Solution 1:

Part 1:

```python
In [170]:  import numpy as np
           import matplotlib.pyplot as plt
           from mpl_toolkits.mplot3d import Axes3D
           from scipy.stats import multivariate_normal
           from scipy.linalg import sqrtm
           from sklearn.datasets import make_spd_matrix
           from sklearn.model_selection import KFold
           from sklearn.model_selection import GridSearchCV
           import math

           from keras.models import Sequential
           from keras.layers import Dense
           from keras.wrappers.scikit_learn import KerasClassifier
```

```python
In [171]:  mu = [[2, 2, 0], [-2, 2, 0], [-2, -2, 0], [2, -2, 0]]
           var_1 = make_spd_matrix(3)
           var_2 = make_spd_matrix(3)
           var_3 = make_spd_matrix(3)
           var_4 = make_spd_matrix(3)
           prior = [0.30, 0.25, 0.35, 0.10]

           N_1 = 1000
           N_2 = 10000
```

```python
In [172]:  #generating number of sample for the GMMs
           def sample_number(N):
               l_1 = 0
               l_2 = 0
               l_3 = 0
               l_4 = 0

               for i in range(N):
                   temp = np.random.uniform(0, 1, 1)
                   if temp <= prior[0]:
                       l_1 = l_1 + 1
                   elif temp <= prior[0] + prior[1]:
                       l_2 = l_2 + 1
                   elif temp <= prior[0] + prior[1] + prior[2]:
                       l_3 = l_3 + 1

               l_4 = N - l_1 - l_2 - l_3
               return l_1, l_2, l_3, l_4
```

In [173]:
```python
#generating data
def data_generator(l_1, l_2, l_3, l_4, mu, var_1, var_2, var_3, var_4):
    data = []
    data_1 = []
    data_2 = []
    data_3 = []
    data_4 = []
    true_label = []
    true_prob = []
    N = l_1 + l_2 + l_3 + l_4

    for i in range(l_1):
        temp = np.random.multivariate_normal(mu[0], var_1, 1)
        data_1.append(temp)
        data.append(temp)
        true_label.append([1])
        true_prob.append([1, 0, 0, 0])
    data_1 = np.array(data_1).reshape((l_1, 3))

    for i in range(l_2):
        temp = np.random.multivariate_normal(mu[1], var_2, 1)
        data_2.append(temp)
        data.append(temp)
        true_label.append([2])
        true_prob.append([0, 1, 0, 0])
    data_2 = np.array(data_2).reshape((l_2, 3))

    for i in range(l_3):
        temp = np.random.multivariate_normal(mu[2], var_3, 1)
        data_3.append(temp)
        data.append(temp)
        true_label.append([3])
        true_prob.append([0, 0, 1, 0])
    data_3 = np.array(data_3).reshape((l_3, 3))

    for i in range(l_4):
        temp = np.random.multivariate_normal(mu[3], var_4, 1)
        data_4.append(temp)
        data.append(temp)
        true_label.append([4])
        true_prob.append([0, 0, 0, 1])
    data_4 = np.array(data_4).reshape((l_4, 3))

    data = np.array(data).reshape((N, 3))
    true_prob = np.array(true_prob).reshape((N, 4))
    true_label = np.array(true_label).reshape((N, 1))

    return data, data_1, data_2, data_3, data_4, true_label, true_prob
```

In [174]:
```python
l_1, l_2, l_3, l_4 = sample_number(N_1)
data, data_1, data_2, data_3, data_4, true_label, true_prob = data_generator(l
_1, l_2, l_3, l_4, mu, var_1, var_2, var_3, var_4)
```

```
In [175]: fig = plt.figure(figsize=(12, 12))
          ax = fig.add_subplot(111, projection='3d')
          ax.scatter(data_1[:, 0], data_1[:, 1], data_1[:, 2], label='Class 1')
          ax.scatter(data_2[:, 0], data_2[:, 1], data_2[:, 2], label='Class 2')
          ax.scatter(data_3[:, 0], data_3[:, 1], data_3[:, 2], label='Class 3')
          ax.scatter(data_4[:, 0], data_4[:, 1], data_4[:, 2], label='Class 4')
          plt.xlabel('X-axis')
          plt.ylabel('Y-axis')
          ax.set_zlabel('Z-axis')
          plt.title('Visualization of data as a 2-D scatter plot')
          ax.legend()
          plt.show()
```
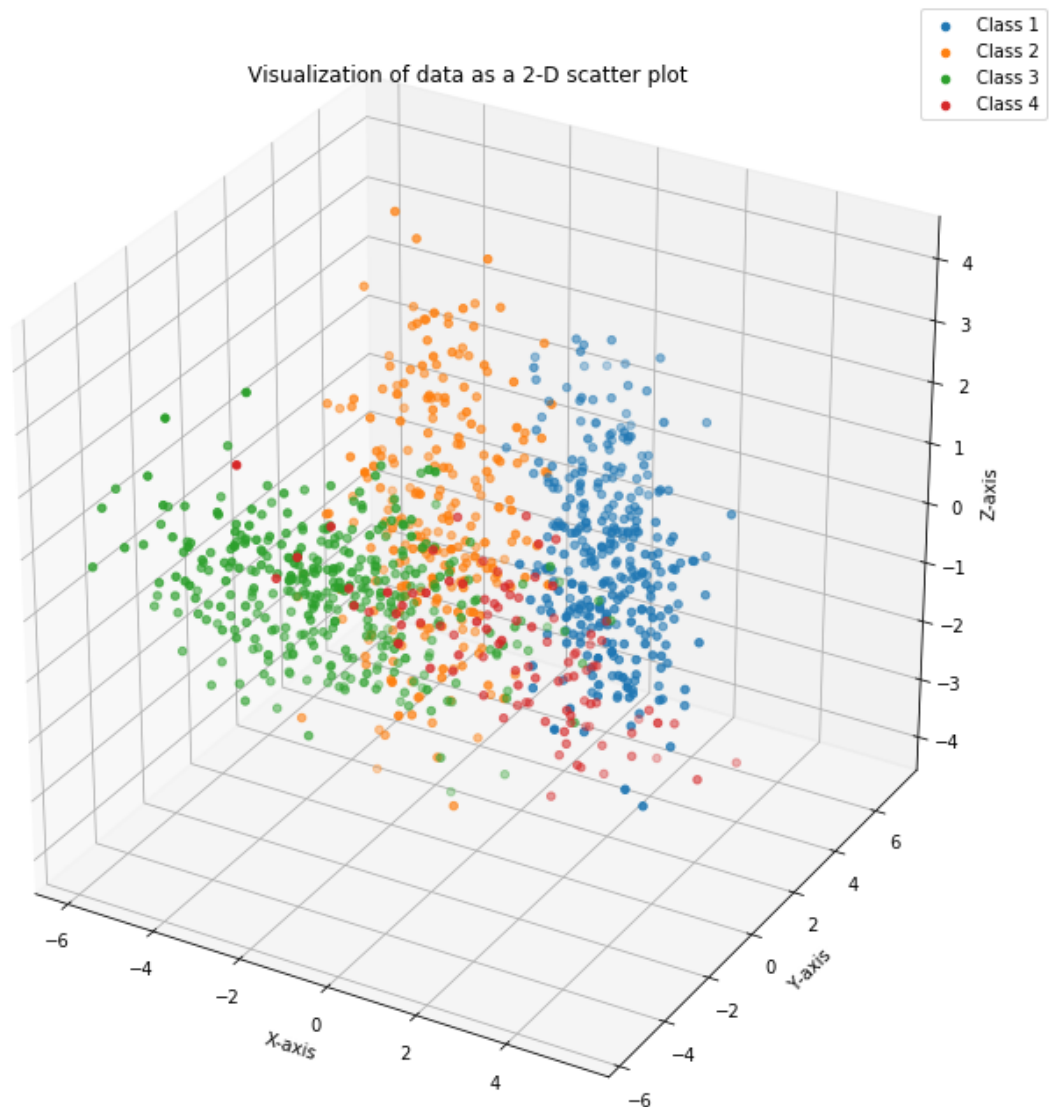
Points to note:

1) The application required that the covariance matrices be symmetric and positive definite for apropriate values of the data points (they were in the gaussian distribution). Hence, to generate such matrices, I have made use of the sklearn.datasets.make_spd_matrix package of sklearn. This package takes the dimensions of the required matrices as arguments and returns a random symmetric, positive-definite matrix.

2) Generation of data: Data is generated in two steps:

Step 1: The number of dataset pairs is calculated of each class using the priors declared (priors are 0.30, 0.25, 0.35, 0.10 for classes 1, 2, 3, and 4 respectively). Uniform distribution is used here to determine the number of pairs for each class.

Step 2: The data is generated according to Gaussian distribution into four classes based on the size of each class determined from the previos step. The samples are generated according to the conditions mentioned in the question. The means of each of the classes are taken as [2, 2, 0], [-2, 2, 0], [-2, -2, 0], [2, -2, 0] for classes 1, 2, 3, and 4 respectively. This gives a theoretical minimum probability of error between 4-15%. The exact values varies depending on the values generated for the covariences (which are randomly generated as mentioned in point 1).

Part 2:

```
In [176]: l_1, l_2, l_3, l_4 = sample_number(N_2)
          data, data_1, data_2, data_3, data_4, true_label, true_prob = data_generator(l
          _1, l_2, l_3, l_4, mu, var_1, var_2, var_3, var_4)
```

```
In [177]: l_1, l_2, l_3, l_4
```

```
Out[177]: (3021, 2535, 3444, 1000)
```

```
In [178]: fig = plt.figure(figsize=(15, 12))
          ax = fig.add_subplot(111, projection='3d')
          ax.scatter(data_1[:, 0], data_1[:, 1], data_1[:, 2], s=10, label='Class 1')
          ax.scatter(data_2[:, 0], data_2[:, 1], data_2[:, 2], s=10, label='Class 2')
          ax.scatter(data_3[:, 0], data_3[:, 1], data_3[:, 2], s=10, label='Class 3')
          ax.scatter(data_4[:, 0], data_4[:, 1], data_4[:, 2], s=10, label='Class 4')
          plt.xlabel('X-axis')
          plt.ylabel('Y-axis')
          ax.set_zlabel('Z-axis')
          plt.title('Visualization of data as a 2-D scatter plot')
          ax.legend()
          plt.show()
```
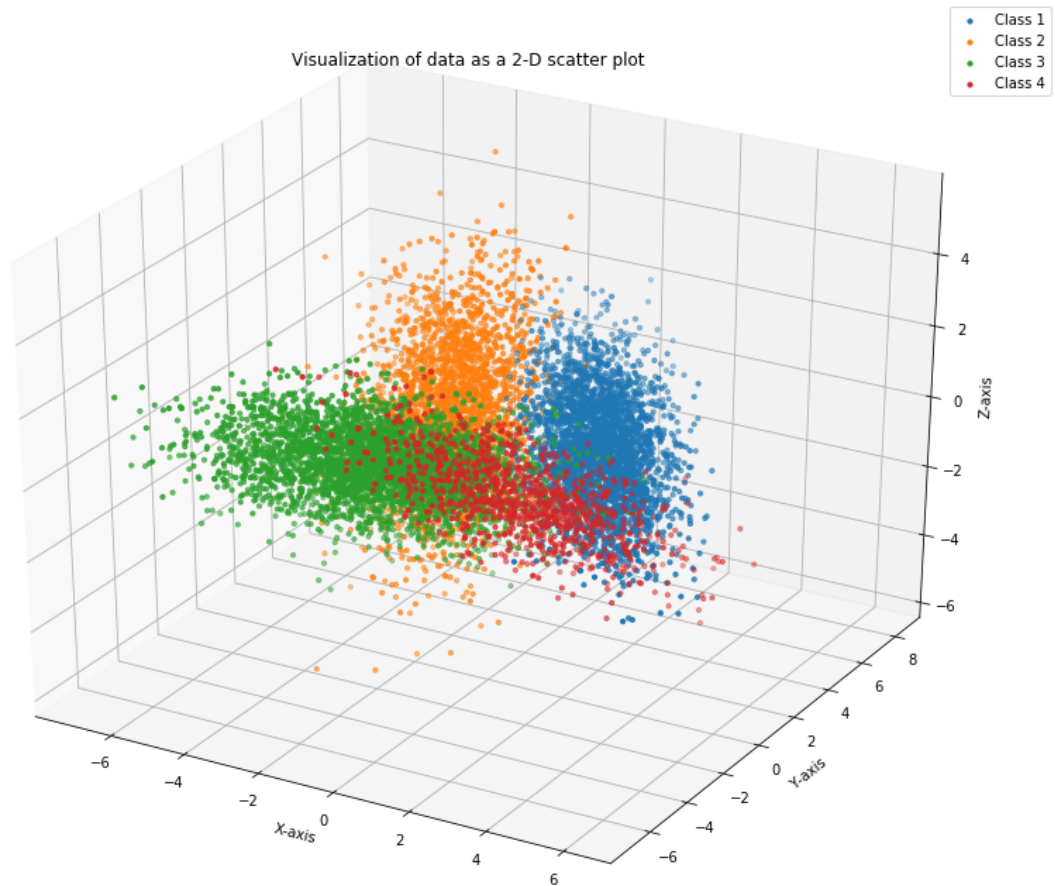


```
In [179]: def normal_prob(x, m, v):
              x_t = x
              m_t = m
              x = np.reshape(x, (3,1))
              m = np.reshape(m, (3,1))
              p = math.exp(-0.5*np.matmul(np.matmul((x_t-m_t), np.linalg.inv(v)), (x-m
          )))/(2*math.pi*np.linalg.det(v))
              return p
```

```
In [180]:  correct_1 = []
           error_1 = []

           correct_2 = []
           error_2 = []

           correct_3 = []
           error_3 = []

           correct_4 = []
           error_4 = []


           for i in range(l_1):
               p_1 = normal_prob(data_1[i, :], mu[0], var_1)*prior[0]
               p_2 = normal_prob(data_1[i, :], mu[1], var_2)*prior[1]
               p_3 = normal_prob(data_1[i, :], mu[2], var_3)*prior[2]
               p_4 = normal_prob(data_1[i, :], mu[3], var_4)*prior[3]
               if p_1 >= max(p_2, p_3, p_4):
                   correct_1.append(data_1[i, :])
               else:
                   error_1.append(data_1[i, :])
           correct_1 = np.array(correct_1)
           error_1 = np.array(error_1)

           for i in range(l_2):
               p_1 = normal_prob(data_2[i, :], mu[0], var_1) * prior[0]
               p_2 = normal_prob(data_2[i, :], mu[1], var_2) * prior[1]
               p_3 = normal_prob(data_2[i, :], mu[2], var_3) * prior[2]
               p_4 = normal_prob(data_2[i, :], mu[3], var_4) * prior[3]
               if max(p_1, p_2, p_3, p_4) == p_2:
                   correct_2.append(data_2[i, :])
               else:
                   error_2.append(data_2[i, :])
           correct_2 = np.array(correct_2)
           error_2 = np.array(error_2)

           for i in range(l_3):
               p_1 = normal_prob(data_3[i, :], mu[0], var_1) * prior[0]
               p_2 = normal_prob(data_3[i, :], mu[1], var_2) * prior[1]
               p_3 = normal_prob(data_3[i, :], mu[2], var_3) * prior[2]
               p_4 = normal_prob(data_3[i, :], mu[3], var_4) * prior[3]
               if max(p_1, p_2, p_3, p_4) == p_3:
                   correct_3.append(data_3[i, :])
               else:
                   error_3.append(data_3[i, :])
           correct_3 = np.array(correct_3)
           error_3 = np.array(error_3)

           for i in range(l_4):
               p_1 = normal_prob(data_4[i, :], mu[0], var_1) * prior[0]
               p_2 = normal_prob(data_4[i, :], mu[1], var_2) * prior[1]
               p_3 = normal_prob(data_4[i, :], mu[2], var_3) * prior[2]
               p_4 = normal_prob(data_4[i, :], mu[3], var_4) * prior[3]
               if max(p_1, p_2, p_3, p_4) == p_4:
                   correct_4.append(data_4[i, :])
```

```
        else:
            error_4.append(data_4[i, :])
correct_4 = np.array(correct_4)
error_4 = np.array(error_4)
```

In [181]:
```python
fig = plt.figure(figsize=(15, 12))
ax = fig.add_subplot(111, projection='3d')
ax.scatter(correct_1[:, 0], correct_1[:, 1], correct_1[:, 2], s=10, label='Cla
ss 1')
ax.scatter(correct_2[:, 0], correct_2[:, 1], correct_2[:, 2], s=10, label='Cla
ss 2')
ax.scatter(correct_3[:, 0], correct_3[:, 1], correct_3[:, 2], s=10, label='Cla
ss 3')
ax.scatter(correct_4[:, 0], correct_4[:, 1], correct_4[:, 2], s=10, label='Cla
ss 4')
if len(error_1) > 0:
    ax.scatter(error_1[:, 0], error_1[:, 1], error_1[:, 2], s=30, label='Class
1 - Misclassified')
if len(error_2) > 0:
    ax.scatter(error_2[:, 0], error_2[:, 1], error_2[:, 2], s=30, label='Class
2 - Misclassified')
if len(error_3) > 0:
    ax.scatter(error_3[:, 0], error_3[:, 1], error_3[:, 2], s=30, label='Class
3 - Misclassified')
if len(error_4) > 0:
    ax.scatter(error_4[:, 0], error_4[:, 1], error_4[:, 2], s=30, label='Class
4 - Misclassified')
plt.xlabel('x-axis')
plt.ylabel('y-axis')
ax.set_zlabel('Z-axis')
plt.title('Visualization of data according to their true labels and decision l
abels')
ax.legend()
plt.show()
```

Visualization of data according to their true labels and decision labels
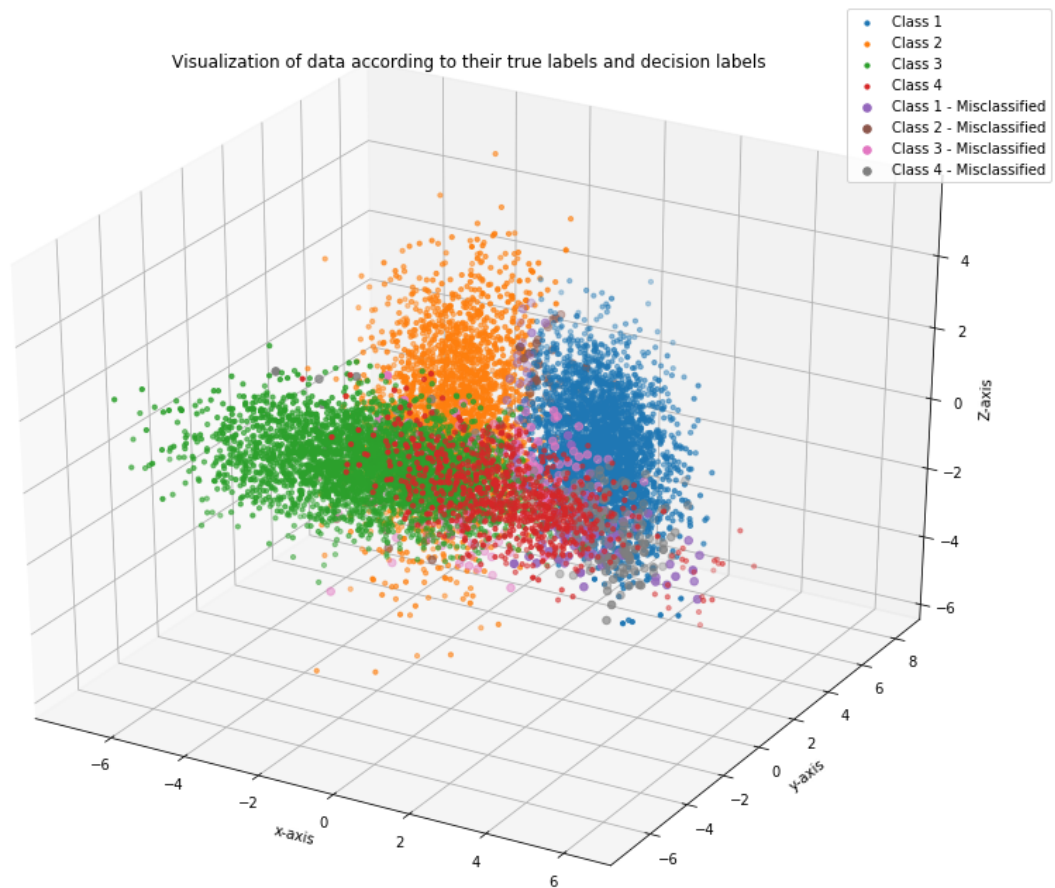
In [182]:
```python
print("\nThe total number of samples misclassified by the classifier are {}".f
ormat(len(error_1) + len(error_2) + len(error_3) + len(error_4)))

print("\nThe error probability is {}.".format((len(error_1) + len(error_2) + l
en(error_3) + len(error_4))/N_2))
```

The total number of samples misclassified by the classifier are 642

The error probability is 0.0642.

In [183]:
```python
print("Wrongly classified points from class 1: {}". format(len(error_1)))
print("Wrongly classified points from class 1: {}". format(len(error_2)))
print("Wrongly classified points from class 1: {}". format(len(error_3)))
print("Wrongly classified points from class 1: {}". format(len(error_4)))
```

Wrongly classified points from class 1: 131
Wrongly classified points from class 1: 154
Wrongly classified points from class 1: 179
Wrongly classified points from class 1: 178

Note:

The theory for this part is mentioned at the end of this program.

Part 3:

In [184]:
```
N1 = 100
N2 = 1000
N3 = 10000
M = [6, 10, 14, 18, 22, 26, 30, 34, 38]
```

In [185]:
```
l1_1, l1_2, l1_3, l1_4 = sample_number(N1)
data1, data1_1, data1_2, data1_3, data1_4, true_label1, true_prob1 = data_gene
rator(l1_1, l1_2, l1_3, l1_4, mu, var_1, var_2, var_3, var_4)
```

In [186]:
```
l2_1, l2_2, l2_3, l2_4 = sample_number(N2)
data2, data2_1, data2_2, data2_3, data2_4, true_label2, true_prob2 = data_gene
rator(l2_1, l2_2, l2_3, l2_4, mu, var_1, var_2, var_3, var_4)
```

In [187]:
```
l3_1, l3_2, l3_3, l3_4 = sample_number(N3)
data3, data3_1, data3_2, data3_3, data3_4, true_label3, true_prob3 = data_gene
rator(l3_1, l3_2, l3_3, l3_4, mu, var_1, var_2, var_3, var_4)
```

In [188]:
```
def neural(data_train, prob_train, data_test, prob_test, m, N):
    model = Sequential()
    model.add(Dense(m, input_dim=3, activation='sigmoid'))
    model.add(Dense(4, activation='softmax'))
    model.compile(optimizer='SGD', loss='categorical_crossentropy', metrics=[
'accuracy'])
    model.fit(data_train, prob_train, epochs=1000, batch_size=N)
    return model.evaluate(data_test, prob_test)
```

In [189]:
```
def best_model_order(accuracy):
    mean_accuracy = []
    for i in range(len(M)):
        total = 0
        for j in range(10):
            total = total + np.array(accuracy)[i*10 + j, 1]
        mean_accuracy.append(total/10)

    param_best = np.array(M)[np.argmax(mean_accuracy)]
    return param_best
```

In [190]:
```
def baseline_model(M=0):
    model = Sequential()
    model.add(Dense(M, input_dim=3, kernel_initializer='normal', activation='s
igmoid'))
    model.add(Dense(4, kernel_initializer='normal', activation='softmax'))
    model.compile(optimizer='SGD', loss='categorical_crossentropy', metrics=[
'accuracy'])
    return model
```

```
In [191]: def training(M, N, data, true_label, true_prob):
              parameters = dict(M=M)
              estimator = KerasClassifier(build_fn=baseline_model, epochs=1000, batch_si
          ze=N, verbose=0)
              kfold = KFold(n_splits=10, shuffle = True)
              gridsrch = GridSearchCV(estimator = estimator, param_grid = parameters, cv
          = kfold, n_jobs=-1)
              result = gridsrch.fit(data, true_prob)
              best_score = result.best_score_
              best_param = result.best_params_
              mean = result.cv_results_['mean_test_score']
              std = result.cv_results_['std_test_score']
              param = result.cv_results_['params']

              return best_score, best_param, mean, std, param
```

100 dataset:

```
In [192]: best_score_1, best_param_1, mean_1, std_1, param_1 = training(M, N1, data1, tr
          ue_label1, true_prob1)
```

```
In [193]: print("The optimal number of perceptrons for minimum error of {} is obtained a
          s {}".format(1-best_score_1, best_param_1))
```

```
The optimal number of perceptrons for minimum error of 0.25000000894069674 is
obtained as {'M': 38}
```

```
In [194]: for mean, stdev, param in zip(mean_1, std_1, param_1):
              print("%f (%f) with: %r" % (mean, stdev, param))
```

```
0.660000 (0.142829) with: {'M': 6}
0.660000 (0.142829) with: {'M': 10}
0.660000 (0.142829) with: {'M': 14}
0.660000 (0.142829) with: {'M': 18}
0.660000 (0.142829) with: {'M': 22}
0.680000 (0.160000) with: {'M': 26}
0.680000 (0.160000) with: {'M': 30}
0.730000 (0.161555) with: {'M': 34}
0.750000 (0.143178) with: {'M': 38}
```

```
In [195]: best_param_1 = best_param_1.get('M')
```

In [196]: `accuracy1 = neural(data1, true_prob1, data, true_prob, best_param_1, N1)`

```
Epoch 1/1000
100/100 [==============================] - 2s 17ms/step - loss: 1.4802 - acc:
0.1900
Epoch 2/1000
100/100 [==============================] - 0s 74us/step - loss: 1.4686 - acc:
0.1600
Epoch 3/1000
100/100 [==============================] - 0s 31us/step - loss: 1.4574 - acc:
0.1400
Epoch 4/1000
100/100 [==============================] - 0s 50us/step - loss: 1.4465 - acc:
0.1200
Epoch 5/1000
100/100 [==============================] - 0s 44us/step - loss: 1.4360 - acc:
0.1000
Epoch 6/1000
100/100 [==============================] - 0s 30us/step - loss: 1.4258 - acc:
0.0800
Epoch 7/1000
100/100 [==============================] - 0s 47us/step - loss: 1.4159 - acc:
0.0800
Epoch 8/1000
100/100 [==============================] - 0s 67us/step - loss: 1.4063 - acc:
0.0800
Epoch 9/1000
100/100 [==============================] - 0s 24us/step - loss: 1.3970 - acc:
0.0800
Epoch 10/1000
100/100 [==============================] - 0s 35us/step - loss: 1.3880 - acc:
0.0800
Epoch 11/1000
100/100 [==============================] - 0s 61us/step - loss: 1.3793 - acc:
0.1000
Epoch 12/1000
100/100 [==============================] - 0s 30us/step - loss: 1.3709 - acc:
0.0900
Epoch 13/1000
100/100 [==============================] - 0s 10us/step - loss: 1.3627 - acc:
0.1000
Epoch 14/1000
100/100 [==============================] - 0s 37us/step - loss: 1.3547 - acc:
0.1800
Epoch 15/1000
100/100 [==============================] - 0s 40us/step - loss: 1.3470 - acc:
0.2500
Epoch 16/1000
100/100 [==============================] - 0s 30us/step - loss: 1.3395 - acc:
0.3200
Epoch 17/1000
100/100 [==============================] - 0s 30us/step - loss: 1.3322 - acc:
0.3500
Epoch 18/1000
100/100 [==============================] - 0s 59us/step - loss: 1.3251 - acc:
0.3600
Epoch 19/1000
100/100 [==============================] - 0s 42us/step - loss: 1.3183 - acc:
0.3500
```

```
Epoch 20/1000
100/100 [==============================] - 0s 23us/step - loss: 1.3116 - acc:
0.3600
Epoch 21/1000
100/100 [==============================] - 0s 40us/step - loss: 1.3051 - acc:
0.3700
Epoch 22/1000
100/100 [==============================] - 0s 48us/step - loss: 1.2988 - acc:
0.3700
Epoch 23/1000
100/100 [==============================] - 0s 77us/step - loss: 1.2927 - acc:
0.3700
Epoch 24/1000
100/100 [==============================] - 0s 17us/step - loss: 1.2867 - acc:
0.4100
Epoch 25/1000
100/100 [==============================] - 0s 28us/step - loss: 1.2809 - acc:
0.4200
Epoch 26/1000
100/100 [==============================] - 0s 42us/step - loss: 1.2752 - acc:
0.4400
Epoch 27/1000
100/100 [==============================] - 0s 45us/step - loss: 1.2697 - acc:
0.4500
Epoch 28/1000
100/100 [==============================] - 0s 29us/step - loss: 1.2644 - acc:
0.4900
Epoch 29/1000
100/100 [==============================] - 0s 20us/step - loss: 1.2591 - acc:
0.4900
Epoch 30/1000
100/100 [==============================] - 0s 40us/step - loss: 1.2540 - acc:
0.5100
Epoch 31/1000
100/100 [==============================] - 0s 44us/step - loss: 1.2491 - acc:
0.5100
Epoch 32/1000
100/100 [==============================] - 0s 25us/step - loss: 1.2442 - acc:
0.5400
Epoch 33/1000
100/100 [==============================] - 0s 40us/step - loss: 1.2395 - acc:
0.5400
Epoch 34/1000
100/100 [==============================] - 0s 40us/step - loss: 1.2348 - acc:
0.5500
Epoch 35/1000
100/100 [==============================] - 0s 39us/step - loss: 1.2303 - acc:
0.5500
Epoch 36/1000
100/100 [==============================] - 0s 54us/step - loss: 1.2259 - acc:
0.5600
Epoch 37/1000
100/100 [==============================] - 0s 0us/step - loss: 1.2215 - acc:
0.5600
Epoch 38/1000
100/100 [==============================] - 0s 36us/step - loss: 1.2173 - acc:
0.5700
```

```
Epoch 39/1000
100/100 [==============================] - 0s 35us/step - loss: 1.2132 - acc:
0.5700
Epoch 40/1000
100/100 [==============================] - 0s 30us/step - loss: 1.2091 - acc:
0.5700
Epoch 41/1000
100/100 [==============================] - 0s 44us/step - loss: 1.2051 - acc:
0.6000
Epoch 42/1000
100/100 [==============================] - 0s 64us/step - loss: 1.2012 - acc:
0.6000
Epoch 43/1000
100/100 [==============================] - 0s 36us/step - loss: 1.1974 - acc:
0.6000
Epoch 44/1000
100/100 [==============================] - 0s 44us/step - loss: 1.1937 - acc:
0.6000
Epoch 45/1000
100/100 [==============================] - 0s 40us/step - loss: 1.1900 - acc:
0.6000
Epoch 46/1000
100/100 [==============================] - 0s 29us/step - loss: 1.1864 - acc:
0.6000
Epoch 47/1000
100/100 [==============================] - 0s 28us/step - loss: 1.1828 - acc:
0.6100
Epoch 48/1000
100/100 [==============================] - 0s 63us/step - loss: 1.1793 - acc:
0.6100
Epoch 49/1000
100/100 [==============================] - 0s 61us/step - loss: 1.1759 - acc:
0.6100
Epoch 50/1000
100/100 [==============================] - 0s 31us/step - loss: 1.1725 - acc:
0.6100
Epoch 51/1000
100/100 [==============================] - 0s 30us/step - loss: 1.1692 - acc:
0.6100
Epoch 52/1000
100/100 [==============================] - 0s 24us/step - loss: 1.1659 - acc:
0.6300
Epoch 53/1000
100/100 [==============================] - 0s 29us/step - loss: 1.1627 - acc:
0.6300
Epoch 54/1000
100/100 [==============================] - 0s 52us/step - loss: 1.1595 - acc:
0.6300
Epoch 55/1000
100/100 [==============================] - 0s 35us/step - loss: 1.1564 - acc:
0.6300
Epoch 56/1000
100/100 [==============================] - 0s 10us/step - loss: 1.1533 - acc:
0.6300
Epoch 57/1000
100/100 [==============================] - 0s 133us/step - loss: 1.1503 - ac
c: 0.6300
```

```
Epoch 58/1000
100/100 [==============================] - 0s 129us/step - loss: 1.1473 - ac
c: 0.6300
Epoch 59/1000
100/100 [==============================] - 0s 46us/step - loss: 1.1444 - acc:
0.6300
Epoch 60/1000
100/100 [==============================] - 0s 10us/step - loss: 1.1414 - acc:
0.6300
Epoch 61/1000
100/100 [==============================] - 0s 57us/step - loss: 1.1386 - acc:
0.6400
Epoch 62/1000
100/100 [==============================] - 0s 31us/step - loss: 1.1357 - acc:
0.6400
Epoch 63/1000
100/100 [==============================] - 0s 54us/step - loss: 1.1329 - acc:
0.6400
Epoch 64/1000
100/100 [==============================] - 0s 51us/step - loss: 1.1301 - acc:
0.6400
Epoch 65/1000
100/100 [==============================] - 0s 10us/step - loss: 1.1274 - acc:
0.6400
Epoch 66/1000
100/100 [==============================] - 0s 63us/step - loss: 1.1247 - acc:
0.6500
Epoch 67/1000
100/100 [==============================] - 0s 41us/step - loss: 1.1220 - acc:
0.6500
Epoch 68/1000
100/100 [==============================] - 0s 10us/step - loss: 1.1194 - acc:
0.6500
Epoch 69/1000
100/100 [==============================] - 0s 77us/step - loss: 1.1167 - acc:
0.6500
Epoch 70/1000
100/100 [==============================] - 0s 38us/step - loss: 1.1141 - acc:
0.6500
Epoch 71/1000
100/100 [==============================] - 0s 25us/step - loss: 1.1116 - acc:
0.6500
Epoch 72/1000
100/100 [==============================] - 0s 38us/step - loss: 1.1090 - acc:
0.6500
Epoch 73/1000
100/100 [==============================] - 0s 35us/step - loss: 1.1065 - acc:
0.6500
Epoch 74/1000
100/100 [==============================] - 0s 36us/step - loss: 1.1040 - acc:
0.6500
Epoch 75/1000
100/100 [==============================] - 0s 43us/step - loss: 1.1015 - acc:
0.6500
Epoch 76/1000
100/100 [==============================] - 0s 56us/step - loss: 1.0991 - acc:
0.6600
```

```
Epoch 77/1000
100/100 [==============================] - 0s 0us/step - loss: 1.0966 - acc:
0.6600
Epoch 78/1000
100/100 [==============================] - 0s 35us/step - loss: 1.0942 - acc:
0.6600
Epoch 79/1000
100/100 [==============================] - 0s 42us/step - loss: 1.0918 - acc:
0.6600
Epoch 80/1000
100/100 [==============================] - 0s 0us/step - loss: 1.0895 - acc:
0.6600
Epoch 81/1000
100/100 [==============================] - 0s 24us/step - loss: 1.0871 - acc:
0.6600
Epoch 82/1000
100/100 [==============================] - 0s 41us/step - loss: 1.0848 - acc:
0.6600
Epoch 83/1000
100/100 [==============================] - 0s 14us/step - loss: 1.0825 - acc:
0.6600
Epoch 84/1000
100/100 [==============================] - 0s 18us/step - loss: 1.0802 - acc:
0.6600
Epoch 85/1000
100/100 [==============================] - 0s 49us/step - loss: 1.0779 - acc:
0.6600
Epoch 86/1000
100/100 [==============================] - 0s 27us/step - loss: 1.0756 - acc:
0.6600
Epoch 87/1000
100/100 [==============================] - 0s 42us/step - loss: 1.0734 - acc:
0.6600
Epoch 88/1000
100/100 [==============================] - 0s 41us/step - loss: 1.0711 - acc:
0.6600
Epoch 89/1000
100/100 [==============================] - 0s 40us/step - loss: 1.0689 - acc:
0.6600
Epoch 90/1000
100/100 [==============================] - 0s 24us/step - loss: 1.0667 - acc:
0.6600
Epoch 91/1000
100/100 [==============================] - 0s 30us/step - loss: 1.0645 - acc:
0.6600
Epoch 92/1000
100/100 [==============================] - 0s 32us/step - loss: 1.0624 - acc:
0.6600
Epoch 93/1000
100/100 [==============================] - 0s 24us/step - loss: 1.0602 - acc:
0.6600
Epoch 94/1000
100/100 [==============================] - 0s 27us/step - loss: 1.0581 - acc:
0.6600
Epoch 95/1000
100/100 [==============================] - 0s 43us/step - loss: 1.0559 - acc:
0.6600
```

```
Epoch 96/1000
100/100 [==============================] - 0s 35us/step - loss: 1.0538 - acc:
0.6600
Epoch 97/1000
100/100 [==============================] - 0s 28us/step - loss: 1.0517 - acc:
0.6600
Epoch 98/1000
100/100 [==============================] - 0s 36us/step - loss: 1.0496 - acc:
0.6600
Epoch 99/1000
100/100 [==============================] - 0s 48us/step - loss: 1.0476 - acc:
0.6600
Epoch 100/1000
100/100 [==============================] - 0s 58us/step - loss: 1.0455 - acc:
0.6600
Epoch 101/1000
100/100 [==============================] - 0s 32us/step - loss: 1.0434 - acc:
0.6600
Epoch 102/1000
100/100 [==============================] - 0s 37us/step - loss: 1.0414 - acc:
0.6600
Epoch 103/1000
100/100 [==============================] - 0s 27us/step - loss: 1.0394 - acc:
0.6600
Epoch 104/1000
100/100 [==============================] - 0s 33us/step - loss: 1.0373 - acc:
0.6600
Epoch 105/1000
100/100 [==============================] - 0s 30us/step - loss: 1.0353 - acc:
0.6600
Epoch 106/1000
100/100 [==============================] - 0s 33us/step - loss: 1.0333 - acc:
0.6600
Epoch 107/1000
100/100 [==============================] - 0s 47us/step - loss: 1.0314 - acc:
0.6600
Epoch 108/1000
100/100 [==============================] - 0s 20us/step - loss: 1.0294 - acc:
0.6600
Epoch 109/1000
100/100 [==============================] - 0s 20us/step - loss: 1.0274 - acc:
0.6600
Epoch 110/1000
100/100 [==============================] - 0s 30us/step - loss: 1.0255 - acc:
0.6600
Epoch 111/1000
100/100 [==============================] - 0s 20us/step - loss: 1.0235 - acc:
0.6600
Epoch 112/1000
100/100 [==============================] - 0s 26us/step - loss: 1.0216 - acc:
0.6600
Epoch 113/1000
100/100 [==============================] - 0s 31us/step - loss: 1.0197 - acc:
0.6600
Epoch 114/1000
100/100 [==============================] - 0s 0us/step - loss: 1.0177 - acc:
0.6600
```

```
Epoch 115/1000
100/100 [==============================] - 0s 40us/step - loss: 1.0158 - acc:
0.6600
Epoch 116/1000
100/100 [==============================] - 0s 44us/step - loss: 1.0139 - acc:
0.6600
Epoch 117/1000
100/100 [==============================] - 0s 66us/step - loss: 1.0121 - acc:
0.6600
Epoch 118/1000
100/100 [==============================] - 0s 23us/step - loss: 1.0102 - acc:
0.6600
Epoch 119/1000
100/100 [==============================] - 0s 20us/step - loss: 1.0083 - acc:
0.6600
Epoch 120/1000
100/100 [==============================] - 0s 23us/step - loss: 1.0065 - acc:
0.6600
Epoch 121/1000
100/100 [==============================] - 0s 33us/step - loss: 1.0046 - acc:
0.6600
Epoch 122/1000
100/100 [==============================] - 0s 32us/step - loss: 1.0028 - acc:
0.6600
Epoch 123/1000
100/100 [==============================] - 0s 52us/step - loss: 1.0009 - acc:
0.6600
Epoch 124/1000
100/100 [==============================] - 0s 23us/step - loss: 0.9991 - acc:
0.6600
Epoch 125/1000
100/100 [==============================] - 0s 30us/step - loss: 0.9973 - acc:
0.6600
Epoch 126/1000
100/100 [==============================] - 0s 33us/step - loss: 0.9955 - acc:
0.6700
Epoch 127/1000
100/100 [==============================] - 0s 31us/step - loss: 0.9937 - acc:
0.6700
Epoch 128/1000
100/100 [==============================] - 0s 30us/step - loss: 0.9919 - acc:
0.6700
Epoch 129/1000
100/100 [==============================] - 0s 30us/step - loss: 0.9901 - acc:
0.6700
Epoch 130/1000
100/100 [==============================] - 0s 20us/step - loss: 0.9883 - acc:
0.6700
Epoch 131/1000
100/100 [==============================] - 0s 43us/step - loss: 0.9865 - acc:
0.6700
Epoch 132/1000
100/100 [==============================] - 0s 34us/step - loss: 0.9848 - acc:
0.6700
Epoch 133/1000
100/100 [==============================] - 0s 36us/step - loss: 0.9830 - acc:
0.6700
```

```
Epoch 134/1000
100/100 [==============================] - 0s 32us/step - loss: 0.9813 - acc:
0.6700
Epoch 135/1000
100/100 [==============================] - 0s 31us/step - loss: 0.9795 - acc:
0.6700
Epoch 136/1000
100/100 [==============================] - 0s 39us/step - loss: 0.9778 - acc:
0.6700
Epoch 137/1000
100/100 [==============================] - 0s 24us/step - loss: 0.9761 - acc:
0.6700
Epoch 138/1000
100/100 [==============================] - 0s 34us/step - loss: 0.9744 - acc:
0.6700
Epoch 139/1000
100/100 [==============================] - 0s 45us/step - loss: 0.9726 - acc:
0.6700
Epoch 140/1000
100/100 [==============================] - 0s 20us/step - loss: 0.9709 - acc:
0.6700
Epoch 141/1000
100/100 [==============================] - 0s 23us/step - loss: 0.9692 - acc:
0.6700
Epoch 142/1000
100/100 [==============================] - 0s 51us/step - loss: 0.9676 - acc:
0.6700
Epoch 143/1000
100/100 [==============================] - 0s 41us/step - loss: 0.9659 - acc:
0.6700
Epoch 144/1000
100/100 [==============================] - 0s 28us/step - loss: 0.9642 - acc:
0.6700
Epoch 145/1000
100/100 [==============================] - 0s 39us/step - loss: 0.9625 - acc:
0.6700
Epoch 146/1000
100/100 [==============================] - 0s 31us/step - loss: 0.9609 - acc:
0.6700
Epoch 147/1000
100/100 [==============================] - 0s 43us/step - loss: 0.9592 - acc:
0.6700
Epoch 148/1000
100/100 [==============================] - 0s 40us/step - loss: 0.9575 - acc:
0.6700
Epoch 149/1000
100/100 [==============================] - 0s 42us/step - loss: 0.9559 - acc:
0.6700
Epoch 150/1000
100/100 [==============================] - 0s 28us/step - loss: 0.9543 - acc:
0.6700
Epoch 151/1000
100/100 [==============================] - 0s 43us/step - loss: 0.9526 - acc:
0.6700
Epoch 152/1000
100/100 [==============================] - 0s 46us/step - loss: 0.9510 - acc:
0.6700
```

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Epoch 153/1000
100/100 [==============================] - 0s 41us/step - loss: 0.9494 - acc:
0.6700
Epoch 154/1000
100/100 [==============================] - 0s 56us/step - loss: 0.9478 - acc:
0.6700
Epoch 155/1000
100/100 [==============================] - 0s 37us/step - loss: 0.9462 - acc:
0.6700
Epoch 156/1000
100/100 [==============================] - 0s 61us/step - loss: 0.9446 - acc:
0.6700
Epoch 157/1000
100/100 [==============================] - 0s 40us/step - loss: 0.9430 - acc:
0.6700
Epoch 158/1000
100/100 [==============================] - 0s 54us/step - loss: 0.9414 - acc:
0.6700
Epoch 159/1000
100/100 [==============================] - 0s 40us/step - loss: 0.9398 - acc:
0.6700
Epoch 160/1000
100/100 [==============================] - 0s 73us/step - loss: 0.9382 - acc:
0.6700
Epoch 161/1000
100/100 [==============================] - 0s 33us/step - loss: 0.9366 - acc:
0.6700
Epoch 162/1000
100/100 [==============================] - 0s 52us/step - loss: 0.9351 - acc:
0.6700
Epoch 163/1000
100/100 [==============================] - 0s 36us/step - loss: 0.9335 - acc:
0.6700
Epoch 164/1000
100/100 [==============================] - 0s 41us/step - loss: 0.9320 - acc:
0.6700
Epoch 165/1000
100/100 [==============================] - 0s 50us/step - loss: 0.9304 - acc:
0.6700
Epoch 166/1000
100/100 [==============================] - 0s 31us/step - loss: 0.9289 - acc:
0.6700
Epoch 167/1000
100/100 [==============================] - 0s 45us/step - loss: 0.9273 - acc:
0.6700
Epoch 168/1000
100/100 [==============================] - 0s 55us/step - loss: 0.9258 - acc:
0.6700
Epoch 169/1000
100/100 [==============================] - 0s 28us/step - loss: 0.9243 - acc:
0.6700
Epoch 170/1000
100/100 [==============================] - 0s 57us/step - loss: 0.9227 - acc:
0.6700
Epoch 171/1000
100/100 [==============================] - 0s 37us/step - loss: 0.9212 - acc:
0.6700
```

```
Epoch 172/1000
100/100 [==============================] - 0s 41us/step - loss: 0.9197 - acc:
0.6700
Epoch 173/1000
100/100 [==============================] - 0s 52us/step - loss: 0.9182 - acc:
0.6700
Epoch 174/1000
100/100 [==============================] - 0s 31us/step - loss: 0.9167 - acc:
0.6700
Epoch 175/1000
100/100 [==============================] - 0s 51us/step - loss: 0.9152 - acc:
0.6700
Epoch 176/1000
100/100 [==============================] - 0s 72us/step - loss: 0.9137 - acc:
0.6700
Epoch 177/1000
100/100 [==============================] - 0s 0us/step - loss: 0.9122 - acc:
0.6700
Epoch 178/1000
100/100 [==============================] - 0s 41us/step - loss: 0.9107 - acc:
0.6700
Epoch 179/1000
100/100 [==============================] - 0s 47us/step - loss: 0.9093 - acc:
0.6800
Epoch 180/1000
100/100 [==============================] - 0s 51us/step - loss: 0.9078 - acc:
0.6800
Epoch 181/1000
100/100 [==============================] - 0s 62us/step - loss: 0.9063 - acc:
0.6800
Epoch 182/1000
100/100 [==============================] - 0s 40us/step - loss: 0.9049 - acc:
0.6800
Epoch 183/1000
100/100 [==============================] - 0s 43us/step - loss: 0.9034 - acc:
0.6800
Epoch 184/1000
100/100 [==============================] - 0s 40us/step - loss: 0.9020 - acc:
0.6800
Epoch 185/1000
100/100 [==============================] - 0s 40us/step - loss: 0.9005 - acc:
0.6800
Epoch 186/1000
100/100 [==============================] - 0s 42us/step - loss: 0.8991 - acc:
0.6800
Epoch 187/1000
100/100 [==============================] - 0s 39us/step - loss: 0.8976 - acc:
0.6800
Epoch 188/1000
100/100 [==============================] - 0s 36us/step - loss: 0.8962 - acc:
0.6800
Epoch 189/1000
100/100 [==============================] - 0s 36us/step - loss: 0.8948 - acc:
0.6800
Epoch 190/1000
100/100 [==============================] - 0s 35us/step - loss: 0.8934 - acc:
0.6800
```

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Epoch 191/1000
100/100 [==============================] - 0s 39us/step - loss: 0.8919 - acc:
0.6800
Epoch 192/1000
100/100 [==============================] - 0s 50us/step - loss: 0.8905 - acc:
0.6800
Epoch 193/1000
100/100 [==============================] - 0s 47us/step - loss: 0.8891 - acc:
0.6800
Epoch 194/1000
100/100 [==============================] - 0s 40us/step - loss: 0.8877 - acc:
0.6800
Epoch 195/1000
100/100 [==============================] - 0s 41us/step - loss: 0.8863 - acc:
0.6800
Epoch 196/1000
100/100 [==============================] - 0s 38us/step - loss: 0.8849 - acc:
0.6800
Epoch 197/1000
100/100 [==============================] - 0s 27us/step - loss: 0.8835 - acc:
0.6800
Epoch 198/1000
100/100 [==============================] - 0s 33us/step - loss: 0.8821 - acc:
0.6800
Epoch 199/1000
100/100 [==============================] - 0s 30us/step - loss: 0.8808 - acc:
0.6800
Epoch 200/1000
100/100 [==============================] - 0s 41us/step - loss: 0.8794 - acc:
0.6800
Epoch 201/1000
100/100 [==============================] - 0s 16us/step - loss: 0.8780 - acc:
0.6800
Epoch 202/1000
100/100 [==============================] - 0s 37us/step - loss: 0.8766 - acc:
0.6800
Epoch 203/1000
100/100 [==============================] - 0s 48us/step - loss: 0.8753 - acc:
0.6800
Epoch 204/1000
100/100 [==============================] - 0s 0us/step - loss: 0.8739 - acc:
0.6800
Epoch 205/1000
100/100 [==============================] - 0s 39us/step - loss: 0.8726 - acc:
0.6800
Epoch 206/1000
100/100 [==============================] - 0s 20us/step - loss: 0.8712 - acc:
0.6800
Epoch 207/1000
100/100 [==============================] - 0s 20us/step - loss: 0.8699 - acc:
0.6800
Epoch 208/1000
100/100 [==============================] - 0s 30us/step - loss: 0.8685 - acc:
0.6800
Epoch 209/1000
100/100 [==============================] - 0s 20us/step - loss: 0.8672 - acc:
0.6800
```

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Epoch 210/1000
100/100 [==============================] - 0s 20us/step - loss: 0.8659 - acc:
0.6800
Epoch 211/1000
100/100 [==============================] - 0s 30us/step - loss: 0.8645 - acc:
0.6800
Epoch 212/1000
100/100 [==============================] - 0s 30us/step - loss: 0.8632 - acc:
0.6800
Epoch 213/1000
100/100 [==============================] - 0s 21us/step - loss: 0.8619 - acc:
0.6800
Epoch 214/1000
100/100 [==============================] - 0s 30us/step - loss: 0.8606 - acc:
0.6800
Epoch 215/1000
100/100 [==============================] - 0s 17us/step - loss: 0.8592 - acc:
0.6800
Epoch 216/1000
100/100 [==============================] - 0s 30us/step - loss: 0.8579 - acc:
0.6800
Epoch 217/1000
100/100 [==============================] - 0s 20us/step - loss: 0.8566 - acc:
0.6800
Epoch 218/1000
100/100 [==============================] - 0s 26us/step - loss: 0.8553 - acc:
0.6800
Epoch 219/1000
100/100 [==============================] - 0s 48us/step - loss: 0.8540 - acc:
0.6900
Epoch 220/1000
100/100 [==============================] - 0s 27us/step - loss: 0.8527 - acc:
0.6900
Epoch 221/1000
100/100 [==============================] - 0s 69us/step - loss: 0.8514 - acc:
0.6900
Epoch 222/1000
100/100 [==============================] - 0s 65us/step - loss: 0.8502 - acc:
0.6900
Epoch 223/1000
100/100 [==============================] - 0s 51us/step - loss: 0.8489 - acc:
0.6900
Epoch 224/1000
100/100 [==============================] - 0s 32us/step - loss: 0.8476 - acc:
0.6900
Epoch 225/1000
100/100 [==============================] - 0s 54us/step - loss: 0.8463 - acc:
0.6900
Epoch 226/1000
100/100 [==============================] - 0s 63us/step - loss: 0.8451 - acc:
0.6900
Epoch 227/1000
100/100 [==============================] - 0s 83us/step - loss: 0.8438 - acc:
0.6900
Epoch 228/1000
100/100 [==============================] - 0s 55us/step - loss: 0.8425 - acc:
0.6900
```

```
Epoch 229/1000
100/100 [==============================] - 0s 51us/step - loss: 0.8413 - acc:
0.6900
Epoch 230/1000
100/100 [==============================] - 0s 58us/step - loss: 0.8400 - acc:
0.6900
Epoch 231/1000
100/100 [==============================] - 0s 59us/step - loss: 0.8388 - acc:
0.6900
Epoch 232/1000
100/100 [==============================] - 0s 32us/step - loss: 0.8375 - acc:
0.6900
Epoch 233/1000
100/100 [==============================] - 0s 140us/step - loss: 0.8363 - ac
c: 0.6900
Epoch 234/1000
100/100 [==============================] - 0s 51us/step - loss: 0.8350 - acc:
0.6900
Epoch 235/1000
100/100 [==============================] - 0s 51us/step - loss: 0.8338 - acc:
0.6900
Epoch 236/1000
100/100 [==============================] - 0s 123us/step - loss: 0.8326 - ac
c: 0.6900
Epoch 237/1000
100/100 [==============================] - 0s 34us/step - loss: 0.8313 - acc:
0.6900
Epoch 238/1000
100/100 [==============================] - 0s 62us/step - loss: 0.8301 - acc:
0.7000
Epoch 239/1000
100/100 [==============================] - 0s 42us/step - loss: 0.8289 - acc:
0.7000
Epoch 240/1000
100/100 [==============================] - 0s 137us/step - loss: 0.8277 - ac
c: 0.7000
Epoch 241/1000
100/100 [==============================] - 0s 42us/step - loss: 0.8264 - acc:
0.7000
Epoch 242/1000
100/100 [==============================] - 0s 54us/step - loss: 0.8252 - acc:
0.7000
Epoch 243/1000
100/100 [==============================] - 0s 92us/step - loss: 0.8240 - acc:
0.7000
Epoch 244/1000
100/100 [==============================] - 0s 44us/step - loss: 0.8228 - acc:
0.7000
Epoch 245/1000
100/100 [==============================] - 0s 46us/step - loss: 0.8216 - acc:
0.7000
Epoch 246/1000
100/100 [==============================] - 0s 31us/step - loss: 0.8204 - acc:
0.7000
Epoch 247/1000
100/100 [==============================] - 0s 31us/step - loss: 0.8192 - acc:
0.7000
```

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Epoch 248/1000
100/100 [==============================] - 0s 32us/step - loss: 0.8180 - acc:
0.7000
Epoch 249/1000
100/100 [==============================] - 0s 44us/step - loss: 0.8168 - acc:
0.7100
Epoch 250/1000
100/100 [==============================] - 0s 32us/step - loss: 0.8157 - acc:
0.7100
Epoch 251/1000
100/100 [==============================] - 0s 52us/step - loss: 0.8145 - acc:
0.7100
Epoch 252/1000
100/100 [==============================] - 0s 0us/step - loss: 0.8133 - acc:
0.7100
Epoch 253/1000
100/100 [==============================] - 0s 27us/step - loss: 0.8121 - acc:
0.7100
Epoch 254/1000
100/100 [==============================] - 0s 0us/step - loss: 0.8110 - acc:
0.7100
Epoch 255/1000
100/100 [==============================] - 0s 43us/step - loss: 0.8098 - acc:
0.7200
Epoch 256/1000
100/100 [==============================] - 0s 46us/step - loss: 0.8086 - acc:
0.7200
Epoch 257/1000
100/100 [==============================] - 0s 31us/step - loss: 0.8075 - acc:
0.7200
Epoch 258/1000
100/100 [==============================] - 0s 29us/step - loss: 0.8063 - acc:
0.7200
Epoch 259/1000
100/100 [==============================] - 0s 46us/step - loss: 0.8051 - acc:
0.7200
Epoch 260/1000
100/100 [==============================] - 0s 41us/step - loss: 0.8040 - acc:
0.7200
Epoch 261/1000
100/100 [==============================] - 0s 0us/step - loss: 0.8028 - acc:
0.7200
Epoch 262/1000
100/100 [==============================] - 0s 27us/step - loss: 0.8017 - acc:
0.7200
Epoch 263/1000
100/100 [==============================] - 0s 15us/step - loss: 0.8006 - acc:
0.7200
Epoch 264/1000
100/100 [==============================] - 0s 20us/step - loss: 0.7994 - acc:
0.7200
Epoch 265/1000
100/100 [==============================] - 0s 44us/step - loss: 0.7983 - acc:
0.7200
Epoch 266/1000
100/100 [==============================] - 0s 33us/step - loss: 0.7972 - acc:
0.7200
```

```
Epoch 267/1000
100/100 [==============================] - 0s 40us/step - loss: 0.7960 - acc:
0.7200
Epoch 268/1000
100/100 [==============================] - 0s 32us/step - loss: 0.7949 - acc:
0.7200
Epoch 269/1000
100/100 [==============================] - 0s 47us/step - loss: 0.7938 - acc:
0.7200
Epoch 270/1000
100/100 [==============================] - 0s 41us/step - loss: 0.7927 - acc:
0.7200
Epoch 271/1000
100/100 [==============================] - 0s 0us/step - loss: 0.7915 - acc:
0.7200
Epoch 272/1000
100/100 [==============================] - 0s 40us/step - loss: 0.7904 - acc:
0.7200
Epoch 273/1000
100/100 [==============================] - 0s 0us/step - loss: 0.7893 - acc:
0.7300
Epoch 274/1000
100/100 [==============================] - 0s 0us/step - loss: 0.7882 - acc:
0.7300
Epoch 275/1000
100/100 [==============================] - 0s 26us/step - loss: 0.7871 - acc:
0.7300
Epoch 276/1000
100/100 [==============================] - 0s 41us/step - loss: 0.7860 - acc:
0.7300
Epoch 277/1000
100/100 [==============================] - 0s 24us/step - loss: 0.7849 - acc:
0.7300
Epoch 278/1000
100/100 [==============================] - 0s 42us/step - loss: 0.7838 - acc:
0.7300
Epoch 279/1000
100/100 [==============================] - 0s 0us/step - loss: 0.7827 - acc:
0.7300
Epoch 280/1000
100/100 [==============================] - 0s 27us/step - loss: 0.7816 - acc:
0.7300
Epoch 281/1000
100/100 [==============================] - 0s 38us/step - loss: 0.7805 - acc:
0.7300
Epoch 282/1000
100/100 [==============================] - 0s 10us/step - loss: 0.7794 - acc:
0.7300
Epoch 283/1000
100/100 [==============================] - 0s 31us/step - loss: 0.7784 - acc:
0.7300
Epoch 284/1000
100/100 [==============================] - 0s 25us/step - loss: 0.7773 - acc:
0.7300
Epoch 285/1000
100/100 [==============================] - 0s 29us/step - loss: 0.7762 - acc:
0.7300
```

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Epoch 286/1000
100/100 [==============================] - 0s 34us/step - loss: 0.7751 - acc:
0.7300
Epoch 287/1000
100/100 [==============================] - 0s 25us/step - loss: 0.7741 - acc:
0.7300
Epoch 288/1000
100/100 [==============================] - 0s 58us/step - loss: 0.7730 - acc:
0.7400
Epoch 289/1000
100/100 [==============================] - 0s 39us/step - loss: 0.7719 - acc:
0.7400
Epoch 290/1000
100/100 [==============================] - 0s 10us/step - loss: 0.7709 - acc:
0.7400
Epoch 291/1000
100/100 [==============================] - 0s 27us/step - loss: 0.7698 - acc:
0.7500
Epoch 292/1000
100/100 [==============================] - 0s 35us/step - loss: 0.7688 - acc:
0.7500
Epoch 293/1000
100/100 [==============================] - 0s 43us/step - loss: 0.7677 - acc:
0.7500
Epoch 294/1000
100/100 [==============================] - 0s 42us/step - loss: 0.7667 - acc:
0.7500
Epoch 295/1000
100/100 [==============================] - 0s 49us/step - loss: 0.7656 - acc:
0.7500
Epoch 296/1000
100/100 [==============================] - 0s 34us/step - loss: 0.7646 - acc:
0.7500
Epoch 297/1000
100/100 [==============================] - 0s 21us/step - loss: 0.7635 - acc:
0.7500
Epoch 298/1000
100/100 [==============================] - 0s 20us/step - loss: 0.7625 - acc:
0.7500
Epoch 299/1000
100/100 [==============================] - 0s 36us/step - loss: 0.7614 - acc:
0.7500
Epoch 300/1000
100/100 [==============================] - 0s 20us/step - loss: 0.7604 - acc:
0.7500
Epoch 301/1000
100/100 [==============================] - 0s 24us/step - loss: 0.7594 - acc:
0.7500
Epoch 302/1000
100/100 [==============================] - 0s 10us/step - loss: 0.7584 - acc:
0.7500
Epoch 303/1000
100/100 [==============================] - 0s 55us/step - loss: 0.7573 - acc:
0.7500
Epoch 304/1000
100/100 [==============================] - 0s 13us/step - loss: 0.7563 - acc:
0.7500
```

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Epoch 305/1000
100/100 [==============================] - 0s 20us/step - loss: 0.7553 - acc:
0.7500
Epoch 306/1000
100/100 [==============================] - 0s 24us/step - loss: 0.7543 - acc:
0.7500
Epoch 307/1000
100/100 [==============================] - 0s 34us/step - loss: 0.7533 - acc:
0.7500
Epoch 308/1000
100/100 [==============================] - 0s 30us/step - loss: 0.7522 - acc:
0.7500
Epoch 309/1000
100/100 [==============================] - 0s 31us/step - loss: 0.7512 - acc:
0.7500
Epoch 310/1000
100/100 [==============================] - 0s 20us/step - loss: 0.7502 - acc:
0.7500
Epoch 311/1000
100/100 [==============================] - 0s 50us/step - loss: 0.7492 - acc:
0.7500
Epoch 312/1000
100/100 [==============================] - 0s 82us/step - loss: 0.7482 - acc:
0.7500
Epoch 313/1000
100/100 [==============================] - 0s 29us/step - loss: 0.7472 - acc:
0.7600
Epoch 314/1000
100/100 [==============================] - 0s 28us/step - loss: 0.7462 - acc:
0.7600
Epoch 315/1000
100/100 [==============================] - 0s 48us/step - loss: 0.7452 - acc:
0.7600
Epoch 316/1000
100/100 [==============================] - 0s 50us/step - loss: 0.7442 - acc:
0.7600
Epoch 317/1000
100/100 [==============================] - 0s 20us/step - loss: 0.7432 - acc:
0.7600
Epoch 318/1000
100/100 [==============================] - 0s 42us/step - loss: 0.7423 - acc:
0.7600
Epoch 319/1000
100/100 [==============================] - 0s 41us/step - loss: 0.7413 - acc:
0.7600
Epoch 320/1000
100/100 [==============================] - 0s 30us/step - loss: 0.7403 - acc:
0.7600
Epoch 321/1000
100/100 [==============================] - 0s 20us/step - loss: 0.7393 - acc:
0.7600
Epoch 322/1000
100/100 [==============================] - 0s 32us/step - loss: 0.7383 - acc:
0.7600
Epoch 323/1000
100/100 [==============================] - 0s 20us/step - loss: 0.7374 - acc:
0.7600
```

```
Epoch 324/1000
100/100 [==============================] - 0s 57us/step - loss: 0.7364 - acc:
0.7600
Epoch 325/1000
100/100 [==============================] - 0s 33us/step - loss: 0.7354 - acc:
0.7600
Epoch 326/1000
100/100 [==============================] - 0s 38us/step - loss: 0.7345 - acc:
0.7600
Epoch 327/1000
100/100 [==============================] - 0s 31us/step - loss: 0.7335 - acc:
0.7600
Epoch 328/1000
100/100 [==============================] - 0s 34us/step - loss: 0.7325 - acc:
0.7600
Epoch 329/1000
100/100 [==============================] - 0s 60us/step - loss: 0.7316 - acc:
0.7600
Epoch 330/1000
100/100 [==============================] - 0s 23us/step - loss: 0.7306 - acc:
0.7600
Epoch 331/1000
100/100 [==============================] - 0s 93us/step - loss: 0.7297 - acc:
0.7600
Epoch 332/1000
100/100 [==============================] - 0s 23us/step - loss: 0.7287 - acc:
0.7600
Epoch 333/1000
100/100 [==============================] - 0s 30us/step - loss: 0.7278 - acc:
0.7600
Epoch 334/1000
100/100 [==============================] - 0s 45us/step - loss: 0.7268 - acc:
0.7600
Epoch 335/1000
100/100 [==============================] - 0s 52us/step - loss: 0.7259 - acc:
0.7600
Epoch 336/1000
100/100 [==============================] - 0s 179us/step - loss: 0.7249 - ac
c: 0.7600
Epoch 337/1000
100/100 [==============================] - 0s 54us/step - loss: 0.7240 - acc:
0.7700
Epoch 338/1000
100/100 [==============================] - 0s 64us/step - loss: 0.7230 - acc:
0.7700
Epoch 339/1000
100/100 [==============================] - 0s 73us/step - loss: 0.7221 - acc:
0.7700
Epoch 340/1000
100/100 [==============================] - 0s 53us/step - loss: 0.7212 - acc:
0.7700
Epoch 341/1000
100/100 [==============================] - 0s 70us/step - loss: 0.7202 - acc:
0.7700
Epoch 342/1000
100/100 [==============================] - 0s 77us/step - loss: 0.7193 - acc:
0.7700
```

```
Epoch 343/1000
100/100 [==============================] - 0s 40us/step - loss: 0.7184 - acc:
0.7700
Epoch 344/1000
100/100 [==============================] - 0s 58us/step - loss: 0.7175 - acc:
0.7700
Epoch 345/1000
100/100 [==============================] - 0s 45us/step - loss: 0.7165 - acc:
0.7700
Epoch 346/1000
100/100 [==============================] - 0s 102us/step - loss: 0.7156 - ac
c: 0.7700
Epoch 347/1000
100/100 [==============================] - 0s 48us/step - loss: 0.7147 - acc:
0.7700
Epoch 348/1000
100/100 [==============================] - 0s 40us/step - loss: 0.7138 - acc:
0.7700
Epoch 349/1000
100/100 [==============================] - 0s 37us/step - loss: 0.7129 - acc:
0.7700
Epoch 350/1000
100/100 [==============================] - 0s 123us/step - loss: 0.7120 - ac
c: 0.7700
Epoch 351/1000
100/100 [==============================] - 0s 50us/step - loss: 0.7111 - acc:
0.7700
Epoch 352/1000
100/100 [==============================] - 0s 46us/step - loss: 0.7101 - acc:
0.7700
Epoch 353/1000
100/100 [==============================] - 0s 52us/step - loss: 0.7092 - acc:
0.7700
Epoch 354/1000
100/100 [==============================] - 0s 38us/step - loss: 0.7083 - acc:
0.7700
Epoch 355/1000
100/100 [==============================] - 0s 58us/step - loss: 0.7074 - acc:
0.7700
Epoch 356/1000
100/100 [==============================] - 0s 30us/step - loss: 0.7065 - acc:
0.7800
Epoch 357/1000
100/100 [==============================] - 0s 56us/step - loss: 0.7056 - acc:
0.7800
Epoch 358/1000
100/100 [==============================] - 0s 49us/step - loss: 0.7048 - acc:
0.7800
Epoch 359/1000
100/100 [==============================] - 0s 57us/step - loss: 0.7039 - acc:
0.7800
Epoch 360/1000
100/100 [==============================] - 0s 48us/step - loss: 0.7030 - acc:
0.7800
Epoch 361/1000
100/100 [==============================] - 0s 74us/step - loss: 0.7021 - acc:
0.7800
```

```
Epoch 362/1000
100/100 [==============================] - 0s 56us/step - loss: 0.7012 - acc:
0.7800
Epoch 363/1000
100/100 [==============================] - 0s 53us/step - loss: 0.7003 - acc:
0.7800
Epoch 364/1000
100/100 [==============================] - 0s 59us/step - loss: 0.6994 - acc:
0.7900
Epoch 365/1000
100/100 [==============================] - 0s 70us/step - loss: 0.6986 - acc:
0.7900
Epoch 366/1000
100/100 [==============================] - 0s 47us/step - loss: 0.6977 - acc:
0.7900
Epoch 367/1000
100/100 [==============================] - 0s 41us/step - loss: 0.6968 - acc:
0.7900
Epoch 368/1000
100/100 [==============================] - 0s 49us/step - loss: 0.6959 - acc:
0.7900
Epoch 369/1000
100/100 [==============================] - 0s 61us/step - loss: 0.6951 - acc:
0.7900
Epoch 370/1000
100/100 [==============================] - 0s 44us/step - loss: 0.6942 - acc:
0.7900
Epoch 371/1000
100/100 [==============================] - 0s 33us/step - loss: 0.6933 - acc:
0.7900
Epoch 372/1000
100/100 [==============================] - 0s 26us/step - loss: 0.6925 - acc:
0.7900
Epoch 373/1000
100/100 [==============================] - 0s 44us/step - loss: 0.6916 - acc:
0.7900
Epoch 374/1000
100/100 [==============================] - 0s 48us/step - loss: 0.6908 - acc:
0.7900
Epoch 375/1000
100/100 [==============================] - 0s 57us/step - loss: 0.6899 - acc:
0.7900
Epoch 376/1000
100/100 [==============================] - 0s 60us/step - loss: 0.6890 - acc:
0.7900
Epoch 377/1000
100/100 [==============================] - 0s 15us/step - loss: 0.6882 - acc:
0.7900
Epoch 378/1000
100/100 [==============================] - 0s 27us/step - loss: 0.6873 - acc:
0.7900
Epoch 379/1000
100/100 [==============================] - 0s 20us/step - loss: 0.6865 - acc:
0.7900
Epoch 380/1000
100/100 [==============================] - 0s 16us/step - loss: 0.6856 - acc:
0.7900
```

```
Epoch 381/1000
100/100 [==============================] - 0s 28us/step - loss: 0.6848 - acc:
0.7900
Epoch 382/1000
100/100 [==============================] - 0s 19us/step - loss: 0.6840 - acc:
0.7900
Epoch 383/1000
100/100 [==============================] - 0s 34us/step - loss: 0.6831 - acc:
0.7900
Epoch 384/1000
100/100 [==============================] - 0s 19us/step - loss: 0.6823 - acc:
0.7900
Epoch 385/1000
100/100 [==============================] - 0s 20us/step - loss: 0.6814 - acc:
0.7900
Epoch 386/1000
100/100 [==============================] - 0s 20us/step - loss: 0.6806 - acc:
0.7900
Epoch 387/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6798 - acc:
0.7900
Epoch 388/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6789 - acc:
0.7900
Epoch 389/1000
100/100 [==============================] - 0s 33us/step - loss: 0.6781 - acc:
0.8000
Epoch 390/1000
100/100 [==============================] - 0s 39us/step - loss: 0.6773 - acc:
0.8000
Epoch 391/1000
100/100 [==============================] - 0s 33us/step - loss: 0.6765 - acc:
0.8000
Epoch 392/1000
100/100 [==============================] - 0s 38us/step - loss: 0.6756 - acc:
0.8000
Epoch 393/1000
100/100 [==============================] - 0s 29us/step - loss: 0.6748 - acc:
0.8000
Epoch 394/1000
100/100 [==============================] - 0s 39us/step - loss: 0.6740 - acc:
0.8000
Epoch 395/1000
100/100 [==============================] - 0s 33us/step - loss: 0.6732 - acc:
0.8000
Epoch 396/1000
100/100 [==============================] - 0s 40us/step - loss: 0.6724 - acc:
0.8000
Epoch 397/1000
100/100 [==============================] - 0s 47us/step - loss: 0.6715 - acc:
0.8000
Epoch 398/1000
100/100 [==============================] - 0s 49us/step - loss: 0.6707 - acc:
0.8000
Epoch 399/1000
100/100 [==============================] - 0s 35us/step - loss: 0.6699 - acc:
0.8000
```

```
Epoch 400/1000
100/100 [==============================] - 0s 47us/step - loss: 0.6691 - acc:
0.8000
Epoch 401/1000
100/100 [==============================] - 0s 20us/step - loss: 0.6683 - acc:
0.8000
Epoch 402/1000
100/100 [==============================] - 0s 40us/step - loss: 0.6675 - acc:
0.8000
Epoch 403/1000
100/100 [==============================] - 0s 49us/step - loss: 0.6667 - acc:
0.8000
Epoch 404/1000
100/100 [==============================] - 0s 65us/step - loss: 0.6659 - acc:
0.8000
Epoch 405/1000
100/100 [==============================] - 0s 63us/step - loss: 0.6651 - acc:
0.8000
Epoch 406/1000
100/100 [==============================] - 0s 53us/step - loss: 0.6643 - acc:
0.8000
Epoch 407/1000
100/100 [==============================] - 0s 42us/step - loss: 0.6635 - acc:
0.8000
Epoch 408/1000
100/100 [==============================] - 0s 44us/step - loss: 0.6627 - acc:
0.8000
Epoch 409/1000
100/100 [==============================] - 0s 94us/step - loss: 0.6619 - acc:
0.8000
Epoch 410/1000
100/100 [==============================] - 0s 50us/step - loss: 0.6611 - acc:
0.8000
Epoch 411/1000
100/100 [==============================] - 0s 49us/step - loss: 0.6603 - acc:
0.8000
Epoch 412/1000
100/100 [==============================] - 0s 88us/step - loss: 0.6596 - acc:
0.8000
Epoch 413/1000
100/100 [==============================] - 0s 36us/step - loss: 0.6588 - acc:
0.8000
Epoch 414/1000
100/100 [==============================] - 0s 35us/step - loss: 0.6580 - acc:
0.8000
Epoch 415/1000
100/100 [==============================] - 0s 49us/step - loss: 0.6572 - acc:
0.8000
Epoch 416/1000
100/100 [==============================] - 0s 41us/step - loss: 0.6564 - acc:
0.8000
Epoch 417/1000
100/100 [==============================] - 0s 34us/step - loss: 0.6557 - acc:
0.8000
Epoch 418/1000
100/100 [==============================] - 0s 41us/step - loss: 0.6549 - acc:
0.8000
```

```
Epoch 419/1000
100/100 [==============================] - 0s 72us/step - loss: 0.6541 - acc:
0.8000
Epoch 420/1000
100/100 [==============================] - 0s 50us/step - loss: 0.6533 - acc:
0.8000
Epoch 421/1000
100/100 [==============================] - 0s 40us/step - loss: 0.6526 - acc:
0.8000
Epoch 422/1000
100/100 [==============================] - 0s 58us/step - loss: 0.6518 - acc:
0.8000
Epoch 423/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6510 - acc:
0.8000
Epoch 424/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6503 - acc:
0.8000
Epoch 425/1000
100/100 [==============================] - 0s 10us/step - loss: 0.6495 - acc:
0.8000
Epoch 426/1000
100/100 [==============================] - 0s 24us/step - loss: 0.6487 - acc:
0.8000
Epoch 427/1000
100/100 [==============================] - 0s 37us/step - loss: 0.6480 - acc:
0.8000
Epoch 428/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6472 - acc:
0.8000
Epoch 429/1000
100/100 [==============================] - 0s 10us/step - loss: 0.6465 - acc:
0.8100
Epoch 430/1000
100/100 [==============================] - 0s 10us/step - loss: 0.6457 - acc:
0.8100
Epoch 431/1000
100/100 [==============================] - 0s 157us/step - loss: 0.6450 - ac
c: 0.8100
Epoch 432/1000
100/100 [==============================] - 0s 85us/step - loss: 0.6442 - acc:
0.8100
Epoch 433/1000
100/100 [==============================] - 0s 81us/step - loss: 0.6435 - acc:
0.8100
Epoch 434/1000
100/100 [==============================] - 0s 79us/step - loss: 0.6427 - acc:
0.8100
Epoch 435/1000
100/100 [==============================] - 0s 84us/step - loss: 0.6420 - acc:
0.8100
Epoch 436/1000
100/100 [==============================] - 0s 64us/step - loss: 0.6412 - acc:
0.8100
Epoch 437/1000
100/100 [==============================] - 0s 57us/step - loss: 0.6405 - acc:
0.8100
```

```
Epoch 438/1000
100/100 [==============================] - 0s 60us/step - loss: 0.6397 - acc:
0.8100
Epoch 439/1000
100/100 [==============================] - 0s 31us/step - loss: 0.6390 - acc:
0.8100
Epoch 440/1000
100/100 [==============================] - 0s 65us/step - loss: 0.6383 - acc:
0.8100
Epoch 441/1000
100/100 [==============================] - 0s 56us/step - loss: 0.6375 - acc:
0.8100
Epoch 442/1000
100/100 [==============================] - 0s 54us/step - loss: 0.6368 - acc:
0.8100
Epoch 443/1000
100/100 [==============================] - 0s 25us/step - loss: 0.6361 - acc:
0.8100
Epoch 444/1000
100/100 [==============================] - 0s 16us/step - loss: 0.6353 - acc:
0.8100
Epoch 445/1000
100/100 [==============================] - 0s 41us/step - loss: 0.6346 - acc:
0.8100
Epoch 446/1000
100/100 [==============================] - 0s 56us/step - loss: 0.6339 - acc:
0.8100
Epoch 447/1000
100/100 [==============================] - 0s 33us/step - loss: 0.6332 - acc:
0.8100
Epoch 448/1000
100/100 [==============================] - 0s 33us/step - loss: 0.6324 - acc:
0.8100
Epoch 449/1000
100/100 [==============================] - 0s 54us/step - loss: 0.6317 - acc:
0.8100
Epoch 450/1000
100/100 [==============================] - 0s 41us/step - loss: 0.6310 - acc:
0.8100
Epoch 451/1000
100/100 [==============================] - 0s 10us/step - loss: 0.6303 - acc:
0.8100
Epoch 452/1000
100/100 [==============================] - 0s 55us/step - loss: 0.6295 - acc:
0.8100
Epoch 453/1000
100/100 [==============================] - 0s 47us/step - loss: 0.6288 - acc:
0.8100
Epoch 454/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6281 - acc:
0.8100
Epoch 455/1000
100/100 [==============================] - 0s 35us/step - loss: 0.6274 - acc:
0.8200
Epoch 456/1000
100/100 [==============================] - 0s 33us/step - loss: 0.6267 - acc:
0.8200
```

```
Epoch 457/1000
100/100 [==============================] - 0s 37us/step - loss: 0.6260 - acc:
0.8200
Epoch 458/1000
100/100 [==============================] - 0s 36us/step - loss: 0.6253 - acc:
0.8200
Epoch 459/1000
100/100 [==============================] - 0s 10us/step - loss: 0.6246 - acc:
0.8200
Epoch 460/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6239 - acc:
0.8200
Epoch 461/1000
100/100 [==============================] - 0s 20us/step - loss: 0.6232 - acc:
0.8200
Epoch 462/1000
100/100 [==============================] - 0s 24us/step - loss: 0.6225 - acc:
0.8200
Epoch 463/1000
100/100 [==============================] - 0s 23us/step - loss: 0.6218 - acc:
0.8200
Epoch 464/1000
100/100 [==============================] - 0s 31us/step - loss: 0.6211 - acc:
0.8200
Epoch 465/1000
100/100 [==============================] - 0s 10us/step - loss: 0.6204 - acc:
0.8200
Epoch 466/1000
100/100 [==============================] - 0s 41us/step - loss: 0.6197 - acc:
0.8200
Epoch 467/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6190 - acc:
0.8200
Epoch 468/1000
100/100 [==============================] - 0s 20us/step - loss: 0.6183 - acc:
0.8200
Epoch 469/1000
100/100 [==============================] - 0s 28us/step - loss: 0.6176 - acc:
0.8200
Epoch 470/1000
100/100 [==============================] - 0s 26us/step - loss: 0.6169 - acc:
0.8200
Epoch 471/1000
100/100 [==============================] - 0s 36us/step - loss: 0.6162 - acc:
0.8200
Epoch 472/1000
100/100 [==============================] - 0s 36us/step - loss: 0.6155 - acc:
0.8200
Epoch 473/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6148 - acc:
0.8200
Epoch 474/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6141 - acc:
0.8200
Epoch 475/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6135 - acc:
0.8200
```

```
Epoch 476/1000
100/100 [==============================] - 0s 34us/step - loss: 0.6128 - acc:
0.8200
Epoch 477/1000
100/100 [==============================] - 0s 30us/step - loss: 0.6121 - acc:
0.8200
Epoch 478/1000
100/100 [==============================] - 0s 34us/step - loss: 0.6114 - acc:
0.8200
Epoch 479/1000
100/100 [==============================] - 0s 43us/step - loss: 0.6108 - acc:
0.8200
Epoch 480/1000
100/100 [==============================] - 0s 0us/step - loss: 0.6101 - acc:
0.8200
Epoch 481/1000
100/100 [==============================] - 0s 32us/step - loss: 0.6094 - acc:
0.8200
Epoch 482/1000
100/100 [==============================] - 0s 44us/step - loss: 0.6087 - acc:
0.8200
Epoch 483/1000
100/100 [==============================] - 0s 40us/step - loss: 0.6081 - acc:
0.8200
Epoch 484/1000
100/100 [==============================] - 0s 37us/step - loss: 0.6074 - acc:
0.8300
Epoch 485/1000
100/100 [==============================] - 0s 78us/step - loss: 0.6067 - acc:
0.8300
Epoch 486/1000
100/100 [==============================] - 0s 39us/step - loss: 0.6061 - acc:
0.8300
Epoch 487/1000
100/100 [==============================] - 0s 34us/step - loss: 0.6054 - acc:
0.8300
Epoch 488/1000
100/100 [==============================] - 0s 38us/step - loss: 0.6047 - acc:
0.8300
Epoch 489/1000
100/100 [==============================] - 0s 45us/step - loss: 0.6041 - acc:
0.8300
Epoch 490/1000
100/100 [==============================] - 0s 31us/step - loss: 0.6034 - acc:
0.8300
Epoch 491/1000
100/100 [==============================] - 0s 68us/step - loss: 0.6028 - acc:
0.8300
Epoch 492/1000
100/100 [==============================] - 0s 42us/step - loss: 0.6021 - acc:
0.8300
Epoch 493/1000
100/100 [==============================] - 0s 79us/step - loss: 0.6014 - acc:
0.8300
Epoch 494/1000
100/100 [==============================] - 0s 47us/step - loss: 0.6008 - acc:
0.8300
```

```
Epoch 495/1000
100/100 [==============================] - 0s 51us/step - loss: 0.6001 - acc:
0.8300
Epoch 496/1000
100/100 [==============================] - 0s 53us/step - loss: 0.5995 - acc:
0.8300
Epoch 497/1000
100/100 [==============================] - 0s 192us/step - loss: 0.5988 - ac
c: 0.8300
Epoch 498/1000
100/100 [==============================] - 0s 46us/step - loss: 0.5982 - acc:
0.8300
Epoch 499/1000
100/100 [==============================] - 0s 48us/step - loss: 0.5975 - acc:
0.8300
Epoch 500/1000
100/100 [==============================] - 0s 32us/step - loss: 0.5969 - acc:
0.8300
Epoch 501/1000
100/100 [==============================] - 0s 53us/step - loss: 0.5962 - acc:
0.8300
Epoch 502/1000
100/100 [==============================] - 0s 42us/step - loss: 0.5956 - acc:
0.8300
Epoch 503/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5950 - acc:
0.8300
Epoch 504/1000
100/100 [==============================] - 0s 42us/step - loss: 0.5943 - acc:
0.8300
Epoch 505/1000
100/100 [==============================] - 0s 39us/step - loss: 0.5937 - acc:
0.8300
Epoch 506/1000
100/100 [==============================] - 0s 42us/step - loss: 0.5930 - acc:
0.8300
Epoch 507/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5924 - acc:
0.8300
Epoch 508/1000
100/100 [==============================] - 0s 34us/step - loss: 0.5918 - acc:
0.8300
Epoch 509/1000
100/100 [==============================] - 0s 51us/step - loss: 0.5911 - acc:
0.8300
Epoch 510/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5905 - acc:
0.8300
Epoch 511/1000
100/100 [==============================] - 0s 29us/step - loss: 0.5899 - acc:
0.8300
Epoch 512/1000
100/100 [==============================] - 0s 37us/step - loss: 0.5892 - acc:
0.8300
Epoch 513/1000
100/100 [==============================] - 0s 121us/step - loss: 0.5886 - ac
c: 0.8300
```

```
Epoch 514/1000
100/100 [==============================] - 0s 54us/step - loss: 0.5880 - acc:
0.8300
Epoch 515/1000
100/100 [==============================] - 0s 54us/step - loss: 0.5874 - acc:
0.8300
Epoch 516/1000
100/100 [==============================] - 0s 39us/step - loss: 0.5867 - acc:
0.8300
Epoch 517/1000
100/100 [==============================] - 0s 55us/step - loss: 0.5861 - acc:
0.8300
Epoch 518/1000
100/100 [==============================] - 0s 33us/step - loss: 0.5855 - acc:
0.8300
Epoch 519/1000
100/100 [==============================] - 0s 33us/step - loss: 0.5849 - acc:
0.8300
Epoch 520/1000
100/100 [==============================] - 0s 42us/step - loss: 0.5842 - acc:
0.8300
Epoch 521/1000
100/100 [==============================] - 0s 51us/step - loss: 0.5836 - acc:
0.8300
Epoch 522/1000
100/100 [==============================] - 0s 50us/step - loss: 0.5830 - acc:
0.8300
Epoch 523/1000
100/100 [==============================] - 0s 37us/step - loss: 0.5824 - acc:
0.8300
Epoch 524/1000
100/100 [==============================] - 0s 39us/step - loss: 0.5818 - acc:
0.8300
Epoch 525/1000
100/100 [==============================] - 0s 46us/step - loss: 0.5812 - acc:
0.8300
Epoch 526/1000
100/100 [==============================] - 0s 44us/step - loss: 0.5806 - acc:
0.8300
Epoch 527/1000
100/100 [==============================] - 0s 50us/step - loss: 0.5799 - acc:
0.8300
Epoch 528/1000
100/100 [==============================] - 0s 85us/step - loss: 0.5793 - acc:
0.8300
Epoch 529/1000
100/100 [==============================] - 0s 72us/step - loss: 0.5787 - acc:
0.8300
Epoch 530/1000
100/100 [==============================] - 0s 34us/step - loss: 0.5781 - acc:
0.8300
Epoch 531/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5775 - acc:
0.8300
Epoch 532/1000
100/100 [==============================] - 0s 56us/step - loss: 0.5769 - acc:
0.8300
```

```
Epoch 533/1000
100/100 [==============================] - 0s 33us/step - loss: 0.5763 - acc:
0.8300
Epoch 534/1000
100/100 [==============================] - 0s 50us/step - loss: 0.5757 - acc:
0.8300
Epoch 535/1000
100/100 [==============================] - 0s 35us/step - loss: 0.5751 - acc:
0.8300
Epoch 536/1000
100/100 [==============================] - 0s 145us/step - loss: 0.5745 - ac
c: 0.8300
Epoch 537/1000
100/100 [==============================] - 0s 49us/step - loss: 0.5739 - acc:
0.8300
Epoch 538/1000
100/100 [==============================] - 0s 49us/step - loss: 0.5733 - acc:
0.8300
Epoch 539/1000
100/100 [==============================] - 0s 42us/step - loss: 0.5727 - acc:
0.8300
Epoch 540/1000
100/100 [==============================] - 0s 60us/step - loss: 0.5721 - acc:
0.8300
Epoch 541/1000
100/100 [==============================] - 0s 53us/step - loss: 0.5715 - acc:
0.8300
Epoch 542/1000
100/100 [==============================] - 0s 25us/step - loss: 0.5710 - acc:
0.8300
Epoch 543/1000
100/100 [==============================] - 0s 63us/step - loss: 0.5704 - acc:
0.8300
Epoch 544/1000
100/100 [==============================] - 0s 44us/step - loss: 0.5698 - acc:
0.8300
Epoch 545/1000
100/100 [==============================] - 0s 49us/step - loss: 0.5692 - acc:
0.8300
Epoch 546/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5686 - acc:
0.8300
Epoch 547/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5680 - acc:
0.8300
Epoch 548/1000
100/100 [==============================] - 0s 31us/step - loss: 0.5674 - acc:
0.8400
Epoch 549/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5668 - acc:
0.8400
Epoch 550/1000
100/100 [==============================] - 0s 60us/step - loss: 0.5663 - acc:
0.8400
Epoch 551/1000
100/100 [==============================] - 0s 35us/step - loss: 0.5657 - acc:
0.8400
```

```
Epoch 552/1000
100/100 [==============================] - 0s 49us/step - loss: 0.5651 - acc:
0.8400
Epoch 553/1000
100/100 [==============================] - 0s 54us/step - loss: 0.5645 - acc:
0.8400
Epoch 554/1000
100/100 [==============================] - 0s 10us/step - loss: 0.5640 - acc:
0.8400
Epoch 555/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5634 - acc:
0.8400
Epoch 556/1000
100/100 [==============================] - 0s 31us/step - loss: 0.5628 - acc:
0.8400
Epoch 557/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5622 - acc:
0.8400
Epoch 558/1000
100/100 [==============================] - 0s 37us/step - loss: 0.5617 - acc:
0.8400
Epoch 559/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5611 - acc:
0.8400
Epoch 560/1000
100/100 [==============================] - 0s 48us/step - loss: 0.5605 - acc:
0.8400
Epoch 561/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5599 - acc:
0.8400
Epoch 562/1000
100/100 [==============================] - 0s 66us/step - loss: 0.5594 - acc:
0.8400
Epoch 563/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5588 - acc:
0.8400
Epoch 564/1000
100/100 [==============================] - 0s 45us/step - loss: 0.5583 - acc:
0.8400
Epoch 565/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5577 - acc:
0.8400
Epoch 566/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5571 - acc:
0.8400
Epoch 567/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5566 - acc:
0.8400
Epoch 568/1000
100/100 [==============================] - 0s 36us/step - loss: 0.5560 - acc:
0.8400
Epoch 569/1000
100/100 [==============================] - 0s 39us/step - loss: 0.5554 - acc:
0.8400
Epoch 570/1000
100/100 [==============================] - 0s 12us/step - loss: 0.5549 - acc:
0.8400
```

```
Epoch 571/1000
100/100 [==============================] - 0s 24us/step - loss: 0.5543 - acc:
0.8400
Epoch 572/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5538 - acc:
0.8400
Epoch 573/1000
100/100 [==============================] - 0s 42us/step - loss: 0.5532 - acc:
0.8400
Epoch 574/1000
100/100 [==============================] - 0s 29us/step - loss: 0.5527 - acc:
0.8400
Epoch 575/1000
100/100 [==============================] - 0s 41us/step - loss: 0.5521 - acc:
0.8400
Epoch 576/1000
100/100 [==============================] - 0s 29us/step - loss: 0.5516 - acc:
0.8400
Epoch 577/1000
100/100 [==============================] - 0s 49us/step - loss: 0.5510 - acc:
0.8400
Epoch 578/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5505 - acc:
0.8400
Epoch 579/1000
100/100 [==============================] - 0s 32us/step - loss: 0.5499 - acc:
0.8400
Epoch 580/1000
100/100 [==============================] - 0s 33us/step - loss: 0.5494 - acc:
0.8400
Epoch 581/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5488 - acc:
0.8400
Epoch 582/1000
100/100 [==============================] - 0s 10us/step - loss: 0.5483 - acc:
0.8400
Epoch 583/1000
100/100 [==============================] - 0s 42us/step - loss: 0.5477 - acc:
0.8400
Epoch 584/1000
100/100 [==============================] - 0s 31us/step - loss: 0.5472 - acc:
0.8400
Epoch 585/1000
100/100 [==============================] - 0s 22us/step - loss: 0.5467 - acc:
0.8400
Epoch 586/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5461 - acc:
0.8400
Epoch 587/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5456 - acc:
0.8400
Epoch 588/1000
100/100 [==============================] - 0s 10us/step - loss: 0.5450 - acc:
0.8400
Epoch 589/1000
100/100 [==============================] - 0s 57us/step - loss: 0.5445 - acc:
0.8400
```

```
Epoch 590/1000
100/100 [==============================] - 0s 34us/step - loss: 0.5440 - acc:
0.8400
Epoch 591/1000
100/100 [==============================] - 0s 0us/step - loss: 0.5434 - acc:
0.8400
Epoch 592/1000
100/100 [==============================] - 0s 10us/step - loss: 0.5429 - acc:
0.8400
Epoch 593/1000
100/100 [==============================] - 0s 39us/step - loss: 0.5424 - acc:
0.8400
Epoch 594/1000
100/100 [==============================] - 0s 81us/step - loss: 0.5418 - acc:
0.8500
Epoch 595/1000
100/100 [==============================] - 0s 44us/step - loss: 0.5413 - acc:
0.8500
Epoch 596/1000
100/100 [==============================] - 0s 37us/step - loss: 0.5408 - acc:
0.8500
Epoch 597/1000
100/100 [==============================] - 0s 0us/step - loss: 0.5403 - acc:
0.8500
Epoch 598/1000
100/100 [==============================] - 0s 38us/step - loss: 0.5397 - acc:
0.8500
Epoch 599/1000
100/100 [==============================] - 0s 49us/step - loss: 0.5392 - acc:
0.8600
Epoch 600/1000
100/100 [==============================] - 0s 10us/step - loss: 0.5387 - acc:
0.8600
Epoch 601/1000
100/100 [==============================] - 0s 66us/step - loss: 0.5381 - acc:
0.8600
Epoch 602/1000
100/100 [==============================] - 0s 54us/step - loss: 0.5376 - acc:
0.8600
Epoch 603/1000
100/100 [==============================] - 0s 10us/step - loss: 0.5371 - acc:
0.8600
Epoch 604/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5366 - acc:
0.8600
Epoch 605/1000
100/100 [==============================] - 0s 53us/step - loss: 0.5361 - acc:
0.8600
Epoch 606/1000
100/100 [==============================] - 0s 57us/step - loss: 0.5355 - acc:
0.8600
Epoch 607/1000
100/100 [==============================] - 0s 18us/step - loss: 0.5350 - acc:
0.8600
Epoch 608/1000
100/100 [==============================] - 0s 38us/step - loss: 0.5345 - acc:
0.8600
```

```
Epoch 609/1000
100/100 [==============================] - 0s 10us/step - loss: 0.5340 - acc:
0.8600
Epoch 610/1000
100/100 [==============================] - 0s 41us/step - loss: 0.5335 - acc:
0.8600
Epoch 611/1000
100/100 [==============================] - 0s 27us/step - loss: 0.5330 - acc:
0.8600
Epoch 612/1000
100/100 [==============================] - 0s 41us/step - loss: 0.5325 - acc:
0.8600
Epoch 613/1000
100/100 [==============================] - 0s 25us/step - loss: 0.5319 - acc:
0.8600
Epoch 614/1000
100/100 [==============================] - 0s 20us/step - loss: 0.5314 - acc:
0.8600
Epoch 615/1000
100/100 [==============================] - 0s 63us/step - loss: 0.5309 - acc:
0.8600
Epoch 616/1000
100/100 [==============================] - 0s 25us/step - loss: 0.5304 - acc:
0.8600
Epoch 617/1000
100/100 [==============================] - 0s 38us/step - loss: 0.5299 - acc:
0.8600
Epoch 618/1000
100/100 [==============================] - 0s 33us/step - loss: 0.5294 - acc:
0.8700
Epoch 619/1000
100/100 [==============================] - 0s 49us/step - loss: 0.5289 - acc:
0.8700
Epoch 620/1000
100/100 [==============================] - 0s 41us/step - loss: 0.5284 - acc:
0.8800
Epoch 621/1000
100/100 [==============================] - 0s 50us/step - loss: 0.5279 - acc:
0.8800
Epoch 622/1000
100/100 [==============================] - 0s 10us/step - loss: 0.5274 - acc:
0.8800
Epoch 623/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5269 - acc:
0.8900
Epoch 624/1000
100/100 [==============================] - 0s 81us/step - loss: 0.5264 - acc:
0.8900
Epoch 625/1000
100/100 [==============================] - 0s 45us/step - loss: 0.5259 - acc:
0.8900
Epoch 626/1000
100/100 [==============================] - 0s 49us/step - loss: 0.5254 - acc:
0.8900
Epoch 627/1000
100/100 [==============================] - 0s 19us/step - loss: 0.5249 - acc:
0.8900
```

```
Epoch 628/1000
100/100 [==============================] - 0s 20us/step - loss: 0.5244 - acc:
0.8900
Epoch 629/1000
100/100 [==============================] - 0s 21us/step - loss: 0.5239 - acc:
0.8900
Epoch 630/1000
100/100 [==============================] - 0s 20us/step - loss: 0.5234 - acc:
0.9000
Epoch 631/1000
100/100 [==============================] - 0s 23us/step - loss: 0.5229 - acc:
0.9000
Epoch 632/1000
100/100 [==============================] - 0s 35us/step - loss: 0.5224 - acc:
0.9000
Epoch 633/1000
100/100 [==============================] - 0s 38us/step - loss: 0.5219 - acc:
0.9000
Epoch 634/1000
100/100 [==============================] - 0s 20us/step - loss: 0.5214 - acc:
0.9000
Epoch 635/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5210 - acc:
0.9000
Epoch 636/1000
100/100 [==============================] - 0s 26us/step - loss: 0.5205 - acc:
0.9000
Epoch 637/1000
100/100 [==============================] - 0s 21us/step - loss: 0.5200 - acc:
0.9000
Epoch 638/1000
100/100 [==============================] - 0s 20us/step - loss: 0.5195 - acc:
0.9000
Epoch 639/1000
100/100 [==============================] - 0s 19us/step - loss: 0.5190 - acc:
0.9000
Epoch 640/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5185 - acc:
0.9000
Epoch 641/1000
100/100 [==============================] - 0s 31us/step - loss: 0.5180 - acc:
0.9000
Epoch 642/1000
100/100 [==============================] - 0s 28us/step - loss: 0.5176 - acc:
0.9000
Epoch 643/1000
100/100 [==============================] - 0s 28us/step - loss: 0.5171 - acc:
0.9000
Epoch 644/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5166 - acc:
0.9000
Epoch 645/1000
100/100 [==============================] - 0s 31us/step - loss: 0.5161 - acc:
0.9000
Epoch 646/1000
100/100 [==============================] - 0s 20us/step - loss: 0.5156 - acc:
0.9000
```

```
Epoch 647/1000
100/100 [==============================] - 0s 32us/step - loss: 0.5152 - acc:
0.9100
Epoch 648/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5147 - acc:
0.9100
Epoch 649/1000
100/100 [==============================] - 0s 34us/step - loss: 0.5142 - acc:
0.9100
Epoch 650/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5137 - acc:
0.9100
Epoch 651/1000
100/100 [==============================] - 0s 44us/step - loss: 0.5133 - acc:
0.9100
Epoch 652/1000
100/100 [==============================] - 0s 26us/step - loss: 0.5128 - acc:
0.9100
Epoch 653/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5123 - acc:
0.9100
Epoch 654/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5118 - acc:
0.9100
Epoch 655/1000
100/100 [==============================] - 0s 31us/step - loss: 0.5114 - acc:
0.9100
Epoch 656/1000
100/100 [==============================] - 0s 59us/step - loss: 0.5109 - acc:
0.9100
Epoch 657/1000
100/100 [==============================] - 0s 25us/step - loss: 0.5104 - acc:
0.9100
Epoch 658/1000
100/100 [==============================] - 0s 103us/step - loss: 0.5100 - ac
c: 0.9100
Epoch 659/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5095 - acc:
0.9100
Epoch 660/1000
100/100 [==============================] - 0s 30us/step - loss: 0.5090 - acc:
0.9100
Epoch 661/1000
100/100 [==============================] - 0s 40us/step - loss: 0.5086 - acc:
0.9100
Epoch 662/1000
100/100 [==============================] - 0s 42us/step - loss: 0.5081 - acc:
0.9100
Epoch 663/1000
100/100 [==============================] - 0s 41us/step - loss: 0.5076 - acc:
0.9100
Epoch 664/1000
100/100 [==============================] - 0s 21us/step - loss: 0.5072 - acc:
0.9100
Epoch 665/1000
100/100 [==============================] - 0s 32us/step - loss: 0.5067 - acc:
0.9100
```

```
Epoch 666/1000
100/100 [==============================] - 0s 57us/step - loss: 0.5063 - acc:
0.9100
Epoch 667/1000
100/100 [==============================] - 0s 27us/step - loss: 0.5058 - acc:
0.9100
Epoch 668/1000
100/100 [==============================] - 0s 31us/step - loss: 0.5053 - acc:
0.9100
Epoch 669/1000
100/100 [==============================] - 0s 43us/step - loss: 0.5049 - acc:
0.9100
Epoch 670/1000
100/100 [==============================] - 0s 34us/step - loss: 0.5044 - acc:
0.9100
Epoch 671/1000
100/100 [==============================] - 0s 39us/step - loss: 0.5040 - acc:
0.9100
Epoch 672/1000
100/100 [==============================] - 0s 38us/step - loss: 0.5035 - acc:
0.9100
Epoch 673/1000
100/100 [==============================] - 0s 70us/step - loss: 0.5031 - acc:
0.9100
Epoch 674/1000
100/100 [==============================] - 0s 38us/step - loss: 0.5026 - acc:
0.9100
Epoch 675/1000
100/100 [==============================] - 0s 52us/step - loss: 0.5021 - acc:
0.9100
Epoch 676/1000
100/100 [==============================] - 0s 34us/step - loss: 0.5017 - acc:
0.9100
Epoch 677/1000
100/100 [==============================] - 0s 51us/step - loss: 0.5012 - acc:
0.9100
Epoch 678/1000
100/100 [==============================] - 0s 50us/step - loss: 0.5008 - acc:
0.9100
Epoch 679/1000
100/100 [==============================] - 0s 41us/step - loss: 0.5003 - acc:
0.9100
Epoch 680/1000
100/100 [==============================] - 0s 54us/step - loss: 0.4999 - acc:
0.9100
Epoch 681/1000
100/100 [==============================] - 0s 49us/step - loss: 0.4994 - acc:
0.9100
Epoch 682/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4990 - acc:
0.9100
Epoch 683/1000
100/100 [==============================] - 0s 36us/step - loss: 0.4986 - acc:
0.9100
Epoch 684/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4981 - acc:
0.9100
```

```
Epoch 685/1000
100/100 [==============================] - 0s 66us/step - loss: 0.4977 - acc:
0.9100
Epoch 686/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4972 - acc:
0.9100
Epoch 687/1000
100/100 [==============================] - 0s 35us/step - loss: 0.4968 - acc:
0.9100
Epoch 688/1000
100/100 [==============================] - 0s 82us/step - loss: 0.4963 - acc:
0.9100
Epoch 689/1000
100/100 [==============================] - 0s 58us/step - loss: 0.4959 - acc:
0.9100
Epoch 690/1000
100/100 [==============================] - 0s 21us/step - loss: 0.4955 - acc:
0.9100
Epoch 691/1000
100/100 [==============================] - 0s 72us/step - loss: 0.4950 - acc:
0.9100
Epoch 692/1000
100/100 [==============================] - 0s 32us/step - loss: 0.4946 - acc:
0.9100
Epoch 693/1000
100/100 [==============================] - 0s 35us/step - loss: 0.4941 - acc:
0.9100
Epoch 694/1000
100/100 [==============================] - 0s 47us/step - loss: 0.4937 - acc:
0.9100
Epoch 695/1000
100/100 [==============================] - 0s 57us/step - loss: 0.4933 - acc:
0.9100
Epoch 696/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4928 - acc:
0.9100
Epoch 697/1000
100/100 [==============================] - 0s 39us/step - loss: 0.4924 - acc:
0.9100
Epoch 698/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4920 - acc:
0.9100
Epoch 699/1000
100/100 [==============================] - 0s 47us/step - loss: 0.4915 - acc:
0.9100
Epoch 700/1000
100/100 [==============================] - 0s 75us/step - loss: 0.4911 - acc:
0.9100
Epoch 701/1000
100/100 [==============================] - 0s 58us/step - loss: 0.4907 - acc:
0.9100
Epoch 702/1000
100/100 [==============================] - 0s 34us/step - loss: 0.4903 - acc:
0.9100
Epoch 703/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4898 - acc:
0.9100
```

```
Epoch 704/1000
100/100 [==============================] - 0s 59us/step - loss: 0.4894 - acc:
0.9100
Epoch 705/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4890 - acc:
0.9100
Epoch 706/1000
100/100 [==============================] - 0s 76us/step - loss: 0.4885 - acc:
0.9100
Epoch 707/1000
100/100 [==============================] - 0s 35us/step - loss: 0.4881 - acc:
0.9100
Epoch 708/1000
100/100 [==============================] - 0s 26us/step - loss: 0.4877 - acc:
0.9100
Epoch 709/1000
100/100 [==============================] - 0s 59us/step - loss: 0.4873 - acc:
0.9100
Epoch 710/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4868 - acc:
0.9100
Epoch 711/1000
100/100 [==============================] - 0s 32us/step - loss: 0.4864 - acc:
0.9100
Epoch 712/1000
100/100 [==============================] - 0s 33us/step - loss: 0.4860 - acc:
0.9100
Epoch 713/1000
100/100 [==============================] - 0s 13us/step - loss: 0.4856 - acc:
0.9100
Epoch 714/1000
100/100 [==============================] - 0s 34us/step - loss: 0.4852 - acc:
0.9100
Epoch 715/1000
100/100 [==============================] - 0s 26us/step - loss: 0.4847 - acc:
0.9100
Epoch 716/1000
100/100 [==============================] - 0s 32us/step - loss: 0.4843 - acc:
0.9100
Epoch 717/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4839 - acc:
0.9100
Epoch 718/1000
100/100 [==============================] - 0s 23us/step - loss: 0.4835 - acc:
0.9100
Epoch 719/1000
100/100 [==============================] - 0s 13us/step - loss: 0.4831 - acc:
0.9100
Epoch 720/1000
100/100 [==============================] - 0s 33us/step - loss: 0.4827 - acc:
0.9100
Epoch 721/1000
100/100 [==============================] - 0s 22us/step - loss: 0.4822 - acc:
0.9100
Epoch 722/1000
100/100 [==============================] - 0s 64us/step - loss: 0.4818 - acc:
0.9100
```

```
Epoch 723/1000
100/100 [==============================] - 0s 0us/step - loss: 0.4814 - acc:
 0.9100
Epoch 724/1000
100/100 [==============================] - 0s 58us/step - loss: 0.4810 - acc:
0.9100
Epoch 725/1000
100/100 [==============================] - 0s 53us/step - loss: 0.4806 - acc:
0.9100
Epoch 726/1000
100/100 [==============================] - 0s 39us/step - loss: 0.4802 - acc:
0.9100
Epoch 727/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4798 - acc:
0.9100
Epoch 728/1000
100/100 [==============================] - 0s 51us/step - loss: 0.4794 - acc:
0.9100
Epoch 729/1000
100/100 [==============================] - 0s 39us/step - loss: 0.4790 - acc:
0.9100
Epoch 730/1000
100/100 [==============================] - 0s 51us/step - loss: 0.4785 - acc:
0.9100
Epoch 731/1000
100/100 [==============================] - 0s 54us/step - loss: 0.4781 - acc:
0.9100
Epoch 732/1000
100/100 [==============================] - 0s 113us/step - loss: 0.4777 - ac
c: 0.9100
Epoch 733/1000
100/100 [==============================] - 0s 73us/step - loss: 0.4773 - acc:
0.9100
Epoch 734/1000
100/100 [==============================] - 0s 58us/step - loss: 0.4769 - acc:
0.9100
Epoch 735/1000
100/100 [==============================] - 0s 70us/step - loss: 0.4765 - acc:
0.9100
Epoch 736/1000
100/100 [==============================] - 0s 56us/step - loss: 0.4761 - acc:
0.9100
Epoch 737/1000
100/100 [==============================] - 0s 57us/step - loss: 0.4757 - acc:
0.9100
Epoch 738/1000
100/100 [==============================] - 0s 62us/step - loss: 0.4753 - acc:
0.9100
Epoch 739/1000
100/100 [==============================] - 0s 54us/step - loss: 0.4749 - acc:
0.9100
Epoch 740/1000
100/100 [==============================] - 0s 47us/step - loss: 0.4745 - acc:
0.9100
Epoch 741/1000
100/100 [==============================] - 0s 69us/step - loss: 0.4741 - acc:
0.9100
```

```
Epoch 742/1000
100/100 [==============================] - 0s 67us/step - loss: 0.4737 - acc:
0.9100
Epoch 743/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4733 - acc:
0.9100
Epoch 744/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4729 - acc:
0.9100
Epoch 745/1000
100/100 [==============================] - 0s 66us/step - loss: 0.4725 - acc:
0.9100
Epoch 746/1000
100/100 [==============================] - 0s 92us/step - loss: 0.4721 - acc:
0.9100
Epoch 747/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4717 - acc:
0.9100
Epoch 748/1000
100/100 [==============================] - 0s 61us/step - loss: 0.4713 - acc:
0.9100
Epoch 749/1000
100/100 [==============================] - 0s 58us/step - loss: 0.4709 - acc:
0.9100
Epoch 750/1000
100/100 [==============================] - 0s 62us/step - loss: 0.4705 - acc:
0.9100
Epoch 751/1000
100/100 [==============================] - 0s 42us/step - loss: 0.4702 - acc:
0.9100
Epoch 752/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4698 - acc:
0.9100
Epoch 753/1000
100/100 [==============================] - 0s 62us/step - loss: 0.4694 - acc:
0.9100
Epoch 754/1000
100/100 [==============================] - 0s 80us/step - loss: 0.4690 - acc:
0.9200
Epoch 755/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4686 - acc:
0.9200
Epoch 756/1000
100/100 [==============================] - 0s 45us/step - loss: 0.4682 - acc:
0.9200
Epoch 757/1000
100/100 [==============================] - 0s 56us/step - loss: 0.4678 - acc:
0.9200
Epoch 758/1000
100/100 [==============================] - 0s 56us/step - loss: 0.4674 - acc:
0.9200
Epoch 759/1000
100/100 [==============================] - 0s 52us/step - loss: 0.4670 - acc:
0.9200
Epoch 760/1000
100/100 [==============================] - 0s 49us/step - loss: 0.4667 - acc:
0.9200
```

```
Epoch 761/1000
100/100 [==============================] - 0s 54us/step - loss: 0.4663 - acc:
0.9200
Epoch 762/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4659 - acc:
0.9300
Epoch 763/1000
100/100 [==============================] - 0s 60us/step - loss: 0.4655 - acc:
0.9400
Epoch 764/1000
100/100 [==============================] - 0s 49us/step - loss: 0.4651 - acc:
0.9400
Epoch 765/1000
100/100 [==============================] - 0s 51us/step - loss: 0.4647 - acc:
0.9400
Epoch 766/1000
100/100 [==============================] - 0s 46us/step - loss: 0.4644 - acc:
0.9400
Epoch 767/1000
100/100 [==============================] - 0s 58us/step - loss: 0.4640 - acc:
0.9400
Epoch 768/1000
100/100 [==============================] - 0s 72us/step - loss: 0.4636 - acc:
0.9400
Epoch 769/1000
100/100 [==============================] - 0s 74us/step - loss: 0.4632 - acc:
0.9400
Epoch 770/1000
100/100 [==============================] - 0s 61us/step - loss: 0.4628 - acc:
0.9400
Epoch 771/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4625 - acc:
0.9400
Epoch 772/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4621 - acc:
0.9400
Epoch 773/1000
100/100 [==============================] - 0s 72us/step - loss: 0.4617 - acc:
0.9400
Epoch 774/1000
100/100 [==============================] - 0s 60us/step - loss: 0.4613 - acc:
0.9400
Epoch 775/1000
100/100 [==============================] - 0s 66us/step - loss: 0.4610 - acc:
0.9400
Epoch 776/1000
100/100 [==============================] - 0s 46us/step - loss: 0.4606 - acc:
0.9400
Epoch 777/1000
100/100 [==============================] - 0s 42us/step - loss: 0.4602 - acc:
0.9400
Epoch 778/1000
100/100 [==============================] - 0s 54us/step - loss: 0.4598 - acc:
0.9400
Epoch 779/1000
100/100 [==============================] - 0s 27us/step - loss: 0.4595 - acc:
0.9400
```

```
Epoch 780/1000
100/100 [==============================] - 0s 64us/step - loss: 0.4591 - acc:
0.9400
Epoch 781/1000
100/100 [==============================] - 0s 49us/step - loss: 0.4587 - acc:
0.9400
Epoch 782/1000
100/100 [==============================] - 0s 69us/step - loss: 0.4584 - acc:
0.9400
Epoch 783/1000
100/100 [==============================] - 0s 61us/step - loss: 0.4580 - acc:
0.9500
Epoch 784/1000
100/100 [==============================] - 0s 63us/step - loss: 0.4576 - acc:
0.9500
Epoch 785/1000
100/100 [==============================] - 0s 58us/step - loss: 0.4573 - acc:
0.9500
Epoch 786/1000
100/100 [==============================] - 0s 65us/step - loss: 0.4569 - acc:
0.9500
Epoch 787/1000
100/100 [==============================] - 0s 10us/step - loss: 0.4565 - acc:
0.9500
Epoch 788/1000
100/100 [==============================] - 0s 16us/step - loss: 0.4561 - acc:
0.9500
Epoch 789/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4558 - acc:
0.9500
Epoch 790/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4554 - acc:
0.9500
Epoch 791/1000
100/100 [==============================] - 0s 16us/step - loss: 0.4551 - acc:
0.9500
Epoch 792/1000
100/100 [==============================] - 0s 28us/step - loss: 0.4547 - acc:
0.9500
Epoch 793/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4543 - acc:
0.9500
Epoch 794/1000
100/100 [==============================] - 0s 23us/step - loss: 0.4540 - acc:
0.9500
Epoch 795/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4536 - acc:
0.9500
Epoch 796/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4532 - acc:
0.9500
Epoch 797/1000
100/100 [==============================] - 0s 58us/step - loss: 0.4529 - acc:
0.9500
Epoch 798/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4525 - acc:
0.9500
```

```
Epoch 799/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4522 - acc:
0.9500
Epoch 800/1000
100/100 [==============================] - 0s 11us/step - loss: 0.4518 - acc:
0.9500
Epoch 801/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4514 - acc:
0.9500
Epoch 802/1000
100/100 [==============================] - 0s 35us/step - loss: 0.4511 - acc:
0.9500
Epoch 803/1000
100/100 [==============================] - 0s 28us/step - loss: 0.4507 - acc:
0.9500
Epoch 804/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4504 - acc:
0.9500
Epoch 805/1000
100/100 [==============================] - 0s 44us/step - loss: 0.4500 - acc:
0.9500
Epoch 806/1000
100/100 [==============================] - 0s 24us/step - loss: 0.4497 - acc:
0.9500
Epoch 807/1000
100/100 [==============================] - 0s 34us/step - loss: 0.4493 - acc:
0.9500
Epoch 808/1000
100/100 [==============================] - 0s 38us/step - loss: 0.4490 - acc:
0.9500
Epoch 809/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4486 - acc:
0.9500
Epoch 810/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4483 - acc:
0.9500
Epoch 811/1000
100/100 [==============================] - 0s 49us/step - loss: 0.4479 - acc:
0.9500
Epoch 812/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4476 - acc:
0.9500
Epoch 813/1000
100/100 [==============================] - 0s 44us/step - loss: 0.4472 - acc:
0.9500
Epoch 814/1000
100/100 [==============================] - 0s 42us/step - loss: 0.4469 - acc:
0.9500
Epoch 815/1000
100/100 [==============================] - 0s 32us/step - loss: 0.4465 - acc:
0.9500
Epoch 816/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4462 - acc:
0.9500
Epoch 817/1000
100/100 [==============================] - 0s 38us/step - loss: 0.4458 - acc:
0.9500
```

```
Epoch 818/1000
100/100 [==============================] - 0s 51us/step - loss: 0.4455 - acc:
0.9500
Epoch 819/1000
100/100 [==============================] - 0s 125us/step - loss: 0.4451 - ac
c: 0.9500
Epoch 820/1000
100/100 [==============================] - 0s 42us/step - loss: 0.4448 - acc:
0.9500
Epoch 821/1000
100/100 [==============================] - 0s 33us/step - loss: 0.4444 - acc:
0.9500
Epoch 822/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4441 - acc:
0.9500
Epoch 823/1000
100/100 [==============================] - 0s 38us/step - loss: 0.4437 - acc:
0.9500
Epoch 824/1000
100/100 [==============================] - 0s 60us/step - loss: 0.4434 - acc:
0.9500
Epoch 825/1000
100/100 [==============================] - 0s 50us/step - loss: 0.4431 - acc:
0.9500
Epoch 826/1000
100/100 [==============================] - 0s 48us/step - loss: 0.4427 - acc:
0.9500
Epoch 827/1000
100/100 [==============================] - 0s 48us/step - loss: 0.4424 - acc:
0.9500
Epoch 828/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4420 - acc:
0.9500
Epoch 829/1000
100/100 [==============================] - 0s 42us/step - loss: 0.4417 - acc:
0.9500
Epoch 830/1000
100/100 [==============================] - 0s 37us/step - loss: 0.4413 - acc:
0.9500
Epoch 831/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4410 - acc:
0.9500
Epoch 832/1000
100/100 [==============================] - 0s 47us/step - loss: 0.4407 - acc:
0.9500
Epoch 833/1000
100/100 [==============================] - 0s 55us/step - loss: 0.4403 - acc:
0.9500
Epoch 834/1000
100/100 [==============================] - 0s 42us/step - loss: 0.4400 - acc:
0.9500
Epoch 835/1000
100/100 [==============================] - 0s 47us/step - loss: 0.4397 - acc:
0.9500
Epoch 836/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4393 - acc:
0.9500
```

```
Epoch 837/1000
100/100 [==============================] - 0s 36us/step - loss: 0.4390 - acc:
0.9500
Epoch 838/1000
100/100 [==============================] - 0s 52us/step - loss: 0.4387 - acc:
0.9500
Epoch 839/1000
100/100 [==============================] - 0s 68us/step - loss: 0.4383 - acc:
0.9500
Epoch 840/1000
100/100 [==============================] - 0s 34us/step - loss: 0.4380 - acc:
0.9500
Epoch 841/1000
100/100 [==============================] - 0s 47us/step - loss: 0.4377 - acc:
0.9500
Epoch 842/1000
100/100 [==============================] - 0s 77us/step - loss: 0.4373 - acc:
0.9500
Epoch 843/1000
100/100 [==============================] - 0s 74us/step - loss: 0.4370 - acc:
0.9500
Epoch 844/1000
100/100 [==============================] - 0s 57us/step - loss: 0.4367 - acc:
0.9500
Epoch 845/1000
100/100 [==============================] - 0s 59us/step - loss: 0.4363 - acc:
0.9500
Epoch 846/1000
100/100 [==============================] - 0s 63us/step - loss: 0.4360 - acc:
0.9500
Epoch 847/1000
100/100 [==============================] - 0s 49us/step - loss: 0.4357 - acc:
0.9500
Epoch 848/1000
100/100 [==============================] - 0s 86us/step - loss: 0.4353 - acc:
0.9500
Epoch 849/1000
100/100 [==============================] - 0s 65us/step - loss: 0.4350 - acc:
0.9500
Epoch 850/1000
100/100 [==============================] - 0s 48us/step - loss: 0.4347 - acc:
0.9500
Epoch 851/1000
100/100 [==============================] - 0s 108us/step - loss: 0.4344 - ac
c: 0.9500
Epoch 852/1000
100/100 [==============================] - 0s 37us/step - loss: 0.4340 - acc:
0.9500
Epoch 853/1000
100/100 [==============================] - 0s 24us/step - loss: 0.4337 - acc:
0.9500
Epoch 854/1000
100/100 [==============================] - 0s 39us/step - loss: 0.4334 - acc:
0.9500
Epoch 855/1000
100/100 [==============================] - 0s 18us/step - loss: 0.4330 - acc:
0.9500
```

```
Epoch 856/1000
100/100 [==============================] - 0s 42us/step - loss: 0.4327 - acc:
0.9500
Epoch 857/1000
100/100 [==============================] - 0s 8us/step - loss: 0.4324 - acc:
 0.9500
Epoch 858/1000
100/100 [==============================] - 0s 52us/step - loss: 0.4321 - acc:
0.9500
Epoch 859/1000
100/100 [==============================] - 0s 42us/step - loss: 0.4318 - acc:
0.9500
Epoch 860/1000
100/100 [==============================] - 0s 49us/step - loss: 0.4314 - acc:
0.9500
Epoch 861/1000
100/100 [==============================] - 0s 65us/step - loss: 0.4311 - acc:
0.9500
Epoch 862/1000
100/100 [==============================] - 0s 56us/step - loss: 0.4308 - acc:
0.9500
Epoch 863/1000
100/100 [==============================] - 0s 38us/step - loss: 0.4305 - acc:
0.9500
Epoch 864/1000
100/100 [==============================] - 0s 46us/step - loss: 0.4301 - acc:
0.9500
Epoch 865/1000
100/100 [==============================] - 0s 48us/step - loss: 0.4298 - acc:
0.9500
Epoch 866/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4295 - acc:
0.9500
Epoch 867/1000
100/100 [==============================] - 0s 53us/step - loss: 0.4292 - acc:
0.9500
Epoch 868/1000
100/100 [==============================] - 0s 51us/step - loss: 0.4289 - acc:
0.9500
Epoch 869/1000
100/100 [==============================] - 0s 60us/step - loss: 0.4286 - acc:
0.9500
Epoch 870/1000
100/100 [==============================] - 0s 53us/step - loss: 0.4282 - acc:
0.9500
Epoch 871/1000
100/100 [==============================] - 0s 74us/step - loss: 0.4279 - acc:
0.9500
Epoch 872/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4276 - acc:
0.9500
Epoch 873/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4273 - acc:
0.9500
Epoch 874/1000
100/100 [==============================] - 0s 28us/step - loss: 0.4270 - acc:
0.9500
```

```
Epoch 875/1000
100/100 [==============================] - 0s 25us/step - loss: 0.4267 - acc:
0.9500
Epoch 876/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4264 - acc:
0.9500
Epoch 877/1000
100/100 [==============================] - 0s 42us/step - loss: 0.4260 - acc:
0.9500
Epoch 878/1000
100/100 [==============================] - 0s 33us/step - loss: 0.4257 - acc:
0.9500
Epoch 879/1000
100/100 [==============================] - 0s 28us/step - loss: 0.4254 - acc:
0.9500
Epoch 880/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4251 - acc:
0.9500
Epoch 881/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4248 - acc:
0.9500
Epoch 882/1000
100/100 [==============================] - 0s 44us/step - loss: 0.4245 - acc:
0.9500
Epoch 883/1000
100/100 [==============================] - 0s 10us/step - loss: 0.4242 - acc:
0.9500
Epoch 884/1000
100/100 [==============================] - 0s 36us/step - loss: 0.4239 - acc:
0.9500
Epoch 885/1000
100/100 [==============================] - 0s 33us/step - loss: 0.4236 - acc:
0.9500
Epoch 886/1000
100/100 [==============================] - 0s 57us/step - loss: 0.4232 - acc:
0.9500
Epoch 887/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4229 - acc:
0.9500
Epoch 888/1000
100/100 [==============================] - 0s 37us/step - loss: 0.4226 - acc:
0.9500
Epoch 889/1000
100/100 [==============================] - 0s 47us/step - loss: 0.4223 - acc:
0.9500
Epoch 890/1000
100/100 [==============================] - 0s 38us/step - loss: 0.4220 - acc:
0.9500
Epoch 891/1000
100/100 [==============================] - 0s 64us/step - loss: 0.4217 - acc:
0.9500
Epoch 892/1000
100/100 [==============================] - 0s 82us/step - loss: 0.4214 - acc:
0.9500
Epoch 893/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4211 - acc:
0.9500
```

```
Epoch 894/1000
100/100 [==============================] - 0s 63us/step - loss: 0.4208 - acc:
0.9500
Epoch 895/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4205 - acc:
0.9500
Epoch 896/1000
100/100 [==============================] - 0s 53us/step - loss: 0.4202 - acc:
0.9500
Epoch 897/1000
100/100 [==============================] - 0s 52us/step - loss: 0.4199 - acc:
0.9500
Epoch 898/1000
100/100 [==============================] - 0s 50us/step - loss: 0.4196 - acc:
0.9500
Epoch 899/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4193 - acc:
0.9500
Epoch 900/1000
100/100 [==============================] - 0s 36us/step - loss: 0.4190 - acc:
0.9500
Epoch 901/1000
100/100 [==============================] - 0s 38us/step - loss: 0.4187 - acc:
0.9500
Epoch 902/1000
100/100 [==============================] - 0s 56us/step - loss: 0.4184 - acc:
0.9500
Epoch 903/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4181 - acc:
0.9500
Epoch 904/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4178 - acc:
0.9500
Epoch 905/1000
100/100 [==============================] - 0s 79us/step - loss: 0.4175 - acc:
0.9500
Epoch 906/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4172 - acc:
0.9500
Epoch 907/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4169 - acc:
0.9500
Epoch 908/1000
100/100 [==============================] - 0s 51us/step - loss: 0.4166 - acc:
0.9500
Epoch 909/1000
100/100 [==============================] - 0s 44us/step - loss: 0.4163 - acc:
0.9500
Epoch 910/1000
100/100 [==============================] - 0s 45us/step - loss: 0.4160 - acc:
0.9500
Epoch 911/1000
100/100 [==============================] - 0s 48us/step - loss: 0.4157 - acc:
0.9500
Epoch 912/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4154 - acc:
0.9500
```

```
Epoch 913/1000
100/100 [==============================] - 0s 50us/step - loss: 0.4151 - acc:
0.9500
Epoch 914/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4148 - acc:
0.9500
Epoch 915/1000
100/100 [==============================] - 0s 35us/step - loss: 0.4145 - acc:
0.9500
Epoch 916/1000
100/100 [==============================] - 0s 60us/step - loss: 0.4142 - acc:
0.9500
Epoch 917/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4140 - acc:
0.9500
Epoch 918/1000
100/100 [==============================] - 0s 39us/step - loss: 0.4137 - acc:
0.9500
Epoch 919/1000
100/100 [==============================] - 0s 40us/step - loss: 0.4134 - acc:
0.9500
Epoch 920/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4131 - acc:
0.9500
Epoch 921/1000
100/100 [==============================] - 0s 63us/step - loss: 0.4128 - acc:
0.9500
Epoch 922/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4125 - acc:
0.9500
Epoch 923/1000
100/100 [==============================] - 0s 38us/step - loss: 0.4122 - acc:
0.9500
Epoch 924/1000
100/100 [==============================] - 0s 62us/step - loss: 0.4119 - acc:
0.9500
Epoch 925/1000
100/100 [==============================] - 0s 72us/step - loss: 0.4116 - acc:
0.9500
Epoch 926/1000
100/100 [==============================] - 0s 36us/step - loss: 0.4113 - acc:
0.9500
Epoch 927/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4111 - acc:
0.9500
Epoch 928/1000
100/100 [==============================] - 0s 61us/step - loss: 0.4108 - acc:
0.9500
Epoch 929/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4105 - acc:
0.9500
Epoch 930/1000
100/100 [==============================] - 0s 48us/step - loss: 0.4102 - acc:
0.9500
Epoch 931/1000
100/100 [==============================] - 0s 51us/step - loss: 0.4099 - acc:
0.9500
```

```
Epoch 932/1000
100/100 [==============================] - 0s 52us/step - loss: 0.4096 - acc:
0.9500
Epoch 933/1000
100/100 [==============================] - 0s 61us/step - loss: 0.4093 - acc:
0.9500
Epoch 934/1000
100/100 [==============================] - 0s 36us/step - loss: 0.4091 - acc:
0.9500
Epoch 935/1000
100/100 [==============================] - 0s 70us/step - loss: 0.4088 - acc:
0.9500
Epoch 936/1000
100/100 [==============================] - 0s 50us/step - loss: 0.4085 - acc:
0.9500
Epoch 937/1000
100/100 [==============================] - 0s 48us/step - loss: 0.4082 - acc:
0.9600
Epoch 938/1000
100/100 [==============================] - 0s 71us/step - loss: 0.4079 - acc:
0.9600
Epoch 939/1000
100/100 [==============================] - 0s 51us/step - loss: 0.4076 - acc:
0.9600
Epoch 940/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4074 - acc:
0.9600
Epoch 941/1000
100/100 [==============================] - 0s 98us/step - loss: 0.4071 - acc:
0.9600
Epoch 942/1000
100/100 [==============================] - 0s 59us/step - loss: 0.4068 - acc:
0.9600
Epoch 943/1000
100/100 [==============================] - 0s 37us/step - loss: 0.4065 - acc:
0.9600
Epoch 944/1000
100/100 [==============================] - 0s 46us/step - loss: 0.4062 - acc:
0.9600
Epoch 945/1000
100/100 [==============================] - 0s 46us/step - loss: 0.4060 - acc:
0.9600
Epoch 946/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4057 - acc:
0.9600
Epoch 947/1000
100/100 [==============================] - 0s 41us/step - loss: 0.4054 - acc:
0.9600
Epoch 948/1000
100/100 [==============================] - 0s 55us/step - loss: 0.4051 - acc:
0.9600
Epoch 949/1000
100/100 [==============================] - 0s 61us/step - loss: 0.4049 - acc:
0.9600
Epoch 950/1000
100/100 [==============================] - 0s 45us/step - loss: 0.4046 - acc:
0.9600
```

```
Epoch 951/1000
100/100 [==============================] - 0s 86us/step - loss: 0.4043 - acc:
0.9600
Epoch 952/1000
100/100 [==============================] - 0s 48us/step - loss: 0.4040 - acc:
0.9600
Epoch 953/1000
100/100 [==============================] - 0s 43us/step - loss: 0.4038 - acc:
0.9600
Epoch 954/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4035 - acc:
0.9600
Epoch 955/1000
100/100 [==============================] - 0s 32us/step - loss: 0.4032 - acc:
0.9600
Epoch 956/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4029 - acc:
0.9600
Epoch 957/1000
100/100 [==============================] - 0s 16us/step - loss: 0.4027 - acc:
0.9600
Epoch 958/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4024 - acc:
0.9600
Epoch 959/1000
100/100 [==============================] - 0s 30us/step - loss: 0.4021 - acc:
0.9600
Epoch 960/1000
100/100 [==============================] - 0s 31us/step - loss: 0.4018 - acc:
0.9500
Epoch 961/1000
100/100 [==============================] - 0s 15us/step - loss: 0.4016 - acc:
0.9500
Epoch 962/1000
100/100 [==============================] - 0s 21us/step - loss: 0.4013 - acc:
0.9500
Epoch 963/1000
100/100 [==============================] - 0s 23us/step - loss: 0.4010 - acc:
0.9500
Epoch 964/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4008 - acc:
0.9500
Epoch 965/1000
100/100 [==============================] - 0s 36us/step - loss: 0.4005 - acc:
0.9500
Epoch 966/1000
100/100 [==============================] - 0s 17us/step - loss: 0.4002 - acc:
0.9500
Epoch 967/1000
100/100 [==============================] - 0s 20us/step - loss: 0.4000 - acc:
0.9500
Epoch 968/1000
100/100 [==============================] - 0s 32us/step - loss: 0.3997 - acc:
0.9500
Epoch 969/1000
100/100 [==============================] - 0s 61us/step - loss: 0.3994 - acc:
0.9500
```

```
Epoch 970/1000
100/100 [==============================] - 0s 32us/step - loss: 0.3991 - acc:
0.9500
Epoch 971/1000
100/100 [==============================] - 0s 60us/step - loss: 0.3989 - acc:
0.9500
Epoch 972/1000
100/100 [==============================] - 0s 24us/step - loss: 0.3986 - acc:
0.9500
Epoch 973/1000
100/100 [==============================] - 0s 113us/step - loss: 0.3983 - ac
c: 0.9500
Epoch 974/1000
100/100 [==============================] - 0s 42us/step - loss: 0.3981 - acc:
0.9500
Epoch 975/1000
100/100 [==============================] - 0s 120us/step - loss: 0.3978 - ac
c: 0.9500
Epoch 976/1000
100/100 [==============================] - 0s 35us/step - loss: 0.3976 - acc:
0.9500
Epoch 977/1000
100/100 [==============================] - 0s 48us/step - loss: 0.3973 - acc:
0.9500
Epoch 978/1000
100/100 [==============================] - 0s 51us/step - loss: 0.3970 - acc:
0.9500
Epoch 979/1000
100/100 [==============================] - 0s 31us/step - loss: 0.3968 - acc:
0.9500
Epoch 980/1000
100/100 [==============================] - 0s 44us/step - loss: 0.3965 - acc:
0.9500
Epoch 981/1000
100/100 [==============================] - 0s 154us/step - loss: 0.3962 - ac
c: 0.9500
Epoch 982/1000
100/100 [==============================] - 0s 53us/step - loss: 0.3960 - acc:
0.9500
Epoch 983/1000
100/100 [==============================] - 0s 40us/step - loss: 0.3957 - acc:
0.9500
Epoch 984/1000
100/100 [==============================] - 0s 36us/step - loss: 0.3954 - acc:
0.9500
Epoch 985/1000
100/100 [==============================] - 0s 74us/step - loss: 0.3952 - acc:
0.9500
Epoch 986/1000
100/100 [==============================] - 0s 53us/step - loss: 0.3949 - acc:
0.9500
Epoch 987/1000
100/100 [==============================] - 0s 41us/step - loss: 0.3947 - acc:
0.9500
Epoch 988/1000
100/100 [==============================] - 0s 176us/step - loss: 0.3944 - ac
c: 0.9500
```

```
Epoch 989/1000
100/100 [==============================] - 0s 68us/step - loss: 0.3941 - acc:
0.9500
Epoch 990/1000
100/100 [==============================] - 0s 50us/step - loss: 0.3939 - acc:
0.9500
Epoch 991/1000
100/100 [==============================] - 0s 42us/step - loss: 0.3936 - acc:
0.9500
Epoch 992/1000
100/100 [==============================] - 0s 36us/step - loss: 0.3934 - acc:
0.9500
Epoch 993/1000
100/100 [==============================] - 0s 34us/step - loss: 0.3931 - acc:
0.9500
Epoch 994/1000
100/100 [==============================] - 0s 38us/step - loss: 0.3929 - acc:
0.9500
Epoch 995/1000
100/100 [==============================] - 0s 36us/step - loss: 0.3926 - acc:
0.9500
Epoch 996/1000
100/100 [==============================] - 0s 47us/step - loss: 0.3923 - acc:
0.9500
Epoch 997/1000
100/100 [==============================] - 0s 50us/step - loss: 0.3921 - acc:
0.9500
Epoch 998/1000
100/100 [==============================] - 0s 45us/step - loss: 0.3918 - acc:
0.9500
Epoch 999/1000
100/100 [==============================] - 0s 52us/step - loss: 0.3916 - acc:
0.9500
Epoch 1000/1000
100/100 [==============================] - 0s 35us/step - loss: 0.3913 - acc:
0.9500
10000/10000 [==============================] - 1s 91us/step
```

In [197]:
```python
print("The minimum error obtained by applying the above obtained optimal numbe
r of perceptrons is {}".format(1-accuracy1[1]))
```

The minimum error obtained by applying the above obtained optimal number of p
erceptrons is 0.12780000000000002

1000 dataset:

In [198]:
```python
best_score_2, best_param_2, mean_2, std_2, param_2 = training(M, N2, data2, tr
ue_label2, true_prob2)
```

In [199]:
```python
print("The optimal number of perceptrons for minimum error of {} is obtained a
s {}".format(1-best_score_2, best_param_2))
```

The optimal number of perceptrons for minimum error of 0.17500000000000004 is
obtained as {'M': 38}

```
In [200]: for mean, stdev, param in zip(mean_2, std_2, param_2):
              print("%f (%f) with: %r" % (mean, stdev, param))
```

```
0.715000 (0.060704) with: {'M': 6}
0.769000 (0.044147) with: {'M': 10}
0.808000 (0.036000) with: {'M': 14}
0.802000 (0.035721) with: {'M': 18}
0.808000 (0.042379) with: {'M': 22}
0.821000 (0.037802) with: {'M': 26}
0.825000 (0.037483) with: {'M': 30}
0.823000 (0.035228) with: {'M': 34}
0.825000 (0.036946) with: {'M': 38}
```

```
In [201]: best_param_2 = best_param_2.get('M')
```

In [202]:
```
accuracy2 = neural(data2, true_prob2, data, true_prob, best_param_2, N2)
```

```
Epoch 1/1000
1000/1000 [==============================] - 2s 2ms/step - loss: 1.6109 - ac
c: 0.1030
Epoch 2/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.5894 - ac
c: 0.1030
Epoch 3/1000
1000/1000 [==============================] - 0s 16us/step - loss: 1.5691 - ac
c: 0.1030
Epoch 4/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.5497 - ac
c: 0.1030
Epoch 5/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.5314 - ac
c: 0.1030
Epoch 6/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.5139 - ac
c: 0.1030
Epoch 7/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.4973 - ac
c: 0.1030
Epoch 8/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.4815 - ac
c: 0.1040
Epoch 9/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.4664 - ac
c: 0.1080
Epoch 10/1000
1000/1000 [==============================] - 0s 16us/step - loss: 1.4520 - ac
c: 0.1200
Epoch 11/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.4382 - ac
c: 0.1430
Epoch 12/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.4251 - ac
c: 0.1910
Epoch 13/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.4125 - ac
c: 0.2560
Epoch 14/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.4005 - ac
c: 0.3280
Epoch 15/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.3890 - ac
c: 0.3990
Epoch 16/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.3779 - ac
c: 0.4610
Epoch 17/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.3673 - ac
c: 0.5100
Epoch 18/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.3571 - ac
c: 0.5390
Epoch 19/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.3472 - ac
c: 0.5530
```

```
Epoch 20/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.3378 - ac
c: 0.5620
Epoch 21/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.3287 - ac
c: 0.5600
Epoch 22/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.3199 - ac
c: 0.5520
Epoch 23/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.3114 - ac
c: 0.5520
Epoch 24/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.3033 - ac
c: 0.5500
Epoch 25/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.2954 - ac
c: 0.5450
Epoch 26/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.2877 - ac
c: 0.5360
Epoch 27/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.2803 - ac
c: 0.5250
Epoch 28/1000
1000/1000 [==============================] - 0s 36us/step - loss: 1.2732 - ac
c: 0.5170
Epoch 29/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.2662 - ac
c: 0.5120
Epoch 30/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.2595 - ac
c: 0.5080
Epoch 31/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.2530 - ac
c: 0.5050
Epoch 32/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.2466 - ac
c: 0.5010
Epoch 33/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.2405 - ac
c: 0.4980
Epoch 34/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.2345 - ac
c: 0.4970
Epoch 35/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.2287 - ac
c: 0.4970
Epoch 36/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.2230 - ac
c: 0.5000
Epoch 37/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.2175 - ac
c: 0.4990
Epoch 38/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.2121 - ac
c: 0.4980
```

```
Epoch 39/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.2068 - ac
c: 0.4970
Epoch 40/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.2017 - ac
c: 0.4940
Epoch 41/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.1967 - ac
c: 0.4950
Epoch 42/1000
1000/1000 [==============================] - 0s 16us/step - loss: 1.1918 - ac
c: 0.4930
Epoch 43/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.1870 - ac
c: 0.4920
Epoch 44/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.1823 - ac
c: 0.4930
Epoch 45/1000
1000/1000 [==============================] - 0s 16us/step - loss: 1.1778 - ac
c: 0.4950
Epoch 46/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.1733 - ac
c: 0.5080
Epoch 47/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.1689 - ac
c: 0.5100
Epoch 48/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.1646 - ac
c: 0.5160
Epoch 49/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.1604 - ac
c: 0.5200
Epoch 50/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.1563 - ac
c: 0.5260
Epoch 51/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.1522 - ac
c: 0.5330
Epoch 52/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.1483 - ac
c: 0.5370
Epoch 53/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.1444 - ac
c: 0.5430
Epoch 54/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.1405 - ac
c: 0.5500
Epoch 55/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.1368 - ac
c: 0.5520
Epoch 56/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.1331 - ac
c: 0.5640
Epoch 57/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.1294 - ac
c: 0.5710
```

```
Epoch 58/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.1259 - ac
c: 0.5740
Epoch 59/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.1223 - ac
c: 0.5800
Epoch 60/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.1189 - ac
c: 0.5850
Epoch 61/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.1155 - ac
c: 0.5970
Epoch 62/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.1121 - ac
c: 0.6030
Epoch 63/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.1088 - ac
c: 0.6040
Epoch 64/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.1055 - ac
c: 0.6090
Epoch 65/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.1023 - ac
c: 0.6170
Epoch 66/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0991 - ac
c: 0.6250
Epoch 67/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.0960 - ac
c: 0.6330
Epoch 68/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0929 - ac
c: 0.6400
Epoch 69/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0899 - ac
c: 0.6440
Epoch 70/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0869 - ac
c: 0.6500
Epoch 71/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0839 - ac
c: 0.6580
Epoch 72/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0810 - ac
c: 0.6610
Epoch 73/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0781 - ac
c: 0.6620
Epoch 74/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0752 - ac
c: 0.6690
Epoch 75/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0724 - ac
c: 0.6730
Epoch 76/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.0696 - ac
c: 0.6780
```

```
Epoch 77/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0668 - ac
c: 0.6840
Epoch 78/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0641 - ac
c: 0.6900
Epoch 79/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0614 - ac
c: 0.6910
Epoch 80/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0587 - ac
c: 0.6940
Epoch 81/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0560 - ac
c: 0.6960
Epoch 82/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.0534 - ac
c: 0.6970
Epoch 83/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0508 - ac
c: 0.7030
Epoch 84/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0483 - ac
c: 0.7050
Epoch 85/1000
1000/1000 [==============================] - 0s 16us/step - loss: 1.0457 - ac
c: 0.7080
Epoch 86/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0432 - ac
c: 0.7100
Epoch 87/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0407 - ac
c: 0.7120
Epoch 88/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0383 - ac
c: 0.7150
Epoch 89/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0358 - ac
c: 0.7170
Epoch 90/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0334 - ac
c: 0.7190
Epoch 91/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0310 - ac
c: 0.7190
Epoch 92/1000
1000/1000 [==============================] - 0s 28us/step - loss: 1.0286 - ac
c: 0.7190
Epoch 93/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.0263 - ac
c: 0.7210
Epoch 94/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0239 - ac
c: 0.7210
Epoch 95/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0216 - ac
c: 0.7210
```

```
Epoch 96/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.0193 - ac
c: 0.7240
Epoch 97/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.0170 - ac
c: 0.7240
Epoch 98/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.0148 - ac
c: 0.7260
Epoch 99/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.0125 - ac
c: 0.7270
Epoch 100/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.0103 - ac
c: 0.7280
Epoch 101/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0081 - ac
c: 0.7330
Epoch 102/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0059 - ac
c: 0.7350
Epoch 103/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.0037 - ac
c: 0.7360
Epoch 104/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.0016 - ac
c: 0.7380
Epoch 105/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9994 - ac
c: 0.7410
Epoch 106/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9973 - ac
c: 0.7430
Epoch 107/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9952 - ac
c: 0.7460
Epoch 108/1000
1000/1000 [==============================] - 0s 35us/step - loss: 0.9931 - ac
c: 0.7480
Epoch 109/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.9910 - ac
c: 0.7500
Epoch 110/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9890 - ac
c: 0.7520
Epoch 111/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9869 - ac
c: 0.7550
Epoch 112/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9849 - ac
c: 0.7570
Epoch 113/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9829 - ac
c: 0.7590
Epoch 114/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9809 - ac
c: 0.7590
```

```
Epoch 115/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9789 - ac
c: 0.7620
Epoch 116/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9769 - ac
c: 0.7610
Epoch 117/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9749 - ac
c: 0.7620
Epoch 118/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.9730 - ac
c: 0.7640
Epoch 119/1000
1000/1000 [==============================] - 0s 24us/step - loss: 0.9710 - ac
c: 0.7650
Epoch 120/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9691 - ac
c: 0.7660
Epoch 121/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9672 - ac
c: 0.7660
Epoch 122/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9653 - ac
c: 0.7670
Epoch 123/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9634 - ac
c: 0.7680
Epoch 124/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9615 - ac
c: 0.7690
Epoch 125/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.9596 - ac
c: 0.7720
Epoch 126/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9578 - ac
c: 0.7730
Epoch 127/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9559 - ac
c: 0.7760
Epoch 128/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9541 - ac
c: 0.7760
Epoch 129/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.9523 - ac
c: 0.7770
Epoch 130/1000
1000/1000 [==============================] - 0s 36us/step - loss: 0.9505 - ac
c: 0.7770
Epoch 131/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9487 - ac
c: 0.7770
Epoch 132/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9469 - ac
c: 0.7770
Epoch 133/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9451 - ac
c: 0.7770
```

```
Epoch 134/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9433 - ac
c: 0.7780
Epoch 135/1000
1000/1000 [==============================] - 0s 27us/step - loss: 0.9416 - ac
c: 0.7800
Epoch 136/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.9398 - ac
c: 0.7800
Epoch 137/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9381 - ac
c: 0.7810
Epoch 138/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.9363 - ac
c: 0.7810
Epoch 139/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9346 - ac
c: 0.7810
Epoch 140/1000
1000/1000 [==============================] - 0s 24us/step - loss: 0.9329 - ac
c: 0.7820
Epoch 141/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9312 - ac
c: 0.7850
Epoch 142/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9295 - ac
c: 0.7870
Epoch 143/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9278 - ac
c: 0.7870
Epoch 144/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9261 - ac
c: 0.7880
Epoch 145/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9245 - ac
c: 0.7880
Epoch 146/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9228 - ac
c: 0.7880
Epoch 147/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9212 - ac
c: 0.7880
Epoch 148/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9195 - ac
c: 0.7880
Epoch 149/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.9179 - ac
c: 0.7890
Epoch 150/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9163 - ac
c: 0.7890
Epoch 151/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9147 - ac
c: 0.7890
Epoch 152/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9130 - ac
c: 0.7910
```

```
Epoch 153/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9114 - ac
c: 0.7910
Epoch 154/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.9099 - ac
c: 0.7920
Epoch 155/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9083 - ac
c: 0.7920
Epoch 156/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9067 - ac
c: 0.7930
Epoch 157/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9051 - ac
c: 0.7930
Epoch 158/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9036 - ac
c: 0.7930
Epoch 159/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.9020 - ac
c: 0.7930
Epoch 160/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.9005 - ac
c: 0.7920
Epoch 161/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8989 - ac
c: 0.7920
Epoch 162/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8974 - ac
c: 0.7910
Epoch 163/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8959 - ac
c: 0.7910
Epoch 164/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8944 - ac
c: 0.7910
Epoch 165/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8929 - ac
c: 0.7920
Epoch 166/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8914 - ac
c: 0.7920
Epoch 167/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8899 - ac
c: 0.7920
Epoch 168/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8884 - ac
c: 0.7930
Epoch 169/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8869 - ac
c: 0.7930
Epoch 170/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8854 - ac
c: 0.7940
Epoch 171/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8840 - ac
c: 0.7950
```

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Epoch 172/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8825 - ac
c: 0.7950
Epoch 173/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8811 - ac
c: 0.7970
Epoch 174/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8796 - ac
c: 0.7980
Epoch 175/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8782 - ac
c: 0.7980
Epoch 176/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8767 - ac
c: 0.7970
Epoch 177/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8753 - ac
c: 0.7970
Epoch 178/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8739 - ac
c: 0.7970
Epoch 179/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8725 - ac
c: 0.7970
Epoch 180/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8711 - ac
c: 0.7980
Epoch 181/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8697 - ac
c: 0.7990
Epoch 182/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8683 - ac
c: 0.7990
Epoch 183/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8669 - ac
c: 0.8000
Epoch 184/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8655 - ac
c: 0.8030
Epoch 185/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8641 - ac
c: 0.8030
Epoch 186/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8628 - ac
c: 0.8030
Epoch 187/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8614 - ac
c: 0.8030
Epoch 188/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8601 - ac
c: 0.8040
Epoch 189/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8587 - ac
c: 0.8050
Epoch 190/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8574 - ac
c: 0.8050
```

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Epoch 191/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8560 - ac
c: 0.8050
Epoch 192/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8547 - ac
c: 0.8050
Epoch 193/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8534 - ac
c: 0.8060
Epoch 194/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8520 - ac
c: 0.8060
Epoch 195/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.8507 - ac
c: 0.8070
Epoch 196/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8494 - ac
c: 0.8070
Epoch 197/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8481 - ac
c: 0.8080
Epoch 198/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8468 - ac
c: 0.8080
Epoch 199/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8455 - ac
c: 0.8070
Epoch 200/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8442 - ac
c: 0.8080
Epoch 201/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8429 - ac
c: 0.8090
Epoch 202/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8416 - ac
c: 0.8090
Epoch 203/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8404 - ac
c: 0.8090
Epoch 204/1000
1000/1000 [==============================] - 0s 36us/step - loss: 0.8391 - ac
c: 0.8090
Epoch 205/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8378 - ac
c: 0.8090
Epoch 206/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.8366 - ac
c: 0.8090
Epoch 207/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.8353 - ac
c: 0.8090
Epoch 208/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8341 - ac
c: 0.8090
Epoch 209/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8328 - ac
c: 0.8100
```

```
Epoch 210/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8316 - ac
c: 0.8100
Epoch 211/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.8304 - ac
c: 0.8100
Epoch 212/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8291 - ac
c: 0.8100
Epoch 213/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8279 - ac
c: 0.8100
Epoch 214/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8267 - ac
c: 0.8100
Epoch 215/1000
1000/1000 [==============================] - 0s 36us/step - loss: 0.8255 - ac
c: 0.8110
Epoch 216/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8243 - ac
c: 0.8110
Epoch 217/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8231 - ac
c: 0.8110
Epoch 218/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8219 - ac
c: 0.8110
Epoch 219/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8207 - ac
c: 0.8110
Epoch 220/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8195 - ac
c: 0.8110
Epoch 221/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8183 - ac
c: 0.8110
Epoch 222/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8171 - ac
c: 0.8110
Epoch 223/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.8159 - ac
c: 0.8110
Epoch 224/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8148 - ac
c: 0.8110
Epoch 225/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8136 - ac
c: 0.8110
Epoch 226/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.8124 - ac
c: 0.8110
Epoch 227/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8113 - ac
c: 0.8110
Epoch 228/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8101 - ac
c: 0.8110
```

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Epoch 229/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8090 - ac
c: 0.8110
Epoch 230/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8078 - ac
c: 0.8110
Epoch 231/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8067 - ac
c: 0.8120
Epoch 232/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8055 - ac
c: 0.8120
Epoch 233/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8044 - ac
c: 0.8120
Epoch 234/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8033 - ac
c: 0.8120
Epoch 235/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.8022 - ac
c: 0.8120
Epoch 236/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.8010 - ac
c: 0.8120
Epoch 237/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7999 - ac
c: 0.8120
Epoch 238/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7988 - ac
c: 0.8120
Epoch 239/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7977 - ac
c: 0.8120
Epoch 240/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7966 - ac
c: 0.8120
Epoch 241/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7955 - ac
c: 0.8120
Epoch 242/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7944 - ac
c: 0.8120
Epoch 243/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7933 - ac
c: 0.8120
Epoch 244/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7922 - ac
c: 0.8120
Epoch 245/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7912 - ac
c: 0.8120
Epoch 246/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7901 - ac
c: 0.8120
Epoch 247/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7890 - ac
c: 0.8120
```

```
Epoch 248/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7879 - ac
c: 0.8120
Epoch 249/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7869 - ac
c: 0.8120
Epoch 250/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7858 - ac
c: 0.8120
Epoch 251/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7847 - ac
c: 0.8120
Epoch 252/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7837 - ac
c: 0.8120
Epoch 253/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7826 - ac
c: 0.8130
Epoch 254/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7816 - ac
c: 0.8130
Epoch 255/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7805 - ac
c: 0.8120
Epoch 256/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7795 - ac
c: 0.8120
Epoch 257/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7785 - ac
c: 0.8120
Epoch 258/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7774 - ac
c: 0.8120
Epoch 259/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7764 - ac
c: 0.8120
Epoch 260/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7754 - ac
c: 0.8120
Epoch 261/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7744 - ac
c: 0.8120
Epoch 262/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7733 - ac
c: 0.8120
Epoch 263/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7723 - ac
c: 0.8120
Epoch 264/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7713 - ac
c: 0.8120
Epoch 265/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7703 - ac
c: 0.8130
Epoch 266/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7693 - ac
c: 0.8130
```

```
Epoch 267/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7683 - ac
c: 0.8130
Epoch 268/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7673 - ac
c: 0.8130
Epoch 269/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7663 - ac
c: 0.8130
Epoch 270/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7653 - ac
c: 0.8130
Epoch 271/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7643 - ac
c: 0.8130
Epoch 272/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7633 - ac
c: 0.8130
Epoch 273/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7624 - ac
c: 0.8130
Epoch 274/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7614 - ac
c: 0.8130
Epoch 275/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7604 - ac
c: 0.8130
Epoch 276/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.7594 - ac
c: 0.8140
Epoch 277/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.7585 - ac
c: 0.8140
Epoch 278/1000
1000/1000 [==============================] - 0s 36us/step - loss: 0.7575 - ac
c: 0.8140
Epoch 279/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7565 - ac
c: 0.8140
Epoch 280/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.7556 - ac
c: 0.8140
Epoch 281/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7546 - ac
c: 0.8150
Epoch 282/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7537 - ac
c: 0.8150
Epoch 283/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7527 - ac
c: 0.8150
Epoch 284/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7518 - ac
c: 0.8150
Epoch 285/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.7508 - ac
c: 0.8150
```

```
Epoch 286/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.7499 - ac
c: 0.8150
Epoch 287/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.7490 - ac
c: 0.8150
Epoch 288/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7480 - ac
c: 0.8150
Epoch 289/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7471 - ac
c: 0.8150
Epoch 290/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7462 - ac
c: 0.8150
Epoch 291/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7453 - ac
c: 0.8150
Epoch 292/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7443 - ac
c: 0.8150
Epoch 293/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7434 - ac
c: 0.8150
Epoch 294/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7425 - ac
c: 0.8150
Epoch 295/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7416 - ac
c: 0.8150
Epoch 296/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7407 - ac
c: 0.8150
Epoch 297/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7398 - ac
c: 0.8150
Epoch 298/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7389 - ac
c: 0.8150
Epoch 299/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7380 - ac
c: 0.8150
Epoch 300/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7371 - ac
c: 0.8150
Epoch 301/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.7362 - ac
c: 0.8150
Epoch 302/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.7353 - ac
c: 0.8160
Epoch 303/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7344 - ac
c: 0.8160
Epoch 304/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7335 - ac
c: 0.8170
```

```
Epoch 305/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7327 - ac
c: 0.8170
Epoch 306/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7318 - ac
c: 0.8170
Epoch 307/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7309 - ac
c: 0.8170
Epoch 308/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.7300 - ac
c: 0.8170
Epoch 309/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7291 - ac
c: 0.8170
Epoch 310/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7283 - ac
c: 0.8170
Epoch 311/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.7274 - ac
c: 0.8180
Epoch 312/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.7266 - ac
c: 0.8180
Epoch 313/1000
1000/1000 [==============================] - 0s 32us/step - loss: 0.7257 - ac
c: 0.8180
Epoch 314/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7248 - ac
c: 0.8170
Epoch 315/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7240 - ac
c: 0.8170
Epoch 316/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7231 - ac
c: 0.8170
Epoch 317/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7223 - ac
c: 0.8170
Epoch 318/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7214 - ac
c: 0.8170
Epoch 319/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7206 - ac
c: 0.8170
Epoch 320/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7197 - ac
c: 0.8170
Epoch 321/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7189 - ac
c: 0.8170
Epoch 322/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7181 - ac
c: 0.8180
Epoch 323/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7172 - ac
c: 0.8200
```

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Epoch 324/1000
1000/1000 [==============================] - 0s 28us/step - loss: 0.7164 - ac
c: 0.8200
Epoch 325/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7156 - ac
c: 0.8200
Epoch 326/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7148 - ac
c: 0.8200
Epoch 327/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7139 - ac
c: 0.8200
Epoch 328/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7131 - ac
c: 0.8200
Epoch 329/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7123 - ac
c: 0.8200
Epoch 330/1000
1000/1000 [==============================] - 0s 32us/step - loss: 0.7115 - ac
c: 0.8200
Epoch 331/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.7107 - ac
c: 0.8200
Epoch 332/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.7099 - ac
c: 0.8210
Epoch 333/1000
1000/1000 [==============================] - 0s 2us/step - loss: 0.7090 - ac
c: 0.8210
Epoch 334/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7082 - ac
c: 0.8220
Epoch 335/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7074 - ac
c: 0.8220
Epoch 336/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.7066 - ac
c: 0.8220
Epoch 337/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7058 - ac
c: 0.8220
Epoch 338/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.7050 - ac
c: 0.8220
Epoch 339/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7042 - ac
c: 0.8220
Epoch 340/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.7035 - ac
c: 0.8220
Epoch 341/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.7027 - ac
c: 0.8220
Epoch 342/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.7019 - ac
c: 0.8220
```

```
Epoch 343/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.7011 - ac
c: 0.8220
Epoch 344/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.7003 - ac
c: 0.8220
Epoch 345/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.6995 - ac
c: 0.8220
Epoch 346/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6988 - ac
c: 0.8220
Epoch 347/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.6980 - ac
c: 0.8230
Epoch 348/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6972 - ac
c: 0.8230
Epoch 349/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.6964 - ac
c: 0.8230
Epoch 350/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6957 - ac
c: 0.8230
Epoch 351/1000
1000/1000 [==============================] - 0s 32us/step - loss: 0.6949 - ac
c: 0.8230
Epoch 352/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6941 - ac
c: 0.8230
Epoch 353/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6934 - ac
c: 0.8240
Epoch 354/1000
1000/1000 [==============================] - 0s 26us/step - loss: 0.6926 - ac
c: 0.8240
Epoch 355/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6919 - ac
c: 0.8240
Epoch 356/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.6911 - ac
c: 0.8240
Epoch 357/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.6904 - ac
c: 0.8240
Epoch 358/1000
1000/1000 [==============================] - 0s 77us/step - loss: 0.6896 - ac
c: 0.8250
Epoch 359/1000
1000/1000 [==============================] - 0s 24us/step - loss: 0.6889 - ac
c: 0.8250
Epoch 360/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6881 - ac
c: 0.8250
Epoch 361/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6874 - ac
c: 0.8250
```

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Epoch 362/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.6866 - ac
c: 0.8250
Epoch 363/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6859 - ac
c: 0.8250
Epoch 364/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6852 - ac
c: 0.8250
Epoch 365/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6844 - ac
c: 0.8250
Epoch 366/1000
1000/1000 [==============================] - 0s 41us/step - loss: 0.6837 - ac
c: 0.8250
Epoch 367/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.6830 - ac
c: 0.8250
Epoch 368/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.6822 - ac
c: 0.8250
Epoch 369/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6815 - ac
c: 0.8250
Epoch 370/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6808 - ac
c: 0.8240
Epoch 371/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6800 - ac
c: 0.8240
Epoch 372/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.6793 - ac
c: 0.8240
Epoch 373/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6786 - ac
c: 0.8240
Epoch 374/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.6779 - ac
c: 0.8240
Epoch 375/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.6772 - ac
c: 0.8240
Epoch 376/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6765 - ac
c: 0.8240
Epoch 377/1000
1000/1000 [==============================] - 0s 3us/step - loss: 0.6758 - ac
c: 0.8240
Epoch 378/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.6750 - ac
c: 0.8240
Epoch 379/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.6743 - ac
c: 0.8240
Epoch 380/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.6736 - ac
c: 0.8240
```

```
Epoch 381/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6729 - ac
c: 0.8240
Epoch 382/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6722 - ac
c: 0.8240
Epoch 383/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.6715 - ac
c: 0.8240
Epoch 384/1000
1000/1000 [==============================] - 0s 22us/step - loss: 0.6708 - ac
c: 0.8240
Epoch 385/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6701 - ac
c: 0.8240
Epoch 386/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.6694 - ac
c: 0.8240
Epoch 387/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.6688 - ac
c: 0.8240
Epoch 388/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.6681 - ac
c: 0.8240
Epoch 389/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.6674 - ac
c: 0.8240
Epoch 390/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.6667 - ac
c: 0.8240
Epoch 391/1000
1000/1000 [==============================] - 0s 27us/step - loss: 0.6660 - ac
c: 0.8240
Epoch 392/1000
1000/1000 [==============================] - 0s 32us/step - loss: 0.6653 - ac
c: 0.8240
Epoch 393/1000
1000/1000 [==============================] - 0s 35us/step - loss: 0.6646 - ac
c: 0.8240
Epoch 394/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6640 - ac
c: 0.8240
Epoch 395/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6633 - ac
c: 0.8240
Epoch 396/1000
1000/1000 [==============================] - 0s 36us/step - loss: 0.6626 - ac
c: 0.8240
Epoch 397/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6619 - ac
c: 0.8240
Epoch 398/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6613 - ac
c: 0.8240
Epoch 399/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6606 - ac
c: 0.8240
```

```
Epoch 400/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.6599 - ac
c: 0.8240
Epoch 401/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.6593 - ac
c: 0.8240
Epoch 402/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6586 - ac
c: 0.8240
Epoch 403/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6580 - ac
c: 0.8240
Epoch 404/1000
1000/1000 [==============================] - 0s 22us/step - loss: 0.6573 - ac
c: 0.8240
Epoch 405/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6566 - ac
c: 0.8240
Epoch 406/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6560 - ac
c: 0.8240
Epoch 407/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6553 - ac
c: 0.8240
Epoch 408/1000
1000/1000 [==============================] - 0s 2us/step - loss: 0.6547 - ac
c: 0.8240
Epoch 409/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6540 - ac
c: 0.8240
Epoch 410/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6534 - ac
c: 0.8240
Epoch 411/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6527 - ac
c: 0.8250
Epoch 412/1000
1000/1000 [==============================] - 0s 24us/step - loss: 0.6521 - ac
c: 0.8250
Epoch 413/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.6514 - ac
c: 0.8260
Epoch 414/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6508 - ac
c: 0.8260
Epoch 415/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.6502 - ac
c: 0.8260
Epoch 416/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.6495 - ac
c: 0.8260
Epoch 417/1000
1000/1000 [==============================] - 0s 31us/step - loss: 0.6489 - ac
c: 0.8260
Epoch 418/1000
1000/1000 [==============================] - 0s 28us/step - loss: 0.6482 - ac
c: 0.8260
```

```
Epoch 419/1000
1000/1000 [==============================] - 0s 24us/step - loss: 0.6476 - ac
c: 0.8260
Epoch 420/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6470 - ac
c: 0.8260
Epoch 421/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6463 - ac
c: 0.8260
Epoch 422/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6457 - ac
c: 0.8260
Epoch 423/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6451 - ac
c: 0.8260
Epoch 424/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6445 - ac
c: 0.8260
Epoch 425/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6438 - ac
c: 0.8260
Epoch 426/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6432 - ac
c: 0.8270
Epoch 427/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6426 - ac
c: 0.8270
Epoch 428/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6420 - ac
c: 0.8270
Epoch 429/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6414 - ac
c: 0.8270
Epoch 430/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6407 - ac
c: 0.8260
Epoch 431/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6401 - ac
c: 0.8260
Epoch 432/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6395 - ac
c: 0.8260
Epoch 433/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6389 - ac
c: 0.8260
Epoch 434/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6383 - ac
c: 0.8260
Epoch 435/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6377 - ac
c: 0.8260
Epoch 436/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6371 - ac
c: 0.8260
Epoch 437/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6365 - ac
c: 0.8260
```

```
Epoch 438/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6359 - ac
c: 0.8260
Epoch 439/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6353 - ac
c: 0.8260
Epoch 440/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6347 - ac
c: 0.8260
Epoch 441/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6341 - ac
c: 0.8260
Epoch 442/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.6335 - ac
c: 0.8260
Epoch 443/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6329 - ac
c: 0.8260
Epoch 444/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6323 - ac
c: 0.8260
Epoch 445/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6317 - ac
c: 0.8260
Epoch 446/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6311 - ac
c: 0.8260
Epoch 447/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6305 - ac
c: 0.8260
Epoch 448/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6299 - ac
c: 0.8260
Epoch 449/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6293 - ac
c: 0.8260
Epoch 450/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6288 - ac
c: 0.8260
Epoch 451/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6282 - ac
c: 0.8260
Epoch 452/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6276 - ac
c: 0.8260
Epoch 453/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6270 - ac
c: 0.8260
Epoch 454/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.6264 - ac
c: 0.8260
Epoch 455/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6259 - ac
c: 0.8260
Epoch 456/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6253 - ac
c: 0.8260
```

```
Epoch 457/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.6247 - ac
c: 0.8260
Epoch 458/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6241 - ac
c: 0.8260
Epoch 459/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6236 - ac
c: 0.8260
Epoch 460/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6230 - ac
c: 0.8260
Epoch 461/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6224 - ac
c: 0.8260
Epoch 462/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.6219 - ac
c: 0.8260
Epoch 463/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6213 - ac
c: 0.8260
Epoch 464/1000
1000/1000 [==============================] - 0s 22us/step - loss: 0.6207 - ac
c: 0.8270
Epoch 465/1000
1000/1000 [==============================] - 0s 30us/step - loss: 0.6202 - ac
c: 0.8270
Epoch 466/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.6196 - ac
c: 0.8270
Epoch 467/1000
1000/1000 [==============================] - 0s 33us/step - loss: 0.6190 - ac
c: 0.8270
Epoch 468/1000
1000/1000 [==============================] - 0s 26us/step - loss: 0.6185 - ac
c: 0.8270
Epoch 469/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.6179 - ac
c: 0.8270
Epoch 470/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6174 - ac
c: 0.8270
Epoch 471/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.6168 - ac
c: 0.8270
Epoch 472/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6163 - ac
c: 0.8270
Epoch 473/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6157 - ac
c: 0.8270
Epoch 474/1000
1000/1000 [==============================] - 0s 30us/step - loss: 0.6152 - ac
c: 0.8270
Epoch 475/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.6146 - ac
c: 0.8270
```

```
Epoch 476/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6141 - ac
c: 0.8270
Epoch 477/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.6135 - ac
c: 0.8270
Epoch 478/1000
1000/1000 [==============================] - 0s 34us/step - loss: 0.6130 - ac
c: 0.8270
Epoch 479/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6124 - ac
c: 0.8270
Epoch 480/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6119 - ac
c: 0.8280
Epoch 481/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6113 - ac
c: 0.8280
Epoch 482/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6108 - ac
c: 0.8280
Epoch 483/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6103 - ac
c: 0.8280
Epoch 484/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6097 - ac
c: 0.8280
Epoch 485/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6092 - ac
c: 0.8280
Epoch 486/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6086 - ac
c: 0.8280
Epoch 487/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.6081 - ac
c: 0.8280
Epoch 488/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6076 - ac
c: 0.8280
Epoch 489/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.6070 - ac
c: 0.8280
Epoch 490/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.6065 - ac
c: 0.8280
Epoch 491/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6060 - ac
c: 0.8280
Epoch 492/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6055 - ac
c: 0.8280
Epoch 493/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6049 - ac
c: 0.8280
Epoch 494/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6044 - ac
c: 0.8280
```

```
Epoch 495/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.6039 - ac
c: 0.8280
Epoch 496/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6034 - ac
c: 0.8280
Epoch 497/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.6028 - ac
c: 0.8280
Epoch 498/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.6023 - ac
c: 0.8280
Epoch 499/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6018 - ac
c: 0.8280
Epoch 500/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.6013 - ac
c: 0.8280
Epoch 501/1000
1000/1000 [==============================] - 0s 30us/step - loss: 0.6008 - ac
c: 0.8280
Epoch 502/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.6003 - ac
c: 0.8280
Epoch 503/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5997 - ac
c: 0.8290
Epoch 504/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5992 - ac
c: 0.8290
Epoch 505/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5987 - ac
c: 0.8290
Epoch 506/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5982 - ac
c: 0.8290
Epoch 507/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5977 - ac
c: 0.8290
Epoch 508/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5972 - ac
c: 0.8290
Epoch 509/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5967 - ac
c: 0.8290
Epoch 510/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5962 - ac
c: 0.8290
Epoch 511/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5957 - ac
c: 0.8290
Epoch 512/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5952 - ac
c: 0.8290
Epoch 513/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5947 - ac
c: 0.8290
```

```
Epoch 514/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5942 - ac
c: 0.8290
Epoch 515/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.5937 - ac
c: 0.8290
Epoch 516/1000
1000/1000 [==============================] - 0s 30us/step - loss: 0.5932 - ac
c: 0.8290
Epoch 517/1000
1000/1000 [==============================] - 0s 35us/step - loss: 0.5927 - ac
c: 0.8290
Epoch 518/1000
1000/1000 [==============================] - 0s 32us/step - loss: 0.5922 - ac
c: 0.8290
Epoch 519/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.5917 - ac
c: 0.8290
Epoch 520/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5912 - ac
c: 0.8290
Epoch 521/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.5907 - ac
c: 0.8290
Epoch 522/1000
1000/1000 [==============================] - 0s 32us/step - loss: 0.5902 - ac
c: 0.8290
Epoch 523/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5897 - ac
c: 0.8290
Epoch 524/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5892 - ac
c: 0.8290
Epoch 525/1000
1000/1000 [==============================] - 0s 51us/step - loss: 0.5887 - ac
c: 0.8290
Epoch 526/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5882 - ac
c: 0.8290
Epoch 527/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5878 - ac
c: 0.8290
Epoch 528/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.5873 - ac
c: 0.8290
Epoch 529/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5868 - ac
c: 0.8290
Epoch 530/1000
1000/1000 [==============================] - 0s 30us/step - loss: 0.5863 - ac
c: 0.8290
Epoch 531/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.5858 - ac
c: 0.8290
Epoch 532/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5853 - ac
c: 0.8290
```

```
Epoch 533/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5849 - ac
c: 0.8290
Epoch 534/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5844 - ac
c: 0.8290
Epoch 535/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5839 - ac
c: 0.8300
Epoch 536/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.5834 - ac
c: 0.8300
Epoch 537/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.5830 - ac
c: 0.8300
Epoch 538/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5825 - ac
c: 0.8300
Epoch 539/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5820 - ac
c: 0.8300
Epoch 540/1000
1000/1000 [==============================] - 0s 32us/step - loss: 0.5815 - ac
c: 0.8300
Epoch 541/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5811 - ac
c: 0.8300
Epoch 542/1000
1000/1000 [==============================] - 0s 34us/step - loss: 0.5806 - ac
c: 0.8300
Epoch 543/1000
1000/1000 [==============================] - 0s 28us/step - loss: 0.5801 - ac
c: 0.8300
Epoch 544/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5797 - ac
c: 0.8300
Epoch 545/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5792 - ac
c: 0.8300
Epoch 546/1000
1000/1000 [==============================] - 0s 22us/step - loss: 0.5787 - ac
c: 0.8310
Epoch 547/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5783 - ac
c: 0.8310
Epoch 548/1000
1000/1000 [==============================] - 0s 24us/step - loss: 0.5778 - ac
c: 0.8310
Epoch 549/1000
1000/1000 [==============================] - 0s 30us/step - loss: 0.5773 - ac
c: 0.8310
Epoch 550/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.5769 - ac
c: 0.8310
Epoch 551/1000
1000/1000 [==============================] - 0s 35us/step - loss: 0.5764 - ac
c: 0.8310
```

```
Epoch 552/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5760 - ac
c: 0.8310
Epoch 553/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5755 - ac
c: 0.8310
Epoch 554/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5750 - ac
c: 0.8310
Epoch 555/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.5746 - ac
c: 0.8310
Epoch 556/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5741 - ac
c: 0.8310
Epoch 557/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5737 - ac
c: 0.8310
Epoch 558/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5732 - ac
c: 0.8310
Epoch 559/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5728 - ac
c: 0.8310
Epoch 560/1000
1000/1000 [==============================] - 0s 69us/step - loss: 0.5723 - ac
c: 0.8310
Epoch 561/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5719 - ac
c: 0.8310
Epoch 562/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5714 - ac
c: 0.8310
Epoch 563/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5710 - ac
c: 0.8310
Epoch 564/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5705 - ac
c: 0.8310
Epoch 565/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5701 - ac
c: 0.8310
Epoch 566/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.5696 - ac
c: 0.8320
Epoch 567/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5692 - ac
c: 0.8340
Epoch 568/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5687 - ac
c: 0.8340
Epoch 569/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5683 - ac
c: 0.8340
Epoch 570/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5679 - ac
c: 0.8340
```

```
Epoch 571/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5674 - ac
c: 0.8350
Epoch 572/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.5670 - ac
c: 0.8350
Epoch 573/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5665 - ac
c: 0.8350
Epoch 574/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5661 - ac
c: 0.8370
Epoch 575/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5657 - ac
c: 0.8370
Epoch 576/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5652 - ac
c: 0.8370
Epoch 577/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.5648 - ac
c: 0.8370
Epoch 578/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5644 - ac
c: 0.8370
Epoch 579/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5639 - ac
c: 0.8370
Epoch 580/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5635 - ac
c: 0.8380
Epoch 581/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5631 - ac
c: 0.8380
Epoch 582/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5626 - ac
c: 0.8380
Epoch 583/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5622 - ac
c: 0.8380
Epoch 584/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.5618 - ac
c: 0.8390
Epoch 585/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5614 - ac
c: 0.8390
Epoch 586/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5609 - ac
c: 0.8390
Epoch 587/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5605 - ac
c: 0.8400
Epoch 588/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5601 - ac
c: 0.8400
Epoch 589/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5597 - ac
c: 0.8400
```

```
Epoch 590/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5592 - ac
c: 0.8400
Epoch 591/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5588 - ac
c: 0.8400
Epoch 592/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5584 - ac
c: 0.8400
Epoch 593/1000
1000/1000 [==============================] - 0s 70us/step - loss: 0.5580 - ac
c: 0.8400
Epoch 594/1000
1000/1000 [==============================] - 0s 49us/step - loss: 0.5575 - ac
c: 0.8400
Epoch 595/1000
1000/1000 [==============================] - 0s 27us/step - loss: 0.5571 - ac
c: 0.8400
Epoch 596/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5567 - ac
c: 0.8400
Epoch 597/1000
1000/1000 [==============================] - 0s 33us/step - loss: 0.5563 - ac
c: 0.8400
Epoch 598/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5559 - ac
c: 0.8400
Epoch 599/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5555 - ac
c: 0.8400
Epoch 600/1000
1000/1000 [==============================] - 0s 37us/step - loss: 0.5550 - ac
c: 0.8400
Epoch 601/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5546 - ac
c: 0.8400
Epoch 602/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5542 - ac
c: 0.8400
Epoch 603/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5538 - ac
c: 0.8400
Epoch 604/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5534 - ac
c: 0.8400
Epoch 605/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.5530 - ac
c: 0.8400
Epoch 606/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5526 - ac
c: 0.8400
Epoch 607/1000
1000/1000 [==============================] - 0s 28us/step - loss: 0.5522 - ac
c: 0.8400
Epoch 608/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5518 - ac
c: 0.8400
```

```
Epoch 609/1000
1000/1000 [==============================] - 0s 24us/step - loss: 0.5514 - ac
c: 0.8420
Epoch 610/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.5510 - ac
c: 0.8420
Epoch 611/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5506 - ac
c: 0.8420
Epoch 612/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5501 - ac
c: 0.8420
Epoch 613/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5497 - ac
c: 0.8420
Epoch 614/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5493 - ac
c: 0.8420
Epoch 615/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5489 - ac
c: 0.8420
Epoch 616/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5485 - ac
c: 0.8420
Epoch 617/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5481 - ac
c: 0.8420
Epoch 618/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5477 - ac
c: 0.8420
Epoch 619/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5473 - ac
c: 0.8410
Epoch 620/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5470 - ac
c: 0.8410
Epoch 621/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5466 - ac
c: 0.8410
Epoch 622/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5462 - ac
c: 0.8420
Epoch 623/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5458 - ac
c: 0.8420
Epoch 624/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.5454 - ac
c: 0.8420
Epoch 625/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5450 - ac
c: 0.8420
Epoch 626/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5446 - ac
c: 0.8420
Epoch 627/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5442 - ac
c: 0.8430
```

```
Epoch 628/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5438 - ac
c: 0.8430
Epoch 629/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5434 - ac
c: 0.8430
Epoch 630/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5430 - ac
c: 0.8440
Epoch 631/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.5426 - ac
c: 0.8440
Epoch 632/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5423 - ac
c: 0.8440
Epoch 633/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5419 - ac
c: 0.8440
Epoch 634/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5415 - ac
c: 0.8450
Epoch 635/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5411 - ac
c: 0.8450
Epoch 636/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.5407 - ac
c: 0.8450
Epoch 637/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5403 - ac
c: 0.8460
Epoch 638/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.5399 - ac
c: 0.8460
Epoch 639/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5396 - ac
c: 0.8460
Epoch 640/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.5392 - ac
c: 0.8460
Epoch 641/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5388 - ac
c: 0.8470
Epoch 642/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5384 - ac
c: 0.8470
Epoch 643/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5380 - ac
c: 0.8470
Epoch 644/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5377 - ac
c: 0.8470
Epoch 645/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5373 - ac
c: 0.8470
Epoch 646/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5369 - ac
c: 0.8480
```

```
Epoch 647/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5365 - ac
c: 0.8480
Epoch 648/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5362 - ac
c: 0.8480
Epoch 649/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.5358 - ac
c: 0.8480
Epoch 650/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.5354 - ac
c: 0.8480
Epoch 651/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5350 - ac
c: 0.8480
Epoch 652/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5347 - ac
c: 0.8490
Epoch 653/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5343 - ac
c: 0.8500
Epoch 654/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5339 - ac
c: 0.8500
Epoch 655/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5336 - ac
c: 0.8500
Epoch 656/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5332 - ac
c: 0.8500
Epoch 657/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5328 - ac
c: 0.8500
Epoch 658/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5325 - ac
c: 0.8500
Epoch 659/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5321 - ac
c: 0.8500
Epoch 660/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5317 - ac
c: 0.8510
Epoch 661/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5314 - ac
c: 0.8510
Epoch 662/1000
1000/1000 [==============================] - 0s 22us/step - loss: 0.5310 - ac
c: 0.8510
Epoch 663/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5306 - ac
c: 0.8510
Epoch 664/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5303 - ac
c: 0.8510
Epoch 665/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5299 - ac
c: 0.8520
```

```
Epoch 666/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5295 - ac
c: 0.8520
Epoch 667/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5292 - ac
c: 0.8520
Epoch 668/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5288 - ac
c: 0.8530
Epoch 669/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5285 - ac
c: 0.8530
Epoch 670/1000
1000/1000 [==============================] - 0s 25us/step - loss: 0.5281 - ac
c: 0.8530
Epoch 671/1000
1000/1000 [==============================] - 0s 67us/step - loss: 0.5277 - ac
c: 0.8530
Epoch 672/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5274 - ac
c: 0.8530
Epoch 673/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5270 - ac
c: 0.8530
Epoch 674/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5267 - ac
c: 0.8530
Epoch 675/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.5263 - ac
c: 0.8530
Epoch 676/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.5260 - ac
c: 0.8530
Epoch 677/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5256 - ac
c: 0.8530
Epoch 678/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.5253 - ac
c: 0.8530
Epoch 679/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.5249 - ac
c: 0.8530
Epoch 680/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5245 - ac
c: 0.8540
Epoch 681/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5242 - ac
c: 0.8560
Epoch 682/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5238 - ac
c: 0.8560
Epoch 683/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5235 - ac
c: 0.8560
Epoch 684/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.5231 - ac
c: 0.8560
```

```
Epoch 685/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5228 - ac
c: 0.8560
Epoch 686/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.5225 - ac
c: 0.8560
Epoch 687/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5221 - ac
c: 0.8560
Epoch 688/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5218 - ac
c: 0.8560
Epoch 689/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.5214 - ac
c: 0.8560
Epoch 690/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.5211 - ac
c: 0.8560
Epoch 691/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5207 - ac
c: 0.8560
Epoch 692/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.5204 - ac
c: 0.8560
Epoch 693/1000
1000/1000 [==============================] - 0s 22us/step - loss: 0.5200 - ac
c: 0.8560
Epoch 694/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5197 - ac
c: 0.8560
Epoch 695/1000
1000/1000 [==============================] - 0s 22us/step - loss: 0.5194 - ac
c: 0.8560
Epoch 696/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5190 - ac
c: 0.8560
Epoch 697/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.5187 - ac
c: 0.8560
Epoch 698/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5183 - ac
c: 0.8560
Epoch 699/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5180 - ac
c: 0.8560
Epoch 700/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.5177 - ac
c: 0.8560
Epoch 701/1000
1000/1000 [==============================] - 0s 2us/step - loss: 0.5173 - ac
c: 0.8560
Epoch 702/1000
1000/1000 [==============================] - 0s 3us/step - loss: 0.5170 - ac
c: 0.8560
Epoch 703/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5166 - ac
c: 0.8560
```

```
Epoch 704/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5163 - ac
c: 0.8560
Epoch 705/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.5160 - ac
c: 0.8560
Epoch 706/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5156 - ac
c: 0.8560
Epoch 707/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5153 - ac
c: 0.8560
Epoch 708/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.5150 - ac
c: 0.8560
Epoch 709/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5146 - ac
c: 0.8560
Epoch 710/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5143 - ac
c: 0.8560
Epoch 711/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5140 - ac
c: 0.8560
Epoch 712/1000
1000/1000 [==============================] - 0s 2us/step - loss: 0.5136 - ac
c: 0.8560
Epoch 713/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5133 - ac
c: 0.8560
Epoch 714/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5130 - ac
c: 0.8560
Epoch 715/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5127 - ac
c: 0.8560
Epoch 716/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5123 - ac
c: 0.8570
Epoch 717/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5120 - ac
c: 0.8570
Epoch 718/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5117 - ac
c: 0.8570
Epoch 719/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5113 - ac
c: 0.8570
Epoch 720/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5110 - ac
c: 0.8570
Epoch 721/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5107 - ac
c: 0.8570
Epoch 722/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5104 - ac
c: 0.8570
```

```
Epoch 723/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5100 - ac
c: 0.8570
Epoch 724/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5097 - ac
c: 0.8560
Epoch 725/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5094 - ac
c: 0.8560
Epoch 726/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.5091 - ac
c: 0.8560
Epoch 727/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.5088 - ac
c: 0.8570
Epoch 728/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.5084 - ac
c: 0.8570
Epoch 729/1000
1000/1000 [==============================] - 0s 1us/step - loss: 0.5081 - ac
c: 0.8570
Epoch 730/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.5078 - ac
c: 0.8570
Epoch 731/1000
1000/1000 [==============================] - 0s 2us/step - loss: 0.5075 - ac
c: 0.8580
Epoch 732/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.5072 - ac
c: 0.8590
Epoch 733/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.5068 - ac
c: 0.8600
Epoch 734/1000
1000/1000 [==============================] - 0s 2us/step - loss: 0.5065 - ac
c: 0.8600
Epoch 735/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5062 - ac
c: 0.8600
Epoch 736/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.5059 - ac
c: 0.8600
Epoch 737/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5056 - ac
c: 0.8610
Epoch 738/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5053 - ac
c: 0.8610
Epoch 739/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5049 - ac
c: 0.8610
Epoch 740/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5046 - ac
c: 0.8610
Epoch 741/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5043 - ac
c: 0.8610
```

```
Epoch 742/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.5040 - ac
c: 0.8610
Epoch 743/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5037 - ac
c: 0.8610
Epoch 744/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5034 - ac
c: 0.8610
Epoch 745/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5031 - ac
c: 0.8610
Epoch 746/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5028 - ac
c: 0.8610
Epoch 747/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5024 - ac
c: 0.8610
Epoch 748/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5021 - ac
c: 0.8610
Epoch 749/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5018 - ac
c: 0.8610
Epoch 750/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5015 - ac
c: 0.8610
Epoch 751/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5012 - ac
c: 0.8610
Epoch 752/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5009 - ac
c: 0.8600
Epoch 753/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5006 - ac
c: 0.8600
Epoch 754/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.5003 - ac
c: 0.8600
Epoch 755/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.5000 - ac
c: 0.8600
Epoch 756/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4997 - ac
c: 0.8600
Epoch 757/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4994 - ac
c: 0.8600
Epoch 758/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4991 - ac
c: 0.8600
Epoch 759/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4988 - ac
c: 0.8600
Epoch 760/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4985 - ac
c: 0.8600
```

```
Epoch 761/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4982 - ac
c: 0.8610
Epoch 762/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4979 - ac
c: 0.8610
Epoch 763/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4976 - ac
c: 0.8610
Epoch 764/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4973 - ac
c: 0.8610
Epoch 765/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4970 - ac
c: 0.8610
Epoch 766/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4967 - ac
c: 0.8620
Epoch 767/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4964 - ac
c: 0.8620
Epoch 768/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4961 - ac
c: 0.8620
Epoch 769/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4958 - ac
c: 0.8620
Epoch 770/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.4955 - ac
c: 0.8620
Epoch 771/1000
1000/1000 [==============================] - 0s 3us/step - loss: 0.4952 - ac
c: 0.8620
Epoch 772/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4949 - ac
c: 0.8620
Epoch 773/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4946 - ac
c: 0.8620
Epoch 774/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4943 - ac
c: 0.8620
Epoch 775/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4940 - ac
c: 0.8620
Epoch 776/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4937 - ac
c: 0.8620
Epoch 777/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4934 - ac
c: 0.8620
Epoch 778/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4931 - ac
c: 0.8620
Epoch 779/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4928 - ac
c: 0.8620
```

```
Epoch 780/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4925 - ac
c: 0.8620
Epoch 781/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4922 - ac
c: 0.8620
Epoch 782/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4920 - ac
c: 0.8620
Epoch 783/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4917 - ac
c: 0.8620
Epoch 784/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4914 - ac
c: 0.8620
Epoch 785/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4911 - ac
c: 0.8620
Epoch 786/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4908 - ac
c: 0.8620
Epoch 787/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4905 - ac
c: 0.8620
Epoch 788/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4902 - ac
c: 0.8620
Epoch 789/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4899 - ac
c: 0.8620
Epoch 790/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4896 - ac
c: 0.8620
Epoch 791/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.4894 - ac
c: 0.8630
Epoch 792/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.4891 - ac
c: 0.8630
Epoch 793/1000
1000/1000 [==============================] - 0s 26us/step - loss: 0.4888 - ac
c: 0.8630
Epoch 794/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.4885 - ac
c: 0.8630
Epoch 795/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4882 - ac
c: 0.8630
Epoch 796/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4879 - ac
c: 0.8640
Epoch 797/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4877 - ac
c: 0.8640
Epoch 798/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.4874 - ac
c: 0.8640
```

```
Epoch 799/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4871 - ac
c: 0.8640
Epoch 800/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4868 - ac
c: 0.8650
Epoch 801/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4865 - ac
c: 0.8650
Epoch 802/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4862 - ac
c: 0.8650
Epoch 803/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4860 - ac
c: 0.8650
Epoch 804/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.4857 - ac
c: 0.8650
Epoch 805/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4854 - ac
c: 0.8650
Epoch 806/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4851 - ac
c: 0.8650
Epoch 807/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4848 - ac
c: 0.8650
Epoch 808/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.4846 - ac
c: 0.8650
Epoch 809/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4843 - ac
c: 0.8650
Epoch 810/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4840 - ac
c: 0.8650
Epoch 811/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4837 - ac
c: 0.8650
Epoch 812/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4835 - ac
c: 0.8650
Epoch 813/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.4832 - ac
c: 0.8650
Epoch 814/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4829 - ac
c: 0.8650
Epoch 815/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4826 - ac
c: 0.8660
Epoch 816/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.4824 - ac
c: 0.8660
Epoch 817/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4821 - ac
c: 0.8660
```

```
Epoch 818/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4818 - ac
c: 0.8660
Epoch 819/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4815 - ac
c: 0.8660
Epoch 820/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4813 - ac
c: 0.8660
Epoch 821/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4810 - ac
c: 0.8660
Epoch 822/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4807 - ac
c: 0.8660
Epoch 823/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4805 - ac
c: 0.8660
Epoch 824/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4802 - ac
c: 0.8660
Epoch 825/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4799 - ac
c: 0.8660
Epoch 826/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4797 - ac
c: 0.8660
Epoch 827/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.4794 - ac
c: 0.8660
Epoch 828/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4791 - ac
c: 0.8660
Epoch 829/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4788 - ac
c: 0.8660
Epoch 830/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4786 - ac
c: 0.8660
Epoch 831/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.4783 - ac
c: 0.8660
Epoch 832/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4780 - ac
c: 0.8660
Epoch 833/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4778 - ac
c: 0.8660
Epoch 834/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4775 - ac
c: 0.8660
Epoch 835/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4773 - ac
c: 0.8660
Epoch 836/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4770 - ac
c: 0.8660
```

```
Epoch 837/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.4767 - ac
c: 0.8660
Epoch 838/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4765 - ac
c: 0.8660
Epoch 839/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4762 - ac
c: 0.8660
Epoch 840/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4759 - ac
c: 0.8660
Epoch 841/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4757 - ac
c: 0.8660
Epoch 842/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4754 - ac
c: 0.8660
Epoch 843/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4751 - ac
c: 0.8660
Epoch 844/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4749 - ac
c: 0.8660
Epoch 845/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4746 - ac
c: 0.8660
Epoch 846/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4744 - ac
c: 0.8660
Epoch 847/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4741 - ac
c: 0.8660
Epoch 848/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4738 - ac
c: 0.8660
Epoch 849/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4736 - ac
c: 0.8670
Epoch 850/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4733 - ac
c: 0.8670
Epoch 851/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4731 - ac
c: 0.8670
Epoch 852/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4728 - ac
c: 0.8670
Epoch 853/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4726 - ac
c: 0.8670
Epoch 854/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4723 - ac
c: 0.8670
Epoch 855/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4720 - ac
c: 0.8670
```

```
Epoch 856/1000
1000/1000 [==============================] - 0s 26us/step - loss: 0.4718 - ac
c: 0.8660
Epoch 857/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4715 - ac
c: 0.8660
Epoch 858/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4713 - ac
c: 0.8660
Epoch 859/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4710 - ac
c: 0.8660
Epoch 860/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4708 - ac
c: 0.8660
Epoch 861/1000
1000/1000 [==============================] - 0s 32us/step - loss: 0.4705 - ac
c: 0.8670
Epoch 862/1000
1000/1000 [==============================] - 0s 29us/step - loss: 0.4703 - ac
c: 0.8670
Epoch 863/1000
1000/1000 [==============================] - 0s 23us/step - loss: 0.4700 - ac
c: 0.8670
Epoch 864/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4698 - ac
c: 0.8670
Epoch 865/1000
1000/1000 [==============================] - 0s 25us/step - loss: 0.4695 - ac
c: 0.8670
Epoch 866/1000
1000/1000 [==============================] - 0s 22us/step - loss: 0.4693 - ac
c: 0.8670
Epoch 867/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.4690 - ac
c: 0.8670
Epoch 868/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.4688 - ac
c: 0.8670
Epoch 869/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.4685 - ac
c: 0.8670
Epoch 870/1000
1000/1000 [==============================] - 0s 22us/step - loss: 0.4683 - ac
c: 0.8680
Epoch 871/1000
1000/1000 [==============================] - 0s 30us/step - loss: 0.4680 - ac
c: 0.8680
Epoch 872/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4678 - ac
c: 0.8680
Epoch 873/1000
1000/1000 [==============================] - 0s 26us/step - loss: 0.4675 - ac
c: 0.8680
Epoch 874/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.4673 - ac
c: 0.8690
```

```
Epoch 875/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.4670 - ac
c: 0.8690
Epoch 876/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4668 - ac
c: 0.8700
Epoch 877/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.4665 - ac
c: 0.8700
Epoch 878/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.4663 - ac
c: 0.8700
Epoch 879/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4660 - ac
c: 0.8700
Epoch 880/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4658 - ac
c: 0.8700
Epoch 881/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4655 - ac
c: 0.8700
Epoch 882/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4653 - ac
c: 0.8700
Epoch 883/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.4650 - ac
c: 0.8700
Epoch 884/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.4648 - ac
c: 0.8700
Epoch 885/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4646 - ac
c: 0.8700
Epoch 886/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.4643 - ac
c: 0.8700
Epoch 887/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.4641 - ac
c: 0.8700
Epoch 888/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4638 - ac
c: 0.8700
Epoch 889/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4636 - ac
c: 0.8700
Epoch 890/1000
1000/1000 [==============================] - 0s 24us/step - loss: 0.4633 - ac
c: 0.8700
Epoch 891/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4631 - ac
c: 0.8710
Epoch 892/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4629 - ac
c: 0.8710
Epoch 893/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4626 - ac
c: 0.8710
```

```
Epoch 894/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4624 - ac
c: 0.8710
Epoch 895/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.4621 - ac
c: 0.8720
Epoch 896/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.4619 - ac
c: 0.8720
Epoch 897/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.4617 - ac
c: 0.8710
Epoch 898/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4614 - ac
c: 0.8710
Epoch 899/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.4612 - ac
c: 0.8720
Epoch 900/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4610 - ac
c: 0.8720
Epoch 901/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4607 - ac
c: 0.8720
Epoch 902/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4605 - ac
c: 0.8720
Epoch 903/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4602 - ac
c: 0.8720
Epoch 904/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4600 - ac
c: 0.8720
Epoch 905/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4598 - ac
c: 0.8730
Epoch 906/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4595 - ac
c: 0.8730
Epoch 907/1000
1000/1000 [==============================] - 0s 27us/step - loss: 0.4593 - ac
c: 0.8730
Epoch 908/1000
1000/1000 [==============================] - 0s 64us/step - loss: 0.4591 - ac
c: 0.8730
Epoch 909/1000
1000/1000 [==============================] - 0s 25us/step - loss: 0.4588 - ac
c: 0.8730
Epoch 910/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4586 - ac
c: 0.8730
Epoch 911/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4584 - ac
c: 0.8730
Epoch 912/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4581 - ac
c: 0.8730
```

```
Epoch 913/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4579 - ac
c: 0.8740
Epoch 914/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4577 - ac
c: 0.8740
Epoch 915/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4574 - ac
c: 0.8740
Epoch 916/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.4572 - ac
c: 0.8740
Epoch 917/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4570 - ac
c: 0.8740
Epoch 918/1000
1000/1000 [==============================] - 0s 11us/step - loss: 0.4567 - ac
c: 0.8740
Epoch 919/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.4565 - ac
c: 0.8740
Epoch 920/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4563 - ac
c: 0.8740
Epoch 921/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4561 - ac
c: 0.8740
Epoch 922/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4558 - ac
c: 0.8740
Epoch 923/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4556 - ac
c: 0.8740
Epoch 924/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.4554 - ac
c: 0.8740
Epoch 925/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.4551 - ac
c: 0.8740
Epoch 926/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.4549 - ac
c: 0.8740
Epoch 927/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4547 - ac
c: 0.8740
Epoch 928/1000
1000/1000 [==============================] - 0s 12us/step - loss: 0.4545 - ac
c: 0.8740
Epoch 929/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.4542 - ac
c: 0.8740
Epoch 930/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.4540 - ac
c: 0.8740
Epoch 931/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.4538 - ac
c: 0.8740
```

```
Epoch 932/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4535 - ac
c: 0.8740
Epoch 933/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4533 - ac
c: 0.8740
Epoch 934/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4531 - ac
c: 0.8740
Epoch 935/1000
1000/1000 [==============================] - 0s 17us/step - loss: 0.4529 - ac
c: 0.8740
Epoch 936/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4526 - ac
c: 0.8740
Epoch 937/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4524 - ac
c: 0.8740
Epoch 938/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4522 - ac
c: 0.8740
Epoch 939/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4520 - ac
c: 0.8740
Epoch 940/1000
1000/1000 [==============================] - 0s 13us/step - loss: 0.4518 - ac
c: 0.8740
Epoch 941/1000
1000/1000 [==============================] - 0s 19us/step - loss: 0.4515 - ac
c: 0.8740
Epoch 942/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4513 - ac
c: 0.8740
Epoch 943/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4511 - ac
c: 0.8740
Epoch 944/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4509 - ac
c: 0.8750
Epoch 945/1000
1000/1000 [==============================] - 0s 16us/step - loss: 0.4506 - ac
c: 0.8750
Epoch 946/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4504 - ac
c: 0.8750
Epoch 947/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4502 - ac
c: 0.8750
Epoch 948/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4500 - ac
c: 0.8750
Epoch 949/1000
1000/1000 [==============================] - 0s 20us/step - loss: 0.4498 - ac
c: 0.8750
Epoch 950/1000
1000/1000 [==============================] - 0s 18us/step - loss: 0.4495 - ac
c: 0.8750
```

```
Epoch 951/1000
1000/1000 [==============================] - 0s 15us/step - loss: 0.4493 - ac
c: 0.8750
Epoch 952/1000
1000/1000 [==============================] - 0s 14us/step - loss: 0.4491 - ac
c: 0.8750
Epoch 953/1000
1000/1000 [==============================] - 0s 21us/step - loss: 0.4489 - ac
c: 0.8750
Epoch 954/1000
1000/1000 [==============================] - 0s 10us/step - loss: 0.4487 - ac
c: 0.8750
Epoch 955/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4485 - ac
c: 0.8750
Epoch 956/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4482 - ac
c: 0.8750
Epoch 957/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4480 - ac
c: 0.8750
Epoch 958/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4478 - ac
c: 0.8750
Epoch 959/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4476 - ac
c: 0.8760
Epoch 960/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4474 - ac
c: 0.8760
Epoch 961/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4472 - ac
c: 0.8760
Epoch 962/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4469 - ac
c: 0.8760
Epoch 963/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4467 - ac
c: 0.8760
Epoch 964/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4465 - ac
c: 0.8760
Epoch 965/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4463 - ac
c: 0.8760
Epoch 966/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4461 - ac
c: 0.8760
Epoch 967/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4459 - ac
c: 0.8760
Epoch 968/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4457 - ac
c: 0.8760
Epoch 969/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4454 - ac
c: 0.8760
```

```
Epoch 970/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4452 - ac
c: 0.8760
Epoch 971/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4450 - ac
c: 0.8760
Epoch 972/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4448 - ac
c: 0.8760
Epoch 973/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4446 - ac
c: 0.8760
Epoch 974/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4444 - ac
c: 0.8760
Epoch 975/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4442 - ac
c: 0.8760
Epoch 976/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4440 - ac
c: 0.8760
Epoch 977/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4438 - ac
c: 0.8760
Epoch 978/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4435 - ac
c: 0.8760
Epoch 979/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4433 - ac
c: 0.8760
Epoch 980/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4431 - ac
c: 0.8760
Epoch 981/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4429 - ac
c: 0.8760
Epoch 982/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4427 - ac
c: 0.8760
Epoch 983/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4425 - ac
c: 0.8760
Epoch 984/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4423 - ac
c: 0.8760
Epoch 985/1000
1000/1000 [==============================] - 0s 9us/step - loss: 0.4421 - ac
c: 0.8760
Epoch 986/1000
1000/1000 [==============================] - 0s 6us/step - loss: 0.4419 - ac
c: 0.8760
Epoch 987/1000
1000/1000 [==============================] - 0s 7us/step - loss: 0.4417 - ac
c: 0.8760
Epoch 988/1000
1000/1000 [==============================] - 0s 2us/step - loss: 0.4415 - ac
c: 0.8760
```

```
Epoch 989/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4413 - ac
c: 0.8760
Epoch 990/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4410 - ac
c: 0.8760
Epoch 991/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4408 - ac
c: 0.8760
Epoch 992/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4406 - ac
c: 0.8760
Epoch 993/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4404 - ac
c: 0.8760
Epoch 994/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4402 - ac
c: 0.8760
Epoch 995/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4400 - ac
c: 0.8760
Epoch 996/1000
1000/1000 [==============================] - 0s 8us/step - loss: 0.4398 - ac
c: 0.8760
Epoch 997/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4396 - ac
c: 0.8760
Epoch 998/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4394 - ac
c: 0.8760
Epoch 999/1000
1000/1000 [==============================] - 0s 4us/step - loss: 0.4392 - ac
c: 0.8760
Epoch 1000/1000
1000/1000 [==============================] - 0s 5us/step - loss: 0.4390 - ac
c: 0.8760
10000/10000 [==============================] - 1s 94us/step
```

In [203]:
```python
print("The minimum error obtained by applying the above obtained optimal numbe
r of perceptrons is {}".format(1-accuracy2[1]))
```

The minimum error obtained by applying the above obtained optimal number of p
erceptrons is 0.11850000000000005

10000 dataset:

In [204]:
```python
best_score_3, best_param_3, mean_3, std_3, param_3 = training(M, N3, data3, tr
ue_label3, true_prob3)
```

In [205]:
```python
print("The optimal number of perceptrons for minimum error of {} is obtained a
s {}".format(1-best_score_3, best_param_3))
```

The optimal number of perceptrons for minimum error of 0.18719999790191655 is
obtained as {'M': 38}

In [206]:
```python
for mean, stdev, param in zip(mean_3, std_3, param_3):
    print("%f (%f) with: %r" % (mean, stdev, param))
```

```
0.643000 (0.015646) with: {'M': 6}
0.673400 (0.031516) with: {'M': 10}
0.701000 (0.046682) with: {'M': 14}
0.729100 (0.022179) with: {'M': 18}
0.769600 (0.022504) with: {'M': 22}
0.795600 (0.015448) with: {'M': 26}
0.792700 (0.016389) with: {'M': 30}
0.810200 (0.020851) with: {'M': 34}
0.812800 (0.014709) with: {'M': 38}
```

In [207]:
```python
best_param_3 = best_param_3.get('M')
```

```
In [208]: accuracy3 = neural(data3, true_prob3, data, true_prob, best_param_3, N3)
```

```
Epoch 1/1000
10000/10000 [==============================] - 2s 174us/step - loss: 1.7140 -
acc: 0.1723
Epoch 2/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.6952 - a
cc: 0.1686
Epoch 3/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.6769 - a
cc: 0.1660
Epoch 4/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.6593 - a
cc: 0.1635
Epoch 5/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.6422 - a
cc: 0.1607
Epoch 6/1000
10000/10000 [==============================] - 0s 3us/step - loss: 1.6257 - a
cc: 0.1586
Epoch 7/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.6096 - a
cc: 0.1554
Epoch 8/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.5941 - a
cc: 0.1546
Epoch 9/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.5791 - a
cc: 0.1541
Epoch 10/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.5645 - a
cc: 0.1543
Epoch 11/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.5504 - a
cc: 0.1528
Epoch 12/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.5368 - a
cc: 0.1537
Epoch 13/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.5236 - a
cc: 0.1525
Epoch 14/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.5108 - a
cc: 0.1529
Epoch 15/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.4983 - a
cc: 0.1559
Epoch 16/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.4863 - a
cc: 0.1566
Epoch 17/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.4747 - a
cc: 0.1579
Epoch 18/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.4634 - a
cc: 0.1595
Epoch 19/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.4524 - a
cc: 0.1606
```

```
Epoch 20/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.4418 - a
cc: 0.1625
Epoch 21/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.4316 - a
cc: 0.1651
Epoch 22/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.4216 - a
cc: 0.1679
Epoch 23/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.4119 - a
cc: 0.1690
Epoch 24/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.4025 - a
cc: 0.1711
Epoch 25/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.3934 - a
cc: 0.1741
Epoch 26/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.3846 - a
cc: 0.1770
Epoch 27/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.3760 - a
cc: 0.1815
Epoch 28/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.3677 - a
cc: 0.1844
Epoch 29/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.3596 - a
cc: 0.1867
Epoch 30/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.3517 - a
cc: 0.1909
Epoch 31/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.3441 - a
cc: 0.1947
Epoch 32/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.3367 - a
cc: 0.1972
Epoch 33/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.3294 - a
cc: 0.1983
Epoch 34/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.3224 - a
cc: 0.2029
Epoch 35/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.3156 - a
cc: 0.2064
Epoch 36/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.3089 - a
cc: 0.2117
Epoch 37/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.3025 - a
cc: 0.2170
Epoch 38/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.2961 - a
cc: 0.2247
```

```
Epoch 39/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.2900 - a
cc: 0.2348
Epoch 40/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2840 - a
cc: 0.2435
Epoch 41/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2781 - a
cc: 0.2582
Epoch 42/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2724 - a
cc: 0.2749
Epoch 43/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2669 - a
cc: 0.2927
Epoch 44/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2614 - a
cc: 0.3137
Epoch 45/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2561 - a
cc: 0.3331
Epoch 46/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2509 - a
cc: 0.3570
Epoch 47/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2458 - a
cc: 0.3759
Epoch 48/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.2409 - a
cc: 0.3945
Epoch 49/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2360 - a
cc: 0.4173
Epoch 50/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2312 - a
cc: 0.4345
Epoch 51/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2266 - a
cc: 0.4535
Epoch 52/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.2220 - a
cc: 0.4709
Epoch 53/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2175 - a
cc: 0.4875
Epoch 54/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.2131 - a
cc: 0.5017
Epoch 55/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.2088 - a
cc: 0.5147
Epoch 56/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2046 - a
cc: 0.5260
Epoch 57/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.2004 - a
cc: 0.5356
```

```
Epoch 58/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1963 - a
cc: 0.5445
Epoch 59/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.1923 - a
cc: 0.5521
Epoch 60/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1884 - a
cc: 0.5581
Epoch 61/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1845 - a
cc: 0.5657
Epoch 62/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.1807 - a
cc: 0.5703
Epoch 63/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1769 - a
cc: 0.5763
Epoch 64/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1732 - a
cc: 0.5817
Epoch 65/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1696 - a
cc: 0.5871
Epoch 66/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1660 - a
cc: 0.5914
Epoch 67/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.1624 - a
cc: 0.5960
Epoch 68/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1589 - a
cc: 0.5999
Epoch 69/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1555 - a
cc: 0.6041
Epoch 70/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1521 - a
cc: 0.6083
Epoch 71/1000
10000/10000 [==============================] - 0s 3us/step - loss: 1.1487 - a
cc: 0.6115
Epoch 72/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.1454 - a
cc: 0.6134
Epoch 73/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1421 - a
cc: 0.6157
Epoch 74/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1389 - a
cc: 0.6182
Epoch 75/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.1357 - a
cc: 0.6200
Epoch 76/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.1325 - a
cc: 0.6213
```

```
Epoch 77/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.1294 - a
cc: 0.6223
Epoch 78/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.1263 - a
cc: 0.6242
Epoch 79/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1233 - a
cc: 0.6251
Epoch 80/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1203 - a
cc: 0.6264
Epoch 81/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1173 - a
cc: 0.6281
Epoch 82/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1143 - a
cc: 0.6291
Epoch 83/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1114 - a
cc: 0.6300
Epoch 84/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.1085 - a
cc: 0.6311
Epoch 85/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1056 - a
cc: 0.6319
Epoch 86/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.1027 - a
cc: 0.6325
Epoch 87/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0999 - a
cc: 0.6330
Epoch 88/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.0971 - a
cc: 0.6332
Epoch 89/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0943 - a
cc: 0.6334
Epoch 90/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.0916 - a
cc: 0.6337
Epoch 91/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0889 - a
cc: 0.6341
Epoch 92/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0862 - a
cc: 0.6341
Epoch 93/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0835 - a
cc: 0.6344
Epoch 94/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0808 - a
cc: 0.6346
Epoch 95/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0782 - a
cc: 0.6349
```

```
Epoch 96/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0756 - a
cc: 0.6349
Epoch 97/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0730 - a
cc: 0.6350
Epoch 98/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0704 - a
cc: 0.6352
Epoch 99/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0678 - a
cc: 0.6354
Epoch 100/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0653 - a
cc: 0.6354
Epoch 101/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0628 - a
cc: 0.6357
Epoch 102/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0603 - a
cc: 0.6358
Epoch 103/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0578 - a
cc: 0.6360
Epoch 104/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0553 - a
cc: 0.6360
Epoch 105/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0529 - a
cc: 0.6362
Epoch 106/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0504 - a
cc: 0.6362
Epoch 107/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0480 - a
cc: 0.6362
Epoch 108/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.0456 - a
cc: 0.6364
Epoch 109/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.0432 - a
cc: 0.6365
Epoch 110/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0409 - a
cc: 0.6366
Epoch 111/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0385 - a
cc: 0.6369
Epoch 112/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0362 - a
cc: 0.6370
Epoch 113/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0339 - a
cc: 0.6370
Epoch 114/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0315 - a
cc: 0.6372
```

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Epoch 115/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0292 - a
cc: 0.6372
Epoch 116/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0270 - a
cc: 0.6372
Epoch 117/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0247 - a
cc: 0.6372
Epoch 118/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0224 - a
cc: 0.6372
Epoch 119/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0202 - a
cc: 0.6372
Epoch 120/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0180 - a
cc: 0.6372
Epoch 121/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.0158 - a
cc: 0.6375
Epoch 122/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0136 - a
cc: 0.6375
Epoch 123/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0114 - a
cc: 0.6378
Epoch 124/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.0092 - a
cc: 0.6378
Epoch 125/1000
10000/10000 [==============================] - 0s 1us/step - loss: 1.0070 - a
cc: 0.6379
Epoch 126/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0049 - a
cc: 0.6379
Epoch 127/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0028 - a
cc: 0.6379
Epoch 128/1000
10000/10000 [==============================] - 0s 2us/step - loss: 1.0006 - a
cc: 0.6379
Epoch 129/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9985 - a
cc: 0.6380
Epoch 130/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9964 - a
cc: 0.6380
Epoch 131/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9943 - a
cc: 0.6381
Epoch 132/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9922 - a
cc: 0.6381
Epoch 133/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9902 - a
cc: 0.6381
```

```
Epoch 134/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9881 - a
cc: 0.6381
Epoch 135/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9861 - a
cc: 0.6381
Epoch 136/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9840 - a
cc: 0.6381
Epoch 137/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9820 - a
cc: 0.6386
Epoch 138/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9800 - a
cc: 0.6393
Epoch 139/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9780 - a
cc: 0.6397
Epoch 140/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9760 - a
cc: 0.6401
Epoch 141/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9740 - a
cc: 0.6405
Epoch 142/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9720 - a
cc: 0.6412
Epoch 143/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9701 - a
cc: 0.6418
Epoch 144/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9681 - a
cc: 0.6424
Epoch 145/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9662 - a
cc: 0.6430
Epoch 146/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9643 - a
cc: 0.6436
Epoch 147/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9623 - a
cc: 0.6444
Epoch 148/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9604 - a
cc: 0.6452
Epoch 149/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9585 - a
cc: 0.6465
Epoch 150/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9566 - a
cc: 0.6473
Epoch 151/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9547 - a
cc: 0.6487
Epoch 152/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9529 - a
cc: 0.6507
```

```
Epoch 153/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9510 - a
cc: 0.6518
Epoch 154/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9491 - a
cc: 0.6533
Epoch 155/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9473 - a
cc: 0.6543
Epoch 156/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9455 - a
cc: 0.6557
Epoch 157/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9436 - a
cc: 0.6567
Epoch 158/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9418 - a
cc: 0.6588
Epoch 159/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9400 - a
cc: 0.6602
Epoch 160/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9382 - a
cc: 0.6619
Epoch 161/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9364 - a
cc: 0.6632
Epoch 162/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9346 - a
cc: 0.6646
Epoch 163/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9328 - a
cc: 0.6658
Epoch 164/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9311 - a
cc: 0.6669
Epoch 165/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9293 - a
cc: 0.6685
Epoch 166/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9276 - a
cc: 0.6701
Epoch 167/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9258 - a
cc: 0.6721
Epoch 168/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9241 - a
cc: 0.6732
Epoch 169/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9224 - a
cc: 0.6743
Epoch 170/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9206 - a
cc: 0.6760
Epoch 171/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9189 - a
cc: 0.6784
```

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Epoch 172/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9172 - a
cc: 0.6798
Epoch 173/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9155 - a
cc: 0.6814
Epoch 174/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9139 - a
cc: 0.6834
Epoch 175/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9122 - a
cc: 0.6850
Epoch 176/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9105 - a
cc: 0.6867
Epoch 177/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9088 - a
cc: 0.6887
Epoch 178/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9072 - a
cc: 0.6903
Epoch 179/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9055 - a
cc: 0.6922
Epoch 180/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.9039 - a
cc: 0.6944
Epoch 181/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9023 - a
cc: 0.6967
Epoch 182/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.9006 - a
cc: 0.6984
Epoch 183/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8990 - a
cc: 0.7003
Epoch 184/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8974 - a
cc: 0.7020
Epoch 185/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.8958 - a
cc: 0.7043
Epoch 186/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8942 - a
cc: 0.7065
Epoch 187/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8926 - a
cc: 0.7077
Epoch 188/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8910 - a
cc: 0.7101
Epoch 189/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.8895 - a
cc: 0.7124
Epoch 190/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.8879 - a
cc: 0.7135
```

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Epoch 191/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8863 - a
cc: 0.7153
Epoch 192/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8848 - a
cc: 0.7175
Epoch 193/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8832 - a
cc: 0.7187
Epoch 194/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8817 - a
cc: 0.7200
Epoch 195/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8802 - a
cc: 0.7220
Epoch 196/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8786 - a
cc: 0.7241
Epoch 197/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8771 - a
cc: 0.7253
Epoch 198/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8756 - a
cc: 0.7268
Epoch 199/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8741 - a
cc: 0.7279
Epoch 200/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8726 - a
cc: 0.7300
Epoch 201/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8711 - a
cc: 0.7317
Epoch 202/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8696 - a
cc: 0.7334
Epoch 203/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8681 - a
cc: 0.7342
Epoch 204/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8667 - a
cc: 0.7365
Epoch 205/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.8652 - a
cc: 0.7373
Epoch 206/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8637 - a
cc: 0.7389
Epoch 207/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8623 - a
cc: 0.7401
Epoch 208/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8608 - a
cc: 0.7419
Epoch 209/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8594 - a
cc: 0.7438
```

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Epoch 210/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8580 - a
cc: 0.7448
Epoch 211/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8565 - a
cc: 0.7459
Epoch 212/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8551 - a
cc: 0.7478
Epoch 213/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8537 - a
cc: 0.7485
Epoch 214/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8523 - a
cc: 0.7504
Epoch 215/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.8509 - a
cc: 0.7514
Epoch 216/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8495 - a
cc: 0.7532
Epoch 217/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8481 - a
cc: 0.7543
Epoch 218/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8467 - a
cc: 0.7550
Epoch 219/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8453 - a
cc: 0.7565
Epoch 220/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8439 - a
cc: 0.7580
Epoch 221/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8426 - a
cc: 0.7590
Epoch 222/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8412 - a
cc: 0.7599
Epoch 223/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8398 - a
cc: 0.7609
Epoch 224/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8385 - a
cc: 0.7618
Epoch 225/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8371 - a
cc: 0.7630
Epoch 226/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8358 - a
cc: 0.7639
Epoch 227/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.8344 - a
cc: 0.7643
Epoch 228/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8331 - a
cc: 0.7658
```

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Epoch 229/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.8318 - a
cc: 0.7675
Epoch 230/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8305 - a
cc: 0.7686
Epoch 231/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.8291 - a
cc: 0.7691
Epoch 232/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8278 - a
cc: 0.7699
Epoch 233/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.8265 - a
cc: 0.7709
Epoch 234/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8252 - a
cc: 0.7717
Epoch 235/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8239 - a
cc: 0.7725
Epoch 236/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8226 - a
cc: 0.7735
Epoch 237/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8214 - a
cc: 0.7742
Epoch 238/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8201 - a
cc: 0.7749
Epoch 239/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.8188 - a
cc: 0.7757
Epoch 240/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8175 - a
cc: 0.7763
Epoch 241/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.8163 - a
cc: 0.7771
Epoch 242/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8150 - a
cc: 0.7780
Epoch 243/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.8138 - a
cc: 0.7790
Epoch 244/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8125 - a
cc: 0.7796
Epoch 245/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8113 - a
cc: 0.7804
Epoch 246/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8100 - a
cc: 0.7810
Epoch 247/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8088 - a
cc: 0.7818
```

```
Epoch 248/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8076 - a
cc: 0.7828
Epoch 249/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8064 - a
cc: 0.7834
Epoch 250/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8051 - a
cc: 0.7840
Epoch 251/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8039 - a
cc: 0.7848
Epoch 252/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8027 - a
cc: 0.7856
Epoch 253/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8015 - a
cc: 0.7862
Epoch 254/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.8003 - a
cc: 0.7866
Epoch 255/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7991 - a
cc: 0.7871
Epoch 256/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7979 - a
cc: 0.7878
Epoch 257/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7967 - a
cc: 0.7889
Epoch 258/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7956 - a
cc: 0.7898
Epoch 259/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7944 - a
cc: 0.7902
Epoch 260/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7932 - a
cc: 0.7910
Epoch 261/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7920 - a
cc: 0.7921
Epoch 262/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7909 - a
cc: 0.7926
Epoch 263/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7897 - a
cc: 0.7929
Epoch 264/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7886 - a
cc: 0.7934
Epoch 265/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7874 - a
cc: 0.7941
Epoch 266/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7863 - a
cc: 0.7943
```

```
Epoch 267/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7851 - a
cc: 0.7946
Epoch 268/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7840 - a
cc: 0.7955
Epoch 269/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7829 - a
cc: 0.7962
Epoch 270/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7817 - a
cc: 0.7968
Epoch 271/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7806 - a
cc: 0.7978
Epoch 272/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.7795 - a
cc: 0.7986
Epoch 273/1000
10000/10000 [==============================] - 0s 6us/step - loss: 0.7784 - a
cc: 0.7996
Epoch 274/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7773 - a
cc: 0.8002
Epoch 275/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7761 - a
cc: 0.8008
Epoch 276/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7750 - a
cc: 0.8011
Epoch 277/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7739 - a
cc: 0.8019
Epoch 278/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7728 - a
cc: 0.8024
Epoch 279/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7718 - a
cc: 0.8029
Epoch 280/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7707 - a
cc: 0.8033
Epoch 281/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7696 - a
cc: 0.8041
Epoch 282/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7685 - a
cc: 0.8047
Epoch 283/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7674 - a
cc: 0.8048
Epoch 284/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7664 - a
cc: 0.8052
Epoch 285/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7653 - a
cc: 0.8055
```

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Epoch 286/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7642 - a
cc: 0.8061
Epoch 287/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7632 - a
cc: 0.8066
Epoch 288/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7621 - a
cc: 0.8069
Epoch 289/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7611 - a
cc: 0.8075
Epoch 290/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7600 - a
cc: 0.8083
Epoch 291/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7590 - a
cc: 0.8089
Epoch 292/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7579 - a
cc: 0.8092
Epoch 293/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7569 - a
cc: 0.8094
Epoch 294/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7559 - a
cc: 0.8099
Epoch 295/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7548 - a
cc: 0.8103
Epoch 296/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7538 - a
cc: 0.8106
Epoch 297/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.7528 - a
cc: 0.8110
Epoch 298/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7518 - a
cc: 0.8114
Epoch 299/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7508 - a
cc: 0.8117
Epoch 300/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7498 - a
cc: 0.8121
Epoch 301/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7487 - a
cc: 0.8121
Epoch 302/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7477 - a
cc: 0.8127
Epoch 303/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7467 - a
cc: 0.8128
Epoch 304/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7458 - a
cc: 0.8131
```

```
Epoch 305/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7448 - a
cc: 0.8138
Epoch 306/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7438 - a
cc: 0.8145
Epoch 307/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.7428 - a
cc: 0.8148
Epoch 308/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7418 - a
cc: 0.8152
Epoch 309/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7408 - a
cc: 0.8154
Epoch 310/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7399 - a
cc: 0.8156
Epoch 311/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7389 - a
cc: 0.8155
Epoch 312/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7379 - a
cc: 0.8158
Epoch 313/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.7369 - a
cc: 0.8157
Epoch 314/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7360 - a
cc: 0.8161
Epoch 315/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.7350 - a
cc: 0.8163
Epoch 316/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7341 - a
cc: 0.8165
Epoch 317/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7331 - a
cc: 0.8169
Epoch 318/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7322 - a
cc: 0.8174
Epoch 319/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7312 - a
cc: 0.8177
Epoch 320/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7303 - a
cc: 0.8181
Epoch 321/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7293 - a
cc: 0.8182
Epoch 322/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7284 - a
cc: 0.8187
Epoch 323/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7275 - a
cc: 0.8189
```

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Epoch 324/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7266 - a
cc: 0.8190
Epoch 325/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7256 - a
cc: 0.8193
Epoch 326/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7247 - a
cc: 0.8193
Epoch 327/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7238 - a
cc: 0.8194
Epoch 328/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7229 - a
cc: 0.8195
Epoch 329/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7220 - a
cc: 0.8195
Epoch 330/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7211 - a
cc: 0.8196
Epoch 331/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7201 - a
cc: 0.8196
Epoch 332/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7192 - a
cc: 0.8199
Epoch 333/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7183 - a
cc: 0.8202
Epoch 334/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7174 - a
cc: 0.8202
Epoch 335/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7165 - a
cc: 0.8204
Epoch 336/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7157 - a
cc: 0.8205
Epoch 337/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7148 - a
cc: 0.8208
Epoch 338/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7139 - a
cc: 0.8208
Epoch 339/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7130 - a
cc: 0.8208
Epoch 340/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7121 - a
cc: 0.8209
Epoch 341/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7112 - a
cc: 0.8211
Epoch 342/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7104 - a
cc: 0.8214
```

```
Epoch 343/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7095 - a
cc: 0.8216
Epoch 344/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.7086 - a
cc: 0.8221
Epoch 345/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7078 - a
cc: 0.8225
Epoch 346/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7069 - a
cc: 0.8227
Epoch 347/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7060 - a
cc: 0.8230
Epoch 348/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7052 - a
cc: 0.8232
Epoch 349/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7043 - a
cc: 0.8235
Epoch 350/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7035 - a
cc: 0.8238
Epoch 351/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7026 - a
cc: 0.8239
Epoch 352/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7018 - a
cc: 0.8240
Epoch 353/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.7010 - a
cc: 0.8241
Epoch 354/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.7001 - a
cc: 0.8245
Epoch 355/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6993 - a
cc: 0.8245
Epoch 356/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.6984 - a
cc: 0.8246
Epoch 357/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6976 - a
cc: 0.8246
Epoch 358/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6968 - a
cc: 0.8251
Epoch 359/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6960 - a
cc: 0.8253
Epoch 360/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6951 - a
cc: 0.8254
Epoch 361/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6943 - a
cc: 0.8259
```

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Epoch 362/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6935 - a
cc: 0.8259
Epoch 363/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6927 - a
cc: 0.8260
Epoch 364/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6919 - a
cc: 0.8261
Epoch 365/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6911 - a
cc: 0.8264
Epoch 366/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.6902 - a
cc: 0.8265
Epoch 367/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6894 - a
cc: 0.8264
Epoch 368/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6886 - a
cc: 0.8264
Epoch 369/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6878 - a
cc: 0.8268
Epoch 370/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.6870 - a
cc: 0.8270
Epoch 371/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6862 - a
cc: 0.8273
Epoch 372/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6855 - a
cc: 0.8274
Epoch 373/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6847 - a
cc: 0.8276
Epoch 374/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6839 - a
cc: 0.8277
Epoch 375/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6831 - a
cc: 0.8280
Epoch 376/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6823 - a
cc: 0.8280
Epoch 377/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6815 - a
cc: 0.8283
Epoch 378/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6807 - a
cc: 0.8285
Epoch 379/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6800 - a
cc: 0.8285
Epoch 380/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6792 - a
cc: 0.8287
```

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Epoch 381/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6784 - a
cc: 0.8286
Epoch 382/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6777 - a
cc: 0.8289
Epoch 383/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6769 - a
cc: 0.8291
Epoch 384/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6761 - a
cc: 0.8292
Epoch 385/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6754 - a
cc: 0.8296
Epoch 386/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6746 - a
cc: 0.8299
Epoch 387/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6739 - a
cc: 0.8300
Epoch 388/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6731 - a
cc: 0.8300
Epoch 389/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6724 - a
cc: 0.8301
Epoch 390/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6716 - a
cc: 0.8302
Epoch 391/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6709 - a
cc: 0.8302
Epoch 392/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6701 - a
cc: 0.8302
Epoch 393/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6694 - a
cc: 0.8303
Epoch 394/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6686 - a
cc: 0.8303
Epoch 395/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6679 - a
cc: 0.8303
Epoch 396/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6672 - a
cc: 0.8304
Epoch 397/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6664 - a
cc: 0.8304
Epoch 398/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.6657 - a
cc: 0.8304
Epoch 399/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6650 - a
cc: 0.8306
```

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Epoch 400/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6642 - a
cc: 0.8306
Epoch 401/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6635 - a
cc: 0.8308
Epoch 402/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6628 - a
cc: 0.8308
Epoch 403/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6621 - a
cc: 0.8311
Epoch 404/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6613 - a
cc: 0.8312
Epoch 405/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6606 - a
cc: 0.8311
Epoch 406/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6599 - a
cc: 0.8311
Epoch 407/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6592 - a
cc: 0.8311
Epoch 408/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6585 - a
cc: 0.8311
Epoch 409/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6578 - a
cc: 0.8311
Epoch 410/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6571 - a
cc: 0.8312
Epoch 411/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6564 - a
cc: 0.8311
Epoch 412/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6557 - a
cc: 0.8312
Epoch 413/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6550 - a
cc: 0.8311
Epoch 414/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6543 - a
cc: 0.8312
Epoch 415/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6536 - a
cc: 0.8313
Epoch 416/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6529 - a
cc: 0.8313
Epoch 417/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6522 - a
cc: 0.8314
Epoch 418/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6515 - a
cc: 0.8315
```

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Epoch 419/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6508 - a
cc: 0.8315
Epoch 420/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6501 - a
cc: 0.8316
Epoch 421/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6495 - a
cc: 0.8316
Epoch 422/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6488 - a
cc: 0.8316
Epoch 423/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6481 - a
cc: 0.8317
Epoch 424/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6474 - a
cc: 0.8318
Epoch 425/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6467 - a
cc: 0.8319
Epoch 426/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6461 - a
cc: 0.8322
Epoch 427/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6454 - a
cc: 0.8322
Epoch 428/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6447 - a
cc: 0.8326
Epoch 429/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6441 - a
cc: 0.8326
Epoch 430/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6434 - a
cc: 0.8329
Epoch 431/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6427 - a
cc: 0.8329
Epoch 432/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6421 - a
cc: 0.8332
Epoch 433/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6414 - a
cc: 0.8333
Epoch 434/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6408 - a
cc: 0.8335
Epoch 435/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6401 - a
cc: 0.8335
Epoch 436/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6395 - a
cc: 0.8337
Epoch 437/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.6388 - a
cc: 0.8337
```

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Epoch 438/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.6381 - a
cc: 0.8337
Epoch 439/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6375 - a
cc: 0.8336
Epoch 440/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6369 - a
cc: 0.8339
Epoch 441/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6362 - a
cc: 0.8339
Epoch 442/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.6356 - a
cc: 0.8337
Epoch 443/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6349 - a
cc: 0.8338
Epoch 444/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6343 - a
cc: 0.8340
Epoch 445/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6336 - a
cc: 0.8339
Epoch 446/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6330 - a
cc: 0.8340
Epoch 447/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6324 - a
cc: 0.8341
Epoch 448/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6317 - a
cc: 0.8342
Epoch 449/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6311 - a
cc: 0.8343
Epoch 450/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6305 - a
cc: 0.8344
Epoch 451/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6299 - a
cc: 0.8344
Epoch 452/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6292 - a
cc: 0.8345
Epoch 453/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6286 - a
cc: 0.8346
Epoch 454/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6280 - a
cc: 0.8346
Epoch 455/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6274 - a
cc: 0.8348
Epoch 456/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6268 - a
cc: 0.8349
```

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Epoch 457/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6261 - a
cc: 0.8350
Epoch 458/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6255 - a
cc: 0.8352
Epoch 459/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6249 - a
cc: 0.8352
Epoch 460/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6243 - a
cc: 0.8353
Epoch 461/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6237 - a
cc: 0.8354
Epoch 462/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6231 - a
cc: 0.8354
Epoch 463/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6225 - a
cc: 0.8355
Epoch 464/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6219 - a
cc: 0.8355
Epoch 465/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6213 - a
cc: 0.8354
Epoch 466/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6207 - a
cc: 0.8355
Epoch 467/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6201 - a
cc: 0.8356
Epoch 468/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6195 - a
cc: 0.8357
Epoch 469/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6189 - a
cc: 0.8357
Epoch 470/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6183 - a
cc: 0.8361
Epoch 471/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6177 - a
cc: 0.8363
Epoch 472/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6171 - a
cc: 0.8364
Epoch 473/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6165 - a
cc: 0.8366
Epoch 474/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6159 - a
cc: 0.8366
Epoch 475/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6153 - a
cc: 0.8369
```

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Epoch 476/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6147 - a
cc: 0.8372
Epoch 477/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6141 - a
cc: 0.8372
Epoch 478/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6136 - a
cc: 0.8372
Epoch 479/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6130 - a
cc: 0.8372
Epoch 480/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6124 - a
cc: 0.8372
Epoch 481/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6118 - a
cc: 0.8373
Epoch 482/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6113 - a
cc: 0.8373
Epoch 483/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6107 - a
cc: 0.8374
Epoch 484/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6101 - a
cc: 0.8374
Epoch 485/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6095 - a
cc: 0.8375
Epoch 486/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6090 - a
cc: 0.8377
Epoch 487/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6084 - a
cc: 0.8378
Epoch 488/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6078 - a
cc: 0.8379
Epoch 489/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6073 - a
cc: 0.8379
Epoch 490/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6067 - a
cc: 0.8382
Epoch 491/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6061 - a
cc: 0.8384
Epoch 492/1000
10000/10000 [==============================] - 0s 6us/step - loss: 0.6056 - a
cc: 0.8386
Epoch 493/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.6050 - a
cc: 0.8386
Epoch 494/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.6045 - a
cc: 0.8386
```

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Epoch 495/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6039 - a
cc: 0.8386
Epoch 496/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6033 - a
cc: 0.8387
Epoch 497/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.6028 - a
cc: 0.8388
Epoch 498/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.6022 - a
cc: 0.8389
Epoch 499/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.6017 - a
cc: 0.8389
Epoch 500/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.6011 - a
cc: 0.8389
Epoch 501/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.6006 - a
cc: 0.8389
Epoch 502/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.6000 - a
cc: 0.8389
Epoch 503/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5995 - a
cc: 0.8388
Epoch 504/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5990 - a
cc: 0.8391
Epoch 505/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5984 - a
cc: 0.8391
Epoch 506/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5979 - a
cc: 0.8391
Epoch 507/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5973 - a
cc: 0.8390
Epoch 508/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5968 - a
cc: 0.8390
Epoch 509/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5963 - a
cc: 0.8389
Epoch 510/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5957 - a
cc: 0.8389
Epoch 511/1000
10000/10000 [==============================] - 0s 8us/step - loss: 0.5952 - a
cc: 0.8389
Epoch 512/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5946 - a
cc: 0.8389
Epoch 513/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5941 - a
cc: 0.8391
```

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Epoch 514/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5936 - a
cc: 0.8392
Epoch 515/1000
10000/10000 [==============================] - 0s 6us/step - loss: 0.5931 - a
cc: 0.8392
Epoch 516/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5925 - a
cc: 0.8395
Epoch 517/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5920 - a
cc: 0.8395
Epoch 518/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5915 - a
cc: 0.8395
Epoch 519/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5910 - a
cc: 0.8394
Epoch 520/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5904 - a
cc: 0.8394
Epoch 521/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5899 - a
cc: 0.8393
Epoch 522/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5894 - a
cc: 0.8393
Epoch 523/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5889 - a
cc: 0.8393
Epoch 524/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5884 - a
cc: 0.8394
Epoch 525/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5878 - a
cc: 0.8396
Epoch 526/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5873 - a
cc: 0.8396
Epoch 527/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5868 - a
cc: 0.8396
Epoch 528/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5863 - a
cc: 0.8398
Epoch 529/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5858 - a
cc: 0.8398
Epoch 530/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5853 - a
cc: 0.8398
Epoch 531/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5848 - a
cc: 0.8401
Epoch 532/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5843 - a
cc: 0.8401
```

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Epoch 533/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5838 - a
cc: 0.8401
Epoch 534/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5833 - a
cc: 0.8403
Epoch 535/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5828 - a
cc: 0.8403
Epoch 536/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5823 - a
cc: 0.8404
Epoch 537/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5818 - a
cc: 0.8404
Epoch 538/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5813 - a
cc: 0.8405
Epoch 539/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5808 - a
cc: 0.8405
Epoch 540/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5803 - a
cc: 0.8405
Epoch 541/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5798 - a
cc: 0.8407
Epoch 542/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5793 - a
cc: 0.8407
Epoch 543/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5788 - a
cc: 0.8408
Epoch 544/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5783 - a
cc: 0.8409
Epoch 545/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5778 - a
cc: 0.8410
Epoch 546/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5773 - a
cc: 0.8412
Epoch 547/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5768 - a
cc: 0.8414
Epoch 548/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5763 - a
cc: 0.8415
Epoch 549/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5758 - a
cc: 0.8414
Epoch 550/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5754 - a
cc: 0.8414
Epoch 551/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5749 - a
cc: 0.8415
```

```
Epoch 552/1000
10000/10000 [==============================] - 0s 6us/step - loss: 0.5744 - a
cc: 0.8415
Epoch 553/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5739 - a
cc: 0.8420
Epoch 554/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5734 - a
cc: 0.8422
Epoch 555/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5729 - a
cc: 0.8423
Epoch 556/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5725 - a
cc: 0.8426
Epoch 557/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5720 - a
cc: 0.8429
Epoch 558/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5715 - a
cc: 0.8428
Epoch 559/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5710 - a
cc: 0.8429
Epoch 560/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5706 - a
cc: 0.8432
Epoch 561/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5701 - a
cc: 0.8433
Epoch 562/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5696 - a
cc: 0.8435
Epoch 563/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5692 - a
cc: 0.8435
Epoch 564/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5687 - a
cc: 0.8435
Epoch 565/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5682 - a
cc: 0.8437
Epoch 566/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5677 - a
cc: 0.8438
Epoch 567/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5673 - a
cc: 0.8440
Epoch 568/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5668 - a
cc: 0.8440
Epoch 569/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5664 - a
cc: 0.8440
Epoch 570/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5659 - a
cc: 0.8441
```

```
Epoch 571/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5654 - a
cc: 0.8445
Epoch 572/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5650 - a
cc: 0.8445
Epoch 573/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5645 - a
cc: 0.8445
Epoch 574/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5641 - a
cc: 0.8446
Epoch 575/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5636 - a
cc: 0.8446
Epoch 576/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5631 - a
cc: 0.8446
Epoch 577/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5627 - a
cc: 0.8450
Epoch 578/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5622 - a
cc: 0.8451
Epoch 579/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5618 - a
cc: 0.8452
Epoch 580/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5613 - a
cc: 0.8456
Epoch 581/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5609 - a
cc: 0.8457
Epoch 582/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5604 - a
cc: 0.8460
Epoch 583/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5600 - a
cc: 0.8461
Epoch 584/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5595 - a
cc: 0.8463
Epoch 585/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5591 - a
cc: 0.8464
Epoch 586/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5586 - a
cc: 0.8465
Epoch 587/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5582 - a
cc: 0.8466
Epoch 588/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5577 - a
cc: 0.8467
Epoch 589/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5573 - a
cc: 0.8468
```

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Epoch 590/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5569 - a
cc: 0.8470
Epoch 591/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5564 - a
cc: 0.8471
Epoch 592/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5560 - a
cc: 0.8474
Epoch 593/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5555 - a
cc: 0.8474
Epoch 594/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5551 - a
cc: 0.8476
Epoch 595/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5547 - a
cc: 0.8476
Epoch 596/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5542 - a
cc: 0.8478
Epoch 597/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5538 - a
cc: 0.8480
Epoch 598/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5534 - a
cc: 0.8482
Epoch 599/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5529 - a
cc: 0.8481
Epoch 600/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5525 - a
cc: 0.8484
Epoch 601/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5521 - a
cc: 0.8484
Epoch 602/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5516 - a
cc: 0.8487
Epoch 603/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5512 - a
cc: 0.8488
Epoch 604/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5508 - a
cc: 0.8487
Epoch 605/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5504 - a
cc: 0.8489
Epoch 606/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5499 - a
cc: 0.8492
Epoch 607/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5495 - a
cc: 0.8493
Epoch 608/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5491 - a
cc: 0.8493
```

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Epoch 609/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5487 - a
cc: 0.8495
Epoch 610/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5482 - a
cc: 0.8497
Epoch 611/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5478 - a
cc: 0.8496
Epoch 612/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5474 - a
cc: 0.8497
Epoch 613/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5470 - a
cc: 0.8498
Epoch 614/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5466 - a
cc: 0.8496
Epoch 615/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5461 - a
cc: 0.8497
Epoch 616/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5457 - a
cc: 0.8497
Epoch 617/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5453 - a
cc: 0.8499
Epoch 618/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5449 - a
cc: 0.8502
Epoch 619/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5445 - a
cc: 0.8501
Epoch 620/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5441 - a
cc: 0.8502
Epoch 621/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5437 - a
cc: 0.8502
Epoch 622/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5433 - a
cc: 0.8505
Epoch 623/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5428 - a
cc: 0.8505
Epoch 624/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5424 - a
cc: 0.8505
Epoch 625/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5420 - a
cc: 0.8506
Epoch 626/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5416 - a
cc: 0.8506
Epoch 627/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5412 - a
cc: 0.8507
```

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Epoch 628/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5408 - a
cc: 0.8507
Epoch 629/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5404 - a
cc: 0.8508
Epoch 630/1000
10000/10000 [==============================] - 0s 8us/step - loss: 0.5400 - a
cc: 0.8508
Epoch 631/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5396 - a
cc: 0.8507
Epoch 632/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5392 - a
cc: 0.8511
Epoch 633/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5388 - a
cc: 0.8514
Epoch 634/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5384 - a
cc: 0.8514
Epoch 635/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5380 - a
cc: 0.8517
Epoch 636/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5376 - a
cc: 0.8518
Epoch 637/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5372 - a
cc: 0.8520
Epoch 638/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5368 - a
cc: 0.8521
Epoch 639/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5364 - a
cc: 0.8521
Epoch 640/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5360 - a
cc: 0.8523
Epoch 641/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5356 - a
cc: 0.8524
Epoch 642/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5352 - a
cc: 0.8523
Epoch 643/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5348 - a
cc: 0.8523
Epoch 644/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5344 - a
cc: 0.8523
Epoch 645/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5340 - a
cc: 0.8524
Epoch 646/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5337 - a
cc: 0.8525
```

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Epoch 647/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5333 - a
cc: 0.8524
Epoch 648/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5329 - a
cc: 0.8524
Epoch 649/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5325 - a
cc: 0.8529
Epoch 650/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5321 - a
cc: 0.8532
Epoch 651/1000
10000/10000 [==============================] - 0s 6us/step - loss: 0.5317 - a
cc: 0.8533
Epoch 652/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5313 - a
cc: 0.8534
Epoch 653/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5310 - a
cc: 0.8534
Epoch 654/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5306 - a
cc: 0.8535
Epoch 655/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5302 - a
cc: 0.8536
Epoch 656/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5298 - a
cc: 0.8536
Epoch 657/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5294 - a
cc: 0.8537
Epoch 658/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5290 - a
cc: 0.8537
Epoch 659/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5287 - a
cc: 0.8539
Epoch 660/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5283 - a
cc: 0.8540
Epoch 661/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5279 - a
cc: 0.8543
Epoch 662/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5275 - a
cc: 0.8542
Epoch 663/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5272 - a
cc: 0.8545
Epoch 664/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5268 - a
cc: 0.8545
Epoch 665/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5264 - a
cc: 0.8547
```

```
Epoch 666/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5260 - a
cc: 0.8549
Epoch 667/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5257 - a
cc: 0.8549
Epoch 668/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5253 - a
cc: 0.8550
Epoch 669/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5249 - a
cc: 0.8550
Epoch 670/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5245 - a
cc: 0.8549
Epoch 671/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5242 - a
cc: 0.8549
Epoch 672/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5238 - a
cc: 0.8549
Epoch 673/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5234 - a
cc: 0.8550
Epoch 674/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5231 - a
cc: 0.8551
Epoch 675/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5227 - a
cc: 0.8553
Epoch 676/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5223 - a
cc: 0.8553
Epoch 677/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5220 - a
cc: 0.8554
Epoch 678/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5216 - a
cc: 0.8556
Epoch 679/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5212 - a
cc: 0.8556
Epoch 680/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5209 - a
cc: 0.8556
Epoch 681/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5205 - a
cc: 0.8556
Epoch 682/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5202 - a
cc: 0.8559
Epoch 683/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5198 - a
cc: 0.8560
Epoch 684/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5194 - a
cc: 0.8562
```

```
Epoch 685/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5191 - a
cc: 0.8564
Epoch 686/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5187 - a
cc: 0.8567
Epoch 687/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5184 - a
cc: 0.8567
Epoch 688/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5180 - a
cc: 0.8567
Epoch 689/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5177 - a
cc: 0.8570
Epoch 690/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5173 - a
cc: 0.8571
Epoch 691/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5169 - a
cc: 0.8571
Epoch 692/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5166 - a
cc: 0.8573
Epoch 693/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5162 - a
cc: 0.8573
Epoch 694/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5159 - a
cc: 0.8576
Epoch 695/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5155 - a
cc: 0.8580
Epoch 696/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5152 - a
cc: 0.8582
Epoch 697/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5148 - a
cc: 0.8583
Epoch 698/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5145 - a
cc: 0.8583
Epoch 699/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5141 - a
cc: 0.8585
Epoch 700/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5138 - a
cc: 0.8586
Epoch 701/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5134 - a
cc: 0.8589
Epoch 702/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5131 - a
cc: 0.8592
Epoch 703/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5127 - a
cc: 0.8593
```

```
Epoch 704/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5124 - a
cc: 0.8592
Epoch 705/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5120 - a
cc: 0.8593
Epoch 706/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5117 - a
cc: 0.8594
Epoch 707/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5114 - a
cc: 0.8593
Epoch 708/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5110 - a
cc: 0.8595
Epoch 709/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5107 - a
cc: 0.8596
Epoch 710/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5103 - a
cc: 0.8596
Epoch 711/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5100 - a
cc: 0.8599
Epoch 712/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5097 - a
cc: 0.8599
Epoch 713/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5093 - a
cc: 0.8598
Epoch 714/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5090 - a
cc: 0.8600
Epoch 715/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5086 - a
cc: 0.8601
Epoch 716/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5083 - a
cc: 0.8601
Epoch 717/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5080 - a
cc: 0.8602
Epoch 718/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5076 - a
cc: 0.8604
Epoch 719/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5073 - a
cc: 0.8605
Epoch 720/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5070 - a
cc: 0.8609
Epoch 721/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5066 - a
cc: 0.8610
Epoch 722/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5063 - a
cc: 0.8611
```

```
Epoch 723/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5060 - a
cc: 0.8613
Epoch 724/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5056 - a
cc: 0.8613
Epoch 725/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5053 - a
cc: 0.8612
Epoch 726/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5050 - a
cc: 0.8614
Epoch 727/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5046 - a
cc: 0.8615
Epoch 728/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.5043 - a
cc: 0.8616
Epoch 729/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.5040 - a
cc: 0.8616
Epoch 730/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5036 - a
cc: 0.8616
Epoch 731/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5033 - a
cc: 0.8616
Epoch 732/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5030 - a
cc: 0.8617
Epoch 733/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5027 - a
cc: 0.8617
Epoch 734/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5023 - a
cc: 0.8618
Epoch 735/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5020 - a
cc: 0.8619
Epoch 736/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5017 - a
cc: 0.8620
Epoch 737/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5014 - a
cc: 0.8621
Epoch 738/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5010 - a
cc: 0.8624
Epoch 739/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.5007 - a
cc: 0.8627
Epoch 740/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.5004 - a
cc: 0.8628
Epoch 741/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.5001 - a
cc: 0.8631
```

```
Epoch 742/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4998 - a
cc: 0.8631
Epoch 743/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4994 - a
cc: 0.8631
Epoch 744/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4991 - a
cc: 0.8631
Epoch 745/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4988 - a
cc: 0.8630
Epoch 746/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4985 - a
cc: 0.8632
Epoch 747/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4982 - a
cc: 0.8632
Epoch 748/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4978 - a
cc: 0.8634
Epoch 749/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4975 - a
cc: 0.8636
Epoch 750/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4972 - a
cc: 0.8637
Epoch 751/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4969 - a
cc: 0.8637
Epoch 752/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4966 - a
cc: 0.8637
Epoch 753/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4963 - a
cc: 0.8637
Epoch 754/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4960 - a
cc: 0.8639
Epoch 755/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4956 - a
cc: 0.8642
Epoch 756/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4953 - a
cc: 0.8642
Epoch 757/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4950 - a
cc: 0.8645
Epoch 758/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4947 - a
cc: 0.8645
Epoch 759/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4944 - a
cc: 0.8646
Epoch 760/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4941 - a
cc: 0.8646
```

```
Epoch 761/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4938 - a
cc: 0.8647
Epoch 762/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4935 - a
cc: 0.8649
Epoch 763/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4932 - a
cc: 0.8650
Epoch 764/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4929 - a
cc: 0.8650
Epoch 765/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4926 - a
cc: 0.8651
Epoch 766/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4922 - a
cc: 0.8652
Epoch 767/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4919 - a
cc: 0.8652
Epoch 768/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4916 - a
cc: 0.8652
Epoch 769/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4913 - a
cc: 0.8652
Epoch 770/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4910 - a
cc: 0.8655
Epoch 771/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4907 - a
cc: 0.8658
Epoch 772/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4904 - a
cc: 0.8657
Epoch 773/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4901 - a
cc: 0.8657
Epoch 774/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4898 - a
cc: 0.8659
Epoch 775/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4895 - a
cc: 0.8660
Epoch 776/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4892 - a
cc: 0.8661
Epoch 777/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4889 - a
cc: 0.8661
Epoch 778/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4886 - a
cc: 0.8661
Epoch 779/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4883 - a
cc: 0.8662
```

```
Epoch 780/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4880 - a
cc: 0.8663
Epoch 781/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4877 - a
cc: 0.8663
Epoch 782/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4874 - a
cc: 0.8666
Epoch 783/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4871 - a
cc: 0.8667
Epoch 784/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4868 - a
cc: 0.8668
Epoch 785/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4865 - a
cc: 0.8668
Epoch 786/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4862 - a
cc: 0.8668
Epoch 787/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4859 - a
cc: 0.8669
Epoch 788/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4857 - a
cc: 0.8671
Epoch 789/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4854 - a
cc: 0.8672
Epoch 790/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4851 - a
cc: 0.8675
Epoch 791/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4848 - a
cc: 0.8674
Epoch 792/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4845 - a
cc: 0.8676
Epoch 793/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4842 - a
cc: 0.8675
Epoch 794/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4839 - a
cc: 0.8676
Epoch 795/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4836 - a
cc: 0.8679
Epoch 796/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4833 - a
cc: 0.8680
Epoch 797/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4830 - a
cc: 0.8680
Epoch 798/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4827 - a
cc: 0.8680
```

```
Epoch 799/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4825 - a
cc: 0.8681
Epoch 800/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4822 - a
cc: 0.8681
Epoch 801/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4819 - a
cc: 0.8684
Epoch 802/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4816 - a
cc: 0.8684
Epoch 803/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4813 - a
cc: 0.8684
Epoch 804/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4810 - a
cc: 0.8684
Epoch 805/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4807 - a
cc: 0.8685
Epoch 806/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4805 - a
cc: 0.8688
Epoch 807/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4802 - a
cc: 0.8688
Epoch 808/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4799 - a
cc: 0.8688
Epoch 809/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4796 - a
cc: 0.8689
Epoch 810/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4793 - a
cc: 0.8689
Epoch 811/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4790 - a
cc: 0.8690
Epoch 812/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4788 - a
cc: 0.8690
Epoch 813/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4785 - a
cc: 0.8690
Epoch 814/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4782 - a
cc: 0.8692
Epoch 815/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4779 - a
cc: 0.8692
Epoch 816/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4776 - a
cc: 0.8692
Epoch 817/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4774 - a
cc: 0.8694
```

```
Epoch 818/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4771 - a
cc: 0.8696
Epoch 819/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4768 - a
cc: 0.8696
Epoch 820/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4765 - a
cc: 0.8696
Epoch 821/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4762 - a
cc: 0.8697
Epoch 822/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4760 - a
cc: 0.8697
Epoch 823/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4757 - a
cc: 0.8698
Epoch 824/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4754 - a
cc: 0.8698
Epoch 825/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4751 - a
cc: 0.8698
Epoch 826/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4749 - a
cc: 0.8699
Epoch 827/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4746 - a
cc: 0.8699
Epoch 828/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4743 - a
cc: 0.8699
Epoch 829/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4741 - a
cc: 0.8699
Epoch 830/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4738 - a
cc: 0.8699
Epoch 831/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4735 - a
cc: 0.8699
Epoch 832/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4732 - a
cc: 0.8700
Epoch 833/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4730 - a
cc: 0.8700
Epoch 834/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4727 - a
cc: 0.8700
Epoch 835/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4724 - a
cc: 0.8700
Epoch 836/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4722 - a
cc: 0.8700
```

```
Epoch 837/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4719 - a
cc: 0.8702
Epoch 838/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4716 - a
cc: 0.8703
Epoch 839/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4713 - a
cc: 0.8703
Epoch 840/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4711 - a
cc: 0.8703
Epoch 841/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4708 - a
cc: 0.8703
Epoch 842/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4705 - a
cc: 0.8706
Epoch 843/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4703 - a
cc: 0.8707
Epoch 844/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4700 - a
cc: 0.8707
Epoch 845/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4698 - a
cc: 0.8709
Epoch 846/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4695 - a
cc: 0.8708
Epoch 847/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4692 - a
cc: 0.8710
Epoch 848/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4690 - a
cc: 0.8712
Epoch 849/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4687 - a
cc: 0.8712
Epoch 850/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4684 - a
cc: 0.8714
Epoch 851/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4682 - a
cc: 0.8714
Epoch 852/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4679 - a
cc: 0.8716
Epoch 853/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4676 - a
cc: 0.8718
Epoch 854/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4674 - a
cc: 0.8719
Epoch 855/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4671 - a
cc: 0.8721
```

```
Epoch 856/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4669 - a
cc: 0.8721
Epoch 857/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4666 - a
cc: 0.8720
Epoch 858/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4663 - a
cc: 0.8720
Epoch 859/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4661 - a
cc: 0.8722
Epoch 860/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4658 - a
cc: 0.8722
Epoch 861/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4656 - a
cc: 0.8722
Epoch 862/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4653 - a
cc: 0.8722
Epoch 863/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4651 - a
cc: 0.8726
Epoch 864/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4648 - a
cc: 0.8726
Epoch 865/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4645 - a
cc: 0.8726
Epoch 866/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4643 - a
cc: 0.8727
Epoch 867/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4640 - a
cc: 0.8729
Epoch 868/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4638 - a
cc: 0.8731
Epoch 869/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4635 - a
cc: 0.8731
Epoch 870/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4633 - a
cc: 0.8730
Epoch 871/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4630 - a
cc: 0.8731
Epoch 872/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4628 - a
cc: 0.8733
Epoch 873/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4625 - a
cc: 0.8735
Epoch 874/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4623 - a
cc: 0.8737
```

```
Epoch 875/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4620 - a
cc: 0.8739
Epoch 876/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4618 - a
cc: 0.8739
Epoch 877/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4615 - a
cc: 0.8738
Epoch 878/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4613 - a
cc: 0.8739
Epoch 879/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4610 - a
cc: 0.8739
Epoch 880/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4608 - a
cc: 0.8739
Epoch 881/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4605 - a
cc: 0.8740
Epoch 882/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4603 - a
cc: 0.8740
Epoch 883/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4600 - a
cc: 0.8740
Epoch 884/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4598 - a
cc: 0.8742
Epoch 885/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4595 - a
cc: 0.8742
Epoch 886/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4593 - a
cc: 0.8743
Epoch 887/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4590 - a
cc: 0.8743
Epoch 888/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4588 - a
cc: 0.8743
Epoch 889/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4585 - a
cc: 0.8743
Epoch 890/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4583 - a
cc: 0.8744
Epoch 891/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4580 - a
cc: 0.8745
Epoch 892/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4578 - a
cc: 0.8745
Epoch 893/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4575 - a
cc: 0.8746
```

```
Epoch 894/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4573 - a
cc: 0.8747
Epoch 895/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4571 - a
cc: 0.8748
Epoch 896/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4568 - a
cc: 0.8748
Epoch 897/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4566 - a
cc: 0.8748
Epoch 898/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4563 - a
cc: 0.8749
Epoch 899/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4561 - a
cc: 0.8750
Epoch 900/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4558 - a
cc: 0.8750
Epoch 901/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4556 - a
cc: 0.8752
Epoch 902/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4554 - a
cc: 0.8752
Epoch 903/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4551 - a
cc: 0.8754
Epoch 904/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4549 - a
cc: 0.8756
Epoch 905/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4546 - a
cc: 0.8755
Epoch 906/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4544 - a
cc: 0.8756
Epoch 907/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4542 - a
cc: 0.8756
Epoch 908/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4539 - a
cc: 0.8758
Epoch 909/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4537 - a
cc: 0.8758
Epoch 910/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4535 - a
cc: 0.8758
Epoch 911/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4532 - a
cc: 0.8760
Epoch 912/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4530 - a
cc: 0.8759
```

```
Epoch 913/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4527 - a
cc: 0.8760
Epoch 914/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4525 - a
cc: 0.8761
Epoch 915/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4523 - a
cc: 0.8763
Epoch 916/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4520 - a
cc: 0.8764
Epoch 917/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4518 - a
cc: 0.8765
Epoch 918/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4516 - a
cc: 0.8766
Epoch 919/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4513 - a
cc: 0.8766
Epoch 920/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4511 - a
cc: 0.8766
Epoch 921/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4509 - a
cc: 0.8767
Epoch 922/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4506 - a
cc: 0.8767
Epoch 923/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4504 - a
cc: 0.8769
Epoch 924/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4502 - a
cc: 0.8769
Epoch 925/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4499 - a
cc: 0.8769
Epoch 926/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4497 - a
cc: 0.8769
Epoch 927/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4495 - a
cc: 0.8769
Epoch 928/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4493 - a
cc: 0.8769
Epoch 929/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4490 - a
cc: 0.8769
Epoch 930/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4488 - a
cc: 0.8770
Epoch 931/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4486 - a
cc: 0.8770
```

```
Epoch 932/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4483 - a
cc: 0.8771
Epoch 933/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4481 - a
cc: 0.8773
Epoch 934/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4479 - a
cc: 0.8773
Epoch 935/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4477 - a
cc: 0.8774
Epoch 936/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4474 - a
cc: 0.8774
Epoch 937/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4472 - a
cc: 0.8774
Epoch 938/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4470 - a
cc: 0.8775
Epoch 939/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4467 - a
cc: 0.8776
Epoch 940/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4465 - a
cc: 0.8777
Epoch 941/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4463 - a
cc: 0.8776
Epoch 942/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4461 - a
cc: 0.8775
Epoch 943/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4458 - a
cc: 0.8776
Epoch 944/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4456 - a
cc: 0.8776
Epoch 945/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4454 - a
cc: 0.8776
Epoch 946/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4452 - a
cc: 0.8778
Epoch 947/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4449 - a
cc: 0.8778
Epoch 948/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4447 - a
cc: 0.8778
Epoch 949/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4445 - a
cc: 0.8778
Epoch 950/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4443 - a
cc: 0.8778
```

```
Epoch 951/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4441 - a
cc: 0.8777
Epoch 952/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4438 - a
cc: 0.8780
Epoch 953/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4436 - a
cc: 0.8781
Epoch 954/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4434 - a
cc: 0.8782
Epoch 955/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4432 - a
cc: 0.8782
Epoch 956/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4430 - a
cc: 0.8783
Epoch 957/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4427 - a
cc: 0.8784
Epoch 958/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4425 - a
cc: 0.8784
Epoch 959/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4423 - a
cc: 0.8785
Epoch 960/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4421 - a
cc: 0.8786
Epoch 961/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4419 - a
cc: 0.8786
Epoch 962/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4416 - a
cc: 0.8786
Epoch 963/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4414 - a
cc: 0.8787
Epoch 964/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4412 - a
cc: 0.8787
Epoch 965/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4410 - a
cc: 0.8788
Epoch 966/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4408 - a
cc: 0.8788
Epoch 967/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4406 - a
cc: 0.8788
Epoch 968/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4403 - a
cc: 0.8789
Epoch 969/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4401 - a
cc: 0.8792
```

```
Epoch 970/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4399 - a
cc: 0.8792
Epoch 971/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4397 - a
cc: 0.8792
Epoch 972/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4395 - a
cc: 0.8794
Epoch 973/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4393 - a
cc: 0.8793
Epoch 974/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4390 - a
cc: 0.8793
Epoch 975/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4388 - a
cc: 0.8793
Epoch 976/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4386 - a
cc: 0.8794
Epoch 977/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4384 - a
cc: 0.8794
Epoch 978/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4382 - a
cc: 0.8794
Epoch 979/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4380 - a
cc: 0.8795
Epoch 980/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4378 - a
cc: 0.8796
Epoch 981/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4376 - a
cc: 0.8796
Epoch 982/1000
10000/10000 [==============================] - 0s 1us/step - loss: 0.4373 - a
cc: 0.8795
Epoch 983/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4371 - a
cc: 0.8795
Epoch 984/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4369 - a
cc: 0.8795
Epoch 985/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4367 - a
cc: 0.8796
Epoch 986/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4365 - a
cc: 0.8798
Epoch 987/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4363 - a
cc: 0.8798
Epoch 988/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4361 - a
cc: 0.8798
```

```
Epoch 989/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4359 - a
cc: 0.8799
Epoch 990/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4357 - a
cc: 0.8797
Epoch 991/1000
10000/10000 [==============================] - 0s 5us/step - loss: 0.4355 - a
cc: 0.8801
Epoch 992/1000
10000/10000 [==============================] - 0s 3us/step - loss: 0.4353 - a
cc: 0.8803
Epoch 993/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4350 - a
cc: 0.8803
Epoch 994/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4348 - a
cc: 0.8804
Epoch 995/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4346 - a
cc: 0.8805
Epoch 996/1000
10000/10000 [==============================] - 0s 4us/step - loss: 0.4344 - a
cc: 0.8806
Epoch 997/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4342 - a
cc: 0.8807
Epoch 998/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4340 - a
cc: 0.8807
Epoch 999/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4338 - a
cc: 0.8809
Epoch 1000/1000
10000/10000 [==============================] - 0s 2us/step - loss: 0.4336 - a
cc: 0.8810
10000/10000 [==============================] - 1s 59us/step
```

In [209]:
```python
print("The minimum error obtained by applying the above obtained optimal numbe
r of perceptrons is {}".format(1-accuracy3[1]))
```

The minimum error obtained by applying the above obtained optimal number of p
erceptrons is 0.12229999999999996

Points to note (Part 3):

1) All the conditions and steps mentioned in the quesion have been adhered to.

2) The 3 datasets are generated using the same techniques, distributions, and functions as in part 1 and 2.

3) The neural networks have been generated and implemented using the 'keras' package library. All the details mentioned in the question regarding the neural networks (such as the signmoid activation function for the perceptrons, normalized exponential function for the output layer, etc.) have been complied to through this package. The non-specified parameters have been chosen based on common norm for classification problems using neural netwroks.

4) Cross-validation to choose the optimal model order has been implemented manually using a personally created function.

Inferences:

1) The test dataset probability errors have been mentioned above at the end of the code.

2) These results show that, larger the training dataset size, the better the training of the neural network and thus the neural network classifies the test data more accurately (lesser errors). It is observed that the probability of error of classification of the test data decreases as the training dataset size increases from 100 to 10000.

In [ ]:

Question 1 :

Part 2 :

MAP clasification rule:

According to Bayes Decision Theory, the decision rule for minimum risk or loss ~~(i.e. decision rule to minimize the probability of errors)~~ is given by:

$$d = \underset{i}{argmin} \sum_{j=1}^{c} \lambda_{ij} \, P(x|L=j) \, P(L=j)$$

For minimum error rate clasification,

$$\lambda_{ij} = \begin{cases} 0 & \text{if } i=j \\ 1 & \text{if } i \neq j \end{cases} = 1 - \delta_{ij} \qquad \left[\text{where } \delta_{ij} = \begin{cases} 0 & \text{if } i \neq j \\ 1 & \text{if } i = j \end{cases} \right]$$

$$\therefore d = \underset{i}{argmin} \sum_{j=1}^{c} (1 - \delta_{ij}) P(L=j|x)$$

$$= \underset{i}{argmin} \sum_{j=1}^{c} P(L=j|x) - \sum_{j=1}^{c} \delta_{ij} P(L=j|x) \qquad \left[\begin{array}{l} \text{where } \delta_{ij} = 0 \text{ when } i \neq j \text{ and} \\ \delta_{ij} = 1 \text{ when } i = j \end{array} \right]$$

$$= \underset{i}{argmin} \sum_{j=1}^{c} P(L=j|x) - P(L=i|x) \qquad \left[\sum_{j=1}^{c} P(L=j|x) = 1 \right]$$

$$= \underset{i}{argmin} \; 1 - P(L=i|x)$$

$$= \underset{i}{argmax} \; P(L=i|x) \Rightarrow \text{MAP clasifier} \Rightarrow \text{choose } i \text{ such that posterior is maximum}$$

$$= \underset{i}{argmax} \; ~~P(L=i)~~ \frac{P(x|L=i)\{P(L=i)}{~~P(x)~~ \to constant} \leftarrow \text{By Bayes Rule}$$

$$d = \underset{i}{argmax} \; P(x|L=i) P(L=i)$$

Applying to the case of our problem,

$$\boxed{d = \underset{i \in \{1,2,3,4\}}{argmax} \; P(x|L=i) P(L=i)} \to \text{This is the MAP clasifier for our problem.}$$

This is the exact clasifier followed by me in the program. The posterior values for each clas is calculated for each ~~class, then~~ the point is

data point. The class for which the posterior for that point is maximum, is the MAP classification of that point. This is then compared to the true class of label of that point and it is determined if the classification was errored or true.

This way, the MAP classification is compared with the true classes for each point and the total number of errors are counted. The probability of error of the MAP classifier is then calculated based on the following formula:

$$\text{Minimum probability of error} = \frac{\text{Total misclassified points}}{\text{Total number of points}}$$

The MAP classifier gives the minimum probability of error since in this case, the loss is considered as a 1-0 loss wherein the loss is 0 for correct classification and 1 for a misclassification. This is the condition for minimum errors, and thus the MAP classifier gives the minimum error of probability.

Part 3:

① In this part, the data has been calculated in the same way as the data generated in the previous sections.

② The neural network has been created and used using the 'Keras' package; especially the KerasClassifier package which has its applications in classifying data into classes. Therefore, keeping the application of the problem, and also the requirements of the problem, the neural network has been designed in the following manner:

→

Input Layer   Hidden Layer   Output Layer
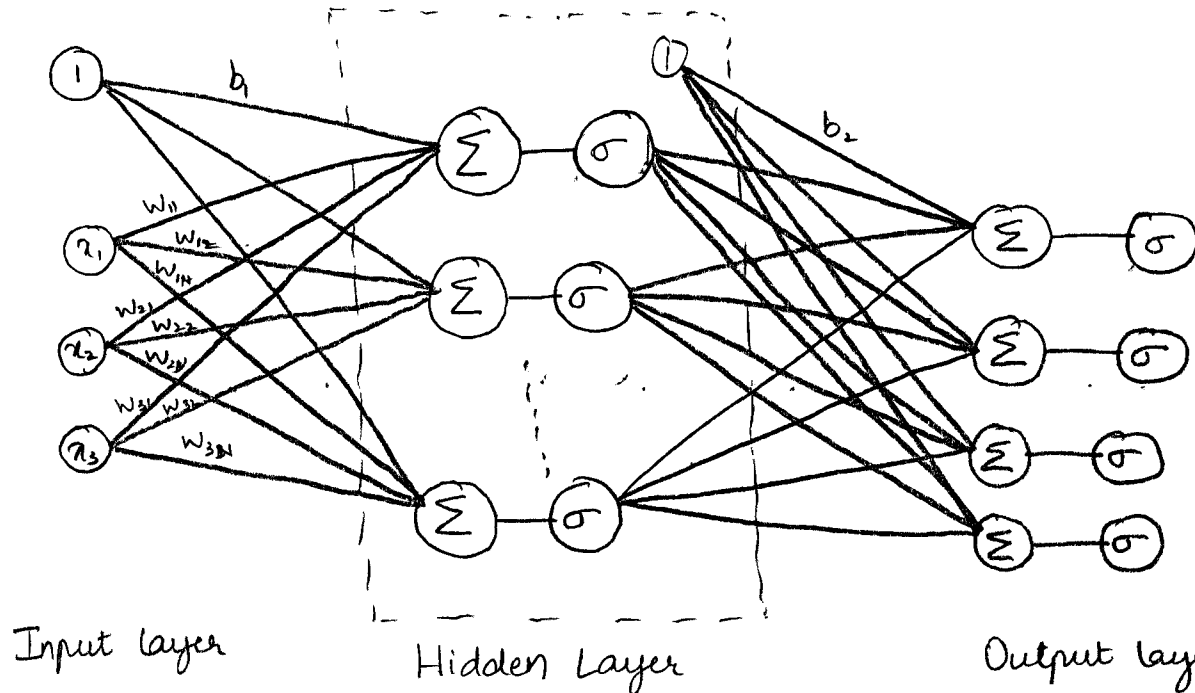
In the input layer, the coordinates of each point is passed into the neural network. These coordinate values are then ~~vested~~ multiplied with the weights and the weighted ~~sum~~ sum of the coordinates are found at each perceptron of the hidden layer. These are then passed through the activation function. In our case, we have chosen the activation function of the hidden layer to be as 'sigmoid.'. The equation for the sigmoid function can be given as:

$$f(x) = \frac{1}{1 + e^{-x}}$$

In our perception, the value of x is the weighted sum that enters the activation function.

The output from the perceptrons are again multiplied with the weights at this point and a new weighted sum is calculated from the outputs of the perceptrons in the hidden layer.

The output layer has only 4 perceptrons signifying the likelihood that the particular point lies in a particular class. The activation function for the output layer is ~~given by~~ the softmax function which is given by the equation:

$$\sigma(z)_i = \frac{e^{z_i}}{\sum_{j=1}^{K} e^{z_j}} \quad \text{for } i=1,\ldots,K \text{ and } Z = (z_1,\ldots,z_k) \in \mathbb{R}^K$$

$$\sigma : \mathbb{R}^K \to \mathbb{R}^K$$

The optimization function used for ~~the~~ updating the weights by back-propagation is the Stochastic Gradient Descent.

In the code, the neural network is ~~in~~ created and implemented by the Keras library package. To conduct crossvalidation and find the optimal values for minimum probability of error, the code uses the Gridsearch cv library from sklearn. The gridsearch function does the cross-validation and also checks the optimal parameters by substituting all the parameters passed into it.

③ This neural network is applied onto all the three datasets of 100, 1000, and 10000 datasets. After finding ~~all~~ the optimal parameters for all the three datasets, the neural network is trained on these same datasets and tested on the datasets from step 2. These probabilities of error obtained after testing are compared with the error probabilities of the MAP classifier.

④ It is observed that the ~~~~probability of error decreases as the neural network is trained on larger datasets. ~~Also,~~ Also, it approaches ~~near~~ the MAP classification, as the number of (prob. of error) perceptrons are increased. But this leads to overfitting the neural network to the (training) data and hence is not a healthy practice.

✏️ Math

data $\in \{(x_1, l_1), \ldots\ldots, (x_m, l_m)\}$ where x is the data and l is the label.

∴, the $\overset{\text{parameter for}}{\wedge}$ Maximum likelihood, (required to find class of a data point)

$$\hat{\Theta}_{ML} = \underset{\Theta}{argmax} \{P((x_1, l_1), (x_2, l_2), \ldots, (x_n, l_n))$$

$$= \underset{\Theta}{argmax} \prod_{i=1}^{N} P(x_i \, l_i | \Theta)$$

$$= \underset{\Theta}{argmax} \prod_{i=1}^{N} P(l_i | x_i, \Theta_*) \cdot \underbrace{P(x_i | \Theta)}_{\substack{\text{constant for} \\ \text{any label}}}$$

$$\hat{\Theta}_{ML} = \underset{\Theta}{argmax} \sum_{i=1}^{N} \ln P(l_i | x_i, \Theta)$$

(Applying log → does not affect the maximum value and hence does not affect value of Θ_{ML})

This is the Maximum likelihood parameter function used to determine the best parameter.

Solution 2:

```
In [252]: import numpy as np
          import matplotlib.pyplot as plt
          from mpl_toolkits.mplot3d import Axes3D
          from scipy.stats import multivariate_normal
          from scipy.linalg import fractional_matrix_power
          from scipy.linalg import sqrtm
          from sklearn.datasets import make_spd_matrix
          from sklearn.model_selection import KFold
          from sklearn.model_selection import GridSearchCV
          import math

          from keras.models import Sequential
          from keras.layers import Dense
          from keras.wrappers.scikit_learn import KerasRegressor
          from sklearn.model_selection import cross_val_score
          from sklearn.model_selection import KFold
          from sklearn.preprocessing import StandardScaler
          from sklearn.pipeline import Pipeline
```

```
In [253]: meanVectors = [[-18, -8], [0, 0], [18, 8]]
          prior = [0.33, 0.34, 0.33]

          N_1 = 1000
          N_2 = 10000

          M = [2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24]
          activ = ['sigmoid', 'softplus']
```

```
In [254]: covEvalues = [[3.2**2, 0], [0, 0.6**2]]
          covEvectors_1 = np.multiply(1/math.sqrt(2), [[1, -1], [1, 1]])
          covEvectors_2 = [[1, 0], [0, 1]]
          covEvectors_3 = np.multiply(1/math.sqrt(2), [[1, -1], [1, 1]])
```

```
In [255]: #generating number of sample for the GMMs
          def sample_number(N):
              l_1 = 0
              l_2 = 0
              l_3 = 0

              for i in range(N):
                  temp = np.random.uniform(0, 1, 1)
                  if temp <= prior[0]:
                      l_1 = l_1 + 1
                  elif temp <= prior[0] + prior[1]:
                      l_2 = l_2 + 1

              l_3 = N - l_1 - l_2
              return l_1, l_2, l_3
```

Generating training data:

```
In [256]: train_l_1, train_l_2, train_l_3 = sample_number(N_1)
```

```
In [257]: train_data = []

          train_data_1 = np.add(np.matmul(np.matmul(np.array(covEvectors_1), np.sqrt(np.
          array(covEvalues))), np.random.randn(2, train_l_1)), np.array(meanVectors)[0,
          :].reshape((2, 1)))
          train_data_2 = np.add(np.matmul(np.matmul(np.array(covEvectors_2), np.sqrt(np.
          array(covEvalues))), np.random.randn(2, train_l_2)), np.array(meanVectors)[1,
          :].reshape((2, 1)))
          train_data_3 = np.add(np.matmul(np.matmul(np.array(covEvectors_3), np.sqrt(np.
          array(covEvalues))), np.random.randn(2, train_l_3)), np.array(meanVectors)[2,
          :].reshape((2, 1)))

          for i in range(train_l_1):
              train_data.append(np.array(train_data_1)[:, i])
          for i in range(train_l_2):
              train_data.append(np.array(train_data_2)[:, i])
          for i in range(train_l_3):
              train_data.append(np.array(train_data_3)[:, i])
```

```
In [258]: fig = plt.figure(figsize=(10, 10))
          ax = fig.add_subplot(1, 1, 1)
          ax.scatter(np.array(train_data)[:, 0], np.array(train_data)[:, 1], s = 10, lab
          el='Data points')
          plt.xlabel('X-axis')
          plt.ylabel('Y-axis')
          plt.title('Visualization of training data as a 2-D scatter plot')
          ax.legend()
          plt.show()
```
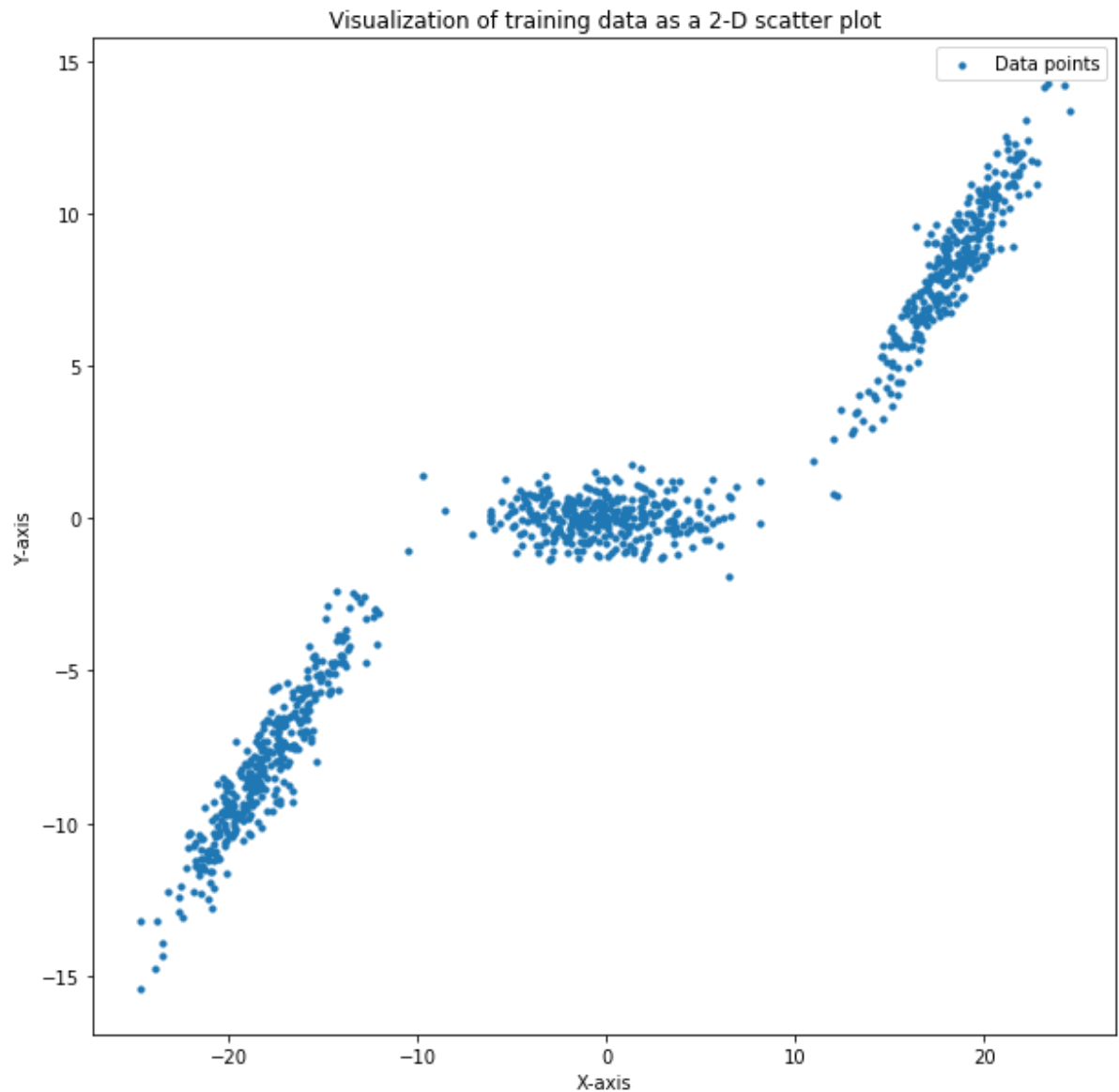

Generating testing data:

```
In [259]: test_l_1, test_l_2, test_l_3 = sample_number(N_2)
```

```
In [260]: test_data = []

          test_data_1 = np.add(np.matmul(np.matmul(np.array(covEvectors_1), np.sqrt(np.a
          rray(covEvalues))), np.random.randn(2, test_l_1)), np.array(meanVectors)[0, :]
          .reshape((2, 1)))
          test_data_2 = np.add(np.matmul(np.matmul(np.array(covEvectors_2), np.sqrt(np.a
          rray(covEvalues))), np.random.randn(2, test_l_2)), np.array(meanVectors)[1, :]
          .reshape((2, 1)))
          test_data_3 = np.add(np.matmul(np.matmul(np.array(covEvectors_3), np.sqrt(np.a
          rray(covEvalues))), np.random.randn(2, test_l_3)), np.array(meanVectors)[2, :]
          .reshape((2, 1)))

          for i in range(test_l_1):
              test_data.append(np.array(test_data_1)[:, i])
          for i in range(test_l_2):
              test_data.append(np.array(test_data_2)[:, i])
          for i in range(test_l_3):
              test_data.append(np.array(test_data_3)[:, i])
```

```
In [261]: fig = plt.figure(figsize=(10, 10))
          ax = fig.add_subplot(1, 1, 1)
          ax.scatter(np.array(test_data)[:, 0], np.array(test_data)[:, 1], s = 10, label
          ='Data points')
          plt.xlabel('X-axis')
          plt.ylabel('Y-axis')
          plt.title('Visualization of testing data as a 2-D scatter plot')
          ax.legend()
          plt.show()
```
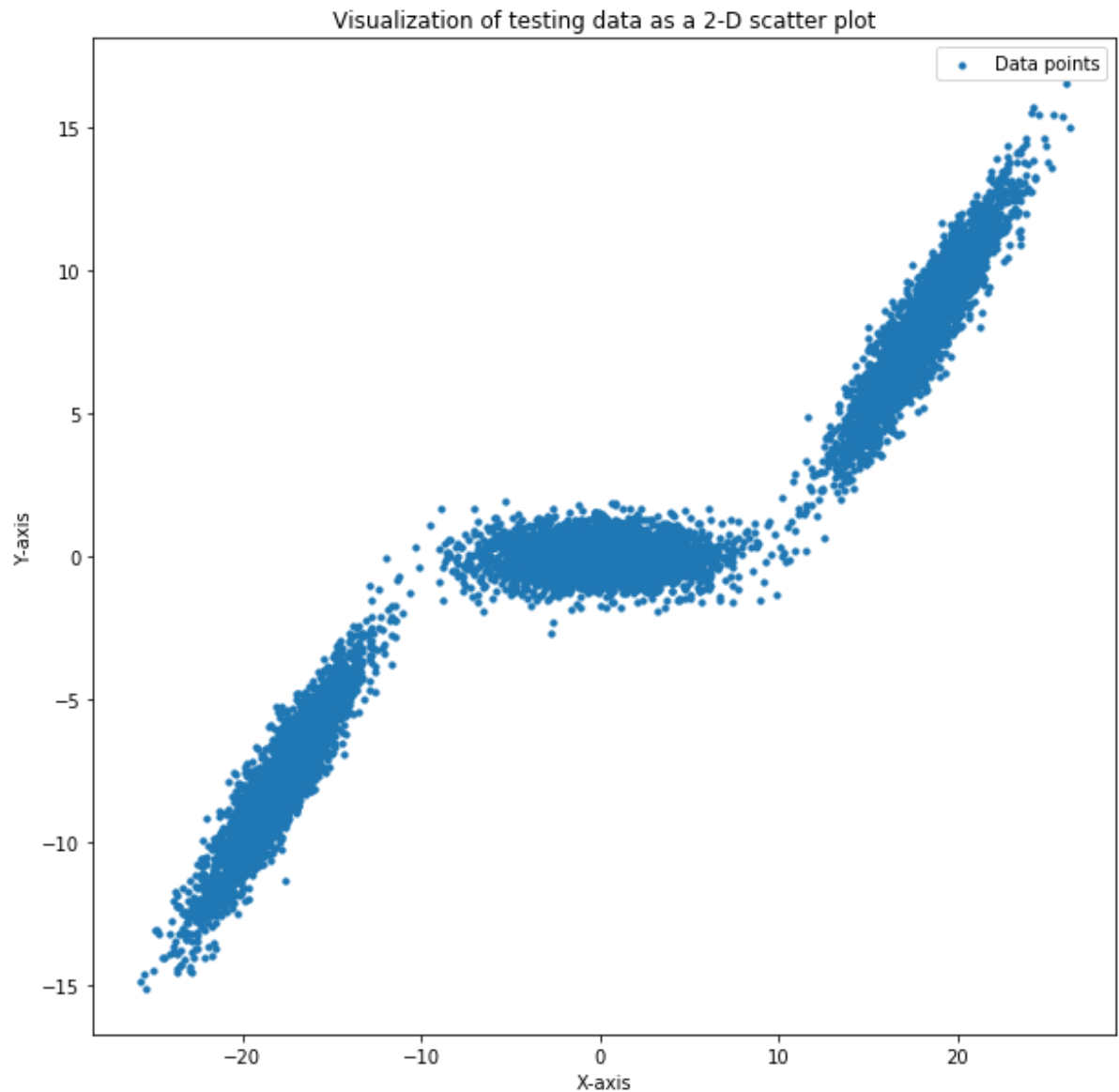

Selecting the optimal model using cross-validation:

Calculating optimal model order for Sigmoid activation

```
In [262]: def baseline_model_1(M=0):
              model = Sequential()
              model.add(Dense(M, input_dim=1, kernel_initializer='normal', activation='s
          igmoid'))
              model.add(Dense(1, kernel_initializer='normal'))
              model.compile(loss='mse', optimizer='RMSprop', metrics = ['mse'])
              return model
```

```
In [263]: X = np.array(train_data)[:, 0]
          Y = np.array(train_data)[:, 1]
          parameters = dict(M=M)
          estimator = KerasRegressor(build_fn=baseline_model_1, epochs=1000, batch_size=
          N_1, verbose=0)
          kfold = KFold(n_splits=10, shuffle = True)
          gridsrch = GridSearchCV(estimator = estimator, param_grid = parameters, cv = k
          fold, n_jobs=-1)
          result = gridsrch.fit(X, Y)
          best_score_1 = -1*result.best_score_
          best_param_1 = result.best_params_
          mean_1 = np.multiply(-1, result.cv_results_['mean_test_score'])
          param_1 = result.cv_results_['params']
```

```
In [264]: print("The best parameter for the sigmoid activation function is {} with a los
          s (mean squared error) of {}".format(best_param_1, best_score_1))
```

The best parameter for the sigmoid activation function is {'M': 24} with a lo
ss (mean squared error) of 3.1476848125457764

```
In [265]: for mean, param in zip(mean_1, param_1):
              print("%f with: %r" % (mean, param))
```

```
36.776821 with: {'M': 2}
28.176666 with: {'M': 4}
21.423724 with: {'M': 6}
16.645076 with: {'M': 8}
11.538482 with: {'M': 10}
9.025888 with: {'M': 12}
6.079369 with: {'M': 14}
4.925154 with: {'M': 16}
4.266614 with: {'M': 18}
3.624024 with: {'M': 20}
3.675913 with: {'M': 22}
3.147685 with: {'M': 24}
```

Calculating optimal model order for Softplus activation

```
In [266]: def baseline_model_2(M=0):
              model = Sequential()
              model.add(Dense(M, input_dim=1, kernel_initializer='normal', activation='s
          oftplus'))
              model.add(Dense(1, kernel_initializer='normal'))
              model.compile(loss='mean_squared_error', optimizer='RMSprop', metrics = [
          'mse'])
              return model
```

```
In [267]: X = np.array(train_data)[:, 0]
          Y = np.array(train_data)[:, 1]
          parameters = dict(M=M)
          estimator = KerasRegressor(build_fn=baseline_model_2, epochs=1000, batch_size=
          N_1, verbose=0)
          kfold = KFold(n_splits=10, shuffle = True)
          gridsrch = GridSearchCV(estimator = estimator, param_grid = parameters, cv = k
          fold, n_jobs=-1)
          result = gridsrch.fit(X, Y)
          best_score_2 = -1*result.best_score_
          best_param_2 = result.best_params_
          mean_2 = np.multiply(-1, result.cv_results_['mean_test_score'])
          param_2 = result.cv_results_['params']
```

```
In [268]: print("The best parameter for the softplus activation function is {} with a lo
          ss (mean squared error) of {}".format(best_param_2, best_score_2))
```

```
The best parameter for the softplus activation function is {'M': 24} with a l
oss (mean squared error) of 1.7073563635349274
```

```
In [269]: for mean, param in zip(mean_2, param_2):
              print("%f with: %r" % (mean, param))
```

```
13.200888 with: {'M': 2}
7.285174 with: {'M': 4}
1.959078 with: {'M': 6}
1.879596 with: {'M': 8}
1.837582 with: {'M': 10}
1.797388 with: {'M': 12}
1.784011 with: {'M': 14}
1.760713 with: {'M': 16}
1.750147 with: {'M': 18}
1.727451 with: {'M': 20}
1.711531 with: {'M': 22}
1.707356 with: {'M': 24}
```

```
In [270]: if abs(best_score_1) < abs(best_score_2):
              act = 'sigmoid'
              best_param = best_param_1.get('M')
          else:
              act = 'softplus'
              best_param = best_param_2.get('M')
```

```
In [271]: fig = plt.figure(figsize=(10, 10))
          ax = fig.add_subplot(1, 1, 1)
          ax.plot(M, mean_1, label='Sigmoid')
          ax.plot(M, mean_2, label='Softplus')
          plt.xlabel('Number of Perceptrons')
          plt.ylabel('Mean Squared Error')
          plt.title('Plot of Mean Squared Error vs Number of Perceptrons for both activa
          tion functions')
          ax.legend()
          plt.show()
```
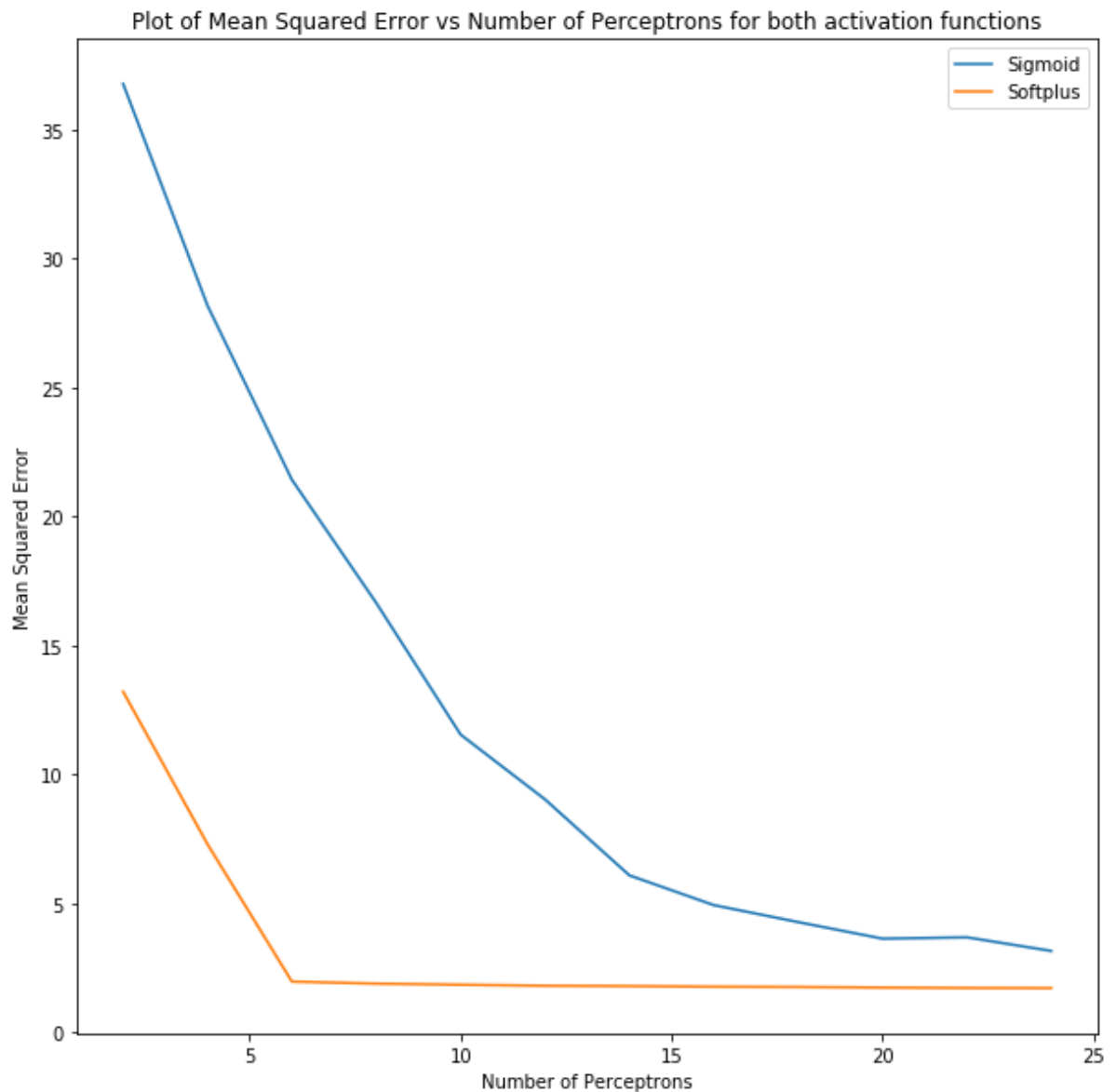

Predicting the results for the optimal parameters

```
In [272]: X_test = np.array(test_data)[:, 0]
          Y_test = np.array(test_data)[:, 1]
```

In [273]:
```python
model = Sequential()
model.add(Dense(best_param, input_dim=1, kernel_initializer='normal', activati
on=act))
model.add(Dense(1, kernel_initializer='normal'))
model.compile(loss='mse', optimizer='RMSprop', metrics = ['mse'])
model.fit(X, Y, epochs=1000, batch_size=1000)
loss, accuracy = model.evaluate(X_test, Y_test)
predictions = model.predict(X_test)
```

```
Epoch 1/1000
1000/1000 [==============================] - 2s 2ms/step - loss: 47.5638 - me
an_squared_error: 47.5638
Epoch 2/1000
1000/1000 [==============================] - 0s 39us/step - loss: 46.9474 - m
ean_squared_error: 46.9474
Epoch 3/1000
1000/1000 [==============================] - 0s 8us/step - loss: 46.5012 - me
an_squared_error: 46.5012
Epoch 4/1000
1000/1000 [==============================] - 0s 32us/step - loss: 46.1236 - m
ean_squared_error: 46.1236
Epoch 5/1000
1000/1000 [==============================] - 0s 9us/step - loss: 45.7844 - me
an_squared_error: 45.7844
Epoch 6/1000
1000/1000 [==============================] - 0s 10us/step - loss: 45.4691 - m
ean_squared_error: 45.4691
Epoch 7/1000
1000/1000 [==============================] - 0s 37us/step - loss: 45.1707 - m
ean_squared_error: 45.1707
Epoch 8/1000
1000/1000 [==============================] - 0s 30us/step - loss: 44.8837 - m
ean_squared_error: 44.8837
Epoch 9/1000
1000/1000 [==============================] - 0s 22us/step - loss: 44.6051 - m
ean_squared_error: 44.6051
Epoch 10/1000
1000/1000 [==============================] - 0s 49us/step - loss: 44.3325 - m
ean_squared_error: 44.3325
Epoch 11/1000
1000/1000 [==============================] - 0s 11us/step - loss: 44.0643 - m
ean_squared_error: 44.0643
Epoch 12/1000
1000/1000 [==============================] - 0s 11us/step - loss: 43.7990 - m
ean_squared_error: 43.7990
Epoch 13/1000
1000/1000 [==============================] - 0s 30us/step - loss: 43.5354 - m
ean_squared_error: 43.5354
Epoch 14/1000
1000/1000 [==============================] - 0s 9us/step - loss: 43.2732 - me
an_squared_error: 43.2732
Epoch 15/1000
1000/1000 [==============================] - 0s 7us/step - loss: 43.0110 - me
an_squared_error: 43.0110
Epoch 16/1000
1000/1000 [==============================] - 0s 7us/step - loss: 42.7488 - me
an_squared_error: 42.7488
Epoch 17/1000
1000/1000 [==============================] - 0s 10us/step - loss: 42.4857 - m
ean_squared_error: 42.4857
Epoch 18/1000
1000/1000 [==============================] - 0s 6us/step - loss: 42.2215 - me
an_squared_error: 42.2215
Epoch 19/1000
1000/1000 [==============================] - 0s 11us/step - loss: 41.9556 - m
ean_squared_error: 41.9556
```

```
Epoch 20/1000
1000/1000 [==============================] - 0s 10us/step - loss: 41.6878 - m
ean_squared_error: 41.6878
Epoch 21/1000
1000/1000 [==============================] - 0s 5us/step - loss: 41.4179 - me
an_squared_error: 41.4179
Epoch 22/1000
1000/1000 [==============================] - 0s 7us/step - loss: 41.1458 - me
an_squared_error: 41.1458
Epoch 23/1000
1000/1000 [==============================] - 0s 11us/step - loss: 40.8713 - m
ean_squared_error: 40.8713
Epoch 24/1000
1000/1000 [==============================] - 0s 9us/step - loss: 40.5943 - me
an_squared_error: 40.5943
Epoch 25/1000
1000/1000 [==============================] - 0s 9us/step - loss: 40.3147 - me
an_squared_error: 40.3147
Epoch 26/1000
1000/1000 [==============================] - 0s 11us/step - loss: 40.0324 - m
ean_squared_error: 40.0324
Epoch 27/1000
1000/1000 [==============================] - 0s 9us/step - loss: 39.7473 - me
an_squared_error: 39.7473
Epoch 28/1000
1000/1000 [==============================] - 0s 7us/step - loss: 39.4595 - me
an_squared_error: 39.4595
Epoch 29/1000
1000/1000 [==============================] - 0s 13us/step - loss: 39.1688 - m
ean_squared_error: 39.1688
Epoch 30/1000
1000/1000 [==============================] - 0s 8us/step - loss: 38.8751 - me
an_squared_error: 38.8751
Epoch 31/1000
1000/1000 [==============================] - 0s 6us/step - loss: 38.5784 - me
an_squared_error: 38.5784
Epoch 32/1000
1000/1000 [==============================] - 0s 11us/step - loss: 38.2786 - m
ean_squared_error: 38.2786
Epoch 33/1000
1000/1000 [==============================] - 0s 7us/step - loss: 37.9756 - me
an_squared_error: 37.9756
Epoch 34/1000
1000/1000 [==============================] - 0s 8us/step - loss: 37.6695 - me
an_squared_error: 37.6695
Epoch 35/1000
1000/1000 [==============================] - 0s 9us/step - loss: 37.3603 - me
an_squared_error: 37.3603
Epoch 36/1000
1000/1000 [==============================] - 0s 11us/step - loss: 37.0479 - m
ean_squared_error: 37.0479
Epoch 37/1000
1000/1000 [==============================] - 0s 9us/step - loss: 36.7324 - me
an_squared_error: 36.7324
Epoch 38/1000
1000/1000 [==============================] - 0s 15us/step - loss: 36.4140 - m
ean_squared_error: 36.4140
```

```
Epoch 39/1000
1000/1000 [==============================] - 0s 62us/step - loss: 36.0926 - m
ean_squared_error: 36.0926
Epoch 40/1000
1000/1000 [==============================] - 0s 34us/step - loss: 35.7682 - m
ean_squared_error: 35.7682
Epoch 41/1000
1000/1000 [==============================] - 0s 8us/step - loss: 35.4414 - me
an_squared_error: 35.4414
Epoch 42/1000
1000/1000 [==============================] - 0s 7us/step - loss: 35.1121 - me
an_squared_error: 35.1121
Epoch 43/1000
1000/1000 [==============================] - 0s 39us/step - loss: 34.7803 - m
ean_squared_error: 34.7803
Epoch 44/1000
1000/1000 [==============================] - 0s 10us/step - loss: 34.4451 - m
ean_squared_error: 34.4451
Epoch 45/1000
1000/1000 [==============================] - 0s 5us/step - loss: 34.1089 - me
an_squared_error: 34.1089
Epoch 46/1000
1000/1000 [==============================] - 0s 14us/step - loss: 33.7706 - m
ean_squared_error: 33.7706
Epoch 47/1000
1000/1000 [==============================] - 0s 7us/step - loss: 33.4302 - me
an_squared_error: 33.4302
Epoch 48/1000
1000/1000 [==============================] - 0s 10us/step - loss: 33.0879 - m
ean_squared_error: 33.0879
Epoch 49/1000
1000/1000 [==============================] - 0s 8us/step - loss: 32.7429 - me
an_squared_error: 32.7429
Epoch 50/1000
1000/1000 [==============================] - 0s 60us/step - loss: 32.3963 - m
ean_squared_error: 32.3963
Epoch 51/1000
1000/1000 [==============================] - 0s 65us/step - loss: 32.0487 - m
ean_squared_error: 32.0487
Epoch 52/1000
1000/1000 [==============================] - 0s 45us/step - loss: 31.6987 - m
ean_squared_error: 31.6987
Epoch 53/1000
1000/1000 [==============================] - 0s 7us/step - loss: 31.3479 - me
an_squared_error: 31.3479
Epoch 54/1000
1000/1000 [==============================] - 0s 11us/step - loss: 30.9957 - m
ean_squared_error: 30.9957
Epoch 55/1000
1000/1000 [==============================] - 0s 6us/step - loss: 30.6420 - me
an_squared_error: 30.6420
Epoch 56/1000
1000/1000 [==============================] - 0s 12us/step - loss: 30.2869 - m
ean_squared_error: 30.2869
Epoch 57/1000
1000/1000 [==============================] - 0s 41us/step - loss: 29.9300 - m
ean_squared_error: 29.9300
```

```
Epoch 58/1000
1000/1000 [==============================] - 0s 8us/step - loss: 29.5727 - me
an_squared_error: 29.5727
Epoch 59/1000
1000/1000 [==============================] - 0s 28us/step - loss: 29.2138 - m
ean_squared_error: 29.2138
Epoch 60/1000
1000/1000 [==============================] - 0s 27us/step - loss: 28.8546 - m
ean_squared_error: 28.8546
Epoch 61/1000
1000/1000 [==============================] - 0s 36us/step - loss: 28.4945 - m
ean_squared_error: 28.4945
Epoch 62/1000
1000/1000 [==============================] - 0s 32us/step - loss: 28.1337 - m
ean_squared_error: 28.1337
Epoch 63/1000
1000/1000 [==============================] - 0s 7us/step - loss: 27.7713 - me
an_squared_error: 27.7713
Epoch 64/1000
1000/1000 [==============================] - 0s 13us/step - loss: 27.4093 - m
ean_squared_error: 27.4093
Epoch 65/1000
1000/1000 [==============================] - 0s 9us/step - loss: 27.0469 - me
an_squared_error: 27.0469
Epoch 66/1000
1000/1000 [==============================] - 0s 22us/step - loss: 26.6840 - m
ean_squared_error: 26.6840
Epoch 67/1000
1000/1000 [==============================] - 0s 7us/step - loss: 26.3208 - me
an_squared_error: 26.3208
Epoch 68/1000
1000/1000 [==============================] - 0s 7us/step - loss: 25.9574 - me
an_squared_error: 25.9574
Epoch 69/1000
1000/1000 [==============================] - 0s 6us/step - loss: 25.5939 - me
an_squared_error: 25.5939
Epoch 70/1000
1000/1000 [==============================] - 0s 9us/step - loss: 25.2303 - me
an_squared_error: 25.2303
Epoch 71/1000
1000/1000 [==============================] - 0s 17us/step - loss: 24.8669 - m
ean_squared_error: 24.8669
Epoch 72/1000
1000/1000 [==============================] - 0s 10us/step - loss: 24.5033 - m
ean_squared_error: 24.5033
Epoch 73/1000
1000/1000 [==============================] - 0s 75us/step - loss: 24.1404 - m
ean_squared_error: 24.1404
Epoch 74/1000
1000/1000 [==============================] - 0s 15us/step - loss: 23.7780 - m
ean_squared_error: 23.7780
Epoch 75/1000
1000/1000 [==============================] - 0s 10us/step - loss: 23.4155 - m
ean_squared_error: 23.4155
Epoch 76/1000
1000/1000 [==============================] - 0s 15us/step - loss: 23.0543 - m
ean_squared_error: 23.0543
```

```
Epoch 77/1000
1000/1000 [==============================] - 0s 8us/step - loss: 22.6938 - me
an_squared_error: 22.6938
Epoch 78/1000
1000/1000 [==============================] - 0s 7us/step - loss: 22.3343 - me
an_squared_error: 22.3343
Epoch 79/1000
1000/1000 [==============================] - 0s 15us/step - loss: 21.9754 - m
ean_squared_error: 21.9754
Epoch 80/1000
1000/1000 [==============================] - 0s 9us/step - loss: 21.6180 - me
an_squared_error: 21.6180
Epoch 81/1000
1000/1000 [==============================] - 0s 37us/step - loss: 21.2618 - m
ean_squared_error: 21.2618
Epoch 82/1000
1000/1000 [==============================] - 0s 22us/step - loss: 20.9067 - m
ean_squared_error: 20.9067
Epoch 83/1000
1000/1000 [==============================] - 0s 17us/step - loss: 20.5533 - m
ean_squared_error: 20.5533
Epoch 84/1000
1000/1000 [==============================] - 0s 9us/step - loss: 20.2015 - me
an_squared_error: 20.2015
Epoch 85/1000
1000/1000 [==============================] - 0s 11us/step - loss: 19.8513 - m
ean_squared_error: 19.8513
Epoch 86/1000
1000/1000 [==============================] - 0s 8us/step - loss: 19.5028 - me
an_squared_error: 19.5028
Epoch 87/1000
1000/1000 [==============================] - 0s 10us/step - loss: 19.1563 - m
ean_squared_error: 19.1563
Epoch 88/1000
1000/1000 [==============================] - 0s 9us/step - loss: 18.8117 - me
an_squared_error: 18.8117
Epoch 89/1000
1000/1000 [==============================] - 0s 11us/step - loss: 18.4691 - m
ean_squared_error: 18.4691
Epoch 90/1000
1000/1000 [==============================] - 0s 13us/step - loss: 18.1286 - m
ean_squared_error: 18.1286
Epoch 91/1000
1000/1000 [==============================] - 0s 9us/step - loss: 17.7905 - me
an_squared_error: 17.7905
Epoch 92/1000
1000/1000 [==============================] - 0s 14us/step - loss: 17.4549 - m
ean_squared_error: 17.4549
Epoch 93/1000
1000/1000 [==============================] - 0s 12us/step - loss: 17.1215 - m
ean_squared_error: 17.1215
Epoch 94/1000
1000/1000 [==============================] - 0s 9us/step - loss: 16.7909 - me
an_squared_error: 16.7909
Epoch 95/1000
1000/1000 [==============================] - 0s 11us/step - loss: 16.4630 - m
ean_squared_error: 16.4630
```

```
Epoch 96/1000
1000/1000 [==============================] - 0s 11us/step - loss: 16.1376 - m
ean_squared_error: 16.1376
Epoch 97/1000
1000/1000 [==============================] - 0s 12us/step - loss: 15.8153 - m
ean_squared_error: 15.8153
Epoch 98/1000
1000/1000 [==============================] - 0s 7us/step - loss: 15.4960 - me
an_squared_error: 15.4960
Epoch 99/1000
1000/1000 [==============================] - 0s 14us/step - loss: 15.1797 - m
ean_squared_error: 15.1797
Epoch 100/1000
1000/1000 [==============================] - 0s 14us/step - loss: 14.8664 - m
ean_squared_error: 14.8664
Epoch 101/1000
1000/1000 [==============================] - 0s 7us/step - loss: 14.5563 - me
an_squared_error: 14.5563
Epoch 102/1000
1000/1000 [==============================] - 0s 7us/step - loss: 14.2498 - me
an_squared_error: 14.2498
Epoch 103/1000
1000/1000 [==============================] - 0s 13us/step - loss: 13.9467 - m
ean_squared_error: 13.9467
Epoch 104/1000
1000/1000 [==============================] - 0s 29us/step - loss: 13.6470 - m
ean_squared_error: 13.6470
Epoch 105/1000
1000/1000 [==============================] - 0s 13us/step - loss: 13.3507 - m
ean_squared_error: 13.3507
Epoch 106/1000
1000/1000 [==============================] - 0s 14us/step - loss: 13.0581 - m
ean_squared_error: 13.0581
Epoch 107/1000
1000/1000 [==============================] - 0s 7us/step - loss: 12.7695 - me
an_squared_error: 12.7695
Epoch 108/1000
1000/1000 [==============================] - 0s 10us/step - loss: 12.4846 - m
ean_squared_error: 12.4846
Epoch 109/1000
1000/1000 [==============================] - 0s 43us/step - loss: 12.2036 - m
ean_squared_error: 12.2036
Epoch 110/1000
1000/1000 [==============================] - 0s 15us/step - loss: 11.9266 - m
ean_squared_error: 11.9266
Epoch 111/1000
1000/1000 [==============================] - 0s 20us/step - loss: 11.6536 - m
ean_squared_error: 11.6536
Epoch 112/1000
1000/1000 [==============================] - 0s 21us/step - loss: 11.3847 - m
ean_squared_error: 11.3847
Epoch 113/1000
1000/1000 [==============================] - 0s 17us/step - loss: 11.1200 - m
ean_squared_error: 11.1200
Epoch 114/1000
1000/1000 [==============================] - 0s 12us/step - loss: 10.8595 - m
ean_squared_error: 10.8595
```

```
Epoch 115/1000
1000/1000 [==============================] - 0s 15us/step - loss: 10.6033 - m
ean_squared_error: 10.6033
Epoch 116/1000
1000/1000 [==============================] - 0s 11us/step - loss: 10.3515 - m
ean_squared_error: 10.3515
Epoch 117/1000
1000/1000 [==============================] - 0s 25us/step - loss: 10.1040 - m
ean_squared_error: 10.1040
Epoch 118/1000
1000/1000 [==============================] - 0s 13us/step - loss: 9.8609 - me
an_squared_error: 9.8609
Epoch 119/1000
1000/1000 [==============================] - 0s 11us/step - loss: 9.6224 - me
an_squared_error: 9.6224
Epoch 120/1000
1000/1000 [==============================] - 0s 10us/step - loss: 9.3884 - me
an_squared_error: 9.3884
Epoch 121/1000
1000/1000 [==============================] - 0s 11us/step - loss: 9.1591 - me
an_squared_error: 9.1591
Epoch 122/1000
1000/1000 [==============================] - 0s 13us/step - loss: 8.9343 - me
an_squared_error: 8.9343
Epoch 123/1000
1000/1000 [==============================] - 0s 6us/step - loss: 8.7142 - mea
n_squared_error: 8.7142
Epoch 124/1000
1000/1000 [==============================] - 0s 10us/step - loss: 8.4987 - me
an_squared_error: 8.4987
Epoch 125/1000
1000/1000 [==============================] - 0s 10us/step - loss: 8.2879 - me
an_squared_error: 8.2879
Epoch 126/1000
1000/1000 [==============================] - 0s 6us/step - loss: 8.0818 - mea
n_squared_error: 8.0818
Epoch 127/1000
1000/1000 [==============================] - 0s 11us/step - loss: 7.8804 - me
an_squared_error: 7.8804
Epoch 128/1000
1000/1000 [==============================] - 0s 9us/step - loss: 7.6837 - mea
n_squared_error: 7.6837
Epoch 129/1000
1000/1000 [==============================] - 0s 6us/step - loss: 7.4918 - mea
n_squared_error: 7.4918
Epoch 130/1000
1000/1000 [==============================] - 0s 7us/step - loss: 7.3045 - mea
n_squared_error: 7.3045
Epoch 131/1000
1000/1000 [==============================] - 0s 6us/step - loss: 7.1219 - mea
n_squared_error: 7.1219
Epoch 132/1000
1000/1000 [==============================] - 0s 5us/step - loss: 6.9440 - mea
n_squared_error: 6.9440
Epoch 133/1000
1000/1000 [==============================] - 0s 9us/step - loss: 6.7706 - mea
n_squared_error: 6.7706
```

```
Epoch 134/1000
1000/1000 [==============================] - 0s 9us/step - loss: 6.6018 - mea
n_squared_error: 6.6018
Epoch 135/1000
1000/1000 [==============================] - 0s 9us/step - loss: 6.4376 - mea
n_squared_error: 6.4376
Epoch 136/1000
1000/1000 [==============================] - 0s 6us/step - loss: 6.2778 - mea
n_squared_error: 6.2778
Epoch 137/1000
1000/1000 [==============================] - 0s 8us/step - loss: 6.1224 - mea
n_squared_error: 6.1224
Epoch 138/1000
1000/1000 [==============================] - 0s 4us/step - loss: 5.9713 - mea
n_squared_error: 5.9713
Epoch 139/1000
1000/1000 [==============================] - 0s 12us/step - loss: 5.8245 - me
an_squared_error: 5.8245
Epoch 140/1000
1000/1000 [==============================] - 0s 6us/step - loss: 5.6819 - mea
n_squared_error: 5.6819
Epoch 141/1000
1000/1000 [==============================] - 0s 3us/step - loss: 5.5433 - mea
n_squared_error: 5.5433
Epoch 142/1000
1000/1000 [==============================] - 0s 6us/step - loss: 5.4086 - mea
n_squared_error: 5.4086
Epoch 143/1000
1000/1000 [==============================] - 0s 6us/step - loss: 5.2778 - mea
n_squared_error: 5.2778
Epoch 144/1000
1000/1000 [==============================] - 0s 8us/step - loss: 5.1508 - mea
n_squared_error: 5.1508
Epoch 145/1000
1000/1000 [==============================] - 0s 11us/step - loss: 5.0274 - me
an_squared_error: 5.0274
Epoch 146/1000
1000/1000 [==============================] - 0s 6us/step - loss: 4.9075 - mea
n_squared_error: 4.9075
Epoch 147/1000
1000/1000 [==============================] - 0s 8us/step - loss: 4.7910 - mea
n_squared_error: 4.7910
Epoch 148/1000
1000/1000 [==============================] - 0s 6us/step - loss: 4.6778 - mea
n_squared_error: 4.6778
Epoch 149/1000
1000/1000 [==============================] - 0s 8us/step - loss: 4.5678 - mea
n_squared_error: 4.5678
Epoch 150/1000
1000/1000 [==============================] - 0s 9us/step - loss: 4.4609 - mea
n_squared_error: 4.4609
Epoch 151/1000
1000/1000 [==============================] - 0s 15us/step - loss: 4.3570 - me
an_squared_error: 4.3570
Epoch 152/1000
1000/1000 [==============================] - 0s 10us/step - loss: 4.2560 - me
an_squared_error: 4.2560
```

```
Epoch 153/1000
1000/1000 [==============================] - 0s 13us/step - loss: 4.1578 - me
an_squared_error: 4.1578
Epoch 154/1000
1000/1000 [==============================] - 0s 9us/step - loss: 4.0624 - mea
n_squared_error: 4.0624
Epoch 155/1000
1000/1000 [==============================] - 0s 10us/step - loss: 3.9696 - me
an_squared_error: 3.9696
Epoch 156/1000
1000/1000 [==============================] - 0s 9us/step - loss: 3.8796 - mea
n_squared_error: 3.8796
Epoch 157/1000
1000/1000 [==============================] - 0s 6us/step - loss: 3.7921 - mea
n_squared_error: 3.7921
Epoch 158/1000
1000/1000 [==============================] - 0s 14us/step - loss: 3.7072 - me
an_squared_error: 3.7072
Epoch 159/1000
1000/1000 [==============================] - 0s 9us/step - loss: 3.6248 - mea
n_squared_error: 3.6248
Epoch 160/1000
1000/1000 [==============================] - 0s 8us/step - loss: 3.5450 - mea
n_squared_error: 3.5450
Epoch 161/1000
1000/1000 [==============================] - 0s 8us/step - loss: 3.4677 - mea
n_squared_error: 3.4677
Epoch 162/1000
1000/1000 [==============================] - 0s 7us/step - loss: 3.3929 - mea
n_squared_error: 3.3929
Epoch 163/1000
1000/1000 [==============================] - 0s 12us/step - loss: 3.3206 - me
an_squared_error: 3.3206
Epoch 164/1000
1000/1000 [==============================] - 0s 9us/step - loss: 3.2508 - mea
n_squared_error: 3.2508
Epoch 165/1000
1000/1000 [==============================] - 0s 9us/step - loss: 3.1835 - mea
n_squared_error: 3.1835
Epoch 166/1000
1000/1000 [==============================] - 0s 9us/step - loss: 3.1187 - mea
n_squared_error: 3.1187
Epoch 167/1000
1000/1000 [==============================] - 0s 10us/step - loss: 3.0563 - me
an_squared_error: 3.0563
Epoch 168/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.9964 - me
an_squared_error: 2.9964
Epoch 169/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.9390 - mea
n_squared_error: 2.9390
Epoch 170/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.8840 - mea
n_squared_error: 2.8840
Epoch 171/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.8314 - mea
n_squared_error: 2.8314
```

```
Epoch 172/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.7813 - mea
n_squared_error: 2.7813
Epoch 173/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.7336 - mea
n_squared_error: 2.7336
Epoch 174/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.6884 - mea
n_squared_error: 2.6884
Epoch 175/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.6454 - mea
n_squared_error: 2.6454
Epoch 176/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.6049 - mea
n_squared_error: 2.6049
Epoch 177/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.5666 - mea
n_squared_error: 2.5666
Epoch 178/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.5306 - mea
n_squared_error: 2.5306
Epoch 179/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.4969 - mea
n_squared_error: 2.4969
Epoch 180/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.4653 - mea
n_squared_error: 2.4653
Epoch 181/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.4359 - mea
n_squared_error: 2.4359
Epoch 182/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.4086 - mea
n_squared_error: 2.4086
Epoch 183/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.3834 - mea
n_squared_error: 2.3834
Epoch 184/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.3601 - mea
n_squared_error: 2.3601
Epoch 185/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.3388 - mea
n_squared_error: 2.3388
Epoch 186/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.3193 - mea
n_squared_error: 2.3193
Epoch 187/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.3016 - mea
n_squared_error: 2.3016
Epoch 188/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.2856 - mea
n_squared_error: 2.2856
Epoch 189/1000
1000/1000 [==============================] - 0s 3us/step - loss: 2.2712 - mea
n_squared_error: 2.2712
Epoch 190/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.2583 - mea
n_squared_error: 2.2583
```

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Epoch 191/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.2469 - mea
n_squared_error: 2.2469
Epoch 192/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.2368 - me
an_squared_error: 2.2368
Epoch 193/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.2279 - mea
n_squared_error: 2.2279
Epoch 194/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.2203 - me
an_squared_error: 2.2203
Epoch 195/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.2136 - mea
n_squared_error: 2.2136
Epoch 196/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.2079 - mea
n_squared_error: 2.2079
Epoch 197/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.2031 - mea
n_squared_error: 2.2031
Epoch 198/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1991 - mea
n_squared_error: 2.1991
Epoch 199/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1957 - mea
n_squared_error: 2.1957
Epoch 200/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1929 - me
an_squared_error: 2.1929
Epoch 201/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1905 - mea
n_squared_error: 2.1905
Epoch 202/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1886 - mea
n_squared_error: 2.1886
Epoch 203/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1870 - mea
n_squared_error: 2.1870
Epoch 204/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1857 - mea
n_squared_error: 2.1857
Epoch 205/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1847 - mea
n_squared_error: 2.1847
Epoch 206/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1838 - mea
n_squared_error: 2.1838
Epoch 207/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.1830 - me
an_squared_error: 2.1830
Epoch 208/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1823 - mea
n_squared_error: 2.1823
Epoch 209/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.1817 - me
an_squared_error: 2.1817
```

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Epoch 210/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1811 - mea
n_squared_error: 2.1811
Epoch 211/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1806 - mea
n_squared_error: 2.1806
Epoch 212/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1801 - mea
n_squared_error: 2.1801
Epoch 213/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1796 - mea
n_squared_error: 2.1796
Epoch 214/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1791 - mea
n_squared_error: 2.1791
Epoch 215/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1786 - me
an_squared_error: 2.1786
Epoch 216/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1781 - mea
n_squared_error: 2.1781
Epoch 217/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1776 - mea
n_squared_error: 2.1776
Epoch 218/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1779 - me
an_squared_error: 2.1779
Epoch 219/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1808 - mea
n_squared_error: 2.1808
Epoch 220/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1807 - mea
n_squared_error: 2.1807
Epoch 221/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1773 - mea
n_squared_error: 2.1773
Epoch 222/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1757 - mea
n_squared_error: 2.1757
Epoch 223/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1748 - mea
n_squared_error: 2.1748
Epoch 224/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.1741 - mea
n_squared_error: 2.1741
Epoch 225/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.1735 - me
an_squared_error: 2.1735
Epoch 226/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1730 - mea
n_squared_error: 2.1730
Epoch 227/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1725 - mea
n_squared_error: 2.1725
Epoch 228/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1719 - mea
n_squared_error: 2.1719
```

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Epoch 229/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1714 - mea
n_squared_error: 2.1714
Epoch 230/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1709 - mea
n_squared_error: 2.1709
Epoch 231/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1704 - mea
n_squared_error: 2.1704
Epoch 232/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1701 - mea
n_squared_error: 2.1701
Epoch 233/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1700 - mea
n_squared_error: 2.1700
Epoch 234/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1702 - mea
n_squared_error: 2.1702
Epoch 235/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1702 - mea
n_squared_error: 2.1702
Epoch 236/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1694 - mea
n_squared_error: 2.1694
Epoch 237/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1682 - mea
n_squared_error: 2.1682
Epoch 238/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1672 - mea
n_squared_error: 2.1672
Epoch 239/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1663 - me
an_squared_error: 2.1663
Epoch 240/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1656 - mea
n_squared_error: 2.1656
Epoch 241/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1649 - me
an_squared_error: 2.1649
Epoch 242/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1644 - mea
n_squared_error: 2.1644
Epoch 243/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1638 - mea
n_squared_error: 2.1638
Epoch 244/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1633 - mea
n_squared_error: 2.1633
Epoch 245/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1628 - mea
n_squared_error: 2.1628
Epoch 246/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1624 - mea
n_squared_error: 2.1624
Epoch 247/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1621 - mea
n_squared_error: 2.1621
```

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Epoch 248/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1618 - mea
n_squared_error: 2.1618
Epoch 249/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1614 - mea
n_squared_error: 2.1614
Epoch 250/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1608 - me
an_squared_error: 2.1608
Epoch 251/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1600 - mea
n_squared_error: 2.1600
Epoch 252/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1593 - mea
n_squared_error: 2.1593
Epoch 253/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1585 - mea
n_squared_error: 2.1585
Epoch 254/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1578 - mea
n_squared_error: 2.1578
Epoch 255/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1572 - mea
n_squared_error: 2.1572
Epoch 256/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1566 - mea
n_squared_error: 2.1566
Epoch 257/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1561 - mea
n_squared_error: 2.1561
Epoch 258/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1556 - mea
n_squared_error: 2.1556
Epoch 259/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.1553 - mea
n_squared_error: 2.1553
Epoch 260/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1553 - me
an_squared_error: 2.1553
Epoch 261/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1556 - mea
n_squared_error: 2.1556
Epoch 262/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1555 - mea
n_squared_error: 2.1555
Epoch 263/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1543 - me
an_squared_error: 2.1543
Epoch 264/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1531 - mea
n_squared_error: 2.1531
Epoch 265/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1522 - mea
n_squared_error: 2.1522
Epoch 266/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1514 - mea
n_squared_error: 2.1514
```

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Epoch 267/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1507 - mea
n_squared_error: 2.1507
Epoch 268/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1500 - mea
n_squared_error: 2.1500
Epoch 269/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1494 - mea
n_squared_error: 2.1494
Epoch 270/1000
1000/1000 [==============================] - 0s 16us/step - loss: 2.1489 - me
an_squared_error: 2.1489
Epoch 271/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.1483 - me
an_squared_error: 2.1483
Epoch 272/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1479 - mea
n_squared_error: 2.1479
Epoch 273/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1475 - mea
n_squared_error: 2.1475
Epoch 274/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1472 - mea
n_squared_error: 2.1472
Epoch 275/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1469 - mea
n_squared_error: 2.1469
Epoch 276/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1466 - mea
n_squared_error: 2.1466
Epoch 277/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.1459 - me
an_squared_error: 2.1459
Epoch 278/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1452 - me
an_squared_error: 2.1452
Epoch 279/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1443 - mea
n_squared_error: 2.1443
Epoch 280/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1436 - me
an_squared_error: 2.1436
Epoch 281/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1429 - mea
n_squared_error: 2.1429
Epoch 282/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1423 - mea
n_squared_error: 2.1423
Epoch 283/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1417 - mea
n_squared_error: 2.1417
Epoch 284/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1411 - me
an_squared_error: 2.1411
Epoch 285/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1406 - mea
n_squared_error: 2.1406
```

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Epoch 286/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1401 - mea
n_squared_error: 2.1401
Epoch 287/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1396 - mea
n_squared_error: 2.1396
Epoch 288/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1392 - mea
n_squared_error: 2.1392
Epoch 289/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1387 - mea
n_squared_error: 2.1387
Epoch 290/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1383 - mea
n_squared_error: 2.1383
Epoch 291/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1376 - mea
n_squared_error: 2.1376
Epoch 292/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1370 - mea
n_squared_error: 2.1370
Epoch 293/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1363 - mea
n_squared_error: 2.1363
Epoch 294/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1357 - me
an_squared_error: 2.1357
Epoch 295/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1350 - mea
n_squared_error: 2.1350
Epoch 296/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1344 - mea
n_squared_error: 2.1344
Epoch 297/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1338 - mea
n_squared_error: 2.1338
Epoch 298/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1333 - mea
n_squared_error: 2.1333
Epoch 299/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1327 - me
n_squared_error: 2.1327
Epoch 300/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.1322 - mea
n_squared_error: 2.1322
Epoch 301/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1317 - mea
n_squared_error: 2.1317
Epoch 302/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1312 - mea
n_squared_error: 2.1312
Epoch 303/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1306 - mea
n_squared_error: 2.1306
Epoch 304/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1301 - mea
n_squared_error: 2.1301
```

```
Epoch 305/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1295 - mea
n_squared_error: 2.1295
Epoch 306/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.1289 - me
an_squared_error: 2.1289
Epoch 307/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1283 - mea
n_squared_error: 2.1283
Epoch 308/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1277 - mea
n_squared_error: 2.1277
Epoch 309/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1270 - mea
n_squared_error: 2.1270
Epoch 310/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1265 - mea
n_squared_error: 2.1265
Epoch 311/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1259 - mea
n_squared_error: 2.1259
Epoch 312/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1254 - mea
n_squared_error: 2.1254
Epoch 313/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1248 - mea
n_squared_error: 2.1248
Epoch 314/1000
1000/1000 [==============================] - 0s 19us/step - loss: 2.1242 - me
an_squared_error: 2.1242
Epoch 315/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.1237 - me
an_squared_error: 2.1237
Epoch 316/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.1231 - mea
n_squared_error: 2.1231
Epoch 317/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.1226 - me
an_squared_error: 2.1226
Epoch 318/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.1220 - mea
n_squared_error: 2.1220
Epoch 319/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1214 - mea
n_squared_error: 2.1214
Epoch 320/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1208 - mea
n_squared_error: 2.1208
Epoch 321/1000
1000/1000 [==============================] - 0s 31us/step - loss: 2.1202 - me
an_squared_error: 2.1202
Epoch 322/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1196 - mea
n_squared_error: 2.1196
Epoch 323/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1190 - mea
n_squared_error: 2.1190
```

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Epoch 324/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1185 - mea
n_squared_error: 2.1185
Epoch 325/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1179 - mea
n_squared_error: 2.1179
Epoch 326/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.1173 - me
an_squared_error: 2.1173
Epoch 327/1000
1000/1000 [==============================] - 0s 40us/step - loss: 2.1167 - me
an_squared_error: 2.1167
Epoch 328/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.1162 - me
an_squared_error: 2.1162
Epoch 329/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1156 - mea
n_squared_error: 2.1156
Epoch 330/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1151 - mea
n_squared_error: 2.1151
Epoch 331/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1145 - mea
n_squared_error: 2.1145
Epoch 332/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1139 - me
an_squared_error: 2.1139
Epoch 333/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1133 - mea
n_squared_error: 2.1133
Epoch 334/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1128 - me
an_squared_error: 2.1128
Epoch 335/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1121 - mea
n_squared_error: 2.1121
Epoch 336/1000
1000/1000 [==============================] - 0s 19us/step - loss: 2.1116 - me
an_squared_error: 2.1116
Epoch 337/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1110 - mea
n_squared_error: 2.1110
Epoch 338/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1104 - mea
n_squared_error: 2.1104
Epoch 339/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1098 - mea
n_squared_error: 2.1098
Epoch 340/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1093 - mea
n_squared_error: 2.1093
Epoch 341/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1087 - mea
n_squared_error: 2.1087
Epoch 342/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.1081 - me
an_squared_error: 2.1081
```

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Epoch 343/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1075 - mea
n_squared_error: 2.1075
Epoch 344/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.1070 - mea
n_squared_error: 2.1070
Epoch 345/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.1064 - mea
n_squared_error: 2.1064
Epoch 346/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.1058 - mea
n_squared_error: 2.1058
Epoch 347/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1052 - mea
n_squared_error: 2.1052
Epoch 348/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1046 - mea
n_squared_error: 2.1046
Epoch 349/1000
1000/1000 [==============================] - 0s 31us/step - loss: 2.1040 - me
an_squared_error: 2.1040
Epoch 350/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.1035 - mea
n_squared_error: 2.1035
Epoch 351/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.1028 - me
an_squared_error: 2.1028
Epoch 352/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.1023 - me
an_squared_error: 2.1023
Epoch 353/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1017 - mea
n_squared_error: 2.1017
Epoch 354/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.1011 - mea
n_squared_error: 2.1011
Epoch 355/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.1005 - mea
n_squared_error: 2.1005
Epoch 356/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.1000 - me
an_squared_error: 2.1000
Epoch 357/1000
1000/1000 [==============================] - 0s 14us/step - loss: 2.0994 - me
an_squared_error: 2.0994
Epoch 358/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0988 - me
an_squared_error: 2.0988
Epoch 359/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.0982 - mea
n_squared_error: 2.0982
Epoch 360/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.0977 - me
an_squared_error: 2.0977
Epoch 361/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.0970 - mea
n_squared_error: 2.0970
```

```
Epoch 362/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0965 - me
an_squared_error: 2.0965
Epoch 363/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0959 - mea
n_squared_error: 2.0959
Epoch 364/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0953 - mea
n_squared_error: 2.0953
Epoch 365/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0947 - mea
n_squared_error: 2.0947
Epoch 366/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0941 - mea
n_squared_error: 2.0941
Epoch 367/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0935 - mea
n_squared_error: 2.0935
Epoch 368/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0930 - mea
n_squared_error: 2.0930
Epoch 369/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0924 - mea
n_squared_error: 2.0924
Epoch 370/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0918 - mea
n_squared_error: 2.0918
Epoch 371/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.0912 - mea
n_squared_error: 2.0912
Epoch 372/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0906 - mea
n_squared_error: 2.0906
Epoch 373/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0900 - mea
n_squared_error: 2.0900
Epoch 374/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.0895 - me
an_squared_error: 2.0895
Epoch 375/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.0889 - mea
n_squared_error: 2.0889
Epoch 376/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0883 - mea
n_squared_error: 2.0883
Epoch 377/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0877 - mea
n_squared_error: 2.0877
Epoch 378/1000
1000/1000 [==============================] - 0s 21us/step - loss: 2.0871 - me
an_squared_error: 2.0871
Epoch 379/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0865 - mea
n_squared_error: 2.0865
Epoch 380/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0859 - me
an_squared_error: 2.0859
```

```
Epoch 381/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0853 - mea
n_squared_error: 2.0853
Epoch 382/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0848 - mea
n_squared_error: 2.0848
Epoch 383/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0842 - mea
n_squared_error: 2.0842
Epoch 384/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0836 - mea
n_squared_error: 2.0836
Epoch 385/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.0830 - mea
n_squared_error: 2.0830
Epoch 386/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0824 - mea
n_squared_error: 2.0824
Epoch 387/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0818 - mea
n_squared_error: 2.0818
Epoch 388/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0812 - mea
n_squared_error: 2.0812
Epoch 389/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0806 - mea
n_squared_error: 2.0806
Epoch 390/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.0801 - mea
n_squared_error: 2.0801
Epoch 391/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.0794 - me
an_squared_error: 2.0794
Epoch 392/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.0789 - mea
n_squared_error: 2.0789
Epoch 393/1000
1000/1000 [==============================] - 0s 38us/step - loss: 2.0782 - me
an_squared_error: 2.0782
Epoch 394/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.0777 - me
an_squared_error: 2.0777
Epoch 395/1000
1000/1000 [==============================] - 0s 62us/step - loss: 2.0771 - me
an_squared_error: 2.0771
Epoch 396/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0765 - mea
n_squared_error: 2.0765
Epoch 397/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0759 - me
an_squared_error: 2.0759
Epoch 398/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0753 - mea
n_squared_error: 2.0753
Epoch 399/1000
1000/1000 [==============================] - 0s 32us/step - loss: 2.0747 - me
an_squared_error: 2.0747
```

```
Epoch 400/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0741 - mea
n_squared_error: 2.0741
Epoch 401/1000
1000/1000 [==============================] - 0s 14us/step - loss: 2.0735 - me
an_squared_error: 2.0735
Epoch 402/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0730 - mea
n_squared_error: 2.0730
Epoch 403/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0724 - mea
n_squared_error: 2.0724
Epoch 404/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0718 - mea
n_squared_error: 2.0718
Epoch 405/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0712 - mea
n_squared_error: 2.0712
Epoch 406/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0706 - me
an_squared_error: 2.0706
Epoch 407/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0700 - mea
n_squared_error: 2.0700
Epoch 408/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0694 - mea
n_squared_error: 2.0694
Epoch 409/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0688 - me
an_squared_error: 2.0688
Epoch 410/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0682 - mea
n_squared_error: 2.0682
Epoch 411/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.0676 - me
an_squared_error: 2.0676
Epoch 412/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.0670 - mea
n_squared_error: 2.0670
Epoch 413/1000
1000/1000 [==============================] - 0s 16us/step - loss: 2.0664 - me
an_squared_error: 2.0664
Epoch 414/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0658 - mea
n_squared_error: 2.0658
Epoch 415/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0652 - mea
n_squared_error: 2.0652
Epoch 416/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0647 - mea
n_squared_error: 2.0647
Epoch 417/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0640 - mea
n_squared_error: 2.0640
Epoch 418/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.0635 - me
an_squared_error: 2.0635
```

```
Epoch 419/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0628 - me
an_squared_error: 2.0628
Epoch 420/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0623 - mea
n_squared_error: 2.0623
Epoch 421/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0616 - mea
n_squared_error: 2.0616
Epoch 422/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.0611 - me
an_squared_error: 2.0611
Epoch 423/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0605 - mea
n_squared_error: 2.0605
Epoch 424/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0599 - mea
n_squared_error: 2.0599
Epoch 425/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.0593 - me
an_squared_error: 2.0593
Epoch 426/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0587 - me
an_squared_error: 2.0587
Epoch 427/1000
1000/1000 [==============================] - 0s 2us/step - loss: 2.0581 - mea
n_squared_error: 2.0581
Epoch 428/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.0575 - me
an_squared_error: 2.0575
Epoch 429/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.0569 - mea
n_squared_error: 2.0569
Epoch 430/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0563 - mea
n_squared_error: 2.0563
Epoch 431/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0557 - mea
n_squared_error: 2.0557
Epoch 432/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0551 - mea
n_squared_error: 2.0551
Epoch 433/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0545 - mea
n_squared_error: 2.0545
Epoch 434/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.0539 - me
an_squared_error: 2.0539
Epoch 435/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.0533 - me
an_squared_error: 2.0533
Epoch 436/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0527 - me
an_squared_error: 2.0527
Epoch 437/1000
1000/1000 [==============================] - 0s 14us/step - loss: 2.0521 - me
an_squared_error: 2.0521
```

```
Epoch 438/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0515 - mea
n_squared_error: 2.0515
Epoch 439/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0509 - mea
n_squared_error: 2.0509
Epoch 440/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0503 - mea
n_squared_error: 2.0503
Epoch 441/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0497 - mea
n_squared_error: 2.0497
Epoch 442/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0491 - mea
n_squared_error: 2.0491
Epoch 443/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0485 - mea
n_squared_error: 2.0485
Epoch 444/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.0479 - mea
n_squared_error: 2.0479
Epoch 445/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0473 - mea
n_squared_error: 2.0473
Epoch 446/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0467 - mea
n_squared_error: 2.0467
Epoch 447/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0461 - mea
n_squared_error: 2.0461
Epoch 448/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0455 - mea
n_squared_error: 2.0455
Epoch 449/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.0449 - mea
n_squared_error: 2.0449
Epoch 450/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0443 - mea
n_squared_error: 2.0443
Epoch 451/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0437 - me
an_squared_error: 2.0437
Epoch 452/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0431 - mea
n_squared_error: 2.0431
Epoch 453/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0425 - mea
n_squared_error: 2.0425
Epoch 454/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0419 - mea
n_squared_error: 2.0419
Epoch 455/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0413 - me
an_squared_error: 2.0413
Epoch 456/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0407 - mea
n_squared_error: 2.0407
```

```
Epoch 457/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0401 - mea
n_squared_error: 2.0401
Epoch 458/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.0395 - me
an_squared_error: 2.0395
Epoch 459/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0389 - mea
n_squared_error: 2.0389
Epoch 460/1000
1000/1000 [==============================] - 0s 15us/step - loss: 2.0383 - me
an_squared_error: 2.0383
Epoch 461/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0377 - mea
n_squared_error: 2.0377
Epoch 462/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.0371 - mea
n_squared_error: 2.0371
Epoch 463/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0365 - me
an_squared_error: 2.0365
Epoch 464/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0359 - me
an_squared_error: 2.0359
Epoch 465/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0352 - mea
n_squared_error: 2.0352
Epoch 466/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0347 - mea
n_squared_error: 2.0347
Epoch 467/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0340 - mea
n_squared_error: 2.0340
Epoch 468/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0335 - mea
n_squared_error: 2.0335
Epoch 469/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0328 - mea
n_squared_error: 2.0328
Epoch 470/1000
1000/1000 [==============================] - 0s 32us/step - loss: 2.0322 - me
an_squared_error: 2.0322
Epoch 471/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.0316 - me
an_squared_error: 2.0316
Epoch 472/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.0310 - me
an_squared_error: 2.0310
Epoch 473/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.0304 - me
an_squared_error: 2.0304
Epoch 474/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.0298 - mea
n_squared_error: 2.0298
Epoch 475/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.0292 - me
an_squared_error: 2.0292
```

```
Epoch 476/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0286 - mea
n_squared_error: 2.0286
Epoch 477/1000
1000/1000 [==============================] - 0s 14us/step - loss: 2.0280 - me
an_squared_error: 2.0280
Epoch 478/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.0274 - me
an_squared_error: 2.0274
Epoch 479/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0268 - me
an_squared_error: 2.0268
Epoch 480/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.0262 - me
an_squared_error: 2.0262
Epoch 481/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0256 - mea
n_squared_error: 2.0256
Epoch 482/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0250 - me
an_squared_error: 2.0250
Epoch 483/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.0243 - me
an_squared_error: 2.0243
Epoch 484/1000
1000/1000 [==============================] - 0s 4us/step - loss: 2.0237 - mea
n_squared_error: 2.0237
Epoch 485/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0231 - mea
n_squared_error: 2.0231
Epoch 486/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0225 - mea
n_squared_error: 2.0225
Epoch 487/1000
1000/1000 [==============================] - 0s 19us/step - loss: 2.0219 - me
an_squared_error: 2.0219
Epoch 488/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0213 - mea
n_squared_error: 2.0213
Epoch 489/1000
1000/1000 [==============================] - 0s 13us/step - loss: 2.0207 - me
an_squared_error: 2.0207
Epoch 490/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0201 - mea
n_squared_error: 2.0201
Epoch 491/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.0195 - me
an_squared_error: 2.0195
Epoch 492/1000
1000/1000 [==============================] - 0s 15us/step - loss: 2.0189 - me
an_squared_error: 2.0189
Epoch 493/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0183 - mea
n_squared_error: 2.0183
Epoch 494/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.0177 - me
an_squared_error: 2.0177
```

```
Epoch 495/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.0170 - me
an_squared_error: 2.0170
Epoch 496/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.0165 - me
an_squared_error: 2.0165
Epoch 497/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0158 - me
an_squared_error: 2.0158
Epoch 498/1000
1000/1000 [==============================] - 0s 21us/step - loss: 2.0152 - me
an_squared_error: 2.0152
Epoch 499/1000
1000/1000 [==============================] - 0s 17us/step - loss: 2.0146 - me
an_squared_error: 2.0146
Epoch 500/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0140 - mea
n_squared_error: 2.0140
Epoch 501/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0134 - mea
n_squared_error: 2.0134
Epoch 502/1000
1000/1000 [==============================] - 0s 5us/step - loss: 2.0128 - mea
n_squared_error: 2.0128
Epoch 503/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0121 - me
an_squared_error: 2.0121
Epoch 504/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0116 - mea
n_squared_error: 2.0116
Epoch 505/1000
1000/1000 [==============================] - 0s 12us/step - loss: 2.0109 - me
an_squared_error: 2.0109
Epoch 506/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.0103 - me
an_squared_error: 2.0103
Epoch 507/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0097 - mea
n_squared_error: 2.0097
Epoch 508/1000
1000/1000 [==============================] - 0s 7us/step - loss: 2.0091 - mea
n_squared_error: 2.0091
Epoch 509/1000
1000/1000 [==============================] - 0s 8us/step - loss: 2.0085 - mea
n_squared_error: 2.0085
Epoch 510/1000
1000/1000 [==============================] - 0s 40us/step - loss: 2.0079 - me
an_squared_error: 2.0079
Epoch 511/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0072 - mea
n_squared_error: 2.0072
Epoch 512/1000
1000/1000 [==============================] - 0s 6us/step - loss: 2.0066 - mea
n_squared_error: 2.0066
Epoch 513/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0060 - mea
n_squared_error: 2.0060
```

```
Epoch 514/1000
1000/1000 [==============================] - 0s 11us/step - loss: 2.0054 - me
an_squared_error: 2.0054
Epoch 515/1000
1000/1000 [==============================] - 0s 16us/step - loss: 2.0048 - me
an_squared_error: 2.0048
Epoch 516/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0042 - mea
n_squared_error: 2.0042
Epoch 517/1000
1000/1000 [==============================] - 0s 10us/step - loss: 2.0036 - me
an_squared_error: 2.0036
Epoch 518/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0030 - mea
n_squared_error: 2.0030
Epoch 519/1000
1000/1000 [==============================] - 0s 14us/step - loss: 2.0023 - me
an_squared_error: 2.0023
Epoch 520/1000
1000/1000 [==============================] - 0s 17us/step - loss: 2.0017 - me
an_squared_error: 2.0017
Epoch 521/1000
1000/1000 [==============================] - 0s 9us/step - loss: 2.0011 - mea
n_squared_error: 2.0011
Epoch 522/1000
1000/1000 [==============================] - 0s 14us/step - loss: 2.0005 - me
an_squared_error: 2.0005
Epoch 523/1000
1000/1000 [==============================] - 0s 15us/step - loss: 1.9999 - me
an_squared_error: 1.9999
Epoch 524/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9993 - mea
n_squared_error: 1.9993
Epoch 525/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9986 - me
an_squared_error: 1.9986
Epoch 526/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9980 - mea
n_squared_error: 1.9980
Epoch 527/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9974 - me
an_squared_error: 1.9974
Epoch 528/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9968 - me
an_squared_error: 1.9968
Epoch 529/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.9962 - mea
n_squared_error: 1.9962
Epoch 530/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9956 - mea
n_squared_error: 1.9956
Epoch 531/1000
1000/1000 [==============================] - 0s 21us/step - loss: 1.9949 - me
an_squared_error: 1.9949
Epoch 532/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9943 - mea
n_squared_error: 1.9943
```

```
Epoch 533/1000
1000/1000 [==============================] - 0s 19us/step - loss: 1.9937 - me
an_squared_error: 1.9937
Epoch 534/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9931 - mea
n_squared_error: 1.9931
Epoch 535/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9925 - me
an_squared_error: 1.9925
Epoch 536/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9919 - mea
n_squared_error: 1.9919
Epoch 537/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9912 - mea
n_squared_error: 1.9912
Epoch 538/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9906 - mea
n_squared_error: 1.9906
Epoch 539/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9900 - mea
n_squared_error: 1.9900
Epoch 540/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.9894 - mea
n_squared_error: 1.9894
Epoch 541/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9887 - me
an_squared_error: 1.9887
Epoch 542/1000
1000/1000 [==============================] - 0s 13us/step - loss: 1.9881 - me
an_squared_error: 1.9881
Epoch 543/1000
1000/1000 [==============================] - 0s 20us/step - loss: 1.9875 - me
an_squared_error: 1.9875
Epoch 544/1000
1000/1000 [==============================] - 0s 13us/step - loss: 1.9869 - me
an_squared_error: 1.9869
Epoch 545/1000
1000/1000 [==============================] - 0s 15us/step - loss: 1.9863 - me
an_squared_error: 1.9863
Epoch 546/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9857 - mea
n_squared_error: 1.9857
Epoch 547/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9850 - mea
n_squared_error: 1.9850
Epoch 548/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9844 - mea
n_squared_error: 1.9844
Epoch 549/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9838 - me
an_squared_error: 1.9838
Epoch 550/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9832 - mea
n_squared_error: 1.9832
Epoch 551/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9826 - me
an_squared_error: 1.9826
```

```
Epoch 552/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9820 - me
an_squared_error: 1.9820
Epoch 553/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9813 - me
an_squared_error: 1.9813
Epoch 554/1000
1000/1000 [==============================] - 0s 21us/step - loss: 1.9807 - me
an_squared_error: 1.9807
Epoch 555/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9801 - mea
n_squared_error: 1.9801
Epoch 556/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.9795 - me
an_squared_error: 1.9795
Epoch 557/1000
1000/1000 [==============================] - 0s 15us/step - loss: 1.9788 - me
an_squared_error: 1.9788
Epoch 558/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9782 - mea
n_squared_error: 1.9782
Epoch 559/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9776 - me
an_squared_error: 1.9776
Epoch 560/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9770 - me
an_squared_error: 1.9770
Epoch 561/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9763 - mea
n_squared_error: 1.9763
Epoch 562/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9757 - mea
n_squared_error: 1.9757
Epoch 563/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9751 - me
an_squared_error: 1.9751
Epoch 564/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9745 - mea
n_squared_error: 1.9745
Epoch 565/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.9739 - me
an_squared_error: 1.9739
Epoch 566/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9733 - me
an_squared_error: 1.9733
Epoch 567/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.9726 - me
an_squared_error: 1.9726
Epoch 568/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9720 - me
an_squared_error: 1.9720
Epoch 569/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9713 - mea
n_squared_error: 1.9713
Epoch 570/1000
1000/1000 [==============================] - 0s 14us/step - loss: 1.9707 - me
an_squared_error: 1.9707
```

```
Epoch 571/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9701 - mea
n_squared_error: 1.9701
Epoch 572/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9695 - mea
n_squared_error: 1.9695
Epoch 573/1000
1000/1000 [==============================] - 0s 13us/step - loss: 1.9689 - me
an_squared_error: 1.9689
Epoch 574/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9683 - mea
n_squared_error: 1.9683
Epoch 575/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9676 - me
an_squared_error: 1.9676
Epoch 576/1000
1000/1000 [==============================] - 0s 13us/step - loss: 1.9670 - me
an_squared_error: 1.9670
Epoch 577/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.9664 - me
an_squared_error: 1.9664
Epoch 578/1000
1000/1000 [==============================] - 0s 14us/step - loss: 1.9658 - me
an_squared_error: 1.9658
Epoch 579/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9651 - mea
n_squared_error: 1.9651
Epoch 580/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9645 - mea
n_squared_error: 1.9645
Epoch 581/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9639 - me
an_squared_error: 1.9639
Epoch 582/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9633 - mea
n_squared_error: 1.9633
Epoch 583/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9626 - mea
n_squared_error: 1.9626
Epoch 584/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9620 - mea
n_squared_error: 1.9620
Epoch 585/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9614 - me
an_squared_error: 1.9614
Epoch 586/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9608 - mea
n_squared_error: 1.9608
Epoch 587/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9601 - me
an_squared_error: 1.9601
Epoch 588/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9595 - mea
n_squared_error: 1.9595
Epoch 589/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9589 - me
an_squared_error: 1.9589
```

```
Epoch 590/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9582 - me
an_squared_error: 1.9582
Epoch 591/1000
1000/1000 [==============================] - 0s 13us/step - loss: 1.9576 - me
an_squared_error: 1.9576
Epoch 592/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.9570 - mea
n_squared_error: 1.9570
Epoch 593/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9564 - mea
n_squared_error: 1.9564
Epoch 594/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9558 - mea
n_squared_error: 1.9558
Epoch 595/1000
1000/1000 [==============================] - 0s 31us/step - loss: 1.9551 - me
an_squared_error: 1.9551
Epoch 596/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9545 - mea
n_squared_error: 1.9545
Epoch 597/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.9538 - mea
n_squared_error: 1.9538
Epoch 598/1000
1000/1000 [==============================] - 0s 68us/step - loss: 1.9532 - me
an_squared_error: 1.9532
Epoch 599/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9526 - me
an_squared_error: 1.9526
Epoch 600/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9520 - mea
n_squared_error: 1.9520
Epoch 601/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9513 - me
an_squared_error: 1.9513
Epoch 602/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9507 - mea
n_squared_error: 1.9507
Epoch 603/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9501 - mea
n_squared_error: 1.9501
Epoch 604/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9495 - mea
n_squared_error: 1.9495
Epoch 605/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.9488 - mea
n_squared_error: 1.9488
Epoch 606/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9482 - mea
n_squared_error: 1.9482
Epoch 607/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9476 - me
an_squared_error: 1.9476
Epoch 608/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.9470 - mea
n_squared_error: 1.9470
```

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Epoch 609/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.9463 - mea
n_squared_error: 1.9463
Epoch 610/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.9457 - me
an_squared_error: 1.9457
Epoch 611/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9450 - mea
n_squared_error: 1.9450
Epoch 612/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9444 - mea
n_squared_error: 1.9444
Epoch 613/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.9438 - mea
n_squared_error: 1.9438
Epoch 614/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9432 - mea
n_squared_error: 1.9432
Epoch 615/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9425 - mea
n_squared_error: 1.9425
Epoch 616/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9419 - mea
n_squared_error: 1.9419
Epoch 617/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.9413 - mea
n_squared_error: 1.9413
Epoch 618/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9406 - mea
n_squared_error: 1.9406
Epoch 619/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9400 - mea
n_squared_error: 1.9400
Epoch 620/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.9394 - mea
n_squared_error: 1.9394
Epoch 621/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9387 - mea
n_squared_error: 1.9387
Epoch 622/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9381 - mea
n_squared_error: 1.9381
Epoch 623/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9375 - mea
n_squared_error: 1.9375
Epoch 624/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9369 - mea
n_squared_error: 1.9369
Epoch 625/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9362 - mea
n_squared_error: 1.9362
Epoch 626/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9356 - mea
n_squared_error: 1.9356
Epoch 627/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9349 - mea
n_squared_error: 1.9349
```

```
Epoch 628/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9343 - mea
n_squared_error: 1.9343
Epoch 629/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9337 - mea
n_squared_error: 1.9337
Epoch 630/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9331 - mea
n_squared_error: 1.9331
Epoch 631/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9324 - mea
n_squared_error: 1.9324
Epoch 632/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9318 - me
an_squared_error: 1.9318
Epoch 633/1000
1000/1000 [==============================] - 0s 15us/step - loss: 1.9311 - me
an_squared_error: 1.9311
Epoch 634/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9305 - mea
n_squared_error: 1.9305
Epoch 635/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9299 - mea
n_squared_error: 1.9299
Epoch 636/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9293 - mea
n_squared_error: 1.9293
Epoch 637/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9286 - mea
n_squared_error: 1.9286
Epoch 638/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.9280 - mea
n_squared_error: 1.9280
Epoch 639/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9273 - mea
n_squared_error: 1.9273
Epoch 640/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9267 - me
an_squared_error: 1.9267
Epoch 641/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9261 - mea
n_squared_error: 1.9261
Epoch 642/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9255 - me
an_squared_error: 1.9255
Epoch 643/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9248 - mea
n_squared_error: 1.9248
Epoch 644/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9242 - mea
n_squared_error: 1.9242
Epoch 645/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9236 - mea
n_squared_error: 1.9236
Epoch 646/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9229 - mea
n_squared_error: 1.9229
```

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Epoch 647/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9223 - mea
n_squared_error: 1.9223
Epoch 648/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9217 - me
an_squared_error: 1.9217
Epoch 649/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9210 - mea
n_squared_error: 1.9210
Epoch 650/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9204 - mea
n_squared_error: 1.9204
Epoch 651/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9198 - mea
n_squared_error: 1.9198
Epoch 652/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9191 - mea
n_squared_error: 1.9191
Epoch 653/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.9185 - mea
n_squared_error: 1.9185
Epoch 654/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9178 - me
an_squared_error: 1.9178
Epoch 655/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.9172 - mea
n_squared_error: 1.9172
Epoch 656/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.9166 - me
an_squared_error: 1.9166
Epoch 657/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9159 - mea
n_squared_error: 1.9159
Epoch 658/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9153 - mea
n_squared_error: 1.9153
Epoch 659/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9147 - mea
n_squared_error: 1.9147
Epoch 660/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9140 - mea
n_squared_error: 1.9140
Epoch 661/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.9134 - mea
n_squared_error: 1.9134
Epoch 662/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9128 - mea
n_squared_error: 1.9128
Epoch 663/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9121 - me
an_squared_error: 1.9121
Epoch 664/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9115 - mea
n_squared_error: 1.9115
Epoch 665/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9109 - me
an_squared_error: 1.9109
```

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Epoch 666/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.9103 - mea
n_squared_error: 1.9103
Epoch 667/1000
1000/1000 [==============================] - 0s 2us/step - loss: 1.9096 - mea
n_squared_error: 1.9096
Epoch 668/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9089 - mea
n_squared_error: 1.9089
Epoch 669/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9083 - mea
n_squared_error: 1.9083
Epoch 670/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9077 - mea
n_squared_error: 1.9077
Epoch 671/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9070 - mea
n_squared_error: 1.9070
Epoch 672/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9064 - mea
n_squared_error: 1.9064
Epoch 673/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9058 - mea
n_squared_error: 1.9058
Epoch 674/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9051 - mea
n_squared_error: 1.9051
Epoch 675/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9045 - mea
n_squared_error: 1.9045
Epoch 676/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.9038 - mea
n_squared_error: 1.9038
Epoch 677/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.9032 - mea
n_squared_error: 1.9032
Epoch 678/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.9026 - mea
n_squared_error: 1.9026
Epoch 679/1000
1000/1000 [==============================] - 0s 29us/step - loss: 1.9020 - me
an_squared_error: 1.9020
Epoch 680/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.9013 - me
an_squared_error: 1.9013
Epoch 681/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9006 - mea
n_squared_error: 1.9006
Epoch 682/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.9000 - mea
n_squared_error: 1.9000
Epoch 683/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8993 - mea
n_squared_error: 1.8993
Epoch 684/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8987 - mea
n_squared_error: 1.8987
```

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Epoch 685/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8981 - mea
n_squared_error: 1.8981
Epoch 686/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.8975 - mea
n_squared_error: 1.8975
Epoch 687/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8968 - mea
n_squared_error: 1.8968
Epoch 688/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8962 - mea
n_squared_error: 1.8962
Epoch 689/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8955 - mea
n_squared_error: 1.8955
Epoch 690/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8949 - mea
n_squared_error: 1.8949
Epoch 691/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8943 - mea
n_squared_error: 1.8943
Epoch 692/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8937 - mea
n_squared_error: 1.8937
Epoch 693/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8930 - mea
n_squared_error: 1.8930
Epoch 694/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.8924 - me
an_squared_error: 1.8924
Epoch 695/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8917 - mea
n_squared_error: 1.8917
Epoch 696/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8911 - mea
n_squared_error: 1.8911
Epoch 697/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8904 - mea
n_squared_error: 1.8904
Epoch 698/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8898 - mea
n_squared_error: 1.8898
Epoch 699/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8892 - mea
n_squared_error: 1.8892
Epoch 700/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8886 - mea
n_squared_error: 1.8886
Epoch 701/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8879 - mea
n_squared_error: 1.8879
Epoch 702/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8873 - mea
n_squared_error: 1.8873
Epoch 703/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8866 - mea
n_squared_error: 1.8866
```

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Epoch 704/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8860 - mea
n_squared_error: 1.8860
Epoch 705/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8853 - mea
n_squared_error: 1.8853
Epoch 706/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8847 - mea
n_squared_error: 1.8847
Epoch 707/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8841 - mea
n_squared_error: 1.8841
Epoch 708/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8834 - mea
n_squared_error: 1.8834
Epoch 709/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8828 - mea
n_squared_error: 1.8828
Epoch 710/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8821 - mea
n_squared_error: 1.8821
Epoch 711/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8814 - mea
n_squared_error: 1.8814
Epoch 712/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8808 - mea
n_squared_error: 1.8808
Epoch 713/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8802 - mea
n_squared_error: 1.8802
Epoch 714/1000
1000/1000 [==============================] - 0s 15us/step - loss: 1.8796 - me
an_squared_error: 1.8796
Epoch 715/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.8789 - me
an_squared_error: 1.8789
Epoch 716/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8783 - mea
n_squared_error: 1.8783
Epoch 717/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8776 - mea
n_squared_error: 1.8776
Epoch 718/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8770 - mea
n_squared_error: 1.8770
Epoch 719/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8763 - mea
n_squared_error: 1.8763
Epoch 720/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8757 - mea
n_squared_error: 1.8757
Epoch 721/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8751 - mea
n_squared_error: 1.8751
Epoch 722/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8745 - mea
n_squared_error: 1.8745
```

```
Epoch 723/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8738 - mea
n_squared_error: 1.8738
Epoch 724/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8731 - mea
n_squared_error: 1.8731
Epoch 725/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8725 - mea
n_squared_error: 1.8725
Epoch 726/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8719 - mea
n_squared_error: 1.8719
Epoch 727/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8712 - mea
n_squared_error: 1.8712
Epoch 728/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8706 - mea
n_squared_error: 1.8706
Epoch 729/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8700 - mea
n_squared_error: 1.8700
Epoch 730/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8693 - mea
n_squared_error: 1.8693
Epoch 731/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8686 - mea
n_squared_error: 1.8686
Epoch 732/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8680 - mea
n_squared_error: 1.8680
Epoch 733/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8673 - mea
n_squared_error: 1.8673
Epoch 734/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8667 - mea
n_squared_error: 1.8667
Epoch 735/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8661 - mea
n_squared_error: 1.8661
Epoch 736/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8655 - mea
n_squared_error: 1.8655
Epoch 737/1000
1000/1000 [==============================] - 0s 18us/step - loss: 1.8648 - me
an_squared_error: 1.8648
Epoch 738/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.8642 - mea
n_squared_error: 1.8642
Epoch 739/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8635 - mea
n_squared_error: 1.8635
Epoch 740/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8629 - mea
n_squared_error: 1.8629
Epoch 741/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8622 - mea
n_squared_error: 1.8622
```

```
Epoch 742/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8616 - mea
n_squared_error: 1.8616
Epoch 743/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8610 - mea
n_squared_error: 1.8610
Epoch 744/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8604 - mea
n_squared_error: 1.8604
Epoch 745/1000
1000/1000 [==============================] - 0s 13us/step - loss: 1.8597 - me
an_squared_error: 1.8597
Epoch 746/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8590 - mea
n_squared_error: 1.8590
Epoch 747/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.8583 - me
an_squared_error: 1.8583
Epoch 748/1000
1000/1000 [==============================] - 0s 17us/step - loss: 1.8577 - me
an_squared_error: 1.8577
Epoch 749/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8571 - mea
n_squared_error: 1.8571
Epoch 750/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8565 - mea
n_squared_error: 1.8565
Epoch 751/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8558 - mea
n_squared_error: 1.8558
Epoch 752/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8552 - mea
n_squared_error: 1.8552
Epoch 753/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8545 - mea
n_squared_error: 1.8545
Epoch 754/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8539 - mea
n_squared_error: 1.8539
Epoch 755/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8532 - mea
n_squared_error: 1.8532
Epoch 756/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8526 - mea
n_squared_error: 1.8526
Epoch 757/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8520 - mea
n_squared_error: 1.8520
Epoch 758/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8514 - mea
n_squared_error: 1.8514
Epoch 759/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8507 - mea
n_squared_error: 1.8507
Epoch 760/1000
1000/1000 [==============================] - 0s 3us/step - loss: 1.8500 - mea
n_squared_error: 1.8500
```

```
Epoch 761/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.8493 - me
an_squared_error: 1.8493
Epoch 762/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8487 - mea
n_squared_error: 1.8487
Epoch 763/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8481 - mea
n_squared_error: 1.8481
Epoch 764/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8475 - mea
n_squared_error: 1.8475
Epoch 765/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8468 - mea
n_squared_error: 1.8468
Epoch 766/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8462 - mea
n_squared_error: 1.8462
Epoch 767/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8455 - mea
n_squared_error: 1.8455
Epoch 768/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8448 - mea
n_squared_error: 1.8448
Epoch 769/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.8442 - me
an_squared_error: 1.8442
Epoch 770/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8436 - mea
n_squared_error: 1.8436
Epoch 771/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8430 - mea
n_squared_error: 1.8430
Epoch 772/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8424 - mea
n_squared_error: 1.8424
Epoch 773/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8417 - mea
n_squared_error: 1.8417
Epoch 774/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8410 - mea
n_squared_error: 1.8410
Epoch 775/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8403 - mea
n_squared_error: 1.8403
Epoch 776/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8397 - mea
n_squared_error: 1.8397
Epoch 777/1000
1000/1000 [==============================] - 0s 13us/step - loss: 1.8391 - me
an_squared_error: 1.8391
Epoch 778/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8385 - mea
n_squared_error: 1.8385
Epoch 779/1000
1000/1000 [==============================] - 0s 3us/step - loss: 1.8378 - mea
n_squared_error: 1.8378
```

```
Epoch 780/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8372 - mea
n_squared_error: 1.8372
Epoch 781/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8365 - mea
n_squared_error: 1.8365
Epoch 782/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8358 - mea
n_squared_error: 1.8358
Epoch 783/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8352 - mea
n_squared_error: 1.8352
Epoch 784/1000
1000/1000 [==============================] - 0s 13us/step - loss: 1.8346 - me
an_squared_error: 1.8346
Epoch 785/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8339 - mea
n_squared_error: 1.8339
Epoch 786/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8333 - mea
n_squared_error: 1.8333
Epoch 787/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8327 - mea
n_squared_error: 1.8327
Epoch 788/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8320 - mea
n_squared_error: 1.8320
Epoch 789/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.8313 - me
an_squared_error: 1.8313
Epoch 790/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8307 - mea
n_squared_error: 1.8307
Epoch 791/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8300 - mea
n_squared_error: 1.8300
Epoch 792/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8295 - mea
n_squared_error: 1.8295
Epoch 793/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8288 - mea
n_squared_error: 1.8288
Epoch 794/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8282 - mea
n_squared_error: 1.8282
Epoch 795/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8275 - mea
n_squared_error: 1.8275
Epoch 796/1000
1000/1000 [==============================] - 0s 17us/step - loss: 1.8268 - me
an_squared_error: 1.8268
Epoch 797/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8261 - mea
n_squared_error: 1.8261
Epoch 798/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8255 - mea
n_squared_error: 1.8255
```

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Epoch 799/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8249 - mea
n_squared_error: 1.8249
Epoch 800/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8243 - mea
n_squared_error: 1.8243
Epoch 801/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8236 - mea
n_squared_error: 1.8236
Epoch 802/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8230 - mea
n_squared_error: 1.8230
Epoch 803/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.8223 - mea
n_squared_error: 1.8223
Epoch 804/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8217 - mea
n_squared_error: 1.8217
Epoch 805/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8210 - mea
n_squared_error: 1.8210
Epoch 806/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8204 - mea
n_squared_error: 1.8204
Epoch 807/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.8198 - me
an_squared_error: 1.8198
Epoch 808/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8192 - mea
n_squared_error: 1.8192
Epoch 809/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8184 - mea
n_squared_error: 1.8184
Epoch 810/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8178 - mea
n_squared_error: 1.8178
Epoch 811/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8171 - mea
n_squared_error: 1.8171
Epoch 812/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8165 - mea
n_squared_error: 1.8165
Epoch 813/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8159 - mea
n_squared_error: 1.8159
Epoch 814/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8153 - mea
n_squared_error: 1.8153
Epoch 815/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8146 - mea
n_squared_error: 1.8146
Epoch 816/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8140 - mea
n_squared_error: 1.8140
Epoch 817/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8133 - mea
n_squared_error: 1.8133
```

```
Epoch 818/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.8126 - mea
n_squared_error: 1.8126
Epoch 819/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8120 - mea
n_squared_error: 1.8120
Epoch 820/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8114 - mea
n_squared_error: 1.8114
Epoch 821/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8108 - mea
n_squared_error: 1.8108
Epoch 822/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8101 - mea
n_squared_error: 1.8101
Epoch 823/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.8094 - me
an_squared_error: 1.8094
Epoch 824/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.8088 - mea
n_squared_error: 1.8088
Epoch 825/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8081 - mea
n_squared_error: 1.8081
Epoch 826/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8075 - mea
n_squared_error: 1.8075
Epoch 827/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8068 - mea
n_squared_error: 1.8068
Epoch 828/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8063 - mea
n_squared_error: 1.8063
Epoch 829/1000
1000/1000 [==============================] - 0s 13us/step - loss: 1.8056 - me
an_squared_error: 1.8056
Epoch 830/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8049 - mea
n_squared_error: 1.8049
Epoch 831/1000
1000/1000 [==============================] - 0s 16us/step - loss: 1.8042 - me
an_squared_error: 1.8042
Epoch 832/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.8036 - mea
n_squared_error: 1.8036
Epoch 833/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8029 - mea
n_squared_error: 1.8029
Epoch 834/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.8024 - me
an_squared_error: 1.8024
Epoch 835/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.8017 - mea
n_squared_error: 1.8017
Epoch 836/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.8011 - mea
n_squared_error: 1.8011
```

```
Epoch 837/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.8004 - me
an_squared_error: 1.8004
Epoch 838/1000
1000/1000 [==============================] - 0s 32us/step - loss: 1.7997 - me
an_squared_error: 1.7997
Epoch 839/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7990 - me
an_squared_error: 1.7990
Epoch 840/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7984 - mea
n_squared_error: 1.7984
Epoch 841/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.7978 - me
an_squared_error: 1.7978
Epoch 842/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7972 - mea
n_squared_error: 1.7972
Epoch 843/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7966 - mea
n_squared_error: 1.7966
Epoch 844/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7959 - me
an_squared_error: 1.7959
Epoch 845/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7952 - mea
n_squared_error: 1.7952
Epoch 846/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7946 - mea
n_squared_error: 1.7946
Epoch 847/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7939 - mea
n_squared_error: 1.7939
Epoch 848/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.7933 - mea
n_squared_error: 1.7933
Epoch 849/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7927 - mea
n_squared_error: 1.7927
Epoch 850/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.7921 - me
an_squared_error: 1.7921
Epoch 851/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.7914 - me
an_squared_error: 1.7914
Epoch 852/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7907 - mea
n_squared_error: 1.7907
Epoch 853/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7900 - me
an_squared_error: 1.7900
Epoch 854/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7894 - mea
n_squared_error: 1.7894
Epoch 855/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7887 - mea
n_squared_error: 1.7887
```

```
Epoch 856/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7882 - mea
n_squared_error: 1.7882
Epoch 857/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7875 - mea
n_squared_error: 1.7875
Epoch 858/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7869 - mea
n_squared_error: 1.7869
Epoch 859/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7862 - mea
n_squared_error: 1.7862
Epoch 860/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7855 - mea
n_squared_error: 1.7855
Epoch 861/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7849 - mea
n_squared_error: 1.7849
Epoch 862/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.7843 - me
an_squared_error: 1.7843
Epoch 863/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7836 - mea
n_squared_error: 1.7836
Epoch 864/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7830 - mea
n_squared_error: 1.7830
Epoch 865/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7824 - mea
n_squared_error: 1.7824
Epoch 866/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7817 - mea
n_squared_error: 1.7817
Epoch 867/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7810 - mea
n_squared_error: 1.7810
Epoch 868/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7803 - mea
n_squared_error: 1.7803
Epoch 869/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7797 - mea
n_squared_error: 1.7797
Epoch 870/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7791 - mea
n_squared_error: 1.7791
Epoch 871/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7785 - mea
n_squared_error: 1.7785
Epoch 872/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7779 - mea
n_squared_error: 1.7779
Epoch 873/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7772 - mea
n_squared_error: 1.7772
Epoch 874/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7765 - me
an_squared_error: 1.7765
```

```
Epoch 875/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7758 - mea
n_squared_error: 1.7758
Epoch 876/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7752 - mea
n_squared_error: 1.7752
Epoch 877/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7746 - mea
n_squared_error: 1.7746
Epoch 878/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.7740 - me
an_squared_error: 1.7740
Epoch 879/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7733 - mea
n_squared_error: 1.7733
Epoch 880/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7727 - mea
n_squared_error: 1.7727
Epoch 881/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7720 - mea
n_squared_error: 1.7720
Epoch 882/1000
1000/1000 [==============================] - 0s 23us/step - loss: 1.7713 - me
an_squared_error: 1.7713
Epoch 883/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7707 - mea
n_squared_error: 1.7707
Epoch 884/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7701 - mea
n_squared_error: 1.7701
Epoch 885/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7695 - mea
n_squared_error: 1.7695
Epoch 886/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7689 - mea
n_squared_error: 1.7689
Epoch 887/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.7682 - me
an_squared_error: 1.7682
Epoch 888/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.7675 - mea
n_squared_error: 1.7675
Epoch 889/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7668 - mea
n_squared_error: 1.7668
Epoch 890/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7662 - mea
n_squared_error: 1.7662
Epoch 891/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.7656 - mea
n_squared_error: 1.7656
Epoch 892/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7650 - mea
n_squared_error: 1.7650
Epoch 893/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7643 - mea
n_squared_error: 1.7643
```

```
Epoch 894/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7637 - mea
n_squared_error: 1.7637
Epoch 895/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7629 - mea
n_squared_error: 1.7629
Epoch 896/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7623 - mea
n_squared_error: 1.7623
Epoch 897/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7616 - mea
n_squared_error: 1.7616
Epoch 898/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7610 - mea
n_squared_error: 1.7610
Epoch 899/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7604 - mea
n_squared_error: 1.7604
Epoch 900/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.7598 - mea
n_squared_error: 1.7598
Epoch 901/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7591 - mea
n_squared_error: 1.7591
Epoch 902/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7585 - mea
n_squared_error: 1.7585
Epoch 903/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7578 - mea
n_squared_error: 1.7578
Epoch 904/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7571 - me
an_squared_error: 1.7571
Epoch 905/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7565 - mea
n_squared_error: 1.7565
Epoch 906/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7559 - mea
n_squared_error: 1.7559
Epoch 907/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7553 - mea
n_squared_error: 1.7553
Epoch 908/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7547 - mea
n_squared_error: 1.7547
Epoch 909/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7539 - me
an_squared_error: 1.7539
Epoch 910/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7533 - mea
n_squared_error: 1.7533
Epoch 911/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7526 - mea
n_squared_error: 1.7526
Epoch 912/1000
1000/1000 [==============================] - 0s 37us/step - loss: 1.7520 - me
an_squared_error: 1.7520
```

```
Epoch 913/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7514 - mea
n_squared_error: 1.7514
Epoch 914/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7508 - mea
n_squared_error: 1.7508
Epoch 915/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7501 - mea
n_squared_error: 1.7501
Epoch 916/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7495 - mea
n_squared_error: 1.7495
Epoch 917/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7488 - mea
n_squared_error: 1.7488
Epoch 918/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7481 - mea
n_squared_error: 1.7481
Epoch 919/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7475 - mea
n_squared_error: 1.7475
Epoch 920/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7469 - mea
n_squared_error: 1.7469
Epoch 921/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7463 - mea
n_squared_error: 1.7463
Epoch 922/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7456 - mea
n_squared_error: 1.7456
Epoch 923/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7449 - mea
n_squared_error: 1.7449
Epoch 924/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7443 - mea
n_squared_error: 1.7443
Epoch 925/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7436 - mea
n_squared_error: 1.7436
Epoch 926/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7430 - me
an_squared_error: 1.7430
Epoch 927/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7424 - mea
n_squared_error: 1.7424
Epoch 928/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7418 - mea
n_squared_error: 1.7418
Epoch 929/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.7411 - mea
n_squared_error: 1.7411
Epoch 930/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.7405 - me
an_squared_error: 1.7405
Epoch 931/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7398 - mea
n_squared_error: 1.7398
```

```
Epoch 932/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7391 - mea
n_squared_error: 1.7391
Epoch 933/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7385 - mea
n_squared_error: 1.7385
Epoch 934/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7379 - mea
n_squared_error: 1.7379
Epoch 935/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.7372 - mea
n_squared_error: 1.7372
Epoch 936/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7366 - mea
n_squared_error: 1.7366
Epoch 937/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7359 - mea
n_squared_error: 1.7359
Epoch 938/1000
1000/1000 [==============================] - 0s 14us/step - loss: 1.7353 - me
an_squared_error: 1.7353
Epoch 939/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7346 - mea
n_squared_error: 1.7346
Epoch 940/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7340 - mea
n_squared_error: 1.7340
Epoch 941/1000
1000/1000 [==============================] - 0s 28us/step - loss: 1.7333 - me
an_squared_error: 1.7333
Epoch 942/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7328 - mea
n_squared_error: 1.7328
Epoch 943/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7321 - mea
n_squared_error: 1.7321
Epoch 944/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7315 - mea
n_squared_error: 1.7315
Epoch 945/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7307 - mea
n_squared_error: 1.7307
Epoch 946/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7301 - me
an_squared_error: 1.7301
Epoch 947/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7294 - me
an_squared_error: 1.7294
Epoch 948/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7288 - mea
n_squared_error: 1.7288
Epoch 949/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7282 - mea
n_squared_error: 1.7282
Epoch 950/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7276 - mea
n_squared_error: 1.7276
```

```
Epoch 951/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7269 - mea
n_squared_error: 1.7269
Epoch 952/1000
1000/1000 [==============================] - 0s 14us/step - loss: 1.7263 - me
an_squared_error: 1.7263
Epoch 953/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7256 - mea
n_squared_error: 1.7256
Epoch 954/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7249 - mea
n_squared_error: 1.7249
Epoch 955/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7243 - mea
n_squared_error: 1.7243
Epoch 956/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7237 - mea
n_squared_error: 1.7237
Epoch 957/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7231 - mea
n_squared_error: 1.7231
Epoch 958/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7225 - mea
n_squared_error: 1.7225
Epoch 959/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7218 - mea
n_squared_error: 1.7218
Epoch 960/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.7211 - me
an_squared_error: 1.7211
Epoch 961/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7204 - mea
n_squared_error: 1.7204
Epoch 962/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7198 - mea
n_squared_error: 1.7198
Epoch 963/1000
1000/1000 [==============================] - 0s 24us/step - loss: 1.7192 - me
an_squared_error: 1.7192
Epoch 964/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7186 - mea
n_squared_error: 1.7186
Epoch 965/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7179 - mea
n_squared_error: 1.7179
Epoch 966/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7173 - mea
n_squared_error: 1.7173
Epoch 967/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7166 - mea
n_squared_error: 1.7166
Epoch 968/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7159 - mea
n_squared_error: 1.7159
Epoch 969/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7153 - mea
n_squared_error: 1.7153
```

```
Epoch 970/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7147 - mea
n_squared_error: 1.7147
Epoch 971/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7141 - mea
n_squared_error: 1.7141
Epoch 972/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7135 - mea
n_squared_error: 1.7135
Epoch 973/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7128 - mea
n_squared_error: 1.7128
Epoch 974/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.7121 - mea
n_squared_error: 1.7121
Epoch 975/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.7114 - mea
n_squared_error: 1.7114
Epoch 976/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7108 - mea
n_squared_error: 1.7108
Epoch 977/1000
1000/1000 [==============================] - 0s 5us/step - loss: 1.7102 - mea
n_squared_error: 1.7102
Epoch 978/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.7096 - me
an_squared_error: 1.7096
Epoch 979/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7089 - mea
n_squared_error: 1.7089
Epoch 980/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.7083 - me
an_squared_error: 1.7083
Epoch 981/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7076 - mea
n_squared_error: 1.7076
Epoch 982/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7069 - mea
n_squared_error: 1.7069
Epoch 983/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.7063 - mea
n_squared_error: 1.7063
Epoch 984/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7057 - mea
n_squared_error: 1.7057
Epoch 985/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7051 - mea
n_squared_error: 1.7051
Epoch 986/1000
1000/1000 [==============================] - 0s 12us/step - loss: 1.7045 - me
an_squared_error: 1.7045
Epoch 987/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7038 - mea
n_squared_error: 1.7038
Epoch 988/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7031 - mea
n_squared_error: 1.7031
```

```
Epoch 989/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7024 - mea
n_squared_error: 1.7024
Epoch 990/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.7018 - mea
n_squared_error: 1.7018
Epoch 991/1000
1000/1000 [==============================] - 0s 9us/step - loss: 1.7012 - mea
n_squared_error: 1.7012
Epoch 992/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.7006 - mea
n_squared_error: 1.7006
Epoch 993/1000
1000/1000 [==============================] - 0s 11us/step - loss: 1.7000 - me
an_squared_error: 1.7000
Epoch 994/1000
1000/1000 [==============================] - 0s 8us/step - loss: 1.6993 - mea
n_squared_error: 1.6993
Epoch 995/1000
1000/1000 [==============================] - 0s 4us/step - loss: 1.6986 - mea
n_squared_error: 1.6986
Epoch 996/1000
1000/1000 [==============================] - 0s 19us/step - loss: 1.6980 - me
an_squared_error: 1.6980
Epoch 997/1000
1000/1000 [==============================] - 0s 10us/step - loss: 1.6973 - me
an_squared_error: 1.6973
Epoch 998/1000
1000/1000 [==============================] - 0s 6us/step - loss: 1.6967 - mea
n_squared_error: 1.6967
Epoch 999/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.6961 - mea
n_squared_error: 1.6961
Epoch 1000/1000
1000/1000 [==============================] - 0s 7us/step - loss: 1.6955 - mea
n_squared_error: 1.6955
10000/10000 [==============================] - 1s 59us/step
```

In [274]:
```python
print("The loss (mean squared error) obtained by applying the neural network o
n the test dataset is {}".format(loss))
```

```
The loss (mean squared error) obtained by applying the neural network on the
test dataset is 1.7025480363845826
```

```
In [275]: fig = plt.figure(figsize=(10, 10))
          ax = fig.add_subplot(1, 1, 1)
          plt.plot(model.history.history['loss'])
          plt.xlabel('Epochs')
          plt.ylabel('Loss (mean squared error)')
          plt.title('Plot of loss at various epochs')
          plt.show()
```
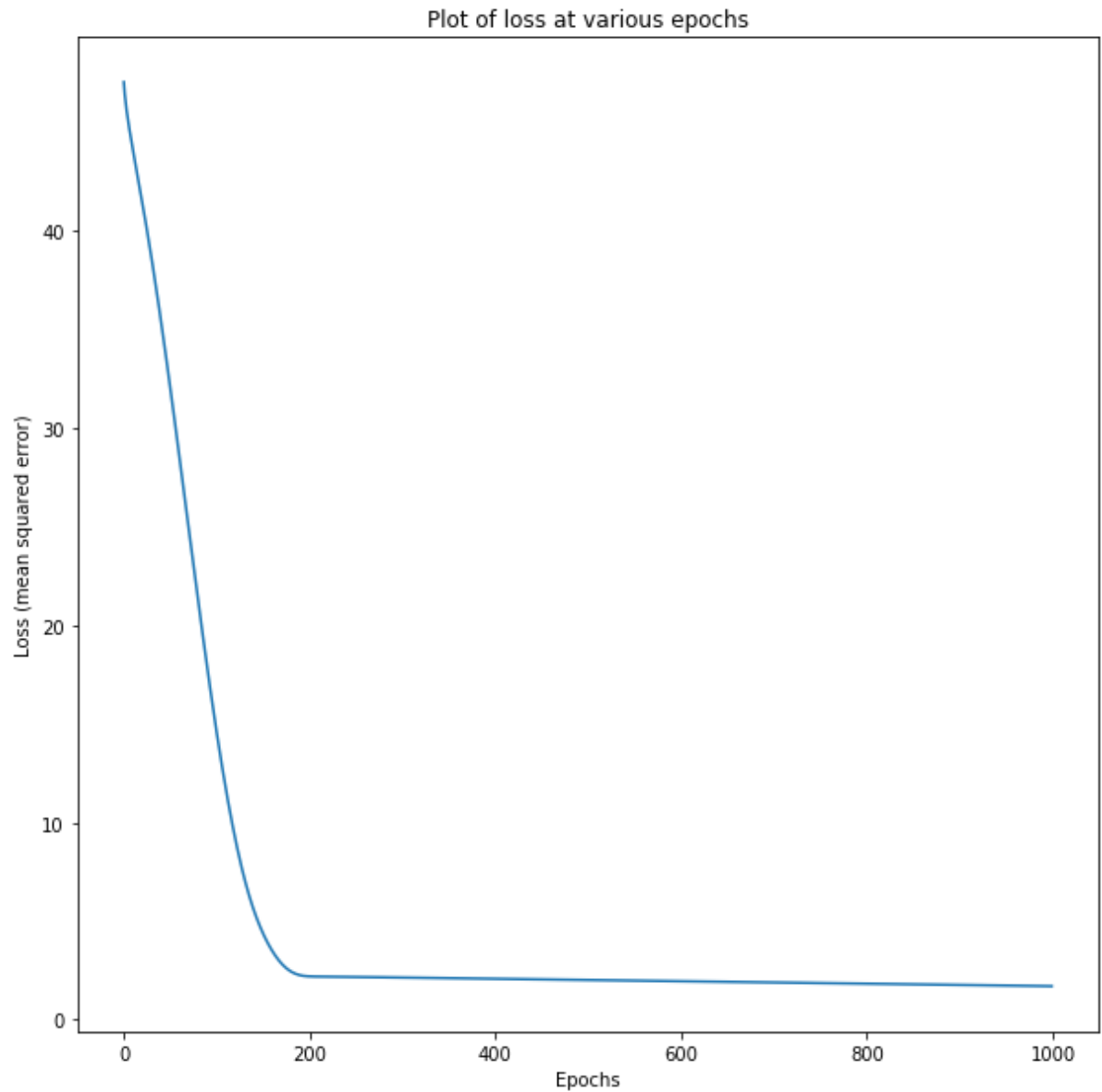
```
In [276]: fig = plt.figure(figsize=(10, 10))
          ax = fig.add_subplot(1, 1, 1)
          ax.scatter(np.array(test_data)[:, 0], np.array(test_data)[:, 1], s = 10, label
          ='Data points')
          ax.scatter(X_test, predictions, s = 10, label = 'Predicted points')
          plt.xlabel('X-axis')
          plt.ylabel('Y-axis')
          plt.title('Plot of real dataset and predicted points')
          ax.legend()
          plt.show()
```

Plot of real dataset and predicted points


```
In [ ]:
```
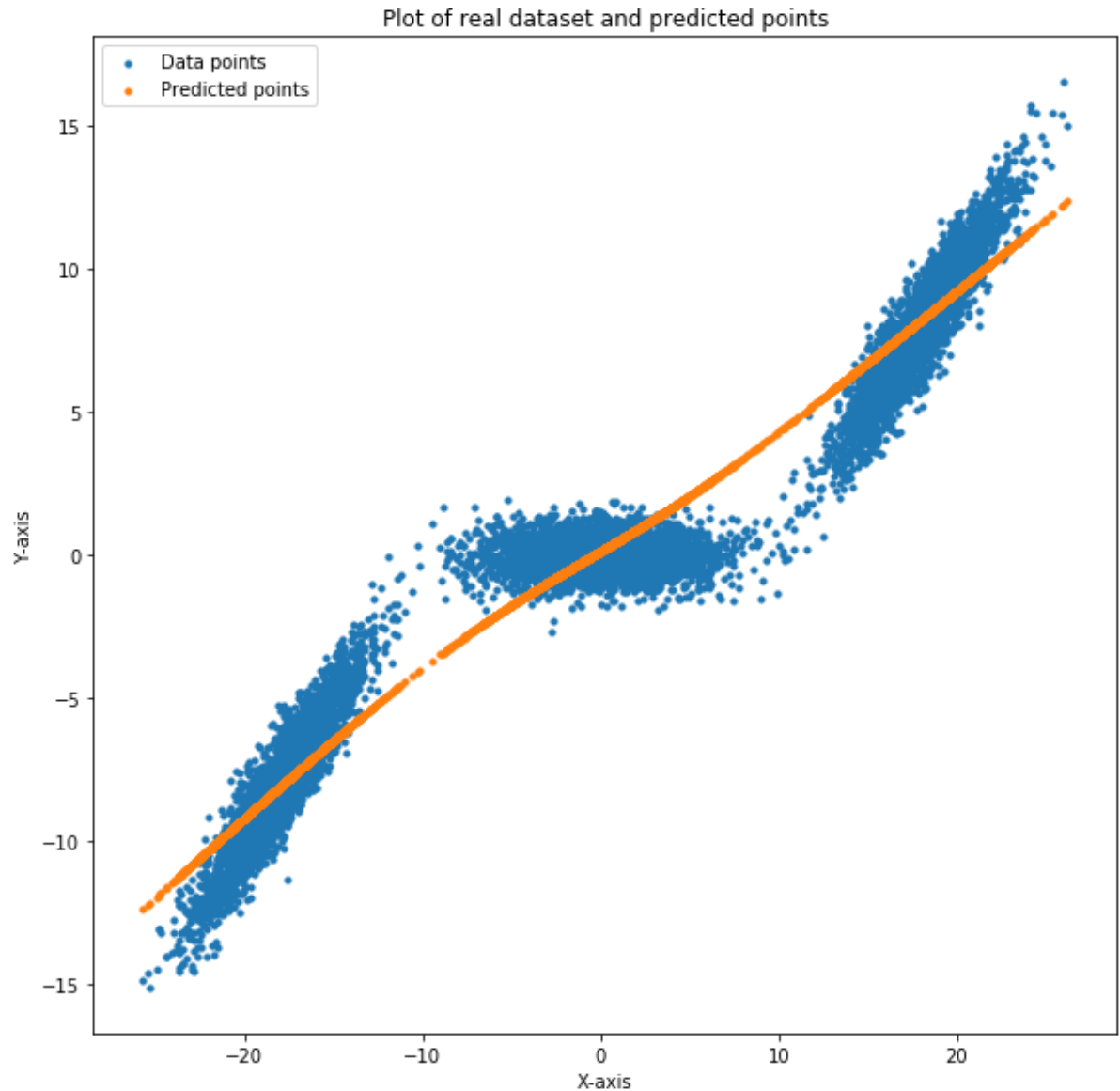
Question 2 :

In this problem, we have to predict the value of x_2 given x_1 for a given point (x_1, x_2) such that the point lies on the data distribution given. Here, a neural network was used that was similar in characteristics to that of the previous question. The major difference between the two problems was that the application here was to calculate the mean squared error of the true and predicted value of x_2 for each x_1. This falls into a regression type of modelling and hence, the package used for this problem was the KerasRegressor library. The working of the neural network here is the same as the previous one. The only major changes are that in this case, we had to find the optimal activation functions (between sigmoid & softplus) along with optimal number of perceptrons in the hidden layer. Hence, in this code, we conduct the cross validation and find the optimal parameters using the GridSearchCV function as used in the previous question. Here, since it is a regression type of application, the loss is Mean Squared Error type and the optimizer used is RMSprop type.

$$MSE = \frac{1}{N} \sum_{i=1}^{N} (y_i - \tilde{y}_i)^2, \quad \text{Softplus}, \rightarrow f(x) = \ln(1 + e^x)$$

Here, in most of the results observed, the softplus function is almost always chosen as the optimal activation function. To find the optimal parameters, we first find the best model order for each of the activation functions and then compare both the functions at their best parameters to decide between the activation functions.

Once the optimal parameters are known, we train the neural network on the 1000 ~~data points~~ training dataset ~~and~~ using the optimal parameters ~~to~~ and then predict the x_2 values for the 10000 ~~data~~ test data set. ~~It is~~

It is observed that the error (loss) decreases as the 'epochs' value increases thus giving better results.

Also, the error reduces as the value of no. of perceptrons increases. But this also leads to overfitting ~~and in~~ of the neural network to the training data.

Note: The codes for the above program been uploaded as both python files as well as jupyter notebooks onto blackboard and also maintained on GitHub (https://github.com/nandayvk/ML_EECE5644_Exam_2.git)

References:

https://scikit-learn.org/stable/

https://keras.io/

https://machinelearningmastery.com/

https://stackoverflow.com/

https://docs.scipy.org/

https://www.anaconda.com/

https://jupyter.org/