

Tugas Hetero Associative Memory Neural Network

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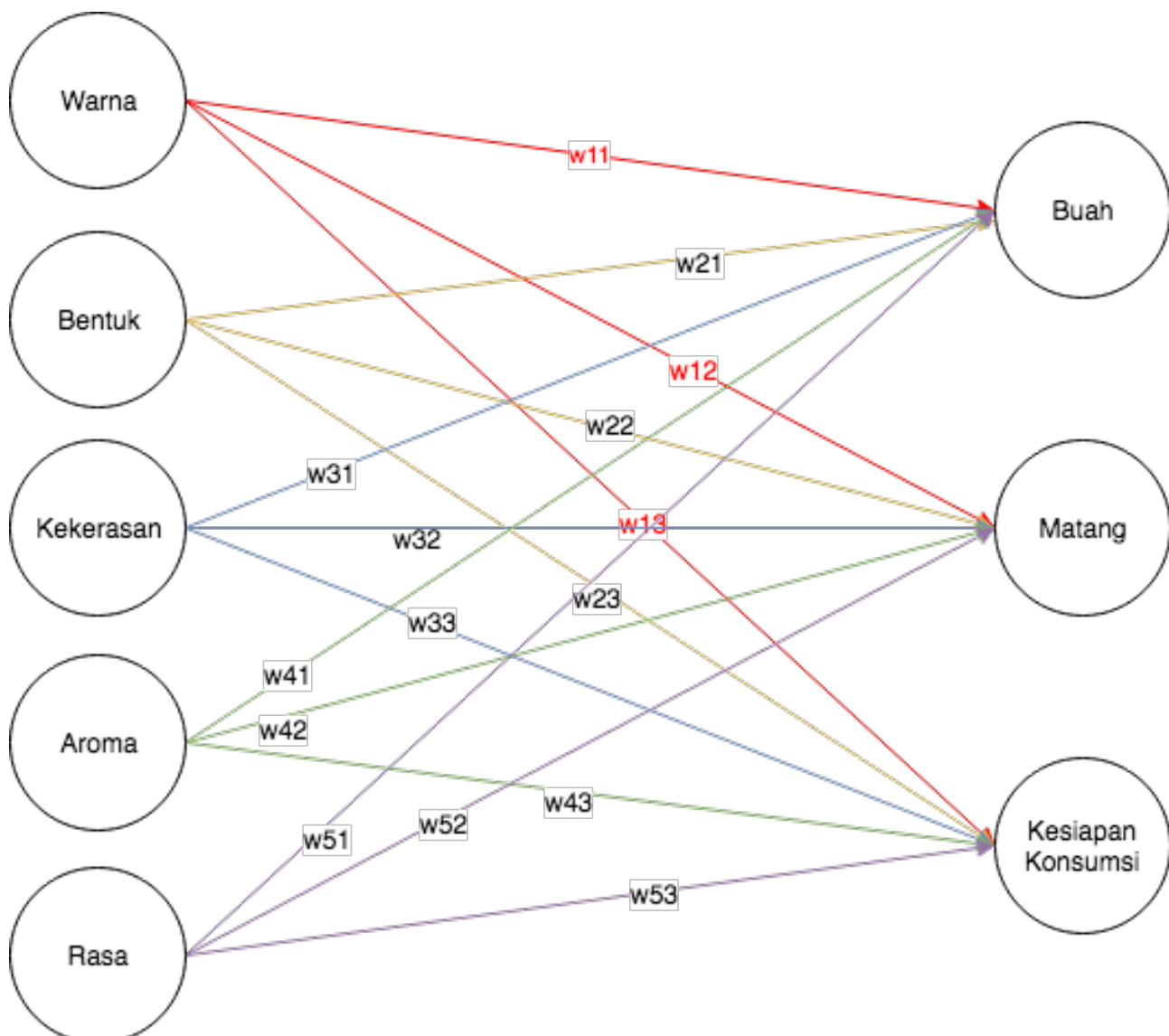
Penentuan asosiasi ciri dan output

Ditentukan terlebih dahulu suatu ciri dalam buah :

1. Warna (1 untuk kuning, 0 untuk hijau)
2. Bentuk (1 untuk lonjong, 0 untuk bulat)
3. Kekerasan (1 untuk keras, 0 untuk lunak)
4. Aroma (1 untuk harum, 0 untuk busuk)
5. Rasa (1 untuk manis, 0 untuk asam)

dan output sebagai berikut :

1. Buah (1 untuk mangga, 0 untuk jeruk)
2. Kematangan (1 untuk matang, 0 untuk mentah)
3. Kesiapan konsumsi (1 untuk bisa, 0 untuk tidak bisa)



Penentuan training

Ditentukan menggunakan kumpulan training seperti berikut :

Warna	Bentuk	Kekerasan	Aroma	Rasa		Buah	Matang	Kesiapan konsumsi
1	1	1	1	1		1	1	1
0	1	0	0	1		1	0	0
0	0	0	1	0		0	1	1
1	1	0	0	0		1	0	0
0	0	1	0	1		0	0	0

Melakukan training menggunakan Hebb's rule

Step 0 : Inisialisasi semua $w = 0$

Step 1 : Pasangan 1 $\Rightarrow (1,1,1,1,1)$ dan $(1,1,1)$

Step 2 : $w_{11}(\text{baru}) = w_{11}(\text{lama}) + x_1y_1 \Rightarrow 1$

$w_{12}(\text{baru}) = w_{12}(\text{lama}) + x_1y_2 \Rightarrow 1$

$w_{13}(\text{baru}) = w_{13}(\text{lama}) + x_1y_3 \Rightarrow 1$

$w_{21}(\text{baru}) = w_{21}(\text{lama}) + x_2y_1 \Rightarrow 1$

$w_{22}(\text{baru}) = w_{22}(\text{lama}) + x_2y_2 \Rightarrow 1$

$w_{23}(\text{baru}) = w_{23}(\text{lama}) + x_2y_3 \Rightarrow 1$

$w_{31}(\text{baru}) = w_{31}(\text{lama}) + x_3y_1 \Rightarrow 1$

$w_{32}(\text{baru}) = w_{32}(\text{lama}) + x_3y_2 \Rightarrow 1$

$w_{33}(\text{baru}) = w_{33}(\text{lama}) + x_3y_3 \Rightarrow 1$

$w_{41}(\text{baru}) = w_{41}(\text{lama}) + x_4y_1 \Rightarrow 1$

$w_{42}(\text{baru}) = w_{42}(\text{lama}) + x_4y_2 \Rightarrow 1$

$w_{43}(\text{baru}) = w_{43}(\text{lama}) + x_4y_3 \Rightarrow 1$

$w_{51}(\text{baru}) = w_{51}(\text{lama}) + x_5y_1 \Rightarrow 1$

$w_{52}(\text{baru}) = w_{52}(\text{lama}) + x_5y_2 \Rightarrow 1$

$w_{53}(\text{baru}) = w_{53}(\text{lama}) + x_5y_3 \Rightarrow 1$

Step 1 : Pasangan 2 $\Rightarrow (0,1,0,0,1)$ dan $(1,0,0)$

Step 2 : $w_{11}(\text{baru}) = w_{11}(\text{lama}) + x_1y_1 \Rightarrow 1$

$w_{12}(\text{baru}) = w_{12}(\text{lama}) + x_1y_2 \Rightarrow 1$

$w_{13}(\text{baru}) = w_{13}(\text{lama}) + x_1y_3 \Rightarrow 1$

$w_{21}(\text{baru}) = w_{21}(\text{lama}) + x_2y_1 \Rightarrow 2$

$w_{22}(\text{baru}) = w_{22}(\text{lama}) + x_2y_2 \Rightarrow 1$

$w_{23}(\text{baru}) = w_{23}(\text{lama}) + x_2y_3 \Rightarrow 1$

$w_{31}(\text{baru}) = w_{31}(\text{lama}) + x_3y_1 \Rightarrow 1$

$w_{32}(\text{baru}) = w_{32}(\text{lama}) + x_3y_2 \Rightarrow 1$

$w_{33}(\text{baru}) = w_{33}(\text{lama}) + x_3y_3 \Rightarrow 1$

$w_{41}(\text{baru}) = w_{41}(\text{lama}) + x_4y_1 \Rightarrow 1$

$w_{42}(\text{baru}) = w_{42}(\text{lama}) + x_4y_2 \Rightarrow 1$

$w_{43}(\text{baru}) = w_{43}(\text{lama}) + x_4y_3 \Rightarrow 1$

$w_{51}(\text{baru}) = w_{51}(\text{lama}) + x_5y_1 \Rightarrow 2$

$w_{52}(\text{baru}) = w_{52}(\text{lama}) + x_5y_2 \Rightarrow 1$

$w_{53}(\text{baru}) = w_{53}(\text{lama}) + x_5y_3 \Rightarrow 1$

Step 1 : Pasangan 3 $\Rightarrow (0,0,0,1,0)$ dan $(0,1,1)$

Step 2 : $w_{11}(\text{baru}) = w_{11}(\text{lama}) + x_1y_1 \Rightarrow 1$

$w_{12}(\text{baru}) = w_{12}(\text{lama}) + x_1y_2 \Rightarrow 1$

$w_{13}(\text{baru}) = w_{13}(\text{lama}) + x_1y_3 \Rightarrow 1$

$$\begin{aligned}
w_{21}(\text{baru}) &= w_{21}(\text{lama}) + x_2y_1 \Rightarrow 2 \\
w_{22}(\text{baru}) &= w_{22}(\text{lama}) + x_2y_2 \Rightarrow 1 \\
w_{23}(\text{baru}) &= w_{23}(\text{lama}) + x_2y_3 \Rightarrow 1 \\
w_{31}(\text{baru}) &= w_{31}(\text{lama}) + x_3y_1 \Rightarrow 1 \\
w_{32}(\text{baru}) &= w_{32}(\text{lama}) + x_3y_2 \Rightarrow 1 \\
w_{33}(\text{baru}) &= w_{33}(\text{lama}) + x_3y_3 \Rightarrow 1 \\
w_{41}(\text{baru}) &= w_{41}(\text{lama}) + x_4y_1 \Rightarrow 1 \\
w_{42}(\text{baru}) &= w_{42}(\text{lama}) + x_4y_2 \Rightarrow 2 \\
w_{43}(\text{baru}) &= w_{43}(\text{lama}) + x_4y_3 \Rightarrow 2 \\
w_{51}(\text{baru}) &= w_{51}(\text{lama}) + x_5y_1 \Rightarrow 2 \\
w_{52}(\text{baru}) &= w_{52}(\text{lama}) + x_5y_2 \Rightarrow 1 \\
w_{53}(\text{baru}) &= w_{53}(\text{lama}) + x_5y_3 \Rightarrow 1
\end{aligned}$$

Step 1 : Pasangan 4 $\Rightarrow (1,1,0,0,0)$ dan $(0,0,0)$

Step 2 :

$$\begin{aligned}
w_{11}(\text{baru}) &= w_{11}(\text{lama}) + x_1y_1 \Rightarrow 2 \\
w_{12}(\text{baru}) &= w_{12}(\text{lama}) + x_1y_2 \Rightarrow 1 \\
w_{13}(\text{baru}) &= w_{13}(\text{lama}) + x_1y_3 \Rightarrow 1 \\
w_{21}(\text{baru}) &= w_{21}(\text{lama}) + x_2y_1 \Rightarrow 3 \\
w_{22}(\text{baru}) &= w_{22}(\text{lama}) + x_2y_2 \Rightarrow 1 \\
w_{23}(\text{baru}) &= w_{23}(\text{lama}) + x_2y_3 \Rightarrow 1 \\
w_{31}(\text{baru}) &= w_{31}(\text{lama}) + x_3y_1 \Rightarrow 1 \\
w_{32}(\text{baru}) &= w_{32}(\text{lama}) + x_3y_2 \Rightarrow 1 \\
w_{33}(\text{baru}) &= w_{33}(\text{lama}) + x_3y_3 \Rightarrow 1 \\
w_{41}(\text{baru}) &= w_{41}(\text{lama}) + x_4y_1 \Rightarrow 1 \\
w_{42}(\text{baru}) &= w_{42}(\text{lama}) + x_4y_2 \Rightarrow 2 \\
w_{43}(\text{baru}) &= w_{43}(\text{lama}) + x_4y_3 \Rightarrow 2 \\
w_{51}(\text{baru}) &= w_{51}(\text{lama}) + x_5y_1 \Rightarrow 2 \\
w_{52}(\text{baru}) &= w_{52}(\text{lama}) + x_5y_2 \Rightarrow 1 \\
w_{53}(\text{baru}) &= w_{53}(\text{lama}) + x_5y_3 \Rightarrow 1
\end{aligned}$$

Step 1 : Pasangan 5 $\Rightarrow (0,0,1,0,1)$ dan $(1,0,0)$

Step 2 :

$$\begin{aligned}
w_{11}(\text{baru}) &= w_{11}(\text{lama}) + x_1y_1 \Rightarrow 2 \\
w_{12}(\text{baru}) &= w_{12}(\text{lama}) + x_1y_2 \Rightarrow 1 \\
w_{13}(\text{baru}) &= w_{13}(\text{lama}) + x_1y_3 \Rightarrow 1 \\
w_{21}(\text{baru}) &= w_{21}(\text{lama}) + x_2y_1 \Rightarrow 3 \\
w_{22}(\text{baru}) &= w_{22}(\text{lama}) + x_2y_2 \Rightarrow 1 \\
w_{23}(\text{baru}) &= w_{23}(\text{lama}) + x_2y_3 \Rightarrow 1 \\
w_{31}(\text{baru}) &= w_{31}(\text{lama}) + x_3y_1 \Rightarrow 1 \\
w_{32}(\text{baru}) &= w_{32}(\text{lama}) + x_3y_2 \Rightarrow 1 \\
w_{33}(\text{baru}) &= w_{33}(\text{lama}) + x_3y_3 \Rightarrow 1 \\
w_{41}(\text{baru}) &= w_{41}(\text{lama}) + x_4y_1 \Rightarrow 1 \\
w_{42}(\text{baru}) &= w_{42}(\text{lama}) + x_4y_2 \Rightarrow 2 \\
w_{43}(\text{baru}) &= w_{43}(\text{lama}) + x_4y_3 \Rightarrow 2 \\
w_{51}(\text{baru}) &= w_{51}(\text{lama}) + x_5y_1 \Rightarrow 2 \\
w_{52}(\text{baru}) &= w_{52}(\text{lama}) + x_5y_2 \Rightarrow 1 \\
w_{53}(\text{baru}) &= w_{53}(\text{lama}) + x_5y_3 \Rightarrow 1
\end{aligned}$$

Didapatkan matriks

$$W = \begin{pmatrix} 2 & 1 & 1 \\ 3 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 2 & 2 \\ 2 & 1 & 1 \end{pmatrix}$$

Testing Data

Diketahui suatu buah berwarna Kuning, Bulat, Lunak, Harum dan Manis. Tentukan jenis buah, kematangan dan kesiapan konsumsi buah tersebut !

$$f(x) = \begin{cases} 1 & \text{if } x > 0; \\ 0 & \text{if } x \leq 0. \end{cases}$$

Step 0 : 2 1 1
 3 1 1
 W = 1 1 1
 1 2 2
 2 1 1

Step 1 : Input data tes x = (0,0,0,1,1)

Step 2 : y_in1 = x1w11 + x2w21 + x3w21 + x4w41 + x5w51 => 0 + 0 + 0 + 1 + 2 = 3

 y_in2 = x1w12 + x2w22 + x3w22 + x4w42 + x5w52 => 0 + 0 + 0 + 2 + 1 = 3

 y_in3 = x1w13 + x2w23 + x3w23 + x4w43 + x5w53 => 0 + 0 + 0 + 2 + 1 = 3

Step 3 : y1 = f(y_in1) => f(3) = 1

 y2 = f(y_in2) => f(3) = 1

 y3 = f(y_in3) => f(3) = 1

Jadi berdasarkan data Training dengan model Hebb's rule dan data test yang diberikan, maka output dari ciri-ciri buah yang disebut adalah buah Mangga matang dan siap untuk dikonsumsi.

Implementasi di Python3

```
import numpy as np
```

```
#Memasukkan data train
```

```
train_x = [[1,1,1,1,1], [0,1,0,0,1], [0,0,0,1,0], [1,1,0,0,0],  
[0,0,1,0,1]]
```

```
train_y = [[1,1,1], [1,0,0], [0,1,1], [1,0,0], [0,0,0]]
```

```
#Inisialisasi weight = 0
```

```
w = np.zeros((len(train_x[0]), len(train_y[0])))
```

```
#Update nilai weighy
```

```
if len(train_x) == len(train_y):
```

```
    for i in range(len(train_x)):
```

```
        for j in range(len(train_x[0])):
```

```
            for k in range(len(train_y[0])):
```

```
                w[j][k] += train_x[i][j] * train_y[i][k]
```

```
else:
```

```
    print("Jumlah x dan Jumlah y tidak sama")
```

```
# Test data pada weight yang sudah ditentukan
```

```
test_x = [[0,0,0,1,1]]
```

```
test_y = np.dot(test_x, w)
```

```
#Fungsi aktivasi
```

```
for i in range(len(test_y)):
```

```
    for j in range(len(test_y[0])):
```

```
        if test_y[i][j] > 0:
```

```
            test_y[i][j] = 1
```

```
        else:
```

```
test_y[i][j] = 0
```

```
#Output hasil test
```

```
print(test_y)
```