BE-350 ML-DL

Tutorial-1 Report

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Data Generator

The data generator works in the following way.

Enter the value of m and c for a line of form y = mx + c, around which we want to find the data. Enter the percentage(%) of points to flip the true label in the case of Non-Linearly separable Data.

Points generation

```
for i in range(n):
    x = random.uniform(-100, 100)
    y = random.uniform(-100, 100)
    X.append(x)
    Y.append(y)
    if y > m*x + c:
        true_label.append(1)
    elif y < m*x + c:
        true_label.append(-1)
    else:
        true_label.append(0)
```

Flipping (Non-Linearly separable Data)

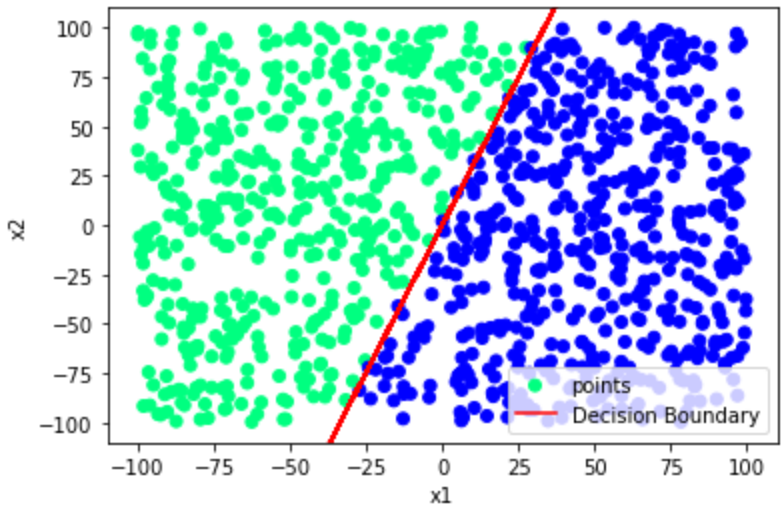
```
# Flip labels
for i in range(int(n*flip/100)):
    if true_label[i] == -1:
        true_label[i] = 1
    else:
        true_label[i] = -1
```

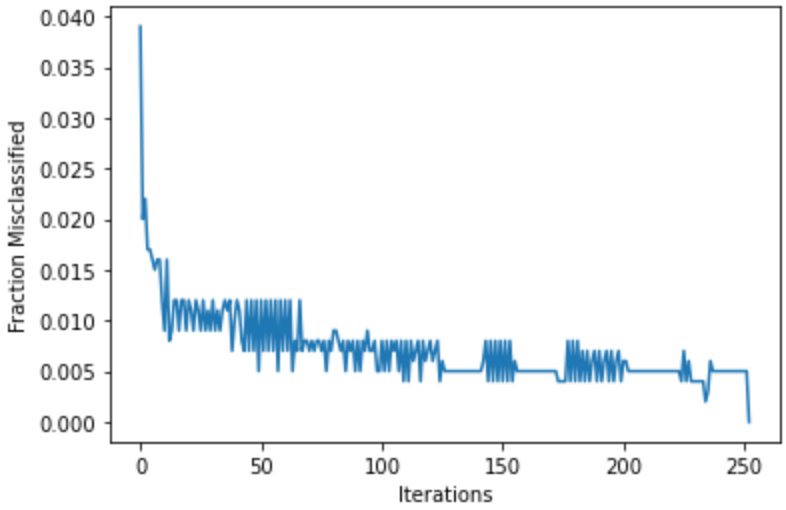
Linearly Separable

a. **PLA**

Finds boundary that classifies with 0 error where all points are correctly classified.

```
Dimension of weights:  (3,)
Dimension of X[0]:  (1000, 3)
Dimension of Y[0]:  (1000,)
Weights:  [-535.90900044  179.84683259 -399.8       ]
```

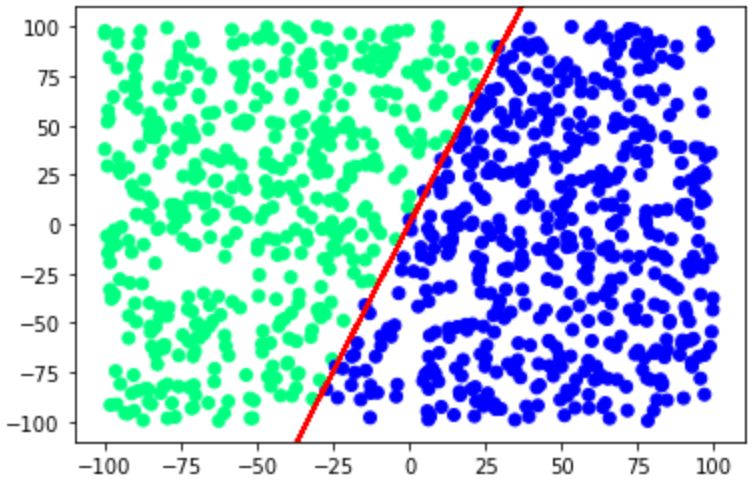


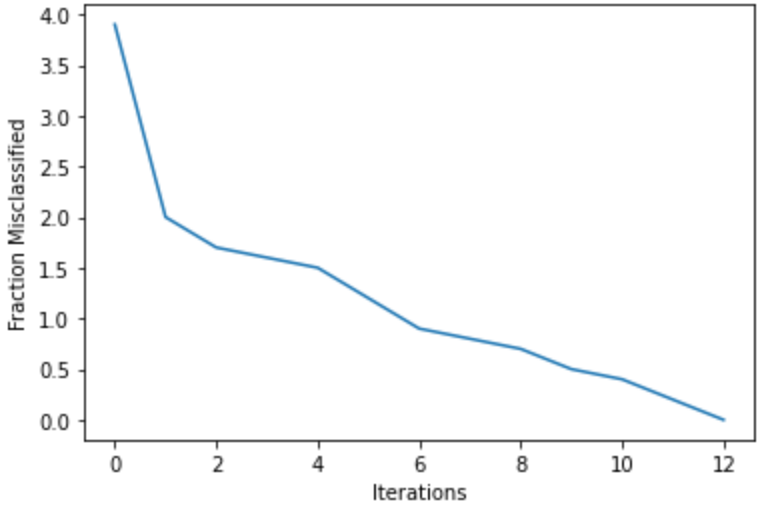


b. **Pocket**

Finds boundary that classifies with minimum error in this case 0.

```
Dimension of weights:  (3,)
Dimension of X[0]:  (1000, 3)
Dimension of Y[0]:  (1000,)
Error:  [3.9, 2.0, 1.7000000000000002, 1.6, 1.5, 1.2, 0.8999999999999999, 0.8, 0.7000000000000001, 0.5, 0.4, 0.2, 0.0]
Weights:  [-535.90900044  179.84683259 -399.8       ]
```



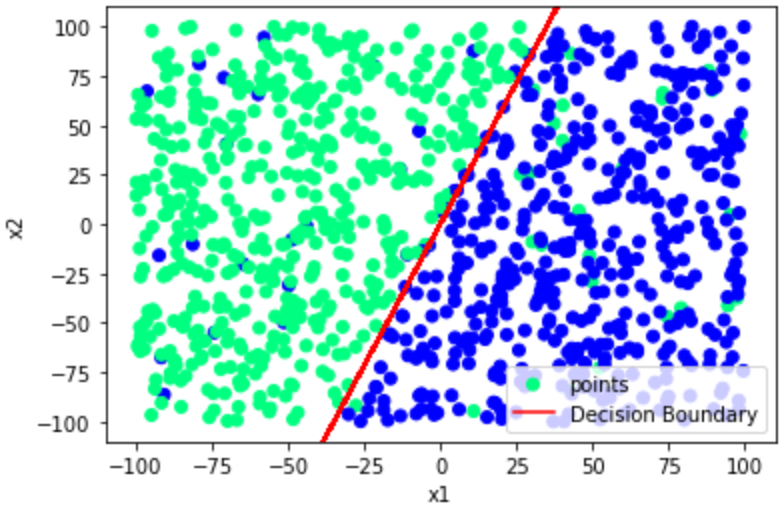


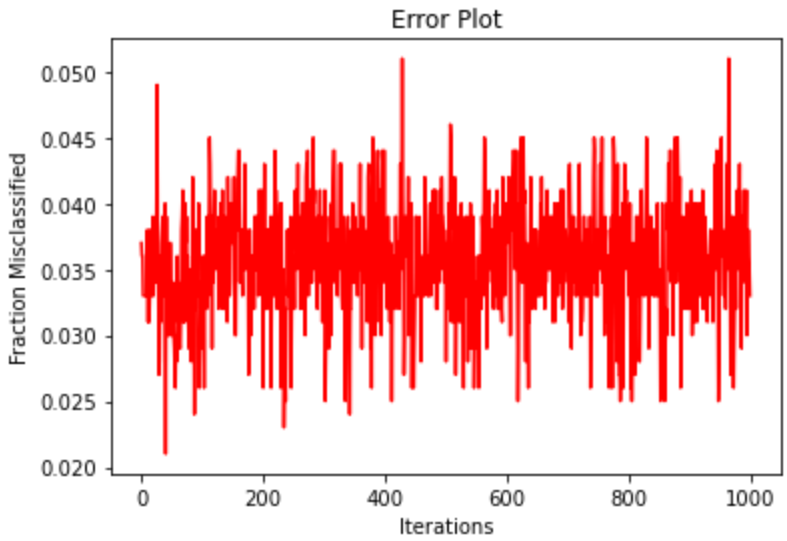
Non-Linearly Separable

a. **PLA**

For Non-Linearly separable data PLA will never stop as the error will never become zero and there will always exist some point that will be misclassified.

```
Dimension of weights:  (3,)
Dimension of X[0]:  (1000, 3)
Dimension of Y[0]:  (1000,)
Weights:  [-141.10441196   30.66171954   91.        ]
```

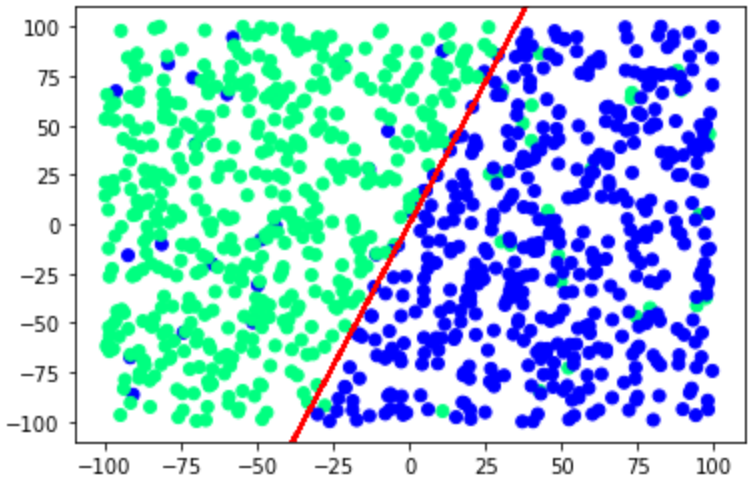


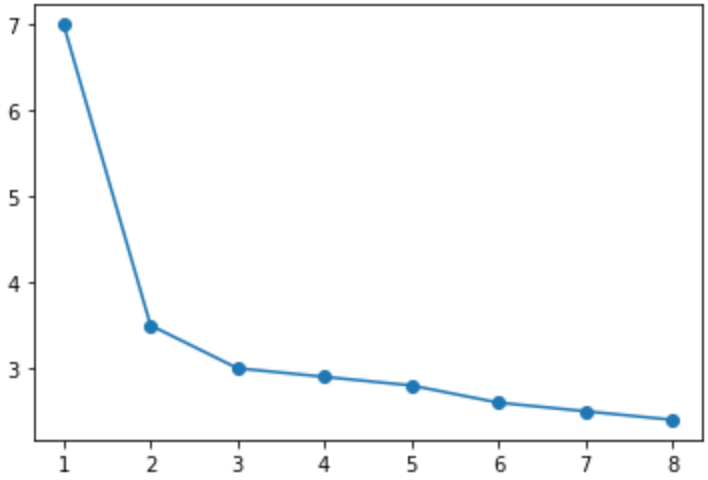


b. Pocket

Pocket will find the best weight for which the error will be the minimum.

```
Dimension of weights:  (3,)
Dimension of X[0]:  (1000, 3)
Dimension of Y[0]:  (1000,)
Weights:  [-124.33560957   34.31819062   85.6       ]
```


100
75
50
25
0
−25
−50
−75
−100
−100
−75
−50
−25
0
25
50
75
100


7
6
5
4
3
1
2
3
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5
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