**Lembar Jawaban Kalkulasi Neural Network**

**Initial Value**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **x1** | **x2** | **x3** | **α** | **Threshold** | **Yd,6** |
| 0,7 | 0,8 | 0,9 | 0,1 | -1 | 0 |

**Initial Random**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **W14** | **W15** | **W24** | **W25** | **W34** | **W35** | **W46** | **W56** | **θ4** | **θ5** | **θ6** |
| 0,5 | 0,6 | 0,3 | 1,1 | -1,0 | 0,1 | -1,1 | -0,7 | 0,2 | 0,3 | 0,4 |

**Forward Pass**

**Langkah 1: Menghitung output Neuron 4 (y4), Neuron 5 (y5), Neuron 6 (y6), dan Error menggunakan sigmoid function**

|  |  |
| --- | --- |
| Y4 | = Sigmoid (X1 W14 + X2 W24 + X3 W34 – θ4) |
|  | = 1 / [1 + e-(0,7\*0,5 + 0,8\*0,3 + 0,9\*(-1,0) – 0,2)] |
|  | = 0,3752 |
| Y5 | = Sigmoid (X1 W15 + X2 W25 + X3 W35 – θ5) |
|  | = 1 / [1 + e-(0,7\*0,6 + 0,8\*1,1 + 0,9\*0,1 – 0,3)] |
|  | = 0,7484 |
| Y6 | = Sigmoid (Y4 W46 + Y5 W56 -θ6) |
|  | = 1 / [1 + e-(0,3752\*(-1,1) + 0,7484\*(-0,7) – 0,4)] |
|  | = 0,2081 |
| e | = Yd,6 – Y6 |
|  | = 0 – 0,2081 |
|  | = -0,2081 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Y4** | **Y5** | **Y6** | **e** |
| 0,3752 | 0,7484 | 0,2081 | -0,2081 |

**Backward Pass**

**Langkah 2: Hitung error gradient untuk Neuron 6 di Output Layer dan weight corrections**

|  |  |
| --- | --- |
| δ6 | = Y6 (1 – Y6) e |
|  | = 0,2081 \* (1-0,2081) \* (-0,2081) |
|  | = -0,03 |
| ∇46 | = α \* Y4 \* δ6 |
|  | = 0,1 \* 0,3752 \* (-0,03) |
|  | = -0,0013 |
| ∇56 | = α \* Y5 \* δ6 |
|  | = 0,1 \* 0,7484 \* (-0,03) |
|  | = -0,0026 |
| ∇θ6 | = α \* (-1)\* δ6 |
|  | = 0,1 \* (-1) \* (-0,03) |
|  | = 0,003 |

|  |  |  |  |
| --- | --- | --- | --- |
| **δ6** | **∇46** | **∇56** | **∇θ6** |
| -0,03 | -0,0013 | -0,0026 | 0,003 |

**Langkah 3: Hitung error gradients untuk Neuron 4 dan Neuron 5 di Middle Layer/Hidden Layer**

|  |  |
| --- | --- |
| δ4 | = Y4 (1 – Y4) \* δ6 \* W46 |
|  | = 0,3752 \* (1 – 0,3752) \* (-0,03) (-1,1) |
|  | = 0,009 |
| δ5 | = Y5 (1 – Y5) \* δ6 \* W56 |
|  | = 0, 7484 \* (1 – 0,7484) \* (-0,03) \* (-0,7) |
|  | = 0,005 |

|  |  |
| --- | --- |
| **δ4** | **δ5** |
| 0,009 | 0,005 |

**Langkah 4: Hitung weight corrections**

|  |  |
| --- | --- |
| ∇w14 | = α \* X1 \* δ4 |
|  | = 0,1 \* 0,7 \* 0,009 |
|  | = 0,0006189 |
| ∇w24 | = α \* X2 \* δ4 |
|  | = 0,1 \* 0,8 \* 0,009 |
|  | = 0,0007073 |
| ∇w34 | = α \* X3 \* δ4 |
|  | = 0,1 \* 0,9 \* 0,009 |
|  | = 0,0007073 |
| ∇θ4 | = α \* (-1)\* δ4 |
|  | = 0,1 \* (-1) \* 0,009 |
|  | = -0,000884 |
| ∇w15 | = α \* X1 \* δ5 |
|  | = 0,1 \* 0,7 \* 0,005 |
|  | = 0,0003164 |
| ∇w25 | = α \* X2 \* δ5 |
|  | = 0,1 \* 0,8 \* 0,005 |
|  | = 0,0003616 |
| ∇w35 | = α \* X3 \* δ5 |
|  | = 0,1 \* 0,9 \* 0,005 |
|  | = 0,0004067 |
| ∇θ5 | = α \* (-1)\* δ5 |
|  | = 0,1 \* (-1) \* 0,005 |
|  | = -0,000452 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **∇w14** | **∇w24** | **∇w34** | **∇θ4** | **∇w15** | **∇w25** | **∇w35** | **∇θ5** |
| 0,0006189 | 0,0007073 | 0,0007957 | -0,000884 | 0,0003164 | 0,0003616 | 0,0004067 | -0,000452 |

**Backward Pass**

**Langkah 5: Hitung semua weights dan theta pada arsitektur yang telah diperbarui**

|  |  |
| --- | --- |
| w14 | = W14 + ∇w14 |
|  | = 0,5 + 0,0006189 |
|  | = 0,501 |
| w15 | = W15 + ∇w15 |
|  | = 0,6 + 0,0003164 |
|  | = 0,600 |
| w24 | = W24 + ∇w24 |
|  | = 0,3 + 0,0007073 |
|  | = 0,301 |
| w25 | = W25 + ∇w25 |
|  | = 1,1 + 0,0003616 |
|  | = 1,100 |
| w34 | = W34 + ∇w34 |
|  | = -1 + 0,0007957 |
|  | = -0,999 |
| w35 | = W35 + ∇w35 |
|  | = 0,1 + 0,0004067 |
|  | = 0,100 |
| θ4 | = θ4 + ∇θ4 |
|  | = 0,2 + (-0,000884) |
|  | = 0,199 |
| θ5 | = θ5 + ∇θ5 |
|  | = 0,3 + (-0,000452) |
|  | = 0,300 |
| θ6 | = θ6 + ∇θ6 |
|  | = 0,4 + 0,003 |
|  | = 0,403 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **w14** | **w15** | **w24** | **w25** | **w34** | **w35** | **θ3** | **θ4** | **θ5** |
| 0,501 | 0,600 | 0,301 | 1,100 | -0,999 | 0,100 | 0,199 | 0,300 | 0,403 |