Koczeń Piotr, grupa 2

Sprawozdanie 1

Temat: Budowa i działanie perceptronu.

1. Syntetyczny opis budowy oraz wykorzystanego algorytmu uczenia.

**Sztuczny neuron**- prosty system przetwarzający wartości sygnałów wprowadzanych na jego wejścia w pojedynczą wartość wyjściową, wysyłaną na jego jedynym wyjściu.

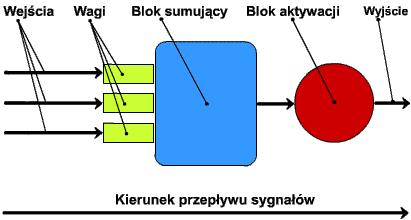
**Sztuczna sieć neuronowa** to ogólna nazwa struktur matematycznych i ich programowych lub sprzętowych modeli, realizujących obliczenia lub przetwarzanie sygnałów poprzez rzędy elementów wykonujących pewną podstawową operację na swoim wejściu, zwanych neuronami.

**Perceptron** to prosty element obliczeniowy. Sumuje ważone sygnały wejściowe oraz porównuje ją z progiem aktywacji. Zależnie od wyniku perceptron może być wzbudzony albo nie.

Algorytm uczenia perceptronu

Wybieramy losowo początkowe wartości wag.

1. Podajemy na wejście neuronu wektor uczący   
   **x=x(**τ**)=[**x0(τ), x1(τ),..., xn(τ)]T, τ=1,2,....
2. Obliczenie wartości wyjściowej perceptronu y.
3. Porównanie wartości wyjściowej *y(*τ*)* z wartością wzorcową (uczącą) *t=t*(**x**(τ)).
4. Modyfikacja wag:  
   *wi(*τ*+1) = wi(*τ*) + (t – y)xi(*τ*)*
5. Powrót do punktu 2.



2. Zestawienie wyników:

Próba nr 1.

(dane wejściowe: 100, learning rate: 0.00000001)

30 595 iteracji.

Testy:

Input: 74; 68; Output: 0; Desired output: 0; Error: 0;

Input: 22; 2; Output: 0; Desired output: 0; Error: 0;

Input: 19; 16; Output: 0; Desired output: 0; Error: 0;

Input: 0; 9; Output: 0; Desired output: 1; Error: -1;

Input: 74; 88; Output: 1; Desired output: 1; Error: 0;

Input: 54; 23; Output: 0; Desired output: 0; Error: 0;

Input: 57; 67; Output: 1; Desired output: 1; Error: 0;

Input: 47; 69; Output: 1; Desired output: 1; Error: 0;

Input: 98; 17; Output: 0; Desired output: 0; Error: 0;

Input: 75; 46; Output: 0; Desired output: 0; Error: 0;

Input: 8; 21; Output: 0; Desired output: 1; Error: -1;

Input: 39; 91; Output: 1; Desired output: 1; Error: 0;

Input: 31; 72; Output: 1; Desired output: 1; Error: 0;

Input: 97; 66; Output: 0; Desired output: 0; Error: 0;

Input: 63; 75; Output: 1; Desired output: 1; Error: 0;

Input: 52; 49; Output: 0; Desired output: 0; Error: 0;

Input: 86; 48; Output: 0; Desired output: 0; Error: 0;

Input: 97; 15; Output: 0; Desired output: 0; Error: 0;

Input: 78; 83; Output: 1; Desired output: 1; Error: 0;

Input: 4; 81; Output: 1; Desired output: 1; Error: 0;

Input: 27; 14; Output: 0; Desired output: 0; Error: 0;

Input: 41; 0; Output: 1; Desired output: 0; Error: 0;

Input: 72; 67; Output: 0; Desired output: 0; Error: 0;

Input: 63; 50; Output: 0; Desired output: 0; Error: 0;

Input: 100; 40; Output: 0; Desired output: 0; Error: 0;

Input: 19; 32; Output: 1; Desired output: 1; Error: 0;

Input: 72; 77; Output: 1; Desired output: 1; Error: 0;

Input: 71; 78; Output: 1; Desired output: 1; Error: 0;

Input: 22; 25; Output: 0; Desired output: 1; Error: -1;

Input: 16; 23; Output: 1; Desired output: 1; Error: -1;

Input: 17; 60; Output: 1; Desired output: 1; Error: 0;

Input: 25; 15; Output: 0; Desired output: 0; Error: 0;

Input: 61; 82; Output: 1; Desired output: 1; Error: 0;

Input: 27; 7; Output: 0; Desired output: 0; Error: 0;

Input: 40; 35; Output: 0; Desired output: 0; Error: 0;

Input: 95; 84; Output: 0; Desired output: 0; Error: 0;

Input: 34; 87; Output: 1; Desired output: 1; Error: 0;

Input: 80; 90; Output: 1; Desired output: 1; Error: 0;

Input: 6; 26; Output: 1; Desired output: 1; Error: 0;

Input: 86; 63; Output: 0; Desired output: 0; Error: 0;

Input: 63; 9; Output: 0; Desired output: 0; Error: 0;

Input: 37; 19; Output: 0; Desired output: 0; Error: 0;

Input: 17; 15; Output: 0; Desired output: 0; Error: 0;

Input: 21; 23; Output: 0; Desired output: 1; Error: -1;

Input: 46; 32; Output: 0; Desired output: 0; Error: 0;

Input: 47; 24; Output: 1; Desired output: 0; Error: 0;

Input: 77; 55; Output: 0; Desired output: 0; Error: 0;

Input: 43; 38; Output: 0; Desired output: 0; Error: 0;

Input: 85; 76; Output: 0; Desired output: 0; Error: 0;

Input: 92; 6; Output: 0; Desired output: 0; Error: 0;

Input: 57; 31; Output: 0; Desired output: 0; Error: 0;

Input: 40; 75; Output: 1; Desired output: 1; Error: 0;

Input: 48; 98; Output: 1; Desired output: 1; Error: 0;

Input: 55; 13; Output: 0; Desired output: 0; Error: 0;

Input: 90; 11; Output: 0; Desired output: 0; Error: 0;

Input: 7; 27; Output: 1; Desired output: 1; Error: 0;

Input: 50; 20; Output: 0; Desired output: 0; Error: 0;

Input: 69; 4; Output: 0; Desired output: 0; Error: 0;

Input: 34; 33; Output: 0; Desired output: 0; Error: 0;

Input: 84; 34; Output: 0; Desired output: 0; Error: 0;

Input: 90; 97; Output: 1; Desired output: 1; Error: 0;

Input: 89; 18; Output: 0; Desired output: 0; Error: 0;

Input: 88; 53; Output: 0; Desired output: 0; Error: 0;

Input: 87; 71; Output: 0; Desired output: 0; Error: 0;

Input: 33; 94; Output: 1; Desired output: 1; Error: 0;

Input: 68; 31; Output: 0; Desired output: 0; Error: 0;

Input: 2; 78; Output: 1; Desired output: 1; Error: 0;

Input: 61; 57; Output: 0; Desired output: 0; Error: 0;

Input: 16; 22; Output: 0; Desired output: 1; Error: -1;

Input: 84; 99; Output: 1; Desired output: 1; Error: 0;

Input: 99; 17; Output: 0; Desired output: 0; Error: 0;

Input: 64; 78; Output: 1; Desired output: 1; Error: 0;

Input: 36; 60; Output: 1; Desired output: 1; Error: 0;

Input: 79; 97; Output: 1; Desired output: 1; Error: 0;

Input: 42; 87; Output: 1; Desired output: 1; Error: 0;

Input: 86; 26; Output: 0; Desired output: 0; Error: 0;

Input: 67; 75; Output: 1; Desired output: 1; Error: 0;

Input: 69; 40; Output: 0; Desired output: 0; Error: 0;

Input: 89; 27; Output: 0; Desired output: 0; Error: 0;

Input: 83; 81; Output: 1; Desired output: 0; Error: 1;

Input: 12; 7; Output: 0; Desired output: 0; Error: 0;

Input: 27; 89; Output: 1; Desired output: 1; Error: 0;

Input: 67; 60; Output: 0; Desired output: 0; Error: 0;

Input: 78; 96; Output: 1; Desired output: 1; Error: 0;

Input: 28; 20; Output: 0; Desired output: 0; Error: 0;

Input: 14; 36; Output: 1; Desired output: 1; Error: 0;

Input: 18; 58; Output: 1; Desired output: 1; Error: 0;

Input: 86; 2; Output: 0; Desired output: 0; Error: 0;

Input: 9; 97; Output: 1; Desired output: 1; Error: 0;

Input: 2; 90; Output: 1; Desired output: 1; Error: 0;

Input: 95; 89; Output: 0; Desired output: 0; Error: 0;

Input: 5; 24; Output: 1; Desired output: 1; Error: 0;

Input: 69; 41; Output: 0; Desired output: 0; Error: 0;

Input: 64; 25; Output: 0; Desired output: 0; Error: 0;

Input: 24; 39; Output: 1; Desired output: 1; Error: 0;

Input: 48; 40; Output: 0; Desired output: 0; Error: 0;

Input: 29; 38; Output: 0; Desired output: 1; Error: -1;

Input: 18; 59; Output: 1; Desired output: 1; Error: 0;

Input: 69; 71; Output: 1; Desired output: 1; Error: 0;

Input: 10; 73; Output: 1; Desired output: 1; Error: 0;

Total Mean Square Error: 0.08

Próba nr 2.

(dane wejściowe: 100, learning rate: 0.000001)

7801 iteracji.

Input: 74; 68; Output: 0; Desired output: 0; Error: 0;

Input: 22; 2; Output: 0; Desired output: 0; Error: 0;

Input: 19; 16; Output: 0; Desired output: 0; Error: 0;

Input: 0; 9; Output: 1; Desired output: 1; Error: 0;

Input: 74; 88; Output: 1; Desired output: 1; Error: 0;

Input: 54; 23; Output: 0; Desired output: 0; Error: 0;

Input: 57; 67; Output: 1; Desired output: 1; Error: 0;

Input: 47; 69; Output: 1; Desired output: 1; Error: 0;

Input: 98; 17; Output: 0; Desired output: 0; Error: 0;

Input: 75; 46; Output: 0; Desired output: 0; Error: 0;

Input: 8; 21; Output: 1; Desired output: 1; Error: 0;

Input: 39; 91; Output: 1; Desired output: 1; Error: 0;

Input: 31; 72; Output: 1; Desired output: 1; Error: 0;

Input: 97; 66; Output: 0; Desired output: 0; Error: 0;

Input: 63; 75; Output: 1; Desired output: 1; Error: 0;

Input: 52; 49; Output: 0; Desired output: 0; Error: 0;

Input: 86; 48; Output: 0; Desired output: 0; Error: 0;

Input: 97; 15; Output: 0; Desired output: 0; Error: 0;

Input: 78; 83; Output: 1; Desired output: 1; Error: 0;

Input: 4; 81; Output: 1; Desired output: 1; Error: 0;

Input: 27; 14; Output: 0; Desired output: 0; Error: 0;

Input: 41; 0; Output: 0; Desired output: 0; Error: 0;

Input: 72; 67; Output: 0; Desired output: 0; Error: 0;

Input: 63; 50; Output: 0; Desired output: 0; Error: 0;

Input: 100; 40; Output: 0; Desired output: 0; Error: 0;

Input: 19; 32; Output: 1; Desired output: 1; Error: 0;

Input: 72; 77; Output: 1; Desired output: 1; Error: 0;

Input: 71; 78; Output: 1; Desired output: 1; Error: 0;

Input: 22; 25; Output: 1; Desired output: 1; Error: 0;

Input: 16; 23; Output: 1; Desired output: 1; Error: 0;

Input: 17; 60; Output: 1; Desired output: 1; Error: 0;

Input: 25; 15; Output: 0; Desired output: 0; Error: 0;

Input: 61; 82; Output: 1; Desired output: 1; Error: 0;

Input: 27; 7; Output: 0; Desired output: 0; Error: 0;

Input: 40; 35; Output: 0; Desired output: 0; Error: 0;

Input: 95; 84; Output: 0; Desired output: 0; Error: 0;

Input: 34; 87; Output: 1; Desired output: 1; Error: 0;

Input: 80; 90; Output: 1; Desired output: 1; Error: 0;

Input: 6; 26; Output: 1; Desired output: 1; Error: 0;

Input: 86; 63; Output: 0; Desired output: 0; Error: 0;

Input: 63; 9; Output: 0; Desired output: 0; Error: 0;

Input: 37; 19; Output: 0; Desired output: 0; Error: 0;

Input: 17; 15; Output: 0; Desired output: 0; Error: 0;

Input: 21; 23; Output: 0; Desired output: 1; Error: -1;

Input: 46; 32; Output: 0; Desired output: 0; Error: 0;

Input: 47; 24; Output: 0; Desired output: 0; Error: 0;

Input: 77; 55; Output: 0; Desired output: 0; Error: 0;

Input: 43; 38; Output: 0; Desired output: 0; Error: 0;

Input: 85; 76; Output: 0; Desired output: 0; Error: 0;

Input: 92; 6; Output: 0; Desired output: 0; Error: 0;

Input: 57; 31; Output: 0; Desired output: 0; Error: 0;

Input: 40; 75; Output: 1; Desired output: 1; Error: 0;

Input: 48; 98; Output: 1; Desired output: 1; Error: 0;

Input: 55; 13; Output: 0; Desired output: 0; Error: 0;

Input: 90; 11; Output: 0; Desired output: 0; Error: 0;

Input: 7; 27; Output: 1; Desired output: 1; Error: 0;

Input: 50; 20; Output: 0; Desired output: 0; Error: 0;

Input: 69; 4; Output: 0; Desired output: 0; Error: 0;

Input: 34; 33; Output: 0; Desired output: 0; Error: 0;

Input: 84; 34; Output: 0; Desired output: 0; Error: 0;

Input: 90; 97; Output: 1; Desired output: 1; Error: 0;

Input: 89; 18; Output: 0; Desired output: 0; Error: 0;

Input: 88; 53; Output: 0; Desired output: 0; Error: 0;

Input: 87; 71; Output: 0; Desired output: 0; Error: 0;

Input: 33; 94; Output: 1; Desired output: 1; Error: 0;

Input: 68; 31; Output: 0; Desired output: 0; Error: 0;

Input: 2; 78; Output: 1; Desired output: 1; Error: 0;

Input: 61; 57; Output: 0; Desired output: 0; Error: 0;

Input: 16; 22; Output: 1; Desired output: 1; Error: 0;

Input: 84; 99; Output: 1; Desired output: 1; Error: 0;

Input: 99; 17; Output: 0; Desired output: 0; Error: 0;

Input: 64; 78; Output: 1; Desired output: 1; Error: 0;

Input: 36; 60; Output: 1; Desired output: 1; Error: 0;

Input: 79; 97; Output: 1; Desired output: 1; Error: 0;

Input: 42; 87; Output: 1; Desired output: 1; Error: 0;

Input: 86; 26; Output: 0; Desired output: 0; Error: 0;

Input: 67; 75; Output: 1; Desired output: 1; Error: 0;

Input: 69; 40; Output: 0; Desired output: 0; Error: 0;

Input: 89; 27; Output: 0; Desired output: 0; Error: 0;

Input: 83; 81; Output: 0; Desired output: 0; Error: 0;

Input: 12; 7; Output: 0; Desired output: 0; Error: 0;

Input: 27; 89; Output: 1; Desired output: 1; Error: 0;

Input: 67; 60; Output: 0; Desired output: 0; Error: 0;

Input: 78; 96; Output: 1; Desired output: 1; Error: 0;

Input: 28; 20; Output: 0; Desired output: 0; Error: 0;

Input: 14; 36; Output: 1; Desired output: 1; Error: 0;

Input: 18; 58; Output: 1; Desired output: 1; Error: 0;

Input: 86; 2; Output: 0; Desired output: 0; Error: 0;

Input: 9; 97; Output: 1; Desired output: 1; Error: 0;

Input: 2; 90; Output: 1; Desired output: 1; Error: 0;

Input: 95; 89; Output: 0; Desired output: 0; Error: 0;

Input: 5; 24; Output: 1; Desired output: 1; Error: 0;

Input: 69; 41; Output: 0; Desired output: 0; Error: 0;

Input: 64; 25; Output: 0; Desired output: 0; Error: 0;

Input: 24; 39; Output: 1; Desired output: 1; Error: 0;

Input: 48; 40; Output: 0; Desired output: 0; Error: 0;

Input: 29; 38; Output: 1; Desired output: 1; Error: 0;

Input: 18; 59; Output: 1; Desired output: 1; Error: 0;

Input: 69; 71; Output: 1; Desired output: 1; Error: 0;

Input: 10; 73; Output: 1; Desired output: 1; Error: 0;

Total Mean Square Error: 0.01

Próba nr 3.

(dane wejściowe: 100, learning rate: 0.0001)

18 iteracji

Input: 74; 68; Output: 0; Desired output: 0; Error: 0;

Input: 22; 2; Output: 0; Desired output: 0; Error: 0;

Input: 19; 16; Output: 0; Desired output: 0; Error: 0;

Input: 0; 9; Output: 1; Desired output: 1; Error: 0;

Input: 74; 88; Output: 1; Desired output: 1; Error: 0;

Input: 54; 23; Output: 0; Desired output: 0; Error: 0;

Input: 57; 67; Output: 1; Desired output: 1; Error: 0;

Input: 47; 69; Output: 1; Desired output: 1; Error: 0;

Input: 98; 17; Output: 0; Desired output: 0; Error: 0;

Input: 75; 46; Output: 0; Desired output: 0; Error: 0;

Input: 8; 21; Output: 1; Desired output: 1; Error: 0;

Input: 39; 91; Output: 1; Desired output: 1; Error: 0;

Input: 31; 72; Output: 1; Desired output: 1; Error: 0;

Input: 97; 66; Output: 0; Desired output: 0; Error: 0;

Input: 63; 75; Output: 1; Desired output: 1; Error: 0;

Input: 52; 49; Output: 0; Desired output: 0; Error: 0;

Input: 86; 48; Output: 0; Desired output: 0; Error: 0;

Input: 97; 15; Output: 0; Desired output: 0; Error: 0;

Input: 78; 83; Output: 1; Desired output: 1; Error: 0;

Input: 4; 81; Output: 1; Desired output: 1; Error: 0;

Input: 27; 14; Output: 0; Desired output: 0; Error: 0;

Input: 41; 0; Output: 0; Desired output: 0; Error: 0;

Input: 72; 67; Output: 0; Desired output: 0; Error: 0;

Input: 63; 50; Output: 0; Desired output: 0; Error: 0;

Input: 100; 40; Output: 0; Desired output: 0; Error: 0;

Input: 19; 32; Output: 1; Desired output: 1; Error: 0;

Input: 72; 77; Output: 1; Desired output: 1; Error: 0;

Input: 71; 78; Output: 1; Desired output: 1; Error: 0;

Input: 22; 25; Output: 1; Desired output: 1; Error: 0;

Input: 16; 23; Output: 1; Desired output: 1; Error: 0;

Input: 17; 60; Output: 1; Desired output: 1; Error: 0;

Input: 25; 15; Output: 0; Desired output: 0; Error: 0;

Input: 61; 82; Output: 1; Desired output: 1; Error: 0;

Input: 27; 7; Output: 0; Desired output: 0; Error: 0;

Input: 40; 35; Output: 0; Desired output: 0; Error: 0;

Input: 95; 84; Output: 0; Desired output: 0; Error: 0;

Input: 34; 87; Output: 1; Desired output: 1; Error: 0;

Input: 80; 90; Output: 1; Desired output: 1; Error: 0;

Input: 6; 26; Output: 1; Desired output: 1; Error: 0;

Input: 86; 63; Output: 0; Desired output: 0; Error: 0;

Input: 63; 9; Output: 0; Desired output: 0; Error: 0;

Input: 37; 19; Output: 0; Desired output: 0; Error: 0;

Input: 17; 15; Output: 0; Desired output: 0; Error: 0;

Input: 21; 23; Output: 1; Desired output: 1; Error: 0;

Input: 46; 32; Output: 0; Desired output: 0; Error: 0;

Input: 47; 24; Output: 0; Desired output: 0; Error: 0;

Input: 77; 55; Output: 0; Desired output: 0; Error: 0;

Input: 43; 38; Output: 0; Desired output: 0; Error: 0;

Input: 85; 76; Output: 0; Desired output: 0; Error: 0;

Input: 92; 6; Output: 0; Desired output: 0; Error: 0;

Input: 57; 31; Output: 0; Desired output: 0; Error: 0;

Input: 40; 75; Output: 1; Desired output: 1; Error: 0;

Input: 48; 98; Output: 1; Desired output: 1; Error: 0;

Input: 55; 13; Output: 0; Desired output: 0; Error: 0;

Input: 90; 11; Output: 0; Desired output: 0; Error: 0;

Input: 7; 27; Output: 1; Desired output: 1; Error: 0;

Input: 50; 20; Output: 0; Desired output: 0; Error: 0;

Input: 69; 4; Output: 0; Desired output: 0; Error: 0;

Input: 34; 33; Output: 0; Desired output: 0; Error: 0;

Input: 84; 34; Output: 0; Desired output: 0; Error: 0;

Input: 90; 97; Output: 1; Desired output: 1; Error: 0;

Input: 89; 18; Output: 0; Desired output: 0; Error: 0;

Input: 88; 53; Output: 0; Desired output: 0; Error: 0;

Input: 87; 71; Output: 0; Desired output: 0; Error: 0;

Input: 33; 94; Output: 1; Desired output: 1; Error: 0;

Input: 68; 31; Output: 0; Desired output: 0; Error: 0;

Input: 2; 78; Output: 1; Desired output: 1; Error: 0;

Input: 61; 57; Output: 0; Desired output: 0; Error: 0;

Input: 16; 22; Output: 1; Desired output: 1; Error: 0;

Input: 84; 99; Output: 1; Desired output: 1; Error: 0;

Input: 99; 17; Output: 0; Desired output: 0; Error: 0;

Input: 64; 78; Output: 1; Desired output: 1; Error: 0;

Input: 36; 60; Output: 1; Desired output: 1; Error: 0;

Input: 79; 97; Output: 1; Desired output: 1; Error: 0;

Input: 42; 87; Output: 1; Desired output: 1; Error: 0;

Input: 86; 26; Output: 0; Desired output: 0; Error: 0;

Input: 67; 75; Output: 1; Desired output: 1; Error: 0;

Input: 69; 40; Output: 0; Desired output: 0; Error: 0;

Input: 89; 27; Output: 0; Desired output: 0; Error: 0;

Input: 83; 81; Output: 0; Desired output: 0; Error: 0;

Input: 12; 7; Output: 0; Desired output: 0; Error: 0;

Input: 27; 89; Output: 1; Desired output: 1; Error: 0;

Input: 67; 60; Output: 0; Desired output: 0; Error: 0;

Input: 78; 96; Output: 1; Desired output: 1; Error: 0;

Input: 28; 20; Output: 0; Desired output: 0; Error: 0;

Input: 14; 36; Output: 1; Desired output: 1; Error: 0;

Input: 18; 58; Output: 1; Desired output: 1; Error: 0;

Input: 86; 2; Output: 0; Desired output: 0; Error: 0;

Input: 9; 97; Output: 1; Desired output: 1; Error: 0;

Input: 2; 90; Output: 1; Desired output: 1; Error: 0;

Input: 95; 89; Output: 0; Desired output: 0; Error: 0;

Input: 5; 24; Output: 1; Desired output: 1; Error: 0;

Input: 69; 41; Output: 0; Desired output: 0; Error: 0;

Input: 64; 25; Output: 0; Desired output: 0; Error: 0;

Input: 24; 39; Output: 1; Desired output: 1; Error: 0;

Input: 48; 40; Output: 0; Desired output: 0; Error: 0;

Input: 29; 38; Output: 1; Desired output: 1; Error: 0;

Input: 18; 59; Output: 1; Desired output: 1; Error: 0;

Input: 69; 71; Output: 1; Desired output: 1; Error: 0;

Input: 10; 73; Output: 1; Desired output: 1; Error: 0;

Total Mean Square Error: 0.0

Próba nr 4.

(dane wejściowe: 100, learning rate: 0.1)

3 iteracje.

Input: 74; 68; Output: 0; Desired output: 0; Error: 0;

Input: 22; 2; Output: 0; Desired output: 0; Error: 0;

Input: 19; 16; Output: 0; Desired output: 0; Error: 0;

Input: 0; 9; Output: 1; Desired output: 1; Error: 0;

Input: 74; 88; Output: 1; Desired output: 1; Error: 0;

Input: 54; 23; Output: 0; Desired output: 0; Error: 0;

Input: 57; 67; Output: 1; Desired output: 1; Error: 0;

Input: 47; 69; Output: 1; Desired output: 1; Error: 0;

Input: 98; 17; Output: 0; Desired output: 0; Error: 0;

Input: 75; 46; Output: 0; Desired output: 0; Error: 0;

Input: 8; 21; Output: 1; Desired output: 1; Error: 0;

Input: 39; 91; Output: 1; Desired output: 1; Error: 0;

Input: 31; 72; Output: 1; Desired output: 1; Error: 0;

Input: 97; 66; Output: 0; Desired output: 0; Error: 0;

Input: 63; 75; Output: 1; Desired output: 1; Error: 0;

Input: 52; 49; Output: 0; Desired output: 0; Error: 0;

Input: 86; 48; Output: 0; Desired output: 0; Error: 0;

Input: 97; 15; Output: 0; Desired output: 0; Error: 0;

Input: 78; 83; Output: 1; Desired output: 1; Error: 0;

Input: 4; 81; Output: 1; Desired output: 1; Error: 0;

Input: 27; 14; Output: 0; Desired output: 0; Error: 0;

Input: 41; 0; Output: 0; Desired output: 0; Error: 0;

Input: 72; 67; Output: 0; Desired output: 0; Error: 0;

Input: 63; 50; Output: 0; Desired output: 0; Error: 0;

Input: 100; 40; Output: 0; Desired output: 0; Error: 0;

Input: 19; 32; Output: 1; Desired output: 1; Error: 0;

Input: 72; 77; Output: 1; Desired output: 1; Error: 0;

Input: 71; 78; Output: 1; Desired output: 1; Error: 0;

Input: 22; 25; Output: 1; Desired output: 1; Error: 0;

Input: 16; 23; Output: 1; Desired output: 1; Error: 0;

Input: 17; 60; Output: 1; Desired output: 1; Error: 0;

Input: 25; 15; Output: 0; Desired output: 0; Error: 0;

Input: 61; 82; Output: 1; Desired output: 1; Error: 0;

Input: 27; 7; Output: 0; Desired output: 0; Error: 0;

Input: 40; 35; Output: 0; Desired output: 0; Error: 0;

Input: 95; 84; Output: 0; Desired output: 0; Error: 0;

Input: 34; 87; Output: 1; Desired output: 1; Error: 0;

Input: 80; 90; Output: 1; Desired output: 1; Error: 0;

Input: 6; 26; Output: 1; Desired output: 1; Error: 0;

Input: 86; 63; Output: 0; Desired output: 0; Error: 0;

Input: 63; 9; Output: 0; Desired output: 0; Error: 0;

Input: 37; 19; Output: 0; Desired output: 0; Error: 0;

Input: 17; 15; Output: 0; Desired output: 0; Error: 0;

Input: 21; 23; Output: 1; Desired output: 1; Error: 0;

Input: 46; 32; Output: 0; Desired output: 0; Error: 0;

Input: 47; 24; Output: 0; Desired output: 0; Error: 0;

Input: 77; 55; Output: 0; Desired output: 0; Error: 0;

Input: 43; 38; Output: 0; Desired output: 0; Error: 0;

Input: 85; 76; Output: 0; Desired output: 0; Error: 0;

Input: 92; 6; Output: 0; Desired output: 0; Error: 0;

Input: 57; 31; Output: 0; Desired output: 0; Error: 0;

Input: 40; 75; Output: 1; Desired output: 1; Error: 0;

Input: 48; 98; Output: 1; Desired output: 1; Error: 0;

Input: 55; 13; Output: 0; Desired output: 0; Error: 0;

Input: 90; 11; Output: 0; Desired output: 0; Error: 0;

Input: 7; 27; Output: 1; Desired output: 1; Error: 0;

Input: 50; 20; Output: 0; Desired output: 0; Error: 0;

Input: 69; 4; Output: 0; Desired output: 0; Error: 0;

Input: 34; 33; Output: 0; Desired output: 0; Error: 0;

Input: 84; 34; Output: 0; Desired output: 0; Error: 0;

Input: 90; 97; Output: 1; Desired output: 1; Error: 0;

Input: 89; 18; Output: 0; Desired output: 0; Error: 0;

Input: 88; 53; Output: 0; Desired output: 0; Error: 0;

Input: 87; 71; Output: 0; Desired output: 0; Error: 0;

Input: 33; 94; Output: 1; Desired output: 1; Error: 0;

Input: 68; 31; Output: 0; Desired output: 0; Error: 0;

Input: 2; 78; Output: 1; Desired output: 1; Error: 0;

Input: 61; 57; Output: 0; Desired output: 0; Error: 0;

Input: 16; 22; Output: 1; Desired output: 1; Error: 0;

Input: 84; 99; Output: 1; Desired output: 1; Error: 0;

Input: 99; 17; Output: 0; Desired output: 0; Error: 0;

Input: 64; 78; Output: 1; Desired output: 1; Error: 0;

Input: 36; 60; Output: 1; Desired output: 1; Error: 0;

Input: 79; 97; Output: 1; Desired output: 1; Error: 0;

Input: 42; 87; Output: 1; Desired output: 1; Error: 0;

Input: 86; 26; Output: 0; Desired output: 0; Error: 0;

Input: 67; 75; Output: 1; Desired output: 1; Error: 0;

Input: 69; 40; Output: 0; Desired output: 0; Error: 0;

Input: 89; 27; Output: 0; Desired output: 0; Error: 0;

Input: 83; 81; Output: 0; Desired output: 0; Error: 0;

Input: 12; 7; Output: 0; Desired output: 0; Error: 0;

Input: 27; 89; Output: 1; Desired output: 1; Error: 0;

Input: 67; 60; Output: 0; Desired output: 0; Error: 0;

Input: 78; 96; Output: 1; Desired output: 1; Error: 0;

Input: 28; 20; Output: 0; Desired output: 0; Error: 0;

Input: 14; 36; Output: 1; Desired output: 1; Error: 0;

Input: 18; 58; Output: 1; Desired output: 1; Error: 0;

Input: 86; 2; Output: 0; Desired output: 0; Error: 0;

Input: 9; 97; Output: 1; Desired output: 1; Error: 0;

Input: 2; 90; Output: 1; Desired output: 1; Error: 0;

Input: 95; 89; Output: 0; Desired output: 0; Error: 0;

Input: 5; 24; Output: 1; Desired output: 1; Error: 0;

Input: 69; 41; Output: 0; Desired output: 0; Error: 0;

Input: 64; 25; Output: 0; Desired output: 0; Error: 0;

Input: 24; 39; Output: 1; Desired output: 1; Error: 0;

Input: 48; 40; Output: 0; Desired output: 0; Error: 0;

Input: 29; 38; Output: 1; Desired output: 1; Error: 0;

Input: 18; 59; Output: 1; Desired output: 1; Error: 0;

Input: 69; 71; Output: 1; Desired output: 1; Error: 0;

Input: 10; 73; Output: 1; Desired output: 1; Error: 0;

Total Mean Square Error: 0.0

Próba nr 5.

(dane wejściowe: 50, learning rate: 0.00000001)

Iteracji: 35 291

Input: 74; 68; Output: 0; Desired output: 0; Error: 0;

Input: 22; 2; Output: 0; Desired output: 0; Error: 0;

Input: 19; 16; Output: 0; Desired output: 0; Error: 0;

Input: 0; 9; Output: 1; Desired output: 1; Error: 0;

Input: 74; 88; Output: 1; Desired output: 1; Error: 0;

Input: 54; 23; Output: 0; Desired output: 0; Error: 0;

Input: 57; 67; Output: 1; Desired output: 1; Error: 0;

Input: 47; 69; Output: 1; Desired output: 1; Error: 0;

Input: 98; 17; Output: 0; Desired output: 0; Error: 0;

Input: 75; 46; Output: 0; Desired output: 0; Error: 0;

Input: 8; 21; Output: 1; Desired output: 1; Error: 0;

Input: 39; 91; Output: 1; Desired output: 1; Error: 0;

Input: 31; 72; Output: 1; Desired output: 1; Error: 0;

Input: 97; 66; Output: 0; Desired output: 0; Error: 0;

Input: 63; 75; Output: 1; Desired output: 1; Error: 0;

Input: 52; 49; Output: 0; Desired output: 0; Error: 0;

Input: 86; 48; Output: 0; Desired output: 0; Error: 0;

Input: 97; 15; Output: 0; Desired output: 0; Error: 0;

Input: 78; 83; Output: 1; Desired output: 1; Error: 0;

Input: 4; 81; Output: 1; Desired output: 1; Error: 0;

Input: 27; 14; Output: 0; Desired output: 0; Error: 0;

Input: 41; 0; Output: 0; Desired output: 0; Error: 0;

Input: 72; 67; Output: 0; Desired output: 0; Error: 0;

Input: 63; 50; Output: 0; Desired output: 0; Error: 0;

Input: 100; 40; Output: 0; Desired output: 0; Error: 0;

Input: 19; 32; Output: 1; Desired output: 1; Error: 0;

Input: 72; 77; Output: 1; Desired output: 1; Error: 0;

Input: 71; 78; Output: 1; Desired output: 1; Error: 0;

Input: 22; 25; Output: 1; Desired output: 1; Error: 0;

Input: 16; 23; Output: 1; Desired output: 1; Error: 0;

Input: 17; 60; Output: 1; Desired output: 1; Error: 0;

Input: 25; 15; Output: 0; Desired output: 0; Error: 0;

Input: 61; 82; Output: 1; Desired output: 1; Error: 0;

Input: 27; 7; Output: 0; Desired output: 0; Error: 0;

Input: 40; 35; Output: 0; Desired output: 0; Error: 0;

Input: 95; 84; Output: 0; Desired output: 0; Error: 0;

Input: 34; 87; Output: 1; Desired output: 1; Error: 0;

Input: 80; 90; Output: 1; Desired output: 1; Error: 0;

Input: 6; 26; Output: 1; Desired output: 1; Error: 0;

Input: 86; 63; Output: 0; Desired output: 0; Error: 0;

Input: 63; 9; Output: 0; Desired output: 0; Error: 0;

Input: 37; 19; Output: 0; Desired output: 0; Error: 0;

Input: 17; 15; Output: 0; Desired output: 0; Error: 0;

Input: 21; 23; Output: 1; Desired output: 1; Error: 0;

Input: 46; 32; Output: 0; Desired output: 0; Error: 0;

Input: 47; 24; Output: 0; Desired output: 0; Error: 0;

Input: 77; 55; Output: 0; Desired output: 0; Error: 0;

Input: 43; 38; Output: 0; Desired output: 0; Error: 0;

Input: 85; 76; Output: 0; Desired output: 0; Error: 0;

Input: 92; 6; Output: 0; Desired output: 0; Error: 0;

Total Mean Square Error: 0.0

Próba nr 6.

(dane wejściowe: 50, learning rate: 0,000001)

Iteracji:

27 787

Input: 74; 68; Output: 0; Desired output: 0; Error: 0;

Input: 22; 2; Output: 0; Desired output: 0; Error: 0;

Input: 19; 16; Output: 0; Desired output: 0; Error: 0;

Input: 0; 9; Output: 1; Desired output: 1; Error: 0;

Input: 74; 88; Output: 1; Desired output: 1; Error: 0;

Input: 54; 23; Output: 0; Desired output: 0; Error: 0;

Input: 57; 67; Output: 1; Desired output: 1; Error: 0;

Input: 47; 69; Output: 1; Desired output: 1; Error: 0;

Input: 98; 17; Output: 0; Desired output: 0; Error: 0;

Input: 75; 46; Output: 0; Desired output: 0; Error: 0;

Input: 8; 21; Output: 1; Desired output: 1; Error: 0;

Input: 39; 91; Output: 1; Desired output: 1; Error: 0;

Input: 31; 72; Output: 1; Desired output: 1; Error: 0;

Input: 97; 66; Output: 0; Desired output: 0; Error: 0;

Input: 63; 75; Output: 1; Desired output: 1; Error: 0;

Input: 52; 49; Output: 0; Desired output: 0; Error: 0;

Input: 86; 48; Output: 0; Desired output: 0; Error: 0;

Input: 97; 15; Output: 0; Desired output: 0; Error: 0;

Input: 78; 83; Output: 1; Desired output: 1; Error: 0;

Input: 4; 81; Output: 1; Desired output: 1; Error: 0;

Input: 27; 14; Output: 0; Desired output: 0; Error: 0;

Input: 41; 0; Output: 0; Desired output: 0; Error: 0;

Input: 72; 67; Output: 0; Desired output: 0; Error: 0;

Input: 63; 50; Output: 0; Desired output: 0; Error: 0;

Input: 100; 40; Output: 0; Desired output: 0; Error: 0;

Input: 19; 32; Output: 1; Desired output: 1; Error: 0;

Input: 72; 77; Output: 1; Desired output: 1; Error: 0;

Input: 71; 78; Output: 1; Desired output: 1; Error: 0;

Input: 22; 25; Output: 1; Desired output: 1; Error: 0;

Input: 16; 23; Output: 1; Desired output: 1; Error: 0;

Input: 17; 60; Output: 1; Desired output: 1; Error: 0;

Input: 25; 15; Output: 0; Desired output: 0; Error: 0;

Input: 61; 82; Output: 1; Desired output: 1; Error: 0;

Input: 27; 7; Output: 0; Desired output: 0; Error: 0;

Input: 40; 35; Output: 0; Desired output: 0; Error: 0;

Input: 95; 84; Output: 0; Desired output: 0; Error: 0;

Input: 34; 87; Output: 1; Desired output: 1; Error: 0;

Input: 80; 90; Output: 1; Desired output: 1; Error: 0;

Input: 6; 26; Output: 1; Desired output: 1; Error: 0;

Input: 86; 63; Output: 0; Desired output: 0; Error: 0;

Input: 63; 9; Output: 0; Desired output: 0; Error: 0;

Input: 37; 19; Output: 0; Desired output: 0; Error: 0;

Input: 17; 15; Output: 0; Desired output: 0; Error: 0;

Input: 21; 23; Output: 1; Desired output: 1; Error: 0;

Input: 46; 32; Output: 0; Desired output: 0; Error: 0;

Input: 47; 24; Output: 0; Desired output: 0; Error: 0;

Input: 77; 55; Output: 0; Desired output: 0; Error: 0;

Input: 43; 38; Output: 0; Desired output: 0; Error: 0;

Input: 85; 76; Output: 0; Desired output: 0; Error: 0;

Input: 92; 6; Output: 0; Desired output: 0; Error: 0;

Total Mean Square Error: 0.0

Próba nr 7.

(dane wejściowe: 50, learning rate: 0,1)

Input: 74; 68; Output: 0; Desired output: 0; Error: 0;

Input: 22; 2; Output: 0; Desired output: 0; Error: 0;

Input: 19; 16; Output: 0; Desired output: 0; Error: 0;

Input: 0; 9; Output: 1; Desired output: 1; Error: 0;

Input: 74; 88; Output: 1; Desired output: 1; Error: 0;

Input: 54; 23; Output: 0; Desired output: 0; Error: 0;

Input: 57; 67; Output: 1; Desired output: 1; Error: 0;

Input: 47; 69; Output: 1; Desired output: 1; Error: 0;

Input: 98; 17; Output: 0; Desired output: 0; Error: 0;

Input: 75; 46; Output: 0; Desired output: 0; Error: 0;

Input: 8; 21; Output: 1; Desired output: 1; Error: 0;

Input: 39; 91; Output: 1; Desired output: 1; Error: 0;

Input: 31; 72; Output: 1; Desired output: 1; Error: 0;

Input: 97; 66; Output: 0; Desired output: 0; Error: 0;

Input: 63; 75; Output: 1; Desired output: 1; Error: 0;

Input: 52; 49; Output: 0; Desired output: 0; Error: 0;

Input: 86; 48; Output: 0; Desired output: 0; Error: 0;

Input: 97; 15; Output: 0; Desired output: 0; Error: 0;

Input: 78; 83; Output: 1; Desired output: 1; Error: 0;

Input: 4; 81; Output: 1; Desired output: 1; Error: 0;

Input: 27; 14; Output: 0; Desired output: 0; Error: 0;

Input: 41; 0; Output: 0; Desired output: 0; Error: 0;

Input: 72; 67; Output: 0; Desired output: 0; Error: 0;

Input: 63; 50; Output: 0; Desired output: 0; Error: 0;

Input: 100; 40; Output: 0; Desired output: 0; Error: 0;

Input: 19; 32; Output: 1; Desired output: 1; Error: 0;

Input: 72; 77; Output: 1; Desired output: 1; Error: 0;

Input: 71; 78; Output: 1; Desired output: 1; Error: 0;

Input: 22; 25; Output: 1; Desired output: 1; Error: 0;

Input: 16; 23; Output: 1; Desired output: 1; Error: 0;

Input: 17; 60; Output: 1; Desired output: 1; Error: 0;

Input: 25; 15; Output: 0; Desired output: 0; Error: 0;

Input: 61; 82; Output: 1; Desired output: 1; Error: 0;

Input: 27; 7; Output: 0; Desired output: 0; Error: 0;

Input: 40; 35; Output: 0; Desired output: 0; Error: 0;

Input: 95; 84; Output: 0; Desired output: 0; Error: 0;

Input: 34; 87; Output: 1; Desired output: 1; Error: 0;

Input: 80; 90; Output: 1; Desired output: 1; Error: 0;

Input: 6; 26; Output: 1; Desired output: 1; Error: 0;

Input: 86; 63; Output: 0; Desired output: 0; Error: 0;

Input: 63; 9; Output: 0; Desired output: 0; Error: 0;

Input: 37; 19; Output: 0; Desired output: 0; Error: 0;

Input: 17; 15; Output: 0; Desired output: 0; Error: 0;

Input: 21; 23; Output: 1; Desired output: 1; Error: 0;

Input: 46; 32; Output: 0; Desired output: 0; Error: 0;

Input: 47; 24; Output: 0; Desired output: 0; Error: 0;

Input: 77; 55; Output: 0; Desired output: 0; Error: 0;

Input: 43; 38; Output: 0; Desired output: 0; Error: 0;

Input: 85; 76; Output: 0; Desired output: 0; Error: 0;

Input: 92; 6; Output: 0; Desired output: 0; Error: 0;

Total Mean Square Error: 0.0

3. Wnioski

Szybkość uczenia się perceptronu jest uzależniona od dwóch wartości: współczynnika uczenia, oraz ilości danych uczących.

Im większy współczynnik tym mniejsza ilość prób jest potrzebna do nauczenia się perceptronu, ale wynik często nie jest tak dokładny.

Im mniejsza ilość danych tym potrzebna jest większa ilość prób na naukę perceptronu.