In [5]:
```
import numpy as np
import pandas as pd
from sklearn.datasets import make_classification
```

In [6]:
```
X, y = make_classification(n_samples=50000, n_features=15, n_informativ
e=10, n_redundant=5,
                           n_classes=2, weights=[0.7], class_sep=0.7, r
andom_state=15)
X.shape, y.shape
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2
5, random_state=15)
X_train.shape, y_train.shape, X_test.shape, y_test.shape
from sklearn import linear_model
clf = linear_model.SGDClassifier(eta0=0.0001, alpha=0.0001, loss='log',
 random_state=15, penalty='l2', tol=1e-3, verbose=2, learning_rate='con
stant')
clf
clf.fit(X=X_train, y=y_train)
clf.coef_, clf.coef_.shape, clf.intercept_
# alpha : float
# Constant that multiplies the regularization term.

# eta0 : double
# The initial learning rate for the ‘constant’, ‘invscaling’ or ‘adapti
ve’ schedules.
```

```
-- Epoch 1
Norm: 0.77, NNZs: 15, Bias: -0.316653, T: 37500, Avg. loss: 0.455552
Total training time: 0.02 seconds.
-- Epoch 2
Norm: 0.91, NNZs: 15, Bias: -0.472747, T: 75000, Avg. loss: 0.394686
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.98, NNZs: 15, Bias: -0.580082, T: 112500, Avg. loss: 0.385711
Total training time: 0.04 seconds.
-- Epoch 4
```

```
-- Epoch 4
Norm: 1.02, NNZs: 15, Bias: -0.658292, T: 150000, Avg. loss: 0.382083
Total training time: 0.08 seconds.
-- Epoch 5
Norm: 1.04, NNZs: 15, Bias: -0.719528, T: 187500, Avg. loss: 0.380486
Total training time: 0.09 seconds.
-- Epoch 6
Norm: 1.05, NNZs: 15, Bias: -0.763409, T: 225000, Avg. loss: 0.379578
Total training time: 0.11 seconds.
-- Epoch 7
Norm: 1.06, NNZs: 15, Bias: -0.795106, T: 262500, Avg. loss: 0.379150
Total training time: 0.12 seconds.
-- Epoch 8
Norm: 1.06, NNZs: 15, Bias: -0.819925, T: 300000, Avg. loss: 0.378856
Total training time: 0.14 seconds.
-- Epoch 9
Norm: 1.07, NNZs: 15, Bias: -0.837805, T: 337500, Avg. loss: 0.378585
Total training time: 0.17 seconds.
-- Epoch 10
Norm: 1.08, NNZs: 15, Bias: -0.853138, T: 375000, Avg. loss: 0.378630
Total training time: 0.19 seconds.
Convergence after 10 epochs took 0.19 seconds
```

Out[6]:

```
(array([[-0.42336692,  0.18547565, -0.14859036,  0.34144407, -0.2081867
,
         0.56016579, -0.45242483, -0.09408813,  0.2092732 ,  0.1808412
6,
         0.19705191,  0.00421916, -0.0796037 ,  0.33852802,  0.0226672
1]]),
 (1, 15),
 array([-0.8531383]))
```

In [44]:

```
import numpy as np
import math
from tqdm import tqdm

def sigmoid(w,x,b):
    return 1/(1+np.exp(-(np.dot(x,w)+b)))
```

```
def coefficients_sgd(x_train,x_test,y_train,y_test,n_epoch,):
    coef = np.random.normal(0, 0.1, size=(len(x_train[0])))
    intcpt=np.random.normal(0,0.1)
    alpha=0.001
    lamda=0.001
    N = len(X_train)
    LOSS_TRAIN=[]
    LOSS_TEST=[]
    for epoch in tqdm(range(n_epoch)):
        for i in range(len(x_train)):
            dcoef=(x_train[i]*(y_train[i]-sigmoid(coef,x_train[i],intcp
t)))
            dintcpt=(y_train[i]-sigmoid(coef,x_train[i],intcpt))
            coef=((1-(alpha*lamda)/N)*coef+alpha*dcoef)
            intcpt=((1-(alpha*lamda)/N)*intcpt+(alpha*dintcpt))
        ypred_train=sigmoid(coef,x_train,intcpt)
        ypred_test=sigmoid(coef,x_test,intcpt)
        loss_train=0
        for i in range(len(y_train)):
                loss_train=-((y_train[i]*(math.log(ypred_train[i])))+
((1-y_train[i])*(math.log(1-ypred_train[i]))))
        for j in range(len(y_test)):
                loss_test=-((y_test[j]*(math.log(ypred_test[j])))+ ((1-
y_test[j])*(math.log(1-ypred_test[j]))))
        Avg_Loss_Train=loss_train/len(y_train)
        LOSS_TRAIN.append(Avg_Loss_Train)
        Avg_Loss_Test=loss_test/len(y_test)
        LOSS_TEST.append(Avg_Loss_Test)
        print("epoch=",epoch,"; Loss_Train:",Avg_Loss_Train,"Loss_Test"
,Avg_Loss_Test)
    return coef,intcpt,LOSS_TRAIN,LOSS_TEST
```

In [45]:
```
coef,intcpt,LOSS_TRAIN,LOSS_TEST = coefficients_sgd(X_train,X_test,y_tr
ain,y_test,125)
```

```
  0%|
                          | 0/125 [00:00<?, ?it/s]
```

```
epoch= 0 ; Loss_Train: 1.4475087647129872e-05 Loss_Test 7.4044295532967
03e-05

  1%|▌                | 1/125 [00:01<02:06,  1.02s/it]
epoch= 1 ; Loss_Train: 1.4438467302761018e-05 Loss_Test 7.2516200282418
13e-05

  2%|▊                | 2/125 [00:02<02:05,  1.02s/it]
epoch= 2 ; Loss_Train: 1.4436269810386812e-05 Loss_Test 7.2423339907236
33e-05

  2%|██               | 3/125 [00:03<02:04,  1.02s/it]
epoch= 3 ; Loss_Train: 1.4436133107232305e-05 Loss_Test 7.2417552782650
23e-05

  3%|██▍              | 4/125 [00:04<02:03,  1.02s/it]
epoch= 4 ; Loss_Train: 1.4436124573435198e-05 Loss_Test 7.2417191462215
12e-05

  4%|██▊              | 5/125 [00:05<02:02,  1.02s/it]
epoch= 5 ; Loss_Train: 1.4436124040564499e-05 Loss_Test 7.2417168900254
16e-05

  5%|███▏             | 6/125 [00:06<02:01,  1.02s/it]
```

```
epoch= 6 ; Loss_Train: 1.4436124007290143e-05 Loss_Test 7.2417167491403
88e-05

  6%|▋                 | 7/125 [00:07<02:00,  1.02s/it]
epoch= 7 ; Loss_Train: 1.4436124005212403e-05 Loss_Test 7.2417167403430
09e-05

  6%|▋                 | 8/125 [00:08<01:59,  1.02s/it]
epoch= 8 ; Loss_Train: 1.4436124005082677e-05 Loss_Test 7.2417167397936
73e-05

  7%|▊                 | 9/125 [00:09<01:58,  1.03s/it]
epoch= 9 ; Loss_Train: 1.4436124005074528e-05 Loss_Test 7.2417167397593
86e-05

  8%|▊                | 10/125 [00:10<01:58,  1.03s/it]
epoch= 10 ; Loss_Train: 1.443612400507404e-05 Loss_Test 7.2417167397572
37e-05

  9%|▉                | 11/125 [00:11<01:57,  1.03s/it]
epoch= 11 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
098e-05

 10%|▉                | 12/125 [00:12<01:56,  1.03s/it]
```

```
epoch= 12 ; Loss_Train: 1.443612400507404e-05 Loss_Test 7.241716739757086e-05

 10%|▉         | 13/125 [00:13<01:55,  1.03s/it]

epoch= 13 ; Loss_Train: 1.4436124005074022e-05 Loss_Test 7.241716739757088e-05

 11%|▉         | 14/125 [00:14<01:54,  1.03s/it]

epoch= 14 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757091e-05

 12%|▉         | 15/125 [00:15<01:53,  1.03s/it]

epoch= 15 ; Loss_Train: 1.4436124005074e-05 Loss_Test 7.241716739757095e-05

 13%|▉         | 16/125 [00:16<01:53,  1.04s/it]

epoch= 16 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757095e-05

 14%|▉         | 17/125 [00:17<01:52,  1.04s/it]

epoch= 17 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757091e-05

 14%|▉         | 18/125 [00:18<01:50,  1.04s/it]
```

```
epoch= 18 ; Loss_Train: 1.4436124005074022e-05 Loss_Test 7.241716739757
086e-05

 15%|██████████
              | 19/125 [00:19<01:49,  1.03s/it]

epoch= 19 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757
082e-05

 16%|██████████
              | 20/125 [00:20<01:47,  1.03s/it]

epoch= 20 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757
082e-05

 17%|███████████
              | 21/125 [00:21<01:47,  1.03s/it]

epoch= 21 ; Loss_Train: 1.4436124005073988e-05 Loss_Test 7.241716739757
08e-05

 18%|███████████
              | 22/125 [00:22<01:45,  1.03s/it]

epoch= 22 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757
08e-05

 18%|████████████
              | 23/125 [00:23<01:44,  1.03s/it]

epoch= 23 ; Loss_Train: 1.4436124005073988e-05 Loss_Test 7.241716739757
075e-05

 19%|████████████
              | 24/125 [00:24<01:44,  1.03s/it]
```

```
epoch= 24 ; Loss_Train: 1.4436124005073973e-05 Loss_Test 7.241716739757
084e-05
 20%|██████████████
              | 25/125 [00:25<01:42,  1.03s/it]
epoch= 25 ; Loss_Train: 1.4436124005073978e-05 Loss_Test 7.241716739757
082e-05
 21%|███████████████
              | 26/125 [00:26<01:41,  1.02s/it]
epoch= 26 ; Loss_Train: 1.4436124005073984e-05 Loss_Test 7.241716739757
084e-05
 22%|████████████████
              | 27/125 [00:27<01:40,  1.02s/it]
epoch= 27 ; Loss_Train: 1.4436124005073993e-05 Loss_Test 7.241716739757
075e-05
 22%|████████████████
              | 28/125 [00:28<01:39,  1.02s/it]
epoch= 28 ; Loss_Train: 1.4436124005074e-05 Loss_Test 7.24171673975708e
-05
 23%|████████████████
              | 29/125 [00:29<01:41,  1.05s/it]
epoch= 29 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757
08e-05
 24%|█████████████████
              | 30/125 [00:31<01:41,  1.07s/it]
epoch= 30 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757
```

```
08e-05

 25%|██████████████████▌
              | 31/125 [00:32<01:40,  1.07s/it]

epoch= 31 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.241716739757
084e-05

 26%|███████████████████
              | 32/125 [00:33<01:38,  1.05s/it]

epoch= 32 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.241716739757
075e-05

 26%|███████████████████▍
              | 33/125 [00:34<01:36,  1.05s/it]

epoch= 33 ; Loss_Train: 1.4436124005074034e-05 Loss_Test 7.241716739757
086e-05

 27%|███████████████████▉
              | 34/125 [00:35<01:34,  1.04s/it]

epoch= 34 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.2417167397570
86e-05

 28%|████████████████████▎
              | 35/125 [00:36<01:33,  1.04s/it]

epoch= 35 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.2417167397570
8e-05

 29%|████████████████████▊
              | 36/125 [00:37<01:32,  1.04s/it]
```

```
epoch= 36 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757
082e-05

 30%|████████████████████████
              | 37/125 [00:38<01:30,  1.03s/it]

epoch= 37 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757
075e-05

 30%|████████████████████████
              | 38/125 [00:39<01:29,  1.02s/it]

epoch= 38 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757
08e-05

 31%|████████████████████████
              | 39/125 [00:40<01:27,  1.02s/it]

epoch= 39 ; Loss_Train: 1.4436124005074022e-05 Loss_Test 7.241716739757
075e-05

 32%|████████████████████████
              | 40/125 [00:41<01:26,  1.02s/it]

epoch= 40 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757
082e-05

 33%|████████████████████████
              | 41/125 [00:42<01:25,  1.02s/it]

epoch= 41 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757
082e-05

 34%|████████████████████████
              | 42/125 [00:43<01:24,  1.01s/it]
```

```
epoch= 42 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757
082e-05

 34%|                                  | 43/125 [00:44<01:22,  1.01s/it]

epoch= 43 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.2417167397570
82e-05

 35%|                                  | 44/125 [00:45<01:21,  1.01s/it]

epoch= 44 ; Loss_Train: 1.4436124005073993e-05 Loss_Test 7.241716739757
088e-05

 36%|                                  | 45/125 [00:46<01:20,  1.01s/it]

epoch= 45 ; Loss_Train: 1.4436124005073988e-05 Loss_Test 7.241716739757
086e-05

 37%|                                  | 46/125 [00:47<01:19,  1.01s/it]

epoch= 46 ; Loss_Train: 1.4436124005073988e-05 Loss_Test 7.241716739757
091e-05

 38%|                                  | 47/125 [00:48<01:18,  1.01s/it]

epoch= 47 ; Loss_Train: 1.4436124005073988e-05 Loss_Test 7.241716739757
088e-05

 38%|                                  | 48/125 [00:49<01:18,  1.01s/it]

epoch= 48 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.241716739757
```

```
075e-05
 39%|████████████████████████████████
                | 49/125 [00:50<01:17,  1.02s/it]
epoch= 49 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.241716739757
075e-05
 40%|████████████████████████████████
                | 50/125 [00:51<01:16,  1.02s/it]
epoch= 50 ; Loss_Train: 1.4436124005074064e-05 Loss_Test 7.241716739757
072e-05
 41%|████████████████████████████████
                | 51/125 [00:52<01:15,  1.02s/it]
epoch= 51 ; Loss_Train: 1.4436124005074057e-05 Loss_Test 7.241716739757
071e-05
 42%|████████████████████████████████
                | 52/125 [00:53<01:14,  1.02s/it]
epoch= 52 ; Loss_Train: 1.4436124005074057e-05 Loss_Test 7.241716739757
08e-05
 42%|████████████████████████████████
                | 53/125 [00:54<01:13,  1.02s/it]
epoch= 53 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.241716739757
078e-05
 43%|████████████████████████████████
                | 54/125 [00:55<01:12,  1.02s/it]
epoch= 54 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
078e-05
```

```
44%|████████████████████████████████████
             | 55/125 [00:56<01:11,  1.02s/it]
epoch= 55 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.241716739757
08e-05

45%|████████████████████████████████████
             | 56/125 [00:57<01:10,  1.02s/it]
epoch= 56 ; Loss_Train: 1.4436124005074064e-05 Loss_Test 7.241716739757
068e-05

46%|████████████████████████████████████
             | 57/125 [00:58<01:09,  1.03s/it]
epoch= 57 ; Loss_Train: 1.4436124005074069e-05 Loss_Test 7.241716739757
065e-05

46%|████████████████████████████████████
             | 58/125 [00:59<01:08,  1.03s/it]
epoch= 58 ; Loss_Train: 1.44361240050741e-05 Loss_Test 7.24171673975706
5e-05

47%|████████████████████████████████████
             | 59/125 [01:00<01:07,  1.03s/it]
epoch= 59 ; Loss_Train: 1.4436124005074091e-05 Loss_Test 7.241716739757
067e-05

48%|████████████████████████████████████
             | 60/125 [01:01<01:06,  1.03s/it]
epoch= 60 ; Loss_Train: 1.4436124005074057e-05 Loss_Test 7.241716739757
075e-05
```

```
 49%|████████████████████████████████████████
                | 61/125 [01:02<01:06,  1.03s/it]
```

```
epoch= 61 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
08e-05
```

```
 50%|████████████████████████████████████████
                | 62/125 [01:03<01:05,  1.03s/it]
```

```
epoch= 62 ; Loss_Train: 1.443612400507404e-05 Loss_Test 7.2417167397570
82e-05
```

```
 50%|████████████████████████████████████████
                | 63/125 [01:04<01:05,  1.05s/it]
```

```
epoch= 63 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757
082e-05
```

```
 51%|████████████████████████████████████████
                | 64/125 [01:05<01:04,  1.06s/it]
```

```
epoch= 64 ; Loss_Train: 1.4436124005074e-05 Loss_Test 7.24171673975708e
-05
```

```
 52%|████████████████████████████████████████
                | 65/125 [01:06<01:03,  1.06s/it]
```

```
epoch= 65 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.2417167397570
8e-05
```

```
 53%|████████████████████████████████████████
                | 66/125 [01:08<01:02,  1.06s/it]
```

```
epoch= 66 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.2417167397570
72e-05
```

```
 54%|████████████████████████████████████████
                | 67/125 [01:09<01:02,  1.08s/it]
epoch= 67 ; Loss_Train: 1.4436124005074022e-05 Loss_Test 7.241716739757
072e-05

 54%|████████████████████████████████████████
                | 68/125 [01:10<01:01,  1.08s/it]
epoch= 68 ; Loss_Train: 1.4436124005074034e-05 Loss_Test 7.241716739757
072e-05

 55%|████████████████████████████████████████
                | 69/125 [01:11<00:59,  1.07s/it]
epoch= 69 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
071e-05

 56%|████████████████████████████████████████
                | 70/125 [01:12<00:58,  1.07s/it]
epoch= 70 ; Loss_Train: 1.443612400507408e-05 Loss_Test 7.2417167397570
65e-05

 57%|████████████████████████████████████████
                | 71/125 [01:13<00:57,  1.06s/it]
epoch= 71 ; Loss_Train: 1.4436124005074069e-05 Loss_Test 7.241716739757
072e-05

 58%|████████████████████████████████████████
                | 72/125 [01:14<00:55,  1.05s/it]
epoch= 72 ; Loss_Train: 1.4436124005074057e-05 Loss_Test 7.241716739757
078e-05

 ________________________________________
```

```
 58%|                                                  | 73/125 [01:15<00:54,  1.04s/it]
epoch= 73 ; Loss_Train: 1.4436124005074057e-05 Loss_Test 7.241716739757075e-05

 59%|                                                  | 74/125 [01:16<00:52,  1.03s/it]
epoch= 74 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.241716739757072e-05

 60%|                                                  | 75/125 [01:17<00:51,  1.03s/it]
epoch= 75 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757068e-05

 61%|                                                  | 76/125 [01:18<00:50,  1.03s/it]
epoch= 76 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757067e-05

 62%|                                                  | 77/125 [01:19<00:49,  1.03s/it]
epoch= 77 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.241716739757072e-05

 62%|                                                  | 78/125 [01:20<00:48,  1.03s/it]
epoch= 78 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757067e-05

                                                    
```

```
 63%|                                                  | 79/125 [01:21<00:47,  1.03s/it]
epoch= 79 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
072e-05

 64%|                                                  | 80/125 [01:22<00:46,  1.04s/it]
epoch= 80 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.2417167397570
68e-05

 65%|                                                  | 81/125 [01:23<00:45,  1.04s/it]
epoch= 81 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757
068e-05

 66%|                                                  | 82/125 [01:24<00:44,  1.04s/it]
epoch= 82 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.2417167397570
75e-05

 66%|                                                  | 83/125 [01:25<00:43,  1.04s/it]
epoch= 83 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.2417167397570
68e-05

 67%|                                                  | 84/125 [01:26<00:42,  1.04s/it]
epoch= 84 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.2417167397570
75e-05

 68%|                                                  |
```

```
               | 85/125 [01:27<00:41,  1.03s/it]
epoch= 85 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
06e-05
 69%|
               | 86/125 [01:28<00:40,  1.03s/it]
epoch= 86 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
065e-05
 70%|
               | 87/125 [01:29<00:39,  1.03s/it]
epoch= 87 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
067e-05
 70%|
               | 88/125 [01:30<00:38,  1.03s/it]
epoch= 88 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757
08e-05
 71%|
               | 89/125 [01:31<00:37,  1.03s/it]
epoch= 89 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.241716739757
08e-05
 72%|
               | 90/125 [01:32<00:36,  1.03s/it]
epoch= 90 ; Loss_Train: 1.4436124005074064e-05 Loss_Test 7.241716739757
072e-05
 73%|
```

```
               | 91/125 [01:34<00:34,  1.03s/it]
epoch= 91 ; Loss_Train: 1.4436124005074057e-05 Loss_Test 7.241716739757
072e-05
 74%|
               | 92/125 [01:35<00:34,  1.03s/it]
epoch= 92 ; Loss_Train: 1.4436124005074064e-05 Loss_Test 7.241716739757
072e-05
 74%|
               | 93/125 [01:36<00:33,  1.04s/it]
epoch= 93 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
078e-05
 75%|
               | 94/125 [01:37<00:32,  1.03s/it]
epoch= 94 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
08e-05
 76%|
               | 95/125 [01:38<00:30,  1.03s/it]
epoch= 95 ; Loss_Train: 1.443612400507404e-05 Loss_Test 7.2417167397570
75e-05
 77%|
               | 96/125 [01:39<00:29,  1.02s/it]
epoch= 96 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.241716739757
072e-05
 78%|
```

```
              | 97/125 [01:40<00:28,  1.02s/it]

epoch= 97 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.241716739757
071e-05

 78%|
              | 98/125 [01:41<00:27,  1.02s/it]

epoch= 98 ; Loss_Train: 1.4436124005074057e-05 Loss_Test 7.241716739757
075e-05

 79%|
              | 99/125 [01:42<00:26,  1.02s/it]

epoch= 99 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.241716739757
08e-05

 80%|
             | 100/125 [01:43<00:25,  1.02s/it]

epoch= 100 ; Loss_Train: 1.443612400507404e-05 Loss_Test 7.241716739757
08e-05

 81%|
             | 101/125 [01:44<00:24,  1.02s/it]

epoch= 101 ; Loss_Train: 1.4436124005074057e-05 Loss_Test 7.24171673975
7075e-05

 82%|
             | 102/125 [01:45<00:23,  1.02s/it]

epoch= 102 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.24171673975
7078e-05

 82%|
```

```
              | 103/125 [01:46<00:22,  1.02s/it]
epoch= 103 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.24171673975
708e-05

 83%|████████████████████████████████████████████████████████████
              | 104/125 [01:47<00:21,  1.02s/it]
epoch= 104 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.241716739757
071e-05

 84%|████████████████████████████████████████████████████████████
              | 105/125 [01:48<00:20,  1.02s/it]
epoch= 105 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.24171673975
7067e-05

 85%|████████████████████████████████████████████████████████████
              | 106/125 [01:49<00:19,  1.03s/it]
epoch= 106 ; Loss_Train: 1.4436124005074028e-05 Loss_Test 7.24171673975
7075e-05

 86%|████████████████████████████████████████████████████████████
              | 107/125 [01:50<00:18,  1.03s/it]
epoch= 107 ; Loss_Train: 1.443612400507402e-05 Loss_Test 7.241716739757
075e-05

 86%|████████████████████████████████████████████████████████████
              | 108/125 [01:51<00:17,  1.03s/it]
epoch= 108 ; Loss_Train: 1.443612400507404e-05 Loss_Test 7.241716739757
067e-05

 87%|████████████████████████████████████████████████████████████
```

```
 88%|▉| 110/125 [01:53<00:15,  1.03s/it]
epoch= 110 ; Loss_Train: 1.4436124005074069e-05 Loss_Test 7.24171673975
7065e-05

 89%|▉| 111/125 [01:54<00:14,  1.03s/it]
epoch= 111 ; Loss_Train: 1.4436124005074057e-05 Loss_Test 7.24171673975
7067e-05

 90%|▉| 112/125 [01:55<00:13,  1.03s/it]
epoch= 112 ; Loss_Train: 1.443612400507408e-05 Loss_Test 7.241716739757
068e-05

 90%|▉| 113/125 [01:56<00:12,  1.03s/it]
epoch= 113 ; Loss_Train: 1.443612400507408e-05 Loss_Test 7.241716739757
068e-05

 91%|▉| 114/125 [01:57<00:11,  1.03s/it]
epoch= 114 ; Loss_Train: 1.443612400507404e-05 Loss_Test 7.241716739757
075e-05

 92%|▉| 115/125 [01:58<00:10,  1.04s/it]
```

```
epoch= 115 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.24171673975
7084e-05

 93%|
        | 116/125 [01:59<00:09,  1.03s/it]

epoch= 116 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.24171673975
7086e-05

 94%|
        | 117/125 [02:00<00:08,  1.03s/it]

epoch= 117 ; Loss_Train: 1.443612400507404e-05 Loss_Test 7.241716739757
072e-05

 94%|
        | 118/125 [02:01<00:07,  1.03s/it]

epoch= 118 ; Loss_Train: 1.4436124005074044e-05 Loss_Test 7.24171673975
708e-05

 95%|
        | 119/125 [02:02<00:06,  1.03s/it]

epoch= 119 ; Loss_Train: 1.4436124005074049e-05 Loss_Test 7.24171673975
7075e-05

 96%|
        | 120/125 [02:03<00:05,  1.04s/it]

epoch= 120 ; Loss_Train: 1.4436124005074022e-05 Loss_Test 7.24171673975
7086e-05

 97%|
```

```
epoch= 121 ; Loss_Train: 1.4436124005074e-05 Loss_Test 7.241716739757
084e-05

 98%|
  | 122/125 [02:05<00:03,  1.04s/it]

epoch= 122 ; Loss_Train: 1.4436124005074e-05 Loss_Test 7.241716739757
08e-05

 98%|
  | 123/125 [02:06<00:02,  1.03s/it]

epoch= 123 ; Loss_Train: 1.4436124005074034e-05 Loss_Test 7.24171673975
708e-05

 99%|
  | 124/125 [02:07<00:01,  1.03s/it]

epoch= 124 ; Loss_Train: 1.4436124005074008e-05 Loss_Test 7.24171673975
7082e-05

100%|
| 125/125 [02:08<00:00,  1.03s/it]
```

In [31]:

```
print("Coeficients:",coef)
print("\nIntercept=",intcpt)
```

```
Coeficients: [-0.44111805  0.20645173 -0.18764973  0.39600147 -0.316155
13  0.46151931
 -0.4008853   0.11739699  0.1411747   0.13449745  0.18814554  0.0228939
  0.12568807  0.56950933  0.10128067]

Intercept= -0.9016732865682981
```

In [34]:
```
print(abs(coef-clf.coef_))
print("\n",abs(intcpt-clf.intercept_))
```

```
[[0.01775114 0.02097608 0.03905937 0.0545574  0.10796843 0.09864647
  0.05153953 0.21148512 0.0680985  0.04634381 0.00890636 0.01867474
  0.20529177 0.23098131 0.07861346]]

 [0.04853499]
```

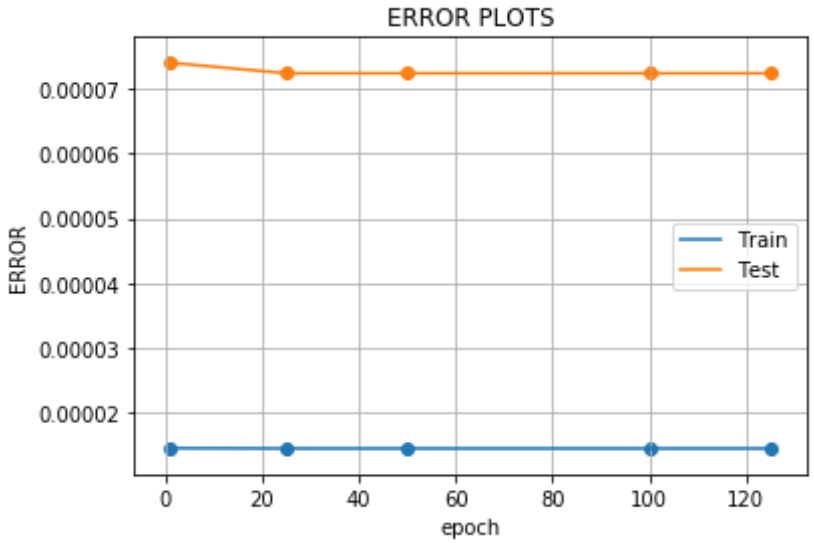
In [54]:
```
import matplotlib.pyplot as plt
error_train=[]
error_train.append(LOSS_TRAIN[0])
error_train.append(LOSS_TRAIN[24])
error_train.append(LOSS_TRAIN[49])
error_train.append(LOSS_TRAIN[99])
error_train.append(LOSS_TRAIN[124])

error_test=[]
error_test.append(LOSS_TEST[0])
error_test.append(LOSS_TEST[24])
error_test.append(LOSS_TEST[49])
error_test.append(LOSS_TEST[99])
error_test.append(LOSS_TEST[124])


epoch=[1,25,50,100,125]
plt.plot(epoch,error_train, label='Train')
plt.plot(epoch,error_test, label='Test')

plt.scatter(epoch,error_train)
plt.scatter(epoch,error_test)

plt.legend()
plt.xlabel("epoch")
plt.ylabel("ERROR")
plt.title("ERROR PLOTS")
plt.grid()
plt.show()
```



In [ ]: