

Solution to Problem 25

Task. Suppose that a 2-layer neural network has two inputs $x_1 = 0$ and $x_2 = 1$.

- In the first layer, we perform a linear transformation and compute the value $y = w_0 + w_1 \cdot x_1 + w_2 \cdot x_2$.
- In the second layer, we apply, to the result of the first layer, the rectified linear activation function and get $z = F(y)$.

What will be the result z of this data processing in the following two situations:

- when $w_0 = w_1 = w_2 = 1$, and
- when $w_0 = w_1 = w_2 = -1$.

Solution. For $w_0 = w_1 = w_2 = 1$, after the first layer, we get

$$y = w_0 + w_1 \cdot x_1 + w_2 \cdot x_2 = 1 + 1 \cdot 0 + 1 \cdot 1 = 1 + 0 + 1 = 2;$$

after which, we compute

$$z = \max(0, y) = \max(0, 2) = 2.$$

For $w_0 = w_1 = w_2 = -1$, after the first layer, we get

$$y = w_0 + w_1 \cdot x_1 + w_2 \cdot x_2 = -1 + (-1) \cdot 0 + (-1) \cdot 1 = -1 + 0 - 1 = -2;$$

after which, we compute

$$z = \max(0, y) = \max(0, -2) = 0.$$