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lecture 3

الماتريز

Quiz 1

$$w = b = 0.2, \quad \eta = 0.2$$

| x_1 | x_2 | y |
|-------|-------|-----|
| 1 | 1 | -1 |
| 1 | -1 | 1 |
| -1 | 1 | 1 |
| -1 | -1 | 1 |

first input $y_{in} = \sum x_i w_i + b$
 $x_1 w_1 + x_2 w_2 + b$

$$y_{in} = 0.2 \times 1 + 1 \times 0.2 + 0.2 = 0.6$$

$$w_1(\text{new}) = w_1(\text{old}) + \eta (t - y_{in}) x_1$$

$$0.2 + 0.2 (-1 - 0.6) \times 1 = -0.12$$

$$w_2(\text{new}) = 0.2 + 0.2 (-1 - 0.6) \times 1 = -0.12$$

$$b(\text{new}) = b(\text{old}) + \eta (t - y_{in})$$

$$0.2 + 0.2 (-1 - 0.6) = -0.12$$

$$E_1 = (t - y_{in})^2 = (-1 - 0.6)^2 = 2.56$$

second input

$$w_1 = w_2 = b = -0.12$$

$$y_{in} = -0.12 + 0.12 \times 1 + 0.12 = -0.12$$

$$w_1(\text{new}) = -0.12 + 0.2 (1 + 0.12) \times 1 = 0.104$$

$$w_2(\text{new}) = -0.12 + 0.2 (1 + 0.12) \times -1 = -0.344$$

$$b = -0.12 + 0.2 (1 + 0.12) = 0.344$$

$$E_2 = (1 + 0.12)^2 = 1.2544$$

third input

$$y_{in} = -0.104 + 0.344 + 0.344 = -0.104$$

$$w_1(\text{new}) = 0.104 + 0.2 (1 + 0.104) \times 1 = 0.1168$$

$$w_2(\text{new}) = 0.344 + 0.2 (1 + 0.104) \times 1 = -0.1232$$

$$b = 0.344 + 0.2 (1 + 0.104) = 0.5648$$

$$E_3 = (1 + 0.104)^2 = 1.218816$$

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Fourth input

$$y_{in} = 0.1168 + 0.1232 + 0.5648 = 0.8048$$

$$w_1(\text{new}) = -0.1163 + 0.2(1 - 0.8048) \times -1 = -0.15584$$

$$w_2(\text{new}) = -0.1232 + 0.2(1 - 0.8048) \times -1 = -0.16224$$

$$b = 0.5648 + 0.2(1 - 0.8048) = 0.60384$$

$$E_1 = (1 - 0.8048)^2 = 0.03810304$$

Epoch 1

| x_1 | x_2 | y_{in} | y | Δw_1 | Δw_2 | Δb | w_1 | w_2 | b | error |
|-------|-------|----------|-----|--------------|--------------|------------|----------|----------|---------|------------|
| 1 | 1 | 0.6 | 0 | -0.32 | -0.32 | -0.32 | 0.12 | -0.12 | -0.12 | 2.56 |
| 1 | -1 | -0.12 | 1 | 0.224 | -0.224 | 0.448 | 0.104 | -0.344 | 0.344 | 1.2644 |
| -1 | 1 | -0.104 | 1 | -0.2288 | 0.2208 | -0.1108 | -0.1108 | -0.1232 | 0.5648 | 1.216816 |
| -1 | -1 | 0.8048 | 0 | -0.0324 | -0.0324 | -0.0648 | -0.15584 | -0.16224 | 0.60384 | 0.03810304 |

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$$E_T = \sum (1 - y_i)^2 = 2.56 + 1.2519 + 1.218816 + 0.03816379$$

$$= 5.07$$

Epoch 2

| x_1 | x_2 | y | y_{in} | Δw_1 | Δw_2 | Δb | w_1 | w_2 | bias |
|-------|-------|-----|----------|--------------|--------------|------------|---------|---------|--------|
| 1 | 1 | -1 | 0.2858 | -0.2876 | -0.28176 | -0.25827 | -0.412 | -0.414 | 0.346 |
| 1 | -1 | 1 | 0.35312 | 0.12938 | -0.12938 | 0.19419 | -0.2836 | -0.5483 | 0.476 |
| -1 | 1 | 1 | 0.21688 | 0.1578 | 0.1578 | 0.1578 | -0.444 | -0.341 | 0.6327 |
| -1 | -1 | 1 | 1.9663 | 0.0433 | 0.0433 | -0.0433 | -0.2981 | -0.2477 | 0.5406 |

$$E_T = \sum (t - y_{in})^2 = 0.61 + 0.4185 + 0.6227 +$$

$$0.2174 = 1.766$$

error

0.51

0.4185

0.6227

0.2174

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Quiz 2

$$w_1 + w_2 = 0$$

$$b = 0$$

$$w_{\text{new}} = w_{\text{old}} + \Delta w$$

| x_1 | x_2 | b | y |
|-------|-------|-----|-----|
| 1 | 1 | 1 | 1 |
| 1 | 0 | 1 | -1 |
| 0 | 1 | 1 | -1 |
| 0 | 0 | 1 | -1 |

$$(1,1) \quad w_1(\text{new}) = 0 + 1 = 1$$

$$w_2(\text{new}) = 0 + 1 = 1$$

$$b(\text{new}) = 0 + 1 = 1$$

$$(1,0)$$

$$w_1 = 1 - 1 = 0$$

$$b = 1 - 1 = 0$$

$$w_2 = 1 + 0 = 1$$

$$(0,1)$$

$$w_1 = 0 + 0 = 0$$

$$b = 0 - 1 = -1$$

$$w_2 = 1 - 1 = 0$$



Decision Boundary $b = \text{just}$

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$$w_1 = w_2 = 0, b = 0$$

$$(1,1)$$

$$w_1 = 0 + 1 = 1, b = 0 + 1 = 1$$

$$w_2 = 0 + 1 = 1$$

| x_1 | x_2 | b | y |
|-------|-------|-----|-----|
| 1 | 1 | 1 | 1 |
| 1 | -1 | 1 | -1 |
| -1 | 1 | 1 | -1 |
| -1 | -1 | 1 | -1 |

$$(1,-1)$$

$$w_1 = 1 - 1 = 0$$

$$b = 1 - 1 = 0$$

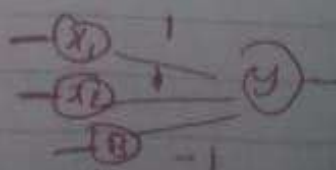
$$w_2 = 1 + 1 = 2$$

$$(-1,1)$$

$$w_1 = 0 + 1 = 1$$

$$b = 0 - 1 = -1$$

$$w_2 = 2 - 1 = 1$$



Decision Boundary $x_1 + x_2 - 1 = \text{just}$