Faculty of Engineering

HEMN451 – Medical Pattern Recognition

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Code Description

Online Training

1. Returns weights, number of weight updates, number of epochs
2. Create random weights ranging from -1 to 1
3. Initialize the variables
4. Loop from 1 to length of x
5. Check if y[m] dot product with x[m] is less than or equal to 0
6. ***W and delta are updated within each point***
7. The delta will be delta - y[m]*x[m]
8. The weight will be w = w - delta / len(x)
9. Append to the w_steps and increment the number of updates
10. Increment the number of epochs
11. Append to deltas norm(delta,1)
12. Return outputs

ONLINE TRAINING

Input: $(\mathbf{X}_m, y_m)$, m = 1, 2, …,N

Set $\mathbf{W} = [0, 0,.., 0]^T$

Repeat

$\quad$ **delta** $= [0, 0,.., 0]^T$

$\quad$ for m = 1 to N do

$\quad\quad$ if $y_m\mathbf{W}.\mathbf{X}_m <\ = 0$

$\quad\quad\quad$ **delta = delta** $-\ y_m\mathbf{X}_m$

$\quad\quad\quad$ **W = W** $-$ **delta** / N

Until $\|\mathbf{delta}\| < \epsilon$

Batch Perceptron

1. Returns weights, number of weight updates, number of epochs
2. Create random weights ranging from -1 to 1
3. Initialize the variables
4. Loop from 1 to length of x
5. Check if y[m] dot product with x[m] is less than or equal to 0
6. Delta is updated within each point
7. The delta will be delta - y[m]*x[m]
8. ***After looping through all points***
9. The weight will be w = w - delta / len(x)
10. Append to the w_steps and increment the number of updates
11. Increment the number of epochs
12. Append to deltas norm(delta,1)
13. Return outputs

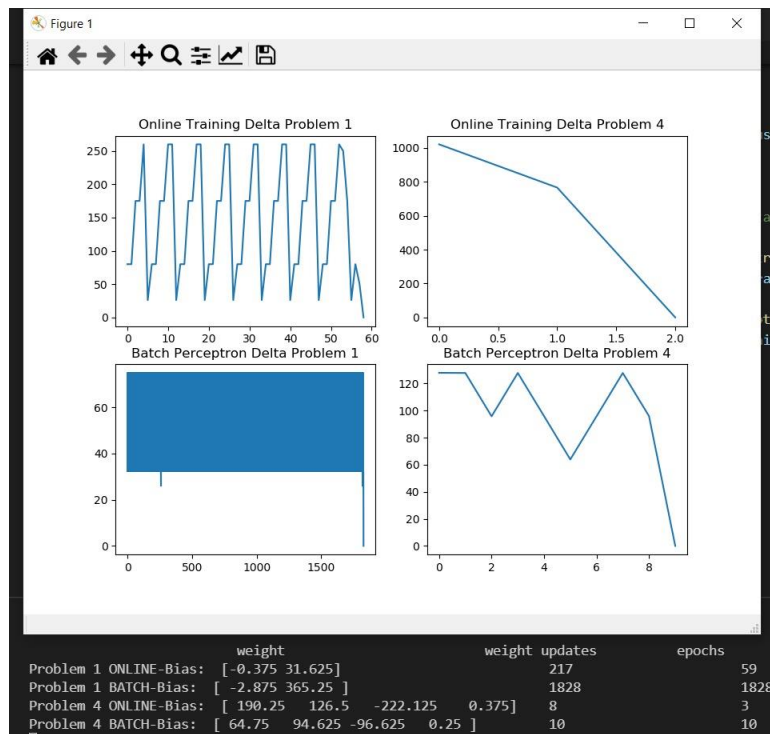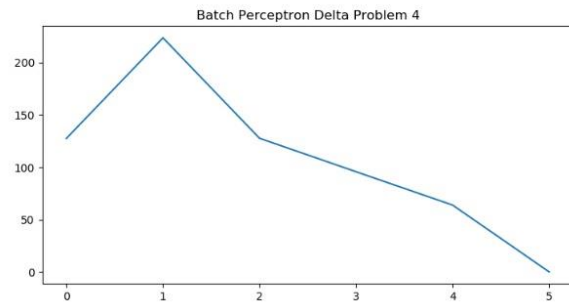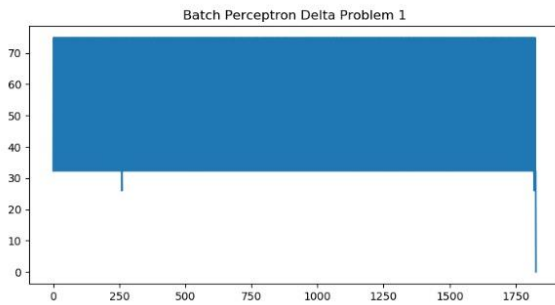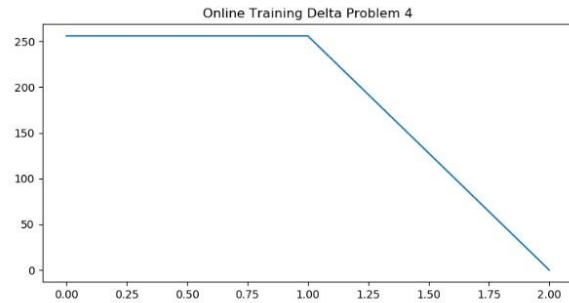$$\text{Given}: \text{training examples } (\mathbf{x}_m, y_m), m = 1,...,n$$
$$\text{Let } \mathbf{w} \leftarrow (0,0,0,...,0)$$
$$\text{do}$$
$$\qquad delta \leftarrow (0,0,0,...,0)$$
$$\qquad \text{for } m = 1 \text{ to } n \text{ do}$$
$$\qquad\qquad u_m \leftarrow \mathbf{w} \cdot \mathbf{x}_m$$
$$\qquad\qquad \text{if } y_m \cdot u_m \leq 0$$
$$\qquad\qquad\qquad delta \leftarrow delta - y_m \cdot x_m$$
$$\qquad delta \leftarrow delta / n$$
$$\qquad \mathbf{w} \leftarrow \mathbf{w} - \lambda \, delta$$
$$\text{until } |delta| < \varepsilon$$

Output

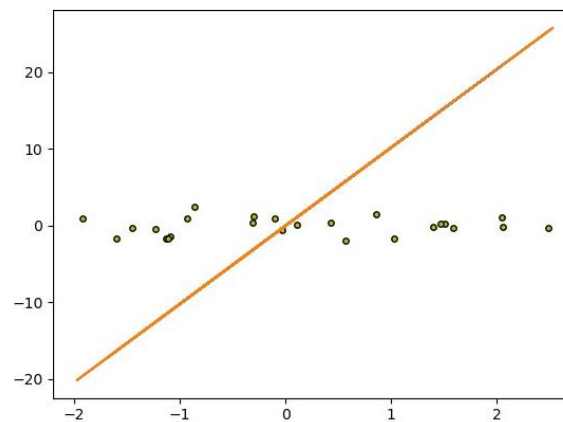|	weight	weight updates	epochs
Problem 1 ONLINE-Bias:	[-0.375 30.5]	208	58
Problem 1 BATCH-Bias:	[-2.875 364.25]	1828	1828
Problem 4 ONLINE-Bias:	[31.875 1. -32.875 0.375]	4	3
Problem 4 BATCH-Bias:	[63.75 64.75 -126.5 0.25]	6	6
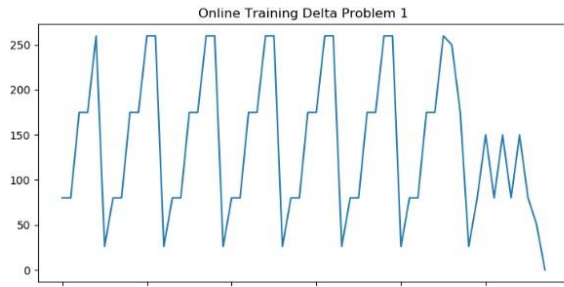
Delta comparison between generated data without bias
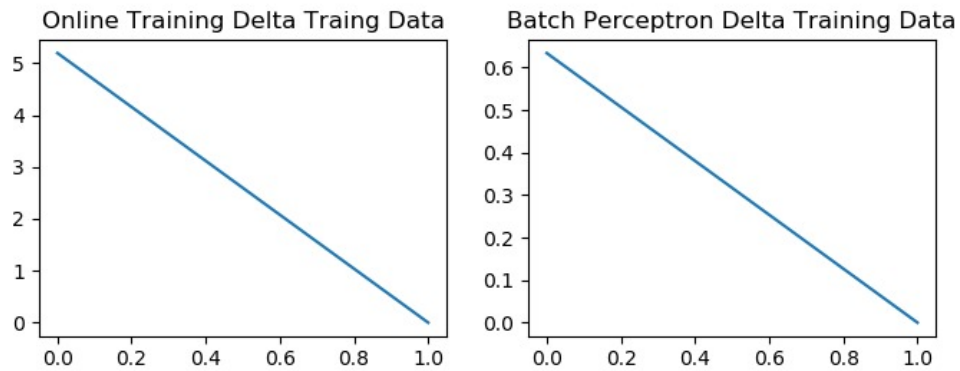
Online Training Model Visualization
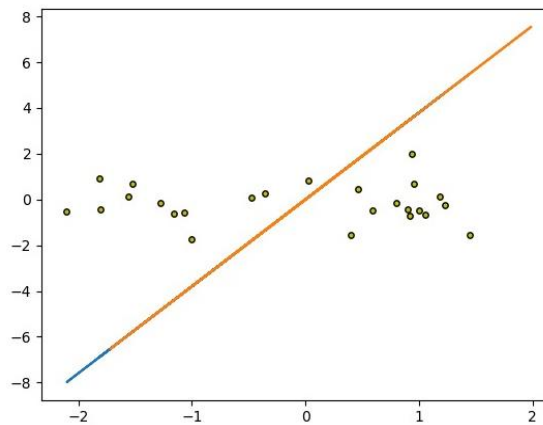
Batch Preceptron Model Visualization

Accuracy

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                    weight                      weight updates        epochs
ONLINE 75%:  [ 2.71556496 -0.26634462]          24                    2
Batch 75%:   [1.22732111 0.63038481]            5                     5
Accuracy of Online Training 0.42857142857142855
Accuracy of Batch Perceptron 0.42857142857142855
```