MLP (Backpropagation)

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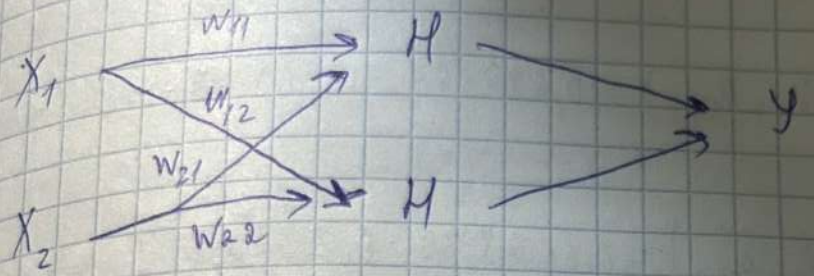

$X_1 = 0,35$ $\quad X_2 = 0,9$

$w_{11} = 0,1$ $\quad \ell_x = 1$

$w_{12} = 0,34$ $\quad y_{target} = 0,5$

$w_{21} = 0,8$

$w_{22} = 0,6$

$y = 0,5$

$$H = f\left(\sum w_{ij} \cdot X_i\right) = \frac{\ell}{1 + e^{-\sum w_{ij} \cdot x_i}}$$

N1

$\alpha_1 = X_1 w_{11} + X_2 w_{21} = 0,35 \cdot 0,1 + 0,9 \cdot 0,8 = 0,755$

$H_1 = \alpha(\alpha_1) = 0,68026$

$\alpha_2 = X_1 w_{12} + X_2 w_{22} = 0,35 \cdot 0,34 + 0,9 \cdot 0,6 = 0,68$

$H_2 = \alpha(\alpha_2) = 0,663739$

$\alpha_y = H_1 w_{13} + H_2 w_{23} = 0,68026 \cdot 0,3 + 0,663739 \cdot 0,9 = 0,801445$

$y = \alpha(\alpha_y) = 0,690283$

$\delta_{out} = (t-y)\, y(1-y) = (0,5-0,69)\cdot 0,69\cdot(1-0,69028) =$

$= 0,040681$

$\delta_1 = H_1(1-H_1)(W_{13}\delta_{out}) = 0,680267\cdot 0,319732 = (0,3-0,040681) =$

$= -0,002654$

$\delta_2 = H_2(1-H_2)(W_{23}\delta_{out}) = 0,663739\cdot 0,336251\cdot(0,9-0,040681) =$

$= -0,008172$

$\Delta W_{13} = \eta\,\delta_{out}\cdot H_1 = 1\cdot(-0,040681)\cdot 0,680267 = -0,027674$

$W_{13}^{new} = 0,3 + (-0,027674) = 0,272326$

$\Delta W_{23} = \eta\,\delta_{out}\cdot H_2 = 1(-0,40681)\cdot 0,663739 = -0,027002$

$W_{23}^{new} = 0,9 + (-0,027002) = 0,872996$

$\Delta W_4 = 1(-0,002654)\cdot 0,35 = -0,000929$

$\Delta W_{21} = 1(-0,002654)\cdot 0,9 = -0,002389$

$\Delta W_{12} = 1(-0,008172)\cdot 0,35 = -0,002860$

$\Delta W_{22} = 1(-0,008172)\cdot 0,9 = -0,007354$

$y_{next} = (H_1 W_{13}^{new} + H_2 W_{23}^{new}) = 0,682019$

№2

$a_1 = 0,35 \cdot 0,093071 + 0,9 \cdot 0,797611 = 0,752525$

$H_1 = 0,679729$

$a_2 = 0,35 \cdot 0,397140 + 0,9 \cdot 0,592646 = 0,672380$

$H_2 = 0,662036$

$E = \frac{1}{2}(0,5 - 0,682201)^2 = 0,016566$

$\delta_{out} = (0,5 - 0,682201) \cdot 0,682201 \cdot 0,317981 = -0,039474$

$\delta_1^2 = H_1(1 - H_1)(W_{13} \cdot \delta_{out}) = -0,002340$

$\delta_2^2 = H_2(1 - H_2)(W_{23} \cdot \delta_{out}) = -0,007710$

$\Delta W_{13} = -0,026832$

$\Delta W_{13}^{new} = 0,245494$

$\Delta W_{11} = -0,000819$

$\Delta W_{11}^{new} = 0,098252$

$\Delta W_{12} = -0,002699$

$\Delta W_{12}^{new} = 0,394441$

$\Delta W_{23} = -0,026133$

$\Delta W_{23}^{new} = 0,246835$

$\Delta W_{21} = -0,002106$

$\Delta W_{21}^{new} = 0,795595$

$\Delta W_{22} = -0,006939$

$\Delta W_{22}^{new} = 0,585706$

N3

$\alpha_1 = 0,35 \cdot 0,098252 + 0,9 \cdot 0,795505 = 0,752090$

$H_1 = 0,679634$

$\alpha_2 = 0,35 \cdot 0,39441 + 0,9 \cdot 0,585766 = 0,670890$

$H_2 = 0,661703$

$\alpha_y = 0,679634 \cdot 0,245494 + 0,661703 \cdot 0,846865 = 0,755770$

$y = 0,680435$

$E = \frac{1}{2}(t-y)^2 = \frac{1}{2}(0,5 - 0,680435)^2 = 0,016279$

$\delta_{out} = (0,5 - 0,680435) \cdot 0,680435 \cdot 0,319565 = -0,039234$

$\tilde{\delta}_1 = -0,002281$

$\tilde{\delta}_2 = -0,007622$

$\Delta w_{13} = -0,026665$

$\Delta w_{13}^{new} = 0,218829$

$\Delta w_{23} = -0,025961$

$\Delta w_{23}^{new} = 0,820904$

$\Delta w_{12} = -0,002668$

$\Delta w_{12}^{new} = 0,391773$

$\Delta w_{11} = \cancel{0,097454} - 0,000798$

$\Delta w_{11}^{new} = 0,097454$

$\Delta w_{21} = -0,002053$

$\Delta w_{21}^{new} = 0,798452$

$\Delta w_{22} = -0,006860$

$\Delta w_{22}^{new} = 0,578846$

№4

$z_1 = 0,35 \cdot 0,097454 + 0,9 \cdot 0,798452 = 0,7482157$

$H_1 = 0,678789$

$z_2 = 0,658081$

$H_2 = 0,658829$

$z_y = 0,689374$

$y = 0,665827$

$E = \frac{1}{2}(0,5 - 0,665827)^2 = 0,013749$

$\delta_{out} = -0,003689872$

$\delta_1 = -0,001760481$

$\delta_2 = -0,006808109$

$\Delta W_{13} = -0,025045 2$

$W_{13}^{new} = 0,193783$

$\Delta W_{11} = -0,000616$

$W_{11}^{new} = 0,096837$

$\Delta W_{12} = -0,002382$

$W_{12}^{new} = 0,389301$

$\Delta W_{23} = -0,024308$

$\Delta W_{23}^{new} = 0,796595$

$\Delta W_{21} = -0,001584$

$W_{21}^{new} = 0,79,1867$

$\Delta W_{22} = -0,006127$

$W_{22}^{new} = 0,572718$