

# CS 6375

## Lab Work-1

Names of student:

Adrita Dutta-axd172930

Number of free late days used: 0

Till now we have used only one late day

Please list clearly all the sources/references that you have used in this assignment.

- Scikit-learn - [scikit-learn.org](https://scikit-learn.org)

# SCIKIT-LEARN LAB

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The questions below are based on the steps in the Scikit-Learn lab.

What to submit:

- Your code
- Output
- README file indicating which dataset you used for part 2

This is an individual assignment. No late days can be used for this assignment.

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1. We learned in class that the XOR problem can't be solved using a single perceptron and requires a neural network to solve. In this part, you have to create the best possible neural net i.e. the one with the minimum number of layers and fewest number of parameters that will solve the XOR problem.

Give the weights and intercepts for each neuron and any other parameters that you have used.

Output:

Number of layers = 1(size- 2 neurons)

Training error = 0.0020524497656838627

Bias values = array([-2.03829407, 2.90611393]), array([7.26301464])]

Weights = array([[ 2.03285044, -3.05323011], [ 2.03829407, -4.17609274]]),  
array([-8.03970899], [-5.68110094])]

2. In this part, you will create a neural net for a dataset chosen from the UCI ML repository. The repository is available at:

<http://archive.ics.uci.edu/ml/datasets.html>

You will first have to read in the dataset using Pandas into a dataframe. The second step will involve pre-processing the dataset - analyze each of the attributes and scale them. Then you will randomly split the data into train and test parts – you are free to decide the split size. Next will be the model creation step – you will need to tune as many parameters as possible. Finally, evaluate the performance of the model using the best set of parameters.

Output:

Number of layers = 2(5,2 neurons respectively)

Predictions :

```
array([0, 3, 2, 1, 1, 0, 3, 0, 3, 3, 3, 1, 3, 2, 2, 3, 3, 2, 1, 1, 3, 2,
       1, 2, 1, 1, 3, 1, 0, 3, 2, 0, 3, 0, 3, 0, 1, 1, 3, 0, 3, 1, 3, 3,
       2, 2, 3, 3, 3, 0, 3, 3, 1, 3, 1, 3, 1, 0, 1, 1, 1, 2, 3, 1, 0, 1,
       0, 3, 3, 0, 3, 0, 0, 3, 1, 1, 3, 0, 0, 3, 1, 1, 2, 3, 2, 1, 3, 2,
       1, 3, 3, 1, 3, 3, 1, 1, 0, 1, 0, 3, 1, 3, 2, 1, 1, 3, 2, 3, 1, 3,
       0, 3, 1, 3, 0, 3, 2, 3, 0, 2, 0, 3, 2, 1, 0, 1, 1, 2, 3, 2, 0, 3,
       0, 0, 3, 3, 1, 1, 3, 0, 2, 0, 1, 3, 0, 3, 0, 0, 2, 3, 0, 1, 0, 1,
```

```

3, 2, 0, 3, 0, 3, 1, 3, 3, 2, 2, 0, 3, 2, 3, 2, 1, 3, 3, 3, 0, 3,
1, 3, 2, 3, 3, 2, 0, 3, 0, 3, 3, 3, 1, 1, 1, 1, 3, 3, 3, 3, 3, 3,
2, 1, 2, 1, 0, 2, 1, 3, 1, 0, 1, 1, 2, 3, 3, 1, 3, 3, 0, 1, 1, 0,
2, 0, 2, 1, 0, 0, 0, 0, 2, 2, 1, 2, 3, 3, 0, 0, 2, 3, 0, 3, 2, 3,
3, 0, 3, 1, 1, 2, 1, 3, 1, 1, 0, 0, 1, 3, 3, 1, 3, 1, 3, 3, 1, 3,
1, 3, 3, 1, 3, 2, 3, 1, 2, 1, 0, 1, 1, 3, 3, 2, 2, 3, 1, 0, 3, 3,
0, 3, 3, 1, 3, 3, 0, 1, 0, 3, 0, 1, 3, 3, 2, 2, 3, 3, 2, 0, 3, 2,
3, 0, 3, 0, 3, 3, 1, 2, 3, 3, 1, 2, 0, 3, 1, 0, 0, 2, 2, 3, 0, 1,
0, 0, 1, 2, 3, 2, 2, 2, 1, 3, 3, 1, 0, 0, 2, 3])

```

Confusion Matrix =

```

[[18 18 11 32]
 [21 33 16 21]
 [23 31 15 25]
 [20 25 13 24]]

```

	precision	recall	f1-score	support
0	0.22	0.23	0.22	79
1	0.31	0.36	0.33	91
2	0.27	0.16	0.20	94
3	0.24	0.29	0.26	82
avg / total	0.26	0.26	0.26	346

Training error = 1.27849795394752

Bias values =

```

[array([ 0.0841416 ,  0.07194117,  0.13425571, -0.10315053, -0.25451419,
         0.20878336, -0.07067458, -0.29113213, -0.19928111,  0.21506895,
         0.13995414,  0.33550199,  0.0919761 ,  0.29072663, -0.32232715,
        -0.27020638,  0.31224304,  0.29737679, -0.2409662 ,  0.09801558,
        -0.30619484,  0.08884478, -0.34148349,  0.11764646]),
 array([-0.30276688, -0.27549597, -0.08758394, -0.44047882])]

```

Weights =

```

[array([[ -0.05361501, -0.08300397, -0.19798012,  0.1649399 ,  0.39145222,
        -0.28260582, -0.18776893,  0.19463582, -0.04511746,  0.26063434,
         0.23525105,  0.13766278, -0.39709483,  0.3015018 ,  0.19526919,
        -0.28050901,  0.1318598 ,  0.26092747, -0.05171661, -0.37897984,
        -0.4965827 ,  0.5570016 , -0.37271952,  0.16912725],

```

```

[ 0.359477 , -0.05061816, 0.40132285, -0.24189764, -0.05656987,
-0.07630764, 0.27974523, 0.49721443, 0.24221546, -0.54061488,
-0.25075586, 0.00776744, -0.16355285, -0.1082314 , 0.5051033 ,
-0.02357288, 0.25910566, -0.37385151, 0.17911297, -0.06996702,
-0.02249499, -0.19364185, 0.27001769, 0.41164771],
[-0.15925909, 0.07492449, 0.0435348 , -0.16543137, 0.32980688,
0.20163989, -0.08552885, -0.39849021, -0.39491924, 0.0992472 ,
-0.09832568, 0.124985 , 0.07076463, -0.0045085 , 0.21523683,
-0.01019819, -0.09002943, 0.09610662, 0.51326279, 0.23197881,
-0.03956229, -0.0121956 , 0.19522757, 0.22986629],
[-0.16483141, 0.38628082, 0.18720485, 0.35562955, 0.1675783 ,
-0.59522025, 0.3324122 , -0.0566009 , 0.42459098, -0.007189 ,
0.46965931, 0.16898084, 0.38861363, 0.15923254, 0.0246969 ,
0.17601667, -0.03424828, -0.1994142 , -0.52105642, 0.26093992,
-0.21858642, 0.24297033, -0.24460957, 0.0972185 ],
[-0.64623376, 0.29846165, -0.35175675, -0.4752388 , 0.17212864,
0.14866696, -0.33732226, -0.06766274, 0.07174798, 0.31120664,
0.12689256, 0.33025826, -0.01257807, 0.16128175, 0.08687009,
0.87303243, 0.03026397, 0.12984454, 0.69972236, 0.16248128,
-0.1705967 , 0.23940016, 0.29279627, -0.39569072],
[-0.64841489, 0.39113324, 0.06291361, -0.14386714, 0.43089722,
0.73840527, -0.1722138 , 0.09579189, -0.05838311, 0.26344019,
-0.56058901, -0.24099816, 0.24467628, 0.48518608, -0.05556401,
0.84364682, -0.33058968, -0.07190974, 0.15120758, 0.05035324,
-0.61083246, 0.43246674, 0.11974341, -0.4232221 ]],
array([[ 0.34799657, -0.12633467, 0.07046419, 0.43731549],
[-0.22340674, -0.25070474, -0.10264309, 0.52704626],
[-0.03911619, -0.0097323 , -0.2526695 , -0.40017513],
[ 0.28641477, -0.02527645, 0.01098769, 0.10740117],
[ 0.1543882 , -0.33285098, 0.12513268, 0.11142494],
[-0.32424186, 0.3317058 , 0.19920239, -0.05676894],
[-0.34788307, 0.10992459, -0.3273975 , 0.27323175],
[ 0.19579861, 0.53418469, 0.05656165, 0.26927867],
[-0.17059137, -0.05259399, 0.26142655, -0.20667336],
[ 0.33976891, 0.09428065, 0.36135606, -0.28710836],
[-0.18181782, 0.69261959, 0.47699097, -0.19228566],
[-0.12258375, 0.42660388, -0.0321309 , -0.31027167],
[-0.04130179, 0.08401698, -0.07044437, 0.27163907],
[ 0.3726244 , -0.1312234 , -0.00665967, -0.11564322],
[-0.069027 , 0.31193632, 0.16125967, 0.1975943 ],
[-0.11388403, -0.90024597, -0.59788318, -0.06959416],
[-0.10709766, -0.3381508 , 0.01273815, -0.5424819 ],
[-0.41422737, -0.06610781, -0.34615308, 0.36517847],
[-0.22230535, -0.51033998, -0.54892464, -0.06691519],
[ 0.16918043, 0.10580698, 0.16266903, -0.42739482],
[ 0.527416 , -0.2943654 , -0.15049904, -0.02473287],
[ 0.1748881 , 0.12467827, -0.28809986, 0.56006997],
[-0.33331824, 0.030014 , -0.24410959, 0.08207607],
[ 0.01749549, -0.15165363, 0.09630552, 0.19428138]])]

```