160 [=====] - 0s 893us/step - loss: 7.9712
Epoch 17/400
160/160 [=====] - 0s 803us/step - loss: 7.9712
Epoch 18/400
160/160 [=====] - 0s 937us/step - loss: 7.9712
Epoch 19/400
160/160 [=====] - 0s 907us/step - loss: 7.9712
Epoch 20/400
160/160 [=====] - 0s 937us/step - loss: 7.9712
Epoch 21/400
160/160 [=====] - 0s 828us/step - loss: 7.9712
Epoch 22/400
160/160 [=====] - 0s 876us/step - loss: 7.9712
Epoch 23/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 24/400
160/160 [=====] - 0s 785us/step - loss: 7.9712
Epoch 25/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 26/400
160/160 [=====] - 0s 748us/step - loss: 7.9712
Epoch 27/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 28/400
160/160 [=====] - 0s 736us/step - loss: 7.9712
Epoch 29/400
160/160 [=====] - 0s 725us/step - loss: 7.9712
Epoch 30/400
160/160 [=====] - 0s 756us/step - loss: 7.9712
Epoch 31/400
160/160 [=====] - 0s 809us/step - loss: 7.9712
Epoch 32/400
160/160 [=====] - 0s 773us/step - loss: 7.9712
Epoch 33/400
160/160 [=====] - 0s 743us/step - loss: 7.9712
Epoch 34/400
160/160 [=====] - 0s 739us/step - loss: 7.9712
Epoch 35/400
160/160 [=====] - 0s 739us/step - loss: 7.9712
Epoch 36/400
160/160 [=====] - 0s 736us/step - loss: 7.9712
Epoch 37/400
160/160 [=====] - 0s 735us/step - loss: 7.9712
Epoch 38/400
160/160 [=====] - 0s 764us/step - loss: 7.9712
Epoch 39/400
160/160 [=====] - 0s 878us/step - loss: 7.9712

Epoch 40/400
160/160 [=====] - 0s 727us/step - loss: 7.9712
Epoch 41/400
160/160 [=====] - 0s 813us/step - loss: 7.9712
Epoch 42/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 43/400
160/160 [=====] - 0s 748us/step - loss: 7.9712
Epoch 44/400
160/160 [=====] - 0s 803us/step - loss: 7.9712
Epoch 45/400
160/160 [=====] - 0s 739us/step - loss: 7.9712
Epoch 46/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 47/400
160/160 [=====] - 0s 771us/step - loss: 7.9712
Epoch 48/400
160/160 [=====] - 0s 861us/step - loss: 7.9712
Epoch 49/400
160/160 [=====] - 0s 858us/step - loss: 7.9712
Epoch 50/400
160/160 [=====] - 0s 844us/step - loss: 7.9712
Epoch 51/400
160/160 [=====] - 0s 903us/step - loss: 7.9712
Epoch 52/400
160/160 [=====] - 0s 819us/step - loss: 7.9712
Epoch 53/400
160/160 [=====] - 0s 801us/step - loss: 7.9712
Epoch 54/400
160/160 [=====] - 0s 810us/step - loss: 7.9712
Epoch 55/400
160/160 [=====] - 0s 855us/step - loss: 7.9712
Epoch 56/400
160/160 [=====] - 0s 851us/step - loss: 7.9712
Epoch 57/400
160/160 [=====] - 0s 840us/step - loss: 7.9712
Epoch 58/400
160/160 [=====] - 0s 854us/step - loss: 7.9712
Epoch 59/400
160/160 [=====] - 0s 797us/step - loss: 7.9712
Epoch 60/400
160/160 [=====] - 0s 850us/step - loss: 7.9712
Epoch 61/400
160/160 [=====] - 0s 775us/step - loss: 7.9712
Epoch 62/400
160/160 [=====] - 0s 763us/step - loss: 7.9712
Epoch 63/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 64/400
160/160 [=====] - 0s 959us/step - loss: 7.9712
Epoch 65/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 66/400
160/160 [=====] - 0s 894us/step - loss: 7.9712
Epoch 67/400
160/160 [=====] - 0s 800us/step - loss: 7.9712
Epoch 68/400
160/160 [=====] - 0s 824us/step - loss: 7.9712
Epoch 69/400
160/160 [=====] - 0s 760us/step - loss: 7.9712
Epoch 70/400
160/160 [=====] - 0s 763us/step - loss: 7.9712
Epoch 71/400
160/160 [=====] - 0s 758us/step - loss: 7.9712
Epoch 72/400
160/160 [=====] - 0s 920us/step - loss: 7.9712
Epoch 73/400
160/160 [=====] - 0s 771us/step - loss: 7.9712
Epoch 74/400
160/160 [=====] - 0s 948us/step - loss: 7.9712
Epoch 75/400
160/160 [=====] - 0s 938us/step - loss: 7.9712
Epoch 76/400
160/160 [=====] - 0s 774us/step - loss: 7.9712
Epoch 77/400
160/160 [=====] - 0s 830us/step - loss: 7.9712
Epoch 78/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 79/400
160/160 [=====] - 0s 949us/step - loss: 7.9712
Epoch 80/400
160/160 [=====] - 0s 837us/step - loss: 7.9712
Epoch 81/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 82/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 83/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 84/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 85/400
160/160 [=====] - 0s 980us/step - loss: 7.9712
Epoch 86/400
160/160 [=====] - 0s 964us/step - loss: 7.9712
Epoch 87/400
160/160 [=====] - 0s 793us/step - loss: 7.9712

Epoch 88/400
160/160 [=====] - 0s 801us/step - loss: 7.9712
Epoch 89/400
160/160 [=====] - 0s 788us/step - loss: 7.9712
Epoch 90/400
160/160 [=====] - 0s 776us/step - loss: 7.9712
Epoch 91/400
160/160 [=====] - 0s 729us/step - loss: 7.9712
Epoch 92/400
160/160 [=====] - 0s 735us/step - loss: 7.9712
Epoch 93/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 94/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 95/400
160/160 [=====] - 0s 742us/step - loss: 7.9712
Epoch 96/400
160/160 [=====] - 0s 756us/step - loss: 7.9712
Epoch 97/400
160/160 [=====] - 0s 755us/step - loss: 7.9712
Epoch 98/400
160/160 [=====] - 0s 753us/step - loss: 7.9712
Epoch 99/400
160/160 [=====] - 0s 733us/step - loss: 7.9712
Epoch 100/400
160/160 [=====] - 0s 730us/step - loss: 7.9712
Epoch 101/400
160/160 [=====] - 0s 775us/step - loss: 7.9712
Epoch 102/400
160/160 [=====] - 0s 739us/step - loss: 7.9712
Epoch 103/400
160/160 [=====] - 0s 755us/step - loss: 7.9712
Epoch 104/400
160/160 [=====] - 0s 744us/step - loss: 7.9712
Epoch 105/400
160/160 [=====] - 0s 780us/step - loss: 7.9712
Epoch 106/400
160/160 [=====] - 0s 940us/step - loss: 7.9712
Epoch 107/400
160/160 [=====] - 0s 885us/step - loss: 7.9712
Epoch 108/400
160/160 [=====] - 0s 824us/step - loss: 7.9712
Epoch 109/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 110/400
160/160 [=====] - 0s 744us/step - loss: 7.9712
Epoch 111/400
160/160 [=====] - 0s 732us/step - loss: 7.9712

Epoch 112/400
160/160 [=====] - 0s 788us/step - loss: 7.9712
Epoch 113/400
160/160 [=====] - 0s 874us/step - loss: 7.9712
Epoch 114/400
160/160 [=====] - 0s 847us/step - loss: 7.9712
Epoch 115/400
160/160 [=====] - 0s 786us/step - loss: 7.9712
Epoch 116/400
160/160 [=====] - 0s 972us/step - loss: 7.9712
Epoch 117/400
160/160 [=====] - 0s 993us/step - loss: 7.9712
Epoch 118/400
160/160 [=====] - 0s 924us/step - loss: 7.9712
Epoch 119/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 120/400
160/160 [=====] - 0s 927us/step - loss: 7.9712
Epoch 121/400
160/160 [=====] - 0s 865us/step - loss: 7.9712
Epoch 122/400
160/160 [=====] - 0s 962us/step - loss: 7.9712
Epoch 123/400
160/160 [=====] - 0s 844us/step - loss: 7.9712
Epoch 124/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 125/400
160/160 [=====] - 0s 853us/step - loss: 7.9712
Epoch 126/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 127/400
160/160 [=====] - 0s 928us/step - loss: 7.9712
Epoch 128/400
160/160 [=====] - 0s 982us/step - loss: 7.9712
Epoch 129/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 130/400
160/160 [=====] - 0s 859us/step - loss: 7.9712
Epoch 131/400
160/160 [=====] - 0s 845us/step - loss: 7.9712
Epoch 132/400
160/160 [=====] - 0s 916us/step - loss: 7.9712
Epoch 133/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 134/400
160/160 [=====] - 0s 910us/step - loss: 7.9712
Epoch 135/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 136/400
160/160 [=====] - 0s 861us/step - loss: 7.9712
Epoch 137/400
160/160 [=====] - 0s 922us/step - loss: 7.9712
Epoch 138/400
160/160 [=====] - 0s 985us/step - loss: 7.9712
Epoch 139/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 140/400
160/160 [=====] - 0s 815us/step - loss: 7.9712
Epoch 141/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 142/400
160/160 [=====] - 0s 878us/step - loss: 7.9712
Epoch 143/400
160/160 [=====] - 0s 788us/step - loss: 7.9712
Epoch 144/400
160/160 [=====] - 0s 759us/step - loss: 7.9712
Epoch 145/400
160/160 [=====] - 0s 811us/step - loss: 7.9712
Epoch 146/400
160/160 [=====] - 0s 822us/step - loss: 7.9712
Epoch 147/400
160/160 [=====] - 0s 782us/step - loss: 7.9712
Epoch 148/400
160/160 [=====] - 0s 749us/step - loss: 7.9712
Epoch 149/400
160/160 [=====] - 0s 831us/step - loss: 7.9712
Epoch 150/400
160/160 [=====] - 0s 831us/step - loss: 7.9712
Epoch 151/400
160/160 [=====] - 0s 834us/step - loss: 7.9712
Epoch 152/400
160/160 [=====] - 0s 951us/step - loss: 7.9712
Epoch 153/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 154/400
160/160 [=====] - 0s 3ms/step - loss: 7.9712
Epoch 155/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 156/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 157/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 158/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 159/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712

Epoch 160/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 161/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 162/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 163/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712
 Epoch 164/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 165/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712
 Epoch 166/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 167/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 168/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 169/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 170/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 171/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712
 Epoch 172/400
 160/160 [=====] - 0s 912us/step - loss: 7.9712
 Epoch 173/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712A: 0s - loss: 7.81
 Epoch 174/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712
 Epoch 175/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712
 Epoch 176/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712
 Epoch 177/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712
 Epoch 178/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 179/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 180/400
 160/160 [=====] - 0s 2ms/step - loss: 7.9712
 Epoch 181/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712
 Epoch 182/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712
 Epoch 183/400
 160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 184/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 185/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 186/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 187/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 188/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 189/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 190/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 191/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 192/400
160/160 [=====] - 0s 917us/step - loss: 7.9712
Epoch 193/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 194/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 195/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 196/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 197/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 198/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 199/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 200/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 201/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 202/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 203/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 204/400
160/160 [=====] - 0s 889us/step - loss: 7.9712
Epoch 205/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 206/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 207/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 208/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 209/400
160/160 [=====] - 0s 904us/step - loss: 7.9712
Epoch 210/400
160/160 [=====] - 0s 904us/step - loss: 7.9712
Epoch 211/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 212/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 213/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 214/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 215/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 216/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 217/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 218/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 219/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 220/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 221/400
160/160 [=====] - 0s 965us/step - loss: 7.9712
Epoch 222/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 223/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 224/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 225/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 226/400
160/160 [=====] - 0s 853us/step - loss: 7.9712
Epoch 227/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 228/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 229/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 230/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 231/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 232/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 233/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 234/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 235/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 236/400
160/160 [=====] - 0s 967us/step - loss: 7.9712
Epoch 237/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 238/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 239/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 240/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 241/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 242/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 243/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 244/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 245/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 246/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 247/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 248/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 249/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 250/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 251/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 252/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 253/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 254/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 255/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 256/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 257/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 258/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 259/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 260/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 261/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 262/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 263/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 264/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 265/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 266/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 267/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 268/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 269/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 270/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 271/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 272/400
160/160 [=====] - 0s 887us/step - loss: 7.9712
Epoch 273/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 274/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 275/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 276/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 277/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 278/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 279/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 280/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 281/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 282/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 283/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 284/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 285/400
160/160 [=====] - 0s 781us/step - loss: 7.9712
Epoch 286/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 287/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 288/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 289/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 290/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 291/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 292/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 293/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 294/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 295/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 296/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 297/400
160/160 [=====] - 0s 872us/step - loss: 7.9712
Epoch 298/400
160/160 [=====] - 0s 938us/step - loss: 7.9712
Epoch 299/400
160/160 [=====] - 0s 819us/step - loss: 7.9712
Epoch 300/400
160/160 [=====] - 0s 944us/step - loss: 7.9712
Epoch 301/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 302/400
160/160 [=====] - 0s 958us/step - loss: 7.9712
Epoch 303/400
160/160 [=====] - 0s 792us/step - loss: 7.9712

Epoch 304/400
160/160 [=====] - 0s 894us/step - loss: 7.9712
Epoch 305/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 306/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 307/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 308/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 309/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 310/400
160/160 [=====] - 0s 933us/step - loss: 7.9712
Epoch 311/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 312/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 313/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 314/400
160/160 [=====] - 0s 866us/step - loss: 7.9712
Epoch 315/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 316/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 317/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 318/400
160/160 [=====] - 0s 910us/step - loss: 7.9712
Epoch 319/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 320/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 321/400
160/160 [=====] - 0s 864us/step - loss: 7.9712
Epoch 322/400
160/160 [=====] - 0s 976us/step - loss: 7.9712
Epoch 323/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 324/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 325/400
160/160 [=====] - 0s 908us/step - loss: 7.9712
Epoch 326/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 327/400
160/160 [=====] - 0s 888us/step - loss: 7.9712

Epoch 328/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 329/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 330/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 331/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 332/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 333/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 334/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 335/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 336/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 337/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 338/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 339/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 340/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 341/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 342/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 343/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 344/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 345/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 346/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 347/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 348/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 349/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 350/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 351/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 352/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 353/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 354/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 355/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 356/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 357/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 358/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 359/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 360/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 361/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 362/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 363/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 364/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 365/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 366/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 367/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 368/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 369/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 370/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 371/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 372/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 373/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 374/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 375/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 376/400
160/160 [=====] - 0s 985us/step - loss: 7.9712
Epoch 377/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 378/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 379/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 380/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 381/400
160/160 [=====] - 0s 959us/step - loss: 7.9712
Epoch 382/400
160/160 [=====] - 0s 881us/step - loss: 7.9712
Epoch 383/400
160/160 [=====] - 0s 907us/step - loss: 7.9712
Epoch 384/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 385/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 386/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 387/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 388/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 389/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 390/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 391/400
160/160 [=====] - 0s 800us/step - loss: 7.9712
Epoch 392/400
160/160 [=====] - 0s 934us/step - loss: 7.9712
Epoch 393/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 394/400
160/160 [=====] - 0s 2ms/step - loss: 7.9712
Epoch 395/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712
Epoch 396/400
160/160 [=====] - 0s 885us/step - loss: 7.9712
Epoch 397/400
160/160 [=====] - 0s 817us/step - loss: 7.9712
Epoch 398/400
160/160 [=====] - 0s 784us/step - loss: 7.9712
Epoch 399/400
160/160 [=====] - 0s 1ms/step - loss: 7.9712

Epoch 400/400

160/160 [=====] - 0s 1ms/step - loss: 7.9712

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. ')

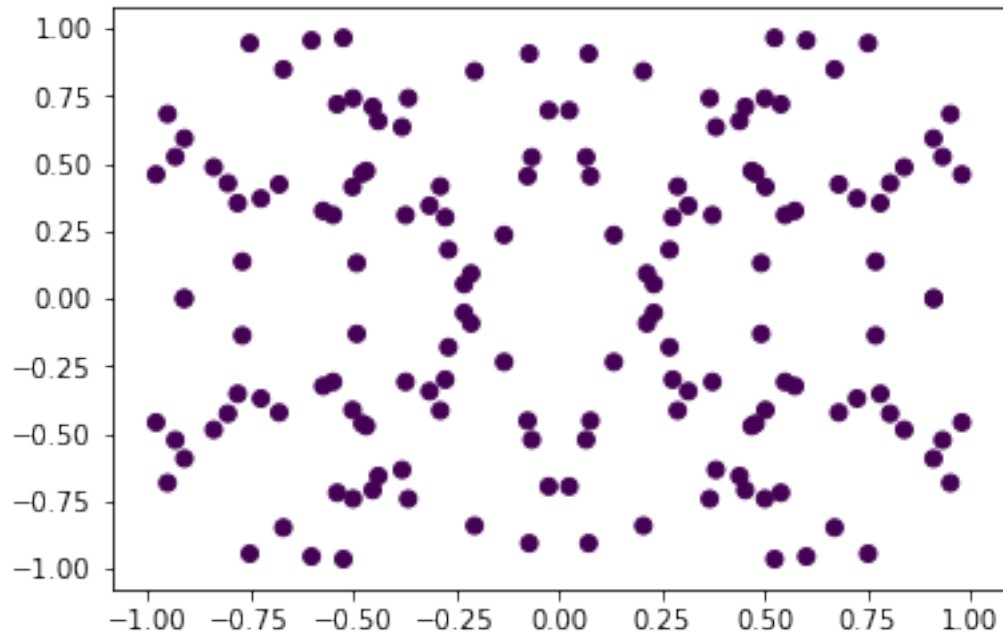
[1.1882819 1.1879174 1.1961437 1.188085 1.1931014 1.1994995 1.1881846
1.2041738 1.1826775 1.2001079 1.1894156 1.1904175 1.1948874 1.1901236
1.1875578 1.1805024 1.1816298 1.1983495 1.1951518 1.1954908 1.2118491
1.2022939 1.1811749 1.1855686 1.197734 1.1837682 1.2113954 1.2133157
1.2069925 1.189814 1.2021756 1.1818053 1.1851283 1.1895708 1.199048
1.1927872 1.182464 1.1858402 1.186052 1.1848553 1.1853341 1.1955256
1.1959932 1.1947244 1.2026291 1.2000469 1.1913109 1.1965461 1.1847247
1.1998903 1.1949409 1.1976879 1.194203 1.1863836 1.1877729 1.1929505
1.1836946 1.1978315 1.2033433 1.189522 1.2104799 1.209112 1.1837994
1.1903062 1.204905 1.1835282 1.2088687 1.2141477 1.2078708 1.1919187
1.1969562 1.1872975 1.1874505 1.1918974 1.1970259 1.1999846 1.1917925
1.1870583 1.1909845 1.1859505 1.1883745 1.1911916 1.1942071 1.1907543
1.1945026 1.1961921 1.1893934 1.2033325 1.1849879 1.1967177 1.1909382
1.1921902 1.1934456 1.1900762 1.1882179 1.1929276 1.1839614 1.1956857
1.1947676 1.1953515 1.2040497 1.197672 1.1839291 1.1884567 1.1956081
1.1847172 1.2044328 1.2038591 1.2004309 1.1901731 1.200176 1.1867077
1.1870645 1.190062 1.1965425 1.1932824 1.1901432 1.1871719 1.1888323
1.1863452 1.1834315 1.1778296 1.1827607 1.1780188 1.1776431 1.1829287
1.179263 1.1939265 1.179886 1.1837353 1.1783804 1.1779373 1.1829345
1.184623 1.180855 1.1804572 1.180336 1.183591 1.1780553 1.1887485
1.187801 1.1794968 1.1804072 1.1785579 1.1786686 1.1809446 1.1889992
1.1859338 1.1843808 1.1799778 1.1898397 1.1790355 1.1795044 1.1798205
1.1852154 1.1781118 1.1786133 1.180086 1.1784847 1.1801268]
160/160 [=====] - 0s 3ms/step

In [130]: scores, model.metrics_names

Out[130]: (7.971192407608049, ['loss'])

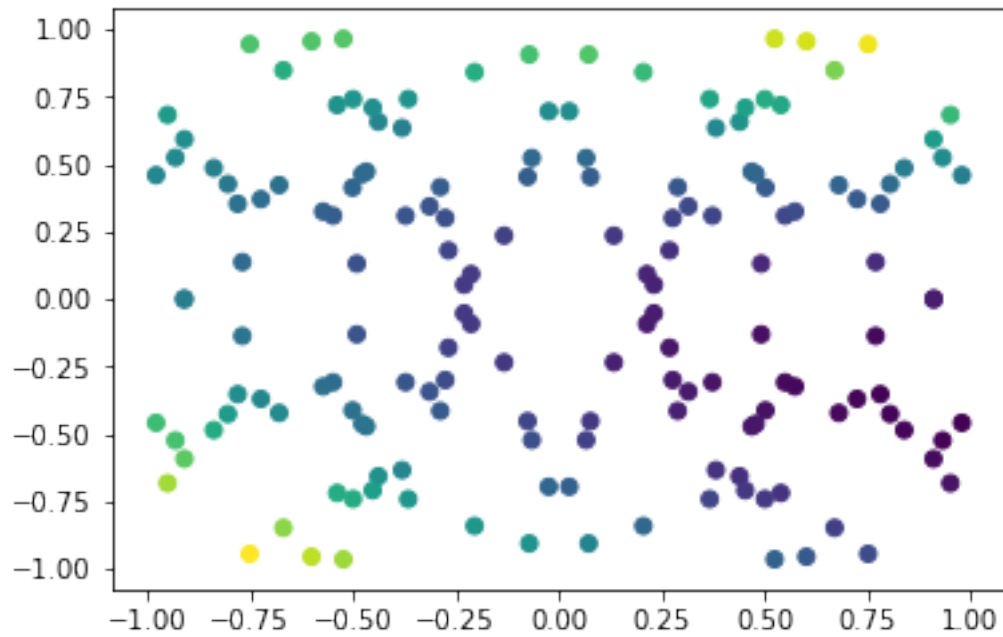
In [131]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())

Out[131]: <matplotlib.collections.PathCollection at 0xb303cabe0>



```
In [132]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[132]: <matplotlib.collections.PathCollection at 0xb3039af98>
```



```

In [133]: # Using tanh for 4 neuron
          model = Sequential()

          model.add(Dense(4, input_dim=2, activation='relu'))
          model.add(Dense(4, activation='relu'))
          model.add(Dense(4, activation='relu'))
          model.add(Dense(4, activation='relu'))

          # The output has 1 neuron for predicting whatever we are iterating
          model.add(Dense(1, activation='relu'))

          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))

          scores = model.evaluate(X, y)

```

```

Epoch 1/400
160/160 [=====] - 1s 9ms/step - loss: 0.9614
Epoch 2/400
160/160 [=====] - 0s 887us/step - loss: 0.7540
Epoch 3/400
160/160 [=====] - 0s 974us/step - loss: 0.7411
Epoch 4/400
160/160 [=====] - 0s 911us/step - loss: 0.7159
Epoch 5/400
160/160 [=====] - 0s 955us/step - loss: 0.7113
Epoch 6/400
160/160 [=====] - 0s 854us/step - loss: 0.7094
Epoch 7/400
160/160 [=====] - 0s 973us/step - loss: 0.6880
Epoch 8/400
160/160 [=====] - 0s 1ms/step - loss: 0.6895
Epoch 9/400
160/160 [=====] - 0s 1ms/step - loss: 0.6665
Epoch 10/400
160/160 [=====] - 0s 904us/step - loss: 0.6301
Epoch 11/400
160/160 [=====] - 0s 1ms/step - loss: 0.5996
Epoch 12/400
160/160 [=====] - 0s 1ms/step - loss: 0.5218
Epoch 13/400
160/160 [=====] - 0s 847us/step - loss: 0.4438
Epoch 14/400
160/160 [=====] - 0s 873us/step - loss: 0.3436
Epoch 15/400

```

160/160 [=====] - 0s 1ms/step - loss: 0.4788
Epoch 16/400
160/160 [=====] - 0s 1ms/step - loss: 0.3094
Epoch 17/400
160/160 [=====] - 0s 951us/step - loss: 0.4972
Epoch 18/400
160/160 [=====] - 0s 1ms/step - loss: 0.3805
Epoch 19/400
160/160 [=====] - 0s 1ms/step - loss: 1.7403
Epoch 20/400
160/160 [=====] - 0s 959us/step - loss: 4.1448
Epoch 21/400
160/160 [=====] - 0s 944us/step - loss: 4.1524
Epoch 22/400
160/160 [=====] - 0s 907us/step - loss: 4.1644
Epoch 23/400
160/160 [=====] - 0s 1ms/step - loss: 4.1873
Epoch 24/400
160/160 [=====] - 0s 1ms/step - loss: 1.8125
Epoch 25/400
160/160 [=====] - 0s 878us/step - loss: 2.1584
Epoch 26/400
160/160 [=====] - 0s 863us/step - loss: 0.2309
Epoch 27/400
160/160 [=====] - 0s 820us/step - loss: 0.1864
Epoch 28/400
160/160 [=====] - 0s 859us/step - loss: 0.2501
Epoch 29/400
160/160 [=====] - 0s 848us/step - loss: 0.2288
Epoch 30/400
160/160 [=====] - 0s 835us/step - loss: 0.3595
Epoch 31/400
160/160 [=====] - 0s 918us/step - loss: 4.2767
Epoch 32/400
160/160 [=====] - 0s 1ms/step - loss: 1.8486
Epoch 33/400
160/160 [=====] - 0s 892us/step - loss: 0.2181
Epoch 34/400
160/160 [=====] - 0s 892us/step - loss: 0.1687
Epoch 35/400
160/160 [=====] - 0s 964us/step - loss: 0.2378
Epoch 36/400
160/160 [=====] - 0s 959us/step - loss: 0.2338
Epoch 37/400
160/160 [=====] - 0s 851us/step - loss: 0.2426
Epoch 38/400
160/160 [=====] - 0s 899us/step - loss: 5.5125
Epoch 39/400

160/160 [=====] - 0s 920us/step - loss: 8.0590
Epoch 40/400
160/160 [=====] - 0s 985us/step - loss: 8.0590
Epoch 41/400
160/160 [=====] - 0s 865us/step - loss: 8.0590
Epoch 42/400
160/160 [=====] - 0s 946us/step - loss: 8.0590
Epoch 43/400
160/160 [=====] - 0s 996us/step - loss: 8.0590
Epoch 44/400
160/160 [=====] - 0s 916us/step - loss: 8.0590
Epoch 45/400
160/160 [=====] - 0s 846us/step - loss: 8.0590
Epoch 46/400
160/160 [=====] - 0s 876us/step - loss: 8.0590
Epoch 47/400
160/160 [=====] - 0s 838us/step - loss: 8.0590
Epoch 48/400
160/160 [=====] - 0s 826us/step - loss: 8.0590
Epoch 49/400
160/160 [=====] - 0s 872us/step - loss: 8.0590
Epoch 50/400
160/160 [=====] - 0s 881us/step - loss: 8.0590
Epoch 51/400
160/160 [=====] - 0s 820us/step - loss: 8.0590
Epoch 52/400
160/160 [=====] - 0s 838us/step - loss: 8.0590
Epoch 53/400
160/160 [=====] - 0s 809us/step - loss: 8.0590
Epoch 54/400
160/160 [=====] - 0s 826us/step - loss: 8.0590
Epoch 55/400
160/160 [=====] - 0s 789us/step - loss: 8.0590
Epoch 56/400
160/160 [=====] - 0s 878us/step - loss: 8.0590
Epoch 57/400
160/160 [=====] - 0s 918us/step - loss: 8.0590
Epoch 58/400
160/160 [=====] - 0s 820us/step - loss: 8.0590
Epoch 59/400
160/160 [=====] - 0s 871us/step - loss: 8.0590
Epoch 60/400
160/160 [=====] - 0s 840us/step - loss: 8.0590
Epoch 61/400
160/160 [=====] - 0s 822us/step - loss: 8.0590
Epoch 62/400
160/160 [=====] - 0s 878us/step - loss: 8.0590
Epoch 63/400

160/160 [=====] - 0s 841us/step - loss: 8.0590
Epoch 64/400
160/160 [=====] - 0s 852us/step - loss: 8.0590
Epoch 65/400
160/160 [=====] - 0s 848us/step - loss: 8.0590
Epoch 66/400
160/160 [=====] - 0s 812us/step - loss: 8.0590
Epoch 67/400
160/160 [=====] - 0s 897us/step - loss: 8.0590
Epoch 68/400
160/160 [=====] - 0s 813us/step - loss: 8.0590
Epoch 69/400
160/160 [=====] - 0s 791us/step - loss: 8.0590
Epoch 70/400
160/160 [=====] - 0s 758us/step - loss: 8.0590
Epoch 71/400
160/160 [=====] - 0s 851us/step - loss: 8.0590
Epoch 72/400
160/160 [=====] - 0s 822us/step - loss: 8.0590
Epoch 73/400
160/160 [=====] - 0s 945us/step - loss: 8.0590
Epoch 74/400
160/160 [=====] - 0s 975us/step - loss: 8.0590
Epoch 75/400
160/160 [=====] - 0s 969us/step - loss: 8.0590
Epoch 76/400
160/160 [=====] - 0s 926us/step - loss: 8.0590
Epoch 77/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 78/400
160/160 [=====] - 0s 898us/step - loss: 8.0590
Epoch 79/400
160/160 [=====] - 0s 951us/step - loss: 8.0590
Epoch 80/400
160/160 [=====] - 0s 998us/step - loss: 8.0590
Epoch 81/400
160/160 [=====] - 0s 964us/step - loss: 8.0590
Epoch 82/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 83/400
160/160 [=====] - 0s 848us/step - loss: 8.0590
Epoch 84/400
160/160 [=====] - 0s 774us/step - loss: 8.0590
Epoch 85/400
160/160 [=====] - 0s 820us/step - loss: 8.0590
Epoch 86/400
160/160 [=====] - 0s 879us/step - loss: 8.0590
Epoch 87/400

160/160 [=====] - 0s 831us/step - loss: 8.0590
Epoch 88/400
160/160 [=====] - 0s 879us/step - loss: 8.0590
Epoch 89/400
160/160 [=====] - 0s 861us/step - loss: 8.0590
Epoch 90/400
160/160 [=====] - 0s 829us/step - loss: 8.0590
Epoch 91/400
160/160 [=====] - 0s 826us/step - loss: 8.0590
Epoch 92/400
160/160 [=====] - 0s 817us/step - loss: 8.0590
Epoch 93/400
160/160 [=====] - 0s 843us/step - loss: 8.0590
Epoch 94/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 95/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 96/400
160/160 [=====] - 0s 884us/step - loss: 8.0590
Epoch 97/400
160/160 [=====] - 0s 847us/step - loss: 8.0590
Epoch 98/400
160/160 [=====] - 0s 767us/step - loss: 8.0590
Epoch 99/400
160/160 [=====] - 0s 794us/step - loss: 8.0590
Epoch 100/400
160/160 [=====] - 0s 863us/step - loss: 8.0590
Epoch 101/400
160/160 [=====] - 0s 883us/step - loss: 8.0590
Epoch 102/400
160/160 [=====] - 0s 832us/step - loss: 8.0590
Epoch 103/400
160/160 [=====] - 0s 841us/step - loss: 8.0590
Epoch 104/400
160/160 [=====] - 0s 815us/step - loss: 8.0590
Epoch 105/400
160/160 [=====] - 0s 843us/step - loss: 8.0590
Epoch 106/400
160/160 [=====] - 0s 827us/step - loss: 8.0590
Epoch 107/400
160/160 [=====] - 0s 937us/step - loss: 8.0590
Epoch 108/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 109/400
160/160 [=====] - 0s 961us/step - loss: 8.0590
Epoch 110/400
160/160 [=====] - 0s 818us/step - loss: 8.0590
Epoch 111/400

160/160 [=====] - 0s 823us/step - loss: 8.0590
Epoch 112/400
160/160 [=====] - 0s 787us/step - loss: 8.0590
Epoch 113/400
160/160 [=====] - 0s 752us/step - loss: 8.0590
Epoch 114/400
160/160 [=====] - 0s 779us/step - loss: 8.0590
Epoch 115/400
160/160 [=====] - 0s 813us/step - loss: 8.0590
Epoch 116/400
160/160 [=====] - 0s 892us/step - loss: 8.0590
Epoch 117/400
160/160 [=====] - 0s 884us/step - loss: 8.0590
Epoch 118/400
160/160 [=====] - 0s 804us/step - loss: 8.0590
Epoch 119/400
160/160 [=====] - 0s 928us/step - loss: 8.0590
Epoch 120/400
160/160 [=====] - 0s 947us/step - loss: 8.0590
Epoch 121/400
160/160 [=====] - 0s 807us/step - loss: 8.0590
Epoch 122/400
160/160 [=====] - 0s 820us/step - loss: 8.0590
Epoch 123/400
160/160 [=====] - 0s 811us/step - loss: 8.0590
Epoch 124/400
160/160 [=====] - 0s 903us/step - loss: 8.0590
Epoch 125/400
160/160 [=====] - 0s 813us/step - loss: 8.0590
Epoch 126/400
160/160 [=====] - 0s 825us/step - loss: 8.0590
Epoch 127/400
160/160 [=====] - 0s 907us/step - loss: 8.0590
Epoch 128/400
160/160 [=====] - 0s 840us/step - loss: 8.0590
Epoch 129/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 130/400
160/160 [=====] - 0s 786us/step - loss: 8.0590
Epoch 131/400
160/160 [=====] - 0s 813us/step - loss: 8.0590
Epoch 132/400
160/160 [=====] - 0s 907us/step - loss: 8.0590
Epoch 133/400
160/160 [=====] - 0s 824us/step - loss: 8.0590
Epoch 134/400
160/160 [=====] - 0s 950us/step - loss: 8.0590
Epoch 135/400

160/160 [=====] - 0s 916us/step - loss: 8.0590
Epoch 136/400
160/160 [=====] - 0s 822us/step - loss: 8.0590
Epoch 137/400
160/160 [=====] - 0s 816us/step - loss: 8.0590
Epoch 138/400
160/160 [=====] - 0s 822us/step - loss: 8.0590
Epoch 139/400
160/160 [=====] - 0s 866us/step - loss: 8.0590
Epoch 140/400
160/160 [=====] - 0s 808us/step - loss: 8.0590
Epoch 141/400
160/160 [=====] - 0s 802us/step - loss: 8.0590
Epoch 142/400
160/160 [=====] - 0s 815us/step - loss: 8.0590
Epoch 143/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 144/400
160/160 [=====] - 0s 863us/step - loss: 8.0590
Epoch 145/400
160/160 [=====] - 0s 884us/step - loss: 8.0590
Epoch 146/400
160/160 [=====] - 0s 877us/step - loss: 8.0590
Epoch 147/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 148/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 149/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 150/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 151/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 152/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 153/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 154/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 155/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 156/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 157/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 158/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 159/400

160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 160/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 161/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 162/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 163/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 164/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 165/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 166/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 167/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 168/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 169/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 170/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 171/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 172/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 173/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 174/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 175/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 176/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 177/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 178/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 179/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 180/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 181/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 182/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 183/400

160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 184/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 185/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 186/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 187/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 188/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 189/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 190/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 191/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 192/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 193/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 194/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 195/400
160/160 [=====] - 0s 822us/step - loss: 8.0590
Epoch 196/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 197/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 198/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 199/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 200/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 201/400
160/160 [=====] - 0s 892us/step - loss: 8.0590
Epoch 202/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 203/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 204/400
160/160 [=====] - 0s 902us/step - loss: 8.0590
Epoch 205/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 206/400
160/160 [=====] - 0s 867us/step - loss: 8.0590
Epoch 207/400

160/160 [=====] - 0s 788us/step - loss: 8.0590
Epoch 208/400
160/160 [=====] - 0s 797us/step - loss: 8.0590
Epoch 209/400
160/160 [=====] - 0s 855us/step - loss: 8.0590
Epoch 210/400
160/160 [=====] - 0s 936us/step - loss: 8.0590
Epoch 211/400
160/160 [=====] - 0s 922us/step - loss: 8.0590
Epoch 212/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 213/400
160/160 [=====] - 0s 892us/step - loss: 8.0590
Epoch 214/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 215/400
160/160 [=====] - 0s 829us/step - loss: 8.0590
Epoch 216/400
160/160 [=====] - 0s 913us/step - loss: 8.0590
Epoch 217/400
160/160 [=====] - 0s 945us/step - loss: 8.0590
Epoch 218/400
160/160 [=====] - 0s 874us/step - loss: 8.0590
Epoch 219/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 220/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 221/400
160/160 [=====] - 0s 867us/step - loss: 8.0590
Epoch 222/400
160/160 [=====] - 0s 951us/step - loss: 8.0590
Epoch 223/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 224/400
160/160 [=====] - 0s 875us/step - loss: 8.0590
Epoch 225/400
160/160 [=====] - 0s 893us/step - loss: 8.0590
Epoch 226/400
160/160 [=====] - 0s 962us/step - loss: 8.0590
Epoch 227/400
160/160 [=====] - 0s 953us/step - loss: 8.0590
Epoch 228/400
160/160 [=====] - 0s 875us/step - loss: 8.0590
Epoch 229/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 230/400
160/160 [=====] - 0s 875us/step - loss: 8.0590
Epoch 231/400

160/160 [=====] - 0s 947us/step - loss: 8.0590
Epoch 232/400
160/160 [=====] - 0s 846us/step - loss: 8.0590
Epoch 233/400
160/160 [=====] - 0s 784us/step - loss: 8.0590
Epoch 234/400
160/160 [=====] - 0s 847us/step - loss: 8.0590
Epoch 235/400
160/160 [=====] - 0s 916us/step - loss: 8.0590
Epoch 236/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 237/400
160/160 [=====] - 0s 916us/step - loss: 8.0590
Epoch 238/400
160/160 [=====] - 0s 916us/step - loss: 8.0590
Epoch 239/400
160/160 [=====] - 0s 936us/step - loss: 8.0590
Epoch 240/400
160/160 [=====] - 0s 918us/step - loss: 8.0590
Epoch 241/400
160/160 [=====] - 0s 850us/step - loss: 8.0590
Epoch 242/400
160/160 [=====] - 0s 873us/step - loss: 8.0590
Epoch 243/400
160/160 [=====] - 0s 883us/step - loss: 8.0590
Epoch 244/400
160/160 [=====] - 0s 908us/step - loss: 8.0590
Epoch 245/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 246/400
160/160 [=====] - 0s 964us/step - loss: 8.0590
Epoch 247/400
160/160 [=====] - 0s 817us/step - loss: 8.0590
Epoch 248/400
160/160 [=====] - 0s 838us/step - loss: 8.0590
Epoch 249/400
160/160 [=====] - 0s 893us/step - loss: 8.0590
Epoch 250/400
160/160 [=====] - 0s 947us/step - loss: 8.0590
Epoch 251/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 252/400
160/160 [=====] - 0s 970us/step - loss: 8.0590
Epoch 253/400
160/160 [=====] - 0s 858us/step - loss: 8.0590
Epoch 254/400
160/160 [=====] - 0s 879us/step - loss: 8.0590
Epoch 255/400

160/160 [=====] - 0s 865us/step - loss: 8.0590
Epoch 256/400
160/160 [=====] - 0s 970us/step - loss: 8.0590
Epoch 257/400
160/160 [=====] - 0s 927us/step - loss: 8.0590
Epoch 258/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 259/400
160/160 [=====] - 0s 963us/step - loss: 8.0590
Epoch 260/400
160/160 [=====] - 0s 844us/step - loss: 8.0590
Epoch 261/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 262/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 263/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 264/400
160/160 [=====] - 0s 998us/step - loss: 8.0590
Epoch 265/400
160/160 [=====] - 0s 932us/step - loss: 8.0590
Epoch 266/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 267/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 268/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 269/400
160/160 [=====] - 0s 970us/step - loss: 8.0590
Epoch 270/400
160/160 [=====] - 0s 913us/step - loss: 8.0590
Epoch 271/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 272/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 273/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 274/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 275/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 276/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 277/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 278/400
160/160 [=====] - 0s 929us/step - loss: 8.0590
Epoch 279/400

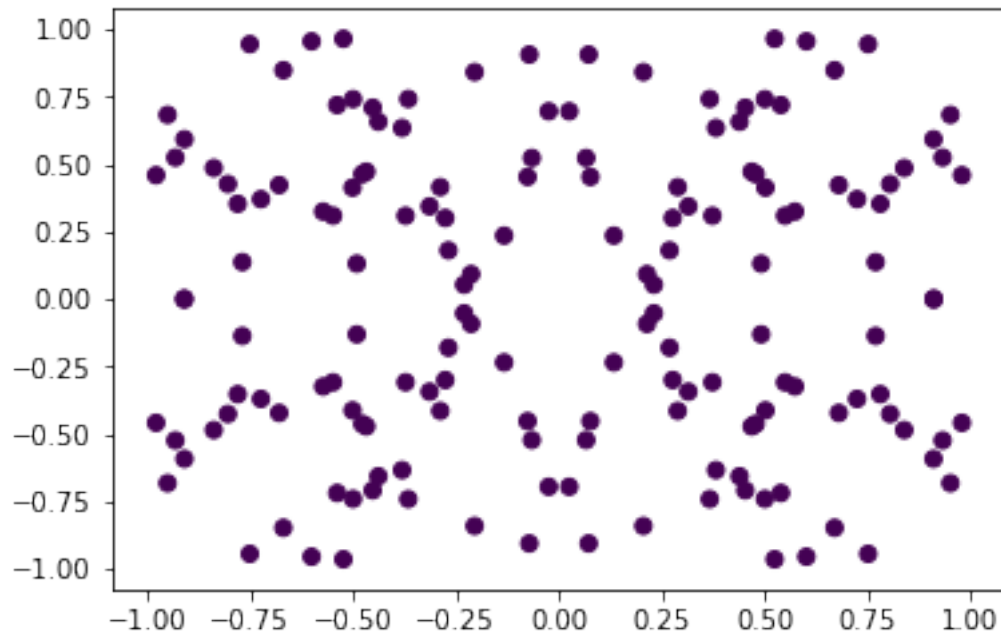
160/160 [=====] - 0s 957us/step - loss: 8.0590
Epoch 280/400
160/160 [=====] - 0s 949us/step - loss: 8.0590
Epoch 281/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 282/400
160/160 [=====] - 0s 922us/step - loss: 8.0590
Epoch 283/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 284/400
160/160 [=====] - 0s 880us/step - loss: 8.0590
Epoch 285/400
160/160 [=====] - 0s 995us/step - loss: 8.0590
Epoch 286/400
160/160 [=====] - 0s 973us/step - loss: 8.0590
Epoch 287/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 288/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 289/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 290/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 291/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 292/400
160/160 [=====] - 0s 940us/step - loss: 8.0590
Epoch 293/400
160/160 [=====] - 0s 926us/step - loss: 8.0590
Epoch 294/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 295/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 296/400
160/160 [=====] - 0s 928us/step - loss: 8.0590
Epoch 297/400
160/160 [=====] - 0s 901us/step - loss: 8.0590
Epoch 298/400
160/160 [=====] - 0s 992us/step - loss: 8.0590
Epoch 299/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 300/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 301/400
160/160 [=====] - 0s 978us/step - loss: 8.0590
Epoch 302/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 303/400

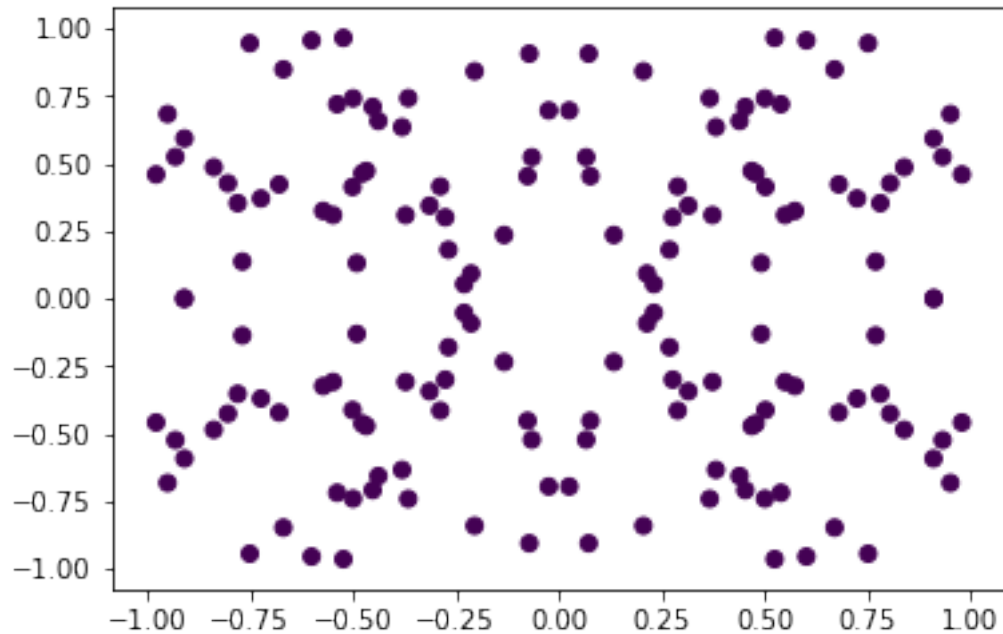
160/160 [=====] - 0s 908us/step - loss: 8.0590
Epoch 304/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 305/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 306/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 307/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 308/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 309/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 310/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 311/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 312/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 313/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 314/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 315/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 316/400
160/160 [=====] - 0s 968us/step - loss: 8.0590
Epoch 317/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 318/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 319/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 320/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 321/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 322/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 323/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 324/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 325/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 326/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 327/400

160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 328/400
160/160 [=====] - 0s 920us/step - loss: 8.0590
Epoch 329/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 330/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 331/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 332/400
160/160 [=====] - 0s 940us/step - loss: 8.0590
Epoch 333/400
160/160 [=====] - 0s 901us/step - loss: 8.0590
Epoch 334/400
160/160 [=====] - 0s 918us/step - loss: 8.0590
Epoch 335/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 336/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 337/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 338/400
160/160 [=====] - 0s 918us/step - loss: 8.0590
Epoch 339/400
160/160 [=====] - 0s 930us/step - loss: 8.0590
Epoch 340/400
160/160 [=====] - 0s 936us/step - loss: 8.0590
Epoch 341/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 342/400
160/160 [=====] - 0s 942us/step - loss: 8.0590
Epoch 343/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 344/400
160/160 [=====] - 0s 885us/step - loss: 8.0590
Epoch 345/400
160/160 [=====] - 0s 887us/step - loss: 8.0590
Epoch 346/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 347/400
160/160 [=====] - 0s 931us/step - loss: 8.0590
Epoch 348/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 349/400
160/160 [=====] - 0s 961us/step - loss: 8.0590
Epoch 350/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 351/400

160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 352/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 353/400
160/160 [=====] - 0s 905us/step - loss: 8.0590
Epoch 354/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 355/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 356/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 357/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 358/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 359/400
160/160 [=====] - 0s 957us/step - loss: 8.0590
Epoch 360/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 361/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 362/400
160/160 [=====] - 0s 953us/step - loss: 8.0590
Epoch 363/400
160/160 [=====] - 0s 956us/step - loss: 8.0590
Epoch 364/400
160/160 [=====] - 0s 912us/step - loss: 8.0590
Epoch 365/400
160/160 [=====] - 0s 964us/step - loss: 8.0590
Epoch 366/400
160/160 [=====] - 0s 895us/step - loss: 8.0590
Epoch 367/400
160/160 [=====] - 0s 854us/step - loss: 8.0590
Epoch 368/400
160/160 [=====] - 0s 929us/step - loss: 8.0590
Epoch 369/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 370/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 371/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 372/400
160/160 [=====] - 0s 2ms/step - loss: 8.0590
Epoch 373/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 374/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 375/400

160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 376/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 377/400
160/160 [=====] - 0s 996us/step - loss: 8.0590
Epoch 378/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 379/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 380/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 381/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 382/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 383/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 384/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 385/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 386/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 387/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 388/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 389/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 390/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 391/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 392/400
160/160 [=====] - 0s 964us/step - loss: 8.0590
Epoch 393/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 394/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 395/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 396/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 397/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 398/400
160/160 [=====] - 0s 1ms/step - loss: 8.0590
Epoch 399/400

[illegible]



```
In [137]: # Using tanh for 4 neuron
          model = Sequential()

          model.add(Dense(4, input_dim=2, activation='tanh'))
          model.add(Dense(4, activation='tanh'))
          model.add(Dense(4, activation='tanh'))
          model.add(Dense(4, activation='tanh'))

          # The output has 1 neuron for predicting whatever we are iterating
          model.add(Dense(1, activation='tanh'))

          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))

          scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 2s 12ms/step - loss: 4.3449
Epoch 2/400
160/160 [=====] - 0s 1ms/step - loss: 4.2928
Epoch 3/400
160/160 [=====] - 0s 990us/step - loss: 4.3200
Epoch 4/400
```

```

160/160 [=====] - 0s 989us/step - loss: 4.2059
Epoch 5/400
160/160 [=====] - 0s 1ms/step - loss: 4.2157
Epoch 6/400
160/160 [=====] - 0s 1ms/step - loss: 4.4523
Epoch 7/400
160/160 [=====] - 0s 1ms/step - loss: 4.0030
Epoch 8/400
160/160 [=====] - 0s 1ms/step - loss: 0.8542
Epoch 9/400
160/160 [=====] - 0s 1ms/step - loss: 0.6737
Epoch 10/400
160/160 [=====] - 0s 1ms/step - loss: 0.6062
Epoch 11/400
160/160 [=====] - 0s 1ms/step - loss: 0.5457
Epoch 12/400
160/160 [=====] - 0s 1ms/step - loss: 0.5215
Epoch 13/400
160/160 [=====] - 0s 1ms/step - loss: 0.4395
Epoch 14/400
160/160 [=====] - 0s 1ms/step - loss: 0.4252
Epoch 15/400
160/160 [=====] - 0s 1ms/step - loss: 0.4409
Epoch 16/400
160/160 [=====] - 0s 1ms/step - loss: 0.4025
Epoch 17/400
160/160 [=====] - 0s 1ms/step - loss: 0.3700
Epoch 18/400
160/160 [=====] - 0s 898us/step - loss: 0.2799
Epoch 19/400
160/160 [=====] - 0s 965us/step - loss: 0.2851
Epoch 20/400
160/160 [=====] - 0s 1ms/step - loss: 0.2533
Epoch 21/400
160/160 [=====] - 0s 998us/step - loss: 0.2272
Epoch 22/400
160/160 [=====] - 0s 1ms/step - loss: 0.3096
Epoch 23/400
160/160 [=====] - 0s 1ms/step - loss: 0.2184
Epoch 24/400
160/160 [=====] - 0s 1ms/step - loss: 0.1945
Epoch 25/400
160/160 [=====] - 0s 1ms/step - loss: 0.1849
Epoch 26/400
160/160 [=====] - 0s 1ms/step - loss: 0.2329
Epoch 27/400
160/160 [=====] - 0s 1ms/step - loss: 0.2432
Epoch 28/400

```

```

160/160 [=====] - 0s 1ms/step - loss: 0.2291
Epoch 29/400
160/160 [=====] - 0s 1ms/step - loss: 0.1561
Epoch 30/400
160/160 [=====] - 0s 1ms/step - loss: 0.1503
Epoch 31/400
160/160 [=====] - 0s 1ms/step - loss: 0.1837
Epoch 32/400
160/160 [=====] - 0s 1ms/step - loss: 0.1504
Epoch 33/400
160/160 [=====] - 0s 1ms/step - loss: 0.1396
Epoch 34/400
160/160 [=====] - 0s 1ms/step - loss: 0.1207
Epoch 35/400
160/160 [=====] - 0s 1ms/step - loss: 0.2448
Epoch 36/400
160/160 [=====] - 0s 1ms/step - loss: 0.1141
Epoch 37/400
160/160 [=====] - 0s 1ms/step - loss: 0.1415
Epoch 38/400
160/160 [=====] - 0s 934us/step - loss: 0.1745
Epoch 39/400
160/160 [=====] - 0s 3ms/step - loss: 0.3654
Epoch 40/400
160/160 [=====] - 0s 1ms/step - loss: 0.0907
Epoch 41/400
160/160 [=====] - 0s 1ms/step - loss: 0.0910
Epoch 42/400
160/160 [=====] - 0s 1ms/step - loss: 0.0710
Epoch 43/400
160/160 [=====] - 0s 1ms/step - loss: 0.0972
Epoch 44/400
160/160 [=====] - 0s 1ms/step - loss: 0.0887
Epoch 45/400
160/160 [=====] - 0s 1ms/step - loss: 0.0789
Epoch 46/400
160/160 [=====] - 0s 2ms/step - loss: 0.0765
Epoch 47/400
160/160 [=====] - 0s 1ms/step - loss: 0.0805
Epoch 48/400
160/160 [=====] - 0s 1ms/step - loss: 0.0844
Epoch 49/400
160/160 [=====] - 0s 1ms/step - loss: 0.0737
Epoch 50/400
160/160 [=====] - 0s 1ms/step - loss: 0.0697
Epoch 51/400
160/160 [=====] - 0s 1ms/step - loss: 0.0815
Epoch 52/400

```

```

160/160 [=====] - 0s 941us/step - loss: 0.0639
Epoch 53/400
160/160 [=====] - 0s 1ms/step - loss: 0.1102
Epoch 54/400
160/160 [=====] - 0s 888us/step - loss: 0.0864
Epoch 55/400
160/160 [=====] - 0s 884us/step - loss: 0.0673
Epoch 56/400
160/160 [=====] - 0s 1ms/step - loss: 0.0840
Epoch 57/400
160/160 [=====] - 0s 1ms/step - loss: 0.0602
Epoch 58/400
160/160 [=====] - 0s 1ms/step - loss: 0.0673
Epoch 59/400
160/160 [=====] - 0s 1ms/step - loss: 0.0698
Epoch 60/400
160/160 [=====] - 0s 1ms/step - loss: 0.1032
Epoch 61/400
160/160 [=====] - 0s 1ms/step - loss: 0.0685
Epoch 62/400
160/160 [=====] - 0s 1ms/step - loss: 0.0573
Epoch 63/400
160/160 [=====] - 0s 1ms/step - loss: 0.0667
Epoch 64/400
160/160 [=====] - 1s 7ms/step - loss: 0.0560
Epoch 65/400
160/160 [=====] - 0s 3ms/step - loss: 0.0541
Epoch 66/400
160/160 [=====] - 0s 1ms/step - loss: 0.0583
Epoch 67/400
160/160 [=====] - 0s 1ms/step - loss: 0.0567
Epoch 68/400
160/160 [=====] - 0s 1ms/step - loss: 0.0621
Epoch 69/400
160/160 [=====] - 0s 1ms/step - loss: 0.0571
Epoch 70/400
160/160 [=====] - 0s 1ms/step - loss: 0.0974
Epoch 71/400
160/160 [=====] - 0s 1ms/step - loss: 0.0747
Epoch 72/400
160/160 [=====] - 0s 941us/step - loss: 0.2646
Epoch 73/400
160/160 [=====] - 0s 816us/step - loss: 0.0912
Epoch 74/400
160/160 [=====] - 0s 848us/step - loss: 0.0551
Epoch 75/400
160/160 [=====] - 0s 916us/step - loss: 0.0546
Epoch 76/400

```

160/160 [=====] - 0s 920us/step - loss: 0.0481
Epoch 77/400
160/160 [=====] - 0s 886us/step - loss: 0.1005
Epoch 78/400
160/160 [=====] - 0s 893us/step - loss: 0.0622
Epoch 79/400
160/160 [=====] - 0s 1ms/step - loss: 0.0508
Epoch 80/400
160/160 [=====] - 0s 869us/step - loss: 0.0592
Epoch 81/400
160/160 [=====] - 0s 1ms/step - loss: 0.0463
Epoch 82/400
160/160 [=====] - 0s 1ms/step - loss: 0.0431
Epoch 83/400
160/160 [=====] - 0s 1ms/step - loss: 0.1503
Epoch 84/400
160/160 [=====] - 0s 1ms/step - loss: 0.0712
Epoch 85/400
160/160 [=====] - 0s 1ms/step - loss: 0.0566
Epoch 86/400
160/160 [=====] - 0s 1ms/step - loss: 0.0682
Epoch 87/400
160/160 [=====] - 0s 1ms/step - loss: 0.2394
Epoch 88/400
160/160 [=====] - 0s 1ms/step - loss: 0.0662
Epoch 89/400
160/160 [=====] - 0s 1ms/step - loss: 0.0558
Epoch 90/400
160/160 [=====] - 0s 1ms/step - loss: 0.0442
Epoch 91/400
160/160 [=====] - 0s 1ms/step - loss: 0.0506
Epoch 92/400
160/160 [=====] - 0s 1ms/step - loss: 0.0500
Epoch 93/400
160/160 [=====] - 0s 1ms/step - loss: 0.0605
Epoch 94/400
160/160 [=====] - 0s 3ms/step - loss: 0.0508
Epoch 95/400
160/160 [=====] - 0s 1ms/step - loss: 0.1397
Epoch 96/400
160/160 [=====] - 0s 1ms/step - loss: 0.0496
Epoch 97/400
160/160 [=====] - 0s 1ms/step - loss: 0.0439
Epoch 98/400
160/160 [=====] - 0s 2ms/step - loss: 0.0714
Epoch 99/400
160/160 [=====] - 0s 2ms/step - loss: 0.1611
Epoch 100/400

```

160/160 [=====] - 0s 1ms/step - loss: 0.0515
Epoch 101/400
160/160 [=====] - 0s 960us/step - loss: 0.0795
Epoch 102/400
160/160 [=====] - 0s 1ms/step - loss: 0.0458
Epoch 103/400
160/160 [=====] - 0s 1ms/step - loss: 0.0587
Epoch 104/400
160/160 [=====] - 0s 1ms/step - loss: 0.0587
Epoch 105/400
160/160 [=====] - 0s 1ms/step - loss: 0.1372
Epoch 106/400
160/160 [=====] - 0s 1ms/step - loss: 0.0482
Epoch 107/400
160/160 [=====] - 0s 1ms/step - loss: 0.0572
Epoch 108/400
160/160 [=====] - 0s 1ms/step - loss: 0.0382
Epoch 109/400
160/160 [=====] - 0s 1ms/step - loss: 0.0412
Epoch 110/400
160/160 [=====] - 0s 1ms/step - loss: 0.1385
Epoch 111/400
160/160 [=====] - 0s 1ms/step - loss: 0.1412
Epoch 112/400
160/160 [=====] - 0s 2ms/step - loss: 0.0524
Epoch 113/400
160/160 [=====] - 0s 1ms/step - loss: 0.1396
Epoch 114/400
160/160 [=====] - 0s 1ms/step - loss: 0.1439
Epoch 115/400
160/160 [=====] - 0s 1ms/step - loss: 0.0442
Epoch 116/400
160/160 [=====] - 0s 1ms/step - loss: 0.0401
Epoch 117/400
160/160 [=====] - 0s 1ms/step - loss: 0.1196
Epoch 118/400
160/160 [=====] - 0s 1ms/step - loss: 0.1445
Epoch 119/400
160/160 [=====] - 0s 1ms/step - loss: 0.0574
Epoch 120/400
160/160 [=====] - 0s 2ms/step - loss: 0.0440
Epoch 121/400
160/160 [=====] - 0s 1ms/step - loss: 0.0539
Epoch 122/400
160/160 [=====] - 0s 1ms/step - loss: 0.0502
Epoch 123/400
160/160 [=====] - 0s 1ms/step - loss: 0.0561
Epoch 124/400

```

```

160/160 [=====] - 0s 1ms/step - loss: 0.0491
Epoch 125/400
160/160 [=====] - 0s 2ms/step - loss: 0.1659
Epoch 126/400
160/160 [=====] - 0s 2ms/step - loss: 0.1554
Epoch 127/400
160/160 [=====] - 0s 1ms/step - loss: 0.0481
Epoch 128/400
160/160 [=====] - 0s 1ms/step - loss: 0.0467
Epoch 129/400
160/160 [=====] - 0s 1ms/step - loss: 0.0502
Epoch 130/400
160/160 [=====] - 0s 2ms/step - loss: 0.0513
Epoch 131/400
160/160 [=====] - 0s 2ms/step - loss: 0.0499
Epoch 132/400
160/160 [=====] - 0s 2ms/step - loss: 0.0445
Epoch 133/400
160/160 [=====] - 0s 2ms/step - loss: 0.0465
Epoch 134/400
160/160 [=====] - 0s 1ms/step - loss: 0.0431
Epoch 135/400
160/160 [=====] - 0s 1ms/step - loss: 0.0560
Epoch 136/400
160/160 [=====] - 0s 2ms/step - loss: 0.0431
Epoch 137/400
160/160 [=====] - 0s 1ms/step - loss: 0.1347
Epoch 138/400
160/160 [=====] - 0s 1ms/step - loss: 0.1392
Epoch 139/400
160/160 [=====] - 0s 1ms/step - loss: 0.0368
Epoch 140/400
160/160 [=====] - 0s 1ms/step - loss: 0.0442
Epoch 141/400
160/160 [=====] - 0s 1ms/step - loss: 0.0374
Epoch 142/400
160/160 [=====] - 0s 1ms/step - loss: 0.0316
Epoch 143/400
160/160 [=====] - 0s 1ms/step - loss: 0.0621
Epoch 144/400
160/160 [=====] - 0s 895us/step - loss: 0.0520
Epoch 145/400
160/160 [=====] - 0s 1ms/step - loss: 0.0437
Epoch 146/400
160/160 [=====] - 0s 983us/step - loss: 0.1346
Epoch 147/400
160/160 [=====] - 0s 1ms/step - loss: 0.0513
Epoch 148/400

```

```

160/160 [=====] - 0s 1ms/step - loss: 0.1297
Epoch 149/400
160/160 [=====] - 0s 872us/step - loss: 0.0480
Epoch 150/400
160/160 [=====] - 0s 871us/step - loss: 0.1283
Epoch 151/400
160/160 [=====] - 0s 1ms/step - loss: 0.1284
Epoch 152/400
160/160 [=====] - 0s 1ms/step - loss: 0.1328
Epoch 153/400
160/160 [=====] - 0s 1ms/step - loss: 0.0669
Epoch 154/400
160/160 [=====] - 0s 2ms/step - loss: 0.1315
Epoch 155/400
160/160 [=====] - 0s 1ms/step - loss: 0.1296
Epoch 156/400
160/160 [=====] - 0s 1ms/step - loss: 0.0420
Epoch 157/400
160/160 [=====] - 0s 943us/step - loss: 0.1295
Epoch 158/400
160/160 [=====] - 0s 891us/step - loss: 0.1293
Epoch 159/400
160/160 [=====] - 0s 913us/step - loss: 0.1295
Epoch 160/400
160/160 [=====] - 0s 860us/step - loss: 0.1251
Epoch 161/400
160/160 [=====] - 0s 850us/step - loss: 0.1333
Epoch 162/400
160/160 [=====] - 0s 1ms/step - loss: 0.0860
Epoch 163/400
160/160 [=====] - 0s 1ms/step - loss: 0.0403
Epoch 164/400
160/160 [=====] - 0s 1ms/step - loss: 0.0510
Epoch 165/400
160/160 [=====] - 0s 1ms/step - loss: 0.0402
Epoch 166/400
160/160 [=====] - 0s 1ms/step - loss: 0.0493
Epoch 167/400
160/160 [=====] - 0s 1ms/step - loss: 0.1313
Epoch 168/400
160/160 [=====] - 0s 1ms/step - loss: 0.5065
Epoch 169/400
160/160 [=====] - 0s 1ms/step - loss: 0.1137
Epoch 170/400
160/160 [=====] - 0s 1ms/step - loss: 0.0601
Epoch 171/400
160/160 [=====] - 0s 1ms/step - loss: 0.0642
Epoch 172/400

```


160/160 [=====] - 0s 2ms/step - loss: 0.0471
Epoch 173/400
160/160 [=====] - 0s 1ms/step - loss: 0.0576
Epoch 174/400
160/160 [=====] - 0s 2ms/step - loss: 0.0525
Epoch 175/400
160/160 [=====] - 0s 1ms/step - loss: 0.0439
Epoch 176/400
160/160 [=====] - 0s 1ms/step - loss: 0.0508
Epoch 177/400
160/160 [=====] - 0s 1ms/step - loss: 0.0543
Epoch 178/400
160/160 [=====] - 0s 1ms/step - loss: 0.0545
Epoch 179/400
160/160 [=====] - 0s 1ms/step - loss: 0.0509
Epoch 180/400
160/160 [=====] - 0s 974us/step - loss: 0.0450
Epoch 181/400
160/160 [=====] - 0s 1ms/step - loss: 0.0438
Epoch 182/400
160/160 [=====] - 0s 1ms/step - loss: 0.0429
Epoch 183/400
160/160 [=====] - 0s 1ms/step - loss: 0.0438
Epoch 184/400
160/160 [=====] - 0s 1ms/step - loss: 0.0516
Epoch 185/400
160/160 [=====] - 0s 1ms/step - loss: 0.0455
Epoch 186/400
160/160 [=====] - 0s 1ms/step - loss: 0.0438
Epoch 187/400
160/160 [=====] - 0s 1ms/step - loss: 0.0463
Epoch 188/400
160/160 [=====] - 0s 1ms/step - loss: 0.1348
Epoch 189/400
160/160 [=====] - 0s 1ms/step - loss: 0.0807
Epoch 190/400
160/160 [=====] - 0s 1ms/step - loss: 0.0869
Epoch 191/400
160/160 [=====] - 0s 2ms/step - loss: 0.0459
Epoch 192/400
160/160 [=====] - 0s 1ms/step - loss: 0.0450
Epoch 193/400
160/160 [=====] - 0s 1ms/step - loss: 0.0412
Epoch 194/400
160/160 [=====] - 0s 1ms/step - loss: 0.0451
Epoch 195/400
160/160 [=====] - 0s 1ms/step - loss: 0.0456
Epoch 196/400

160/160 [=====] - 0s 1ms/step - loss: 0.0424
 Epoch 197/400
 160/160 [=====] - 0s 932us/step - loss: 0.0422
 Epoch 198/400
 160/160 [=====] - 0s 910us/step - loss: 0.0363
 Epoch 199/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0466
 Epoch 200/400
 160/160 [=====] - 0s 1ms/step - loss: 0.1333
 Epoch 201/400
 160/160 [=====] - 0s 2ms/step - loss: 0.0801
 Epoch 202/400
 160/160 [=====] - 0s 1ms/step - loss: 0.1276
 Epoch 203/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0499
 Epoch 204/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0466
 Epoch 205/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0425
 Epoch 206/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0407
 Epoch 207/400
 160/160 [=====] - 0s 2ms/step - loss: 0.0480
 Epoch 208/400
 160/160 [=====] - 0s 2ms/step - loss: 0.0431
 Epoch 209/400
 160/160 [=====] - 0s 2ms/step - loss: 0.0418
 Epoch 210/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0380
 Epoch 211/400
 160/160 [=====] - 0s 946us/step - loss: 0.1964
 Epoch 212/400
 160/160 [=====] - 0s 908us/step - loss: 0.1218
 Epoch 213/400
 160/160 [=====] - 0s 801us/step - loss: 0.0655
 Epoch 214/400
 160/160 [=====] - 0s 798us/step - loss: 0.0492
 Epoch 215/400
 160/160 [=====] - 0s 822us/step - loss: 0.0456
 Epoch 216/400
 160/160 [=====] - 0s 793us/step - loss: 0.0447
 Epoch 217/400
 160/160 [=====] - 0s 783us/step - loss: 0.0461
 Epoch 218/400
 160/160 [=====] - 0s 790us/step - loss: 0.0415
 Epoch 219/400
 160/160 [=====] - 0s 805us/step - loss: 0.0474
 Epoch 220/400

```

160/160 [=====] - 0s 952us/step - loss: 0.0383
Epoch 221/400
160/160 [=====] - 0s 888us/step - loss: 0.0419
Epoch 222/400
160/160 [=====] - 0s 876us/step - loss: 0.0409
Epoch 223/400
160/160 [=====] - 0s 1ms/step - loss: 0.0473
Epoch 224/400
160/160 [=====] - 0s 859us/step - loss: 0.0428
Epoch 225/400
160/160 [=====] - 0s 940us/step - loss: 0.0391
Epoch 226/400
160/160 [=====] - 0s 930us/step - loss: 0.0385
Epoch 227/400
160/160 [=====] - 0s 886us/step - loss: 0.0381
Epoch 228/400
160/160 [=====] - 0s 851us/step - loss: 0.0449
Epoch 229/400
160/160 [=====] - 0s 815us/step - loss: 0.0374
Epoch 230/400
160/160 [=====] - 0s 920us/step - loss: 0.0416
Epoch 231/400
160/160 [=====] - 0s 1ms/step - loss: 0.0409
Epoch 232/400
160/160 [=====] - 0s 993us/step - loss: 0.0375
Epoch 233/400
160/160 [=====] - 0s 1ms/step - loss: 0.0436
Epoch 234/400
160/160 [=====] - 0s 952us/step - loss: 0.0473
Epoch 235/400
160/160 [=====] - 0s 1ms/step - loss: 0.0417
Epoch 236/400
160/160 [=====] - 0s 1ms/step - loss: 0.0359
Epoch 237/400
160/160 [=====] - 0s 1ms/step - loss: 0.4053
Epoch 238/400
160/160 [=====] - 0s 1ms/step - loss: 0.1372
Epoch 239/400
160/160 [=====] - 0s 942us/step - loss: 0.0555
Epoch 240/400
160/160 [=====] - 0s 1ms/step - loss: 0.0438
Epoch 241/400
160/160 [=====] - 0s 1ms/step - loss: 0.0449
Epoch 242/400
160/160 [=====] - 0s 971us/step - loss: 0.0461
Epoch 243/400
160/160 [=====] - 0s 1ms/step - loss: 0.0435
Epoch 244/400

```

```

160/160 [=====] - 0s 890us/step - loss: 0.0433
Epoch 245/400
160/160 [=====] - 0s 907us/step - loss: 0.0415
Epoch 246/400
160/160 [=====] - 0s 1ms/step - loss: 0.0393
Epoch 247/400
160/160 [=====] - 0s 1ms/step - loss: 0.0419
Epoch 248/400
160/160 [=====] - 0s 1ms/step - loss: 0.0395
Epoch 249/400
160/160 [=====] - 0s 1ms/step - loss: 0.0411
Epoch 250/400
160/160 [=====] - 0s 920us/step - loss: 0.0437
Epoch 251/400
160/160 [=====] - 0s 891us/step - loss: 0.0357
Epoch 252/400
160/160 [=====] - 0s 1ms/step - loss: 0.0384
Epoch 253/400
160/160 [=====] - 0s 2ms/step - loss: 0.0412
Epoch 254/400
160/160 [=====] - 0s 1ms/step - loss: 0.0417
Epoch 255/400
160/160 [=====] - 0s 1ms/step - loss: 0.0382
Epoch 256/400
160/160 [=====] - 0s 2ms/step - loss: 0.0373
Epoch 257/400
160/160 [=====] - 0s 1ms/step - loss: 0.0383
Epoch 258/400
160/160 [=====] - 0s 1ms/step - loss: 0.0361
Epoch 259/400
160/160 [=====] - 0s 1ms/step - loss: 0.0389
Epoch 260/400
160/160 [=====] - 0s 970us/step - loss: 0.1431
Epoch 261/400
160/160 [=====] - 0s 2ms/step - loss: 0.0865
Epoch 262/400
160/160 [=====] - 0s 1ms/step - loss: 0.0537
Epoch 263/400
160/160 [=====] - 0s 2ms/step - loss: 0.0468
Epoch 264/400
160/160 [=====] - 0s 3ms/step - loss: 0.0446
Epoch 265/400
160/160 [=====] - 0s 1ms/step - loss: 0.0442
Epoch 266/400
160/160 [=====] - 0s 1ms/step - loss: 0.0425
Epoch 267/400
160/160 [=====] - 0s 1ms/step - loss: 0.0418
Epoch 268/400

```

160/160 [=====] - 0s 891us/step - loss: 0.0392
Epoch 269/400
160/160 [=====] - 0s 1ms/step - loss: 0.0383
Epoch 270/400
160/160 [=====] - 0s 937us/step - loss: 0.0418
Epoch 271/400
160/160 [=====] - 0s 1ms/step - loss: 0.0356
Epoch 272/400
160/160 [=====] - 0s 2ms/step - loss: 0.0384
Epoch 273/400
160/160 [=====] - 0s 1ms/step - loss: 0.0408
Epoch 274/400
160/160 [=====] - 0s 1ms/step - loss: 0.0384
Epoch 275/400
160/160 [=====] - 0s 847us/step - loss: 0.0347
Epoch 276/400
160/160 [=====] - 0s 818us/step - loss: 0.0419
Epoch 277/400
160/160 [=====] - 0s 848us/step - loss: 0.0380
Epoch 278/400
160/160 [=====] - 0s 1ms/step - loss: 0.0401
Epoch 279/400
160/160 [=====] - 0s 2ms/step - loss: 0.0395
Epoch 280/400
160/160 [=====] - 0s 1ms/step - loss: 0.0355
Epoch 281/400
160/160 [=====] - 0s 866us/step - loss: 0.0401
Epoch 282/400
160/160 [=====] - 0s 1ms/step - loss: 0.0345
Epoch 283/400
160/160 [=====] - 0s 1ms/step - loss: 0.0360
Epoch 284/400
160/160 [=====] - 0s 1ms/step - loss: 0.0387
Epoch 285/400
160/160 [=====] - 0s 1ms/step - loss: 0.0329
Epoch 286/400
160/160 [=====] - 0s 806us/step - loss: 0.0399
Epoch 287/400
160/160 [=====] - 0s 829us/step - loss: 0.0322
Epoch 288/400
160/160 [=====] - 0s 884us/step - loss: 0.0401
Epoch 289/400
160/160 [=====] - 0s 997us/step - loss: 0.0412
Epoch 290/400
160/160 [=====] - 0s 914us/step - loss: 0.0354
Epoch 291/400
160/160 [=====] - 0s 828us/step - loss: 0.0335
Epoch 292/400

```

160/160 [=====] - 0s 895us/step - loss: 0.0407
Epoch 293/400
160/160 [=====] - 0s 988us/step - loss: 0.0548
Epoch 294/400
160/160 [=====] - 0s 883us/step - loss: 0.0426
Epoch 295/400
160/160 [=====] - 0s 835us/step - loss: 0.0391
Epoch 296/400
160/160 [=====] - 0s 822us/step - loss: 0.0346
Epoch 297/400
160/160 [=====] - 0s 787us/step - loss: 0.0327
Epoch 298/400
160/160 [=====] - 0s 810us/step - loss: 0.0338
Epoch 299/400
160/160 [=====] - 0s 1ms/step - loss: 0.0348
Epoch 300/400
160/160 [=====] - 0s 897us/step - loss: 0.0376
Epoch 301/400
160/160 [=====] - 0s 955us/step - loss: 0.0386
Epoch 302/400
160/160 [=====] - 0s 935us/step - loss: 0.0355
Epoch 303/400
160/160 [=====] - 0s 916us/step - loss: 0.0362
Epoch 304/400
160/160 [=====] - 0s 899us/step - loss: 0.0367
Epoch 305/400
160/160 [=====] - 0s 1ms/step - loss: 0.0365
Epoch 306/400
160/160 [=====] - 0s 1ms/step - loss: 0.0350
Epoch 307/400
160/160 [=====] - 0s 951us/step - loss: 0.0339
Epoch 308/400
160/160 [=====] - 0s 1ms/step - loss: 0.0311
Epoch 309/400
160/160 [=====] - 0s 3ms/step - loss: 0.0356
Epoch 310/400
160/160 [=====] - 0s 2ms/step - loss: 0.0505
Epoch 311/400
160/160 [=====] - 0s 1ms/step - loss: 0.0389
Epoch 312/400
160/160 [=====] - 0s 1ms/step - loss: 0.0338
Epoch 313/400
160/160 [=====] - 0s 1ms/step - loss: 0.0369
Epoch 314/400
160/160 [=====] - 0s 1ms/step - loss: 0.0366
Epoch 315/400
160/160 [=====] - 0s 897us/step - loss: 0.0366
Epoch 316/400

```

160/160 [=====] - 0s 1ms/step - loss: 0.0321
 Epoch 317/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0385
 Epoch 318/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0388
 Epoch 319/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0332
 Epoch 320/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0344
 Epoch 321/400
 160/160 [=====] - 0s 849us/step - loss: 0.0347
 Epoch 322/400
 160/160 [=====] - 0s 777us/step - loss: 0.0356
 Epoch 323/400
 160/160 [=====] - 0s 794us/step - loss: 0.0331
 Epoch 324/400
 160/160 [=====] - 0s 874us/step - loss: 0.0324
 Epoch 325/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0324
 Epoch 326/400
 160/160 [=====] - 0s 1ms/step - loss: 0.0344
 Epoch 327/400
 160/160 [=====] - 0s 836us/step - loss: 0.0420
 Epoch 328/400
 160/160 [=====] - 0s 822us/step - loss: 0.0444
 Epoch 329/400
 160/160 [=====] - 0s 937us/step - loss: 0.0327
 Epoch 330/400
 160/160 [=====] - 0s 844us/step - loss: 0.0327
 Epoch 331/400
 160/160 [=====] - 0s 937us/step - loss: 0.0356
 Epoch 332/400
 160/160 [=====] - 0s 900us/step - loss: 0.0339
 Epoch 333/400
 160/160 [=====] - 0s 961us/step - loss: 0.0345
 Epoch 334/400
 160/160 [=====] - 0s 907us/step - loss: 0.0358
 Epoch 335/400
 160/160 [=====] - 0s 867us/step - loss: 0.0344
 Epoch 336/400
 160/160 [=====] - 0s 899us/step - loss: 0.0334
 Epoch 337/400
 160/160 [=====] - 0s 763us/step - loss: 0.0346
 Epoch 338/400
 160/160 [=====] - 0s 795us/step - loss: 0.0315
 Epoch 339/400
 160/160 [=====] - 0s 863us/step - loss: 0.0338
 Epoch 340/400

160/160 [=====] - 0s 1ms/step - loss: 0.0399
Epoch 341/400
160/160 [=====] - 0s 931us/step - loss: 0.0331
Epoch 342/400
160/160 [=====] - 0s 942us/step - loss: 0.0350
Epoch 343/400
160/160 [=====] - 0s 874us/step - loss: 0.0316
Epoch 344/400
160/160 [=====] - 0s 920us/step - loss: 0.0371
Epoch 345/400
160/160 [=====] - 0s 1ms/step - loss: 0.0329
Epoch 346/400
160/160 [=====] - 0s 1ms/step - loss: 0.0321
Epoch 347/400
160/160 [=====] - 0s 1ms/step - loss: 0.0300
Epoch 348/400
160/160 [=====] - 0s 874us/step - loss: 0.0338
Epoch 349/400
160/160 [=====] - 0s 868us/step - loss: 0.0376
Epoch 350/400
160/160 [=====] - 0s 876us/step - loss: 0.0415
Epoch 351/400
160/160 [=====] - 0s 770us/step - loss: 0.0385
Epoch 352/400
160/160 [=====] - 0s 811us/step - loss: 0.0333
Epoch 353/400
160/160 [=====] - 0s 835us/step - loss: 0.0393
Epoch 354/400
160/160 [=====] - 0s 835us/step - loss: 0.0346
Epoch 355/400
160/160 [=====] - 0s 921us/step - loss: 0.0312
Epoch 356/400
160/160 [=====] - 0s 900us/step - loss: 0.0429
Epoch 357/400
160/160 [=====] - 0s 869us/step - loss: 0.0400
Epoch 358/400
160/160 [=====] - 0s 876us/step - loss: 0.0355
Epoch 359/400
160/160 [=====] - 0s 908us/step - loss: 0.0334
Epoch 360/400
160/160 [=====] - 0s 854us/step - loss: 0.0320
Epoch 361/400
160/160 [=====] - 0s 893us/step - loss: 0.0317
Epoch 362/400
160/160 [=====] - 0s 981us/step - loss: 0.0296
Epoch 363/400
160/160 [=====] - 0s 917us/step - loss: 0.0344
Epoch 364/400


```

160/160 [=====] - 0s 1ms/step - loss: 0.0339
Epoch 365/400
160/160 [=====] - 0s 854us/step - loss: 0.0329
Epoch 366/400
160/160 [=====] - 0s 809us/step - loss: 0.0313
Epoch 367/400
160/160 [=====] - 0s 973us/step - loss: 0.0332
Epoch 368/400
160/160 [=====] - 0s 836us/step - loss: 0.0321
Epoch 369/400
160/160 [=====] - 0s 875us/step - loss: 0.0578
Epoch 370/400
160/160 [=====] - 0s 847us/step - loss: 0.0419
Epoch 371/400
160/160 [=====] - 0s 805us/step - loss: 0.0348
Epoch 372/400
160/160 [=====] - 0s 875us/step - loss: 0.0319
Epoch 373/400
160/160 [=====] - 0s 830us/step - loss: 0.0319
Epoch 374/400
160/160 [=====] - 0s 791us/step - loss: 0.0299
Epoch 375/400
160/160 [=====] - 0s 955us/step - loss: 0.0313
Epoch 376/400
160/160 [=====] - 0s 860us/step - loss: 0.0300
Epoch 377/400
160/160 [=====] - 0s 800us/step - loss: 0.0314
Epoch 378/400
160/160 [=====] - 0s 780us/step - loss: 0.0335
Epoch 379/400
160/160 [=====] - 0s 855us/step - loss: 0.0330
Epoch 380/400
160/160 [=====] - 0s 941us/step - loss: 0.0307
Epoch 381/400
160/160 [=====] - 0s 879us/step - loss: 0.0317
Epoch 382/400
160/160 [=====] - 0s 819us/step - loss: 0.0359
Epoch 383/400
160/160 [=====] - 0s 918us/step - loss: 0.0301
Epoch 384/400
160/160 [=====] - 0s 1ms/step - loss: 0.0333
Epoch 385/400
160/160 [=====] - 0s 890us/step - loss: 0.0335
Epoch 386/400
160/160 [=====] - 0s 791us/step - loss: 0.0318
Epoch 387/400
160/160 [=====] - 0s 999us/step - loss: 0.0317
Epoch 388/400

```

```

160/160 [=====] - 0s 849us/step - loss: 0.0293
Epoch 389/400
160/160 [=====] - 0s 924us/step - loss: 0.0311
Epoch 390/400
160/160 [=====] - 0s 814us/step - loss: 0.0323
Epoch 391/400
160/160 [=====] - 0s 771us/step - loss: 0.0312
Epoch 392/400
160/160 [=====] - 0s 886us/step - loss: 0.0301
Epoch 393/400
160/160 [=====] - 0s 883us/step - loss: 0.0362
Epoch 394/400
160/160 [=====] - 0s 910us/step - loss: 0.0365
Epoch 395/400
160/160 [=====] - 0s 809us/step - loss: 0.0332
Epoch 396/400
160/160 [=====] - 0s 1ms/step - loss: 0.0300
Epoch 397/400
160/160 [=====] - 0s 989us/step - loss: 0.0330
Epoch 398/400
160/160 [=====] - 0s 1ms/step - loss: 0.0310
Epoch 399/400
160/160 [=====] - 0s 911us/step - loss: 0.0290
Epoch 400/400
160/160 [=====] - 0s 835us/step - loss: 0.0333

```

```

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '

```

```

[ 0.9943007  0.9995777  0.99968076 0.99959517 0.99961597 0.9996685
 0.99964595 0.998969  0.9995384  0.9996739 0.99962205 0.9996134
 0.9996897 0.9900508 0.99969554 0.5031746 0.99677175 0.99968016
 0.9996318 0.8554199 0.99966586 0.9996457 0.9344861 0.99958205
 0.9996406 0.99961674 0.999674  0.99965614 0.9996594 0.9996635
 0.9997027 0.99746495 0.99964565 0.9996604 0.9996943 0.9996277
 0.9968068 0.9996793 0.9995891 0.9996806 0.99920225 0.99632686
 0.9971404 0.9964159 0.99652725 0.9969523 0.9967904 0.99918437
 0.99670446 0.9970178 0.99657625 0.99651575 0.9973253 0.999022
 0.997763  0.9335234 0.9936583  0.9971139 0.9966286 0.9915658
 0.9969042 0.9967311 0.97871923 0.99636674 0.9966918 0.9992185
 0.9969966 0.9968146 0.99684536 0.9969592 0.99836916 0.99332225
 0.996936  0.99692404 0.99739355 0.9966042 0.99360883 0.9974408
 0.9963992 0.9976474 -0.24570352 -0.29743323 -0.31048992 -0.30219585
 -0.29662955 -0.31173202 -0.310432  -0.08357824 -0.28547543 -0.31081465
 -0.30731627 -0.303014  -0.30913433 -0.21526693 -0.3082215  0.9270224
 -0.16127777 -0.3101216  -0.30319393 0.08061869 -0.30986172 -0.3082807

```

```

0.08359446 -0.30345795 -0.30685666 -0.2852067 -0.30744818 -0.31239086
-0.3122878 -0.3115244 -0.28028995 -0.20575903 -0.30726683 -0.3114429
-0.30621323 -0.3050597 -0.12028626 -0.30829105 -0.30414438 -0.30589768
-0.40200856 -0.17768605 -0.41931903 -0.20858991 -0.15187375 -0.4077675
-0.33884954 -0.3339527 -0.33670658 -0.4186335 -0.25300482 -0.19966653
-0.42614615 -0.38928226 -0.41631046 0.48291153 -0.24478255 -0.42292342
-0.1872065 -0.01005085 -0.4266291 -0.23348965 -0.10862457 -0.2617758
-0.2187198 -0.39434946 -0.43497336 -0.39834276 -0.39976892 -0.3744543
-0.44214863 -0.12432604 -0.35875726 -0.36767593 -0.43554235 -0.2089746
-0.01952418 -0.39496315 -0.2577487 -0.39484555]
160/160 [=====] - 1s 4ms/step

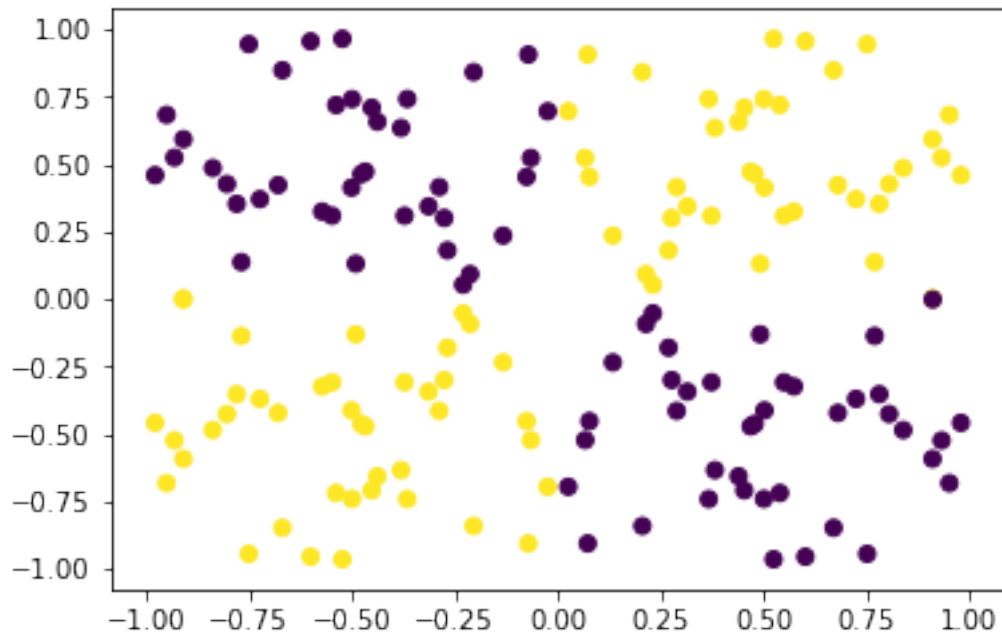
```

```
In [138]: scores, model.metrics_names
```

```
Out[138]: (0.028811794333159925, ['loss'])
```

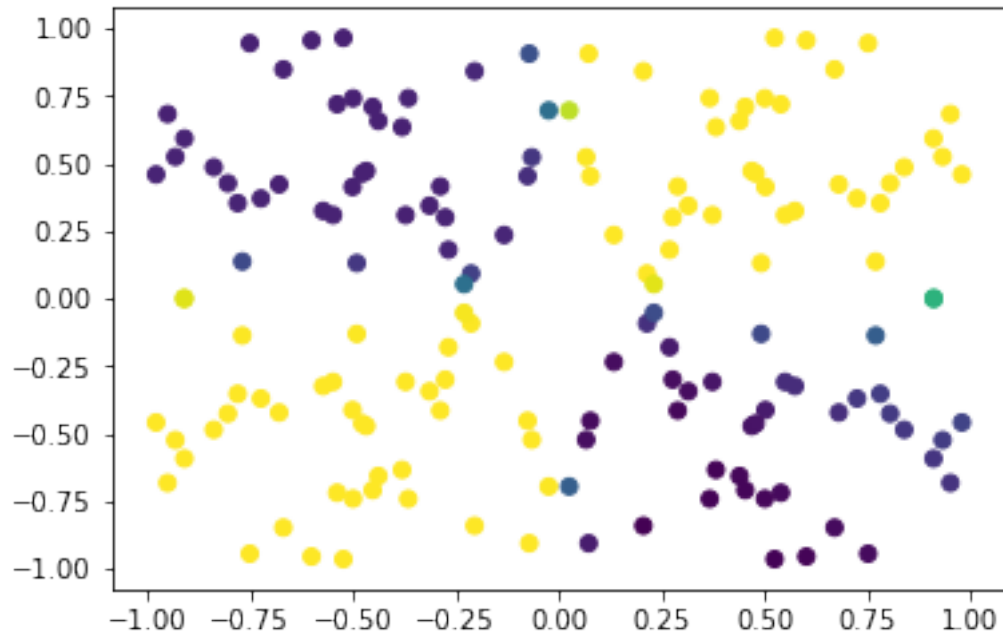
```
In [139]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[139]: <matplotlib.collections.PathCollection at 0xb2b953240>
```



```
In [140]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[140]: <matplotlib.collections.PathCollection at 0xb310b45f8>
```



```
In [143]: from keras.optimizers import Adam
          # Using other optimizers with best performing model
          model = Sequential()

          model.add(Dense(4, input_dim=2, activation='tanh'))
          model.add(Dense(4, activation='tanh'))
          model.add(Dense(4, activation='tanh'))
          model.add(Dense(4, activation='tanh'))

          # The output has 1 neuron for predicting whatever we are iterating
          model.add(Dense(1, activation='tanh'))

          adam = Adam(lr=0.001)
          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))

          scores = model.evaluate(X, y)

Epoch 1/400
160/160 [=====] - 2s 11ms/step - loss: 3.2976
Epoch 2/400
160/160 [=====] - 0s 1ms/step - loss: 0.9051
Epoch 3/400
160/160 [=====] - 0s 1ms/step - loss: 0.7185
```

Epoch 4/400
160/160 [=====] - 0s 1ms/step - loss: 0.6929
Epoch 5/400
160/160 [=====] - 0s 1ms/step - loss: 0.6796
Epoch 6/400
160/160 [=====] - 0s 1ms/step - loss: 0.6732
Epoch 7/400
160/160 [=====] - 0s 1ms/step - loss: 0.6677
Epoch 8/400
160/160 [=====] - 0s 1ms/step - loss: 0.6597
Epoch 9/400
160/160 [=====] - 0s 1ms/step - loss: 0.6513
Epoch 10/400
160/160 [=====] - 0s 1ms/step - loss: 0.6411
Epoch 11/400
160/160 [=====] - 0s 1ms/step - loss: 0.6326
Epoch 12/400
160/160 [=====] - 0s 1ms/step - loss: 0.6194
Epoch 13/400
160/160 [=====] - 0s 1ms/step - loss: 0.6064
Epoch 14/400
160/160 [=====] - 0s 1ms/step - loss: 0.5936
Epoch 15/400
160/160 [=====] - 0s 1ms/step - loss: 0.5804
Epoch 16/400
160/160 [=====] - 0s 1ms/step - loss: 0.5675
Epoch 17/400
160/160 [=====] - 0s 1ms/step - loss: 0.5561
Epoch 18/400
160/160 [=====] - 0s 1ms/step - loss: 0.5472
Epoch 19/400
160/160 [=====] - 0s 1ms/step - loss: 0.5330
Epoch 20/400
160/160 [=====] - 0s 1ms/step - loss: 0.5245
Epoch 21/400
160/160 [=====] - 0s 1ms/step - loss: 0.5193
Epoch 22/400
160/160 [=====] - 0s 1ms/step - loss: 0.5065
Epoch 23/400
160/160 [=====] - 0s 1ms/step - loss: 0.4962
Epoch 24/400
160/160 [=====] - 0s 2ms/step - loss: 0.4869
Epoch 25/400
160/160 [=====] - 0s 1ms/step - loss: 0.4780
Epoch 26/400
160/160 [=====] - 0s 1ms/step - loss: 0.4693
Epoch 27/400
160/160 [=====] - 0s 1ms/step - loss: 0.4591

Epoch 28/400
160/160 [=====] - 0s 1ms/step - loss: 0.4485
Epoch 29/400
160/160 [=====] - 0s 2ms/step - loss: 0.4413
Epoch 30/400
160/160 [=====] - 0s 2ms/step - loss: 0.4267
Epoch 31/400
160/160 [=====] - 0s 1ms/step - loss: 0.4150
Epoch 32/400
160/160 [=====] - 0s 1ms/step - loss: 0.4020
Epoch 33/400
160/160 [=====] - 0s 1ms/step - loss: 0.3939
Epoch 34/400
160/160 [=====] - 0s 1ms/step - loss: 0.3842
Epoch 35/400
160/160 [=====] - 0s 1ms/step - loss: 0.3703
Epoch 36/400
160/160 [=====] - 0s 1ms/step - loss: 0.3593
Epoch 37/400
160/160 [=====] - 0s 1ms/step - loss: 0.3520
Epoch 38/400
160/160 [=====] - 0s 1ms/step - loss: 0.3361
Epoch 39/400
160/160 [=====] - 0s 1ms/step - loss: 0.3278
Epoch 40/400
160/160 [=====] - 0s 2ms/step - loss: 0.3199
Epoch 41/400
160/160 [=====] - 0s 1ms/step - loss: 0.3130
Epoch 42/400
160/160 [=====] - 0s 1ms/step - loss: 0.3064
Epoch 43/400
160/160 [=====] - 0s 1ms/step - loss: 0.3071
Epoch 44/400
160/160 [=====] - 0s 1ms/step - loss: 0.3026
Epoch 45/400
160/160 [=====] - 0s 2ms/step - loss: 0.3008
Epoch 46/400
160/160 [=====] - 0s 2ms/step - loss: 0.2939
Epoch 47/400
160/160 [=====] - 0s 2ms/step - loss: 0.2863
Epoch 48/400
160/160 [=====] - 0s 1ms/step - loss: 0.2885
Epoch 49/400
160/160 [=====] - 0s 1ms/step - loss: 0.2905
Epoch 50/400
160/160 [=====] - 0s 2ms/step - loss: 0.2831
Epoch 51/400
160/160 [=====] - 0s 1ms/step - loss: 0.2779

Epoch 52/400
160/160 [=====] - 0s 1ms/step - loss: 0.2808
Epoch 53/400
160/160 [=====] - 0s 1ms/step - loss: 0.2794
Epoch 54/400
160/160 [=====] - 0s 1ms/step - loss: 0.2803
Epoch 55/400
160/160 [=====] - 0s 1ms/step - loss: 0.2758
Epoch 56/400
160/160 [=====] - 0s 1ms/step - loss: 0.2793
Epoch 57/400
160/160 [=====] - 0s 1ms/step - loss: 0.2724
Epoch 58/400
160/160 [=====] - 0s 1ms/step - loss: 0.2653
Epoch 59/400
160/160 [=====] - 0s 1ms/step - loss: 0.2663
Epoch 60/400
160/160 [=====] - 0s 1ms/step - loss: 0.2620
Epoch 61/400
160/160 [=====] - 0s 1ms/step - loss: 0.2693
Epoch 62/400
160/160 [=====] - 0s 1ms/step - loss: 0.2675
Epoch 63/400
160/160 [=====] - 0s 1ms/step - loss: 0.2586
Epoch 64/400
160/160 [=====] - 0s 2ms/step - loss: 0.2573
Epoch 65/400
160/160 [=====] - 0s 2ms/step - loss: 0.2561
Epoch 66/400
160/160 [=====] - 0s 1ms/step - loss: 0.2527
Epoch 67/400
160/160 [=====] - 0s 1ms/step - loss: 0.2501
Epoch 68/400
160/160 [=====] - 0s 1ms/step - loss: 0.2568
Epoch 69/400
160/160 [=====] - 0s 1ms/step - loss: 0.2476
Epoch 70/400
160/160 [=====] - 0s 1ms/step - loss: 0.2463
Epoch 71/400
160/160 [=====] - 0s 1ms/step - loss: 0.2442
Epoch 72/400
160/160 [=====] - 0s 1ms/step - loss: 0.2446
Epoch 73/400
160/160 [=====] - 0s 1ms/step - loss: 0.2398
Epoch 74/400
160/160 [=====] - 0s 1ms/step - loss: 0.2363
Epoch 75/400
160/160 [=====] - 0s 1ms/step - loss: 0.2380

Epoch 76/400
160/160 [=====] - 0s 1ms/step - loss: 0.2368
Epoch 77/400
160/160 [=====] - 0s 1ms/step - loss: 0.2368
Epoch 78/400
160/160 [=====] - 0s 1ms/step - loss: 0.2282
Epoch 79/400
160/160 [=====] - 0s 1ms/step - loss: 0.2292
Epoch 80/400
160/160 [=====] - 0s 1ms/step - loss: 0.2264
Epoch 81/400
160/160 [=====] - 0s 1ms/step - loss: 0.2276
Epoch 82/400
160/160 [=====] - 0s 1ms/step - loss: 0.2209
Epoch 83/400
160/160 [=====] - 0s 1ms/step - loss: 0.2242
Epoch 84/400
160/160 [=====] - 0s 1ms/step - loss: 0.2160
Epoch 85/400
160/160 [=====] - 0s 1ms/step - loss: 0.2170
Epoch 86/400
160/160 [=====] - 0s 1ms/step - loss: 0.2159
Epoch 87/400
160/160 [=====] - 0s 1ms/step - loss: 0.2131
Epoch 88/400
160/160 [=====] - 0s 1ms/step - loss: 0.2046
Epoch 89/400
160/160 [=====] - 0s 2ms/step - loss: 0.2028
Epoch 90/400
160/160 [=====] - 0s 1ms/step - loss: 0.2015
Epoch 91/400
160/160 [=====] - 0s 1ms/step - loss: 0.2032
Epoch 92/400
160/160 [=====] - 0s 1ms/step - loss: 0.1957
Epoch 93/400
160/160 [=====] - 0s 1ms/step - loss: 0.1923
Epoch 94/400
160/160 [=====] - 0s 1ms/step - loss: 0.1895
Epoch 95/400
160/160 [=====] - 0s 2ms/step - loss: 0.1896
Epoch 96/400
160/160 [=====] - 0s 2ms/step - loss: 0.1851
Epoch 97/400
160/160 [=====] - 0s 2ms/step - loss: 0.1833
Epoch 98/400
160/160 [=====] - 0s 2ms/step - loss: 0.1781
Epoch 99/400
160/160 [=====] - 0s 1ms/step - loss: 0.1799

Epoch 100/400
160/160 [=====] - 0s 1ms/step - loss: 0.1773
Epoch 101/400
160/160 [=====] - 0s 1ms/step - loss: 0.1747
Epoch 102/400
160/160 [=====] - 0s 1ms/step - loss: 0.1717
Epoch 103/400
160/160 [=====] - 0s 1ms/step - loss: 0.1647
Epoch 104/400
160/160 [=====] - 0s 1ms/step - loss: 0.1642
Epoch 105/400
160/160 [=====] - 0s 1ms/step - loss: 0.1601
Epoch 106/400
160/160 [=====] - 0s 1ms/step - loss: 0.1574
Epoch 107/400
160/160 [=====] - 0s 1ms/step - loss: 0.1523
Epoch 108/400
160/160 [=====] - 0s 1ms/step - loss: 0.1525
Epoch 109/400
160/160 [=====] - 0s 1ms/step - loss: 0.1473
Epoch 110/400
160/160 [=====] - 0s 2ms/step - loss: 0.1456
Epoch 111/400
160/160 [=====] - 0s 1ms/step - loss: 0.1462
Epoch 112/400
160/160 [=====] - 0s 1ms/step - loss: 0.1415
Epoch 113/400
160/160 [=====] - 0s 1ms/step - loss: 0.1346
Epoch 114/400
160/160 [=====] - 0s 1ms/step - loss: 0.1344
Epoch 115/400
160/160 [=====] - 0s 1ms/step - loss: 0.1336
Epoch 116/400
160/160 [=====] - 0s 1ms/step - loss: 0.1304
Epoch 117/400
160/160 [=====] - 0s 1ms/step - loss: 0.1247
Epoch 118/400
160/160 [=====] - 0s 1ms/step - loss: 0.1225
Epoch 119/400
160/160 [=====] - 0s 1ms/step - loss: 0.1227
Epoch 120/400
160/160 [=====] - 0s 1ms/step - loss: 0.1199
Epoch 121/400
160/160 [=====] - 0s 2ms/step - loss: 0.1196
Epoch 122/400
160/160 [=====] - 0s 1ms/step - loss: 0.1136
Epoch 123/400
160/160 [=====] - 0s 1ms/step - loss: 0.1100

Epoch 124/400
160/160 [=====] - 0s 1ms/step - loss: 0.1055
Epoch 125/400
160/160 [=====] - 0s 1ms/step - loss: 0.1077
Epoch 126/400
160/160 [=====] - 0s 1ms/step - loss: 0.1008
Epoch 127/400
160/160 [=====] - 0s 1ms/step - loss: 0.1032
Epoch 128/400
160/160 [=====] - 0s 1ms/step - loss: 0.0986
Epoch 129/400
160/160 [=====] - 0s 1ms/step - loss: 0.0972
Epoch 130/400
160/160 [=====] - 0s 1ms/step - loss: 0.0935
Epoch 131/400
160/160 [=====] - 0s 1ms/step - loss: 0.0963
Epoch 132/400
160/160 [=====] - 0s 1ms/step - loss: 0.0872
Epoch 133/400
160/160 [=====] - 0s 1ms/step - loss: 0.0846
Epoch 134/400
160/160 [=====] - 0s 1ms/step - loss: 0.0857
Epoch 135/400
160/160 [=====] - 0s 1ms/step - loss: 0.0853
Epoch 136/400
160/160 [=====] - 0s 1ms/step - loss: 0.0811
Epoch 137/400
160/160 [=====] - 0s 1ms/step - loss: 0.0780
Epoch 138/400
160/160 [=====] - 0s 1ms/step - loss: 0.0761
Epoch 139/400
160/160 [=====] - 0s 1ms/step - loss: 0.0742
Epoch 140/400
160/160 [=====] - 0s 1ms/step - loss: 0.0724
Epoch 141/400
160/160 [=====] - 0s 1ms/step - loss: 0.0731
Epoch 142/400
160/160 [=====] - 0s 1ms/step - loss: 0.0698
Epoch 143/400
160/160 [=====] - 0s 1ms/step - loss: 0.0672
Epoch 144/400
160/160 [=====] - 0s 1ms/step - loss: 0.0638
Epoch 145/400
160/160 [=====] - 0s 1ms/step - loss: 0.0658
Epoch 146/400
160/160 [=====] - 0s 1ms/step - loss: 0.0632
Epoch 147/400
160/160 [=====] - 0s 1ms/step - loss: 0.0614

Epoch 148/400
160/160 [=====] - 0s 1ms/step - loss: 0.0627
Epoch 149/400
160/160 [=====] - 0s 1ms/step - loss: 0.0565
Epoch 150/400
160/160 [=====] - 0s 1ms/step - loss: 0.0565
Epoch 151/400
160/160 [=====] - 0s 1ms/step - loss: 0.0560
Epoch 152/400
160/160 [=====] - 0s 1ms/step - loss: 0.0588
Epoch 153/400
160/160 [=====] - 0s 2ms/step - loss: 0.0544
Epoch 154/400
160/160 [=====] - 0s 1ms/step - loss: 0.0527
Epoch 155/400
160/160 [=====] - 0s 1ms/step - loss: 0.0513
Epoch 156/400
160/160 [=====] - 0s 1ms/step - loss: 0.0510
Epoch 157/400
160/160 [=====] - 0s 1ms/step - loss: 0.0489
Epoch 158/400
160/160 [=====] - 0s 1ms/step - loss: 0.0478
Epoch 159/400
160/160 [=====] - 0s 1ms/step - loss: 0.0480
Epoch 160/400
160/160 [=====] - 0s 1ms/step - loss: 0.0456
Epoch 161/400
160/160 [=====] - 0s 1ms/step - loss: 0.0487
Epoch 162/400
160/160 [=====] - 0s 1ms/step - loss: 0.0454
Epoch 163/400
160/160 [=====] - 0s 1ms/step - loss: 0.0432A: 0s - loss: 0.0
Epoch 164/400
160/160 [=====] - 0s 1ms/step - loss: 0.0441
Epoch 165/400
160/160 [=====] - 0s 1ms/step - loss: 0.0410
Epoch 166/400
160/160 [=====] - 0s 1ms/step - loss: 0.0453
Epoch 167/400
160/160 [=====] - 0s 1ms/step - loss: 0.0415
Epoch 168/400
160/160 [=====] - 0s 1ms/step - loss: 0.0437
Epoch 169/400
160/160 [=====] - 0s 1ms/step - loss: 0.0428
Epoch 170/400
160/160 [=====] - 0s 1ms/step - loss: 0.0420
Epoch 171/400
160/160 [=====] - 0s 1ms/step - loss: 0.0468

Epoch 172/400
160/160 [=====] - 0s 1ms/step - loss: 0.0403
Epoch 173/400
160/160 [=====] - 0s 1ms/step - loss: 0.0404
Epoch 174/400
160/160 [=====] - 0s 1ms/step - loss: 0.0403
Epoch 175/400
160/160 [=====] - 0s 1ms/step - loss: 0.0416
Epoch 176/400
160/160 [=====] - 0s 1ms/step - loss: 0.0398
Epoch 177/400
160/160 [=====] - 0s 1ms/step - loss: 0.0381
Epoch 178/400
160/160 [=====] - 0s 1ms/step - loss: 0.0410
Epoch 179/400
160/160 [=====] - 0s 1ms/step - loss: 0.0385
Epoch 180/400
160/160 [=====] - 0s 1ms/step - loss: 0.0382
Epoch 181/400
160/160 [=====] - 0s 1ms/step - loss: 0.0382
Epoch 182/400
160/160 [=====] - 0s 1ms/step - loss: 0.0387
Epoch 183/400
160/160 [=====] - 0s 1ms/step - loss: 0.0367
Epoch 184/400
160/160 [=====] - 0s 1ms/step - loss: 0.0367
Epoch 185/400
160/160 [=====] - 0s 1ms/step - loss: 0.0352
Epoch 186/400
160/160 [=====] - 0s 1ms/step - loss: 0.0348
Epoch 187/400
160/160 [=====] - 0s 1ms/step - loss: 0.0384
Epoch 188/400
160/160 [=====] - 0s 1ms/step - loss: 0.0381
Epoch 189/400
160/160 [=====] - 0s 1ms/step - loss: 0.0345
Epoch 190/400
160/160 [=====] - 0s 1ms/step - loss: 0.0357
Epoch 191/400
160/160 [=====] - 0s 1ms/step - loss: 0.0331
Epoch 192/400
160/160 [=====] - 0s 1ms/step - loss: 0.0358
Epoch 193/400
160/160 [=====] - 0s 1ms/step - loss: 0.0352
Epoch 194/400
160/160 [=====] - 0s 1ms/step - loss: 0.0350
Epoch 195/400
160/160 [=====] - 0s 1ms/step - loss: 0.0360

Epoch 196/400
160/160 [=====] - 0s 1ms/step - loss: 0.0347
Epoch 197/400
160/160 [=====] - 0s 1ms/step - loss: 0.0334
Epoch 198/400
160/160 [=====] - 0s 1ms/step - loss: 0.0350
Epoch 199/400
160/160 [=====] - 0s 1ms/step - loss: 0.0342
Epoch 200/400
160/160 [=====] - 0s 1ms/step - loss: 0.0329
Epoch 201/400
160/160 [=====] - 0s 1ms/step - loss: 0.0427
Epoch 202/400
160/160 [=====] - 0s 1ms/step - loss: 0.0405
Epoch 203/400
160/160 [=====] - 0s 1ms/step - loss: 0.0317
Epoch 204/400
160/160 [=====] - 0s 1ms/step - loss: 0.0323
Epoch 205/400
160/160 [=====] - 0s 1ms/step - loss: 0.0311
Epoch 206/400
160/160 [=====] - 0s 1ms/step - loss: 0.0308
Epoch 207/400
160/160 [=====] - 0s 1ms/step - loss: 0.0330
Epoch 208/400
160/160 [=====] - 0s 1ms/step - loss: 0.0328
Epoch 209/400
160/160 [=====] - 0s 1ms/step - loss: 0.0311
Epoch 210/400
160/160 [=====] - 0s 1ms/step - loss: 0.0321
Epoch 211/400
160/160 [=====] - 0s 1ms/step - loss: 0.0298
Epoch 212/400
160/160 [=====] - 0s 1ms/step - loss: 0.0315
Epoch 213/400
160/160 [=====] - 0s 1ms/step - loss: 0.0305
Epoch 214/400
160/160 [=====] - 0s 1ms/step - loss: 0.0339
Epoch 215/400
160/160 [=====] - 0s 1ms/step - loss: 0.0319
Epoch 216/400
160/160 [=====] - 0s 1ms/step - loss: 0.0310
Epoch 217/400
160/160 [=====] - 0s 1ms/step - loss: 0.0331
Epoch 218/400
160/160 [=====] - 0s 1ms/step - loss: 0.0300
Epoch 219/400
160/160 [=====] - 0s 1ms/step - loss: 0.0352

Epoch 220/400
160/160 [=====] - 0s 1ms/step - loss: 0.0357
Epoch 221/400
160/160 [=====] - 0s 2ms/step - loss: 0.0297
Epoch 222/400
160/160 [=====] - 0s 1ms/step - loss: 0.0317
Epoch 223/400
160/160 [=====] - 0s 1ms/step - loss: 0.0287
Epoch 224/400
160/160 [=====] - 0s 1ms/step - loss: 0.0258
Epoch 225/400
160/160 [=====] - 0s 1ms/step - loss: 0.0329
Epoch 226/400
160/160 [=====] - 0s 1ms/step - loss: 0.0300
Epoch 227/400
160/160 [=====] - 0s 1ms/step - loss: 0.0298
Epoch 228/400
160/160 [=====] - 0s 1ms/step - loss: 0.0302
Epoch 229/400
160/160 [=====] - 0s 1ms/step - loss: 0.0280
Epoch 230/400
160/160 [=====] - 0s 1ms/step - loss: 0.0306
Epoch 231/400
160/160 [=====] - 0s 1ms/step - loss: 0.0283
Epoch 232/400
160/160 [=====] - 0s 1ms/step - loss: 0.0309
Epoch 233/400
160/160 [=====] - 0s 1ms/step - loss: 0.0307
Epoch 234/400
160/160 [=====] - 0s 1ms/step - loss: 0.0285
Epoch 235/400
160/160 [=====] - 0s 1ms/step - loss: 0.0253
Epoch 236/400
160/160 [=====] - 0s 1ms/step - loss: 0.0274
Epoch 237/400
160/160 [=====] - 0s 1ms/step - loss: 0.0312
Epoch 238/400
160/160 [=====] - 0s 1ms/step - loss: 0.0286
Epoch 239/400
160/160 [=====] - 0s 1ms/step - loss: 0.0325
Epoch 240/400
160/160 [=====] - 0s 1ms/step - loss: 0.0296
Epoch 241/400
160/160 [=====] - 0s 1ms/step - loss: 0.0288
Epoch 242/400
160/160 [=====] - 0s 1ms/step - loss: 0.0260
Epoch 243/400
160/160 [=====] - 0s 1ms/step - loss: 0.0276

Epoch 244/400
160/160 [=====] - 0s 1ms/step - loss: 0.0303
Epoch 245/400
160/160 [=====] - 0s 1ms/step - loss: 0.0267
Epoch 246/400
160/160 [=====] - 0s 1ms/step - loss: 0.0309
Epoch 247/400
160/160 [=====] - 0s 1ms/step - loss: 0.0267
Epoch 248/400
160/160 [=====] - 0s 1ms/step - loss: 0.0335
Epoch 249/400
160/160 [=====] - 0s 1ms/step - loss: 0.0309
Epoch 250/400
160/160 [=====] - 0s 1ms/step - loss: 0.0317
Epoch 251/400
160/160 [=====] - 0s 1ms/step - loss: 0.0289
Epoch 252/400
160/160 [=====] - 0s 1ms/step - loss: 0.0307
Epoch 253/400
160/160 [=====] - 0s 1ms/step - loss: 0.0255
Epoch 254/400
160/160 [=====] - 0s 2ms/step - loss: 0.0276
Epoch 255/400
160/160 [=====] - 0s 1ms/step - loss: 0.0291
Epoch 256/400
160/160 [=====] - 0s 1ms/step - loss: 0.0269
Epoch 257/400
160/160 [=====] - 0s 1ms/step - loss: 0.0289
Epoch 258/400
160/160 [=====] - 0s 1ms/step - loss: 0.0273
Epoch 259/400
160/160 [=====] - 0s 1ms/step - loss: 0.0292
Epoch 260/400
160/160 [=====] - 0s 1ms/step - loss: 0.0301
Epoch 261/400
160/160 [=====] - 0s 1ms/step - loss: 0.0277
Epoch 262/400
160/160 [=====] - 0s 1ms/step - loss: 0.0259
Epoch 263/400
160/160 [=====] - 0s 1ms/step - loss: 0.0285
Epoch 264/400
160/160 [=====] - 0s 1ms/step - loss: 0.0280
Epoch 265/400
160/160 [=====] - 0s 1ms/step - loss: 0.0272
Epoch 266/400
160/160 [=====] - 0s 1ms/step - loss: 0.0300
Epoch 267/400
160/160 [=====] - 0s 1ms/step - loss: 0.0273

Epoch 268/400
160/160 [=====] - 0s 1ms/step - loss: 0.0263
Epoch 269/400
160/160 [=====] - 0s 1ms/step - loss: 0.0258
Epoch 270/400
160/160 [=====] - 0s 1ms/step - loss: 0.0262
Epoch 271/400
160/160 [=====] - 0s 2ms/step - loss: 0.0258
Epoch 272/400
160/160 [=====] - 0s 2ms/step - loss: 0.0288
Epoch 273/400
160/160 [=====] - 0s 1ms/step - loss: 0.0258
Epoch 274/400
160/160 [=====] - 0s 1ms/step - loss: 0.0282
Epoch 275/400
160/160 [=====] - 0s 1ms/step - loss: 0.0266
Epoch 276/400
160/160 [=====] - 0s 1ms/step - loss: 0.0259
Epoch 277/400
160/160 [=====] - 0s 1ms/step - loss: 0.0249
Epoch 278/400
160/160 [=====] - 0s 1ms/step - loss: 0.0243
Epoch 279/400
160/160 [=====] - 0s 1ms/step - loss: 0.0248
Epoch 280/400
160/160 [=====] - 0s 1ms/step - loss: 0.0289
Epoch 281/400
160/160 [=====] - 0s 1ms/step - loss: 0.0273
Epoch 282/400
160/160 [=====] - 0s 1ms/step - loss: 0.0271
Epoch 283/400
160/160 [=====] - 0s 1ms/step - loss: 0.0278
Epoch 284/400
160/160 [=====] - 0s 1ms/step - loss: 0.0265
Epoch 285/400
160/160 [=====] - 0s 1ms/step - loss: 0.0253
Epoch 286/400
160/160 [=====] - 0s 1ms/step - loss: 0.0303
Epoch 287/400
160/160 [=====] - 0s 1ms/step - loss: 0.0253
Epoch 288/400
160/160 [=====] - 0s 1ms/step - loss: 0.0274
Epoch 289/400
160/160 [=====] - 0s 1ms/step - loss: 0.0285
Epoch 290/400
160/160 [=====] - 0s 1ms/step - loss: 0.0275
Epoch 291/400
160/160 [=====] - 0s 1ms/step - loss: 0.0256

Epoch 292/400
160/160 [=====] - 0s 1ms/step - loss: 0.0232
Epoch 293/400
160/160 [=====] - 0s 1ms/step - loss: 0.0279
Epoch 294/400
160/160 [=====] - 0s 1ms/step - loss: 0.0286
Epoch 295/400
160/160 [=====] - 0s 1ms/step - loss: 0.0277
Epoch 296/400
160/160 [=====] - 0s 1ms/step - loss: 0.0248
Epoch 297/400
160/160 [=====] - 0s 1ms/step - loss: 0.0245
Epoch 298/400
160/160 [=====] - 0s 1ms/step - loss: 0.0282
Epoch 299/400
160/160 [=====] - 0s 1ms/step - loss: 0.0260
Epoch 300/400
160/160 [=====] - 0s 1ms/step - loss: 0.0250
Epoch 301/400
160/160 [=====] - 0s 1ms/step - loss: 0.0270
Epoch 302/400
160/160 [=====] - 0s 1ms/step - loss: 0.0258
Epoch 303/400
160/160 [=====] - 0s 1ms/step - loss: 0.0247
Epoch 304/400
160/160 [=====] - 0s 1ms/step - loss: 0.0219
Epoch 305/400
160/160 [=====] - 0s 1ms/step - loss: 0.0248
Epoch 306/400
160/160 [=====] - 0s 2ms/step - loss: 0.0254
Epoch 307/400
160/160 [=====] - 0s 2ms/step - loss: 0.0275
Epoch 308/400
160/160 [=====] - 0s 1ms/step - loss: 0.0292
Epoch 309/400
160/160 [=====] - 0s 1ms/step - loss: 0.0254
Epoch 310/400
160/160 [=====] - 0s 1ms/step - loss: 0.0266
Epoch 311/400
160/160 [=====] - 0s 2ms/step - loss: 0.0268
Epoch 312/400
160/160 [=====] - 0s 2ms/step - loss: 0.0270
Epoch 313/400
160/160 [=====] - 0s 1ms/step - loss: 0.0305
Epoch 314/400
160/160 [=====] - 0s 1ms/step - loss: 0.0251
Epoch 315/400
160/160 [=====] - 0s 2ms/step - loss: 0.0265

Epoch 316/400
160/160 [=====] - 0s 2ms/step - loss: 0.0244
Epoch 317/400
160/160 [=====] - 0s 2ms/step - loss: 0.0251
Epoch 318/400
160/160 [=====] - 0s 2ms/step - loss: 0.0266
Epoch 319/400
160/160 [=====] - 0s 2ms/step - loss: 0.0272
Epoch 320/400
160/160 [=====] - 0s 1ms/step - loss: 0.0254
Epoch 321/400
160/160 [=====] - 0s 1ms/step - loss: 0.0251
Epoch 322/400
160/160 [=====] - 0s 1ms/step - loss: 0.0253
Epoch 323/400
160/160 [=====] - 0s 2ms/step - loss: 0.0272
Epoch 324/400
160/160 [=====] - 0s 1ms/step - loss: 0.0239
Epoch 325/400
160/160 [=====] - 0s 2ms/step - loss: 0.0278
Epoch 326/400
160/160 [=====] - 0s 1ms/step - loss: 0.0226
Epoch 327/400
160/160 [=====] - 0s 1ms/step - loss: 0.0226
Epoch 328/400
160/160 [=====] - 0s 1ms/step - loss: 0.0245
Epoch 329/400
160/160 [=====] - 0s 2ms/step - loss: 0.0270
Epoch 330/400
160/160 [=====] - 0s 2ms/step - loss: 0.0253
Epoch 331/400
160/160 [=====] - 0s 2ms/step - loss: 0.0257
Epoch 332/400
160/160 [=====] - 0s 1ms/step - loss: 0.0267
Epoch 333/400
160/160 [=====] - 0s 1ms/step - loss: 0.0258
Epoch 334/400
160/160 [=====] - 0s 1ms/step - loss: 0.0255
Epoch 335/400
160/160 [=====] - 0s 1ms/step - loss: 0.0236
Epoch 336/400
160/160 [=====] - 0s 1ms/step - loss: 0.0241
Epoch 337/400
160/160 [=====] - 0s 2ms/step - loss: 0.0270
Epoch 338/400
160/160 [=====] - 0s 1ms/step - loss: 0.0242
Epoch 339/400
160/160 [=====] - 0s 1ms/step - loss: 0.0234

Epoch 340/400
160/160 [=====] - 0s 1ms/step - loss: 0.0251
Epoch 341/400
160/160 [=====] - 0s 1ms/step - loss: 0.0289
Epoch 342/400
160/160 [=====] - 0s 1ms/step - loss: 0.0253
Epoch 343/400
160/160 [=====] - 0s 1ms/step - loss: 0.0254
Epoch 344/400
160/160 [=====] - 0s 1ms/step - loss: 0.0252
Epoch 345/400
160/160 [=====] - 0s 2ms/step - loss: 0.0251
Epoch 346/400
160/160 [=====] - 0s 2ms/step - loss: 0.0237
Epoch 347/400
160/160 [=====] - 0s 2ms/step - loss: 0.0241
Epoch 348/400
160/160 [=====] - 0s 2ms/step - loss: 0.0271
Epoch 349/400
160/160 [=====] - 0s 1ms/step - loss: 0.0267
Epoch 350/400
160/160 [=====] - 0s 1ms/step - loss: 0.0244
Epoch 351/400
160/160 [=====] - 0s 2ms/step - loss: 0.0230
Epoch 352/400
160/160 [=====] - 0s 1ms/step - loss: 0.0251
Epoch 353/400
160/160 [=====] - ETA: 0s - loss: 0.031 - 0s 2ms/step - loss: 0.0248
Epoch 354/400
160/160 [=====] - 0s 1ms/step - loss: 0.0244
Epoch 355/400
160/160 [=====] - 0s 1ms/step - loss: 0.0250
Epoch 356/400
160/160 [=====] - 0s 1ms/step - loss: 0.0234
Epoch 357/400
160/160 [=====] - 0s 1ms/step - loss: 0.0223
Epoch 358/400
160/160 [=====] - 0s 1ms/step - loss: 0.0252
Epoch 359/400
160/160 [=====] - 0s 2ms/step - loss: 0.0237
Epoch 360/400
160/160 [=====] - 0s 1ms/step - loss: 0.0246
Epoch 361/400
160/160 [=====] - 0s 1ms/step - loss: 0.0208
Epoch 362/400
160/160 [=====] - 0s 1ms/step - loss: 0.0258
Epoch 363/400
160/160 [=====] - 0s 1ms/step - loss: 0.0271

Epoch 364/400
160/160 [=====] - 0s 2ms/step - loss: 0.0236
Epoch 365/400
160/160 [=====] - 0s 2ms/step - loss: 0.0242
Epoch 366/400
160/160 [=====] - 0s 2ms/step - loss: 0.0209
Epoch 367/400
160/160 [=====] - 0s 1ms/step - loss: 0.0250
Epoch 368/400
160/160 [=====] - 0s 2ms/step - loss: 0.0280
Epoch 369/400
160/160 [=====] - 0s 1ms/step - loss: 0.0263
Epoch 370/400
160/160 [=====] - 0s 1ms/step - loss: 0.0230
Epoch 371/400
160/160 [=====] - 0s 1ms/step - loss: 0.0228
Epoch 372/400
160/160 [=====] - 0s 1ms/step - loss: 0.0237
Epoch 373/400
160/160 [=====] - 0s 2ms/step - loss: 0.0269
Epoch 374/400
160/160 [=====] - 0s 1ms/step - loss: 0.0268
Epoch 375/400
160/160 [=====] - 0s 1ms/step - loss: 0.0230
Epoch 376/400
160/160 [=====] - 0s 2ms/step - loss: 0.0239
Epoch 377/400
160/160 [=====] - 0s 1ms/step - loss: 0.0289
Epoch 378/400
160/160 [=====] - 0s 1ms/step - loss: 0.0248
Epoch 379/400
160/160 [=====] - 0s 1ms/step - loss: 0.0222
Epoch 380/400
160/160 [=====] - 0s 1ms/step - loss: 0.0220
Epoch 381/400
160/160 [=====] - 0s 2ms/step - loss: 0.0250
Epoch 382/400
160/160 [=====] - 0s 2ms/step - loss: 0.0261
Epoch 383/400
160/160 [=====] - 0s 2ms/step - loss: 0.0229
Epoch 384/400
160/160 [=====] - 0s 1ms/step - loss: 0.0243
Epoch 385/400
160/160 [=====] - 0s 1ms/step - loss: 0.0227
Epoch 386/400
160/160 [=====] - 0s 1ms/step - loss: 0.0246
Epoch 387/400
160/160 [=====] - 0s 1ms/step - loss: 0.0238

```

Epoch 388/400
160/160 [=====] - 0s 1ms/step - loss: 0.0256
Epoch 389/400
160/160 [=====] - 0s 1ms/step - loss: 0.0254
Epoch 390/400
160/160 [=====] - 0s 2ms/step - loss: 0.0237
Epoch 391/400
160/160 [=====] - 0s 2ms/step - loss: 0.0220
Epoch 392/400
160/160 [=====] - 0s 2ms/step - loss: 0.0226
Epoch 393/400
160/160 [=====] - 0s 2ms/step - loss: 0.0234
Epoch 394/400
160/160 [=====] - 0s 1ms/step - loss: 0.0229
Epoch 395/400
160/160 [=====] - 0s 1ms/step - loss: 0.0223
Epoch 396/400
160/160 [=====] - 0s 1ms/step - loss: 0.0235
Epoch 397/400
160/160 [=====] - 0s 1ms/step - loss: 0.0232
Epoch 398/400
160/160 [=====] - 0s 2ms/step - loss: 0.0223
Epoch 399/400
160/160 [=====] - 0s 1ms/step - loss: 0.0255
Epoch 400/400
160/160 [=====] - 0s 2ms/step - loss: 0.0264

```

```

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '

```

```

[ 0.9992188  0.99915177 0.9993765  0.99917084 0.99925905 0.9993655
 0.99925524 0.9992198  0.9990475  0.99937725 0.9992236 0.9992264
 0.9993923  0.9989292  0.9993945  0.696443  0.99767804 0.999383
 0.99928784 0.98631245 0.99939454 0.9993393  0.981713  0.9990904
 0.9993126  0.99951047 0.99940485 0.9993846  0.9993747 0.999306
 0.9994755  0.993668  0.9992382  0.9992974  0.99941564 0.9992654
 0.99672663 0.9993419  0.99911594 0.9993574  0.9982493 0.9998286
 0.9998334  0.99983037 0.9998359  0.99983376 0.99983585 0.99543095
 0.9997912  0.99983263 0.99983454 0.9998346  0.99983126 0.9958145
 0.9998309  0.38315392 0.9994732  0.99983245 0.9998364  0.8538378
 0.99982893 0.9998346  0.9761405  0.9998188  0.99983615 0.9997744
 0.9998275  0.9998297  0.99983156 0.99983734 0.9997498 0.99523807
 0.99983066 0.99983734 0.9998261  0.9998361  0.99878395 0.9998348
 0.9998229  0.9998324  -0.36023003 -0.13450482 -0.12644781 -0.13352673
-0.12717056 -0.10962966 -0.13987471 -0.3283572 -0.20903239 -0.11220459
-0.12918799 -0.1280944  -0.14075574 -0.3554906  -0.19428855 0.35089666

```

```

-0.17190796 -0.12074572 -0.12015808  0.00243228 -0.0938195  -0.10676962
-0.09794294 -0.14532833 -0.11346542 -0.30777726 -0.09981524 -0.08977242
-0.09556692 -0.13777708 -0.23106438 -0.13549764 -0.17280231 -0.13744609
-0.13884966 -0.12252983 -0.1048432  -0.18944566 -0.14246    -0.21037163
-0.5084985  -0.7178195  -0.72213805 -0.71865416 -0.72073823 -0.72494584
-0.71831954 -0.53946877 -0.66716063 -0.72459346 -0.7203861  -0.7204696
-0.7195914  -0.4852853  -0.7054263   0.6553131  -0.46301383 -0.72320455
-0.7226618  -0.13680653 -0.72744447 -0.7254686  -0.2685078  -0.7148881
-0.7241308  -0.5506384  -0.7266353  -0.7280492  -0.72716707 -0.71927214
-0.70057124 -0.6832334  -0.7080784  -0.7192662  -0.7203325  -0.72203964
-0.67378306 -0.7046878  -0.71600634 -0.6950429 ]
160/160 [=====] - 0s 3ms/step

```

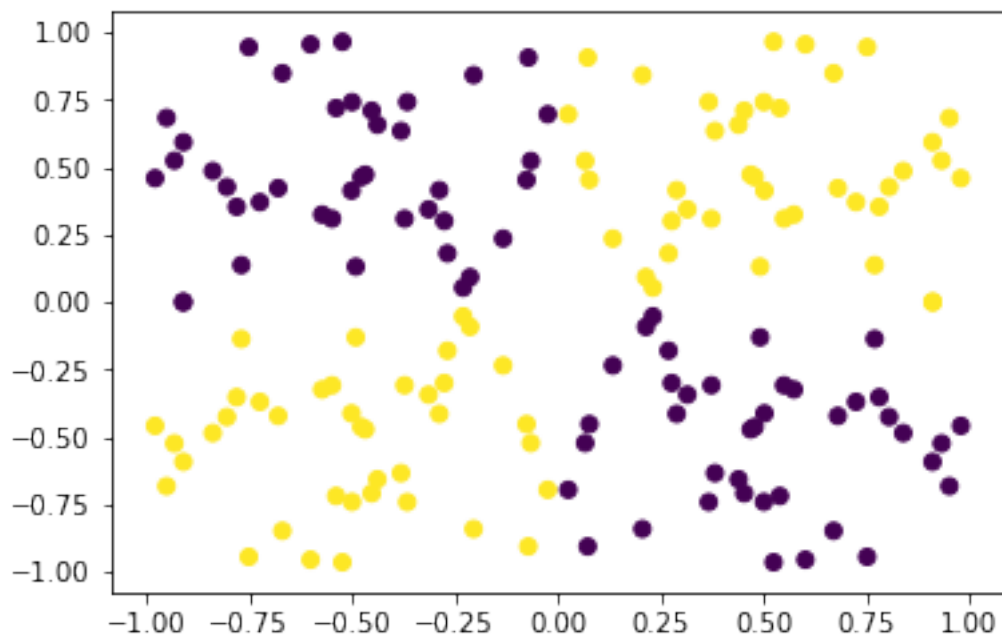
```
In [144]: scores, model.metrics_names
```

```
# Adam performed better
```

```
Out[144]: (0.01933567062660586, ['loss'])
```

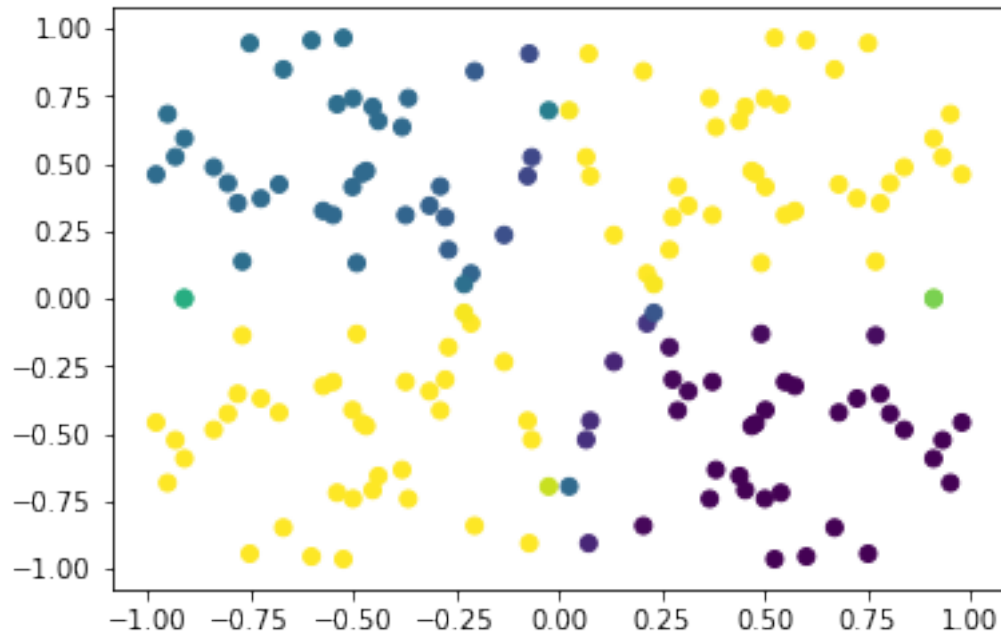
```
In [145]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[145]: <matplotlib.collections.PathCollection at 0xb32261240>
```



```
In [146]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

Out[146]: <matplotlib.collections.PathCollection at 0xb323695f8>



```
In [147]: from keras.optimizers import Adamax
# Using other optimizers with best performing model
model = Sequential()

model.add(Dense(4, input_dim=2, activation='tanh'))
model.add(Dense(4, activation='tanh'))
model.add(Dense(4, activation='tanh'))
model.add(Dense(4, activation='tanh'))

# The output has 1 neuron for predicting whatever we are iterating
model.add(Dense(1, activation='tanh'))

adamax = Adamax(lr=0.002)
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))

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

Epoch 1/400

160/160 [=====] - 2s 11ms/step - loss: 4.2837

Epoch 2/400

160/160 [=====] - 0s 1ms/step - loss: 4.2506

Epoch 3/400
160/160 [=====] - 0s 1ms/step - loss: 4.2304
Epoch 4/400
160/160 [=====] - 0s 1ms/step - loss: 4.2150
Epoch 5/400
160/160 [=====] - 0s 1ms/step - loss: 4.2071
Epoch 6/400
160/160 [=====] - 0s 1ms/step - loss: 4.1969
Epoch 7/400
160/160 [=====] - 0s 2ms/step - loss: 4.1993
Epoch 8/400
160/160 [=====] - 0s 1ms/step - loss: 4.1956
Epoch 9/400
160/160 [=====] - 0s 1ms/step - loss: 4.1971
Epoch 10/400
160/160 [=====] - 0s 1ms/step - loss: 4.1852
Epoch 11/400
160/160 [=====] - 0s 1ms/step - loss: 4.1824
Epoch 12/400
160/160 [=====] - 0s 1ms/step - loss: 4.1789
Epoch 13/400
160/160 [=====] - 0s 1ms/step - loss: 4.1825
Epoch 14/400
160/160 [=====] - 0s 2ms/step - loss: 4.1758
Epoch 15/400
160/160 [=====] - 0s 1ms/step - loss: 4.1738
Epoch 16/400
160/160 [=====] - 0s 1ms/step - loss: 4.1751
Epoch 17/400
160/160 [=====] - 0s 2ms/step - loss: 4.1688
Epoch 18/400
160/160 [=====] - 0s 1ms/step - loss: 4.1621
Epoch 19/400
160/160 [=====] - 0s 1ms/step - loss: 4.1631
Epoch 20/400
160/160 [=====] - 0s 1ms/step - loss: 4.1601
Epoch 21/400
160/160 [=====] - 0s 1ms/step - loss: 4.1535
Epoch 22/400
160/160 [=====] - 0s 1ms/step - loss: 4.1494
Epoch 23/400
160/160 [=====] - 0s 1ms/step - loss: 4.1469
Epoch 24/400
160/160 [=====] - 0s 2ms/step - loss: 4.1423
Epoch 25/400
160/160 [=====] - 0s 2ms/step - loss: 4.1414
Epoch 26/400
160/160 [=====] - 0s 1ms/step - loss: 4.1323

Epoch 27/400
160/160 [=====] - 0s 1ms/step - loss: 4.1289
Epoch 28/400
160/160 [=====] - 0s 2ms/step - loss: 4.1226
Epoch 29/400
160/160 [=====] - 0s 1ms/step - loss: 4.1218
Epoch 30/400
160/160 [=====] - 0s 2ms/step - loss: 4.1153
Epoch 31/400
160/160 [=====] - 0s 1ms/step - loss: 4.1103
Epoch 32/400
160/160 [=====] - 0s 2ms/step - loss: 4.1074
Epoch 33/400
160/160 [=====] - 0s 2ms/step - loss: 4.1034
Epoch 34/400
160/160 [=====] - 0s 1ms/step - loss: 4.1012
Epoch 35/400
160/160 [=====] - 0s 1ms/step - loss: 4.0978
Epoch 36/400
160/160 [=====] - 0s 2ms/step - loss: 4.0942
Epoch 37/400
160/160 [=====] - 0s 2ms/step - loss: 4.0932
Epoch 38/400
160/160 [=====] - 0s 2ms/step - loss: 4.0886
Epoch 39/400
160/160 [=====] - 0s 2ms/step - loss: 4.0872
Epoch 40/400
160/160 [=====] - 0s 1ms/step - loss: 4.0843
Epoch 41/400
160/160 [=====] - 0s 2ms/step - loss: 4.0813
Epoch 42/400
160/160 [=====] - 0s 2ms/step - loss: 4.0801
Epoch 43/400
160/160 [=====] - 0s 1ms/step - loss: 4.0795
Epoch 44/400
160/160 [=====] - 0s 1ms/step - loss: 4.0767
Epoch 45/400
160/160 [=====] - 0s 1ms/step - loss: 4.0743
Epoch 46/400
160/160 [=====] - 0s 1ms/step - loss: 4.0726
Epoch 47/400
160/160 [=====] - 0s 1ms/step - loss: 4.0711
Epoch 48/400
160/160 [=====] - 0s 1ms/step - loss: 4.0686
Epoch 49/400
160/160 [=====] - 0s 2ms/step - loss: 4.0690
Epoch 50/400
160/160 [=====] - 0s 2ms/step - loss: 4.0664

Epoch 51/400
160/160 [=====] - 0s 1ms/step - loss: 4.0677
Epoch 52/400
160/160 [=====] - 0s 1ms/step - loss: 4.0658
Epoch 53/400
160/160 [=====] - 0s 1ms/step - loss: 4.0648
Epoch 54/400
160/160 [=====] - 0s 1ms/step - loss: 4.0620
Epoch 55/400
160/160 [=====] - 0s 1ms/step - loss: 4.0621
Epoch 56/400
160/160 [=====] - 0s 1ms/step - loss: 4.0592
Epoch 57/400
160/160 [=====] - 0s 1ms/step - loss: 4.0587
Epoch 58/400
160/160 [=====] - 0s 2ms/step - loss: 4.0588
Epoch 59/400
160/160 [=====] - 0s 1ms/step - loss: 4.0576
Epoch 60/400
160/160 [=====] - 0s 1ms/step - loss: 4.0561
Epoch 61/400
160/160 [=====] - 0s 1ms/step - loss: 4.0564
Epoch 62/400
160/160 [=====] - 0s 1ms/step - loss: 4.0547
Epoch 63/400
160/160 [=====] - 0s 1ms/step - loss: 4.0544
Epoch 64/400
160/160 [=====] - 0s 2ms/step - loss: 4.0544
Epoch 65/400
160/160 [=====] - 0s 1ms/step - loss: 4.0533
Epoch 66/400
160/160 [=====] - 0s 1ms/step - loss: 4.0547
Epoch 67/400
160/160 [=====] - 0s 2ms/step - loss: 4.0524
Epoch 68/400
160/160 [=====] - 0s 1ms/step - loss: 4.0509
Epoch 69/400
160/160 [=====] - 0s 1ms/step - loss: 4.0515
Epoch 70/400
160/160 [=====] - 0s 1ms/step - loss: 4.0508
Epoch 71/400
160/160 [=====] - 0s 1ms/step - loss: 4.0487
Epoch 72/400
160/160 [=====] - 0s 1ms/step - loss: 4.0510
Epoch 73/400
160/160 [=====] - 0s 1ms/step - loss: 4.0493
Epoch 74/400
160/160 [=====] - 0s 1ms/step - loss: 4.0511

Epoch 75/400
160/160 [=====] - 0s 1ms/step - loss: 4.0499
Epoch 76/400
160/160 [=====] - 0s 1ms/step - loss: 4.0492
Epoch 77/400
160/160 [=====] - 0s 1ms/step - loss: 4.0481
Epoch 78/400
160/160 [=====] - 0s 1ms/step - loss: 4.0503
Epoch 79/400
160/160 [=====] - 0s 1ms/step - loss: 4.0494
Epoch 80/400
160/160 [=====] - 0s 2ms/step - loss: 4.0473
Epoch 81/400
160/160 [=====] - 0s 1ms/step - loss: 4.0490
Epoch 82/400
160/160 [=====] - 0s 2ms/step - loss: 4.0478
Epoch 83/400
160/160 [=====] - 0s 1ms/step - loss: 4.0480
Epoch 84/400
160/160 [=====] - 0s 2ms/step - loss: 4.0479
Epoch 85/400
160/160 [=====] - 0s 1ms/step - loss: 4.0482
Epoch 86/400
160/160 [=====] - 0s 1ms/step - loss: 4.0499
Epoch 87/400
160/160 [=====] - 0s 2ms/step - loss: 4.0464
Epoch 88/400
160/160 [=====] - 0s 1ms/step - loss: 4.0493
Epoch 89/400
160/160 [=====] - 0s 1ms/step - loss: 4.0480
Epoch 90/400
160/160 [=====] - 0s 1ms/step - loss: 4.0474
Epoch 91/400
160/160 [=====] - 0s 1ms/step - loss: 4.0470
Epoch 92/400
160/160 [=====] - 0s 1ms/step - loss: 4.0488
Epoch 93/400
160/160 [=====] - 0s 1ms/step - loss: 4.0444
Epoch 94/400
160/160 [=====] - 0s 1ms/step - loss: 4.0474
Epoch 95/400
160/160 [=====] - 0s 1ms/step - loss: 4.0484
Epoch 96/400
160/160 [=====] - 0s 1ms/step - loss: 4.0458
Epoch 97/400
160/160 [=====] - 0s 1ms/step - loss: 4.0483
Epoch 98/400
160/160 [=====] - 0s 1ms/step - loss: 4.0452

Epoch 99/400
160/160 [=====] - 0s 1ms/step - loss: 4.0448
Epoch 100/400
160/160 [=====] - 0s 1ms/step - loss: 4.0457
Epoch 101/400
160/160 [=====] - 0s 1ms/step - loss: 4.0465
Epoch 102/400
160/160 [=====] - 0s 1ms/step - loss: 4.0465
Epoch 103/400
160/160 [=====] - 0s 2ms/step - loss: 4.0459
Epoch 104/400
160/160 [=====] - 0s 1ms/step - loss: 4.0448
Epoch 105/400
160/160 [=====] - 0s 2ms/step - loss: 4.0435
Epoch 106/400
160/160 [=====] - 0s 1ms/step - loss: 4.0448
Epoch 107/400
160/160 [=====] - 0s 1ms/step - loss: 4.0452
Epoch 108/400
160/160 [=====] - 0s 1ms/step - loss: 4.0436
Epoch 109/400
160/160 [=====] - 0s 1ms/step - loss: 4.0429
Epoch 110/400
160/160 [=====] - 0s 1ms/step - loss: 4.0448
Epoch 111/400
160/160 [=====] - 0s 1ms/step - loss: 4.0445
Epoch 112/400
160/160 [=====] - 0s 1ms/step - loss: 4.0441
Epoch 113/400
160/160 [=====] - 0s 1ms/step - loss: 4.0442
Epoch 114/400
160/160 [=====] - 0s 1ms/step - loss: 4.0447
Epoch 115/400
160/160 [=====] - 0s 1ms/step - loss: 4.0435
Epoch 116/400
160/160 [=====] - 0s 1ms/step - loss: 4.0460
Epoch 117/400
160/160 [=====] - 0s 1ms/step - loss: 4.0457
Epoch 118/400
160/160 [=====] - 0s 1ms/step - loss: 4.0448
Epoch 119/400
160/160 [=====] - 0s 2ms/step - loss: 4.0434
Epoch 120/400
160/160 [=====] - 0s 2ms/step - loss: 4.0443
Epoch 121/400
160/160 [=====] - 0s 2ms/step - loss: 4.0428
Epoch 122/400
160/160 [=====] - 0s 1ms/step - loss: 4.0435

Epoch 123/400
160/160 [=====] - 0s 1ms/step - loss: 4.0429
Epoch 124/400
160/160 [=====] - 0s 1ms/step - loss: 4.0430
Epoch 125/400
160/160 [=====] - 0s 1ms/step - loss: 4.0425
Epoch 126/400
160/160 [=====] - 0s 1ms/step - loss: 4.0440
Epoch 127/400
160/160 [=====] - 0s 1ms/step - loss: 4.0428
Epoch 128/400
160/160 [=====] - 0s 1ms/step - loss: 4.0443
Epoch 129/400
160/160 [=====] - 0s 2ms/step - loss: 4.0414
Epoch 130/400
160/160 [=====] - 0s 2ms/step - loss: 4.0423
Epoch 131/400
160/160 [=====] - 0s 1ms/step - loss: 4.0424
Epoch 132/400
160/160 [=====] - 0s 1ms/step - loss: 4.0421
Epoch 133/400
160/160 [=====] - 0s 1ms/step - loss: 4.0422
Epoch 134/400
160/160 [=====] - 0s 1ms/step - loss: 4.0431
Epoch 135/400
160/160 [=====] - 0s 1ms/step - loss: 4.0434
Epoch 136/400
160/160 [=====] - 0s 1ms/step - loss: 4.0426
Epoch 137/400
160/160 [=====] - 0s 1ms/step - loss: 4.0420
Epoch 138/400
160/160 [=====] - 0s 2ms/step - loss: 4.0428
Epoch 139/400
160/160 [=====] - 0s 1ms/step - loss: 4.0411
Epoch 140/400
160/160 [=====] - 0s 1ms/step - loss: 4.0416
Epoch 141/400
160/160 [=====] - 0s 1ms/step - loss: 4.0415
Epoch 142/400
160/160 [=====] - 0s 1ms/step - loss: 4.0411
Epoch 143/400
160/160 [=====] - 0s 1ms/step - loss: 4.0416
Epoch 144/400
160/160 [=====] - 0s 1ms/step - loss: 4.0414
Epoch 145/400
160/160 [=====] - 0s 1ms/step - loss: 4.0428
Epoch 146/400
160/160 [=====] - 0s 1ms/step - loss: 4.0408

Epoch 147/400
160/160 [=====] - 0s 1ms/step - loss: 4.0429
Epoch 148/400
160/160 [=====] - 0s 1ms/step - loss: 4.0423
Epoch 149/400
160/160 [=====] - 0s 1ms/step - loss: 4.0418
Epoch 150/400
160/160 [=====] - 0s 1ms/step - loss: 4.0424
Epoch 151/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 152/400
160/160 [=====] - 0s 1ms/step - loss: 4.0437
Epoch 153/400
160/160 [=====] - 0s 2ms/step - loss: 4.0413
Epoch 154/400
160/160 [=====] - 0s 1ms/step - loss: 4.0425
Epoch 155/400
160/160 [=====] - 0s 2ms/step - loss: 4.0413
Epoch 156/400
160/160 [=====] - 0s 1ms/step - loss: 4.0410
Epoch 157/400
160/160 [=====] - 0s 1ms/step - loss: 4.0409
Epoch 158/400
160/160 [=====] - 0s 1ms/step - loss: 4.0411
Epoch 159/400
160/160 [=====] - 0s 1ms/step - loss: 4.0417
Epoch 160/400
160/160 [=====] - 0s 1ms/step - loss: 4.0422
Epoch 161/400
160/160 [=====] - 0s 1ms/step - loss: 4.0415
Epoch 162/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 163/400
160/160 [=====] - 0s 1ms/step - loss: 4.0404
Epoch 164/400
160/160 [=====] - 0s 1ms/step - loss: 4.0419
Epoch 165/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 166/400
160/160 [=====] - 0s 1ms/step - loss: 4.0416
Epoch 167/400
160/160 [=====] - 0s 1ms/step - loss: 4.0413
Epoch 168/400
160/160 [=====] - 0s 1ms/step - loss: 4.0410
Epoch 169/400
160/160 [=====] - 0s 1ms/step - loss: 4.0409
Epoch 170/400
160/160 [=====] - 0s 1ms/step - loss: 4.0410

Epoch 171/400
160/160 [=====] - 0s 1ms/step - loss: 4.0401
Epoch 172/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 173/400
160/160 [=====] - 0s 1ms/step - loss: 4.0408
Epoch 174/400
160/160 [=====] - 0s 1ms/step - loss: 4.0403
Epoch 175/400
160/160 [=====] - 0s 1ms/step - loss: 4.0413
Epoch 176/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405
Epoch 177/400
160/160 [=====] - 0s 1ms/step - loss: 4.0408
Epoch 178/400
160/160 [=====] - 0s 1ms/step - loss: 4.0408
Epoch 179/400
160/160 [=====] - 0s 1ms/step - loss: 4.0427
Epoch 180/400
160/160 [=====] - 0s 1ms/step - loss: 4.0413
Epoch 181/400
160/160 [=====] - 0s 1ms/step - loss: 4.0408
Epoch 182/400
160/160 [=====] - 0s 1ms/step - loss: 4.0412
Epoch 183/400
160/160 [=====] - 0s 1ms/step - loss: 4.0411
Epoch 184/400
160/160 [=====] - 0s 1ms/step - loss: 4.0408
Epoch 185/400
160/160 [=====] - 0s 1ms/step - loss: 4.0410
Epoch 186/400
160/160 [=====] - 0s 1ms/step - loss: 4.0424
Epoch 187/400
160/160 [=====] - 0s 1ms/step - loss: 4.0386
Epoch 188/400
160/160 [=====] - 0s 1ms/step - loss: 4.0406
Epoch 189/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405
Epoch 190/400
160/160 [=====] - 0s 1ms/step - loss: 4.0407
Epoch 191/400
160/160 [=====] - 0s 1ms/step - loss: 4.0411
Epoch 192/400
160/160 [=====] - 0s 1ms/step - loss: 4.0403
Epoch 193/400
160/160 [=====] - 0s 1ms/step - loss: 4.0420
Epoch 194/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405

Epoch 195/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405
Epoch 196/400
160/160 [=====] - 0s 1ms/step - loss: 4.0406
Epoch 197/400
160/160 [=====] - 0s 1ms/step - loss: 4.0423
Epoch 198/400
160/160 [=====] - 0s 1ms/step - loss: 4.0407
Epoch 199/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 200/400
160/160 [=====] - 0s 1ms/step - loss: 4.0390
Epoch 201/400
160/160 [=====] - 0s 1ms/step - loss: 4.0414
Epoch 202/400
160/160 [=====] - 0s 1ms/step - loss: 4.0410
Epoch 203/400
160/160 [=====] - 0s 1ms/step - loss: 4.0398
Epoch 204/400
160/160 [=====] - 0s 1ms/step - loss: 4.0392
Epoch 205/400
160/160 [=====] - 0s 1ms/step - loss: 4.0402
Epoch 206/400
160/160 [=====] - 0s 1ms/step - loss: 4.0431
Epoch 207/400
160/160 [=====] - 0s 1ms/step - loss: 4.0406
Epoch 208/400
160/160 [=====] - 0s 1ms/step - loss: 4.0407
Epoch 209/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405
Epoch 210/400
160/160 [=====] - 0s 1ms/step - loss: 4.0406
Epoch 211/400
160/160 [=====] - 0s 1ms/step - loss: 4.0421
Epoch 212/400
160/160 [=====] - 0s 1ms/step - loss: 4.0392
Epoch 213/400
160/160 [=====] - 0s 1ms/step - loss: 4.0404
Epoch 214/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405
Epoch 215/400
160/160 [=====] - 0s 1ms/step - loss: 4.0407
Epoch 216/400
160/160 [=====] - 0s 1ms/step - loss: 4.0420
Epoch 217/400
160/160 [=====] - 0s 1ms/step - loss: 4.0412
Epoch 218/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399

Epoch 219/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405
Epoch 220/400
160/160 [=====] - 0s 1ms/step - loss: 4.0403
Epoch 221/400
160/160 [=====] - 0s 1ms/step - loss: 4.0419
Epoch 222/400
160/160 [=====] - 0s 1ms/step - loss: 4.0425
Epoch 223/400
160/160 [=====] - 0s 1ms/step - loss: 4.0392
Epoch 224/400
160/160 [=====] - 0s 1ms/step - loss: 4.0401
Epoch 225/400
160/160 [=====] - 0s 1ms/step - loss: 4.0389
Epoch 226/400
160/160 [=====] - 0s 1ms/step - loss: 4.0408
Epoch 227/400
160/160 [=====] - 0s 1ms/step - loss: 4.0414
Epoch 228/400
160/160 [=====] - 0s 1ms/step - loss: 4.0416
Epoch 229/400
160/160 [=====] - 0s 1ms/step - loss: 4.0402
Epoch 230/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 231/400
160/160 [=====] - 0s 1ms/step - loss: 4.0407
Epoch 232/400
160/160 [=====] - 0s 1ms/step - loss: 4.0398
Epoch 233/400
160/160 [=====] - 0s 1ms/step - loss: 4.0404
Epoch 234/400
160/160 [=====] - 0s 1ms/step - loss: 4.0416
Epoch 235/400
160/160 [=====] - 0s 1ms/step - loss: 4.0403
Epoch 236/400
160/160 [=====] - 0s 2ms/step - loss: 4.0402
Epoch 237/400
160/160 [=====] - 0s 2ms/step - loss: 4.0393
Epoch 238/400
160/160 [=====] - 0s 1ms/step - loss: 4.0390
Epoch 239/400
160/160 [=====] - 0s 1ms/step - loss: 4.0402
Epoch 240/400
160/160 [=====] - 0s 1ms/step - loss: 4.0402
Epoch 241/400
160/160 [=====] - 0s 1ms/step - loss: 4.0420
Epoch 242/400
160/160 [=====] - 0s 1ms/step - loss: 4.0404

Epoch 243/400
160/160 [=====] - 0s 2ms/step - loss: 4.0396
Epoch 244/400
160/160 [=====] - 0s 1ms/step - loss: 4.0409
Epoch 245/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405
Epoch 246/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 247/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 248/400
160/160 [=====] - 0s 1ms/step - loss: 4.0415
Epoch 249/400
160/160 [=====] - 0s 1ms/step - loss: 4.0396
Epoch 250/400
160/160 [=====] - 0s 1ms/step - loss: 4.0412
Epoch 251/400
160/160 [=====] - 0s 2ms/step - loss: 4.0397
Epoch 252/400
160/160 [=====] - 0s 2ms/step - loss: 4.0400
Epoch 253/400
160/160 [=====] - 0s 2ms/step - loss: 4.0405
Epoch 254/400
160/160 [=====] - 0s 2ms/step - loss: 4.0393
Epoch 255/400
160/160 [=====] - 0s 2ms/step - loss: 4.0421
Epoch 256/400
160/160 [=====] - 0s 2ms/step - loss: 4.0403
Epoch 257/400
160/160 [=====] - 0s 2ms/step - loss: 4.0399
Epoch 258/400
160/160 [=====] - 0s 2ms/step - loss: 4.0402
Epoch 259/400
160/160 [=====] - 0s 2ms/step - loss: 4.0390
Epoch 260/400
160/160 [=====] - 0s 2ms/step - loss: 4.0383
Epoch 261/400
160/160 [=====] - 0s 2ms/step - loss: 4.0415
Epoch 262/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 263/400
160/160 [=====] - 0s 1ms/step - loss: 4.0410
Epoch 264/400
160/160 [=====] - 0s 2ms/step - loss: 4.0393
Epoch 265/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405
Epoch 266/400
160/160 [=====] - 0s 1ms/step - loss: 4.0403

Epoch 267/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 268/400
160/160 [=====] - 0s 1ms/step - loss: 4.0406
Epoch 269/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 270/400
160/160 [=====] - 0s 1ms/step - loss: 4.0386
Epoch 271/400
160/160 [=====] - 0s 1ms/step - loss: 4.0423
Epoch 272/400
160/160 [=====] - 0s 1ms/step - loss: 4.0411
Epoch 273/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 274/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 275/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 276/400
160/160 [=====] - 0s 1ms/step - loss: 4.0398
Epoch 277/400
160/160 [=====] - 0s 1ms/step - loss: 4.0396
Epoch 278/400
160/160 [=====] - 0s 1ms/step - loss: 4.0392
Epoch 279/400
160/160 [=====] - 0s 2ms/step - loss: 4.0419
Epoch 280/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 281/400
160/160 [=====] - 0s 1ms/step - loss: 4.0396
Epoch 282/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 283/400
160/160 [=====] - 0s 1ms/step - loss: 4.0403
Epoch 284/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 285/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 286/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 287/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 288/400
160/160 [=====] - 0s 1ms/step - loss: 4.0422
Epoch 289/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 290/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399

Epoch 291/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 292/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 293/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 294/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 295/400
160/160 [=====] - 0s 1ms/step - loss: 4.0401
Epoch 296/400
160/160 [=====] - 0s 1ms/step - loss: 4.0396
Epoch 297/400
160/160 [=====] - 0s 1ms/step - loss: 4.0403
Epoch 298/400
160/160 [=====] - 0s 1ms/step - loss: 4.0417
Epoch 299/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 300/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 301/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 302/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 303/400
160/160 [=====] - 0s 1ms/step - loss: 4.0393
Epoch 304/400
160/160 [=====] - 0s 1ms/step - loss: 4.0403
Epoch 305/400
160/160 [=====] - 0s 1ms/step - loss: 4.0409
Epoch 306/400
160/160 [=====] - 0s 1ms/step - loss: 4.0386
Epoch 307/400
160/160 [=====] - 0s 1ms/step - loss: 4.0390
Epoch 308/400
160/160 [=====] - 0s 1ms/step - loss: 4.0406
Epoch 309/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 310/400
160/160 [=====] - 0s 1ms/step - loss: 4.0385
Epoch 311/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 312/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 313/400
160/160 [=====] - 0s 1ms/step - loss: 4.0406
Epoch 314/400
160/160 [=====] - 0s 1ms/step - loss: 4.0388

Epoch 315/400
160/160 [=====] - 0s 1ms/step - loss: 4.0404
Epoch 316/400
160/160 [=====] - 0s 1ms/step - loss: 4.0391
Epoch 317/400
160/160 [=====] - 0s 1ms/step - loss: 4.0393
Epoch 318/400
160/160 [=====] - 0s 1ms/step - loss: 4.0416
Epoch 319/400
160/160 [=====] - 0s 2ms/step - loss: 4.0396
Epoch 320/400
160/160 [=====] - 0s 2ms/step - loss: 4.0395
Epoch 321/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 322/400
160/160 [=====] - 0s 1ms/step - loss: 4.0387
Epoch 323/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 324/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 325/400
160/160 [=====] - 0s 2ms/step - loss: 4.0399
Epoch 326/400
160/160 [=====] - 0s 2ms/step - loss: 4.0386
Epoch 327/400
160/160 [=====] - 0s 1ms/step - loss: 4.0423
Epoch 328/400
160/160 [=====] - 0s 1ms/step - loss: 4.0391
Epoch 329/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 330/400
160/160 [=====] - 0s 2ms/step - loss: 4.0398
Epoch 331/400
160/160 [=====] - 0s 1ms/step - loss: 4.0404
Epoch 332/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 333/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 334/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 335/400
160/160 [=====] - 0s 1ms/step - loss: 4.0406
Epoch 336/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 337/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 338/400
160/160 [=====] - 0s 1ms/step - loss: 4.0390

Epoch 339/400
160/160 [=====] - 0s 1ms/step - loss: 4.0404
Epoch 340/400
160/160 [=====] - 0s 1ms/step - loss: 4.0402
Epoch 341/400
160/160 [=====] - 0s 1ms/step - loss: 4.0403
Epoch 342/400
160/160 [=====] - 0s 1ms/step - loss: 4.0392
Epoch 343/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 344/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 345/400
160/160 [=====] - 0s 1ms/step - loss: 4.0396
Epoch 346/400
160/160 [=====] - 0s 1ms/step - loss: 4.0392
Epoch 347/400
160/160 [=====] - 0s 1ms/step - loss: 4.0398
Epoch 348/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 349/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 350/400
160/160 [=====] - 0s 1ms/step - loss: 4.0408
Epoch 351/400
160/160 [=====] - 0s 1ms/step - loss: 4.0387
Epoch 352/400
160/160 [=====] - 0s 1ms/step - loss: 4.0421
Epoch 353/400
160/160 [=====] - 0s 1ms/step - loss: 4.0388
Epoch 354/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 355/400
160/160 [=====] - 0s 1ms/step - loss: 4.0391
Epoch 356/400
160/160 [=====] - 0s 1ms/step - loss: 4.0384
Epoch 357/400
160/160 [=====] - 0s 1ms/step - loss: 4.0401
Epoch 358/400
160/160 [=====] - 0s 1ms/step - loss: 4.0389
Epoch 359/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 360/400
160/160 [=====] - 0s 1ms/step - loss: 4.0385
Epoch 361/400
160/160 [=====] - 0s 1ms/step - loss: 4.0396
Epoch 362/400
160/160 [=====] - 0s 1ms/step - loss: 4.0401

Epoch 363/400
160/160 [=====] - 0s 1ms/step - loss: 4.0388
Epoch 364/400
160/160 [=====] - 0s 1ms/step - loss: 4.0396
Epoch 365/400
160/160 [=====] - 0s 1ms/step - loss: 4.0405
Epoch 366/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 367/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 368/400
160/160 [=====] - 0s 1ms/step - loss: 4.0390
Epoch 369/400
160/160 [=====] - 0s 1ms/step - loss: 4.0429
Epoch 370/400
160/160 [=====] - 0s 1ms/step - loss: 4.0397
Epoch 371/400
160/160 [=====] - 0s 1ms/step - loss: 4.0389
Epoch 372/400
160/160 [=====] - 0s 2ms/step - loss: 4.0399
Epoch 373/400
160/160 [=====] - 0s 2ms/step - loss: 4.0398
Epoch 374/400
160/160 [=====] - 0s 2ms/step - loss: 4.0398
Epoch 375/400
160/160 [=====] - 0s 1ms/step - loss: 4.0393
Epoch 376/400
160/160 [=====] - 0s 1ms/step - loss: 4.0388
Epoch 377/400
160/160 [=====] - 0s 1ms/step - loss: 4.0398
Epoch 378/400
160/160 [=====] - 0s 1ms/step - loss: 4.0406
Epoch 379/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 380/400
160/160 [=====] - 0s 1ms/step - loss: 4.0401
Epoch 381/400
160/160 [=====] - 0s 1ms/step - loss: 4.0400
Epoch 382/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394
Epoch 383/400
160/160 [=====] - 0s 2ms/step - loss: 4.0397
Epoch 384/400
160/160 [=====] - 0s 1ms/step - loss: 4.0392
Epoch 385/400
160/160 [=====] - 0s 1ms/step - loss: 4.0401
Epoch 386/400
160/160 [=====] - 0s 1ms/step - loss: 4.0394

```

Epoch 387/400
160/160 [=====] - 0s 1ms/step - loss: 4.0396
Epoch 388/400
160/160 [=====] - 0s 1ms/step - loss: 4.0387
Epoch 389/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 390/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 391/400
160/160 [=====] - 0s 1ms/step - loss: 4.0392
Epoch 392/400
160/160 [=====] - 0s 1ms/step - loss: 4.0393
Epoch 393/400
160/160 [=====] - 0s 1ms/step - loss: 4.0385
Epoch 394/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 395/400
160/160 [=====] - 0s 1ms/step - loss: 4.0396
Epoch 396/400
160/160 [=====] - 0s 1ms/step - loss: 4.0395
Epoch 397/400
160/160 [=====] - 0s 1ms/step - loss: 4.0391
Epoch 398/400
160/160 [=====] - 0s 1ms/step - loss: 4.0399
Epoch 399/400
160/160 [=====] - 0s 1ms/step - loss: 4.0387
Epoch 400/400
160/160 [=====] - 0s 1ms/step - loss: 4.0419

```

```

/Users/dell/anaconda3/lib/python3.6/site-packages/keras/engine/sequential.py:247: UserWarning: N
warnings.warn('Network returning invalid probability values. '

```

```

[ 0.9985807  0.99956506  0.9995748  0.9995665  0.9995716  0.99957734
  0.9995676  0.998679  0.99950486  0.99957746  0.9995697  0.99957013
  0.9995721  0.9980229  0.9995534  0.5497774  0.99929696  0.9995761
  0.9995739  0.9564852  0.99958014  0.99957687  0.9979063  0.99955976
  0.9995756  0.99935114  0.9995801  0.99957967  0.99957925  0.99956983
  0.99954635  0.9994497  0.99955374  0.9995696  0.9995743  0.99957275
  0.9994329  0.9995516  0.99956167  0.9995396  -0.99985826 -0.99986666
 -0.999867  -0.99986684 -0.9998669  -0.99986696 -0.9998668  -0.999855
 -0.9998648 -0.999867  -0.99986684 -0.99986684 -0.9998669  -0.99985564
 -0.9998668 -0.9887303 -0.9998299  -0.99986714 -0.9998669  -0.9998327
 -0.9998671 -0.99986714 -0.998442  -0.99986666 -0.99986714 -0.99986404
 -0.99986714 -0.9998671  -0.9998671  -0.9998669  -0.99986607 -0.9998358
 -0.99986655 -0.999867  -0.99986714 -0.999867  -0.9998088  -0.99986655
 -0.99986655 -0.9998665  -0.96386886 -0.98442197 -0.98346066 -0.98434895

```



```

-0.98385274 -0.9833754 -0.98426425 -0.94380045 -0.98553824 -0.9833245
-0.9841153 -0.9840275 -0.98340946 -0.9542311 -0.98383224 -0.98864007
-0.98623693 -0.98335344 -0.9836135 -0.74170506 -0.9829847 -0.98320264
-0.9874424 -0.9848346 -0.98341954 -0.9807729 -0.9829086 -0.98296666
-0.9831267 -0.9840223 -0.9800086 -0.98652226 -0.98480076 -0.98405784
-0.98304695 -0.9837717 -0.9863358 -0.9843992 -0.9847172 -0.9844776
-0.9983464 -0.33403057 -0.67283356 -0.36192536 -0.35483214 -0.6274475
-0.48806852 -0.9992731 -0.5488238 -0.66378164 -0.40984005 -0.3751354
-0.7162543 -0.9990239 -0.7177023 0.5318122 -0.48344302 -0.6862115
-0.39353332 -0.99971694 -0.68660456 -0.44926536 -0.10646512 -0.38107598
-0.42609075 -0.96350026 -0.73944896 -0.60758764 -0.6087555 -0.54875773
-0.96741205 -0.15365368 -0.5175911 -0.53602785 -0.78191066 -0.3975633
-0.06413273 -0.62655234 -0.38283777 -0.6610091 ]
160/160 [=====] - 1s 4ms/step

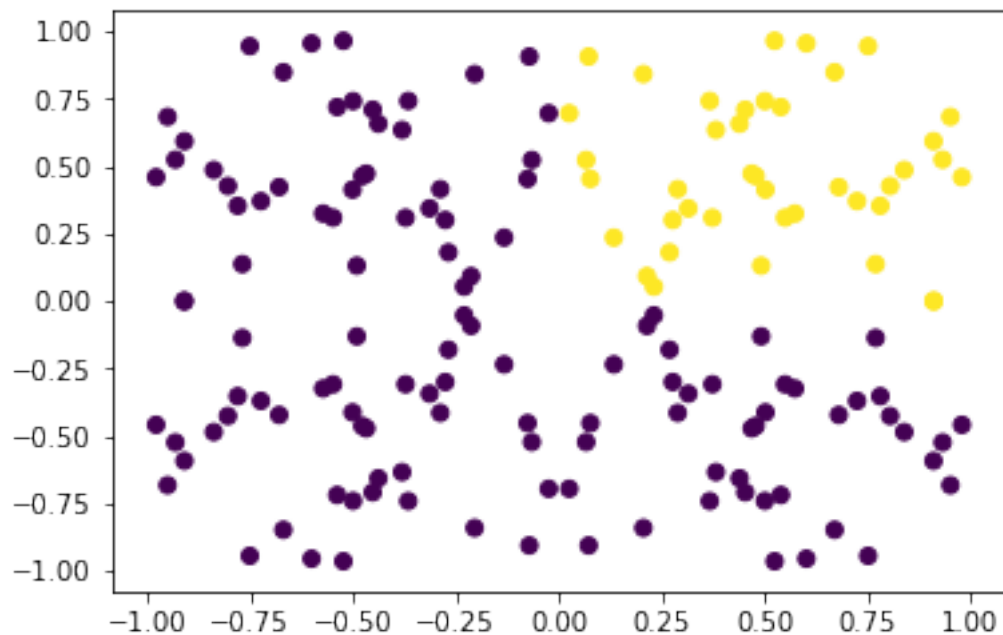
```

```
In [148]: scores, model.metrics_names
```

```
Out[148]: (4.038423474761508, ['loss'])
```

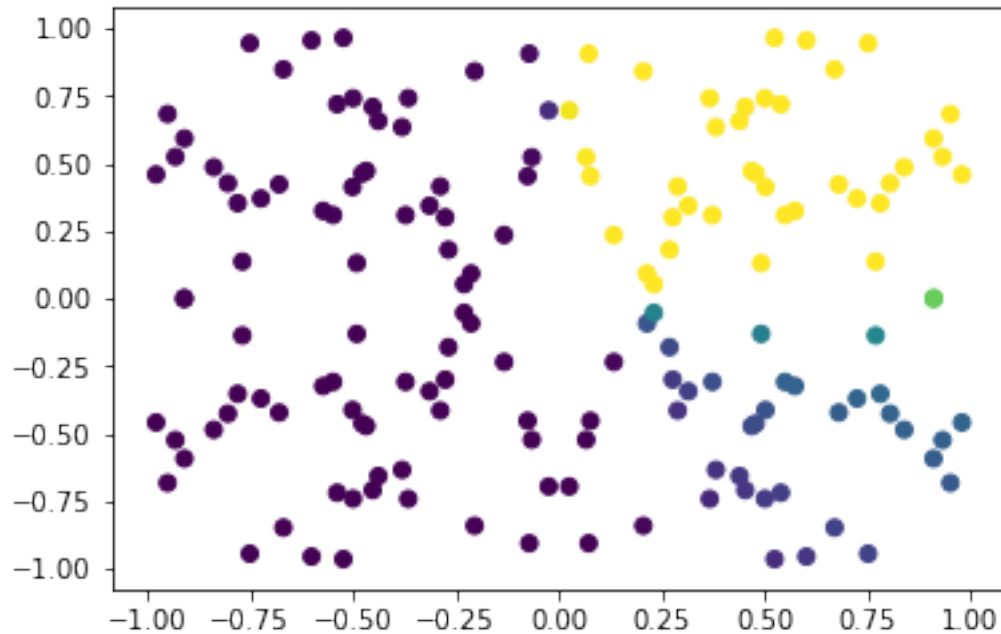
```
In [149]: plt.scatter(*zip(*X), c=model.predict_classes(X).flatten())
```

```
Out[149]: <matplotlib.collections.PathCollection at 0xb2f3a6358>
```



```
In [150]: plt.scatter(*zip(*X), c=model.predict(X).flatten())
```

```
Out[150]: <matplotlib.collections.PathCollection at 0xb2f40a710>
```



In []: *# 4 hidden layers, 4 neuron, and Adam optimizer is the winner of the list.*

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 [ ]: # load pima indians dataset
dataset = np.loadtxt("../data/pima-indians-diabetes.data", delimiter=",")
# split into input (X) and output (Y) variables
X = dataset[:,0:8]
Y = dataset[:,8]
```

```
In [ ]: # 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))

```

```

In [177]: import pandas as pd
          # load pima indians dataset
          dataset = pd.read_csv("../data/HRDataset_v9.csv", delimiter=",")
          dataset = dataset.values

```

```

In [178]: # split into input (X) and output (Y) variables
          X = dataset[:,0:9]
          Y = dataset[:,10]

```

```

In [188]: # create model
          model = Sequential()
          model.add(Dense(16, input_dim=9, 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=9)
          # evaluate the model
          scores = model.evaluate(X, Y)
          print("\n%s: %.2f%%" % (model.metrics_names[1], scores[1]*100))

```

```

Epoch 1/1000
310/310 [=====] - 2s 8ms/step - loss: 0.7134 - acc: 0.5161
Epoch 2/1000
310/310 [=====] - 0s 295us/step - loss: 0.6197 - acc: 0.6677
Epoch 3/1000
310/310 [=====] - 0s 292us/step - loss: 0.6056 - acc: 0.7000
Epoch 4/1000
310/310 [=====] - 0s 301us/step - loss: 0.5919 - acc: 0.6742
Epoch 5/1000
310/310 [=====] - 0s 299us/step - loss: 0.5799 - acc: 0.7097
Epoch 6/1000
310/310 [=====] - 0s 299us/step - loss: 0.5651 - acc: 0.7258
Epoch 7/1000
310/310 [=====] - 0s 293us/step - loss: 0.5537 - acc: 0.7290
Epoch 8/1000
310/310 [=====] - 0s 309us/step - loss: 0.5285 - acc: 0.7355
Epoch 9/1000

```

310/310 [=====] - 0s 378us/step - loss: 0.5131 - acc: 0.7516
 Epoch 10/1000
 310/310 [=====] - 0s 345us/step - loss: 0.4864 - acc: 0.7581
 Epoch 11/1000
 310/310 [=====] - 0s 296us/step - loss: 0.4685 - acc: 0.8032
 Epoch 12/1000
 310/310 [=====] - 0s 300us/step - loss: 0.4320 - acc: 0.8000
 Epoch 13/1000
 310/310 [=====] - 0s 302us/step - loss: 0.3925 - acc: 0.8677
 Epoch 14/1000
 310/310 [=====] - 0s 300us/step - loss: 0.3436 - acc: 0.8903
 Epoch 15/1000
 310/310 [=====] - 0s 294us/step - loss: 0.3093 - acc: 0.9065
 Epoch 16/1000
 310/310 [=====] - 0s 301us/step - loss: 0.2710 - acc: 0.9194
 Epoch 17/1000
 310/310 [=====] - 0s 298us/step - loss: 0.2390 - acc: 0.9226
 Epoch 18/1000
 310/310 [=====] - 0s 301us/step - loss: 0.2013 - acc: 0.9419
 Epoch 19/1000
 310/310 [=====] - 0s 296us/step - loss: 0.1804 - acc: 0.9452
 Epoch 20/1000
 310/310 [=====] - 0s 326us/step - loss: 0.1700 - acc: 0.9516
 Epoch 21/1000
 310/310 [=====] - 0s 319us/step - loss: 0.1443 - acc: 0.9645
 Epoch 22/1000
 310/310 [=====] - 0s 306us/step - loss: 0.1346 - acc: 0.9677
 Epoch 23/1000
 310/310 [=====] - 0s 336us/step - loss: 0.1215 - acc: 0.9742
 Epoch 24/1000
 310/310 [=====] - 0s 322us/step - loss: 0.1145 - acc: 0.9710
 Epoch 25/1000
 310/310 [=====] - 0s 298us/step - loss: 0.1026 - acc: 0.9774
 Epoch 26/1000
 310/310 [=====] - 0s 317us/step - loss: 0.1039 - acc: 0.9742
 Epoch 27/1000
 310/310 [=====] - 0s 347us/step - loss: 0.0933 - acc: 0.9774
 Epoch 28/1000
 310/310 [=====] - 0s 293us/step - loss: 0.0860 - acc: 0.9806
 Epoch 29/1000
 310/310 [=====] - 0s 299us/step - loss: 0.0795 - acc: 0.9806
 Epoch 30/1000
 310/310 [=====] - 0s 299us/step - loss: 0.0748 - acc: 0.9839
 Epoch 31/1000
 310/310 [=====] - 0s 299us/step - loss: 0.0759 - acc: 0.9806
 Epoch 32/1000
 310/310 [=====] - 0s 297us/step - loss: 0.0761 - acc: 0.9774
 Epoch 33/1000

310/310 [=====] - 0s 295us/step - loss: 0.0733 - acc: 0.9839
 Epoch 34/1000
 310/310 [=====] - 0s 291us/step - loss: 0.0673 - acc: 0.9839
 Epoch 35/1000
 310/310 [=====] - 0s 291us/step - loss: 0.0813 - acc: 0.9710
 Epoch 36/1000
 310/310 [=====] - 0s 277us/step - loss: 0.0608 - acc: 0.9742
 Epoch 37/1000
 310/310 [=====] - 0s 276us/step - loss: 0.0598 - acc: 0.9806
 Epoch 38/1000
 310/310 [=====] - 0s 291us/step - loss: 0.0497 - acc: 0.9839
 Epoch 39/1000
 310/310 [=====] - 0s 297us/step - loss: 0.0477 - acc: 0.9839
 Epoch 40/1000
 310/310 [=====] - 0s 293us/step - loss: 0.0439 - acc: 0.9871
 Epoch 41/1000
 310/310 [=====] - 0s 332us/step - loss: 0.0426 - acc: 0.9871
 Epoch 42/1000
 310/310 [=====] - 0s 333us/step - loss: 0.0435 - acc: 0.9903
 Epoch 43/1000
 310/310 [=====] - 0s 338us/step - loss: 0.0364 - acc: 0.9871
 Epoch 44/1000
 310/310 [=====] - 0s 322us/step - loss: 0.0365 - acc: 0.9903
 Epoch 45/1000
 310/310 [=====] - 0s 334us/step - loss: 0.0448 - acc: 0.9806
 Epoch 46/1000
 310/310 [=====] - 0s 322us/step - loss: 0.0369 - acc: 0.9903
 Epoch 47/1000
 310/310 [=====] - 0s 338us/step - loss: 0.0346 - acc: 0.9935
 Epoch 48/1000
 310/310 [=====] - 0s 363us/step - loss: 0.0325 - acc: 0.9903
 Epoch 49/1000
 310/310 [=====] - 0s 331us/step - loss: 0.0316 - acc: 0.9903
 Epoch 50/1000
 310/310 [=====] - 0s 330us/step - loss: 0.0294 - acc: 0.9903
 Epoch 51/1000
 310/310 [=====] - 0s 335us/step - loss: 0.0298 - acc: 0.9935
 Epoch 52/1000
 310/310 [=====] - 0s 300us/step - loss: 0.0335 - acc: 0.9839
 Epoch 53/1000
 310/310 [=====] - 0s 352us/step - loss: 0.0283 - acc: 0.9935
 Epoch 54/1000
 310/310 [=====] - 0s 398us/step - loss: 0.0286 - acc: 0.9935
 Epoch 55/1000
 310/310 [=====] - 0s 396us/step - loss: 0.0273 - acc: 0.9935
 Epoch 56/1000
 310/310 [=====] - 0s 425us/step - loss: 0.0286 - acc: 0.9871
 Epoch 57/1000

310/310 [=====] - 0s 360us/step - loss: 0.0256 - acc: 0.9935
 Epoch 58/1000
 310/310 [=====] - 0s 358us/step - loss: 0.0280 - acc: 0.9839
 Epoch 59/1000
 310/310 [=====] - 0s 358us/step - loss: 0.0301 - acc: 0.9871
 Epoch 60/1000
 310/310 [=====] - 0s 330us/step - loss: 0.0276 - acc: 0.9871
 Epoch 61/1000
 310/310 [=====] - 0s 326us/step - loss: 0.0283 - acc: 0.9903
 Epoch 62/1000
 310/310 [=====] - 0s 337us/step - loss: 0.0301 - acc: 0.9903
 Epoch 63/1000
 310/310 [=====] - 0s 362us/step - loss: 0.0388 - acc: 0.9806
 Epoch 64/1000
 310/310 [=====] - 0s 386us/step - loss: 0.0252 - acc: 0.9935
 Epoch 65/1000
 310/310 [=====] - 0s 303us/step - loss: 0.0239 - acc: 0.9903
 Epoch 66/1000
 310/310 [=====] - 0s 294us/step - loss: 0.0223 - acc: 0.9935
 Epoch 67/1000
 310/310 [=====] - 0s 382us/step - loss: 0.0208 - acc: 0.9903
 Epoch 68/1000
 310/310 [=====] - 0s 284us/step - loss: 0.0250 - acc: 0.9903
 Epoch 69/1000
 310/310 [=====] - 0s 303us/step - loss: 0.0213 - acc: 0.9903
 Epoch 70/1000
 310/310 [=====] - 0s 307us/step - loss: 0.0189 - acc: 0.9903
 Epoch 71/1000
 310/310 [=====] - 0s 360us/step - loss: 0.0230 - acc: 0.9903
 Epoch 72/1000
 310/310 [=====] - 0s 347us/step - loss: 0.0195 - acc: 0.9935
 Epoch 73/1000
 310/310 [=====] - 0s 344us/step - loss: 0.0194 - acc: 0.9903
 Epoch 74/1000
 310/310 [=====] - 0s 341us/step - loss: 0.0183 - acc: 0.9935
 Epoch 75/1000
 310/310 [=====] - 0s 287us/step - loss: 0.0273 - acc: 0.9903
 Epoch 76/1000
 310/310 [=====] - 0s 291us/step - loss: 0.0151 - acc: 0.9968
 Epoch 77/1000
 310/310 [=====] - 0s 292us/step - loss: 0.0191 - acc: 0.9968
 Epoch 78/1000
 310/310 [=====] - 0s 331us/step - loss: 0.0253 - acc: 0.9871
 Epoch 79/1000
 310/310 [=====] - 0s 331us/step - loss: 0.0280 - acc: 0.9903
 Epoch 80/1000
 310/310 [=====] - 0s 327us/step - loss: 0.0243 - acc: 0.9935
 Epoch 81/1000

310/310 [=====] - 0s 369us/step - loss: 0.0147 - acc: 0.9935
 Epoch 82/1000
 310/310 [=====] - 0s 339us/step - loss: 0.0165 - acc: 0.9935
 Epoch 83/1000
 310/310 [=====] - 0s 287us/step - loss: 0.0158 - acc: 0.9903
 Epoch 84/1000
 310/310 [=====] - 0s 316us/step - loss: 0.0174 - acc: 0.9968
 Epoch 85/1000
 310/310 [=====] - 0s 332us/step - loss: 0.0246 - acc: 0.9871
 Epoch 86/1000
 310/310 [=====] - 0s 281us/step - loss: 0.0261 - acc: 0.9871
 Epoch 87/1000
 310/310 [=====] - 0s 277us/step - loss: 0.0210 - acc: 0.9935
 Epoch 88/1000
 310/310 [=====] - 0s 279us/step - loss: 0.0141 - acc: 0.9968
 Epoch 89/1000
 310/310 [=====] - 0s 357us/step - loss: 0.0164 - acc: 0.9903
 Epoch 90/1000
 310/310 [=====] - 0s 312us/step - loss: 0.0352 - acc: 0.9839
 Epoch 91/1000
 310/310 [=====] - 0s 279us/step - loss: 0.0217 - acc: 0.9968
 Epoch 92/1000
 310/310 [=====] - 0s 279us/step - loss: 0.0127 - acc: 0.9968
 Epoch 93/1000
 310/310 [=====] - 0s 276us/step - loss: 0.0157 - acc: 0.9935
 Epoch 94/1000
 310/310 [=====] - 0s 272us/step - loss: 0.0173 - acc: 0.9935
 Epoch 95/1000
 310/310 [=====] - 0s 327us/step - loss: 0.0132 - acc: 0.9968
 Epoch 96/1000
 310/310 [=====] - 0s 341us/step - loss: 0.0118 - acc: 0.9968
 Epoch 97/1000
 310/310 [=====] - 0s 338us/step - loss: 0.0135 - acc: 0.9968
 Epoch 98/1000
 310/310 [=====] - 0s 339us/step - loss: 0.0103 - acc: 0.9968
 Epoch 99/1000
 310/310 [=====] - 0s 339us/step - loss: 0.0099 - acc: 0.9968
 Epoch 100/1000
 310/310 [=====] - 0s 322us/step - loss: 0.0101 - acc: 1.0000
 Epoch 101/1000
 310/310 [=====] - 0s 335us/step - loss: 0.0097 - acc: 1.0000
 Epoch 102/1000
 310/310 [=====] - 0s 325us/step - loss: 0.0126 - acc: 0.9968
 Epoch 103/1000
 310/310 [=====] - 0s 326us/step - loss: 0.0118 - acc: 0.9935
 Epoch 104/1000
 310/310 [=====] - 0s 328us/step - loss: 0.0195 - acc: 0.9903
 Epoch 105/1000

310/310 [=====] - 0s 329us/step - loss: 0.0099 - acc: 0.9968
 Epoch 106/1000
 310/310 [=====] - 0s 299us/step - loss: 0.0112 - acc: 0.9968
 Epoch 107/1000
 310/310 [=====] - 0s 299us/step - loss: 0.0149 - acc: 0.9968
 Epoch 108/1000
 310/310 [=====] - 0s 304us/step - loss: 0.0094 - acc: 1.0000
 Epoch 109/1000
 310/310 [=====] - 0s 339us/step - loss: 0.0085 - acc: 1.0000
 Epoch 110/1000
 310/310 [=====] - 0s 324us/step - loss: 0.0106 - acc: 0.9935
 Epoch 111/1000
 310/310 [=====] - 0s 324us/step - loss: 0.0069 - acc: 1.0000
 Epoch 112/1000
 310/310 [=====] - 0s 355us/step - loss: 0.0114 - acc: 0.9968
 Epoch 113/1000
 310/310 [=====] - 0s 341us/step - loss: 0.0069 - acc: 1.0000
 Epoch 114/1000
 310/310 [=====] - 0s 356us/step - loss: 0.0067 - acc: 1.0000
 Epoch 115/1000
 310/310 [=====] - 0s 333us/step - loss: 0.0087 - acc: 0.9968
 Epoch 116/1000
 310/310 [=====] - 0s 376us/step - loss: 0.0088 - acc: 0.9968
 Epoch 117/1000
 310/310 [=====] - 0s 389us/step - loss: 0.0065 - acc: 1.0000
 Epoch 118/1000
 310/310 [=====] - 0s 287us/step - loss: 0.0075 - acc: 1.0000
 Epoch 119/1000
 310/310 [=====] - 0s 312us/step - loss: 0.0091 - acc: 0.9968
 Epoch 120/1000
 310/310 [=====] - 0s 349us/step - loss: 0.0098 - acc: 1.0000
 Epoch 121/1000
 310/310 [=====] - 0s 300us/step - loss: 0.0050 - acc: 1.0000
 Epoch 122/1000
 310/310 [=====] - 0s 297us/step - loss: 0.0056 - acc: 1.0000
 Epoch 123/1000
 310/310 [=====] - 0s 327us/step - loss: 0.0054 - acc: 1.0000
 Epoch 124/1000
 310/310 [=====] - 0s 333us/step - loss: 0.0056 - acc: 1.0000
 Epoch 125/1000
 310/310 [=====] - 0s 344us/step - loss: 0.0057 - acc: 1.0000
 Epoch 126/1000
 310/310 [=====] - 0s 320us/step - loss: 0.0062 - acc: 1.0000
 Epoch 127/1000
 310/310 [=====] - 0s 326us/step - loss: 0.0054 - acc: 1.0000
 Epoch 128/1000
 310/310 [=====] - 0s 329us/step - loss: 0.0053 - acc: 1.0000
 Epoch 129/1000

310/310 [=====] - 0s 320us/step - loss: 0.0047 - acc: 1.0000
 Epoch 130/1000
 310/310 [=====] - 0s 321us/step - loss: 0.0042 - acc: 1.0000
 Epoch 131/1000
 310/310 [=====] - 0s 304us/step - loss: 0.0045 - acc: 1.0000
 Epoch 132/1000
 310/310 [=====] - 0s 287us/step - loss: 0.0067 - acc: 1.0000
 Epoch 133/1000
 310/310 [=====] - 0s 299us/step - loss: 0.0059 - acc: 1.0000
 Epoch 134/1000
 310/310 [=====] - 0s 289us/step - loss: 0.0086 - acc: 0.9968
 Epoch 135/1000
 310/310 [=====] - 0s 291us/step - loss: 0.0264 - acc: 0.9871
 Epoch 136/1000
 310/310 [=====] - 0s 290us/step - loss: 0.0111 - acc: 0.9968
 Epoch 137/1000
 310/310 [=====] - 0s 326us/step - loss: 0.0078 - acc: 0.9968
 Epoch 138/1000
 310/310 [=====] - 0s 331us/step - loss: 0.0032 - acc: 1.0000
 Epoch 139/1000
 310/310 [=====] - 0s 338us/step - loss: 0.0039 - acc: 1.0000
 Epoch 140/1000
 310/310 [=====] - 0s 295us/step - loss: 0.0110 - acc: 0.9935
 Epoch 141/1000
 310/310 [=====] - 0s 305us/step - loss: 0.0068 - acc: 1.0000
 Epoch 142/1000
 310/310 [=====] - 0s 290us/step - loss: 0.0039 - acc: 1.0000
 Epoch 143/1000
 310/310 [=====] - 0s 322us/step - loss: 0.0049 - acc: 1.0000
 Epoch 144/1000
 310/310 [=====] - 0s 349us/step - loss: 0.0046 - acc: 1.0000
 Epoch 145/1000
 310/310 [=====] - 0s 320us/step - loss: 0.0041 - acc: 1.0000
 Epoch 146/1000
 310/310 [=====] - 0s 326us/step - loss: 0.0065 - acc: 0.9968
 Epoch 147/1000
 310/310 [=====] - 0s 306us/step - loss: 0.0095 - acc: 0.9968
 Epoch 148/1000
 310/310 [=====] - 0s 320us/step - loss: 0.0076 - acc: 0.9968
 Epoch 149/1000
 310/310 [=====] - 0s 312us/step - loss: 0.0028 - acc: 1.0000
 Epoch 150/1000
 310/310 [=====] - 0s 313us/step - loss: 0.0042 - acc: 1.0000
 Epoch 151/1000
 310/310 [=====] - 0s 306us/step - loss: 0.0031 - acc: 1.0000
 Epoch 152/1000
 310/310 [=====] - 0s 282us/step - loss: 0.0066 - acc: 1.0000
 Epoch 153/1000

310/310 [=====] - 0s 298us/step - loss: 0.0037 - acc: 1.0000
 Epoch 154/1000
 310/310 [=====] - 0s 291us/step - loss: 0.0029 - acc: 1.0000
 Epoch 155/1000
 310/310 [=====] - 0s 278us/step - loss: 0.0033 - acc: 1.0000
 Epoch 156/1000
 310/310 [=====] - 0s 292us/step - loss: 0.0030 - acc: 1.0000
 Epoch 157/1000
 310/310 [=====] - 0s 291us/step - loss: 0.0026 - acc: 1.0000
 Epoch 158/1000
 310/310 [=====] - 0s 331us/step - loss: 0.0021 - acc: 1.0000
 Epoch 159/1000
 310/310 [=====] - 0s 335us/step - loss: 0.0021 - acc: 1.0000
 Epoch 160/1000
 310/310 [=====] - 0s 312us/step - loss: 0.0024 - acc: 1.0000
 Epoch 161/1000
 310/310 [=====] - 0s 341us/step - loss: 0.0026 - acc: 1.0000
 Epoch 162/1000
 310/310 [=====] - 0s 340us/step - loss: 0.0028 - acc: 1.0000
 Epoch 163/1000
 310/310 [=====] - 0s 390us/step - loss: 0.0018 - acc: 1.0000
 Epoch 164/1000
 310/310 [=====] - 0s 336us/step - loss: 0.0019 - acc: 1.0000
 Epoch 165/1000
 310/310 [=====] - 0s 278us/step - loss: 0.0018 - acc: 1.0000
 Epoch 166/1000
 310/310 [=====] - 0s 270us/step - loss: 0.0017 - acc: 1.0000
 Epoch 167/1000
 310/310 [=====] - 0s 260us/step - loss: 0.0018 - acc: 1.0000
 Epoch 168/1000
 310/310 [=====] - 0s 275us/step - loss: 0.0020 - acc: 1.0000
 Epoch 169/1000
 310/310 [=====] - 0s 291us/step - loss: 0.0023 - acc: 1.0000
 Epoch 170/1000
 310/310 [=====] - 0s 267us/step - loss: 0.0018 - acc: 1.0000
 Epoch 171/1000
 310/310 [=====] - 0s 265us/step - loss: 0.0028 - acc: 1.0000
 Epoch 172/1000
 310/310 [=====] - 0s 276us/step - loss: 0.0027 - acc: 1.0000
 Epoch 173/1000
 310/310 [=====] - 0s 278us/step - loss: 0.0015 - acc: 1.0000
 Epoch 174/1000
 310/310 [=====] - 0s 273us/step - loss: 0.0014 - acc: 1.0000
 Epoch 175/1000
 310/310 [=====] - 0s 274us/step - loss: 0.0051 - acc: 1.0000
 Epoch 176/1000
 310/310 [=====] - 0s 246us/step - loss: 0.0271 - acc: 0.9806
 Epoch 177/1000

310/310 [=====] - 0s 267us/step - loss: 0.0115 - acc: 0.9935
 Epoch 178/1000
 310/310 [=====] - 0s 257us/step - loss: 0.0186 - acc: 0.9935
 Epoch 179/1000
 310/310 [=====] - 0s 258us/step - loss: 0.0251 - acc: 0.9903
 Epoch 180/1000
 310/310 [=====] - 0s 270us/step - loss: 0.0169 - acc: 0.9935
 Epoch 181/1000
 310/310 [=====] - 0s 274us/step - loss: 0.0052 - acc: 0.9968
 Epoch 182/1000
 310/310 [=====] - 0s 269us/step - loss: 0.0022 - acc: 1.0000
 Epoch 183/1000
 310/310 [=====] - 0s 266us/step - loss: 0.0026 - acc: 1.0000
 Epoch 184/1000
 310/310 [=====] - 0s 278us/step - loss: 0.0026 - acc: 1.0000
 Epoch 185/1000
 310/310 [=====] - 0s 271us/step - loss: 0.0012 - acc: 1.0000
 Epoch 186/1000
 310/310 [=====] - 0s 261us/step - loss: 0.0017 - acc: 1.0000
 Epoch 187/1000
 310/310 [=====] - 0s 268us/step - loss: 0.0030 - acc: 1.0000
 Epoch 188/1000
 310/310 [=====] - 0s 263us/step - loss: 0.0013 - acc: 1.0000
 Epoch 189/1000
 310/310 [=====] - 0s 273us/step - loss: 0.0013 - acc: 1.0000
 Epoch 190/1000
 310/310 [=====] - 0s 316us/step - loss: 0.0012 - acc: 1.0000
 Epoch 191/1000
 310/310 [=====] - 0s 358us/step - loss: 0.0011 - acc: 1.0000
 Epoch 192/1000
 310/310 [=====] - 0s 289us/step - loss: 0.0017 - acc: 1.0000
 Epoch 193/1000
 310/310 [=====] - 0s 276us/step - loss: 0.0016 - acc: 1.0000
 Epoch 194/1000
 310/310 [=====] - 0s 262us/step - loss: 0.0031 - acc: 1.0000
 Epoch 195/1000
 310/310 [=====] - 0s 277us/step - loss: 0.0046 - acc: 1.0000
 Epoch 196/1000
 310/310 [=====] - 0s 291us/step - loss: 0.0019 - acc: 1.0000
 Epoch 197/1000
 310/310 [=====] - 0s 355us/step - loss: 9.4057e-04 - acc: 1.0000
 Epoch 198/1000
 310/310 [=====] - 0s 345us/step - loss: 9.4590e-04 - acc: 1.0000
 Epoch 199/1000
 310/310 [=====] - 0s 346us/step - loss: 9.4537e-04 - acc: 1.0000
 Epoch 200/1000
 310/310 [=====] - 0s 290us/step - loss: 8.5796e-04 - acc: 1.0000
 Epoch 201/1000

310/310 [=====] - 0s 254us/step - loss: 8.5400e-04 - acc: 1.0000
 Epoch 202/1000
 310/310 [=====] - 0s 269us/step - loss: 8.9917e-04 - acc: 1.0000
 Epoch 203/1000
 310/310 [=====] - 0s 272us/step - loss: 0.0013 - acc: 1.0000
 Epoch 204/1000
 310/310 [=====] - 0s 262us/step - loss: 0.0013 - acc: 1.0000
 Epoch 205/1000
 310/310 [=====] - 0s 274us/step - loss: 0.0012 - acc: 1.0000
 Epoch 206/1000
 310/310 [=====] - 0s 283us/step - loss: 0.0020 - acc: 1.0000
 Epoch 207/1000
 310/310 [=====] - 0s 283us/step - loss: 0.0014 - acc: 1.0000
 Epoch 208/1000
 310/310 [=====] - 0s 269us/step - loss: 9.7915e-04 - acc: 1.0000
 Epoch 209/1000
 310/310 [=====] - 0s 282us/step - loss: 9.5885e-04 - acc: 1.0000
 Epoch 210/1000
 310/310 [=====] - 0s 277us/step - loss: 7.4629e-04 - acc: 1.0000
 Epoch 211/1000
 310/310 [=====] - 0s 268us/step - loss: 6.9976e-04 - acc: 1.0000
 Epoch 212/1000
 310/310 [=====] - 0s 274us/step - loss: 6.6374e-04 - acc: 1.0000
 Epoch 213/1000
 310/310 [=====] - 0s 279us/step - loss: 7.5522e-04 - acc: 1.0000
 Epoch 214/1000
 310/310 [=====] - 0s 279us/step - loss: 7.1035e-04 - acc: 1.0000
 Epoch 215/1000
 310/310 [=====] - 0s 286us/step - loss: 6.1696e-04 - acc: 1.0000
 Epoch 216/1000
 310/310 [=====] - 0s 258us/step - loss: 6.6749e-04 - acc: 1.0000
 Epoch 217/1000
 310/310 [=====] - 0s 280us/step - loss: 0.0011 - acc: 1.0000
 Epoch 218/1000
 310/310 [=====] - 0s 273us/step - loss: 6.9292e-04 - acc: 1.0000
 Epoch 219/1000
 310/310 [=====] - 0s 275us/step - loss: 7.5609e-04 - acc: 1.0000
 Epoch 220/1000
 310/310 [=====] - 0s 278us/step - loss: 6.9499e-04 - acc: 1.0000
 Epoch 221/1000
 310/310 [=====] - 0s 266us/step - loss: 6.8320e-04 - acc: 1.0000
 Epoch 222/1000
 310/310 [=====] - 0s 268us/step - loss: 6.5267e-04 - acc: 1.0000
 Epoch 223/1000
 310/310 [=====] - 0s 266us/step - loss: 5.2519e-04 - acc: 1.0000
 Epoch 224/1000
 310/310 [=====] - 0s 269us/step - loss: 5.0876e-04 - acc: 1.0000
 Epoch 225/1000

310/310 [=====] - 0s 298us/step - loss: 5.7012e-04 - acc: 1.0000
 Epoch 226/1000
 310/310 [=====] - 0s 385us/step - loss: 6.6698e-04 - acc: 1.0000
 Epoch 227/1000
 310/310 [=====] - 0s 359us/step - loss: 4.9421e-04 - acc: 1.0000
 Epoch 228/1000
 310/310 [=====] - 0s 333us/step - loss: 4.9732e-04 - acc: 1.0000
 Epoch 229/1000
 310/310 [=====] - 0s 335us/step - loss: 4.9168e-04 - acc: 1.0000
 Epoch 230/1000
 310/310 [=====] - 0s 317us/step - loss: 6.2041e-04 - acc: 1.0000
 Epoch 231/1000
 310/310 [=====] - 0s 322us/step - loss: 4.5537e-04 - acc: 1.0000
 Epoch 232/1000
 310/310 [=====] - 0s 375us/step - loss: 5.1648e-04 - acc: 1.0000
 Epoch 233/1000
 310/310 [=====] - 0s 310us/step - loss: 4.9938e-04 - acc: 1.0000
 Epoch 234/1000
 310/310 [=====] - 0s 263us/step - loss: 5.0651e-04 - acc: 1.0000
 Epoch 235/1000
 310/310 [=====] - 0s 276us/step - loss: 5.5541e-04 - acc: 1.0000
 Epoch 236/1000
 310/310 [=====] - 0s 331us/step - loss: 8.0570e-04 - acc: 1.0000
 Epoch 237/1000
 310/310 [=====] - 0s 332us/step - loss: 9.1265e-04 - acc: 1.0000
 Epoch 238/1000
 310/310 [=====] - 0s 358us/step - loss: 4.7678e-04 - acc: 1.0000
 Epoch 239/1000
 310/310 [=====] - 0s 330us/step - loss: 4.1056e-04 - acc: 1.0000
 Epoch 240/1000
 310/310 [=====] - 0s 338us/step - loss: 4.3096e-04 - acc: 1.0000
 Epoch 241/1000
 310/310 [=====] - 0s 334us/step - loss: 4.1260e-04 - acc: 1.0000
 Epoch 242/1000
 310/310 [=====] - 0s 272us/step - loss: 4.2521e-04 - acc: 1.0000
 Epoch 243/1000
 310/310 [=====] - 0s 274us/step - loss: 3.8377e-04 - acc: 1.0000
 Epoch 244/1000
 310/310 [=====] - 0s 254us/step - loss: 4.4569e-04 - acc: 1.0000
 Epoch 245/1000
 310/310 [=====] - 0s 272us/step - loss: 3.5030e-04 - acc: 1.0000
 Epoch 246/1000
 310/310 [=====] - 0s 271us/step - loss: 4.0551e-04 - acc: 1.0000
 Epoch 247/1000
 310/310 [=====] - 0s 293us/step - loss: 8.5804e-04 - acc: 1.0000
 Epoch 248/1000
 310/310 [=====] - 0s 352us/step - loss: 4.2628e-04 - acc: 1.0000
 Epoch 249/1000

310/310 [=====] - 0s 353us/step - loss: 4.2546e-04 - acc: 1.0000
 Epoch 250/1000
 310/310 [=====] - 0s 344us/step - loss: 3.2551e-04 - acc: 1.0000
 Epoch 251/1000
 310/310 [=====] - 0s 346us/step - loss: 3.8131e-04 - acc: 1.0000
 Epoch 252/1000
 310/310 [=====] - 0s 336us/step - loss: 3.8593e-04 - acc: 1.0000
 Epoch 253/1000
 310/310 [=====] - 0s 346us/step - loss: 3.6076e-04 - acc: 1.0000
 Epoch 254/1000
 310/310 [=====] - 0s 383us/step - loss: 3.0507e-04 - acc: 1.0000
 Epoch 255/1000
 310/310 [=====] - 0s 341us/step - loss: 3.2045e-04 - acc: 1.0000
 Epoch 256/1000
 310/310 [=====] - 0s 359us/step - loss: 3.1045e-04 - acc: 1.0000
 Epoch 257/1000
 310/310 [=====] - 0s 287us/step - loss: 2.8884e-04 - acc: 1.0000
 Epoch 258/1000
 310/310 [=====] - 0s 299us/step - loss: 2.7839e-04 - acc: 1.0000
 Epoch 259/1000
 310/310 [=====] - 0s 281us/step - loss: 2.6541e-04 - acc: 1.0000
 Epoch 260/1000
 310/310 [=====] - 0s 268us/step - loss: 3.0925e-04 - acc: 1.0000
 Epoch 261/1000
 310/310 [=====] - 0s 274us/step - loss: 3.5214e-04 - acc: 1.0000
 Epoch 262/1000
 310/310 [=====] - 0s 270us/step - loss: 2.5916e-04 - acc: 1.0000
 Epoch 263/1000
 310/310 [=====] - 0s 255us/step - loss: 2.8362e-04 - acc: 1.0000
 Epoch 264/1000
 310/310 [=====] - 0s 258us/step - loss: 2.9854e-04 - acc: 1.0000
 Epoch 265/1000
 310/310 [=====] - 0s 256us/step - loss: 2.9251e-04 - acc: 1.0000
 Epoch 266/1000
 310/310 [=====] - 0s 269us/step - loss: 2.5453e-04 - acc: 1.0000
 Epoch 267/1000
 310/310 [=====] - 0s 273us/step - loss: 2.3466e-04 - acc: 1.0000
 Epoch 268/1000
 310/310 [=====] - 0s 271us/step - loss: 2.4499e-04 - acc: 1.0000
 Epoch 269/1000
 310/310 [=====] - 0s 276us/step - loss: 2.3710e-04 - acc: 1.0000
 Epoch 270/1000
 310/310 [=====] - 0s 278us/step - loss: 2.4679e-04 - acc: 1.0000
 Epoch 271/1000
 310/310 [=====] - 0s 276us/step - loss: 2.5522e-04 - acc: 1.0000
 Epoch 272/1000
 310/310 [=====] - 0s 269us/step - loss: 2.2791e-04 - acc: 1.0000
 Epoch 273/1000

310/310 [=====] - 0s 270us/step - loss: 1.8736e-04 - acc: 1.0000
 Epoch 274/1000
 310/310 [=====] - 0s 264us/step - loss: 2.6083e-04 - acc: 1.0000
 Epoch 275/1000
 310/310 [=====] - 0s 281us/step - loss: 1.9483e-04 - acc: 1.0000
 Epoch 276/1000
 310/310 [=====] - 0s 273us/step - loss: 2.4216e-04 - acc: 1.0000
 Epoch 277/1000
 310/310 [=====] - 0s 274us/step - loss: 2.1250e-04 - acc: 1.0000
 Epoch 278/1000
 310/310 [=====] - 0s 264us/step - loss: 1.8467e-04 - acc: 1.0000
 Epoch 279/1000
 310/310 [=====] - 0s 270us/step - loss: 2.4969e-04 - acc: 1.0000
 Epoch 280/1000
 310/310 [=====] - 0s 267us/step - loss: 1.6946e-04 - acc: 1.0000
 Epoch 281/1000
 310/310 [=====] - 0s 278us/step - loss: 2.6294e-04 - acc: 1.0000
 Epoch 282/1000
 310/310 [=====] - 0s 271us/step - loss: 2.4235e-04 - acc: 1.0000
 Epoch 283/1000
 310/310 [=====] - 0s 271us/step - loss: 2.5170e-04 - acc: 1.0000
 Epoch 284/1000
 310/310 [=====] - 0s 281us/step - loss: 3.6925e-04 - acc: 1.0000
 Epoch 285/1000
 310/310 [=====] - 0s 278us/step - loss: 2.1853e-04 - acc: 1.0000
 Epoch 286/1000
 310/310 [=====] - 0s 255us/step - loss: 0.0089 - acc: 0.9968
 Epoch 287/1000
 310/310 [=====] - 0s 250us/step - loss: 0.0590 - acc: 0.9839
 Epoch 288/1000
 310/310 [=====] - 0s 258us/step - loss: 0.1268 - acc: 0.9710
 Epoch 289/1000
 310/310 [=====] - 0s 258us/step - loss: 0.0205 - acc: 0.9935
 Epoch 290/1000
 310/310 [=====] - 0s 275us/step - loss: 0.0260 - acc: 0.9935
 Epoch 291/1000
 310/310 [=====] - 0s 275us/step - loss: 0.0553 - acc: 0.9871
 Epoch 292/1000
 310/310 [=====] - 0s 268us/step - loss: 0.0807 - acc: 0.9871
 Epoch 293/1000
 310/310 [=====] - 0s 282us/step - loss: 0.0147 - acc: 0.9903
 Epoch 294/1000
 310/310 [=====] - 0s 279us/step - loss: 0.0286 - acc: 0.9903
 Epoch 295/1000
 310/310 [=====] - 0s 268us/step - loss: 0.0098 - acc: 0.9968
 Epoch 296/1000
 310/310 [=====] - 0s 272us/step - loss: 0.0029 - acc: 0.9968
 Epoch 297/1000

310/310 [=====] - 0s 302us/step - loss: 0.0027 - acc: 1.0000
 Epoch 298/1000
 310/310 [=====] - 0s 306us/step - loss: 0.0016 - acc: 1.0000
 Epoch 299/1000
 310/310 [=====] - 0s 303us/step - loss: 5.7119e-04 - acc: 1.0000
 Epoch 300/1000
 310/310 [=====] - 0s 301us/step - loss: 6.2535e-04 - acc: 1.0000
 Epoch 301/1000
 310/310 [=====] - 0s 303us/step - loss: 6.1720e-04 - acc: 1.0000
 Epoch 302/1000
 310/310 [=====] - 0s 319us/step - loss: 5.7424e-04 - acc: 1.0000
 Epoch 303/1000
 310/310 [=====] - 0s 289us/step - loss: 5.7480e-04 - acc: 1.0000
 Epoch 304/1000
 310/310 [=====] - 0s 305us/step - loss: 5.6868e-04 - acc: 1.0000
 Epoch 305/1000
 310/310 [=====] - 0s 316us/step - loss: 5.5883e-04 - acc: 1.0000
 Epoch 306/1000
 310/310 [=====] - 0s 302us/step - loss: 5.2456e-04 - acc: 1.0000
 Epoch 307/1000
 310/310 [=====] - 0s 308us/step - loss: 5.2004e-04 - acc: 1.0000
 Epoch 308/1000
 310/310 [=====] - 0s 278us/step - loss: 5.2683e-04 - acc: 1.0000
 Epoch 309/1000
 310/310 [=====] - 0s 279us/step - loss: 5.1352e-04 - acc: 1.0000
 Epoch 310/1000
 310/310 [=====] - 0s 270us/step - loss: 4.9365e-04 - acc: 1.0000
 Epoch 311/1000
 310/310 [=====] - 0s 274us/step - loss: 4.9882e-04 - acc: 1.0000
 Epoch 312/1000
 310/310 [=====] - 0s 305us/step - loss: 5.0660e-04 - acc: 1.0000
 Epoch 313/1000
 310/310 [=====] - 0s 297us/step - loss: 5.2157e-04 - acc: 1.0000
 Epoch 314/1000
 310/310 [=====] - 0s 300us/step - loss: 4.8674e-04 - acc: 1.0000
 Epoch 315/1000
 310/310 [=====] - 0s 309us/step - loss: 4.8714e-04 - acc: 1.0000
 Epoch 316/1000
 310/310 [=====] - 0s 311us/step - loss: 4.6994e-04 - acc: 1.0000
 Epoch 317/1000
 310/310 [=====] - 0s 307us/step - loss: 4.4630e-04 - acc: 1.0000
 Epoch 318/1000
 310/310 [=====] - 0s 297us/step - loss: 4.9258e-04 - acc: 1.0000
 Epoch 319/1000
 310/310 [=====] - 0s 294us/step - loss: 4.9885e-04 - acc: 1.0000
 Epoch 320/1000
 310/310 [=====] - 0s 296us/step - loss: 5.3854e-04 - acc: 1.0000
 Epoch 321/1000

310/310 [=====] - 0s 307us/step - loss: 4.3785e-04 - acc: 1.0000
 Epoch 322/1000
 310/310 [=====] - 0s 277us/step - loss: 4.2785e-04 - acc: 1.0000
 Epoch 323/1000
 310/310 [=====] - 0s 313us/step - loss: 4.3510e-04 - acc: 1.0000
 Epoch 324/1000
 310/310 [=====] - 0s 280us/step - loss: 4.0938e-04 - acc: 1.0000
 Epoch 325/1000
 310/310 [=====] - 0s 291us/step - loss: 4.6999e-04 - acc: 1.0000
 Epoch 326/1000
 310/310 [=====] - 0s 323us/step - loss: 4.2272e-04 - acc: 1.0000
 Epoch 327/1000
 310/310 [=====] - 0s 285us/step - loss: 4.1982e-04 - acc: 1.0000
 Epoch 328/1000
 310/310 [=====] - 0s 290us/step - loss: 4.0566e-04 - acc: 1.0000
 Epoch 329/1000
 310/310 [=====] - 0s 293us/step - loss: 4.3443e-04 - acc: 1.0000
 Epoch 330/1000
 310/310 [=====] - 0s 269us/step - loss: 3.7105e-04 - acc: 1.0000
 Epoch 331/1000
 310/310 [=====] - 0s 265us/step - loss: 3.9016e-04 - acc: 1.0000
 Epoch 332/1000
 310/310 [=====] - 0s 273us/step - loss: 3.6444e-04 - acc: 1.0000
 Epoch 333/1000
 310/310 [=====] - 0s 284us/step - loss: 3.6949e-04 - acc: 1.0000
 Epoch 334/1000
 310/310 [=====] - 0s 302us/step - loss: 3.7400e-04 - acc: 1.0000
 Epoch 335/1000
 310/310 [=====] - 0s 290us/step - loss: 3.7294e-04 - acc: 1.0000
 Epoch 336/1000
 310/310 [=====] - 0s 298us/step - loss: 3.9190e-04 - acc: 1.0000
 Epoch 337/1000
 310/310 [=====] - 0s 302us/step - loss: 3.5477e-04 - acc: 1.0000
 Epoch 338/1000
 310/310 [=====] - 0s 288us/step - loss: 3.4152e-04 - acc: 1.0000
 Epoch 339/1000
 310/310 [=====] - 0s 288us/step - loss: 3.3407e-04 - acc: 1.0000
 Epoch 340/1000
 310/310 [=====] - 0s 299us/step - loss: 3.5282e-04 - acc: 1.0000
 Epoch 341/1000
 310/310 [=====] - 0s 297us/step - loss: 3.5278e-04 - acc: 1.0000
 Epoch 342/1000
 310/310 [=====] - 0s 282us/step - loss: 3.4595e-04 - acc: 1.0000
 Epoch 343/1000
 310/310 [=====] - 0s 280us/step - loss: 3.1463e-04 - acc: 1.0000
 Epoch 344/1000
 310/310 [=====] - 0s 282us/step - loss: 3.1475e-04 - acc: 1.0000
 Epoch 345/1000

310/310 [=====] - 0s 264us/step - loss: 3.1936e-04 - acc: 1.0000
 Epoch 346/1000
 310/310 [=====] - 0s 276us/step - loss: 3.1872e-04 - acc: 1.0000
 Epoch 347/1000
 310/310 [=====] - 0s 265us/step - loss: 3.1131e-04 - acc: 1.0000
 Epoch 348/1000
 310/310 [=====] - 0s 278us/step - loss: 3.0409e-04 - acc: 1.0000
 Epoch 349/1000
 310/310 [=====] - 0s 277us/step - loss: 3.3138e-04 - acc: 1.0000
 Epoch 350/1000
 310/310 [=====] - 0s 273us/step - loss: 3.0029e-04 - acc: 1.0000
 Epoch 351/1000
 310/310 [=====] - 0s 270us/step - loss: 3.0000e-04 - acc: 1.0000
 Epoch 352/1000
 310/310 [=====] - 0s 262us/step - loss: 3.0667e-04 - acc: 1.0000
 Epoch 353/1000
 310/310 [=====] - 0s 255us/step - loss: 2.8051e-04 - acc: 1.0000
 Epoch 354/1000
 310/310 [=====] - 0s 251us/step - loss: 2.8353e-04 - acc: 1.0000
 Epoch 355/1000
 310/310 [=====] - 0s 251us/step - loss: 2.7239e-04 - acc: 1.0000
 Epoch 356/1000
 310/310 [=====] - 0s 278us/step - loss: 2.8714e-04 - acc: 1.0000
 Epoch 357/1000
 310/310 [=====] - 0s 265us/step - loss: 2.6953e-04 - acc: 1.0000
 Epoch 358/1000
 310/310 [=====] - 0s 274us/step - loss: 2.9078e-04 - acc: 1.0000
 Epoch 359/1000
 310/310 [=====] - 0s 267us/step - loss: 3.0662e-04 - acc: 1.0000
 Epoch 360/1000
 310/310 [=====] - 0s 276us/step - loss: 3.0560e-04 - acc: 1.0000
 Epoch 361/1000
 310/310 [=====] - 0s 278us/step - loss: 3.2629e-04 - acc: 1.0000
 Epoch 362/1000
 310/310 [=====] - 0s 265us/step - loss: 2.5299e-04 - acc: 1.0000
 Epoch 363/1000
 310/310 [=====] - 0s 268us/step - loss: 2.7641e-04 - acc: 1.0000
 Epoch 364/1000
 310/310 [=====] - 0s 270us/step - loss: 2.6852e-04 - acc: 1.0000
 Epoch 365/1000
 310/310 [=====] - 0s 275us/step - loss: 2.3328e-04 - acc: 1.0000
 Epoch 366/1000
 310/310 [=====] - 0s 269us/step - loss: 2.4668e-04 - acc: 1.0000
 Epoch 367/1000
 310/310 [=====] - 0s 280us/step - loss: 2.2523e-04 - acc: 1.0000
 Epoch 368/1000
 310/310 [=====] - 0s 298us/step - loss: 2.3317e-04 - acc: 1.0000
 Epoch 369/1000

310/310 [=====] - 0s 296us/step - loss: 2.3990e-04 - acc: 1.0000
 Epoch 370/1000
 310/310 [=====] - 0s 276us/step - loss: 2.3953e-04 - acc: 1.0000
 Epoch 371/1000
 310/310 [=====] - 0s 269us/step - loss: 2.1297e-04 - acc: 1.0000
 Epoch 372/1000
 310/310 [=====] - 0s 282us/step - loss: 2.1604e-04 - acc: 1.0000
 Epoch 373/1000
 310/310 [=====] - 0s 271us/step - loss: 2.0736e-04 - acc: 1.0000
 Epoch 374/1000
 310/310 [=====] - 0s 266us/step - loss: 2.2670e-04 - acc: 1.0000
 Epoch 375/1000
 310/310 [=====] - 0s 274us/step - loss: 2.1190e-04 - acc: 1.0000
 Epoch 376/1000
 310/310 [=====] - 0s 259us/step - loss: 2.1515e-04 - acc: 1.0000
 Epoch 377/1000
 310/310 [=====] - 0s 254us/step - loss: 2.0963e-04 - acc: 1.0000
 Epoch 378/1000
 310/310 [=====] - 0s 254us/step - loss: 2.0824e-04 - acc: 1.0000
 Epoch 379/1000
 310/310 [=====] - 0s 250us/step - loss: 1.8308e-04 - acc: 1.0000
 Epoch 380/1000
 310/310 [=====] - 0s 273us/step - loss: 2.5148e-04 - acc: 1.0000
 Epoch 381/1000
 310/310 [=====] - 0s 276us/step - loss: 2.3296e-04 - acc: 1.0000
 Epoch 382/1000
 310/310 [=====] - 0s 266us/step - loss: 2.0785e-04 - acc: 1.0000
 Epoch 383/1000
 310/310 [=====] - 0s 269us/step - loss: 1.8636e-04 - acc: 1.0000
 Epoch 384/1000
 310/310 [=====] - 0s 278us/step - loss: 1.8788e-04 - acc: 1.0000
 Epoch 385/1000
 310/310 [=====] - 0s 273us/step - loss: 1.7311e-04 - acc: 1.0000
 Epoch 386/1000
 310/310 [=====] - 0s 272us/step - loss: 1.9472e-04 - acc: 1.0000
 Epoch 387/1000
 310/310 [=====] - 0s 277us/step - loss: 1.6989e-04 - acc: 1.0000
 Epoch 388/1000
 310/310 [=====] - 0s 276us/step - loss: 1.6912e-04 - acc: 1.0000
 Epoch 389/1000
 310/310 [=====] - 0s 290us/step - loss: 1.6919e-04 - acc: 1.0000
 Epoch 390/1000
 310/310 [=====] - 0s 285us/step - loss: 1.9008e-04 - acc: 1.0000
 Epoch 391/1000
 310/310 [=====] - 0s 278us/step - loss: 1.5804e-04 - acc: 1.0000
 Epoch 392/1000
 310/310 [=====] - 0s 275us/step - loss: 1.5473e-04 - acc: 1.0000
 Epoch 393/1000

310/310 [=====] - 0s 274us/step - loss: 1.5683e-04 - acc: 1.0000
 Epoch 394/1000
 310/310 [=====] - 0s 270us/step - loss: 1.5637e-04 - acc: 1.0000
 Epoch 395/1000
 310/310 [=====] - 0s 279us/step - loss: 1.6054e-04 - acc: 1.0000
 Epoch 396/1000
 310/310 [=====] - 0s 275us/step - loss: 1.4899e-04 - acc: 1.0000
 Epoch 397/1000
 310/310 [=====] - 0s 277us/step - loss: 1.4716e-04 - acc: 1.0000
 Epoch 398/1000
 310/310 [=====] - 0s 288us/step - loss: 1.5464e-04 - acc: 1.0000
 Epoch 399/1000
 310/310 [=====] - 0s 277us/step - loss: 1.4941e-04 - acc: 1.0000
 Epoch 400/1000
 310/310 [=====] - 0s 260us/step - loss: 1.4395e-04 - acc: 1.0000
 Epoch 401/1000
 310/310 [=====] - 0s 261us/step - loss: 1.4694e-04 - acc: 1.0000
 Epoch 402/1000
 310/310 [=====] - 0s 255us/step - loss: 1.5741e-04 - acc: 1.0000
 Epoch 403/1000
 310/310 [=====] - 0s 280us/step - loss: 1.8748e-04 - acc: 1.0000
 Epoch 404/1000
 310/310 [=====] - 0s 286us/step - loss: 2.3332e-04 - acc: 1.0000
 Epoch 405/1000
 310/310 [=====] - 0s 276us/step - loss: 3.2513e-04 - acc: 1.0000
 Epoch 406/1000
 310/310 [=====] - 0s 272us/step - loss: 1.4343e-04 - acc: 1.0000
 Epoch 407/1000
 310/310 [=====] - 0s 279us/step - loss: 1.3768e-04 - acc: 1.0000
 Epoch 408/1000
 310/310 [=====] - 0s 261us/step - loss: 1.2558e-04 - acc: 1.0000
 Epoch 409/1000
 310/310 [=====] - 0s 265us/step - loss: 1.1872e-04 - acc: 1.0000
 Epoch 410/1000
 310/310 [=====] - 0s 273us/step - loss: 1.2126e-04 - acc: 1.0000
 Epoch 411/1000
 310/310 [=====] - 0s 289us/step - loss: 1.2149e-04 - acc: 1.0000
 Epoch 412/1000
 310/310 [=====] - 0s 274us/step - loss: 1.1110e-04 - acc: 1.0000
 Epoch 413/1000
 310/310 [=====] - 0s 267us/step - loss: 1.1947e-04 - acc: 1.0000
 Epoch 414/1000
 310/310 [=====] - 0s 271us/step - loss: 1.1189e-04 - acc: 1.0000
 Epoch 415/1000
 310/310 [=====] - 0s 282us/step - loss: 1.0886e-04 - acc: 1.0000
 Epoch 416/1000
 310/310 [=====] - 0s 272us/step - loss: 1.0653e-04 - acc: 1.0000
 Epoch 417/1000

310/310 [=====] - 0s 274us/step - loss: 1.1127e-04 - acc: 1.0000
 Epoch 418/1000
 310/310 [=====] - 0s 276us/step - loss: 1.1411e-04 - acc: 1.0000
 Epoch 419/1000
 310/310 [=====] - 0s 279us/step - loss: 1.0926e-04 - acc: 1.0000
 Epoch 420/1000
 310/310 [=====] - 0s 266us/step - loss: 1.0798e-04 - acc: 1.0000
 Epoch 421/1000
 310/310 [=====] - 0s 290us/step - loss: 1.1689e-04 - acc: 1.0000
 Epoch 422/1000
 310/310 [=====] - 0s 289us/step - loss: 1.0237e-04 - acc: 1.0000
 Epoch 423/1000
 310/310 [=====] - 0s 302us/step - loss: 1.1174e-04 - acc: 1.0000
 Epoch 424/1000
 310/310 [=====] - 0s 374us/step - loss: 1.1928e-04 - acc: 1.0000
 Epoch 425/1000
 310/310 [=====] - 0s 333us/step - loss: 1.0855e-04 - acc: 1.0000
 Epoch 426/1000
 310/310 [=====] - 0s 366us/step - loss: 9.6951e-05 - acc: 1.0000
 Epoch 427/1000
 310/310 [=====] - 0s 329us/step - loss: 1.0212e-04 - acc: 1.0000
 Epoch 428/1000
 310/310 [=====] - 0s 268us/step - loss: 9.5786e-05 - acc: 1.0000
 Epoch 429/1000
 310/310 [=====] - 0s 281us/step - loss: 8.7773e-05 - acc: 1.0000
 Epoch 430/1000
 310/310 [=====] - 0s 322us/step - loss: 8.3798e-05 - acc: 1.0000
 Epoch 431/1000
 310/310 [=====] - 0s 364us/step - loss: 8.7343e-05 - acc: 1.0000
 Epoch 432/1000
 310/310 [=====] - 0s 347us/step - loss: 8.7715e-05 - acc: 1.0000
 Epoch 433/1000
 310/310 [=====] - 0s 343us/step - loss: 8.5939e-05 - acc: 1.0000
 Epoch 434/1000
 310/310 [=====] - 0s 319us/step - loss: 8.1556e-05 - acc: 1.0000
 Epoch 435/1000
 310/310 [=====] - 0s 308us/step - loss: 8.5302e-05 - acc: 1.0000
 Epoch 436/1000
 310/310 [=====] - 0s 291us/step - loss: 8.1002e-05 - acc: 1.0000
 Epoch 437/1000
 310/310 [=====] - 0s 278us/step - loss: 9.5683e-05 - acc: 1.0000
 Epoch 438/1000
 310/310 [=====] - 0s 271us/step - loss: 8.0634e-05 - acc: 1.0000
 Epoch 439/1000
 310/310 [=====] - 0s 296us/step - loss: 7.5682e-05 - acc: 1.0000
 Epoch 440/1000
 310/310 [=====] - 0s 349us/step - loss: 7.4398e-05 - acc: 1.0000
 Epoch 441/1000

310/310 [=====] - 0s 374us/step - loss: 7.7335e-05 - acc: 1.0000
 Epoch 442/1000
 310/310 [=====] - 0s 313us/step - loss: 8.0582e-05 - acc: 1.0000
 Epoch 443/1000
 310/310 [=====] - 0s 321us/step - loss: 7.2881e-05 - acc: 1.0000
 Epoch 444/1000
 310/310 [=====] - 0s 340us/step - loss: 7.0236e-05 - acc: 1.0000
 Epoch 445/1000
 310/310 [=====] - 0s 328us/step - loss: 9.1206e-05 - acc: 1.0000
 Epoch 446/1000
 310/310 [=====] - 0s 308us/step - loss: 7.1596e-05 - acc: 1.0000
 Epoch 447/1000
 310/310 [=====] - 0s 315us/step - loss: 8.2539e-05 - acc: 1.0000
 Epoch 448/1000
 310/310 [=====] - 0s 308us/step - loss: 7.7526e-05 - acc: 1.0000
 Epoch 449/1000
 310/310 [=====] - 0s 313us/step - loss: 8.3249e-05 - acc: 1.0000
 Epoch 450/1000
 310/310 [=====] - 0s 354us/step - loss: 6.6594e-05 - acc: 1.0000
 Epoch 451/1000
 310/310 [=====] - 0s 327us/step - loss: 5.9578e-05 - acc: 1.0000
 Epoch 452/1000
 310/310 [=====] - 0s 377us/step - loss: 1.2990e-04 - acc: 1.0000
 Epoch 453/1000
 310/310 [=====] - 0s 311us/step - loss: 7.4822e-05 - acc: 1.0000
 Epoch 454/1000
 310/310 [=====] - 0s 307us/step - loss: 6.2276e-05 - acc: 1.0000
 Epoch 455/1000
 310/310 [=====] - 0s 308us/step - loss: 6.4475e-05 - acc: 1.0000
 Epoch 456/1000
 310/310 [=====] - 0s 285us/step - loss: 6.0140e-05 - acc: 1.0000
 Epoch 457/1000
 310/310 [=====] - 0s 313us/step - loss: 5.6639e-05 - acc: 1.0000
 Epoch 458/1000
 310/310 [=====] - 0s 313us/step - loss: 5.3934e-05 - acc: 1.0000
 Epoch 459/1000
 310/310 [=====] - 0s 316us/step - loss: 5.6832e-05 - acc: 1.0000
 Epoch 460/1000
 310/310 [=====] - 0s 311us/step - loss: 6.1120e-05 - acc: 1.0000
 Epoch 461/1000
 310/310 [=====] - 0s 320us/step - loss: 5.3547e-05 - acc: 1.0000
 Epoch 462/1000
 310/310 [=====] - 0s 286us/step - loss: 5.0598e-05 - acc: 1.0000
 Epoch 463/1000
 310/310 [=====] - 0s 272us/step - loss: 5.4960e-05 - acc: 1.0000
 Epoch 464/1000
 310/310 [=====] - 0s 289us/step - loss: 5.6906e-05 - acc: 1.0000
 Epoch 465/1000

310/310 [=====] - 0s 272us/step - loss: 4.9508e-05 - acc: 1.0000
 Epoch 466/1000
 310/310 [=====] - 0s 290us/step - loss: 4.5667e-05 - acc: 1.0000
 Epoch 467/1000
 310/310 [=====] - 0s 295us/step - loss: 4.9292e-05 - acc: 1.0000
 Epoch 468/1000
 310/310 [=====] - 0s 316us/step - loss: 5.4360e-05 - acc: 1.0000
 Epoch 469/1000
 310/310 [=====] - 0s 305us/step - loss: 4.4662e-05 - acc: 1.0000
 Epoch 470/1000
 310/310 [=====] - 0s 293us/step - loss: 4.7468e-05 - acc: 1.0000
 Epoch 471/1000
 310/310 [=====] - 0s 292us/step - loss: 5.3663e-05 - acc: 1.0000
 Epoch 472/1000
 310/310 [=====] - 0s 284us/step - loss: 4.4800e-05 - acc: 1.0000
 Epoch 473/1000
 310/310 [=====] - 0s 301us/step - loss: 4.6354e-05 - acc: 1.0000
 Epoch 474/1000
 310/310 [=====] - 0s 297us/step - loss: 4.7449e-05 - acc: 1.0000
 Epoch 475/1000
 310/310 [=====] - 0s 300us/step - loss: 5.9236e-05 - acc: 1.0000
 Epoch 476/1000
 310/310 [=====] - 0s 305us/step - loss: 4.4768e-05 - acc: 1.0000
 Epoch 477/1000
 310/310 [=====] - 0s 308us/step - loss: 4.5170e-05 - acc: 1.0000
 Epoch 478/1000
 310/310 [=====] - 0s 311us/step - loss: 5.1633e-05 - acc: 1.0000
 Epoch 479/1000
 310/310 [=====] - 0s 268us/step - loss: 3.9646e-05 - acc: 1.0000
 Epoch 480/1000
 310/310 [=====] - 0s 271us/step - loss: 4.4176e-05 - acc: 1.0000
 Epoch 481/1000
 310/310 [=====] - 0s 274us/step - loss: 4.1677e-05 - acc: 1.0000
 Epoch 482/1000
 310/310 [=====] - 0s 274us/step - loss: 3.7333e-05 - acc: 1.0000
 Epoch 483/1000
 310/310 [=====] - 0s 266us/step - loss: 4.0834e-05 - acc: 1.0000
 Epoch 484/1000
 310/310 [=====] - 0s 263us/step - loss: 4.4248e-05 - acc: 1.0000
 Epoch 485/1000
 310/310 [=====] - 0s 267us/step - loss: 3.7371e-05 - acc: 1.0000
 Epoch 486/1000
 310/310 [=====] - 0s 255us/step - loss: 3.6321e-05 - acc: 1.0000
 Epoch 487/1000
 310/310 [=====] - 0s 257us/step - loss: 3.8932e-05 - acc: 1.0000
 Epoch 488/1000
 310/310 [=====] - 0s 271us/step - loss: 3.2237e-05 - acc: 1.0000
 Epoch 489/1000

310/310 [=====] - 0s 272us/step - loss: 3.8193e-05 - acc: 1.0000
 Epoch 490/1000
 310/310 [=====] - 0s 269us/step - loss: 3.2045e-05 - acc: 1.0000
 Epoch 491/1000
 310/310 [=====] - 0s 273us/step - loss: 3.3877e-05 - acc: 1.0000
 Epoch 492/1000
 310/310 [=====] - 0s 273us/step - loss: 3.4717e-05 - acc: 1.0000
 Epoch 493/1000
 310/310 [=====] - 0s 286us/step - loss: 3.4440e-05 - acc: 1.0000
 Epoch 494/1000
 310/310 [=====] - 0s 315us/step - loss: 2.9725e-05 - acc: 1.0000
 Epoch 495/1000
 310/310 [=====] - 0s 272us/step - loss: 2.8920e-05 - acc: 1.0000
 Epoch 496/1000
 310/310 [=====] - 0s 272us/step - loss: 4.0609e-05 - acc: 1.0000
 Epoch 497/1000
 310/310 [=====] - 0s 271us/step - loss: 4.1724e-05 - acc: 1.0000
 Epoch 498/1000
 310/310 [=====] - 0s 265us/step - loss: 4.3802e-05 - acc: 1.0000
 Epoch 499/1000
 310/310 [=====] - 0s 287us/step - loss: 4.4346e-05 - acc: 1.0000
 Epoch 500/1000
 310/310 [=====] - 0s 273us/step - loss: 2.5686e-05 - acc: 1.0000
 Epoch 501/1000
 310/310 [=====] - 0s 271us/step - loss: 2.6848e-05 - acc: 1.0000
 Epoch 502/1000
 310/310 [=====] - 0s 278us/step - loss: 2.7888e-05 - acc: 1.0000
 Epoch 503/1000
 310/310 [=====] - 0s 342us/step - loss: 2.7206e-05 - acc: 1.0000
 Epoch 504/1000
 310/310 [=====] - 0s 342us/step - loss: 2.5565e-05 - acc: 1.0000
 Epoch 505/1000
 310/310 [=====] - 0s 376us/step - loss: 2.5568e-05 - acc: 1.0000
 Epoch 506/1000
 310/310 [=====] - 0s 393us/step - loss: 2.6073e-05 - acc: 1.0000
 Epoch 507/1000
 310/310 [=====] - 0s 298us/step - loss: 2.3402e-05 - acc: 1.0000
 Epoch 508/1000
 310/310 [=====] - 0s 281us/step - loss: 2.4301e-05 - acc: 1.0000
 Epoch 509/1000
 310/310 [=====] - 0s 280us/step - loss: 2.6403e-05 - acc: 1.0000
 Epoch 510/1000
 310/310 [=====] - 0s 321us/step - loss: 3.1955e-05 - acc: 1.0000
 Epoch 511/1000
 310/310 [=====] - 0s 370us/step - loss: 2.6076e-05 - acc: 1.0000
 Epoch 512/1000
 310/310 [=====] - 0s 382us/step - loss: 2.2483e-05 - acc: 1.0000
 Epoch 513/1000

310/310 [=====] - 0s 399us/step - loss: 2.2847e-05 - acc: 1.0000
 Epoch 514/1000
 310/310 [=====] - 0s 384us/step - loss: 1.9704e-05 - acc: 1.0000
 Epoch 515/1000
 310/310 [=====] - 0s 338us/step - loss: 2.1466e-05 - acc: 1.0000
 Epoch 516/1000
 310/310 [=====] - 0s 329us/step - loss: 2.1153e-05 - acc: 1.0000
 Epoch 517/1000
 310/310 [=====] - 0s 334us/step - loss: 1.8968e-05 - acc: 1.0000
 Epoch 518/1000
 310/310 [=====] - 0s 322us/step - loss: 1.9855e-05 - acc: 1.0000
 Epoch 519/1000
 310/310 [=====] - 0s 328us/step - loss: 2.0687e-05 - acc: 1.0000
 Epoch 520/1000
 310/310 [=====] - 0s 377us/step - loss: 1.8445e-05 - acc: 1.0000
 Epoch 521/1000
 310/310 [=====] - 0s 306us/step - loss: 1.9695e-05 - acc: 1.0000
 Epoch 522/1000
 310/310 [=====] - 0s 307us/step - loss: 2.1163e-05 - acc: 1.0000
 Epoch 523/1000
 310/310 [=====] - 0s 396us/step - loss: 1.8049e-05 - acc: 1.0000
 Epoch 524/1000
 310/310 [=====] - 0s 308us/step - loss: 1.9238e-05 - acc: 1.0000
 Epoch 525/1000
 310/310 [=====] - 0s 302us/step - loss: 1.7259e-05 - acc: 1.0000
 Epoch 526/1000
 310/310 [=====] - 0s 364us/step - loss: 1.9840e-05 - acc: 1.0000
 Epoch 527/1000
 310/310 [=====] - 0s 313us/step - loss: 1.7318e-05 - acc: 1.0000
 Epoch 528/1000
 310/310 [=====] - 0s 290us/step - loss: 2.0636e-05 - acc: 1.0000
 Epoch 529/1000
 310/310 [=====] - 0s 329us/step - loss: 2.2803e-05 - acc: 1.0000
 Epoch 530/1000
 310/310 [=====] - 0s 301us/step - loss: 3.3122e-05 - acc: 1.0000
 Epoch 531/1000
 310/310 [=====] - 0s 314us/step - loss: 4.6167e-05 - acc: 1.0000
 Epoch 532/1000
 310/310 [=====] - 0s 293us/step - loss: 2.0500e-05 - acc: 1.0000
 Epoch 533/1000
 310/310 [=====] - 0s 320us/step - loss: 2.0878e-05 - acc: 1.0000
 Epoch 534/1000
 310/310 [=====] - 0s 304us/step - loss: 2.1188e-05 - acc: 1.0000
 Epoch 535/1000
 310/310 [=====] - 0s 305us/step - loss: 1.3636e-05 - acc: 1.0000
 Epoch 536/1000
 310/310 [=====] - 0s 308us/step - loss: 1.3480e-05 - acc: 1.0000
 Epoch 537/1000

310/310 [=====] - 0s 301us/step - loss: 1.3335e-05 - acc: 1.0000
 Epoch 538/1000
 310/310 [=====] - 0s 312us/step - loss: 1.7206e-05 - acc: 1.0000
 Epoch 539/1000
 310/310 [=====] - 0s 310us/step - loss: 1.2905e-05 - acc: 1.0000
 Epoch 540/1000
 310/310 [=====] - 0s 327us/step - loss: 1.9967e-05 - acc: 1.0000
 Epoch 541/1000
 310/310 [=====] - 0s 323us/step - loss: 1.3127e-05 - acc: 1.0000
 Epoch 542/1000
 310/310 [=====] - 0s 323us/step - loss: 1.1694e-05 - acc: 1.0000
 Epoch 543/1000
 310/310 [=====] - 0s 309us/step - loss: 1.2326e-05 - acc: 1.0000
 Epoch 544/1000
 310/310 [=====] - 0s 328us/step - loss: 1.3690e-05 - acc: 1.0000
 Epoch 545/1000
 310/310 [=====] - 0s 316us/step - loss: 1.0696e-05 - acc: 1.0000
 Epoch 546/1000
 310/310 [=====] - 0s 298us/step - loss: 1.1611e-05 - acc: 1.0000
 Epoch 547/1000
 310/310 [=====] - 0s 317us/step - loss: 1.1666e-05 - acc: 1.0000
 Epoch 548/1000
 310/310 [=====] - 0s 299us/step - loss: 1.3198e-05 - acc: 1.0000
 Epoch 549/1000
 310/310 [=====] - 0s 376us/step - loss: 1.3742e-05 - acc: 1.0000
 Epoch 550/1000
 310/310 [=====] - 0s 329us/step - loss: 1.4328e-05 - acc: 1.0000
 Epoch 551/1000
 310/310 [=====] - 0s 282us/step - loss: 1.6505e-05 - acc: 1.0000
 Epoch 552/1000
 310/310 [=====] - 0s 316us/step - loss: 1.0832e-05 - acc: 1.0000
 Epoch 553/1000
 310/310 [=====] - 0s 259us/step - loss: 1.2950e-05 - acc: 1.0000
 Epoch 554/1000
 310/310 [=====] - 0s 263us/step - loss: 1.0817e-05 - acc: 1.0000
 Epoch 555/1000
 310/310 [=====] - 0s 331us/step - loss: 1.2528e-05 - acc: 1.0000
 Epoch 556/1000
 310/310 [=====] - 0s 318us/step - loss: 1.2590e-05 - acc: 1.0000
 Epoch 557/1000
 310/310 [=====] - 0s 285us/step - loss: 1.0715e-05 - acc: 1.0000
 Epoch 558/1000
 310/310 [=====] - 0s 357us/step - loss: 1.1778e-05 - acc: 1.0000
 Epoch 559/1000
 310/310 [=====] - 0s 368us/step - loss: 8.5805e-06 - acc: 1.0000
 Epoch 560/1000
 310/310 [=====] - 0s 360us/step - loss: 8.6765e-06 - acc: 1.0000
 Epoch 561/1000

310/310 [=====] - 0s 318us/step - loss: 8.6268e-06 - acc: 1.0000
 Epoch 562/1000
 310/310 [=====] - 0s 283us/step - loss: 8.3006e-06 - acc: 1.0000
 Epoch 563/1000
 310/310 [=====] - 0s 296us/step - loss: 9.4784e-06 - acc: 1.0000
 Epoch 564/1000
 310/310 [=====] - 0s 269us/step - loss: 8.7283e-06 - acc: 1.0000
 Epoch 565/1000
 310/310 [=====] - 0s 289us/step - loss: 7.7465e-06 - acc: 1.0000
 Epoch 566/1000
 310/310 [=====] - 0s 285us/step - loss: 8.3329e-06 - acc: 1.0000
 Epoch 567/1000
 310/310 [=====] - 0s 403us/step - loss: 7.7585e-06 - acc: 1.0000
 Epoch 568/1000
 310/310 [=====] - 0s 258us/step - loss: 8.1226e-06 - acc: 1.0000
 Epoch 569/1000
 310/310 [=====] - 0s 234us/step - loss: 7.2889e-06 - acc: 1.0000
 Epoch 570/1000
 310/310 [=====] - 0s 268us/step - loss: 7.3091e-06 - acc: 1.0000
 Epoch 571/1000
 310/310 [=====] - 0s 266us/step - loss: 7.1260e-06 - acc: 1.0000
 Epoch 572/1000
 310/310 [=====] - 0s 264us/step - loss: 8.6269e-06 - acc: 1.0000
 Epoch 573/1000
 310/310 [=====] - 0s 284us/step - loss: 7.0167e-06 - acc: 1.0000
 Epoch 574/1000
 310/310 [=====] - 0s 260us/step - loss: 7.3234e-06 - acc: 1.0000
 Epoch 575/1000
 310/310 [=====] - 0s 272us/step - loss: 8.2720e-06 - acc: 1.0000
 Epoch 576/1000
 310/310 [=====] - 0s 345us/step - loss: 7.8886e-06 - acc: 1.0000
 Epoch 577/1000
 310/310 [=====] - 0s 325us/step - loss: 6.2493e-06 - acc: 1.0000
 Epoch 578/1000
 310/310 [=====] - 0s 273us/step - loss: 6.6711e-06 - acc: 1.0000
 Epoch 579/1000
 310/310 [=====] - 0s 273us/step - loss: 7.2126e-06 - acc: 1.0000
 Epoch 580/1000
 310/310 [=====] - 0s 275us/step - loss: 7.3361e-06 - acc: 1.0000
 Epoch 581/1000
 310/310 [=====] - 0s 301us/step - loss: 7.0340e-06 - acc: 1.0000
 Epoch 582/1000
 310/310 [=====] - 0s 278us/step - loss: 6.5647e-06 - acc: 1.0000
 Epoch 583/1000
 310/310 [=====] - 0s 268us/step - loss: 1.1728e-04 - acc: 1.0000
 Epoch 584/1000
 310/310 [=====] - 0s 272us/step - loss: 0.0793 - acc: 0.9774
 Epoch 585/1000

310/310 [=====] - 0s 269us/step - loss: 0.0580 - acc: 0.9839
 Epoch 586/1000
 310/310 [=====] - 0s 273us/step - loss: 0.0471 - acc: 0.9871
 Epoch 587/1000
 310/310 [=====] - 0s 272us/step - loss: 0.0478 - acc: 0.9903
 Epoch 588/1000
 310/310 [=====] - 0s 267us/step - loss: 0.0013 - acc: 1.0000
 Epoch 589/1000
 310/310 [=====] - 0s 266us/step - loss: 7.6381e-05 - acc: 1.0000
 Epoch 590/1000
 310/310 [=====] - 0s 270us/step - loss: 4.6944e-05 - acc: 1.0000
 Epoch 591/1000
 310/310 [=====] - 0s 267us/step - loss: 3.9267e-05 - acc: 1.0000
 Epoch 592/1000
 310/310 [=====] - 0s 270us/step - loss: 3.5557e-05 - acc: 1.0000
 Epoch 593/1000
 310/310 [=====] - 0s 281us/step - loss: 3.1487e-05 - acc: 1.0000
 Epoch 594/1000
 310/310 [=====] - 0s 271us/step - loss: 2.8790e-05 - acc: 1.0000
 Epoch 595/1000
 310/310 [=====] - 0s 275us/step - loss: 2.6957e-05 - acc: 1.0000
 Epoch 596/1000
 310/310 [=====] - 0s 283us/step - loss: 2.5257e-05 - acc: 1.0000
 Epoch 597/1000
 310/310 [=====] - 0s 297us/step - loss: 2.4020e-05 - acc: 1.0000
 Epoch 598/1000
 310/310 [=====] - 0s 305us/step - loss: 2.2911e-05 - acc: 1.0000
 Epoch 599/1000
 310/310 [=====] - 0s 331us/step - loss: 2.1854e-05 - acc: 1.0000
 Epoch 600/1000
 310/310 [=====] - 0s 345us/step - loss: 2.1043e-05 - acc: 1.0000
 Epoch 601/1000
 310/310 [=====] - 0s 341us/step - loss: 2.0417e-05 - acc: 1.0000
 Epoch 602/1000
 310/310 [=====] - 0s 341us/step - loss: 1.9760e-05 - acc: 1.0000
 Epoch 603/1000
 310/310 [=====] - 0s 339us/step - loss: 1.9150e-05 - acc: 1.0000
 Epoch 604/1000
 310/310 [=====] - 0s 346us/step - loss: 1.8685e-05 - acc: 1.0000
 Epoch 605/1000
 310/310 [=====] - 0s 347us/step - loss: 1.8268e-05 - acc: 1.0000
 Epoch 606/1000
 310/310 [=====] - 0s 366us/step - loss: 1.7868e-05 - acc: 1.0000
 Epoch 607/1000
 310/310 [=====] - 0s 349us/step - loss: 1.7513e-05 - acc: 1.0000
 Epoch 608/1000
 310/310 [=====] - 0s 285us/step - loss: 1.7201e-05 - acc: 1.0000
 Epoch 609/1000

310/310 [=====] - 0s 325us/step - loss: 1.6953e-05 - acc: 1.0000
 Epoch 610/1000
 310/310 [=====] - 0s 342us/step - loss: 1.6700e-05 - acc: 1.0000
 Epoch 611/1000
 310/310 [=====] - 0s 338us/step - loss: 1.6457e-05 - acc: 1.0000
 Epoch 612/1000
 310/310 [=====] - 0s 341us/step - loss: 1.6281e-05 - acc: 1.0000
 Epoch 613/1000
 310/310 [=====] - 0s 335us/step - loss: 1.6018e-05 - acc: 1.0000
 Epoch 614/1000
 310/310 [=====] - 0s 342us/step - loss: 1.5835e-05 - acc: 1.0000
 Epoch 615/1000
 310/310 [=====] - 0s 343us/step - loss: 1.5628e-05 - acc: 1.0000
 Epoch 616/1000
 310/310 [=====] - 0s 342us/step - loss: 1.5441e-05 - acc: 1.0000
 Epoch 617/1000
 310/310 [=====] - 0s 347us/step - loss: 1.5300e-05 - acc: 1.0000
 Epoch 618/1000
 310/310 [=====] - 0s 349us/step - loss: 1.5168e-05 - acc: 1.0000
 Epoch 619/1000
 310/310 [=====] - 0s 337us/step - loss: 1.5038e-05 - acc: 1.0000
 Epoch 620/1000
 310/310 [=====] - 0s 338us/step - loss: 1.4923e-05 - acc: 1.0000
 Epoch 621/1000
 310/310 [=====] - 0s 345us/step - loss: 1.4816e-05 - acc: 1.0000
 Epoch 622/1000
 310/310 [=====] - 0s 382us/step - loss: 1.4723e-05 - acc: 1.0000
 Epoch 623/1000
 310/310 [=====] - 0s 359us/step - loss: 1.4606e-05 - acc: 1.0000
 Epoch 624/1000
 310/310 [=====] - 0s 275us/step - loss: 1.4546e-05 - acc: 1.0000
 Epoch 625/1000
 310/310 [=====] - 0s 278us/step - loss: 1.4389e-05 - acc: 1.0000
 Epoch 626/1000
 310/310 [=====] - 0s 347us/step - loss: 1.4316e-05 - acc: 1.0000
 Epoch 627/1000
 310/310 [=====] - 0s 267us/step - loss: 1.4219e-05 - acc: 1.0000
 Epoch 628/1000
 310/310 [=====] - 0s 268us/step - loss: 1.4153e-05 - acc: 1.0000
 Epoch 629/1000
 310/310 [=====] - 0s 284us/step - loss: 1.4127e-05 - acc: 1.0000
 Epoch 630/1000
 310/310 [=====] - 0s 315us/step - loss: 1.3984e-05 - acc: 1.0000
 Epoch 631/1000
 310/310 [=====] - 0s 253us/step - loss: 1.3911e-05 - acc: 1.0000
 Epoch 632/1000
 310/310 [=====] - 0s 276us/step - loss: 1.3863e-05 - acc: 1.0000
 Epoch 633/1000

310/310 [=====] - 0s 276us/step - loss: 1.3815e-05 - acc: 1.0000
 Epoch 634/1000
 310/310 [=====] - 0s 339us/step - loss: 1.3702e-05 - acc: 1.0000
 Epoch 635/1000
 310/310 [=====] - 0s 339us/step - loss: 1.3596e-05 - acc: 1.0000
 Epoch 636/1000
 310/310 [=====] - 0s 379us/step - loss: 1.3527e-05 - acc: 1.0000
 Epoch 637/1000
 310/310 [=====] - 0s 340us/step - loss: 1.3474e-05 - acc: 1.0000
 Epoch 638/1000
 310/310 [=====] - 0s 344us/step - loss: 1.3367e-05 - acc: 1.0000
 Epoch 639/1000
 310/310 [=====] - 0s 302us/step - loss: 1.3316e-05 - acc: 1.0000
 Epoch 640/1000
 310/310 [=====] - 0s 306us/step - loss: 1.3249e-05 - acc: 1.0000
 Epoch 641/1000
 310/310 [=====] - 0s 295us/step - loss: 1.3199e-05 - acc: 1.0000
 Epoch 642/1000
 310/310 [=====] - 0s 428us/step - loss: 1.3124e-05 - acc: 1.0000
 Epoch 643/1000
 310/310 [=====] - 0s 363us/step - loss: 1.3079e-05 - acc: 1.0000
 Epoch 644/1000
 310/310 [=====] - 0s 324us/step - loss: 1.3027e-05 - acc: 1.0000
 Epoch 645/1000
 310/310 [=====] - 0s 368us/step - loss: 1.2992e-05 - acc: 1.0000
 Epoch 646/1000
 310/310 [=====] - 0s 399us/step - loss: 1.2873e-05 - acc: 1.0000
 Epoch 647/1000
 310/310 [=====] - 0s 314us/step - loss: 1.2913e-05 - acc: 1.0000
 Epoch 648/1000
 310/310 [=====] - 0s 320us/step - loss: 1.2811e-05 - acc: 1.0000
 Epoch 649/1000
 310/310 [=====] - 0s 285us/step - loss: 1.2692e-05 - acc: 1.0000
 Epoch 650/1000
 310/310 [=====] - 0s 286us/step - loss: 1.2658e-05 - acc: 1.0000
 Epoch 651/1000
 310/310 [=====] - 0s 358us/step - loss: 1.2639e-05 - acc: 1.0000
 Epoch 652/1000
 310/310 [=====] - 0s 389us/step - loss: 1.2527e-05 - acc: 1.0000
 Epoch 653/1000
 310/310 [=====] - 0s 358us/step - loss: 1.2614e-05 - acc: 1.0000
 Epoch 654/1000
 310/310 [=====] - 0s 336us/step - loss: 1.2449e-05 - acc: 1.0000
 Epoch 655/1000
 310/310 [=====] - 0s 333us/step - loss: 1.2431e-05 - acc: 1.0000
 Epoch 656/1000
 310/310 [=====] - 0s 340us/step - loss: 1.2321e-05 - acc: 1.0000
 Epoch 657/1000

310/310 [=====] - 0s 345us/step - loss: 1.2330e-05 - acc: 1.0000
 Epoch 658/1000
 310/310 [=====] - 0s 359us/step - loss: 1.2203e-05 - acc: 1.0000
 Epoch 659/1000
 310/310 [=====] - 0s 343us/step - loss: 1.2149e-05 - acc: 1.0000
 Epoch 660/1000
 310/310 [=====] - 0s 347us/step - loss: 1.2179e-05 - acc: 1.0000
 Epoch 661/1000
 310/310 [=====] - 0s 351us/step - loss: 1.2128e-05 - acc: 1.0000
 Epoch 662/1000
 310/310 [=====] - 0s 352us/step - loss: 1.2011e-05 - acc: 1.0000
 Epoch 663/1000
 310/310 [=====] - 0s 346us/step - loss: 1.2065e-05 - acc: 1.0000
 Epoch 664/1000
 310/310 [=====] - 0s 314us/step - loss: 1.1987e-05 - acc: 1.0000
 Epoch 665/1000
 310/310 [=====] - 0s 371us/step - loss: 1.1926e-05 - acc: 1.0000
 Epoch 666/1000
 310/310 [=====] - 0s 274us/step - loss: 1.1840e-05 - acc: 1.0000
 Epoch 667/1000
 310/310 [=====] - 0s 278us/step - loss: 1.1840e-05 - acc: 1.0000
 Epoch 668/1000
 310/310 [=====] - 0s 299us/step - loss: 1.1728e-05 - acc: 1.0000
 Epoch 669/1000
 310/310 [=====] - 0s 312us/step - loss: 1.1852e-05 - acc: 1.0000
 Epoch 670/1000
 310/310 [=====] - 0s 258us/step - loss: 1.1681e-05 - acc: 1.0000
 Epoch 671/1000
 310/310 [=====] - 0s 283us/step - loss: 1.1692e-05 - acc: 1.0000
 Epoch 672/1000
 310/310 [=====] - 0s 308us/step - loss: 1.1760e-05 - acc: 1.0000
 Epoch 673/1000
 310/310 [=====] - 0s 278us/step - loss: 1.1516e-05 - acc: 1.0000
 Epoch 674/1000
 310/310 [=====] - 0s 264us/step - loss: 1.1496e-05 - acc: 1.0000
 Epoch 675/1000
 310/310 [=====] - 0s 328us/step - loss: 1.1487e-05 - acc: 1.0000
 Epoch 676/1000
 310/310 [=====] - 0s 298us/step - loss: 1.1447e-05 - acc: 1.0000
 Epoch 677/1000
 310/310 [=====] - 0s 337us/step - loss: 1.1336e-05 - acc: 1.0000
 Epoch 678/1000
 310/310 [=====] - 0s 324us/step - loss: 1.1364e-05 - acc: 1.0000
 Epoch 679/1000
 310/310 [=====] - 0s 332us/step - loss: 1.1246e-05 - acc: 1.0000
 Epoch 680/1000
 310/310 [=====] - 0s 387us/step - loss: 1.1409e-05 - acc: 1.0000
 Epoch 681/1000

310/310 [=====] - 0s 355us/step - loss: 1.1224e-05 - acc: 1.0000
 Epoch 682/1000
 310/310 [=====] - 0s 293us/step - loss: 1.1169e-05 - acc: 1.0000
 Epoch 683/1000
 310/310 [=====] - 0s 277us/step - loss: 1.1224e-05 - acc: 1.0000
 Epoch 684/1000
 310/310 [=====] - 0s 347us/step - loss: 1.1240e-05 - acc: 1.0000
 Epoch 685/1000
 310/310 [=====] - 0s 301us/step - loss: 1.1143e-05 - acc: 1.0000
 Epoch 686/1000
 310/310 [=====] - 0s 280us/step - loss: 1.1035e-05 - acc: 1.0000
 Epoch 687/1000
 310/310 [=====] - 0s 277us/step - loss: 1.0912e-05 - acc: 1.0000
 Epoch 688/1000
 310/310 [=====] - 0s 278us/step - loss: 1.0957e-05 - acc: 1.0000
 Epoch 689/1000
 310/310 [=====] - 0s 265us/step - loss: 1.0898e-05 - acc: 1.0000
 Epoch 690/1000
 310/310 [=====] - 0s 273us/step - loss: 1.0814e-05 - acc: 1.0000
 Epoch 691/1000
 310/310 [=====] - 0s 264us/step - loss: 1.0827e-05 - acc: 1.0000
 Epoch 692/1000
 310/310 [=====] - 0s 280us/step - loss: 1.0876e-05 - acc: 1.0000
 Epoch 693/1000
 310/310 [=====] - 0s 293us/step - loss: 1.0737e-05 - acc: 1.0000
 Epoch 694/1000
 310/310 [=====] - 0s 275us/step - loss: 1.0838e-05 - acc: 1.0000
 Epoch 695/1000
 310/310 [=====] - 0s 264us/step - loss: 1.0693e-05 - acc: 1.0000
 Epoch 696/1000
 310/310 [=====] - 0s 277us/step - loss: 1.0705e-05 - acc: 1.0000
 Epoch 697/1000
 310/310 [=====] - 0s 286us/step - loss: 1.0600e-05 - acc: 1.0000
 Epoch 698/1000
 310/310 [=====] - 0s 347us/step - loss: 1.0574e-05 - acc: 1.0000
 Epoch 699/1000
 310/310 [=====] - 0s 295us/step - loss: 1.0494e-05 - acc: 1.0000
 Epoch 700/1000
 310/310 [=====] - 0s 271us/step - loss: 1.0453e-05 - acc: 1.0000
 Epoch 701/1000
 310/310 [=====] - 0s 276us/step - loss: 1.0390e-05 - acc: 1.0000
 Epoch 702/1000
 310/310 [=====] - 0s 330us/step - loss: 1.0463e-05 - acc: 1.0000
 Epoch 703/1000
 310/310 [=====] - 0s 315us/step - loss: 1.0467e-05 - acc: 1.0000
 Epoch 704/1000
 310/310 [=====] - 0s 310us/step - loss: 1.0358e-05 - acc: 1.0000
 Epoch 705/1000

310/310 [=====] - 0s 363us/step - loss: 1.0339e-05 - acc: 1.0000
 Epoch 706/1000
 310/310 [=====] - 0s 298us/step - loss: 1.0233e-05 - acc: 1.0000
 Epoch 707/1000
 310/310 [=====] - 0s 289us/step - loss: 1.0128e-05 - acc: 1.0000
 Epoch 708/1000
 310/310 [=====] - 0s 357us/step - loss: 1.0196e-05 - acc: 1.0000
 Epoch 709/1000
 310/310 [=====] - 0s 320us/step - loss: 1.0137e-05 - acc: 1.0000
 Epoch 710/1000
 310/310 [=====] - 0s 334us/step - loss: 1.0031e-05 - acc: 1.0000
 Epoch 711/1000
 310/310 [=====] - 0s 327us/step - loss: 1.0106e-05 - acc: 1.0000
 Epoch 712/1000
 310/310 [=====] - 0s 350us/step - loss: 1.0080e-05 - acc: 1.0000
 Epoch 713/1000
 310/310 [=====] - 0s 362us/step - loss: 1.0141e-05 - acc: 1.0000
 Epoch 714/1000
 310/310 [=====] - 0s 370us/step - loss: 1.0209e-05 - acc: 1.0000
 Epoch 715/1000
 310/310 [=====] - 0s 361us/step - loss: 9.9699e-06 - acc: 1.0000
 Epoch 716/1000
 310/310 [=====] - 0s 323us/step - loss: 9.8823e-06 - acc: 1.0000
 Epoch 717/1000
 310/310 [=====] - 0s 275us/step - loss: 9.8121e-06 - acc: 1.0000
 Epoch 718/1000
 310/310 [=====] - 0s 288us/step - loss: 9.9277e-06 - acc: 1.0000
 Epoch 719/1000
 310/310 [=====] - 0s 357us/step - loss: 9.7765e-06 - acc: 1.0000
 Epoch 720/1000
 310/310 [=====] - 0s 314us/step - loss: 9.7724e-06 - acc: 1.0000
 Epoch 721/1000
 310/310 [=====] - 0s 271us/step - loss: 9.7268e-06 - acc: 1.0000
 Epoch 722/1000
 310/310 [=====] - 0s 285us/step - loss: 9.5849e-06 - acc: 1.0000
 Epoch 723/1000
 310/310 [=====] - 0s 340us/step - loss: 9.6277e-06 - acc: 1.0000
 Epoch 724/1000
 310/310 [=====] - 0s 341us/step - loss: 9.4376e-06 - acc: 1.0000
 Epoch 725/1000
 310/310 [=====] - 0s 346us/step - loss: 9.5518e-06 - acc: 1.0000
 Epoch 726/1000
 310/310 [=====] - 0s 386us/step - loss: 9.7117e-06 - acc: 1.0000
 Epoch 727/1000
 310/310 [=====] - 0s 332us/step - loss: 9.4585e-06 - acc: 1.0000
 Epoch 728/1000
 310/310 [=====] - 0s 322us/step - loss: 9.4026e-06 - acc: 1.0000
 Epoch 729/1000

310/310 [=====] - 0s 336us/step - loss: 9.5046e-06 - acc: 1.0000
 Epoch 730/1000
 310/310 [=====] - 0s 276us/step - loss: 9.2563e-06 - acc: 1.0000
 Epoch 731/1000
 310/310 [=====] - 0s 250us/step - loss: 9.2916e-06 - acc: 1.0000
 Epoch 732/1000
 310/310 [=====] - 0s 296us/step - loss: 9.1648e-06 - acc: 1.0000
 Epoch 733/1000
 310/310 [=====] - 0s 320us/step - loss: 9.3847e-06 - acc: 1.0000
 Epoch 734/1000
 310/310 [=====] - 0s 309us/step - loss: 9.2478e-06 - acc: 1.0000
 Epoch 735/1000
 310/310 [=====] - 0s 309us/step - loss: 9.1484e-06 - acc: 1.0000
 Epoch 736/1000
 310/310 [=====] - 0s 277us/step - loss: 9.2537e-06 - acc: 1.0000
 Epoch 737/1000
 310/310 [=====] - 0s 295us/step - loss: 8.9939e-06 - acc: 1.0000
 Epoch 738/1000
 310/310 [=====] - 0s 269us/step - loss: 9.0481e-06 - acc: 1.0000
 Epoch 739/1000
 310/310 [=====] - 0s 274us/step - loss: 8.9906e-06 - acc: 1.0000
 Epoch 740/1000
 310/310 [=====] - 0s 267us/step - loss: 9.0215e-06 - acc: 1.0000
 Epoch 741/1000
 310/310 [=====] - 0s 284us/step - loss: 8.8952e-06 - acc: 1.0000
 Epoch 742/1000
 310/310 [=====] - 0s 327us/step - loss: 8.8477e-06 - acc: 1.0000
 Epoch 743/1000
 310/310 [=====] - 0s 335us/step - loss: 8.6995e-06 - acc: 1.0000
 Epoch 744/1000
 310/310 [=====] - 0s 273us/step - loss: 8.7785e-06 - acc: 1.0000
 Epoch 745/1000
 310/310 [=====] - 0s 291us/step - loss: 8.8940e-06 - acc: 1.0000
 Epoch 746/1000
 310/310 [=====] - 0s 299us/step - loss: 8.8155e-06 - acc: 1.0000
 Epoch 747/1000
 310/310 [=====] - 0s 305us/step - loss: 8.6625e-06 - acc: 1.0000
 Epoch 748/1000
 310/310 [=====] - 0s 379us/step - loss: 8.6538e-06 - acc: 1.0000
 Epoch 749/1000
 310/310 [=====] - 0s 277us/step - loss: 8.5302e-06 - acc: 1.0000
 Epoch 750/1000
 310/310 [=====] - 0s 268us/step - loss: 8.5933e-06 - acc: 1.0000
 Epoch 751/1000
 310/310 [=====] - 0s 338us/step - loss: 8.3937e-06 - acc: 1.0000
 Epoch 752/1000
 310/310 [=====] - 0s 330us/step - loss: 8.4567e-06 - acc: 1.0000
 Epoch 753/1000

310/310 [=====] - 0s 340us/step - loss: 8.3968e-06 - acc: 1.0000
 Epoch 754/1000
 310/310 [=====] - 0s 347us/step - loss: 8.5702e-06 - acc: 1.0000
 Epoch 755/1000
 310/310 [=====] - 0s 330us/step - loss: 8.5549e-06 - acc: 1.0000
 Epoch 756/1000
 310/310 [=====] - 0s 399us/step - loss: 8.4794e-06 - acc: 1.0000
 Epoch 757/1000
 310/310 [=====] - 0s 319us/step - loss: 8.1860e-06 - acc: 1.0000
 Epoch 758/1000
 310/310 [=====] - 0s 297us/step - loss: 8.1105e-06 - acc: 1.0000
 Epoch 759/1000
 310/310 [=====] - 0s 294us/step - loss: 8.0634e-06 - acc: 1.0000
 Epoch 760/1000
 310/310 [=====] - 0s 308us/step - loss: 8.3963e-06 - acc: 1.0000
 Epoch 761/1000
 310/310 [=====] - 0s 297us/step - loss: 8.0138e-06 - acc: 1.0000
 Epoch 762/1000
 310/310 [=====] - 0s 298us/step - loss: 7.9328e-06 - acc: 1.0000
 Epoch 763/1000
 310/310 [=====] - 0s 333us/step - loss: 7.8204e-06 - acc: 1.0000
 Epoch 764/1000
 310/310 [=====] - 0s 305us/step - loss: 8.0082e-06 - acc: 1.0000
 Epoch 765/1000
 310/310 [=====] - 0s 276us/step - loss: 7.9505e-06 - acc: 1.0000
 Epoch 766/1000
 310/310 [=====] - 0s 301us/step - loss: 7.9568e-06 - acc: 1.0000
 Epoch 767/1000
 310/310 [=====] - 0s 301us/step - loss: 7.7883e-06 - acc: 1.0000
 Epoch 768/1000
 310/310 [=====] - 0s 322us/step - loss: 7.7339e-06 - acc: 1.0000
 Epoch 769/1000
 310/310 [=====] - 0s 300us/step - loss: 7.6224e-06 - acc: 1.0000
 Epoch 770/1000
 310/310 [=====] - 0s 289us/step - loss: 7.6738e-06 - acc: 1.0000
 Epoch 771/1000
 310/310 [=====] - 0s 324us/step - loss: 7.5180e-06 - acc: 1.0000
 Epoch 772/1000
 310/310 [=====] - 0s 328us/step - loss: 7.4675e-06 - acc: 1.0000
 Epoch 773/1000
 310/310 [=====] - 0s 279us/step - loss: 7.5768e-06 - acc: 1.0000
 Epoch 774/1000
 310/310 [=====] - 0s 273us/step - loss: 7.7514e-06 - acc: 1.0000
 Epoch 775/1000
 310/310 [=====] - 0s 310us/step - loss: 7.2555e-06 - acc: 1.0000
 Epoch 776/1000
 310/310 [=====] - 0s 368us/step - loss: 7.4752e-06 - acc: 1.0000
 Epoch 777/1000

310/310 [=====] - 0s 333us/step - loss: 7.4283e-06 - acc: 1.0000
 Epoch 778/1000
 310/310 [=====] - 0s 334us/step - loss: 7.6561e-06 - acc: 1.0000
 Epoch 779/1000
 310/310 [=====] - 0s 337us/step - loss: 7.4251e-06 - acc: 1.0000
 Epoch 780/1000
 310/310 [=====] - 0s 345us/step - loss: 7.0460e-06 - acc: 1.0000
 Epoch 781/1000
 310/310 [=====] - 0s 335us/step - loss: 7.1963e-06 - acc: 1.0000
 Epoch 782/1000
 310/310 [=====] - 0s 349us/step - loss: 7.2832e-06 - acc: 1.0000
 Epoch 783/1000
 310/310 [=====] - 0s 366us/step - loss: 7.1944e-06 - acc: 1.0000
 Epoch 784/1000
 310/310 [=====] - 0s 320us/step - loss: 6.8882e-06 - acc: 1.0000
 Epoch 785/1000
 310/310 [=====] - 0s 327us/step - loss: 7.1038e-06 - acc: 1.0000
 Epoch 786/1000
 310/310 [=====] - 0s 336us/step - loss: 6.7419e-06 - acc: 1.0000
 Epoch 787/1000
 310/310 [=====] - 0s 293us/step - loss: 7.0673e-06 - acc: 1.0000
 Epoch 788/1000
 310/310 [=====] - 0s 323us/step - loss: 6.7644e-06 - acc: 1.0000
 Epoch 789/1000
 310/310 [=====] - 0s 358us/step - loss: 6.6417e-06 - acc: 1.0000
 Epoch 790/1000
 310/310 [=====] - 0s 377us/step - loss: 6.8856e-06 - acc: 1.0000
 Epoch 791/1000
 310/310 [=====] - 0s 326us/step - loss: 6.8639e-06 - acc: 1.0000
 Epoch 792/1000
 310/310 [=====] - 0s 341us/step - loss: 7.7083e-06 - acc: 1.0000
 Epoch 793/1000
 310/310 [=====] - 0s 340us/step - loss: 6.6333e-06 - acc: 1.0000
 Epoch 794/1000
 310/310 [=====] - 0s 366us/step - loss: 6.3758e-06 - acc: 1.0000
 Epoch 795/1000
 310/310 [=====] - 0s 309us/step - loss: 6.3022e-06 - acc: 1.0000
 Epoch 796/1000
 310/310 [=====] - 0s 265us/step - loss: 6.7421e-06 - acc: 1.0000
 Epoch 797/1000
 310/310 [=====] - 0s 283us/step - loss: 5.9364e-06 - acc: 1.0000
 Epoch 798/1000
 310/310 [=====] - 0s 296us/step - loss: 6.3075e-06 - acc: 1.0000
 Epoch 799/1000
 310/310 [=====] - 0s 398us/step - loss: 6.1813e-06 - acc: 1.0000
 Epoch 800/1000
 310/310 [=====] - 0s 338us/step - loss: 6.0576e-06 - acc: 1.0000
 Epoch 801/1000

310/310 [=====] - 0s 367us/step - loss: 6.3336e-06 - acc: 1.0000
 Epoch 802/1000
 310/310 [=====] - 0s 352us/step - loss: 5.9103e-06 - acc: 1.0000
 Epoch 803/1000
 310/310 [=====] - 0s 326us/step - loss: 6.0084e-06 - acc: 1.0000
 Epoch 804/1000
 310/310 [=====] - 0s 364us/step - loss: 6.0323e-06 - acc: 1.0000
 Epoch 805/1000
 310/310 [=====] - 0s 330us/step - loss: 5.9211e-06 - acc: 1.0000
 Epoch 806/1000
 310/310 [=====] - 0s 304us/step - loss: 5.9781e-06 - acc: 1.0000
 Epoch 807/1000
 310/310 [=====] - 0s 297us/step - loss: 6.5976e-06 - acc: 1.0000
 Epoch 808/1000
 310/310 [=====] - 0s 287us/step - loss: 6.0092e-06 - acc: 1.0000
 Epoch 809/1000
 310/310 [=====] - 0s 322us/step - loss: 5.5561e-06 - acc: 1.0000
 Epoch 810/1000
 310/310 [=====] - 0s 295us/step - loss: 5.8228e-06 - acc: 1.0000
 Epoch 811/1000
 310/310 [=====] - 0s 310us/step - loss: 5.8460e-06 - acc: 1.0000
 Epoch 812/1000
 310/310 [=====] - 0s 283us/step - loss: 5.4174e-06 - acc: 1.0000
 Epoch 813/1000
 310/310 [=====] - 0s 270us/step - loss: 5.5706e-06 - acc: 1.0000
 Epoch 814/1000
 310/310 [=====] - 0s 278us/step - loss: 5.5994e-06 - acc: 1.0000
 Epoch 815/1000
 310/310 [=====] - 0s 284us/step - loss: 5.4360e-06 - acc: 1.0000
 Epoch 816/1000
 310/310 [=====] - 0s 380us/step - loss: 5.3377e-06 - acc: 1.0000
 Epoch 817/1000
 310/310 [=====] - 0s 322us/step - loss: 5.3558e-06 - acc: 1.0000
 Epoch 818/1000
 310/310 [=====] - 0s 277us/step - loss: 5.6001e-06 - acc: 1.0000
 Epoch 819/1000
 310/310 [=====] - 0s 313us/step - loss: 5.2315e-06 - acc: 1.0000
 Epoch 820/1000
 310/310 [=====] - 0s 287us/step - loss: 5.1877e-06 - acc: 1.0000
 Epoch 821/1000
 310/310 [=====] - 0s 277us/step - loss: 5.2846e-06 - acc: 1.0000
 Epoch 822/1000
 310/310 [=====] - 0s 346us/step - loss: 4.8573e-06 - acc: 1.0000
 Epoch 823/1000
 310/310 [=====] - 0s 300us/step - loss: 5.0109e-06 - acc: 1.0000
 Epoch 824/1000
 310/310 [=====] - 0s 304us/step - loss: 4.9643e-06 - acc: 1.0000
 Epoch 825/1000

310/310 [=====] - 0s 354us/step - loss: 5.3951e-06 - acc: 1.0000
 Epoch 826/1000
 310/310 [=====] - 0s 352us/step - loss: 4.9794e-06 - acc: 1.0000
 Epoch 827/1000
 310/310 [=====] - 0s 347us/step - loss: 4.7225e-06 - acc: 1.0000
 Epoch 828/1000
 310/310 [=====] - 0s 277us/step - loss: 4.9005e-06 - acc: 1.0000
 Epoch 829/1000
 310/310 [=====] - 0s 277us/step - loss: 4.7443e-06 - acc: 1.0000
 Epoch 830/1000
 310/310 [=====] - 0s 280us/step - loss: 5.1263e-06 - acc: 1.0000
 Epoch 831/1000
 310/310 [=====] - 0s 265us/step - loss: 5.3334e-06 - acc: 1.0000
 Epoch 832/1000
 310/310 [=====] - 0s 282us/step - loss: 4.6711e-06 - acc: 1.0000
 Epoch 833/1000
 310/310 [=====] - 0s 366us/step - loss: 4.9144e-06 - acc: 1.0000
 Epoch 834/1000
 310/310 [=====] - 0s 331us/step - loss: 4.7253e-06 - acc: 1.0000
 Epoch 835/1000
 310/310 [=====] - 0s 338us/step - loss: 4.4347e-06 - acc: 1.0000
 Epoch 836/1000
 310/310 [=====] - 0s 362us/step - loss: 4.4813e-06 - acc: 1.0000
 Epoch 837/1000
 310/310 [=====] - 0s 325us/step - loss: 4.7349e-06 - acc: 1.0000
 Epoch 838/1000
 310/310 [=====] - 0s 326us/step - loss: 5.1752e-06 - acc: 1.0000
 Epoch 839/1000
 310/310 [=====] - 0s 337us/step - loss: 4.2656e-06 - acc: 1.0000
 Epoch 840/1000
 310/310 [=====] - 0s 277us/step - loss: 4.2628e-06 - acc: 1.0000
 Epoch 841/1000
 310/310 [=====] - 0s 261us/step - loss: 4.1709e-06 - acc: 1.0000
 Epoch 842/1000
 310/310 [=====] - 0s 316us/step - loss: 4.0929e-06 - acc: 1.0000
 Epoch 843/1000
 310/310 [=====] - 0s 312us/step - loss: 4.1194e-06 - acc: 1.0000
 Epoch 844/1000
 310/310 [=====] - 0s 280us/step - loss: 3.8821e-06 - acc: 1.0000
 Epoch 845/1000
 310/310 [=====] - 0s 296us/step - loss: 4.1706e-06 - acc: 1.0000
 Epoch 846/1000
 310/310 [=====] - 0s 342us/step - loss: 4.0037e-06 - acc: 1.0000
 Epoch 847/1000
 310/310 [=====] - 0s 306us/step - loss: 3.9575e-06 - acc: 1.0000
 Epoch 848/1000
 310/310 [=====] - 0s 315us/step - loss: 4.0497e-06 - acc: 1.0000
 Epoch 849/1000

310/310 [=====] - 0s 305us/step - loss: 3.7061e-06 - acc: 1.0000
 Epoch 850/1000
 310/310 [=====] - 0s 301us/step - loss: 3.6302e-06 - acc: 1.0000
 Epoch 851/1000
 310/310 [=====] - 0s 268us/step - loss: 4.0711e-06 - acc: 1.0000
 Epoch 852/1000
 310/310 [=====] - 0s 264us/step - loss: 3.6323e-06 - acc: 1.0000
 Epoch 853/1000
 310/310 [=====] - 0s 255us/step - loss: 3.7352e-06 - acc: 1.0000
 Epoch 854/1000
 310/310 [=====] - 0s 272us/step - loss: 3.6783e-06 - acc: 1.0000
 Epoch 855/1000
 310/310 [=====] - 0s 277us/step - loss: 3.8569e-06 - acc: 1.0000
 Epoch 856/1000
 310/310 [=====] - 0s 325us/step - loss: 4.4589e-06 - acc: 1.0000
 Epoch 857/1000
 310/310 [=====] - 0s 335us/step - loss: 3.4117e-06 - acc: 1.0000
 Epoch 858/1000
 310/310 [=====] - 0s 287us/step - loss: 3.4987e-06 - acc: 1.0000
 Epoch 859/1000
 310/310 [=====] - 0s 282us/step - loss: 3.4574e-06 - acc: 1.0000
 Epoch 860/1000
 310/310 [=====] - 0s 282us/step - loss: 3.6456e-06 - acc: 1.0000
 Epoch 861/1000
 310/310 [=====] - 0s 268us/step - loss: 3.3108e-06 - acc: 1.0000
 Epoch 862/1000
 310/310 [=====] - 0s 266us/step - loss: 3.3098e-06 - acc: 1.0000
 Epoch 863/1000
 310/310 [=====] - 0s 354us/step - loss: 3.1873e-06 - acc: 1.0000
 Epoch 864/1000
 310/310 [=====] - 0s 282us/step - loss: 3.3263e-06 - acc: 1.0000
 Epoch 865/1000
 310/310 [=====] - 0s 293us/step - loss: 3.1036e-06 - acc: 1.0000
 Epoch 866/1000
 310/310 [=====] - 0s 276us/step - loss: 3.3320e-06 - acc: 1.0000
 Epoch 867/1000
 310/310 [=====] - 0s 360us/step - loss: 3.1313e-06 - acc: 1.0000
 Epoch 868/1000
 310/310 [=====] - 0s 348us/step - loss: 3.1791e-06 - acc: 1.0000
 Epoch 869/1000
 310/310 [=====] - 0s 347us/step - loss: 3.1109e-06 - acc: 1.0000
 Epoch 870/1000
 310/310 [=====] - 0s 321us/step - loss: 5.7427e-06 - acc: 1.0000
 Epoch 871/1000
 310/310 [=====] - 0s 272us/step - loss: 4.7256e-06 - acc: 1.0000
 Epoch 872/1000
 310/310 [=====] - 0s 315us/step - loss: 3.1850e-06 - acc: 1.0000
 Epoch 873/1000

310/310 [=====] - 0s 344us/step - loss: 2.8283e-06 - acc: 1.0000
 Epoch 874/1000
 310/310 [=====] - 0s 337us/step - loss: 2.8725e-06 - acc: 1.0000
 Epoch 875/1000
 310/310 [=====] - 0s 324us/step - loss: 3.0049e-06 - acc: 1.0000
 Epoch 876/1000
 310/310 [=====] - 0s 335us/step - loss: 3.0302e-06 - acc: 1.0000
 Epoch 877/1000
 310/310 [=====] - 0s 300us/step - loss: 2.6595e-06 - acc: 1.0000
 Epoch 878/1000
 310/310 [=====] - 0s 303us/step - loss: 2.6357e-06 - acc: 1.0000
 Epoch 879/1000
 310/310 [=====] - 0s 286us/step - loss: 2.6443e-06 - acc: 1.0000
 Epoch 880/1000
 310/310 [=====] - 0s 279us/step - loss: 2.5367e-06 - acc: 1.0000
 Epoch 881/1000
 310/310 [=====] - 0s 283us/step - loss: 2.5771e-06 - acc: 1.0000
 Epoch 882/1000
 310/310 [=====] - 0s 324us/step - loss: 2.6590e-06 - acc: 1.0000
 Epoch 883/1000
 310/310 [=====] - 0s 317us/step - loss: 2.6521e-06 - acc: 1.0000
 Epoch 884/1000
 310/310 [=====] - 0s 316us/step - loss: 2.5569e-06 - acc: 1.0000
 Epoch 885/1000
 310/310 [=====] - 0s 370us/step - loss: 2.4172e-06 - acc: 1.0000
 Epoch 886/1000
 310/310 [=====] - 0s 438us/step - loss: 2.4717e-06 - acc: 1.0000
 Epoch 887/1000
 310/310 [=====] - 0s 338us/step - loss: 2.4878e-06 - acc: 1.0000
 Epoch 888/1000
 310/310 [=====] - 0s 300us/step - loss: 2.4472e-06 - acc: 1.0000
 Epoch 889/1000
 310/310 [=====] - 0s 308us/step - loss: 2.3422e-06 - acc: 1.0000
 Epoch 890/1000
 310/310 [=====] - 0s 353us/step - loss: 2.1828e-06 - acc: 1.0000
 Epoch 891/1000
 310/310 [=====] - 0s 321us/step - loss: 2.5024e-06 - acc: 1.0000
 Epoch 892/1000
 310/310 [=====] - 0s 319us/step - loss: 2.2689e-06 - acc: 1.0000
 Epoch 893/1000
 310/310 [=====] - 0s 330us/step - loss: 2.2802e-06 - acc: 1.0000
 Epoch 894/1000
 310/310 [=====] - 0s 302us/step - loss: 2.2516e-06 - acc: 1.0000
 Epoch 895/1000
 310/310 [=====] - 0s 311us/step - loss: 2.2946e-06 - acc: 1.0000
 Epoch 896/1000
 310/310 [=====] - 0s 303us/step - loss: 2.2629e-06 - acc: 1.0000
 Epoch 897/1000

310/310 [=====] - 0s 311us/step - loss: 2.1585e-06 - acc: 1.0000
 Epoch 898/1000
 310/310 [=====] - 0s 360us/step - loss: 2.1628e-06 - acc: 1.0000
 Epoch 899/1000
 310/310 [=====] - 0s 297us/step - loss: 1.9829e-06 - acc: 1.0000
 Epoch 900/1000
 310/310 [=====] - 0s 314us/step - loss: 2.0034e-06 - acc: 1.0000
 Epoch 901/1000
 310/310 [=====] - 0s 322us/step - loss: 1.8682e-06 - acc: 1.0000
 Epoch 902/1000
 310/310 [=====] - 0s 323us/step - loss: 1.9483e-06 - acc: 1.0000 0s - 1
 Epoch 903/1000
 310/310 [=====] - 0s 302us/step - loss: 1.8780e-06 - acc: 1.0000
 Epoch 904/1000
 310/310 [=====] - 0s 309us/step - loss: 1.8256e-06 - acc: 1.0000
 Epoch 905/1000
 310/310 [=====] - 0s 316us/step - loss: 1.8034e-06 - acc: 1.0000
 Epoch 906/1000
 310/310 [=====] - 0s 331us/step - loss: 1.8022e-06 - acc: 1.0000
 Epoch 907/1000
 310/310 [=====] - 0s 353us/step - loss: 1.8389e-06 - acc: 1.0000
 Epoch 908/1000
 310/310 [=====] - 0s 343us/step - loss: 1.9691e-06 - acc: 1.0000
 Epoch 909/1000
 310/310 [=====] - 0s 363us/step - loss: 1.9030e-06 - acc: 1.0000
 Epoch 910/1000
 310/310 [=====] - 0s 320us/step - loss: 2.1251e-06 - acc: 1.0000
 Epoch 911/1000
 310/310 [=====] - 0s 347us/step - loss: 1.8179e-06 - acc: 1.0000
 Epoch 912/1000
 310/310 [=====] - 0s 318us/step - loss: 1.7121e-06 - acc: 1.0000
 Epoch 913/1000
 310/310 [=====] - 0s 332us/step - loss: 1.6690e-06 - acc: 1.0000
 Epoch 914/1000
 310/310 [=====] - 0s 298us/step - loss: 1.7730e-06 - acc: 1.0000
 Epoch 915/1000
 310/310 [=====] - 0s 305us/step - loss: 1.6918e-06 - acc: 1.0000
 Epoch 916/1000
 310/310 [=====] - 0s 323us/step - loss: 1.8645e-06 - acc: 1.0000
 Epoch 917/1000
 310/310 [=====] - 0s 352us/step - loss: 1.6698e-06 - acc: 1.0000
 Epoch 918/1000
 310/310 [=====] - 0s 320us/step - loss: 1.6496e-06 - acc: 1.0000
 Epoch 919/1000
 310/310 [=====] - 0s 313us/step - loss: 1.5794e-06 - acc: 1.0000
 Epoch 920/1000
 310/310 [=====] - 0s 314us/step - loss: 1.4348e-06 - acc: 1.0000
 Epoch 921/1000

310/310 [=====] - 0s 335us/step - loss: 1.6092e-06 - acc: 1.0000
 Epoch 922/1000
 310/310 [=====] - 0s 342us/step - loss: 1.5060e-06 - acc: 1.0000
 Epoch 923/1000
 310/310 [=====] - 0s 329us/step - loss: 1.4265e-06 - acc: 1.0000
 Epoch 924/1000
 310/310 [=====] - 0s 356us/step - loss: 1.4964e-06 - acc: 1.0000
 Epoch 925/1000
 310/310 [=====] - 0s 360us/step - loss: 1.3942e-06 - acc: 1.0000
 Epoch 926/1000
 310/310 [=====] - 0s 388us/step - loss: 1.3646e-06 - acc: 1.0000
 Epoch 927/1000
 310/310 [=====] - 0s 336us/step - loss: 1.3594e-06 - acc: 1.0000
 Epoch 928/1000
 310/310 [=====] - 0s 363us/step - loss: 1.4464e-06 - acc: 1.0000
 Epoch 929/1000
 310/310 [=====] - 0s 348us/step - loss: 1.4022e-06 - acc: 1.0000
 Epoch 930/1000
 310/310 [=====] - 0s 339us/step - loss: 1.3962e-06 - acc: 1.0000
 Epoch 931/1000
 310/310 [=====] - 0s 338us/step - loss: 1.6267e-06 - acc: 1.0000
 Epoch 932/1000
 310/310 [=====] - 0s 346us/step - loss: 1.4470e-06 - acc: 1.0000
 Epoch 933/1000
 310/310 [=====] - 0s 332us/step - loss: 1.4411e-06 - acc: 1.0000
 Epoch 934/1000
 310/310 [=====] - 0s 337us/step - loss: 1.5370e-06 - acc: 1.0000
 Epoch 935/1000
 310/310 [=====] - 0s 349us/step - loss: 1.2579e-06 - acc: 1.0000
 Epoch 936/1000
 310/310 [=====] - 0s 336us/step - loss: 1.1444e-06 - acc: 1.0000
 Epoch 937/1000
 310/310 [=====] - 0s 314us/step - loss: 1.1768e-06 - acc: 1.0000
 Epoch 938/1000
 310/310 [=====] - 0s 304us/step - loss: 1.2318e-06 - acc: 1.0000
 Epoch 939/1000
 310/310 [=====] - 0s 315us/step - loss: 1.3312e-06 - acc: 1.0000
 Epoch 940/1000
 310/310 [=====] - 0s 340us/step - loss: 1.3465e-06 - acc: 1.0000
 Epoch 941/1000
 310/310 [=====] - 0s 332us/step - loss: 1.1556e-06 - acc: 1.0000
 Epoch 942/1000
 310/310 [=====] - 0s 342us/step - loss: 1.1751e-06 - acc: 1.0000
 Epoch 943/1000
 310/310 [=====] - 0s 341us/step - loss: 1.1074e-06 - acc: 1.0000
 Epoch 944/1000
 310/310 [=====] - 0s 358us/step - loss: 1.1556e-06 - acc: 1.0000
 Epoch 945/1000

310/310 [=====] - 0s 362us/step - loss: 1.2178e-06 - acc: 1.0000
 Epoch 946/1000
 310/310 [=====] - 0s 350us/step - loss: 1.0002e-06 - acc: 1.0000
 Epoch 947/1000
 310/310 [=====] - 0s 356us/step - loss: 9.8842e-07 - acc: 1.0000
 Epoch 948/1000
 310/310 [=====] - 0s 352us/step - loss: 1.0124e-06 - acc: 1.0000
 Epoch 949/1000
 310/310 [=====] - 0s 339us/step - loss: 9.8777e-07 - acc: 1.0000
 Epoch 950/1000
 310/310 [=====] - 0s 317us/step - loss: 9.4839e-07 - acc: 1.0000
 Epoch 951/1000
 310/310 [=====] - 0s 307us/step - loss: 1.0112e-06 - acc: 1.0000
 Epoch 952/1000
 310/310 [=====] - 0s 274us/step - loss: 9.9802e-07 - acc: 1.0000
 Epoch 953/1000
 310/310 [=====] - 0s 279us/step - loss: 9.3381e-07 - acc: 1.0000
 Epoch 954/1000
 310/310 [=====] - 0s 319us/step - loss: 9.3601e-07 - acc: 1.0000
 Epoch 955/1000
 310/310 [=====] - 0s 367us/step - loss: 8.6545e-07 - acc: 1.0000
 Epoch 956/1000
 310/310 [=====] - 0s 297us/step - loss: 9.3668e-07 - acc: 1.0000
 Epoch 957/1000
 310/310 [=====] - 0s 367us/step - loss: 9.0930e-07 - acc: 1.0000
 Epoch 958/1000
 310/310 [=====] - 0s 334us/step - loss: 8.4390e-07 - acc: 1.0000
 Epoch 959/1000
 310/310 [=====] - 0s 341us/step - loss: 8.8825e-07 - acc: 1.0000
 Epoch 960/1000
 310/310 [=====] - 0s 347us/step - loss: 8.7382e-07 - acc: 1.0000
 Epoch 961/1000
 310/310 [=====] - 0s 358us/step - loss: 1.0678e-06 - acc: 1.0000
 Epoch 962/1000
 310/310 [=====] - 0s 349us/step - loss: 8.4068e-07 - acc: 1.0000
 Epoch 963/1000
 310/310 [=====] - 0s 352us/step - loss: 8.1026e-07 - acc: 1.0000
 Epoch 964/1000
 310/310 [=====] - 0s 353us/step - loss: 8.1256e-07 - acc: 1.0000
 Epoch 965/1000
 310/310 [=====] - 0s 342us/step - loss: 9.0122e-07 - acc: 1.0000
 Epoch 966/1000
 310/310 [=====] - 0s 350us/step - loss: 7.9040e-07 - acc: 1.0000
 Epoch 967/1000
 310/310 [=====] - 0s 319us/step - loss: 7.6487e-07 - acc: 1.0000
 Epoch 968/1000
 310/310 [=====] - 0s 352us/step - loss: 7.5433e-07 - acc: 1.0000
 Epoch 969/1000

310/310 [=====] - 0s 336us/step - loss: 7.4639e-07 - acc: 1.0000
 Epoch 970/1000
 310/310 [=====] - 0s 336us/step - loss: 7.5036e-07 - acc: 1.0000
 Epoch 971/1000
 310/310 [=====] - 0s 330us/step - loss: 7.3854e-07 - acc: 1.0000
 Epoch 972/1000
 310/310 [=====] - 0s 358us/step - loss: 7.6556e-07 - acc: 1.0000
 Epoch 973/1000
 310/310 [=====] - 0s 339us/step - loss: 7.4264e-07 - acc: 1.0000
 Epoch 974/1000
 310/310 [=====] - 0s 345us/step - loss: 6.8146e-07 - acc: 1.0000
 Epoch 975/1000
 310/310 [=====] - 0s 338us/step - loss: 6.8586e-07 - acc: 1.0000
 Epoch 976/1000
 310/310 [=====] - 0s 333us/step - loss: 6.8480e-07 - acc: 1.0000
 Epoch 977/1000
 310/310 [=====] - 0s 296us/step - loss: 7.0576e-07 - acc: 1.0000
 Epoch 978/1000
 310/310 [=====] - 0s 300us/step - loss: 7.2531e-07 - acc: 1.0000
 Epoch 979/1000
 310/310 [=====] - 0s 296us/step - loss: 6.3521e-07 - acc: 1.0000
 Epoch 980/1000
 310/310 [=====] - 0s 296us/step - loss: 7.4804e-07 - acc: 1.0000
 Epoch 981/1000
 310/310 [=====] - 0s 373us/step - loss: 5.9609e-07 - acc: 1.0000
 Epoch 982/1000
 310/310 [=====] - 0s 330us/step - loss: 6.3700e-07 - acc: 1.0000
 Epoch 983/1000
 310/310 [=====] - 0s 318us/step - loss: 6.4300e-07 - acc: 1.0000
 Epoch 984/1000
 310/310 [=====] - 0s 364us/step - loss: 5.9251e-07 - acc: 1.0000
 Epoch 985/1000
 310/310 [=====] - 0s 346us/step - loss: 5.9631e-07 - acc: 1.0000
 Epoch 986/1000
 310/310 [=====] - 0s 363us/step - loss: 5.8693e-07 - acc: 1.0000
 Epoch 987/1000
 310/310 [=====] - 0s 338us/step - loss: 8.1807e-07 - acc: 1.0000
 Epoch 988/1000
 310/310 [=====] - 0s 344us/step - loss: 6.7481e-07 - acc: 1.0000
 Epoch 989/1000
 310/310 [=====] - 0s 323us/step - loss: 5.6957e-07 - acc: 1.0000
 Epoch 990/1000
 310/310 [=====] - 0s 300us/step - loss: 5.4846e-07 - acc: 1.0000
 Epoch 991/1000
 310/310 [=====] - 0s 319us/step - loss: 6.3745e-07 - acc: 1.0000
 Epoch 992/1000
 310/310 [=====] - 0s 357us/step - loss: 5.7134e-07 - acc: 1.0000
 Epoch 993/1000

```

310/310 [=====] - 0s 329us/step - loss: 5.3176e-07 - acc: 1.0000
Epoch 994/1000
310/310 [=====] - 0s 341us/step - loss: 5.3507e-07 - acc: 1.0000
Epoch 995/1000
310/310 [=====] - 0s 344us/step - loss: 5.0849e-07 - acc: 1.0000
Epoch 996/1000
310/310 [=====] - 0s 357us/step - loss: 5.2352e-07 - acc: 1.0000
Epoch 997/1000
310/310 [=====] - 0s 387us/step - loss: 4.7121e-07 - acc: 1.0000
Epoch 998/1000
310/310 [=====] - 0s 307us/step - loss: 5.4188e-07 - acc: 1.0000
Epoch 999/1000
310/310 [=====] - 0s 359us/step - loss: 5.2378e-07 - acc: 1.0000
Epoch 1000/1000
310/310 [=====] - 0s 337us/step - loss: 4.9831e-07 - acc: 1.0000
310/310 [=====] - 1s 2ms/step

```

acc: 100.00%

In [189]: scores, model.metrics_names

Incredibly accurate?

Out[189]: ([4.3544487198232674e-07, 1.0], ['loss', 'acc'])

```

In [191]: model = Sequential()
          model.add(Dense(2, input_dim=9, 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=9)
          # evaluate the model
          scores = model.evaluate(X, Y)
          print("\n%s: %.2f%%" % (model.metrics_names[1], scores[1]*100))

```

```

Epoch 1/1000
310/310 [=====] - 2s 5ms/step - loss: 0.6366 - acc: 0.6677
Epoch 2/1000
310/310 [=====] - 0s 287us/step - loss: 0.6359 - acc: 0.6677
Epoch 3/1000
310/310 [=====] - 0s 280us/step - loss: 0.6360 - acc: 0.6677
Epoch 4/1000
310/310 [=====] - 0s 281us/step - loss: 0.6360 - acc: 0.6677
Epoch 5/1000
310/310 [=====] - 0s 277us/step - loss: 0.6359 - acc: 0.6677
Epoch 6/1000

```

310/310 [=====] - 0s 281us/step - loss: 0.6361 - acc: 0.6677
 Epoch 7/1000
 310/310 [=====] - 0s 284us/step - loss: 0.6359 - acc: 0.6677
 Epoch 8/1000
 310/310 [=====] - 0s 292us/step - loss: 0.6359 - acc: 0.6677
 Epoch 9/1000
 310/310 [=====] - 0s 257us/step - loss: 0.6359 - acc: 0.6677
 Epoch 10/1000
 310/310 [=====] - 0s 286us/step - loss: 0.6359 - acc: 0.6677
 Epoch 11/1000
 310/310 [=====] - 0s 270us/step - loss: 0.6358 - acc: 0.6677
 Epoch 12/1000
 310/310 [=====] - 0s 278us/step - loss: 0.6360 - acc: 0.6677
 Epoch 13/1000
 310/310 [=====] - 0s 366us/step - loss: 0.6358 - acc: 0.6677
 Epoch 14/1000
 310/310 [=====] - 0s 278us/step - loss: 0.6358 - acc: 0.6677
 Epoch 15/1000
 310/310 [=====] - 0s 324us/step - loss: 0.6359 - acc: 0.6677
 Epoch 16/1000
 310/310 [=====] - 0s 327us/step - loss: 0.6359 - acc: 0.6677
 Epoch 17/1000
 310/310 [=====] - 0s 289us/step - loss: 0.6358 - acc: 0.6677
 Epoch 18/1000
 310/310 [=====] - 0s 306us/step - loss: 0.6358 - acc: 0.6677
 Epoch 19/1000
 310/310 [=====] - 0s 333us/step - loss: 0.6358 - acc: 0.6677
 Epoch 20/1000
 310/310 [=====] - 0s 319us/step - loss: 0.6359 - acc: 0.6677
 Epoch 21/1000
 310/310 [=====] - 0s 323us/step - loss: 0.6359 - acc: 0.6677
 Epoch 22/1000
 310/310 [=====] - 0s 312us/step - loss: 0.6359 - acc: 0.6677
 Epoch 23/1000
 310/310 [=====] - 0s 305us/step - loss: 0.6361 - acc: 0.6677
 Epoch 24/1000
 310/310 [=====] - 0s 327us/step - loss: 0.6359 - acc: 0.6677
 Epoch 25/1000
 310/310 [=====] - 0s 334us/step - loss: 0.6361 - acc: 0.6677
 Epoch 26/1000
 310/310 [=====] - 0s 325us/step - loss: 0.6358 - acc: 0.6677
 Epoch 27/1000
 310/310 [=====] - 0s 319us/step - loss: 0.6360 - acc: 0.6677
 Epoch 28/1000
 310/310 [=====] - 0s 305us/step - loss: 0.6358 - acc: 0.6677
 Epoch 29/1000
 310/310 [=====] - 0s 353us/step - loss: 0.6358 - acc: 0.6677
 Epoch 30/1000

310/310 [=====] - 0s 365us/step - loss: 0.6358 - acc: 0.6677
Epoch 31/1000
310/310 [=====] - 0s 358us/step - loss: 0.6359 - acc: 0.6677
Epoch 32/1000
310/310 [=====] - 0s 318us/step - loss: 0.6362 - acc: 0.6677
Epoch 33/1000
310/310 [=====] - 0s 293us/step - loss: 0.6358 - acc: 0.6677
Epoch 34/1000
310/310 [=====] - 0s 317us/step - loss: 0.6359 - acc: 0.6677
Epoch 35/1000
310/310 [=====] - 0s 367us/step - loss: 0.6360 - acc: 0.6677
Epoch 36/1000
310/310 [=====] - 0s 304us/step - loss: 0.6358 - acc: 0.6677
Epoch 37/1000
310/310 [=====] - 0s 295us/step - loss: 0.6358 - acc: 0.6677
Epoch 38/1000
310/310 [=====] - 0s 263us/step - loss: 0.6360 - acc: 0.6677
Epoch 39/1000
310/310 [=====] - 0s 305us/step - loss: 0.6359 - acc: 0.6677
Epoch 40/1000
310/310 [=====] - 0s 295us/step - loss: 0.6360 - acc: 0.6677
Epoch 41/1000
310/310 [=====] - 0s 324us/step - loss: 0.6360 - acc: 0.6677
Epoch 42/1000
310/310 [=====] - 0s 326us/step - loss: 0.6360 - acc: 0.6677
Epoch 43/1000
310/310 [=====] - 0s 336us/step - loss: 0.6358 - acc: 0.6677
Epoch 44/1000
310/310 [=====] - 0s 309us/step - loss: 0.6359 - acc: 0.6677
Epoch 45/1000
310/310 [=====] - 0s 319us/step - loss: 0.6359 - acc: 0.6677
Epoch 46/1000
310/310 [=====] - 0s 297us/step - loss: 0.6360 - acc: 0.6677
Epoch 47/1000
310/310 [=====] - 0s 278us/step - loss: 0.6358 - acc: 0.6677
Epoch 48/1000
310/310 [=====] - 0s 291us/step - loss: 0.6360 - acc: 0.6677
Epoch 49/1000
310/310 [=====] - 0s 285us/step - loss: 0.6359 - acc: 0.6677
Epoch 50/1000
310/310 [=====] - 0s 279us/step - loss: 0.6360 - acc: 0.6677
Epoch 51/1000
310/310 [=====] - 0s 311us/step - loss: 0.6357 - acc: 0.6677
Epoch 52/1000
310/310 [=====] - 0s 310us/step - loss: 0.6360 - acc: 0.6677
Epoch 53/1000
310/310 [=====] - 0s 308us/step - loss: 0.6358 - acc: 0.6677
Epoch 54/1000

310/310 [=====] - 0s 295us/step - loss: 0.6360 - acc: 0.6677
 Epoch 55/1000
 310/310 [=====] - 0s 367us/step - loss: 0.6360 - acc: 0.6677
 Epoch 56/1000
 310/310 [=====] - 0s 319us/step - loss: 0.6359 - acc: 0.6677
 Epoch 57/1000
 310/310 [=====] - 0s 326us/step - loss: 0.6358 - acc: 0.6677
 Epoch 58/1000
 310/310 [=====] - 0s 326us/step - loss: 0.6358 - acc: 0.6677
 Epoch 59/1000
 310/310 [=====] - 0s 322us/step - loss: 0.6358 - acc: 0.6677
 Epoch 60/1000
 310/310 [=====] - 0s 312us/step - loss: 0.6358 - acc: 0.6677
 Epoch 61/1000
 310/310 [=====] - 0s 308us/step - loss: 0.6359 - acc: 0.6677
 Epoch 62/1000
 310/310 [=====] - 0s 302us/step - loss: 0.6358 - acc: 0.6677
 Epoch 63/1000
 310/310 [=====] - 0s 318us/step - loss: 0.6359 - acc: 0.6677
 Epoch 64/1000
 310/310 [=====] - 0s 322us/step - loss: 0.6358 - acc: 0.6677
 Epoch 65/1000
 310/310 [=====] - 0s 357us/step - loss: 0.6361 - acc: 0.6677
 Epoch 66/1000
 310/310 [=====] - 0s 287us/step - loss: 0.6358 - acc: 0.6677
 Epoch 67/1000
 310/310 [=====] - 0s 297us/step - loss: 0.6360 - acc: 0.6677
 Epoch 68/1000
 310/310 [=====] - 0s 308us/step - loss: 0.6359 - acc: 0.6677
 Epoch 69/1000
 310/310 [=====] - 0s 310us/step - loss: 0.6358 - acc: 0.6677
 Epoch 70/1000
 310/310 [=====] - 0s 284us/step - loss: 0.6358 - acc: 0.6677
 Epoch 71/1000
 310/310 [=====] - 0s 288us/step - loss: 0.6359 - acc: 0.6677
 Epoch 72/1000
 310/310 [=====] - 0s 289us/step - loss: 0.6359 - acc: 0.6677
 Epoch 73/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
 Epoch 74/1000
 310/310 [=====] - 0s 309us/step - loss: 0.6360 - acc: 0.6677
 Epoch 75/1000
 310/310 [=====] - 0s 294us/step - loss: 0.6358 - acc: 0.6677
 Epoch 76/1000
 310/310 [=====] - 0s 293us/step - loss: 0.6360 - acc: 0.6677
 Epoch 77/1000
 310/310 [=====] - 0s 285us/step - loss: 0.6360 - acc: 0.6677
 Epoch 78/1000


```

310/310 [=====] - 0s 289us/step - loss: 0.6359 - acc: 0.6677
Epoch 79/1000
310/310 [=====] - 0s 283us/step - loss: 0.6360 - acc: 0.6677
Epoch 80/1000
310/310 [=====] - 0s 299us/step - loss: 0.6358 - acc: 0.6677
Epoch 81/1000
310/310 [=====] - 0s 339us/step - loss: 0.6359 - acc: 0.6677
Epoch 82/1000
310/310 [=====] - 0s 288us/step - loss: 0.6360 - acc: 0.6677
Epoch 83/1000
310/310 [=====] - 0s 299us/step - loss: 0.6360 - acc: 0.6677
Epoch 84/1000
310/310 [=====] - 0s 322us/step - loss: 0.6360 - acc: 0.6677
Epoch 85/1000
310/310 [=====] - 0s 270us/step - loss: 0.6359 - acc: 0.6677
Epoch 86/1000
310/310 [=====] - 0s 237us/step - loss: 0.6359 - acc: 0.6677
Epoch 87/1000
310/310 [=====] - 0s 257us/step - loss: 0.6358 - acc: 0.6677
Epoch 88/1000
310/310 [=====] - 0s 314us/step - loss: 0.6360 - acc: 0.6677
Epoch 89/1000
310/310 [=====] - 0s 311us/step - loss: 0.6359 - acc: 0.6677
Epoch 90/1000
310/310 [=====] - 0s 351us/step - loss: 0.6358 - acc: 0.6677
Epoch 91/1000
310/310 [=====] - 0s 453us/step - loss: 0.6359 - acc: 0.6677
Epoch 92/1000
310/310 [=====] - 0s 348us/step - loss: 0.6358 - acc: 0.6677
Epoch 93/1000
310/310 [=====] - 0s 328us/step - loss: 0.6359 - acc: 0.6677
Epoch 94/1000
310/310 [=====] - 0s 245us/step - loss: 0.6359 - acc: 0.6677
Epoch 95/1000
310/310 [=====] - ETA: 0s - loss: 0.6462 - acc: 0.652 - 0s 251us/step -
Epoch 96/1000
310/310 [=====] - 0s 276us/step - loss: 0.6359 - acc: 0.6677
Epoch 97/1000
310/310 [=====] - 0s 396us/step - loss: 0.6359 - acc: 0.6677
Epoch 98/1000
310/310 [=====] - 0s 359us/step - loss: 0.6359 - acc: 0.6677
Epoch 99/1000
310/310 [=====] - 0s 230us/step - loss: 0.6360 - acc: 0.6677
Epoch 100/1000
310/310 [=====] - 0s 309us/step - loss: 0.6360 - acc: 0.6677
Epoch 101/1000
310/310 [=====] - 0s 376us/step - loss: 0.6359 - acc: 0.6677
Epoch 102/1000

```

```

310/310 [=====] - 0s 309us/step - loss: 0.6358 - acc: 0.6677
Epoch 103/1000
310/310 [=====] - 0s 298us/step - loss: 0.6360 - acc: 0.6677
Epoch 104/1000
310/310 [=====] - 0s 317us/step - loss: 0.6359 - acc: 0.6677
Epoch 105/1000
310/310 [=====] - 0s 340us/step - loss: 0.6359 - acc: 0.6677
Epoch 106/1000
310/310 [=====] - 0s 301us/step - loss: 0.6359 - acc: 0.6677
Epoch 107/1000
310/310 [=====] - 0s 335us/step - loss: 0.6359 - acc: 0.6677
Epoch 108/1000
310/310 [=====] - 0s 313us/step - loss: 0.6360 - acc: 0.6677
Epoch 109/1000
310/310 [=====] - 0s 345us/step - loss: 0.6359 - acc: 0.6677
Epoch 110/1000
310/310 [=====] - 0s 355us/step - loss: 0.6359 - acc: 0.6677
Epoch 111/1000
310/310 [=====] - 0s 320us/step - loss: 0.6359 - acc: 0.6677
Epoch 112/1000
310/310 [=====] - 0s 310us/step - loss: 0.6360 - acc: 0.6677
Epoch 113/1000
310/310 [=====] - 0s 307us/step - loss: 0.6360 - acc: 0.6677
Epoch 114/1000
310/310 [=====] - 0s 270us/step - loss: 0.6358 - acc: 0.6677
Epoch 115/1000
310/310 [=====] - 0s 296us/step - loss: 0.6360 - acc: 0.6677
Epoch 116/1000
310/310 [=====] - 0s 300us/step - loss: 0.6359 - acc: 0.6677
Epoch 117/1000
310/310 [=====] - 0s 346us/step - loss: 0.6358 - acc: 0.6677
Epoch 118/1000
310/310 [=====] - 0s 318us/step - loss: 0.6360 - acc: 0.6677
Epoch 119/1000
310/310 [=====] - 0s 290us/step - loss: 0.6361 - acc: 0.6677
Epoch 120/1000
310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
Epoch 121/1000
310/310 [=====] - 0s 285us/step - loss: 0.6358 - acc: 0.6677
Epoch 122/1000
310/310 [=====] - 0s 352us/step - loss: 0.6358 - acc: 0.6677
Epoch 123/1000
310/310 [=====] - 0s 331us/step - loss: 0.6359 - acc: 0.6677
Epoch 124/1000
310/310 [=====] - 0s 309us/step - loss: 0.6359 - acc: 0.6677
Epoch 125/1000
310/310 [=====] - 0s 294us/step - loss: 0.6360 - acc: 0.6677
Epoch 126/1000

```

310/310 [=====] - 0s 286us/step - loss: 0.6358 - acc: 0.6677
Epoch 127/1000
310/310 [=====] - 0s 318us/step - loss: 0.6359 - acc: 0.6677
Epoch 128/1000
310/310 [=====] - 0s 349us/step - loss: 0.6358 - acc: 0.6677
Epoch 129/1000
310/310 [=====] - 0s 301us/step - loss: 0.6359 - acc: 0.6677
Epoch 130/1000
310/310 [=====] - 0s 301us/step - loss: 0.6360 - acc: 0.6677
Epoch 131/1000
310/310 [=====] - 0s 312us/step - loss: 0.6359 - acc: 0.6677
Epoch 132/1000
310/310 [=====] - 0s 361us/step - loss: 0.6359 - acc: 0.6677
Epoch 133/1000
310/310 [=====] - 0s 357us/step - loss: 0.6358 - acc: 0.6677
Epoch 134/1000
310/310 [=====] - 0s 294us/step - loss: 0.6360 - acc: 0.6677
Epoch 135/1000
310/310 [=====] - 0s 308us/step - loss: 0.6359 - acc: 0.6677
Epoch 136/1000
310/310 [=====] - 0s 314us/step - loss: 0.6360 - acc: 0.6677
Epoch 137/1000
310/310 [=====] - 0s 339us/step - loss: 0.6361 - acc: 0.6677
Epoch 138/1000
310/310 [=====] - 0s 338us/step - loss: 0.6365 - acc: 0.6677
Epoch 139/1000
310/310 [=====] - 0s 329us/step - loss: 0.6359 - acc: 0.6677
Epoch 140/1000
310/310 [=====] - 0s 322us/step - loss: 0.6359 - acc: 0.6677
Epoch 141/1000
310/310 [=====] - 0s 303us/step - loss: 0.6358 - acc: 0.6677
Epoch 142/1000
310/310 [=====] - 0s 292us/step - loss: 0.6358 - acc: 0.6677
Epoch 143/1000
310/310 [=====] - 0s 314us/step - loss: 0.6359 - acc: 0.6677
Epoch 144/1000
310/310 [=====] - 0s 365us/step - loss: 0.6360 - acc: 0.6677
Epoch 145/1000
310/310 [=====] - 0s 333us/step - loss: 0.6360 - acc: 0.6677
Epoch 146/1000
310/310 [=====] - 0s 310us/step - loss: 0.6358 - acc: 0.6677
Epoch 147/1000
310/310 [=====] - 0s 288us/step - loss: 0.6358 - acc: 0.6677
Epoch 148/1000
310/310 [=====] - 0s 375us/step - loss: 0.6359 - acc: 0.6677
Epoch 149/1000
310/310 [=====] - 0s 370us/step - loss: 0.6359 - acc: 0.6677
Epoch 150/1000

310/310 [=====] - 0s 350us/step - loss: 0.6359 - acc: 0.6677
 Epoch 151/1000
 310/310 [=====] - 0s 343us/step - loss: 0.6358 - acc: 0.6677
 Epoch 152/1000
 310/310 [=====] - 0s 360us/step - loss: 0.6360 - acc: 0.6677
 Epoch 153/1000
 310/310 [=====] - 0s 307us/step - loss: 0.6360 - acc: 0.6677
 Epoch 154/1000
 310/310 [=====] - 0s 377us/step - loss: 0.6359 - acc: 0.6677
 Epoch 155/1000
 310/310 [=====] - 0s 341us/step - loss: 0.6359 - acc: 0.6677
 Epoch 156/1000
 310/310 [=====] - 0s 270us/step - loss: 0.6359 - acc: 0.6677
 Epoch 157/1000
 310/310 [=====] - 0s 303us/step - loss: 0.6359 - acc: 0.6677
 Epoch 158/1000
 310/310 [=====] - 0s 299us/step - loss: 0.6359 - acc: 0.6677
 Epoch 159/1000
 310/310 [=====] - 0s 322us/step - loss: 0.6360 - acc: 0.6677
 Epoch 160/1000
 310/310 [=====] - 0s 342us/step - loss: 0.6359 - acc: 0.6677
 Epoch 161/1000
 310/310 [=====] - 0s 318us/step - loss: 0.6359 - acc: 0.6677
 Epoch 162/1000
 310/310 [=====] - 0s 336us/step - loss: 0.6359 - acc: 0.6677
 Epoch 163/1000
 310/310 [=====] - 0s 298us/step - loss: 0.6360 - acc: 0.6677
 Epoch 164/1000
 310/310 [=====] - 0s 306us/step - loss: 0.6358 - acc: 0.6677
 Epoch 165/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6358 - acc: 0.6677
 Epoch 166/1000
 310/310 [=====] - 0s 245us/step - loss: 0.6359 - acc: 0.6677
 Epoch 167/1000
 310/310 [=====] - 0s 245us/step - loss: 0.6364 - acc: 0.6677
 Epoch 168/1000
 310/310 [=====] - 0s 237us/step - loss: 0.6358 - acc: 0.6677
 Epoch 169/1000
 310/310 [=====] - 0s 271us/step - loss: 0.6358 - acc: 0.6677
 Epoch 170/1000
 310/310 [=====] - 0s 372us/step - loss: 0.6359 - acc: 0.6677
 Epoch 171/1000
 310/310 [=====] - 0s 341us/step - loss: 0.6358 - acc: 0.6677
 Epoch 172/1000
 310/310 [=====] - 0s 371us/step - loss: 0.6359 - acc: 0.6677
 Epoch 173/1000
 310/310 [=====] - 0s 371us/step - loss: 0.6358 - acc: 0.6677
 Epoch 174/1000

310/310 [=====] - 0s 328us/step - loss: 0.6359 - acc: 0.6677
 Epoch 175/1000
 310/310 [=====] - 0s 294us/step - loss: 0.6359 - acc: 0.6677
 Epoch 176/1000
 310/310 [=====] - 0s 341us/step - loss: 0.6359 - acc: 0.6677
 Epoch 177/1000
 310/310 [=====] - 0s 361us/step - loss: 0.6359 - acc: 0.6677
 Epoch 178/1000
 310/310 [=====] - 0s 295us/step - loss: 0.6359 - acc: 0.6677
 Epoch 179/1000
 310/310 [=====] - 0s 321us/step - loss: 0.6359 - acc: 0.6677
 Epoch 180/1000
 310/310 [=====] - 0s 346us/step - loss: 0.6359 - acc: 0.6677
 Epoch 181/1000
 310/310 [=====] - 0s 306us/step - loss: 0.6360 - acc: 0.6677
 Epoch 182/1000
 310/310 [=====] - 0s 325us/step - loss: 0.6361 - acc: 0.6677
 Epoch 183/1000
 310/310 [=====] - 0s 315us/step - loss: 0.6358 - acc: 0.6677
 Epoch 184/1000
 310/310 [=====] - 0s 315us/step - loss: 0.6358 - acc: 0.6677
 Epoch 185/1000
 310/310 [=====] - 0s 319us/step - loss: 0.6359 - acc: 0.6677
 Epoch 186/1000
 310/310 [=====] - 0s 330us/step - loss: 0.6360 - acc: 0.6677
 Epoch 187/1000
 310/310 [=====] - 0s 333us/step - loss: 0.6359 - acc: 0.6677
 Epoch 188/1000
 310/310 [=====] - 0s 311us/step - loss: 0.6358 - acc: 0.6677
 Epoch 189/1000
 310/310 [=====] - 0s 327us/step - loss: 0.6359 - acc: 0.6677
 Epoch 190/1000
 310/310 [=====] - 0s 312us/step - loss: 0.6360 - acc: 0.6677
 Epoch 191/1000
 310/310 [=====] - 0s 333us/step - loss: 0.6358 - acc: 0.6677
 Epoch 192/1000
 310/310 [=====] - 0s 327us/step - loss: 0.6359 - acc: 0.6677
 Epoch 193/1000
 310/310 [=====] - 0s 284us/step - loss: 0.6359 - acc: 0.6677
 Epoch 194/1000
 310/310 [=====] - 0s 330us/step - loss: 0.6358 - acc: 0.6677
 Epoch 195/1000
 310/310 [=====] - 0s 355us/step - loss: 0.6359 - acc: 0.6677
 Epoch 196/1000
 310/310 [=====] - 0s 347us/step - loss: 0.6359 - acc: 0.6677
 Epoch 197/1000
 310/310 [=====] - 0s 306us/step - loss: 0.6361 - acc: 0.6677
 Epoch 198/1000

310/310 [=====] - 0s 331us/step - loss: 0.6359 - acc: 0.6677
Epoch 199/1000
310/310 [=====] - 0s 369us/step - loss: 0.6359 - acc: 0.6677
Epoch 200/1000
310/310 [=====] - 0s 303us/step - loss: 0.6359 - acc: 0.6677
Epoch 201/1000
310/310 [=====] - 0s 294us/step - loss: 0.6359 - acc: 0.6677
Epoch 202/1000
310/310 [=====] - 0s 284us/step - loss: 0.6359 - acc: 0.6677
Epoch 203/1000
310/310 [=====] - 0s 317us/step - loss: 0.6359 - acc: 0.6677
Epoch 204/1000
310/310 [=====] - 0s 349us/step - loss: 0.6360 - acc: 0.6677
Epoch 205/1000
310/310 [=====] - 0s 361us/step - loss: 0.6360 - acc: 0.6677
Epoch 206/1000
310/310 [=====] - 0s 337us/step - loss: 0.6361 - acc: 0.6677
Epoch 207/1000
310/310 [=====] - 0s 321us/step - loss: 0.6359 - acc: 0.6677
Epoch 208/1000
310/310 [=====] - 0s 298us/step - loss: 0.6358 - acc: 0.6677
Epoch 209/1000
310/310 [=====] - 0s 310us/step - loss: 0.6361 - acc: 0.6677
Epoch 210/1000
310/310 [=====] - 0s 289us/step - loss: 0.6359 - acc: 0.6677
Epoch 211/1000
310/310 [=====] - 0s 297us/step - loss: 0.6359 - acc: 0.6677
Epoch 212/1000
310/310 [=====] - 0s 334us/step - loss: 0.6360 - acc: 0.6677
Epoch 213/1000
310/310 [=====] - 0s 362us/step - loss: 0.6359 - acc: 0.6677
Epoch 214/1000
310/310 [=====] - 0s 360us/step - loss: 0.6359 - acc: 0.6677
Epoch 215/1000
310/310 [=====] - 0s 339us/step - loss: 0.6360 - acc: 0.6677
Epoch 216/1000
310/310 [=====] - 0s 342us/step - loss: 0.6358 - acc: 0.6677
Epoch 217/1000
310/310 [=====] - 0s 354us/step - loss: 0.6360 - acc: 0.6677
Epoch 218/1000
310/310 [=====] - 0s 330us/step - loss: 0.6358 - acc: 0.6677
Epoch 219/1000
310/310 [=====] - 0s 307us/step - loss: 0.6358 - acc: 0.6677
Epoch 220/1000
310/310 [=====] - 0s 291us/step - loss: 0.6359 - acc: 0.6677
Epoch 221/1000
310/310 [=====] - 0s 271us/step - loss: 0.6359 - acc: 0.6677
Epoch 222/1000

310/310 [=====] - 0s 331us/step - loss: 0.6359 - acc: 0.6677
 Epoch 223/1000
 310/310 [=====] - 0s 333us/step - loss: 0.6358 - acc: 0.6677
 Epoch 224/1000
 310/310 [=====] - 0s 274us/step - loss: 0.6358 - acc: 0.6677
 Epoch 225/1000
 310/310 [=====] - 0s 334us/step - loss: 0.6360 - acc: 0.6677
 Epoch 226/1000
 310/310 [=====] - 0s 331us/step - loss: 0.6359 - acc: 0.6677
 Epoch 227/1000
 310/310 [=====] - 0s 303us/step - loss: 0.6360 - acc: 0.6677
 Epoch 228/1000
 310/310 [=====] - 0s 326us/step - loss: 0.6358 - acc: 0.6677
 Epoch 229/1000
 310/310 [=====] - 0s 322us/step - loss: 0.6359 - acc: 0.6677
 Epoch 230/1000
 310/310 [=====] - 0s 326us/step - loss: 0.6359 - acc: 0.6677
 Epoch 231/1000
 310/310 [=====] - 0s 336us/step - loss: 0.6358 - acc: 0.6677
 Epoch 232/1000
 310/310 [=====] - 0s 329us/step - loss: 0.6362 - acc: 0.6677
 Epoch 233/1000
 310/310 [=====] - 0s 314us/step - loss: 0.6358 - acc: 0.6677
 Epoch 234/1000
 310/310 [=====] - 0s 291us/step - loss: 0.6359 - acc: 0.6677
 Epoch 235/1000
 310/310 [=====] - 0s 319us/step - loss: 0.6358 - acc: 0.6677
 Epoch 236/1000
 310/310 [=====] - 0s 314us/step - loss: 0.6359 - acc: 0.6677
 Epoch 237/1000
 310/310 [=====] - 0s 320us/step - loss: 0.6359 - acc: 0.6677
 Epoch 238/1000
 310/310 [=====] - 0s 265us/step - loss: 0.6358 - acc: 0.6677
 Epoch 239/1000
 310/310 [=====] - 0s 267us/step - loss: 0.6358 - acc: 0.6677
 Epoch 240/1000
 310/310 [=====] - 0s 293us/step - loss: 0.6358 - acc: 0.6677
 Epoch 241/1000
 310/310 [=====] - 0s 259us/step - loss: 0.6358 - acc: 0.6677
 Epoch 242/1000
 310/310 [=====] - 0s 267us/step - loss: 0.6359 - acc: 0.6677
 Epoch 243/1000
 310/310 [=====] - 0s 283us/step - loss: 0.6359 - acc: 0.6677
 Epoch 244/1000
 310/310 [=====] - 0s 242us/step - loss: 0.6359 - acc: 0.6677
 Epoch 245/1000
 310/310 [=====] - 0s 269us/step - loss: 0.6359 - acc: 0.6677
 Epoch 246/1000

310/310 [=====] - 0s 246us/step - loss: 0.6359 - acc: 0.6677
 Epoch 247/1000
 310/310 [=====] - 0s 234us/step - loss: 0.6359 - acc: 0.6677
 Epoch 248/1000
 310/310 [=====] - 0s 239us/step - loss: 0.6358 - acc: 0.6677
 Epoch 249/1000
 310/310 [=====] - 0s 237us/step - loss: 0.6359 - acc: 0.6677
 Epoch 250/1000
 310/310 [=====] - 0s 231us/step - loss: 0.6359 - acc: 0.6677
 Epoch 251/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6360 - acc: 0.6677
 Epoch 252/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
 Epoch 253/1000
 310/310 [=====] - 0s 251us/step - loss: 0.6359 - acc: 0.6677
 Epoch 254/1000
 310/310 [=====] - 0s 260us/step - loss: 0.6359 - acc: 0.6677
 Epoch 255/1000
 310/310 [=====] - 0s 249us/step - loss: 0.6358 - acc: 0.6677
 Epoch 256/1000
 310/310 [=====] - 0s 256us/step - loss: 0.6360 - acc: 0.6677
 Epoch 257/1000
 310/310 [=====] - 0s 254us/step - loss: 0.6360 - acc: 0.6677
 Epoch 258/1000
 310/310 [=====] - 0s 251us/step - loss: 0.6358 - acc: 0.6677
 Epoch 259/1000
 310/310 [=====] - 0s 284us/step - loss: 0.6359 - acc: 0.6677
 Epoch 260/1000
 310/310 [=====] - 0s 257us/step - loss: 0.6360 - acc: 0.6677
 Epoch 261/1000
 310/310 [=====] - 0s 265us/step - loss: 0.6361 - acc: 0.6677
 Epoch 262/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6361 - acc: 0.6677
 Epoch 263/1000
 310/310 [=====] - 0s 252us/step - loss: 0.6360 - acc: 0.6677
 Epoch 264/1000
 310/310 [=====] - 0s 257us/step - loss: 0.6359 - acc: 0.6677
 Epoch 265/1000
 310/310 [=====] - 0s 257us/step - loss: 0.6360 - acc: 0.6677
 Epoch 266/1000
 310/310 [=====] - 0s 253us/step - loss: 0.6360 - acc: 0.6677
 Epoch 267/1000
 310/310 [=====] - 0s 252us/step - loss: 0.6359 - acc: 0.6677
 Epoch 268/1000
 310/310 [=====] - 0s 257us/step - loss: 0.6358 - acc: 0.6677
 Epoch 269/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
 Epoch 270/1000

310/310 [=====] - 0s 248us/step - loss: 0.6359 - acc: 0.6677
Epoch 271/1000
310/310 [=====] - 0s 264us/step - loss: 0.6360 - acc: 0.6677
Epoch 272/1000
310/310 [=====] - 0s 316us/step - loss: 0.6359 - acc: 0.6677
Epoch 273/1000
310/310 [=====] - 0s 328us/step - loss: 0.6359 - acc: 0.6677
Epoch 274/1000
310/310 [=====] - 0s 320us/step - loss: 0.6358 - acc: 0.6677
Epoch 275/1000
310/310 [=====] - 0s 312us/step - loss: 0.6359 - acc: 0.6677
Epoch 276/1000
310/310 [=====] - 0s 333us/step - loss: 0.6358 - acc: 0.6677
Epoch 277/1000
310/310 [=====] - 0s 371us/step - loss: 0.6359 - acc: 0.6677
Epoch 278/1000
310/310 [=====] - 0s 330us/step - loss: 0.6360 - acc: 0.6677
Epoch 279/1000
310/310 [=====] - 0s 330us/step - loss: 0.6359 - acc: 0.6677
Epoch 280/1000
310/310 [=====] - 0s 330us/step - loss: 0.6359 - acc: 0.6677
Epoch 281/1000
310/310 [=====] - 0s 328us/step - loss: 0.6361 - acc: 0.6677
Epoch 282/1000
310/310 [=====] - 0s 319us/step - loss: 0.6359 - acc: 0.6677
Epoch 283/1000
310/310 [=====] - 0s 386us/step - loss: 0.6359 - acc: 0.6677
Epoch 284/1000
310/310 [=====] - 0s 335us/step - loss: 0.6358 - acc: 0.6677
Epoch 285/1000
310/310 [=====] - 0s 334us/step - loss: 0.6358 - acc: 0.6677
Epoch 286/1000
310/310 [=====] - 0s 278us/step - loss: 0.6359 - acc: 0.6677
Epoch 287/1000
310/310 [=====] - 0s 347us/step - loss: 0.6359 - acc: 0.6677
Epoch 288/1000
310/310 [=====] - 0s 273us/step - loss: 0.6359 - acc: 0.6677
Epoch 289/1000
310/310 [=====] - 0s 320us/step - loss: 0.6360 - acc: 0.6677
Epoch 290/1000
310/310 [=====] - 0s 335us/step - loss: 0.6359 - acc: 0.6677
Epoch 291/1000
310/310 [=====] - 0s 326us/step - loss: 0.6358 - acc: 0.6677
Epoch 292/1000
310/310 [=====] - 0s 308us/step - loss: 0.6359 - acc: 0.6677
Epoch 293/1000
310/310 [=====] - 0s 336us/step - loss: 0.6358 - acc: 0.6677
Epoch 294/1000

310/310 [=====] - 0s 298us/step - loss: 0.6358 - acc: 0.6677
 Epoch 295/1000
 310/310 [=====] - 0s 330us/step - loss: 0.6359 - acc: 0.6677
 Epoch 296/1000
 310/310 [=====] - 0s 276us/step - loss: 0.6359 - acc: 0.6677
 Epoch 297/1000
 310/310 [=====] - 0s 265us/step - loss: 0.6359 - acc: 0.6677
 Epoch 298/1000
 310/310 [=====] - 0s 270us/step - loss: 0.6360 - acc: 0.6677
 Epoch 299/1000
 310/310 [=====] - 0s 363us/step - loss: 0.6359 - acc: 0.6677
 Epoch 300/1000
 310/310 [=====] - 0s 321us/step - loss: 0.6358 - acc: 0.6677
 Epoch 301/1000
 310/310 [=====] - 0s 305us/step - loss: 0.6358 - acc: 0.6677
 Epoch 302/1000
 310/310 [=====] - 0s 306us/step - loss: 0.6359 - acc: 0.6677
 Epoch 303/1000
 310/310 [=====] - 0s 327us/step - loss: 0.6359 - acc: 0.6677
 Epoch 304/1000
 310/310 [=====] - 0s 303us/step - loss: 0.6359 - acc: 0.6677
 Epoch 305/1000
 310/310 [=====] - 0s 312us/step - loss: 0.6359 - acc: 0.6677
 Epoch 306/1000
 310/310 [=====] - 0s 304us/step - loss: 0.6358 - acc: 0.6677
 Epoch 307/1000
 310/310 [=====] - 0s 287us/step - loss: 0.6358 - acc: 0.6677
 Epoch 308/1000
 310/310 [=====] - 0s 296us/step - loss: 0.6359 - acc: 0.6677
 Epoch 309/1000
 310/310 [=====] - 0s 295us/step - loss: 0.6358 - acc: 0.6677
 Epoch 310/1000
 310/310 [=====] - 0s 301us/step - loss: 0.6359 - acc: 0.6677
 Epoch 311/1000
 310/310 [=====] - 0s 300us/step - loss: 0.6360 - acc: 0.6677
 Epoch 312/1000
 310/310 [=====] - 0s 338us/step - loss: 0.6361 - acc: 0.6677
 Epoch 313/1000
 310/310 [=====] - 0s 317us/step - loss: 0.6360 - acc: 0.6677
 Epoch 314/1000
 310/310 [=====] - 0s 337us/step - loss: 0.6359 - acc: 0.6677
 Epoch 315/1000
 310/310 [=====] - 0s 291us/step - loss: 0.6359 - acc: 0.6677
 Epoch 316/1000
 310/310 [=====] - 0s 302us/step - loss: 0.6359 - acc: 0.6677
 Epoch 317/1000
 310/310 [=====] - 0s 323us/step - loss: 0.6359 - acc: 0.6677
 Epoch 318/1000

310/310 [=====] - 0s 296us/step - loss: 0.6359 - acc: 0.6677
 Epoch 319/1000
 310/310 [=====] - 0s 339us/step - loss: 0.6360 - acc: 0.6677
 Epoch 320/1000
 310/310 [=====] - 0s 305us/step - loss: 0.6360 - acc: 0.6677
 Epoch 321/1000
 310/310 [=====] - 0s 301us/step - loss: 0.6359 - acc: 0.6677
 Epoch 322/1000
 310/310 [=====] - 0s 285us/step - loss: 0.6359 - acc: 0.6677
 Epoch 323/1000
 310/310 [=====] - 0s 297us/step - loss: 0.6358 - acc: 0.6677
 Epoch 324/1000
 310/310 [=====] - 0s 283us/step - loss: 0.6359 - acc: 0.6677
 Epoch 325/1000
 310/310 [=====] - 0s 327us/step - loss: 0.6359 - acc: 0.6677
 Epoch 326/1000
 310/310 [=====] - 0s 340us/step - loss: 0.6359 - acc: 0.6677
 Epoch 327/1000
 310/310 [=====] - 0s 286us/step - loss: 0.6358 - acc: 0.6677
 Epoch 328/1000
 310/310 [=====] - 0s 262us/step - loss: 0.6358 - acc: 0.6677
 Epoch 329/1000
 310/310 [=====] - 0s 267us/step - loss: 0.6359 - acc: 0.6677
 Epoch 330/1000
 310/310 [=====] - 0s 288us/step - loss: 0.6359 - acc: 0.6677
 Epoch 331/1000
 310/310 [=====] - 0s 353us/step - loss: 0.6361 - acc: 0.6677
 Epoch 332/1000
 310/310 [=====] - 0s 354us/step - loss: 0.6360 - acc: 0.6677
 Epoch 333/1000
 310/310 [=====] - 0s 314us/step - loss: 0.6359 - acc: 0.6677
 Epoch 334/1000
 310/310 [=====] - 0s 279us/step - loss: 0.6359 - acc: 0.6677
 Epoch 335/1000
 310/310 [=====] - 0s 280us/step - loss: 0.6358 - acc: 0.6677
 Epoch 336/1000
 310/310 [=====] - 0s 295us/step - loss: 0.6359 - acc: 0.6677
 Epoch 337/1000
 310/310 [=====] - 0s 326us/step - loss: 0.6358 - acc: 0.6677
 Epoch 338/1000
 310/310 [=====] - 0s 321us/step - loss: 0.6358 - acc: 0.6677
 Epoch 339/1000
 310/310 [=====] - 0s 294us/step - loss: 0.6359 - acc: 0.6677
 Epoch 340/1000
 310/310 [=====] - 0s 295us/step - loss: 0.6359 - acc: 0.6677
 Epoch 341/1000
 310/310 [=====] - 0s 292us/step - loss: 0.6358 - acc: 0.6677
 Epoch 342/1000

310/310 [=====] - 0s 334us/step - loss: 0.6359 - acc: 0.6677
Epoch 343/1000
310/310 [=====] - 0s 293us/step - loss: 0.6359 - acc: 0.6677
Epoch 344/1000
310/310 [=====] - 0s 278us/step - loss: 0.6360 - acc: 0.6677
Epoch 345/1000
310/310 [=====] - 0s 309us/step - loss: 0.6359 - acc: 0.6677
Epoch 346/1000
310/310 [=====] - 0s 329us/step - loss: 0.6361 - acc: 0.6677
Epoch 347/1000
310/310 [=====] - 0s 321us/step - loss: 0.6358 - acc: 0.6677
Epoch 348/1000
310/310 [=====] - 0s 326us/step - loss: 0.6358 - acc: 0.6677
Epoch 349/1000
310/310 [=====] - 0s 350us/step - loss: 0.6359 - acc: 0.6677
Epoch 350/1000
310/310 [=====] - 0s 346us/step - loss: 0.6359 - acc: 0.6677
Epoch 351/1000
310/310 [=====] - 0s 333us/step - loss: 0.6358 - acc: 0.6677
Epoch 352/1000
310/310 [=====] - 0s 315us/step - loss: 0.6359 - acc: 0.6677
Epoch 353/1000
310/310 [=====] - 0s 316us/step - loss: 0.6360 - acc: 0.6677
Epoch 354/1000
310/310 [=====] - 0s 356us/step - loss: 0.6359 - acc: 0.6677
Epoch 355/1000
310/310 [=====] - 0s 383us/step - loss: 0.6361 - acc: 0.6677
Epoch 356/1000
310/310 [=====] - 0s 290us/step - loss: 0.6360 - acc: 0.6677
Epoch 357/1000
310/310 [=====] - 0s 280us/step - loss: 0.6360 - acc: 0.6677
Epoch 358/1000
310/310 [=====] - 0s 367us/step - loss: 0.6359 - acc: 0.6677
Epoch 359/1000
310/310 [=====] - 0s 318us/step - loss: 0.6361 - acc: 0.6677
Epoch 360/1000
310/310 [=====] - 0s 296us/step - loss: 0.6359 - acc: 0.6677
Epoch 361/1000
310/310 [=====] - 0s 302us/step - loss: 0.6358 - acc: 0.6677
Epoch 362/1000
310/310 [=====] - 0s 361us/step - loss: 0.6358 - acc: 0.6677
Epoch 363/1000
310/310 [=====] - 0s 308us/step - loss: 0.6358 - acc: 0.6677
Epoch 364/1000
310/310 [=====] - 0s 311us/step - loss: 0.6359 - acc: 0.6677
Epoch 365/1000
310/310 [=====] - 0s 340us/step - loss: 0.6359 - acc: 0.6677
Epoch 366/1000

310/310 [=====] - 0s 352us/step - loss: 0.6359 - acc: 0.6677
 Epoch 367/1000
 310/310 [=====] - 0s 341us/step - loss: 0.6359 - acc: 0.6677
 Epoch 368/1000
 310/310 [=====] - 0s 325us/step - loss: 0.6359 - acc: 0.6677
 Epoch 369/1000
 310/310 [=====] - 0s 310us/step - loss: 0.6359 - acc: 0.6677
 Epoch 370/1000
 310/310 [=====] - 0s 310us/step - loss: 0.6358 - acc: 0.6677
 Epoch 371/1000
 310/310 [=====] - 0s 324us/step - loss: 0.6359 - acc: 0.6677
 Epoch 372/1000
 310/310 [=====] - 0s 306us/step - loss: 0.6358 - acc: 0.6677
 Epoch 373/1000
 310/310 [=====] - 0s 308us/step - loss: 0.6360 - acc: 0.6677
 Epoch 374/1000
 310/310 [=====] - 0s 307us/step - loss: 0.6359 - acc: 0.6677
 Epoch 375/1000
 310/310 [=====] - 0s 300us/step - loss: 0.6358 - acc: 0.6677
 Epoch 376/1000
 310/310 [=====] - 0s 327us/step - loss: 0.6360 - acc: 0.6677
 Epoch 377/1000
 310/310 [=====] - 0s 319us/step - loss: 0.6358 - acc: 0.6677
 Epoch 378/1000
 310/310 [=====] - 0s 292us/step - loss: 0.6359 - acc: 0.6677
 Epoch 379/1000
 310/310 [=====] - 0s 279us/step - loss: 0.6360 - acc: 0.6677
 Epoch 380/1000
 310/310 [=====] - 0s 301us/step - loss: 0.6359 - acc: 0.6677
 Epoch 381/1000
 310/310 [=====] - 0s 321us/step - loss: 0.6358 - acc: 0.6677
 Epoch 382/1000
 310/310 [=====] - 0s 315us/step - loss: 0.6359 - acc: 0.6677
 Epoch 383/1000
 310/310 [=====] - 0s 305us/step - loss: 0.6358 - acc: 0.6677
 Epoch 384/1000
 310/310 [=====] - 0s 308us/step - loss: 0.6359 - acc: 0.6677
 Epoch 385/1000
 310/310 [=====] - 0s 305us/step - loss: 0.6358 - acc: 0.6677
 Epoch 386/1000
 310/310 [=====] - 0s 297us/step - loss: 0.6360 - acc: 0.6677
 Epoch 387/1000
 310/310 [=====] - 0s 303us/step - loss: 0.6359 - acc: 0.6677
 Epoch 388/1000
 310/310 [=====] - 0s 321us/step - loss: 0.6359 - acc: 0.6677
 Epoch 389/1000
 310/310 [=====] - 0s 323us/step - loss: 0.6361 - acc: 0.6677
 Epoch 390/1000

310/310 [=====] - 0s 293us/step - loss: 0.6358 - acc: 0.6677
Epoch 391/1000
310/310 [=====] - 0s 311us/step - loss: 0.6359 - acc: 0.6677
Epoch 392/1000
310/310 [=====] - 0s 283us/step - loss: 0.6358 - acc: 0.6677
Epoch 393/1000
310/310 [=====] - 0s 291us/step - loss: 0.6359 - acc: 0.6677
Epoch 394/1000
310/310 [=====] - 0s 289us/step - loss: 0.6359 - acc: 0.6677
Epoch 395/1000
310/310 [=====] - 0s 299us/step - loss: 0.6359 - acc: 0.6677
Epoch 396/1000
310/310 [=====] - 0s 311us/step - loss: 0.6358 - acc: 0.6677
Epoch 397/1000
310/310 [=====] - 0s 298us/step - loss: 0.6360 - acc: 0.6677
Epoch 398/1000
310/310 [=====] - 0s 296us/step - loss: 0.6359 - acc: 0.6677
Epoch 399/1000
310/310 [=====] - 0s 307us/step - loss: 0.6359 - acc: 0.6677
Epoch 400/1000
310/310 [=====] - 0s 306us/step - loss: 0.6358 - acc: 0.6677
Epoch 401/1000
310/310 [=====] - 0s 277us/step - loss: 0.6359 - acc: 0.6677
Epoch 402/1000
310/310 [=====] - 0s 286us/step - loss: 0.6358 - acc: 0.6677
Epoch 403/1000
310/310 [=====] - 0s 273us/step - loss: 0.6359 - acc: 0.6677
Epoch 404/1000
310/310 [=====] - 0s 275us/step - loss: 0.6358 - acc: 0.6677
Epoch 405/1000
310/310 [=====] - 0s 293us/step - loss: 0.6358 - acc: 0.6677
Epoch 406/1000
310/310 [=====] - 0s 302us/step - loss: 0.6358 - acc: 0.6677
Epoch 407/1000
310/310 [=====] - 0s 299us/step - loss: 0.6359 - acc: 0.6677
Epoch 408/1000
310/310 [=====] - 0s 333us/step - loss: 0.6358 - acc: 0.6677
Epoch 409/1000
310/310 [=====] - 0s 321us/step - loss: 0.6359 - acc: 0.6677
Epoch 410/1000
310/310 [=====] - 0s 309us/step - loss: 0.6360 - acc: 0.6677
Epoch 411/1000
310/310 [=====] - 0s 301us/step - loss: 0.6359 - acc: 0.6677
Epoch 412/1000
310/310 [=====] - 0s 250us/step - loss: 0.6360 - acc: 0.6677
Epoch 413/1000
310/310 [=====] - 0s 311us/step - loss: 0.6360 - acc: 0.6677
Epoch 414/1000

310/310 [=====] - 0s 274us/step - loss: 0.6359 - acc: 0.6677
Epoch 415/1000
310/310 [=====] - 0s 255us/step - loss: 0.6358 - acc: 0.6677
Epoch 416/1000
310/310 [=====] - 0s 241us/step - loss: 0.6359 - acc: 0.6677
Epoch 417/1000
310/310 [=====] - 0s 234us/step - loss: 0.6359 - acc: 0.6677
Epoch 418/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 419/1000
310/310 [=====] - 0s 326us/step - loss: 0.6359 - acc: 0.6677
Epoch 420/1000
310/310 [=====] - 0s 349us/step - loss: 0.6359 - acc: 0.6677
Epoch 421/1000
310/310 [=====] - 0s 368us/step - loss: 0.6359 - acc: 0.6677
Epoch 422/1000
310/310 [=====] - 0s 338us/step - loss: 0.6358 - acc: 0.6677
Epoch 423/1000
310/310 [=====] - 0s 272us/step - loss: 0.6359 - acc: 0.6677
Epoch 424/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 425/1000
310/310 [=====] - 0s 280us/step - loss: 0.6361 - acc: 0.6677
Epoch 426/1000
310/310 [=====] - 0s 307us/step - loss: 0.6361 - acc: 0.6677
Epoch 427/1000
310/310 [=====] - 0s 296us/step - loss: 0.6359 - acc: 0.6677
Epoch 428/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 429/1000
310/310 [=====] - 0s 275us/step - loss: 0.6359 - acc: 0.6677
Epoch 430/1000
310/310 [=====] - 0s 246us/step - loss: 0.6359 - acc: 0.6677
Epoch 431/1000
310/310 [=====] - 0s 244us/step - loss: 0.6358 - acc: 0.6677
Epoch 432/1000
310/310 [=====] - 0s 428us/step - loss: 0.6358 - acc: 0.6677
Epoch 433/1000
310/310 [=====] - 0s 304us/step - loss: 0.6359 - acc: 0.6677
Epoch 434/1000
310/310 [=====] - 0s 300us/step - loss: 0.6359 - acc: 0.6677
Epoch 435/1000
310/310 [=====] - 0s 367us/step - loss: 0.6359 - acc: 0.6677
Epoch 436/1000
310/310 [=====] - 0s 247us/step - loss: 0.6359 - acc: 0.6677
Epoch 437/1000
310/310 [=====] - 0s 230us/step - loss: 0.6359 - acc: 0.6677
Epoch 438/1000

310/310 [=====] - 0s 210us/step - loss: 0.6359 - acc: 0.6677
 Epoch 439/1000
 310/310 [=====] - 0s 336us/step - loss: 0.6359 - acc: 0.6677
 Epoch 440/1000
 310/310 [=====] - 0s 323us/step - loss: 0.6358 - acc: 0.6677
 Epoch 441/1000
 310/310 [=====] - 0s 312us/step - loss: 0.6359 - acc: 0.6677
 Epoch 442/1000
 310/310 [=====] - 0s 273us/step - loss: 0.6359 - acc: 0.6677
 Epoch 443/1000
 310/310 [=====] - 0s 279us/step - loss: 0.6358 - acc: 0.6677
 Epoch 444/1000
 310/310 [=====] - 0s 375us/step - loss: 0.6359 - acc: 0.6677
 Epoch 445/1000
 310/310 [=====] - 0s 307us/step - loss: 0.6359 - acc: 0.6677
 Epoch 446/1000
 310/310 [=====] - 0s 269us/step - loss: 0.6359 - acc: 0.6677
 Epoch 447/1000
 310/310 [=====] - 0s 281us/step - loss: 0.6359 - acc: 0.6677
 Epoch 448/1000
 310/310 [=====] - 0s 259us/step - loss: 0.6358 - acc: 0.6677
 Epoch 449/1000
 310/310 [=====] - 0s 268us/step - loss: 0.6359 - acc: 0.6677
 Epoch 450/1000
 310/310 [=====] - 0s 274us/step - loss: 0.6359 - acc: 0.6677
 Epoch 451/1000
 310/310 [=====] - 0s 266us/step - loss: 0.6358 - acc: 0.6677
 Epoch 452/1000
 310/310 [=====] - 0s 282us/step - loss: 0.6359 - acc: 0.6677
 Epoch 453/1000
 310/310 [=====] - 0s 327us/step - loss: 0.6359 - acc: 0.6677
 Epoch 454/1000
 310/310 [=====] - 0s 298us/step - loss: 0.6359 - acc: 0.6677
 Epoch 455/1000
 310/310 [=====] - 0s 318us/step - loss: 0.6359 - acc: 0.6677
 Epoch 456/1000
 310/310 [=====] - 0s 271us/step - loss: 0.6359 - acc: 0.6677
 Epoch 457/1000
 310/310 [=====] - 0s 263us/step - loss: 0.6360 - acc: 0.6677
 Epoch 458/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
 Epoch 459/1000
 310/310 [=====] - 0s 285us/step - loss: 0.6358 - acc: 0.6677
 Epoch 460/1000
 310/310 [=====] - 0s 294us/step - loss: 0.6361 - acc: 0.6677
 Epoch 461/1000
 310/310 [=====] - 0s 319us/step - loss: 0.6359 - acc: 0.6677
 Epoch 462/1000

310/310 [=====] - 0s 336us/step - loss: 0.6363 - acc: 0.6677
 Epoch 463/1000
 310/310 [=====] - 0s 376us/step - loss: 0.6360 - acc: 0.6677
 Epoch 464/1000
 310/310 [=====] - 0s 365us/step - loss: 0.6360 - acc: 0.6677
 Epoch 465/1000
 310/310 [=====] - 0s 339us/step - loss: 0.6360 - acc: 0.6677
 Epoch 466/1000
 310/310 [=====] - 0s 359us/step - loss: 0.6360 - acc: 0.6677
 Epoch 467/1000
 310/310 [=====] - 0s 338us/step - loss: 0.6360 - acc: 0.6677
 Epoch 468/1000
 310/310 [=====] - 0s 323us/step - loss: 0.6358 - acc: 0.6677
 Epoch 469/1000
 310/310 [=====] - 0s 303us/step - loss: 0.6359 - acc: 0.6677
 Epoch 470/1000
 310/310 [=====] - 0s 285us/step - loss: 0.6358 - acc: 0.6677
 Epoch 471/1000
 310/310 [=====] - 0s 324us/step - loss: 0.6358 - acc: 0.6677
 Epoch 472/1000
 310/310 [=====] - 0s 363us/step - loss: 0.6359 - acc: 0.6677
 Epoch 473/1000
 310/310 [=====] - 0s 307us/step - loss: 0.6359 - acc: 0.6677
 Epoch 474/1000
 310/310 [=====] - 0s 290us/step - loss: 0.6358 - acc: 0.6677
 Epoch 475/1000
 310/310 [=====] - 0s 291us/step - loss: 0.6359 - acc: 0.6677
 Epoch 476/1000
 310/310 [=====] - 0s 315us/step - loss: 0.6358 - acc: 0.6677
 Epoch 477/1000
 310/310 [=====] - 0s 277us/step - loss: 0.6359 - acc: 0.6677
 Epoch 478/1000
 310/310 [=====] - 0s 289us/step - loss: 0.6359 - acc: 0.6677
 Epoch 479/1000
 310/310 [=====] - 0s 292us/step - loss: 0.6358 - acc: 0.6677
 Epoch 480/1000
 310/310 [=====] - 0s 296us/step - loss: 0.6360 - acc: 0.6677
 Epoch 481/1000
 310/310 [=====] - 0s 281us/step - loss: 0.6358 - acc: 0.6677
 Epoch 482/1000
 310/310 [=====] - 0s 291us/step - loss: 0.6358 - acc: 0.6677
 Epoch 483/1000
 310/310 [=====] - 0s 299us/step - loss: 0.6359 - acc: 0.6677
 Epoch 484/1000
 310/310 [=====] - 0s 290us/step - loss: 0.6359 - acc: 0.6677
 Epoch 485/1000
 310/310 [=====] - 0s 285us/step - loss: 0.6358 - acc: 0.6677
 Epoch 486/1000

310/310 [=====] - 0s 294us/step - loss: 0.6359 - acc: 0.6677
Epoch 487/1000
310/310 [=====] - 0s 296us/step - loss: 0.6359 - acc: 0.6677
Epoch 488/1000
310/310 [=====] - 0s 287us/step - loss: 0.6359 - acc: 0.6677
Epoch 489/1000
310/310 [=====] - 0s 260us/step - loss: 0.6359 - acc: 0.6677
Epoch 490/1000
310/310 [=====] - 0s 257us/step - loss: 0.6361 - acc: 0.6677
Epoch 491/1000
310/310 [=====] - 0s 253us/step - loss: 0.6361 - acc: 0.6677
Epoch 492/1000
310/310 [=====] - 0s 255us/step - loss: 0.6359 - acc: 0.6677
Epoch 493/1000
310/310 [=====] - 0s 264us/step - loss: 0.6358 - acc: 0.6677
Epoch 494/1000
310/310 [=====] - 0s 255us/step - loss: 0.6359 - acc: 0.6677
Epoch 495/1000
310/310 [=====] - 0s 256us/step - loss: 0.6359 - acc: 0.6677
Epoch 496/1000
310/310 [=====] - 0s 253us/step - loss: 0.6358 - acc: 0.6677
Epoch 497/1000
310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
Epoch 498/1000
310/310 [=====] - 0s 251us/step - loss: 0.6359 - acc: 0.6677
Epoch 499/1000
310/310 [=====] - 0s 260us/step - loss: 0.6359 - acc: 0.6677
Epoch 500/1000
310/310 [=====] - 0s 251us/step - loss: 0.6359 - acc: 0.6677
Epoch 501/1000
310/310 [=====] - 0s 272us/step - loss: 0.6359 - acc: 0.6677
Epoch 502/1000
310/310 [=====] - 0s 258us/step - loss: 0.6360 - acc: 0.6677
Epoch 503/1000
310/310 [=====] - 0s 243us/step - loss: 0.6358 - acc: 0.6677
Epoch 504/1000
310/310 [=====] - 0s 244us/step - loss: 0.6359 - acc: 0.6677
Epoch 505/1000
310/310 [=====] - 0s 245us/step - loss: 0.6359 - acc: 0.6677
Epoch 506/1000
310/310 [=====] - 0s 247us/step - loss: 0.6360 - acc: 0.6677
Epoch 507/1000
310/310 [=====] - 0s 270us/step - loss: 0.6358 - acc: 0.6677
Epoch 508/1000
310/310 [=====] - 0s 243us/step - loss: 0.6359 - acc: 0.6677
Epoch 509/1000
310/310 [=====] - 0s 264us/step - loss: 0.6360 - acc: 0.6677
Epoch 510/1000

310/310 [=====] - 0s 266us/step - loss: 0.6359 - acc: 0.6677
Epoch 511/1000
310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
Epoch 512/1000
310/310 [=====] - 0s 271us/step - loss: 0.6359 - acc: 0.6677
Epoch 513/1000
310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
Epoch 514/1000
310/310 [=====] - 0s 253us/step - loss: 0.6359 - acc: 0.6677
Epoch 515/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 516/1000
310/310 [=====] - 0s 337us/step - loss: 0.6360 - acc: 0.6677
Epoch 517/1000
310/310 [=====] - 0s 285us/step - loss: 0.6359 - acc: 0.6677
Epoch 518/1000
310/310 [=====] - 0s 268us/step - loss: 0.6360 - acc: 0.6677
Epoch 519/1000
310/310 [=====] - 0s 279us/step - loss: 0.6359 - acc: 0.6677
Epoch 520/1000
310/310 [=====] - 0s 248us/step - loss: 0.6358 - acc: 0.6677
Epoch 521/1000
310/310 [=====] - 0s 262us/step - loss: 0.6358 - acc: 0.6677
Epoch 522/1000
310/310 [=====] - 0s 256us/step - loss: 0.6359 - acc: 0.6677
Epoch 523/1000
310/310 [=====] - 0s 257us/step - loss: 0.6359 - acc: 0.6677
Epoch 524/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 525/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 526/1000
310/310 [=====] - 0s 278us/step - loss: 0.6358 - acc: 0.6677
Epoch 527/1000
310/310 [=====] - 0s 247us/step - loss: 0.6359 - acc: 0.6677
Epoch 528/1000
310/310 [=====] - 0s 245us/step - loss: 0.6359 - acc: 0.6677
Epoch 529/1000
310/310 [=====] - 0s 246us/step - loss: 0.6360 - acc: 0.6677
Epoch 530/1000
310/310 [=====] - 0s 240us/step - loss: 0.6358 - acc: 0.6677
Epoch 531/1000
310/310 [=====] - 0s 242us/step - loss: 0.6359 - acc: 0.6677
Epoch 532/1000
310/310 [=====] - 0s 252us/step - loss: 0.6359 - acc: 0.6677
Epoch 533/1000
310/310 [=====] - 0s 264us/step - loss: 0.6358 - acc: 0.6677
Epoch 534/1000

310/310 [=====] - 0s 255us/step - loss: 0.6358 - acc: 0.6677
Epoch 535/1000
310/310 [=====] - 0s 267us/step - loss: 0.6359 - acc: 0.6677
Epoch 536/1000
310/310 [=====] - 0s 282us/step - loss: 0.6358 - acc: 0.6677
Epoch 537/1000
310/310 [=====] - 0s 285us/step - loss: 0.6360 - acc: 0.6677
Epoch 538/1000
310/310 [=====] - 0s 291us/step - loss: 0.6359 - acc: 0.6677
Epoch 539/1000
310/310 [=====] - 0s 266us/step - loss: 0.6358 - acc: 0.6677
Epoch 540/1000
310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
Epoch 541/1000
310/310 [=====] - 0s 265us/step - loss: 0.6358 - acc: 0.6677
Epoch 542/1000
310/310 [=====] - 0s 252us/step - loss: 0.6358 - acc: 0.6677
Epoch 543/1000
310/310 [=====] - 0s 257us/step - loss: 0.6360 - acc: 0.6677
Epoch 544/1000
310/310 [=====] - 0s 263us/step - loss: 0.6358 - acc: 0.6677
Epoch 545/1000
310/310 [=====] - 0s 256us/step - loss: 0.6360 - acc: 0.6677
Epoch 546/1000
310/310 [=====] - 0s 258us/step - loss: 0.6360 - acc: 0.6677
Epoch 547/1000
310/310 [=====] - 0s 281us/step - loss: 0.6361 - acc: 0.6677
Epoch 548/1000
310/310 [=====] - 0s 257us/step - loss: 0.6358 - acc: 0.6677
Epoch 549/1000
310/310 [=====] - 0s 273us/step - loss: 0.6359 - acc: 0.6677
Epoch 550/1000
310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
Epoch 551/1000
310/310 [=====] - 0s 277us/step - loss: 0.6358 - acc: 0.6677
Epoch 552/1000
310/310 [=====] - 0s 247us/step - loss: 0.6359 - acc: 0.6677
Epoch 553/1000
310/310 [=====] - 0s 241us/step - loss: 0.6361 - acc: 0.6677
Epoch 554/1000
310/310 [=====] - 0s 248us/step - loss: 0.6361 - acc: 0.6677
Epoch 555/1000
310/310 [=====] - 0s 243us/step - loss: 0.6360 - acc: 0.6677
Epoch 556/1000
310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
Epoch 557/1000
310/310 [=====] - 0s 263us/step - loss: 0.6358 - acc: 0.6677
Epoch 558/1000

310/310 [=====] - 0s 260us/step - loss: 0.6359 - acc: 0.6677
 Epoch 559/1000
 310/310 [=====] - 0s 265us/step - loss: 0.6359 - acc: 0.6677
 Epoch 560/1000
 310/310 [=====] - 0s 263us/step - loss: 0.6359 - acc: 0.6677
 Epoch 561/1000
 310/310 [=====] - 0s 266us/step - loss: 0.6359 - acc: 0.6677
 Epoch 562/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
 Epoch 563/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
 Epoch 564/1000
 310/310 [=====] - 0s 262us/step - loss: 0.6360 - acc: 0.6677
 Epoch 565/1000
 310/310 [=====] - 0s 279us/step - loss: 0.6361 - acc: 0.6677
 Epoch 566/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
 Epoch 567/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6358 - acc: 0.6677
 Epoch 568/1000
 310/310 [=====] - 0s 286us/step - loss: 0.6359 - acc: 0.6677
 Epoch 569/1000
 310/310 [=====] - 0s 274us/step - loss: 0.6360 - acc: 0.6677
 Epoch 570/1000
 310/310 [=====] - 0s 252us/step - loss: 0.6358 - acc: 0.6677
 Epoch 571/1000
 310/310 [=====] - 0s 268us/step - loss: 0.6360 - acc: 0.6677
 Epoch 572/1000
 310/310 [=====] - 0s 262us/step - loss: 0.6358 - acc: 0.6677
 Epoch 573/1000
 310/310 [=====] - 0s 270us/step - loss: 0.6358 - acc: 0.6677
 Epoch 574/1000
 310/310 [=====] - 0s 259us/step - loss: 0.6360 - acc: 0.6677
 Epoch 575/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6358 - acc: 0.6677
 Epoch 576/1000
 310/310 [=====] - 0s 242us/step - loss: 0.6358 - acc: 0.6677
 Epoch 577/1000
 310/310 [=====] - 0s 254us/step - loss: 0.6359 - acc: 0.6677
 Epoch 578/1000
 310/310 [=====] - 0s 236us/step - loss: 0.6359 - acc: 0.6677
 Epoch 579/1000
 310/310 [=====] - 0s 237us/step - loss: 0.6360 - acc: 0.6677
 Epoch 580/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
 Epoch 581/1000
 310/310 [=====] - 0s 254us/step - loss: 0.6359 - acc: 0.6677
 Epoch 582/1000

310/310 [=====] - 0s 268us/step - loss: 0.6359 - acc: 0.6677
Epoch 583/1000
310/310 [=====] - 0s 264us/step - loss: 0.6360 - acc: 0.6677
Epoch 584/1000
310/310 [=====] - 0s 268us/step - loss: 0.6359 - acc: 0.6677
Epoch 585/1000
310/310 [=====] - 0s 272us/step - loss: 0.6359 - acc: 0.6677
Epoch 586/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 587/1000
310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
Epoch 588/1000
310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
Epoch 589/1000
310/310 [=====] - 0s 255us/step - loss: 0.6359 - acc: 0.6677
Epoch 590/1000
310/310 [=====] - 0s 269us/step - loss: 0.6358 - acc: 0.6677
Epoch 591/1000
310/310 [=====] - 0s 265us/step - loss: 0.6359 - acc: 0.6677
Epoch 592/1000
310/310 [=====] - 0s 279us/step - loss: 0.6359 - acc: 0.6677
Epoch 593/1000
310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
Epoch 594/1000
310/310 [=====] - 0s 260us/step - loss: 0.6358 - acc: 0.6677
Epoch 595/1000
310/310 [=====] - 0s 278us/step - loss: 0.6360 - acc: 0.6677
Epoch 596/1000
310/310 [=====] - 0s 248us/step - loss: 0.6359 - acc: 0.6677
Epoch 597/1000
310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
Epoch 598/1000
310/310 [=====] - 0s 264us/step - loss: 0.6361 - acc: 0.6677
Epoch 599/1000
310/310 [=====] - 0s 259us/step - loss: 0.6358 - acc: 0.6677
Epoch 600/1000
310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
Epoch 601/1000
310/310 [=====] - 0s 239us/step - loss: 0.6362 - acc: 0.6677
Epoch 602/1000
310/310 [=====] - 0s 238us/step - loss: 0.6359 - acc: 0.6677
Epoch 603/1000
310/310 [=====] - 0s 240us/step - loss: 0.6358 - acc: 0.6677
Epoch 604/1000
310/310 [=====] - 0s 235us/step - loss: 0.6359 - acc: 0.6677
Epoch 605/1000
310/310 [=====] - 0s 263us/step - loss: 0.6359 - acc: 0.6677
Epoch 606/1000

310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
 Epoch 607/1000
 310/310 [=====] - 0s 273us/step - loss: 0.6358 - acc: 0.6677
 Epoch 608/1000
 310/310 [=====] - 0s 310us/step - loss: 0.6358 - acc: 0.6677
 Epoch 609/1000
 310/310 [=====] - 0s 312us/step - loss: 0.6358 - acc: 0.6677
 Epoch 610/1000
 310/310 [=====] - 0s 282us/step - loss: 0.6359 - acc: 0.6677
 Epoch 611/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6358 - acc: 0.6677
 Epoch 612/1000
 310/310 [=====] - 0s 259us/step - loss: 0.6358 - acc: 0.6677
 Epoch 613/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
 Epoch 614/1000
 310/310 [=====] - 0s 263us/step - loss: 0.6359 - acc: 0.6677
 Epoch 615/1000
 310/310 [=====] - 0s 260us/step - loss: 0.6359 - acc: 0.6677
 Epoch 616/1000
 310/310 [=====] - 0s 277us/step - loss: 0.6359 - acc: 0.6677
 Epoch 617/1000
 310/310 [=====] - 0s 260us/step - loss: 0.6362 - acc: 0.6677
 Epoch 618/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6358 - acc: 0.6677
 Epoch 619/1000
 310/310 [=====] - 0s 272us/step - loss: 0.6359 - acc: 0.6677
 Epoch 620/1000
 310/310 [=====] - 0s 271us/step - loss: 0.6359 - acc: 0.6677
 Epoch 621/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
 Epoch 622/1000
 310/310 [=====] - 0s 270us/step - loss: 0.6359 - acc: 0.6677
 Epoch 623/1000
 310/310 [=====] - 0s 257us/step - loss: 0.6359 - acc: 0.6677
 Epoch 624/1000
 310/310 [=====] - 0s 273us/step - loss: 0.6358 - acc: 0.6677
 Epoch 625/1000
 310/310 [=====] - 0s 247us/step - loss: 0.6359 - acc: 0.6677
 Epoch 626/1000
 310/310 [=====] - 0s 238us/step - loss: 0.6358 - acc: 0.6677
 Epoch 627/1000
 310/310 [=====] - 0s 236us/step - loss: 0.6359 - acc: 0.6677
 Epoch 628/1000
 310/310 [=====] - 0s 243us/step - loss: 0.6358 - acc: 0.6677
 Epoch 629/1000
 310/310 [=====] - 0s 253us/step - loss: 0.6358 - acc: 0.6677
 Epoch 630/1000

310/310 [=====] - 0s 271us/step - loss: 0.6360 - acc: 0.6677
Epoch 631/1000
310/310 [=====] - 0s 254us/step - loss: 0.6359 - acc: 0.6677
Epoch 632/1000
310/310 [=====] - 0s 267us/step - loss: 0.6359 - acc: 0.6677
Epoch 633/1000
310/310 [=====] - 0s 262us/step - loss: 0.6361 - acc: 0.6677
Epoch 634/1000
310/310 [=====] - 0s 260us/step - loss: 0.6361 - acc: 0.6677
Epoch 635/1000
310/310 [=====] - 0s 293us/step - loss: 0.6359 - acc: 0.6677
Epoch 636/1000
310/310 [=====] - 0s 251us/step - loss: 0.6360 - acc: 0.6677
Epoch 637/1000
310/310 [=====] - 0s 254us/step - loss: 0.6359 - acc: 0.6677
Epoch 638/1000
310/310 [=====] - 0s 264us/step - loss: 0.6360 - acc: 0.6677
Epoch 639/1000
310/310 [=====] - 0s 263us/step - loss: 0.6359 - acc: 0.6677
Epoch 640/1000
310/310 [=====] - 0s 268us/step - loss: 0.6358 - acc: 0.6677
Epoch 641/1000
310/310 [=====] - 0s 256us/step - loss: 0.6360 - acc: 0.6677
Epoch 642/1000
310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
Epoch 643/1000
310/310 [=====] - 0s 261us/step - loss: 0.6361 - acc: 0.6677
Epoch 644/1000
310/310 [=====] - 0s 261us/step - loss: 0.6358 - acc: 0.6677
Epoch 645/1000
310/310 [=====] - 0s 261us/step - loss: 0.6358 - acc: 0.6677
Epoch 646/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 647/1000
310/310 [=====] - 0s 266us/step - loss: 0.6358 - acc: 0.6677
Epoch 648/1000
310/310 [=====] - 0s 256us/step - loss: 0.6360 - acc: 0.6677
Epoch 649/1000
310/310 [=====] - 0s 255us/step - loss: 0.6358 - acc: 0.6677
Epoch 650/1000
310/310 [=====] - 0s 257us/step - loss: 0.6358 - acc: 0.6677
Epoch 651/1000
310/310 [=====] - 0s 247us/step - loss: 0.6362 - acc: 0.6677
Epoch 652/1000
310/310 [=====] - 0s 239us/step - loss: 0.6358 - acc: 0.6677
Epoch 653/1000
310/310 [=====] - 0s 263us/step - loss: 0.6360 - acc: 0.6677
Epoch 654/1000

310/310 [=====] - 0s 268us/step - loss: 0.6359 - acc: 0.6677
Epoch 655/1000
310/310 [=====] - 0s 261us/step - loss: 0.6358 - acc: 0.6677
Epoch 656/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 657/1000
310/310 [=====] - 0s 255us/step - loss: 0.6358 - acc: 0.6677
Epoch 658/1000
310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
Epoch 659/1000
310/310 [=====] - 0s 259us/step - loss: 0.6362 - acc: 0.6677
Epoch 660/1000
310/310 [=====] - 0s 250us/step - loss: 0.6360 - acc: 0.6677
Epoch 661/1000
310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
Epoch 662/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 663/1000
310/310 [=====] - 0s 256us/step - loss: 0.6359 - acc: 0.6677
Epoch 664/1000
310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
Epoch 665/1000
310/310 [=====] - 0s 251us/step - loss: 0.6358 - acc: 0.6677
Epoch 666/1000
310/310 [=====] - 0s 261us/step - loss: 0.6361 - acc: 0.6677
Epoch 667/1000
310/310 [=====] - 0s 257us/step - loss: 0.6361 - acc: 0.6677
Epoch 668/1000
310/310 [=====] - 0s 265us/step - loss: 0.6358 - acc: 0.6677
Epoch 669/1000
310/310 [=====] - 0s 259us/step - loss: 0.6361 - acc: 0.6677
Epoch 670/1000
310/310 [=====] - 0s 265us/step - loss: 0.6359 - acc: 0.6677
Epoch 671/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 672/1000
310/310 [=====] - 0s 268us/step - loss: 0.6359 - acc: 0.6677
Epoch 673/1000
310/310 [=====] - 0s 274us/step - loss: 0.6360 - acc: 0.6677
Epoch 674/1000
310/310 [=====] - 0s 239us/step - loss: 0.6360 - acc: 0.6677
Epoch 675/1000
310/310 [=====] - 0s 245us/step - loss: 0.6359 - acc: 0.6677
Epoch 676/1000
310/310 [=====] - 0s 245us/step - loss: 0.6359 - acc: 0.6677
Epoch 677/1000
310/310 [=====] - 0s 244us/step - loss: 0.6358 - acc: 0.6677
Epoch 678/1000

310/310 [=====] - 0s 244us/step - loss: 0.6358 - acc: 0.6677
 Epoch 679/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6360 - acc: 0.6677
 Epoch 680/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6358 - acc: 0.6677
 Epoch 681/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
 Epoch 682/1000
 310/310 [=====] - 0s 249us/step - loss: 0.6359 - acc: 0.6677
 Epoch 683/1000
 310/310 [=====] - 0s 265us/step - loss: 0.6360 - acc: 0.6677
 Epoch 684/1000
 310/310 [=====] - 0s 268us/step - loss: 0.6359 - acc: 0.6677
 Epoch 685/1000
 310/310 [=====] - 0s 255us/step - loss: 0.6360 - acc: 0.6677
 Epoch 686/1000
 310/310 [=====] - 0s 253us/step - loss: 0.6358 - acc: 0.6677
 Epoch 687/1000
 310/310 [=====] - 0s 271us/step - loss: 0.6359 - acc: 0.6677
 Epoch 688/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
 Epoch 689/1000
 310/310 [=====] - 0s 267us/step - loss: 0.6361 - acc: 0.6677
 Epoch 690/1000
 310/310 [=====] - 0s 265us/step - loss: 0.6360 - acc: 0.6677
 Epoch 691/1000
 310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
 Epoch 692/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
 Epoch 693/1000
 310/310 [=====] - 0s 250us/step - loss: 0.6359 - acc: 0.6677
 Epoch 694/1000
 310/310 [=====] - 0s 262us/step - loss: 0.6358 - acc: 0.6677
 Epoch 695/1000
 310/310 [=====] - 0s 266us/step - loss: 0.6359 - acc: 0.6677
 Epoch 696/1000
 310/310 [=====] - 0s 263us/step - loss: 0.6359 - acc: 0.6677
 Epoch 697/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
 Epoch 698/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
 Epoch 699/1000
 310/310 [=====] - 0s 240us/step - loss: 0.6360 - acc: 0.6677
 Epoch 700/1000
 310/310 [=====] - 0s 231us/step - loss: 0.6359 - acc: 0.6677
 Epoch 701/1000
 310/310 [=====] - 0s 243us/step - loss: 0.6361 - acc: 0.6677
 Epoch 702/1000

310/310 [=====] - 0s 245us/step - loss: 0.6358 - acc: 0.6677
Epoch 703/1000
310/310 [=====] - 0s 265us/step - loss: 0.6359 - acc: 0.6677
Epoch 704/1000
310/310 [=====] - 0s 267us/step - loss: 0.6360 - acc: 0.6677
Epoch 705/1000
310/310 [=====] - 0s 255us/step - loss: 0.6358 - acc: 0.6677
Epoch 706/1000
310/310 [=====] - 0s 252us/step - loss: 0.6359 - acc: 0.6677
Epoch 707/1000
310/310 [=====] - 0s 256us/step - loss: 0.6359 - acc: 0.6677
Epoch 708/1000
310/310 [=====] - 0s 248us/step - loss: 0.6358 - acc: 0.6677
Epoch 709/1000
310/310 [=====] - 0s 266us/step - loss: 0.6359 - acc: 0.6677
Epoch 710/1000
310/310 [=====] - 0s 263us/step - loss: 0.6359 - acc: 0.6677
Epoch 711/1000
310/310 [=====] - 0s 268us/step - loss: 0.6358 - acc: 0.6677
Epoch 712/1000
310/310 [=====] - 0s 257us/step - loss: 0.6359 - acc: 0.6677
Epoch 713/1000
310/310 [=====] - 0s 260us/step - loss: 0.6359 - acc: 0.6677
Epoch 714/1000
310/310 [=====] - 0s 288us/step - loss: 0.6358 - acc: 0.6677
Epoch 715/1000
310/310 [=====] - 0s 267us/step - loss: 0.6358 - acc: 0.6677
Epoch 716/1000
310/310 [=====] - 0s 265us/step - loss: 0.6359 - acc: 0.6677
Epoch 717/1000
310/310 [=====] - 0s 265us/step - loss: 0.6358 - acc: 0.6677
Epoch 718/1000
310/310 [=====] - 0s 267us/step - loss: 0.6358 - acc: 0.6677
Epoch 719/1000
310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
Epoch 720/1000
310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
Epoch 721/1000
310/310 [=====] - 0s 276us/step - loss: 0.6358 - acc: 0.6677
Epoch 722/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 723/1000
310/310 [=====] - 0s 265us/step - loss: 0.6359 - acc: 0.6677
Epoch 724/1000
310/310 [=====] - 0s 257us/step - loss: 0.6361 - acc: 0.6677
Epoch 725/1000
310/310 [=====] - 0s 248us/step - loss: 0.6360 - acc: 0.6677
Epoch 726/1000

310/310 [=====] - 0s 244us/step - loss: 0.6359 - acc: 0.6677
Epoch 727/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 728/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 729/1000
310/310 [=====] - 0s 253us/step - loss: 0.6359 - acc: 0.6677
Epoch 730/1000
310/310 [=====] - 0s 271us/step - loss: 0.6359 - acc: 0.6677
Epoch 731/1000
310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
Epoch 732/1000
310/310 [=====] - 0s 268us/step - loss: 0.6358 - acc: 0.6677
Epoch 733/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 734/1000
310/310 [=====] - 0s 267us/step - loss: 0.6362 - acc: 0.6677
Epoch 735/1000
310/310 [=====] - 0s 247us/step - loss: 0.6360 - acc: 0.6677
Epoch 736/1000
310/310 [=====] - 0s 258us/step - loss: 0.6360 - acc: 0.6677
Epoch 737/1000
310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
Epoch 738/1000
310/310 [=====] - 0s 264us/step - loss: 0.6358 - acc: 0.6677
Epoch 739/1000
310/310 [=====] - 0s 270us/step - loss: 0.6359 - acc: 0.6677
Epoch 740/1000
310/310 [=====] - 0s 249us/step - loss: 0.6358 - acc: 0.6677
Epoch 741/1000
310/310 [=====] - 0s 271us/step - loss: 0.6359 - acc: 0.6677
Epoch 742/1000
310/310 [=====] - 0s 254us/step - loss: 0.6360 - acc: 0.6677
Epoch 743/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 744/1000
310/310 [=====] - 0s 264us/step - loss: 0.6358 - acc: 0.6677
Epoch 745/1000
310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
Epoch 746/1000
310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
Epoch 747/1000
310/310 [=====] - 0s 256us/step - loss: 0.6359 - acc: 0.6677
Epoch 748/1000
310/310 [=====] - 0s 240us/step - loss: 0.6359 - acc: 0.6677
Epoch 749/1000
310/310 [=====] - 0s 236us/step - loss: 0.6358 - acc: 0.6677
Epoch 750/1000

310/310 [=====] - 0s 239us/step - loss: 0.6358 - acc: 0.6677
Epoch 751/1000
310/310 [=====] - 0s 241us/step - loss: 0.6360 - acc: 0.6677
Epoch 752/1000
310/310 [=====] - 0s 248us/step - loss: 0.6362 - acc: 0.6677
Epoch 753/1000
310/310 [=====] - 0s 271us/step - loss: 0.6360 - acc: 0.6677
Epoch 754/1000
310/310 [=====] - 0s 256us/step - loss: 0.6362 - acc: 0.6677
Epoch 755/1000
310/310 [=====] - 0s 272us/step - loss: 0.6359 - acc: 0.6677
Epoch 756/1000
310/310 [=====] - 0s 256us/step - loss: 0.6358 - acc: 0.6677
Epoch 757/1000
310/310 [=====] - 0s 267us/step - loss: 0.6359 - acc: 0.6677
Epoch 758/1000
310/310 [=====] - 0s 263us/step - loss: 0.6359 - acc: 0.6677
Epoch 759/1000
310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
Epoch 760/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 761/1000
310/310 [=====] - 0s 254us/step - loss: 0.6358 - acc: 0.6677
Epoch 762/1000
310/310 [=====] - 0s 265us/step - loss: 0.6359 - acc: 0.6677
Epoch 763/1000
310/310 [=====] - 0s 268us/step - loss: 0.6359 - acc: 0.6677
Epoch 764/1000
310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
Epoch 765/1000
310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
Epoch 766/1000
310/310 [=====] - 0s 268us/step - loss: 0.6361 - acc: 0.6677
Epoch 767/1000
310/310 [=====] - 0s 256us/step - loss: 0.6359 - acc: 0.6677
Epoch 768/1000
310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
Epoch 769/1000
310/310 [=====] - 0s 246us/step - loss: 0.6358 - acc: 0.6677
Epoch 770/1000
310/310 [=====] - 0s 252us/step - loss: 0.6359 - acc: 0.6677
Epoch 771/1000
310/310 [=====] - 0s 258us/step - loss: 0.6361 - acc: 0.6677
Epoch 772/1000
310/310 [=====] - 0s 252us/step - loss: 0.6358 - acc: 0.6677
Epoch 773/1000
310/310 [=====] - 0s 247us/step - loss: 0.6358 - acc: 0.6677
Epoch 774/1000

310/310 [=====] - 0s 242us/step - loss: 0.6360 - acc: 0.6677
Epoch 775/1000
310/310 [=====] - 0s 248us/step - loss: 0.6358 - acc: 0.6677
Epoch 776/1000
310/310 [=====] - 0s 238us/step - loss: 0.6359 - acc: 0.6677
Epoch 777/1000
310/310 [=====] - 0s 257us/step - loss: 0.6360 - acc: 0.6677
Epoch 778/1000
310/310 [=====] - 0s 261us/step - loss: 0.6358 - acc: 0.6677
Epoch 779/1000
310/310 [=====] - 0s 266us/step - loss: 0.6360 - acc: 0.6677
Epoch 780/1000
310/310 [=====] - 0s 264us/step - loss: 0.6358 - acc: 0.6677
Epoch 781/1000
310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
Epoch 782/1000
310/310 [=====] - 0s 269us/step - loss: 0.6358 - acc: 0.6677
Epoch 783/1000
310/310 [=====] - 0s 265us/step - loss: 0.6358 - acc: 0.6677
Epoch 784/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 785/1000
310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
Epoch 786/1000
310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
Epoch 787/1000
310/310 [=====] - 0s 260us/step - loss: 0.6360 - acc: 0.6677
Epoch 788/1000
310/310 [=====] - 0s 256us/step - loss: 0.6360 - acc: 0.6677
Epoch 789/1000
310/310 [=====] - 0s 248us/step - loss: 0.6360 - acc: 0.6677
Epoch 790/1000
310/310 [=====] - 0s 250us/step - loss: 0.6358 - acc: 0.6677
Epoch 791/1000
310/310 [=====] - 0s 267us/step - loss: 0.6360 - acc: 0.6677
Epoch 792/1000
310/310 [=====] - 0s 260us/step - loss: 0.6358 - acc: 0.6677
Epoch 793/1000
310/310 [=====] - 0s 287us/step - loss: 0.6358 - acc: 0.6677
Epoch 794/1000
310/310 [=====] - 0s 252us/step - loss: 0.6362 - acc: 0.6677
Epoch 795/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 796/1000
310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
Epoch 797/1000
310/310 [=====] - 0s 257us/step - loss: 0.6358 - acc: 0.6677
Epoch 798/1000

310/310 [=====] - 0s 240us/step - loss: 0.6359 - acc: 0.6677
 Epoch 799/1000
 310/310 [=====] - 0s 250us/step - loss: 0.6361 - acc: 0.6677
 Epoch 800/1000
 310/310 [=====] - 0s 242us/step - loss: 0.6358 - acc: 0.6677
 Epoch 801/1000
 310/310 [=====] - 0s 250us/step - loss: 0.6358 - acc: 0.6677
 Epoch 802/1000
 310/310 [=====] - 0s 257us/step - loss: 0.6360 - acc: 0.6677
 Epoch 803/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
 Epoch 804/1000
 310/310 [=====] - 0s 262us/step - loss: 0.6358 - acc: 0.6677
 Epoch 805/1000
 310/310 [=====] - 0s 284us/step - loss: 0.6360 - acc: 0.6677
 Epoch 806/1000
 310/310 [=====] - 0s 263us/step - loss: 0.6360 - acc: 0.6677
 Epoch 807/1000
 310/310 [=====] - 0s 262us/step - loss: 0.6361 - acc: 0.6677
 Epoch 808/1000
 310/310 [=====] - 0s 275us/step - loss: 0.6358 - acc: 0.6677
 Epoch 809/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6358 - acc: 0.6677
 Epoch 810/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6360 - acc: 0.6677
 Epoch 811/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
 Epoch 812/1000
 310/310 [=====] - 0s 273us/step - loss: 0.6359 - acc: 0.6677
 Epoch 813/1000
 310/310 [=====] - 0s 260us/step - loss: 0.6359 - acc: 0.6677
 Epoch 814/1000
 310/310 [=====] - 0s 256us/step - loss: 0.6360 - acc: 0.6677
 Epoch 815/1000
 310/310 [=====] - 0s 267us/step - loss: 0.6359 - acc: 0.6677
 Epoch 816/1000
 310/310 [=====] - 0s 255us/step - loss: 0.6358 - acc: 0.6677
 Epoch 817/1000
 310/310 [=====] - 0s 257us/step - loss: 0.6359 - acc: 0.6677
 Epoch 818/1000
 310/310 [=====] - 0s 259us/step - loss: 0.6360 - acc: 0.6677
 Epoch 819/1000
 310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
 Epoch 820/1000
 310/310 [=====] - 0s 253us/step - loss: 0.6360 - acc: 0.6677
 Epoch 821/1000
 310/310 [=====] - 0s 260us/step - loss: 0.6359 - acc: 0.6677
 Epoch 822/1000

310/310 [=====] - 0s 253us/step - loss: 0.6364 - acc: 0.6677
Epoch 823/1000
310/310 [=====] - 0s 241us/step - loss: 0.6361 - acc: 0.6677
Epoch 824/1000
310/310 [=====] - 0s 390us/step - loss: 0.6358 - acc: 0.6677
Epoch 825/1000
310/310 [=====] - 0s 303us/step - loss: 0.6358 - acc: 0.6677
Epoch 826/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 827/1000
310/310 [=====] - 0s 263us/step - loss: 0.6358 - acc: 0.6677
Epoch 828/1000
310/310 [=====] - 0s 260us/step - loss: 0.6361 - acc: 0.6677
Epoch 829/1000
310/310 [=====] - 0s 258us/step - loss: 0.6358 - acc: 0.6677
Epoch 830/1000
310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
Epoch 831/1000
310/310 [=====] - 0s 257us/step - loss: 0.6358 - acc: 0.6677
Epoch 832/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 833/1000
310/310 [=====] - 0s 268us/step - loss: 0.6359 - acc: 0.6677
Epoch 834/1000
310/310 [=====] - 0s 254us/step - loss: 0.6358 - acc: 0.6677
Epoch 835/1000
310/310 [=====] - 0s 260us/step - loss: 0.6358 - acc: 0.6677
Epoch 836/1000
310/310 [=====] - 0s 284us/step - loss: 0.6359 - acc: 0.6677
Epoch 837/1000
310/310 [=====] - 0s 261us/step - loss: 0.6360 - acc: 0.6677
Epoch 838/1000
310/310 [=====] - 0s 251us/step - loss: 0.6359 - acc: 0.6677
Epoch 839/1000
310/310 [=====] - 0s 263us/step - loss: 0.6360 - acc: 0.6677
Epoch 840/1000
310/310 [=====] - 0s 266us/step - loss: 0.6358 - acc: 0.6677
Epoch 841/1000
310/310 [=====] - 0s 254us/step - loss: 0.6360 - acc: 0.6677
Epoch 842/1000
310/310 [=====] - 0s 271us/step - loss: 0.6358 - acc: 0.6677
Epoch 843/1000
310/310 [=====] - 0s 256us/step - loss: 0.6359 - acc: 0.6677
Epoch 844/1000
310/310 [=====] - 0s 277us/step - loss: 0.6358 - acc: 0.6677
Epoch 845/1000
310/310 [=====] - 0s 249us/step - loss: 0.6359 - acc: 0.6677
Epoch 846/1000

310/310 [=====] - 0s 240us/step - loss: 0.6360 - acc: 0.6677
Epoch 847/1000
310/310 [=====] - 0s 243us/step - loss: 0.6358 - acc: 0.6677
Epoch 848/1000
310/310 [=====] - 0s 247us/step - loss: 0.6358 - acc: 0.6677
Epoch 849/1000
310/310 [=====] - 0s 245us/step - loss: 0.6361 - acc: 0.6677
Epoch 850/1000
310/310 [=====] - 0s 280us/step - loss: 0.6359 - acc: 0.6677
Epoch 851/1000
310/310 [=====] - 0s 257us/step - loss: 0.6359 - acc: 0.6677
Epoch 852/1000
310/310 [=====] - 0s 262us/step - loss: 0.6358 - acc: 0.6677
Epoch 853/1000
310/310 [=====] - 0s 263us/step - loss: 0.6359 - acc: 0.6677
Epoch 854/1000
310/310 [=====] - 0s 256us/step - loss: 0.6359 - acc: 0.6677
Epoch 855/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 856/1000
310/310 [=====] - 0s 270us/step - loss: 0.6358 - acc: 0.6677
Epoch 857/1000
310/310 [=====] - 0s 261us/step - loss: 0.6361 - acc: 0.6677
Epoch 858/1000
310/310 [=====] - 0s 257us/step - loss: 0.6358 - acc: 0.6677
Epoch 859/1000
310/310 [=====] - 0s 275us/step - loss: 0.6358 - acc: 0.6677
Epoch 860/1000
310/310 [=====] - 0s 262us/step - loss: 0.6359 - acc: 0.6677
Epoch 861/1000
310/310 [=====] - 0s 252us/step - loss: 0.6361 - acc: 0.6677
Epoch 862/1000
310/310 [=====] - 0s 254us/step - loss: 0.6359 - acc: 0.6677
Epoch 863/1000
310/310 [=====] - 0s 256us/step - loss: 0.6363 - acc: 0.6677
Epoch 864/1000
310/310 [=====] - 0s 265us/step - loss: 0.6359 - acc: 0.6677
Epoch 865/1000
310/310 [=====] - 0s 251us/step - loss: 0.6360 - acc: 0.6677
Epoch 866/1000
310/310 [=====] - 0s 276us/step - loss: 0.6358 - acc: 0.6677
Epoch 867/1000
310/310 [=====] - 0s 259us/step - loss: 0.6359 - acc: 0.6677
Epoch 868/1000
310/310 [=====] - 0s 269us/step - loss: 0.6359 - acc: 0.6677
Epoch 869/1000
310/310 [=====] - 0s 264us/step - loss: 0.6359 - acc: 0.6677
Epoch 870/1000

310/310 [=====] - 0s 270us/step - loss: 0.6359 - acc: 0.6677
 Epoch 871/1000
 310/310 [=====] - 0s 247us/step - loss: 0.6360 - acc: 0.6677
 Epoch 872/1000
 310/310 [=====] - 0s 234us/step - loss: 0.6358 - acc: 0.6677
 Epoch 873/1000
 310/310 [=====] - 0s 241us/step - loss: 0.6359 - acc: 0.6677
 Epoch 874/1000
 310/310 [=====] - 0s 244us/step - loss: 0.6363 - acc: 0.6677
 Epoch 875/1000
 310/310 [=====] - 0s 257us/step - loss: 0.6358 - acc: 0.6677
 Epoch 876/1000
 310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
 Epoch 877/1000
 310/310 [=====] - 0s 268us/step - loss: 0.6358 - acc: 0.6677
 Epoch 878/1000
 310/310 [=====] - 0s 244us/step - loss: 0.6358 - acc: 0.6677
 Epoch 879/1000
 310/310 [=====] - 0s 254us/step - loss: 0.6359 - acc: 0.6677
 Epoch 880/1000
 310/310 [=====] - 0s 253us/step - loss: 0.6358 - acc: 0.6677
 Epoch 881/1000
 310/310 [=====] - 0s 263us/step - loss: 0.6358 - acc: 0.6677
 Epoch 882/1000
 310/310 [=====] - 0s 275us/step - loss: 0.6359 - acc: 0.6677
 Epoch 883/1000
 310/310 [=====] - 0s 255us/step - loss: 0.6358 - acc: 0.6677
 Epoch 884/1000
 310/310 [=====] - 0s 258us/step - loss: 0.6359 - acc: 0.6677
 Epoch 885/1000
 310/310 [=====] - 0s 287us/step - loss: 0.6360 - acc: 0.6677
 Epoch 886/1000
 310/310 [=====] - 0s 259us/step - loss: 0.6360 - acc: 0.6677
 Epoch 887/1000
 310/310 [=====] - 0s 315us/step - loss: 0.6360 - acc: 0.6677
 Epoch 888/1000
 310/310 [=====] - 0s 380us/step - loss: 0.6359 - acc: 0.6677
 Epoch 889/1000
 310/310 [=====] - 0s 307us/step - loss: 0.6358 - acc: 0.6677
 Epoch 890/1000
 310/310 [=====] - 0s 340us/step - loss: 0.6359 - acc: 0.6677
 Epoch 891/1000
 310/310 [=====] - 0s 333us/step - loss: 0.6359 - acc: 0.6677
 Epoch 892/1000
 310/310 [=====] - 0s 320us/step - loss: 0.6359 - acc: 0.6677
 Epoch 893/1000
 310/310 [=====] - 0s 312us/step - loss: 0.6359 - acc: 0.6677
 Epoch 894/1000

310/310 [=====] - 0s 309us/step - loss: 0.6359 - acc: 0.6677
Epoch 895/1000
310/310 [=====] - 0s 261us/step - loss: 0.6359 - acc: 0.6677
Epoch 896/1000
310/310 [=====] - 0s 244us/step - loss: 0.6358 - acc: 0.6677
Epoch 897/1000
310/310 [=====] - 0s 257us/step - loss: 0.6361 - acc: 0.6677
Epoch 898/1000
310/310 [=====] - 0s 260us/step - loss: 0.6358 - acc: 0.6677
Epoch 899/1000
310/310 [=====] - 0s 301us/step - loss: 0.6360 - acc: 0.6677
Epoch 900/1000
310/310 [=====] - 0s 362us/step - loss: 0.6359 - acc: 0.6677
Epoch 901/1000
310/310 [=====] - 0s 366us/step - loss: 0.6359 - acc: 0.6677
Epoch 902/1000
310/310 [=====] - 0s 262us/step - loss: 0.6358 - acc: 0.6677
Epoch 903/1000
310/310 [=====] - 0s 277us/step - loss: 0.6359 - acc: 0.6677
Epoch 904/1000
310/310 [=====] - 0s 346us/step - loss: 0.6359 - acc: 0.6677
Epoch 905/1000
310/310 [=====] - 0s 382us/step - loss: 0.6358 - acc: 0.6677
Epoch 906/1000
310/310 [=====] - 0s 295us/step - loss: 0.6360 - acc: 0.6677
Epoch 907/1000
310/310 [=====] - 0s 339us/step - loss: 0.6358 - acc: 0.6677
Epoch 908/1000
310/310 [=====] - 0s 363us/step - loss: 0.6360 - acc: 0.6677
Epoch 909/1000
310/310 [=====] - 0s 335us/step - loss: 0.6358 - acc: 0.6677
Epoch 910/1000
310/310 [=====] - 0s 335us/step - loss: 0.6359 - acc: 0.6677
Epoch 911/1000
310/310 [=====] - 0s 320us/step - loss: 0.6358 - acc: 0.6677
Epoch 912/1000
310/310 [=====] - 0s 293us/step - loss: 0.6358 - acc: 0.6677
Epoch 913/1000
310/310 [=====] - 0s 303us/step - loss: 0.6360 - acc: 0.6677
Epoch 914/1000
310/310 [=====] - 0s 300us/step - loss: 0.6358 - acc: 0.6677
Epoch 915/1000
310/310 [=====] - 0s 289us/step - loss: 0.6360 - acc: 0.6677
Epoch 916/1000
310/310 [=====] - 0s 291us/step - loss: 0.6359 - acc: 0.6677
Epoch 917/1000
310/310 [=====] - 0s 328us/step - loss: 0.6358 - acc: 0.6677
Epoch 918/1000

310/310 [=====] - 0s 314us/step - loss: 0.6359 - acc: 0.6677
 Epoch 919/1000
 310/310 [=====] - 0s 293us/step - loss: 0.6359 - acc: 0.6677
 Epoch 920/1000
 310/310 [=====] - 0s 340us/step - loss: 0.6358 - acc: 0.6677
 Epoch 921/1000
 310/310 [=====] - 0s 327us/step - loss: 0.6359 - acc: 0.6677
 Epoch 922/1000
 310/310 [=====] - 0s 307us/step - loss: 0.6358 - acc: 0.6677
 Epoch 923/1000
 310/310 [=====] - 0s 297us/step - loss: 0.6359 - acc: 0.6677
 Epoch 924/1000
 310/310 [=====] - 0s 301us/step - loss: 0.6359 - acc: 0.6677
 Epoch 925/1000
 310/310 [=====] - 0s 310us/step - loss: 0.6359 - acc: 0.6677
 Epoch 926/1000
 310/310 [=====] - 0s 329us/step - loss: 0.6359 - acc: 0.6677
 Epoch 927/1000
 310/310 [=====] - 0s 325us/step - loss: 0.6358 - acc: 0.6677
 Epoch 928/1000
 310/310 [=====] - 0s 307us/step - loss: 0.6360 - acc: 0.6677
 Epoch 929/1000
 310/310 [=====] - 0s 336us/step - loss: 0.6360 - acc: 0.6677
 Epoch 930/1000
 310/310 [=====] - 0s 342us/step - loss: 0.6358 - acc: 0.6677
 Epoch 931/1000
 310/310 [=====] - 0s 466us/step - loss: 0.6359 - acc: 0.6677
 Epoch 932/1000
 310/310 [=====] - 0s 314us/step - loss: 0.6361 - acc: 0.6677
 Epoch 933/1000
 310/310 [=====] - 0s 309us/step - loss: 0.6360 - acc: 0.6677
 Epoch 934/1000
 310/310 [=====] - 0s 290us/step - loss: 0.6358 - acc: 0.6677
 Epoch 935/1000
 310/310 [=====] - 0s 321us/step - loss: 0.6358 - acc: 0.6677
 Epoch 936/1000
 310/310 [=====] - 0s 295us/step - loss: 0.6359 - acc: 0.6677
 Epoch 937/1000
 310/310 [=====] - 0s 334us/step - loss: 0.6360 - acc: 0.6677
 Epoch 938/1000
 310/310 [=====] - 0s 298us/step - loss: 0.6359 - acc: 0.6677
 Epoch 939/1000
 310/310 [=====] - 0s 331us/step - loss: 0.6358 - acc: 0.6677
 Epoch 940/1000
 310/310 [=====] - 0s 325us/step - loss: 0.6359 - acc: 0.6677
 Epoch 941/1000
 310/310 [=====] - 0s 331us/step - loss: 0.6359 - acc: 0.6677
 Epoch 942/1000

310/310 [=====] - 0s 331us/step - loss: 0.6359 - acc: 0.6677
Epoch 943/1000
310/310 [=====] - 0s 312us/step - loss: 0.6359 - acc: 0.6677
Epoch 944/1000
310/310 [=====] - 0s 285us/step - loss: 0.6361 - acc: 0.6677
Epoch 945/1000
310/310 [=====] - 0s 315us/step - loss: 0.6358 - acc: 0.6677
Epoch 946/1000
310/310 [=====] - 0s 372us/step - loss: 0.6359 - acc: 0.6677
Epoch 947/1000
310/310 [=====] - 0s 298us/step - loss: 0.6358 - acc: 0.6677
Epoch 948/1000
310/310 [=====] - 0s 289us/step - loss: 0.6359 - acc: 0.6677
Epoch 949/1000
310/310 [=====] - 0s 298us/step - loss: 0.6359 - acc: 0.6677
Epoch 950/1000
310/310 [=====] - 0s 356us/step - loss: 0.6360 - acc: 0.6677
Epoch 951/1000
310/310 [=====] - 0s 317us/step - loss: 0.6362 - acc: 0.6677
Epoch 952/1000
310/310 [=====] - 0s 343us/step - loss: 0.6362 - acc: 0.6677
Epoch 953/1000
310/310 [=====] - 0s 337us/step - loss: 0.6359 - acc: 0.6677
Epoch 954/1000
310/310 [=====] - 0s 289us/step - loss: 0.6358 - acc: 0.6677
Epoch 955/1000
310/310 [=====] - 0s 329us/step - loss: 0.6359 - acc: 0.6677
Epoch 956/1000
310/310 [=====] - 0s 324us/step - loss: 0.6359 - acc: 0.6677
Epoch 957/1000
310/310 [=====] - 0s 326us/step - loss: 0.6359 - acc: 0.6677
Epoch 958/1000
310/310 [=====] - 0s 327us/step - loss: 0.6359 - acc: 0.6677
Epoch 959/1000
310/310 [=====] - 0s 327us/step - loss: 0.6358 - acc: 0.6677
Epoch 960/1000
310/310 [=====] - 0s 306us/step - loss: 0.6359 - acc: 0.6677
Epoch 961/1000
310/310 [=====] - 0s 299us/step - loss: 0.6358 - acc: 0.6677
Epoch 962/1000
310/310 [=====] - 0s 350us/step - loss: 0.6358 - acc: 0.6677
Epoch 963/1000
310/310 [=====] - 0s 331us/step - loss: 0.6360 - acc: 0.6677
Epoch 964/1000
310/310 [=====] - 0s 336us/step - loss: 0.6361 - acc: 0.6677
Epoch 965/1000
310/310 [=====] - 0s 321us/step - loss: 0.6358 - acc: 0.6677
Epoch 966/1000

310/310 [=====] - 0s 331us/step - loss: 0.6358 - acc: 0.6677
Epoch 967/1000
310/310 [=====] - 0s 336us/step - loss: 0.6358 - acc: 0.6677
Epoch 968/1000
310/310 [=====] - 0s 314us/step - loss: 0.6359 - acc: 0.6677
Epoch 969/1000
310/310 [=====] - 0s 344us/step - loss: 0.6359 - acc: 0.6677
Epoch 970/1000
310/310 [=====] - 0s 321us/step - loss: 0.6360 - acc: 0.6677
Epoch 971/1000
310/310 [=====] - 0s 294us/step - loss: 0.6360 - acc: 0.6677
Epoch 972/1000
310/310 [=====] - 0s 320us/step - loss: 0.6358 - acc: 0.6677
Epoch 973/1000
310/310 [=====] - 0s 346us/step - loss: 0.6361 - acc: 0.6677
Epoch 974/1000
310/310 [=====] - 0s 325us/step - loss: 0.6359 - acc: 0.6677
Epoch 975/1000
310/310 [=====] - 0s 347us/step - loss: 0.6360 - acc: 0.6677
Epoch 976/1000
310/310 [=====] - 0s 300us/step - loss: 0.6359 - acc: 0.6677
Epoch 977/1000
310/310 [=====] - 0s 321us/step - loss: 0.6358 - acc: 0.6677
Epoch 978/1000
310/310 [=====] - 0s 337us/step - loss: 0.6358 - acc: 0.6677
Epoch 979/1000
310/310 [=====] - 0s 324us/step - loss: 0.6361 - acc: 0.6677
Epoch 980/1000
310/310 [=====] - 0s 332us/step - loss: 0.6358 - acc: 0.6677
Epoch 981/1000
310/310 [=====] - 0s 324us/step - loss: 0.6359 - acc: 0.6677
Epoch 982/1000
310/310 [=====] - 0s 312us/step - loss: 0.6358 - acc: 0.6677
Epoch 983/1000
310/310 [=====] - 0s 347us/step - loss: 0.6358 - acc: 0.6677
Epoch 984/1000
310/310 [=====] - 0s 321us/step - loss: 0.6359 - acc: 0.6677
Epoch 985/1000
310/310 [=====] - 0s 334us/step - loss: 0.6358 - acc: 0.6677
Epoch 986/1000
310/310 [=====] - 0s 320us/step - loss: 0.6359 - acc: 0.6677
Epoch 987/1000
310/310 [=====] - 0s 295us/step - loss: 0.6358 - acc: 0.6677
Epoch 988/1000
310/310 [=====] - 0s 288us/step - loss: 0.6359 - acc: 0.6677
Epoch 989/1000
310/310 [=====] - 0s 302us/step - loss: 0.6360 - acc: 0.6677
Epoch 990/1000

```

310/310 [=====] - 0s 337us/step - loss: 0.6358 - acc: 0.6677
Epoch 991/1000
310/310 [=====] - 0s 334us/step - loss: 0.6359 - acc: 0.6677
Epoch 992/1000
310/310 [=====] - 0s 340us/step - loss: 0.6358 - acc: 0.6677
Epoch 993/1000
310/310 [=====] - 0s 330us/step - loss: 0.6358 - acc: 0.6677
Epoch 994/1000
310/310 [=====] - 0s 324us/step - loss: 0.6359 - acc: 0.6677
Epoch 995/1000
310/310 [=====] - 0s 321us/step - loss: 0.6358 - acc: 0.6677
Epoch 996/1000
310/310 [=====] - 0s 325us/step - loss: 0.6359 - acc: 0.6677
Epoch 997/1000
310/310 [=====] - 0s 334us/step - loss: 0.6359 - acc: 0.6677
Epoch 998/1000
310/310 [=====] - 0s 316us/step - loss: 0.6359 - acc: 0.6677
Epoch 999/1000
310/310 [=====] - 0s 302us/step - loss: 0.6358 - acc: 0.6677
Epoch 1000/1000
310/310 [=====] - 0s 303us/step - loss: 0.6359 - acc: 0.6677
310/310 [=====] - 1s 2ms/step

```

acc: 66.77%

In []: # I would stick with your model.