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**Tugas Praktikum AI: Perceptron AND**

**Pertanyaan:**

Diketahui tabel data sebagai berikut:

|  |  |  |
| --- | --- | --- |
| **Input (S)** | | **Target (t)** |
| 1 | 1 | 1 |
| 1 | 0 | -1 |
| 0 | 1 | -1 |
| 0 | 0 | -1 |

* W (matriks bobot) = [0, 0]
* b (bias) = 0
* α (learning rate) = 0.8 (0 < α ≤ 1)
* θ (threshold) = 0.5

Dengan operasi perceptron, tentukan nilai bobot akhir dan nilai bias akhir!

**Jawab:**

Hitung respon unit:

y\_in = b + (sigma) x(i) W(i)

Hitung nilai fungsi aktivasi:

* 1 jika y\_in ≥ θ
* 0 jika -θ ≤ y\_in ≤ θ
* -1 jika θ ≤ y\_in

Hasil error:

W(i) baru = W(i) lama + α \* t \* X(i)

b baru = b lama + α \* t

Hasil tidak error:

W(i) baru = W(i) lama

b baru = b lama

Excel

Epoh 1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 0 | 0 | 0 | 0.8 | 0.5 | 1 | 1 | 0 | 0 | 1 | 0.8 | 0.8 | 0.8 | 1 | 0 |
| 2 | 0.8 | 0.8 | 0.8 | 0.8 | 0.5 | 1 | 0 | 1.6 | 1 | -1 | 0 | 0.8 | 0 | 2 | 0 |
| 3 | 0 | 0.8 | 0 | 0.8 | 0.5 | 0 | 1 | 0.8 | 1 | -1 | 0 | 0 | -0.8 | 3 | 0 |
| 4 | 0 | 0 | -0.8 | 0.8 | 0.5 | 0 | 0 | -0.8 | -1 | -1 | 0 | 0 | -0.8 | 3 | 1 |

Epoh 2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 0 | 0 | -0.8 | 0.8 | 0.5 | 1 | 1 | -0.8 | -1 | 1 | 0.8 | 0.8 | 0 | 1 | 0 |
| 2 | 0.8 | 0.8 | 0 | 0.8 | 0.5 | 1 | 0 | 0.8 | 1 | -1 | 0 | 0.8 | -0.8 | 2 | 0 |
| 3 | 0 | 0.8 | -0.8 | 0.8 | 0.5 | 0 | 1 | 0 | 0 | -1 | 0 | 0 | -1.6 | 3 | 0 |
| 4 | 0 | 0 | -1.6 | 0.8 | 0.5 | 0 | 0 | -1.6 | -1 | -1 | 0 | 0 | -1.6 | 3 | 1 |

Epoh 3

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 0 | 0 | -1.6 | 0.8 | 0.5 | 1 | 1 | -1.6 | -1 | 1 | 0.8 | 0.8 | -0.8 | 1 | 0 |
| 2 | 0.8 | 0.8 | -0.8 | 0.8 | 0.5 | 1 | 0 | 0 | 0 | -1 | 0 | 0.8 | -1.6 | 2 | 0 |
| 3 | 0 | 0.8 | -1.6 | 0.8 | 0.5 | 0 | 1 | -0.8 | -1 | -1 | 0 | 0.8 | -1.6 | 2 | 1 |
| 4 | 0 | 0.8 | -1.6 | 0.8 | 0.5 | 0 | 0 | -1.6 | -1 | -1 | 0 | 0.8 | -1.6 | 2 | 1 |

Epoh 4

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 0 | 0.8 | -1.6 | 0.8 | 0.5 | 1 | 1 | -0.8 | -1 | 1 | 0.8 | 1.6 | -0.8 | 1 | 0 |
| 2 | 0.8 | 1.6 | -0.8 | 0.8 | 0.5 | 1 | 0 | 0 | 0 | -1 | 0 | 1.6 | -1.6 | 2 | 0 |
| 3 | 0 | 1.6 | -1.6 | 0.8 | 0.5 | 0 | 1 | 0 | 0 | -1 | 0 | 0.8 | -2.4 | 3 | 0 |
| 4 | 0 | 0.8 | -2.4 | 0.8 | 0.5 | 0 | 0 | -2.4 | -1 | -1 | 0 | 0.8 | -2.4 | 3 | 1 |

Epoh 5

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 0 | 0.8 | -2.4 | 0.8 | 0.5 | 1 | 1 | -1.6 | -1 | 1 | 0.8 | 1.6 | -1.6 | 1 | 0 |
| 2 | 0.8 | 1.6 | -1.6 | 0.8 | 0.5 | 1 | 0 | -0.8 | -1 | -1 | 0.8 | 1.6 | -1.6 | 1 | 1 |
| 3 | 0.8 | 1.6 | -1.6 | 0.8 | 0.5 | 0 | 1 | 0 | 0 | -1 | 0.8 | 0.8 | -2.4 | 2 | 0 |
| 4 | 0.8 | 0.8 | -2.4 | 0.8 | 0.5 | 0 | 0 | -2.4 | -1 | -1 | 0.8 | 0.8 | -2.4 | 2 | 1 |

Epoh 6

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 0.8 | 0.8 | -2.4 | 0.8 | 0.5 | 1 | 1 | -0.8 | -1 | 1 | 1.6 | 1.6 | -1.6 | 1 | 0 |
| 2 | 1.6 | 1.6 | -1.6 | 0.8 | 0.5 | 1 | 0 | 0 | 0 | -1 | 0.8 | 1.6 | -2.4 | 2 | 0 |
| 3 | 0.8 | 1.6 | -2.4 | 0.8 | 0.5 | 0 | 1 | -0.8 | -1 | -1 | 0.8 | 1.6 | -2.4 | 2 | 1 |
| 4 | 0.8 | 1.6 | -2.4 | 0.8 | 0.5 | 0 | 0 | -2.4 | -1 | -1 | 0.8 | 1.6 | -2.4 | 2 | 1 |

Epoh 7

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 0.8 | 1.6 | -2.4 | 0.8 | 0.5 | 1 | 1 | 0 | 0 | 1 | 1.6 | 2.4 | -1.6 | 1 | 0 |
| 2 | 1.6 | 2.4 | -1.6 | 0.8 | 0.5 | 1 | 0 | 0 | 0 | -1 | 0.8 | 2.4 | -2.4 | 2 | 0 |
| 3 | 0.8 | 2.4 | -2.4 | 0.8 | 0.5 | 0 | 1 | 0 | 0 | -1 | 0.8 | 1.6 | -3.2 | 3 | 0 |
| 4 | 0.8 | 1.6 | -3.2 | 0.8 | 0.5 | 0 | 0 | -3.2 | -1 | -1 | 0.8 | 1.6 | -3.2 | 3 | 1 |

Epoh 8

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 0.8 | 1.6 | -3.2 | 0.8 | 0.5 | 1 | 1 | -0.8 | -1 | 1 | 1.6 | 2.4 | -2.4 | 1 | 0 |
| 2 | 1.6 | 2.4 | -2.4 | 0.8 | 0.5 | 1 | 0 | -0.8 | -1 | -1 | 1.6 | 2.4 | -2.4 | 1 | 1 |
| 3 | 1.6 | 2.4 | -2.4 | 0.8 | 0.5 | 0 | 1 | 0 | 0 | -1 | 1.6 | 1.6 | -3.2 | 2 | 0 |
| 4 | 1.6 | 1.6 | -3.2 | 0.8 | 0.5 | 0 | 0 | -3.2 | -1 | -1 | 1.6 | 1.6 | -3.2 | 2 | 1 |

Epoh 9

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 1.6 | 1.6 | -3.2 | 0.8 | 0.5 | 1 | 1 | 0 | 0 | 1 | 2.4 | 2.4 | -2.4 | 1 | 0 |
| 2 | 2.4 | 2.4 | -2.4 | 0.8 | 0.5 | 1 | 0 | 0 | 0 | -1 | 1.6 | 2.4 | -3.2 | 2 | 0 |
| 3 | 1.6 | 2.4 | -3.2 | 0.8 | 0.5 | 0 | 1 | -0.8 | -1 | -1 | 1.6 | 2.4 | -3.2 | 2 | 1 |
| 4 | 1.6 | 2.4 | -3.2 | 0.8 | 0.5 | 0 | 0 | -3.2 | -1 | -1 | 1.6 | 2.4 | -3.2 | 2 | 1 |

Epoh 10

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data ke- | W1 | W2 | b | α | θ | X1 | X2 | y in | y | t | W1 Baru | W2 Baru | b Baru | Error | y=t |
| 1 | 1.6 | 2.4 | -3.2 | 0.8 | 0.5 | 1 | 1 | 0.8 | 1 | 1 | 1.6 | 2.4 | -3.2 | 0 | 1 |
| 2 | 1.6 | 2.4 | -3.2 | 0.8 | 0.5 | 1 | 0 | -1.6 | -1 | -1 | 1.6 | 2.4 | -3.2 | 0 | 1 |
| 3 | 1.6 | 2.4 | -3.2 | 0.8 | 0.5 | 0 | 1 | -0.8 | -1 | -1 | 1.6 | 2.4 | -3.2 | 0 | 1 |
| 4 | 1.6 | 2.4 | -3.2 | 0.8 | 0.5 | 0 | 0 | -3.2 | -1 | -1 | 1.6 | 2.4 | -3.2 | 0 | 1 |

Program Matlab (Maaf untuk sementara masih belum sanggup install Matlab jadi pakai Scilab)

function PerceptronAND()

printf("\tProgram Perceptron AND\n");

printf("\tPatricia Joanne (140810160065)\n");

maxEpoh = 50;

x1 = [1,1,0,0];

x2 = [1,0,1,0];

t = [1,-1,-1,-1];

y = zeros(4);

yIn = zeros(4);

w1 = 0;

w2 = 0;

b = 0;

lRate = 0.8;

errorCount = 0;

threshold = 0.5;

for epoh = 1 : maxEpoh

errorCount = 0;

printf("Epoh ke-%d\n",epoh);

for i = 1 : 4

yIn(i) = (x1(i) \* w1 + x2(i) \* w2) + b;

if yIn(i) <= -threshold then

y(i) = -1;

else

if yIn(i) >= threshold then

y(i) = 1;

else

y(i) = 0;

end

end

printf("\tData ke-%d\n",i);

printf("\t\ty\_in = %f\n",yIn(i));

printf("\t\ty = %f\n",y(i));

if y(i) == t(i) then

printf("\t\tTidak ada error!\n");

else

errorCount = errorCount + 1;

w1 = w1 + (lRate \* t(i) \* x1(i));

w2 = w2 + (lRate \* t(i) \* x2(i));

b = b + (lRate \* t(i));

printf("\t\tAda error!\n");

printf("\t\tw1 = %f\n",w1);

printf("\t\tw2 = %f\n",w2);

printf("\t\tb = %f\n",b);

end

end

printf("\n");

if errorCount == 0 then

break;

end

end

if errorCount == 0 then

printf("w1 = %f\t\tw2 = %f\t\tb = %f",w1,w2,b);

else

printf("Epoh ke-50, pelatihan belum sukses!");

end

endfunction

Screenshot:



















