**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 (x1w14 + x2w24 + x3w34 – θ4)*** |
|  | = 1 / [ 1 + e-(0.7×0.5 + 0.8×0.3 + 0.9× (-1) – 1×0.2) |
|  | = 0.3752 |
| Y5 | = ***sigmoid (x1w15 + x2w25 + x3w35 – θ5)*** |
|  | = 1 / [ 1 + e-(0.7×0.6 + 0.8×1.1 + 0.9×0.1 – 1×0.3) |
|  | = 0.7484 |
| Y6 | = ***sigmoid (y4w46 + y5w56 – θ6)*** |
|  | = 1 / [ 1 + e-(0.3752× (-1.1) + 0.7484×(-0.7) – 1×0.4) |
|  | = 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) |
|  | = -0.0343 |
| ∇46 | = ***α × y4 × δ6*** |
|  | = 0.1 × 0.3752 × (-0.0343) |
|  | = -0.0013 |
| ∇56 | = ***α × y5 × δ6*** |
|  | = 0.1 × 0.7484 × (-0.0343) |
|  | = -0.0026 |
| ∇θ6 | = ***α × (-1) × δ6*** |
|  | = 0.1 × (-1) × (-0.0343) |
|  | = 0.0034 |

|  |  |  |  |
| --- | --- | --- | --- |
| **δ6** | **∇46** | **∇56** | **∇θ6** |
| -0.0343 | -0.0013 | -0.0026 | 0.0034 |

**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) × (-0.0343) × (-1.1) |
|  | = 0.0088 |
| δ5 | = ***y5 (1-y5) δ6 w56*** |
|  | = 0.7484 × (1 - 0.7484) × (-0.0343) × (-0.7) |
|  | = 0.0045 |

|  |  |
| --- | --- |
| **δ4** | **δ5** |
| 0.0088 | 0.0045 |

**Langkah 4: Hitung weight corrections**

|  |  |
| --- | --- |
| ∇w14 | = ***α × x1 × δ4*** |
|  | = 0.1 × 0.7 × 0.0088 |
|  | = 0.0006 |
| ∇w24 | = ***α × x2 × δ4*** |
|  | = 0.1 × 0.8 × 0.0088 |
|  | = 0.0007 |
| ∇w34 | = ***α × x3 × δ4*** |
|  | = 0.1 × 0.9 × 0.0088 |
|  | = 0.0008 |
| ∇θ4 | = ***α × (-1) × δ4*** |
|  | = 0.1 × (-1) × 0.0088 |
|  | = -0.0009 |
| ∇w15 | = ***α × x1 × δ5*** |
|  | = 0.1 × 0.7 × 0.0045 |
|  | = 0.0003 |
| ∇w25 | = ***α × x2 × δ5*** |
|  | = 0.1 × 0.8 × 0.0045 |
|  | = 0.0004 |
| ∇w35 | = ***α × x3 × δ5*** |
|  | = 0.1 × 0.9 × 0.0045 |
|  | = 0.0004 |
| ∇θ5 | = ***α × (-1) × δ5*** |
|  | = 0.1 × (-1) × 0.0045 |
|  | = -0.0005 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **∇w14** | **∇w24** | **∇w34** | **∇θ4** | **∇w15** | **∇w25** | **∇w35** | **∇θ5** |
| 0.0006 | 0.0007 | 0.0008 | -0.0009 | 0.0003 | 0.0004 | 0.0004 | -0.0005 |

**Backward Pass**

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

|  |  |
| --- | --- |
| w14 | = **w14 + ∇w14** |
|  | = 0.5 + 0.0006 |
|  | = 0.5006 |
| w15 | = **w15 + ∇w15** |
|  | = 0.6 + 0.0003 |
|  | = 0.6003 |
| w24 | = **w24 + ∇w24** |
|  | = 0.3 + 0.0007 |
|  | = 0.3007 |
| w25 | = **w25 + ∇w25** |
|  | = 1.1 + 0.0004 |
|  | = 1.1004 |
| w34 | = **w34 + ∇w34** |
|  | = (-1) + 0.0008 |
|  | = -0.9992 |
| w35 | = **w35 + ∇w35** |
|  | = 0.1 + 0.0004 |
|  | = 0.1004 |
| θ4 | = **θ4 + ∇θ4** |
|  | = 0.2 + (-0.0009) |
|  | = 0.1991 |
|  |  |
| θ5 | = **θ5 + ∇θ5** |
|  | = 0.3 + (-0.0005) |
|  | = 0.2995 |
| θ6 | = **θ6 + ∇θ6** |
|  | = 0.4 + 0.0034 |
|  | = 0.4034 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **w14** | **w15** | **w24** | **w25** | **w34** | **w35** | **Θ4** | **Θ5** | **Θ6** |
| 0.5006 | 0.6003 | 0.3007 | 1.1004 | -0.9992 | 0.1004 | 0.1991 | 0.2995 | 0.4034 |