T.C

ERCİYES UNIVERSITY

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INTRODUCTION TO MACHINE LEARNING

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Neural Network Refactoring

Libraries used

```
import numpy as np
import pandas as pd
from sklearn.neural_network import MLPClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report, confusion_matrix,
accuracy_score
```

Reading data from data and labels files.

```
dataset = pd.read_csv("data.csv")
labels = pd.read_csv("labels.csv")

X = dataset.iloc[:, 1:-1].values
y = labels.iloc[:, -1].values
```

A data set with a test size of 30% is determined. Then education begins.

```
x_train, x_test, y_train, y_test = train_test_split(
    X, y, test_size=0.30, random_state=25)
```

Method MLP Classifier used from scikit learn library

```
clf = MLPClassifier(hidden_layer_sizes=(100, 100), max_iter=500,
                    solver='adam', verbose=True,  random_state=20,
tol=0.000000001)
```

And finally, the training is started.

```
clf.fit(x_train, y_train)
y_pred = clf.predict(x_test)
```

Confusion Matrix

```
[[21  1  2  3]
 [ 0 30  0  0]
 [ 0  2  5  2]
 [ 1  1  0 39]]
```

Classification Report

```
  Classification Report:
                  precision    recall  f1-score   support

    breast cancer       0.95      0.78      0.86        27
     colon cancer       0.88      1.00      0.94        30
      lung cancer       0.71      0.56      0.63         9
 prosrtate cancer       0.89      0.95      0.92        41

         accuracy                           0.89       107
        macro avg       0.86      0.82      0.83       107
     weighted avg       0.89      0.89      0.88       107
```

Accuracy: 0.8878504672897196

Statistic Calculation and Print

```
print("\n Breast Cancer:")
print("recall : ", detail['breast cancer']['recall'] , "precision : "
, detail['breast cancer']['precision'] ,"f2-score : "
, ((5*detail['breast cancer']['recall']*detail['breast
cancer']['precision'])/(4*detail['breast cancer']['precision']+detail['breast
cancer']['recall'])))

print("\n Colon Cancer:")
print("recall : ", detail['colon cancer']['recall'] , "precision : "
, detail['colon cancer']['precision'] ,"f2-score : "
, ((5*detail['colon cancer']['recall']*detail['colon
cancer']['precision'])/(4*detail['colon cancer']['precision']+detail['colon
cancer']['recall'])))

print("\n Lung Cancer:")
print("recall : ", detail['lung cancer']['recall'] , "precision : "
, detail['lung cancer']['precision'] ,"f2-score : "
, ((5*detail['lung cancer']['recall']*detail['lung
cancer']['precision'])/(4*detail['lung cancer']['precision']+detail['lung
cancer']['recall'])))

print("\n Prostate Cancer:")
print("recall : ", detail['prosrtate cancer']['recall'] , "precision : "
, detail['prosrtate cancer']['precision'] ,"f2-score : "
, ((5*detail['prosrtate cancer']['recall']*detail['prosrtate
cancer']['precision'])/(4*detail['prosrtate
cancer']['precision']+detail['prosrtate cancer']['recall'])))
```

Output

```
Breast Cancer:

recall :  0.7777777777777778
precision :  0.9545454545454546
f2-score :  0.8076923076923077

Colon Cancer:

recall :  1.0
precision :  0.8823529411764706
f2-score :  0.9740259740259741

Lung Cancer:

recall :  0.5555555555555556
precision :  0.7142857142857143
f2-score :  0.5813953488372092

Prostate Cancer:

recall :  0.9512195121951219
precision :  0.8863636363636364
f2-score :  0.9375000000000001


Accuracy: 0.8878504672897196
```