act_uresti

September 5, 2025

1 Actividad Modulo 2

1.1 Importamos librerias necesarias

[1]:
```
import numpy as np

from matplotlib import pyplot as plt

from sklearn.metrics import ConfusionMatrixDisplay, classification_report
from sklearn.datasets import load_breast_cancer

from NNMultiClass import NNMultiClass, train_test_split_stratified,␣
↪transform_standardizer, fit_standardizer

%matplotlib inline
```

1.2 Data

[2]:
```
data = load_breast_cancer()

X = data.data
y = data.target
```

1.2.1 Train-Test Split

[3]:
```
X_train, X_test, y_train, y_test = train_test_split_stratified(X, y,␣
↪test_size=0.2, seed=42)
```

1.2.2 Scale the data

[4]:
```
X_test_scaled  = transform_standardizer(X_test, *fit_standardizer(X_train))
X_train_scaled = transform_standardizer(X_train, *fit_standardizer(X_train))
```

1.3 Neural Network Configuration

[5]:
```
input_size = X_test_scaled.shape[1]
output_size = len(np.unique(y))
layers = 64

layer_sizes = [input_size] + [layers] + [output_size]

nn = NNMultiClass(layer_sizes=layer_sizes, hidden_activation="relu", seed=42,␣
 ↪lr=3e-1)
nn.show_weights()
y_pred = nn.predict(X_test_scaled)
```

```
Pesos capa 0 (30 → 64):
[[ 0.07867761 -0.26852274  0.19376567 … -0.08646694  0.04202266
   0.15136196]
 [ 0.18363791  0.20484138 -0.09004043 …  0.09214371  0.37782318
  -0.3069373 ]
 [-0.16518314 -0.23924088 -0.10064846 …  0.42626776  0.44504858
  -0.04635166]
 …
 [ 0.0189196   0.00968846 -0.02346277 …  0.2622049  -0.4281804
  -0.00204094]
 [ 0.0707058  -0.07765708 -0.47822613 …  0.17353917  0.12267754
  -0.17865651]
 [-0.0435457   0.26949339  0.10156947 …  0.26474372 -0.08192308
  -0.37856759]]

Pesos capa 1 (64 → 2):
[[-0.13671713  0.12836322]
 [-0.24018807  0.14112389]
 [-0.00688776 -0.14904942]
 [-0.07288938 -0.12715304]
 [ 0.10827815  0.09155348]
 [-0.21489514 -0.05044901]
 [-0.10789821  0.16168875]
 [-0.16876239  0.20052864]
 [-0.00416184 -0.1452418 ]
 [-0.08465927 -0.10020236]
 [-0.1593273   0.01185336]
 [-0.15348944 -0.27254578]
```

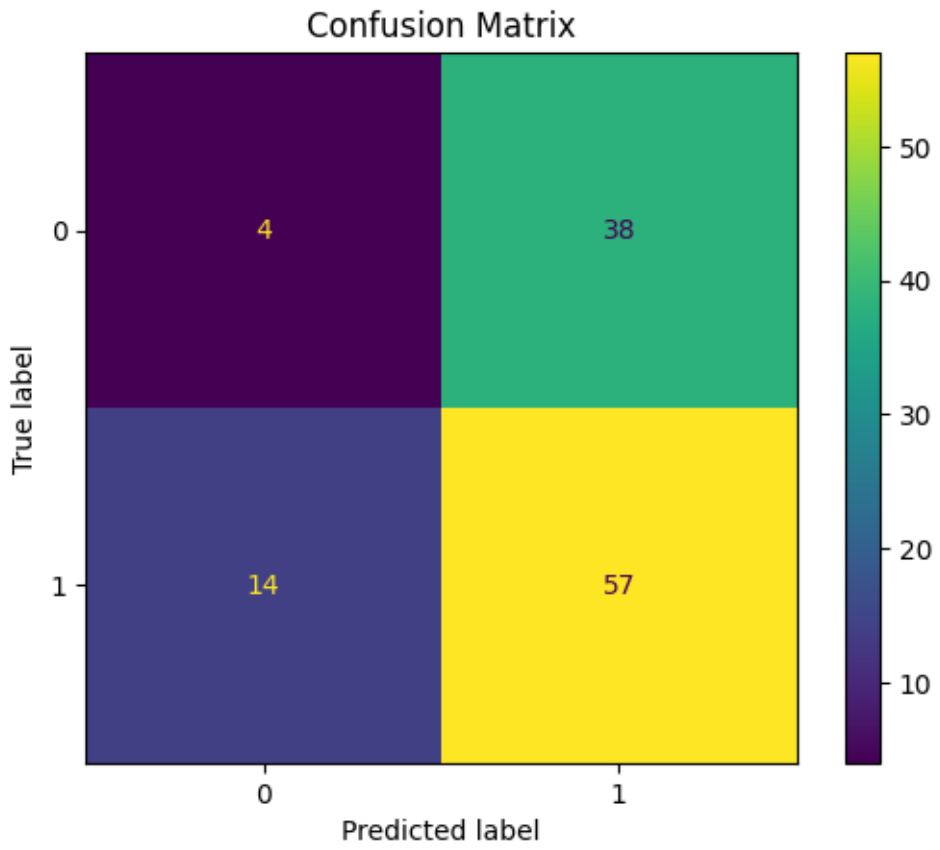
```
[-0.04745956 -0.22535702]
[-0.09402011 -0.11363786]
[-0.10890201  0.25012039]
[ 0.00705145  0.03067138]
[-0.22204979 -0.08174539]
[ 0.02691283 -0.12806611]
[ 0.11350786 -0.15033707]
[-0.03579577 -0.07325645]
[ 0.02054008 -0.08006126]
[-0.0338617  -0.02951626]
[-0.09179847  0.06063673]
[ 0.02979855 -0.01107674]
[-0.05380729  0.099568  ]
[-0.02947928 -0.03833716]
[ 0.01308625  0.21207334]
[-0.16754453  0.09623211]
[-0.2366464   0.02715914]
[ 0.19688535  0.06108357]
[ 0.02132813 -0.07005618]
[ 0.0038809  -0.03150785]
[-0.09824708 -0.03623445]
[ 0.02479765 -0.09590213]
[-0.10078523 -0.17003043]
[ 0.04884063  0.06816541]
[ 0.02895756  0.12064631]
[ 0.01098345  0.04900137]
[ 0.03797968 -0.0114425 ]
[-0.06635273  0.27676908]
[-0.05649387 -0.08323471]
[ 0.05425123  0.0314818 ]
[-0.17559894  0.14033478]
[-0.01177432 -0.13886639]
[ 0.14859801  0.07820945]
[-0.15806775  0.22214786]
[ 0.08234967 -0.00127451]
[ 0.19877735  0.01991222]
[-0.00351038 -0.08253751]
[ 0.0727313   0.05957537]
[ 0.00183502 -0.09874829]
[ 0.01624123 -0.00872485]
[-0.16668429 -0.18397654]
[ 0.07064417 -0.32523604]
[ 0.02567632 -0.05976038]
[ 0.16353083 -0.06168353]
[ 0.08243553 -0.04961423]
[ 0.01421852  0.09210457]
[-0.05781946  0.12456936]
[-0.12421223  0.03682411]
```

```
 [ 0.11532997  0.08250469]
 [ 0.23955561 -0.09542991]
 [-0.17239366 -0.12429189]
 [ 0.08255532  0.06224037]]
```

1.4 Pre - Backpropagation Prediction

1.4.1 Confusion Matrix

[6]:
```
ConfusionMatrixDisplay.from_predictions(y_test, y_pred)
plt.title("Confusion Matrix")
plt.show()
```



1.4.2 Classification Report

[7]:
```
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.22      0.10      0.13        42
           1       0.60      0.80      0.69        71

    accuracy                           0.54       113
   macro avg       0.41      0.45      0.41       113
weighted avg       0.46      0.54      0.48       113
```

1.5 Post - Backpropagation Prediction

[8]:
```
nn.fit(X_train_scaled, y_train, epochs=100, verbose=True, batch_size=12)
nn.show_weights()
y_pred_back = nn.predict(X_test_scaled)
```

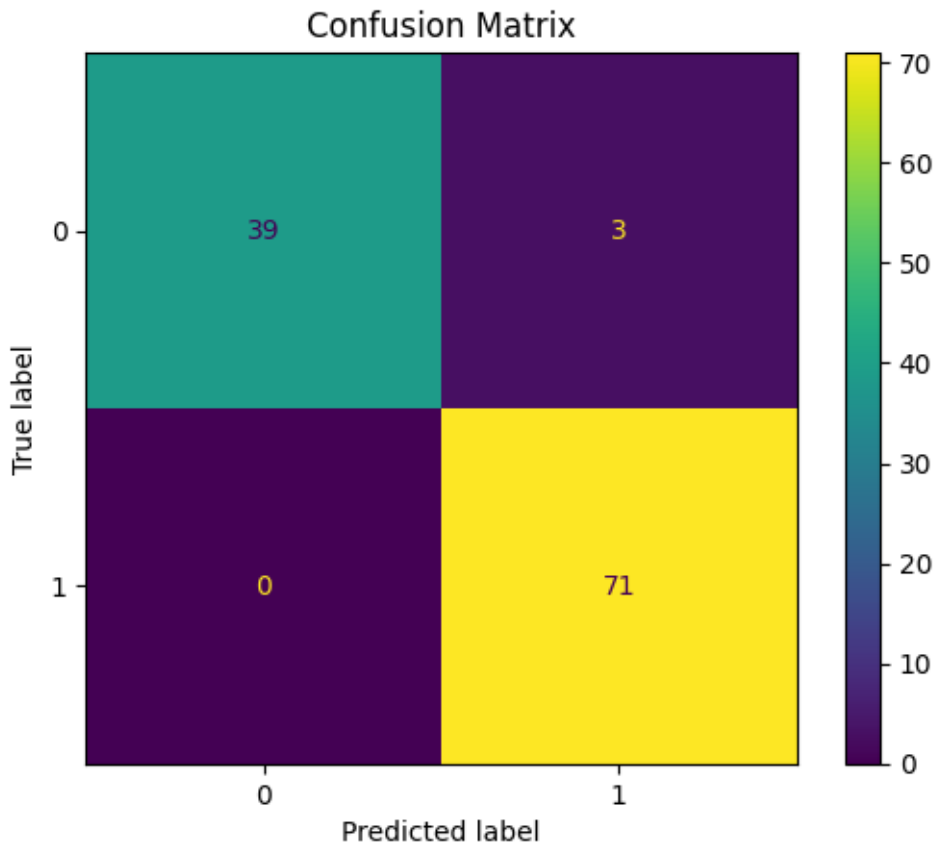
```
Epoch    1 | loss=0.0554 | acc=0.9846
Epoch   10 | loss=0.0099 | acc=1.0000
Epoch   20 | loss=0.0038 | acc=1.0000
Epoch   30 | loss=0.0022 | acc=1.0000
Epoch   40 | loss=0.0016 | acc=1.0000
Epoch   50 | loss=0.0012 | acc=1.0000
Epoch   60 | loss=0.0009 | acc=1.0000
Epoch   70 | loss=0.0008 | acc=1.0000
Epoch   80 | loss=0.0007 | acc=1.0000
Epoch   90 | loss=0.0006 | acc=1.0000
Epoch  100 | loss=0.0005 | acc=1.0000

Pesos capa 0 (30 → 64):
[[ 0.09622694 -0.25723934  0.21605229 … -0.06008279 -0.00423714
   0.07678297]
 [ 0.12223283  0.40444314 -0.03979338 …  0.01615213  0.29317229
  -0.29366199]
 [-0.16066597 -0.21640794 -0.07026397 …  0.45476649  0.39857361
  -0.1163985 ]
 …
 [-0.09277573 -0.13275929  0.04309223 …  0.35624684 -0.38075124
   0.06115216]
 [-0.00942003 -0.21635012 -0.57632465 …  0.17194112  0.13268377
  -0.15635763]
 [-0.32113298  0.37388853  0.32452729 …  0.32392934  0.00314899
  -0.25827847]]
```

```
Pesos capa 1 (64 → 2):
[[-3.72316552e-01  3.63962637e-01]
 [-5.73350290e-01  4.74286112e-01]
 [ 3.59435065e-01 -5.15372244e-01]
 [-1.17249851e-01 -8.27925754e-02]
 [ 7.21040788e-01 -5.21209162e-01]
 [ 6.59735156e-03 -2.71941508e-01]
 [-1.64876113e-01  2.18666651e-01]
 [-2.51200750e-01  2.82966998e-01]
 [ 7.29475994e-01 -8.78879638e-01]
 [ 1.05338318e-01 -2.90199946e-01]
 [ 8.82331303e-01 -1.02980525e+00]
 [-4.13568276e-02 -3.84678392e-01]
 [-4.19258937e-01  1.46442354e-01]
 [-3.40722837e-01  1.33064868e-01]
 [ 7.58788274e-01 -6.17569896e-01]
 [ 3.89333969e-02 -1.21057485e-03]
 [-5.81959051e-01  2.78163872e-01]
 [-8.31215959e-02 -1.80316895e-02]
 [ 2.54403630e-01 -2.91232848e-01]
 [ 3.55952655e-01 -4.65004877e-01]
 [ 1.08025724e-01 -1.67546900e-01]
 [-7.10469615e-02  7.66899666e-03]
 [-1.77360582e-01  1.46198846e-01]
 [-1.86987913e-01  2.05709717e-01]
 [-2.43996651e-01  2.89757363e-01]
 [-2.97760159e-01  2.29943718e-01]
 [-7.38822169e-01  9.63981758e-01]
 [-4.99325878e-01  4.28013464e-01]
 [-4.59809801e-01  2.50322551e-01]
 [-3.80204238e-01  6.38173157e-01]
 [-1.07296839e-01  5.85687903e-02]
 [ 1.42657384e-01 -1.70284336e-01]
 [-8.25452536e-01  6.90971008e-01]
 [ 1.82879670e-01 -2.53984159e-01]
 [-3.35869463e-01  6.50538056e-02]
 [ 7.24025720e-01 -6.07019684e-01]
 [ 8.72440795e-01 -7.22836928e-01]
 [-1.72227229e-01  2.32212051e-01]
 [-1.69037786e-03  2.82275536e-02]
 [-3.01242913e-01  5.11659261e-01]
 [-5.34569207e-01  3.94840621e-01]
 [ 6.79454976e-01 -5.93721946e-01]
 [-5.13834471e-01  4.78570310e-01]
 [-5.20954464e-01  3.70313755e-01]
 [-3.87816777e-01  6.14624238e-01]
 [-5.41613957e-01  6.05694063e-01]
 [ 8.72420548e-03  7.23509511e-02]
```

```
[ 3.27133433e-01 -1.08443859e-01]
[-8.32327086e-02 -2.81519027e-03]
[-3.44291323e-01  4.76597999e-01]
[-3.05665298e-01  2.08752021e-01]
[-1.18619864e-01  1.26136248e-01]
[ 3.23398699e-01 -6.74059533e-01]
[ 2.85534540e-01 -5.40126407e-01]
[-1.86501501e-01  1.52417434e-01]
[-2.94601896e-01  3.96449195e-01]
[-1.26108290e-01  1.58929587e-01]
[ 2.41254763e-02  8.21976092e-02]
[ 4.01150762e-01 -3.34400866e-01]
[-9.98839475e-02  1.24958182e-02]
[ 1.97810834e-01  2.38180662e-05]
[ 2.21137995e-01 -7.70123005e-02]
[ 7.39732017e-02 -3.70658747e-01]
[ 5.98741101e-01 -4.53945414e-01]]
```

1.5.1 Confusion Matrix

[9]:
```
ConfusionMatrixDisplay.from_predictions(y_test, y_pred_back)
plt.title("Confusion Matrix")
plt.show()
```



1.5.2 Classification Report

[10]:
```
print(classification_report(y_test, y_pred_back))
```

```
              precision    recall  f1-score   support

           0       1.00      0.93      0.96        42
           1       0.96      1.00      0.98        71

    accuracy                           0.97       113
   macro avg       0.98      0.96      0.97       113
weighted avg       0.97      0.97      0.97       113
```

---

2 Conclusiones

En resumen, el trabajo realizado permitió consolidar aprendizajes clave, demostrar avances técnicos y prácticos, y fortalecer la capacidad de análisis y adaptación.

Aunque se identificaron áreas de mejora que servirán de guía para el perfeccionamiento futuro, se cuenta ya con una base sólida que permitirá afrontar con mayor claridad y seguridad los retos de las siguientes etapas.
