Multi Perceptron – 7 Segment

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1. Import Library

```
import numpy as np
from sklearn.metrics import accuracy_score
from sklearn.neural_network import MLPClassifier
import matplotlib.pyplot as plt
```

2. Define Input & Output

```
# Define Input
In = np.array([
    [1,1,1,0,1,1,1],
    [0,0,0,0,0,1,1],
    [0,1,1,1,1,1,0],
    [0,0,1,1,1,1,1],
    [1,0,0,1,0,1,1],
    [1,0,1,0,1,0,1],
    [1,1,1,1,1,0,1],
    [0,1,1,1,0,1,0],
    [1,1,1,1,1,1,1],
    [1,0,1,1,1,1,1]
])
print("="*100)
print("Input = \n", In)
```

```
# Define Output
target = np.array([
    0,
    1,
    2,
    3,
    4,
    5,
    6,
    7,
    8,
    9,
])
print("="*100)
print("Target = \n",target)
```

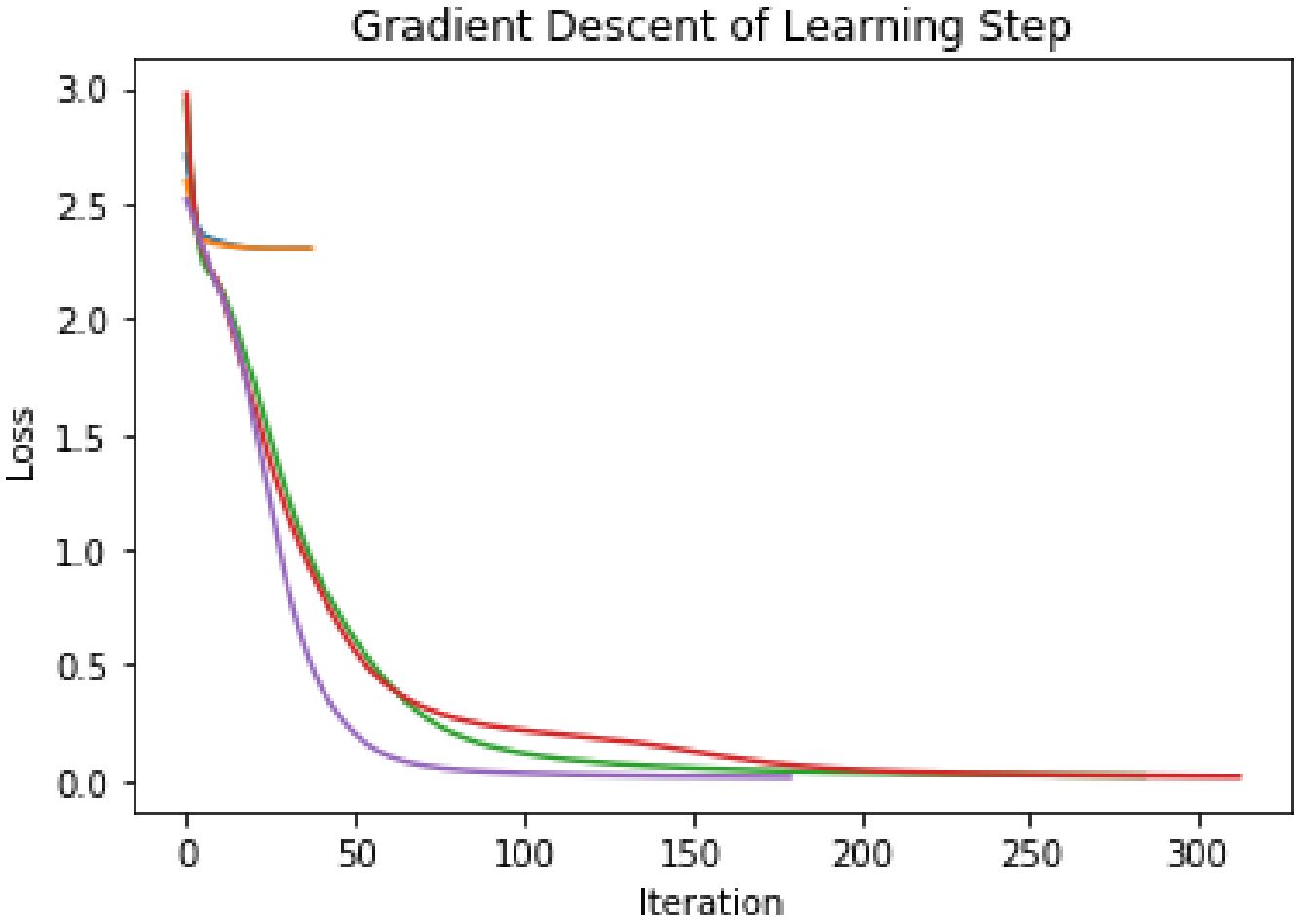
```
====================================================================================================
Input =
 [[1 1 1 0 1 1 1]
 [0 0 0 0 0 1 1]
 [0 1 1 1 1 1 0]
 [0 0 1 1 1 1 1]
 [1 0 0 1 0 1 1]
 [1 0 1 0 1 0 1]
 [1 1 1 1 1 0 1]
 [0 1 1 1 0 1 0]
 [1 1 1 1 1 1 1]
 [1 0 1 1 1 1 1]]
====================================================================================================
Target =
 [0 1 2 3 4 5 6 7 8 9]
```

3. NN – MLP (scikit-learn)

```
print("="*100)
hidden_node = np.array([1,2,3,5,10])
for i in range (len(hidden_node)):
    clf = MLPClassifier(activation='relu',
                        solver='sgd',
                        learning_rate_init=0.1,
                        random_state=0,
                        hidden_layer_sizes=(hidden_node[i]),
                        max_iter=10000)
    fit = clf.fit(In, target)

    print("="*100)
    predict = clf.predict(In)
    print("Predict with ", hidden_node[i], "nodes")
    print(predict)
    plt.plot(clf.loss_curve_)
    plt.xlabel("Iteration")
    plt.ylabel("Loss")
    plt.title("Gradient Descent of Learning Step")
    print("="*100)
    acc = accuracy_score(predict,target)
    print("The Accuracy of Hidden Layer With ", hidden_node[i] ," Nodes is ",(acc*100),"%")
    print()
```

RESULT




```
==========================================================
==========================================================
Predict with  1 nodes
[6 6 6 6 6 6 6 6 6 6]
==========================================================
The Accuracy of Hidden Layer With  1  Nodes is  10.0 %

==========================================================
Predict with  2 nodes
[7 7 7 7 7 7 7 7 7 7]
==========================================================
The Accuracy of Hidden Layer With  2  Nodes is  10.0 %

==========================================================
Predict with  3 nodes
[0 1 2 3 4 5 6 7 8 9]
==========================================================
The Accuracy of Hidden Layer With  3  Nodes is  100.0 %

==========================================================
Predict with  5 nodes
[0 1 2 3 4 5 6 7 8 9]
==========================================================
The Accuracy of Hidden Layer With  5  Nodes is  100.0 %

==========================================================
Predict with  10 nodes
[0 1 2 3 4 5 6 7 8 9]
==========================================================
The Accuracy of Hidden Layer With  10  Nodes is  100.0 %
```