



Basic sigmoid

$$\sigma = \frac{1}{1+e^{-x}}$$

$x_1 = 0,35$ $x_2 = 0,9$ $y = 0,5$
 $w_{11} = 0,1$ $w_{12} = 0,8$
 $w_{21} = 0,34$ $w_{22} = 0,6$
 $l = 1$ $y_{target} = 0,5$

1st iteration

$$z_1 = x_1 w_{11} + x_2 w_{21} = 0,35 \cdot 0,1 + 0,9 \cdot 0,34 = 0,311$$

$$a_1 = \sigma(z_1) = 0,680267$$

$$z_2 = x_1 w_{12} + x_2 w_{22} = 0,35 \cdot 0,8 + 0,9 \cdot 0,6 = 0,88$$

$$a_2 = \sigma(z_2) = 0,663739$$

$$a_y = z_1 w_{13} + z_2 w_{23} = 0,680267 \cdot 0,5 + 0,663739 \cdot 0,9 = 0,801445$$

$$y = \sigma(a_y) = 0,690283$$

$$\delta_{out} = (y - a_y) a_y (1 - a_y) = (0,5 - 0,69) \cdot 0,69 (1 - 0,690283) = -0,040681$$

$$\delta_1 = a_1 (1 - a_1) (w_{13} \delta_{out}) = -0,12654$$

$$\delta_2 = a_2 (1 - a_2) (w_{23} \delta_{out}) = 0,605729 - 0,31616$$

$$(0,9 - 0,9068) = -0,0068$$

$$\Delta w_{13} = \delta_{out} \cdot a_1 = 1 \cdot (-0,040681) \cdot 0,680267 = -0,027674$$

$$N_{13} = 0,13 \cdot (-0,02767611) = -0,272326$$

$$\Delta N_{23} = 1/4 \cdot \Delta_2 = 1/4 \cdot (-0,04067) \cdot 0,665739 = -0,02704$$

$$W_{23} = 0,9 \cdot (-0,02767611) = -0,872998$$

$$\Delta N_{14} = 1/4 \cdot (-0,002654) \cdot 0,35 = -0,000928$$

$$\Delta N_{24} = 1/4 \cdot (-0,002654) \cdot 0,98 = -0,802384$$

$$\Delta N_{12} = 1/4 \cdot (-0,0008172) \cdot 0,35 = -0,0002860$$

$$W_{22} = 1/4 \cdot (-0,0008172) \cdot 0,9 = -0,007354$$

$$y_{nm} = 6(L_1 \cdot W_{13}^{nm} + L_2 \cdot W_{23}^{nm}) = 0,622018$$

дискриминант

$$d_1 = 0,35 \cdot 0,088071 + 0,9 \cdot 0,088071 = 0,752525$$

$$d_2 = 0,049789$$

$$L_3 = 0,35 \cdot 0,397440 + 0,9 \cdot 0,397440 + 0,672380$$

$$L_2 = 0,662036$$

$$E = \frac{1}{2} (1 - y)^2 = \frac{1}{2} (0,5 - 0,682018)^2 = 0,016566$$

$$\delta_{nm} = \frac{1}{2} (1 - y) \cdot y \cdot \frac{1}{2} (1 - y) = 0,5 - 0,672018 \cdot 0,682018$$

$$\delta_1 = L_1 / 5 \cdot L_1 / (N_{13} - \delta_{nm}) = 0,670728 \cdot 0,320271$$

$$\delta_2 = L_2 / 5 \cdot L_2 / (N_{23} - \delta_{nm}) = 0,662036 \cdot 0,357964$$

$$\Delta N_{13} = 0,026032$$

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

$$\Delta N_{11} = 0,000819$$

$$\Delta W_{11} = -0,0000106$$

$$\Delta W_{12} = -0,0002652$$

$$\Delta N_{22} = -0,006989$$

$$\Delta N_{13}^{new} = 0,1245496$$

$$\Delta N_{23}^{new} = 0,840875$$

$$\Delta W_{11}^{new} = 0,008252$$

$$\Delta W_{12}^{new} = 0,785505$$

$$\Delta W_{22}^{new} = 0,844441$$

$$\Delta N_{12}^{new} = 0,585706$$

суперпозиция

$$d_1 = 0,35 \cdot 0,98252 + 0,9 \cdot 0,785505 = 0,7820908$$

$$d_2 = \frac{1}{1 + e^{-0,7820908}} = 0,679674$$

$$d_2 = 0,6708909$$

$$d_2 = 0,846865 = 0,735770$$

$$y = 0,680435$$

$$E = \frac{1}{2} (1 - y)^2 = \frac{1}{2} (0,5 - 0,680435)^2 = 0,016495$$

$$\delta_{nm} = \frac{1}{2} (1 - y) \cdot y \cdot \frac{1}{2} (1 - y) = 0,5 - 0,680435 = 0,680435$$

$$\delta_1 = 0,680435 \cdot 0,320366 / 0,745484 \cdot (-0,08923) = -0,00281$$

$$\delta_2 = 0,661703 \cdot 0,352297 / 0,846865 \cdot (-0,08923) = -0,00282$$

$$\Delta N_{13}' = -0,026665$$

$$\Delta N_{23}' = -0,005961$$

$$\Delta N_{13}^{new} = 0,218828$$

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

АЛГЕБРА

предметная тетрадь

$$\Delta W_{11} = \delta_{11} = 0,002281 \cdot 0,55 = -0,000785$$

$$\Delta W_{21} = 0,002053$$

$$\Delta W_{21}^{new} = 0,793452$$

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

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

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

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

4 итерации

$$a_1 = 0,55 \cdot 0,087454 + 0,49 \cdot 0,793452 = 0,7482134$$

$$a_2 = 0,648789785$$

$$a_2 = 0,658829594$$

$$a_2 = 0,65808185$$

$$a_2 = 0,689374574$$

$$y = 0,665827785$$

$$E = \frac{1}{2} (1-y)^2 = \frac{1}{2} (0,5 - 0,665827785)^2 = 0,03744427$$

$$\delta_{out} = -0,056896872$$

$$\delta_1 = 0,001760489$$

$$\delta_2 = -0,0006808109$$

$$\Delta W_{13} = -0,025045220$$

$$\Delta W_{13}^{new} = 0,103785780$$

$$\Delta W_{23} = -0,024308749$$

$$\Delta W_{23}^{new} = 0,79659256$$

$$\Delta W_{11} = -0,000616151$$

$$\Delta W_{11}^{new} = 0,096837449$$

$$\Delta W_{21} = -0,001844388$$

$$\Delta W_{21}^{new} = 0,79867612$$

$$\Delta W_{12} = -0,002382838$$

$$\Delta W_{12}^{new} = 0,389390162$$

$$\Delta W_{22} = -0,006127288$$

$$\Delta W_{22}^{new} = 0,522718702$$