

Perceptron

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i Szkolnictwa Wyższego



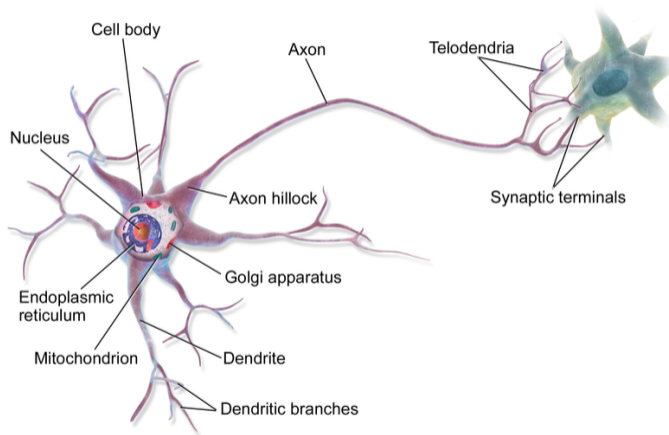
NAUKA DLA
SPOŁECZEŃSTWA



IITiS



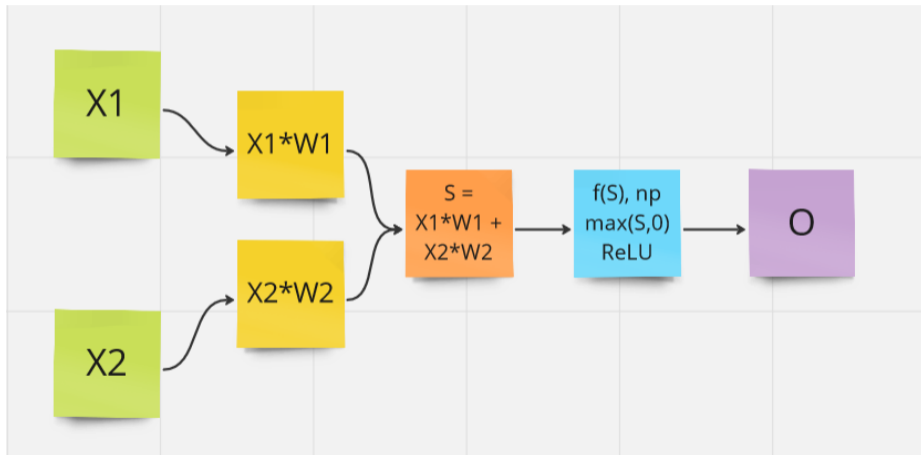
Neuron

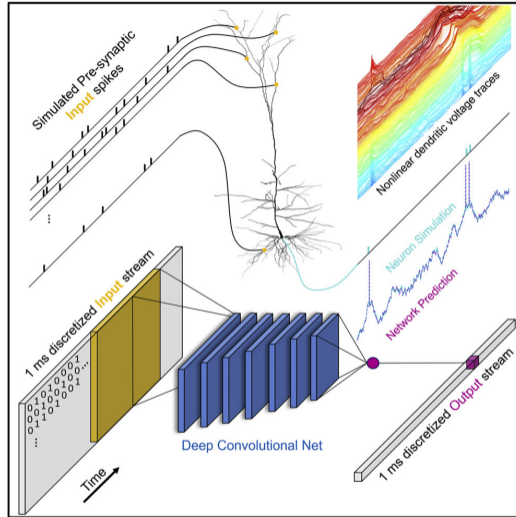


https://en.wikipedia.org/wiki/File:Blausen_0657_MultipolarNeuron.png, User:BruceBlaus, CC 3



✦ Sztuczny neuron (perceptron)





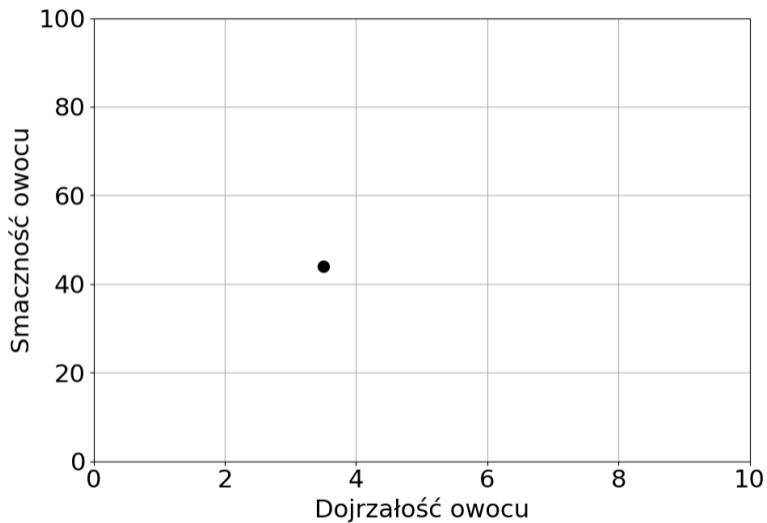
Przykład („toy example”) owoce

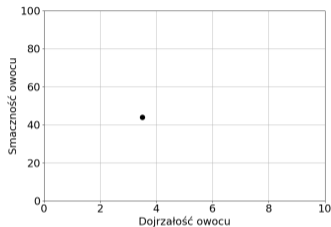




https://en.wikipedia.org/wiki/File:Veraison_Cabernet_Sauvignon.jpg, User:Dominique Hessel, CC 3



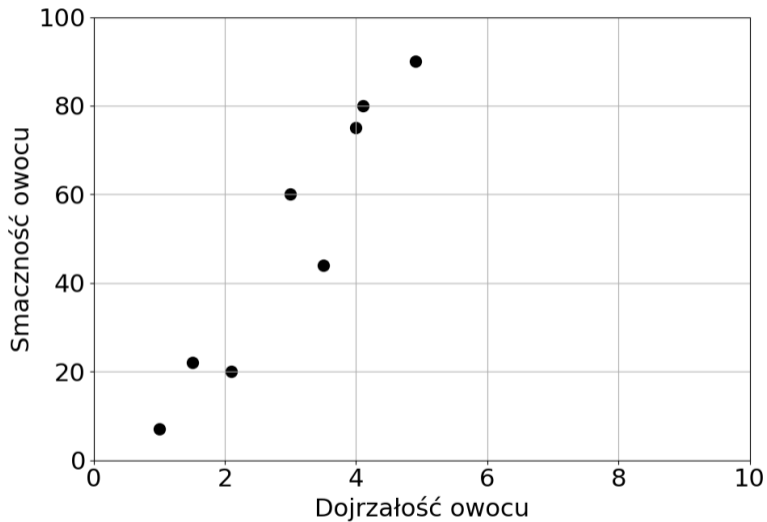




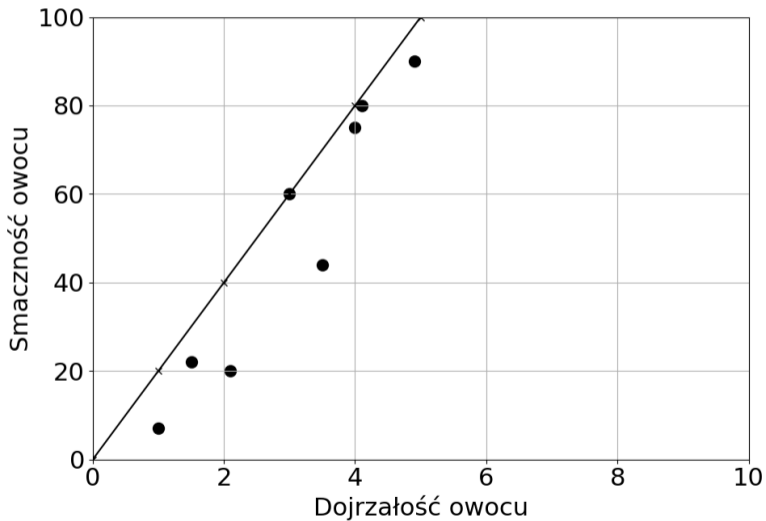
$y = f(wx + b)$, x dojrzałość, y smaczność

np. $f(a) = \max(a, 0)$ (ReLU), $f(a) = \frac{1}{1+e^{-a}}$ (sigmoid), $f(a) = \frac{e^a - e^{-a}}{e^a + e^{-a}}$ (tanh)

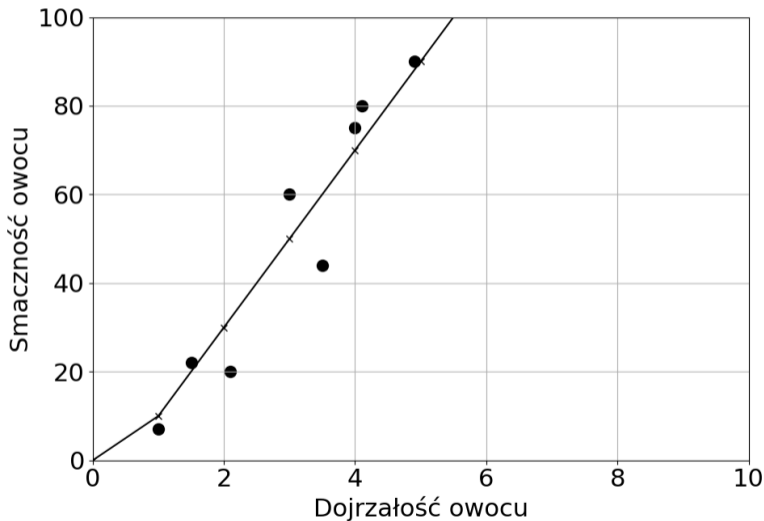




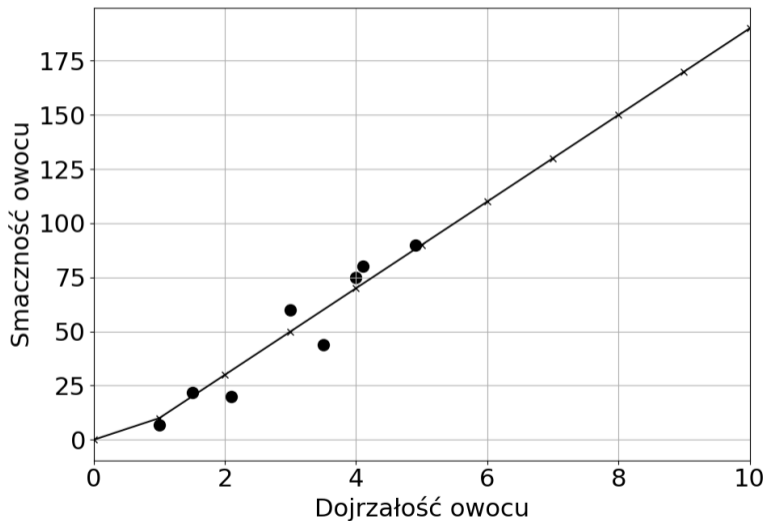
$$y = 20x$$



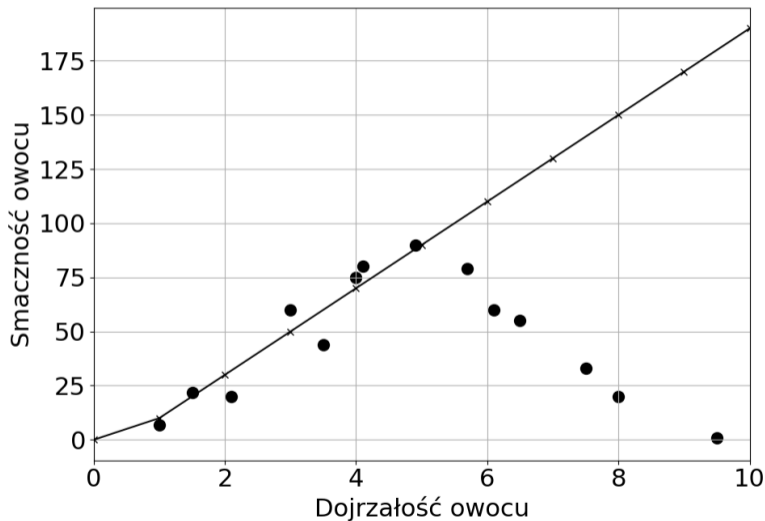
$$y = \max(20x - 10, 0)$$



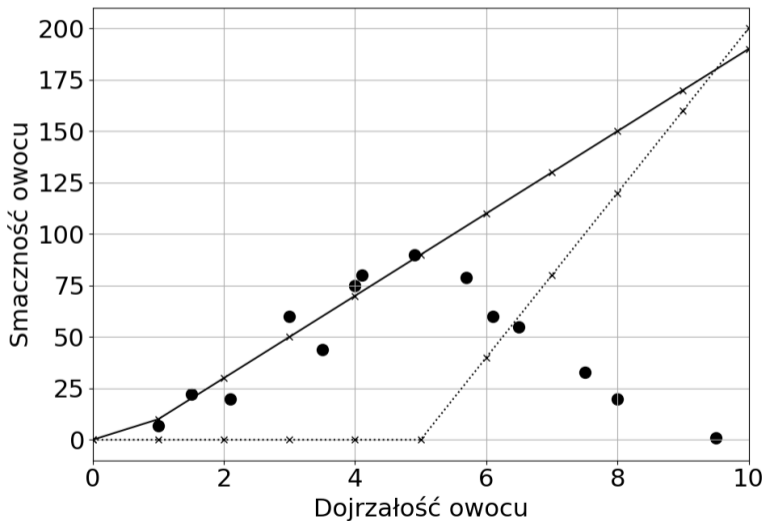
$$y = \max(20x - 10, 0)$$



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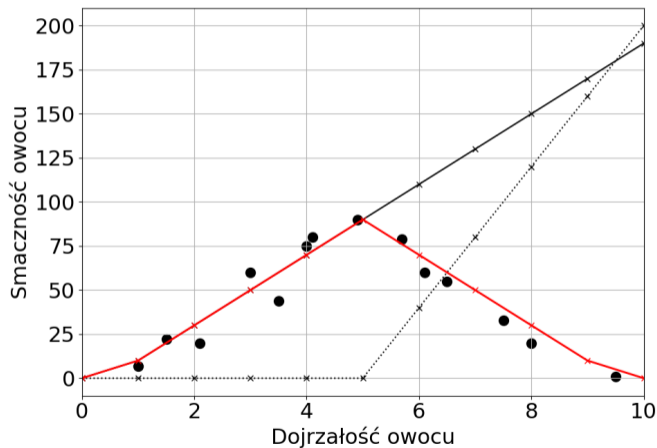


$$y = \max(20x - 10, 0) \quad y_2 = \max(40x - 200, 0)$$



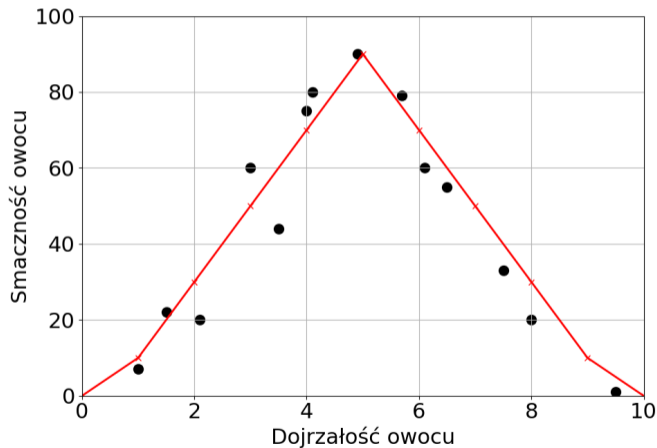
$$y = \max(20x - 10, 0) \quad y_2 = \max(40x - 200, 0)$$

$$y_{\text{out}} = \max(y - y_2, 0)$$



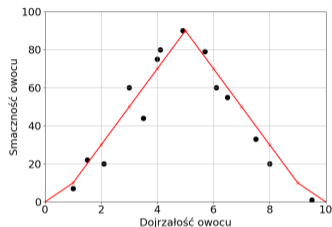
$$y = \max(20x - 10, 0) \quad y_2 = \max(40x - 200, 0)$$

$$y_{\text{out}} = \max(y - y_2, 0)$$



$$y = \max(20x - 10, 0) \quad y_2 = \max(40x - 200, 0)$$

$$y_{\text{out}} = \max(1y - 1y_2 + 0, 0)$$



wynik działa :)

$$x \rightarrow y \quad x \rightarrow y_2$$

$$y \rightarrow y_{\text{out}} \leftarrow y_2$$

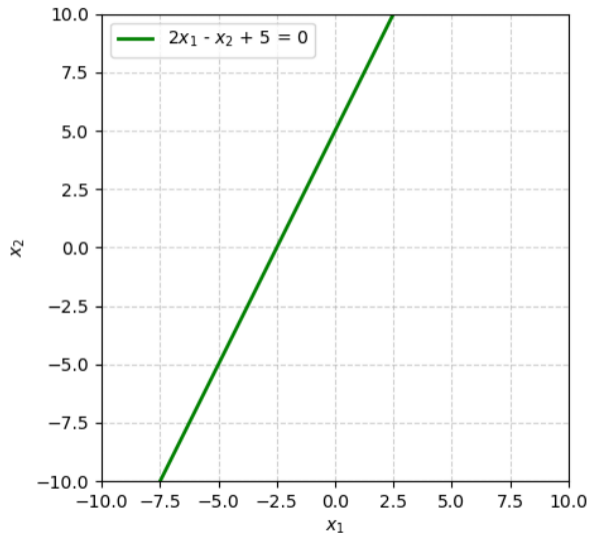
model architektura (schemat połączeń neuronów) oraz wagi (20, -10, 40, -200, 1, -1, 0)

dodatkowo zbiór danych / model dopasowany do zbioru danych; hierarchie cech



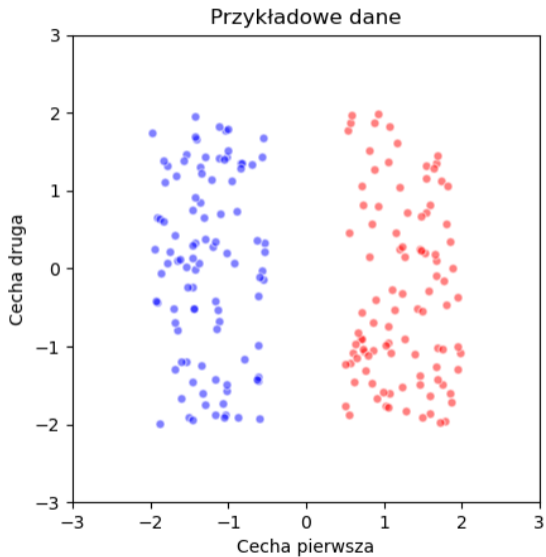
Hierarchie cech

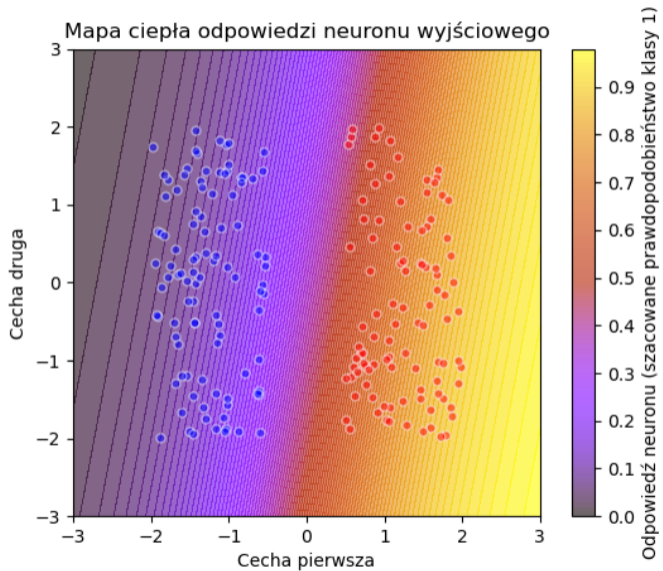


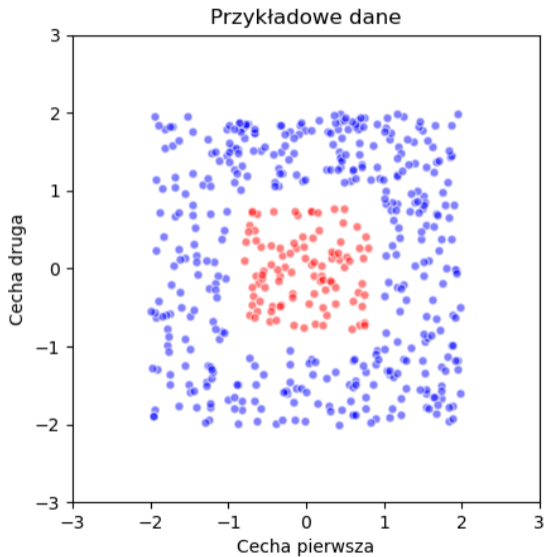


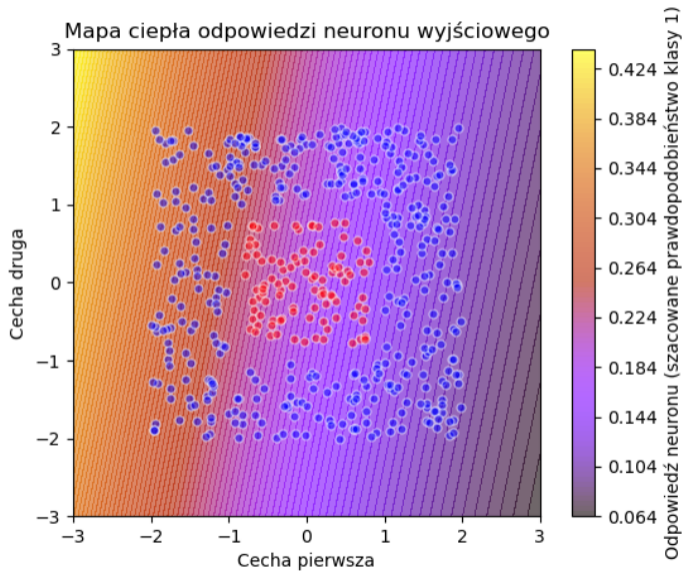
Jeden neuron wyjściowy, $\otimes\otimes \rightarrow \odot$

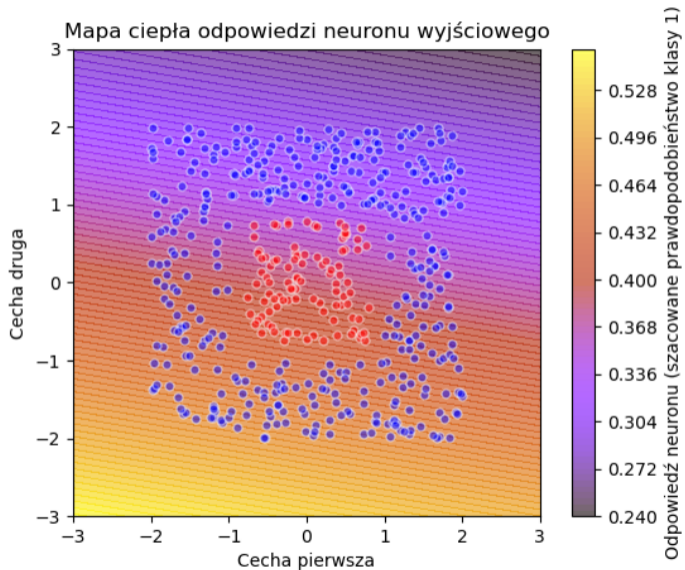








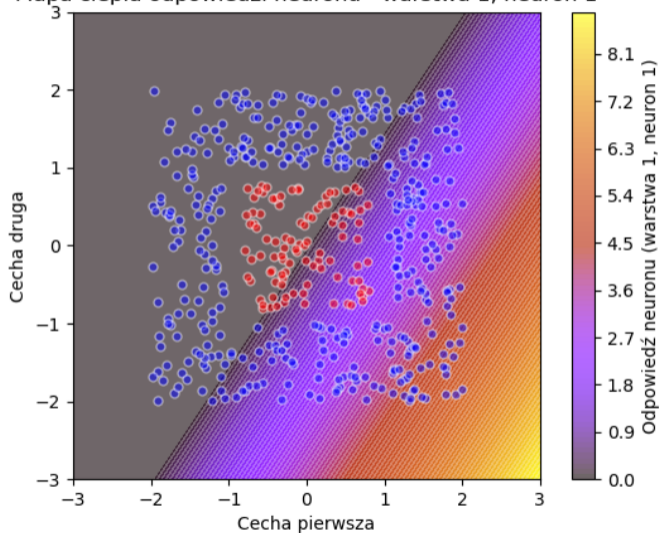




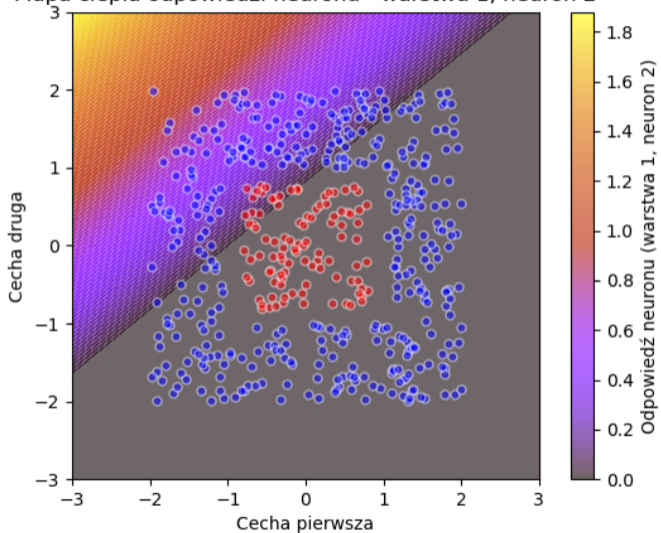
Jeden neuron wyjściowy, cztery w warstwie ukrytej * → ⊖ ⊖ ⊖ ⊖ → ⊙



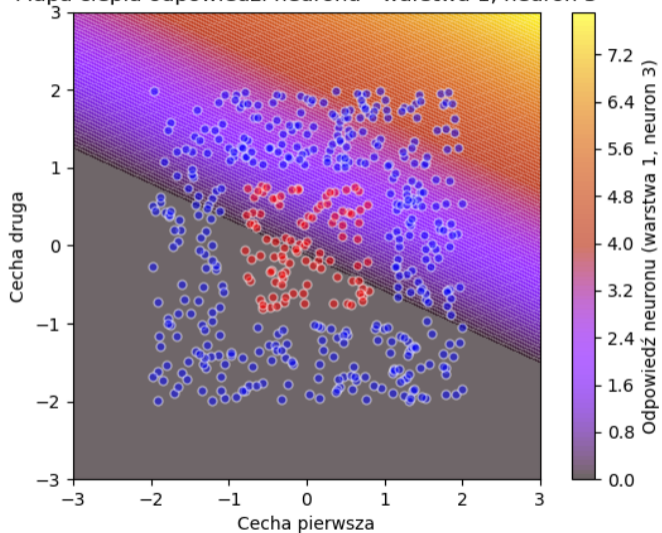
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 1



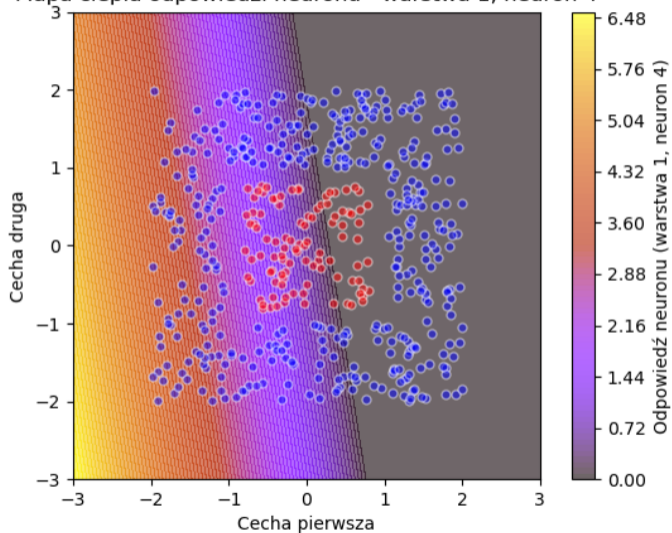
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 2

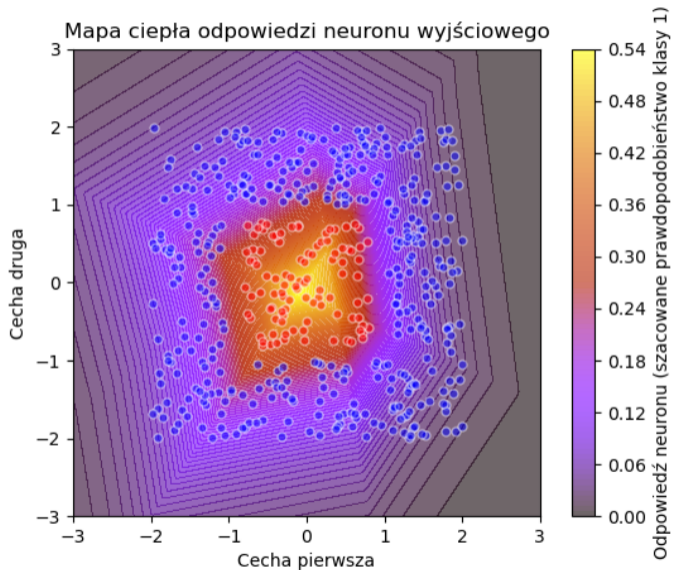


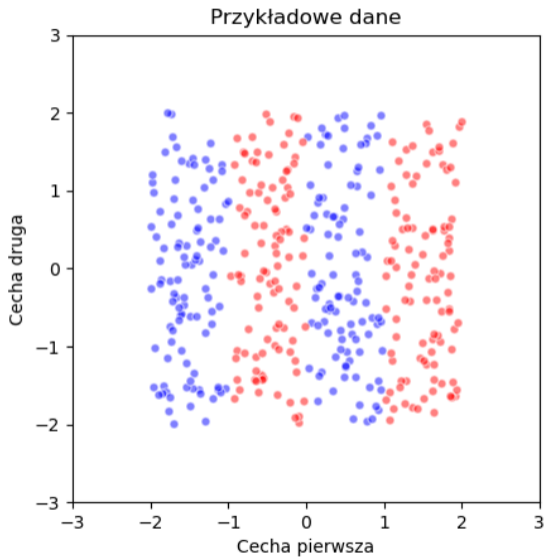
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 3



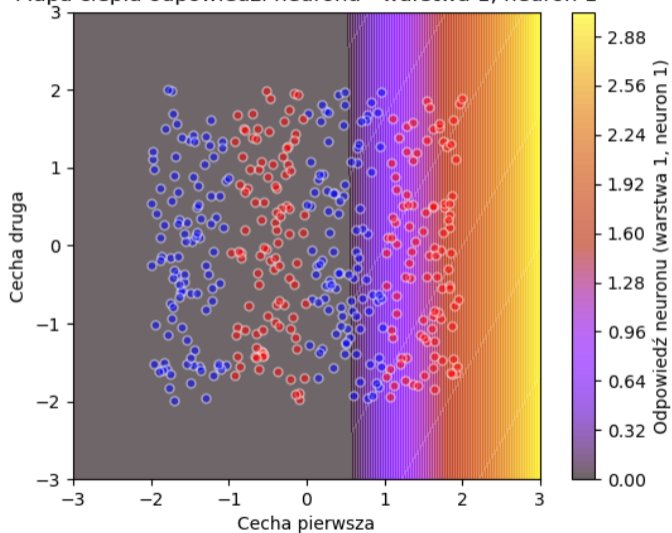
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 4



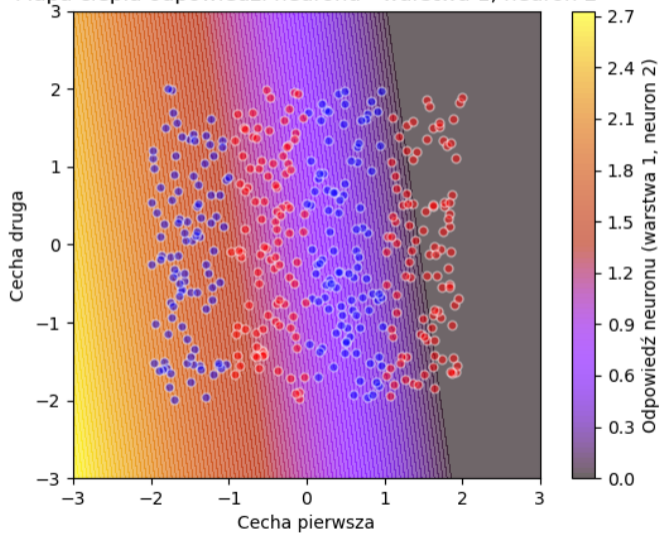




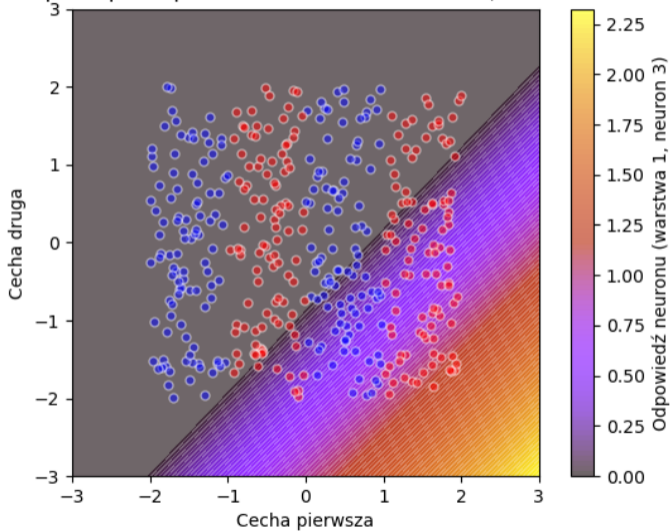
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 1



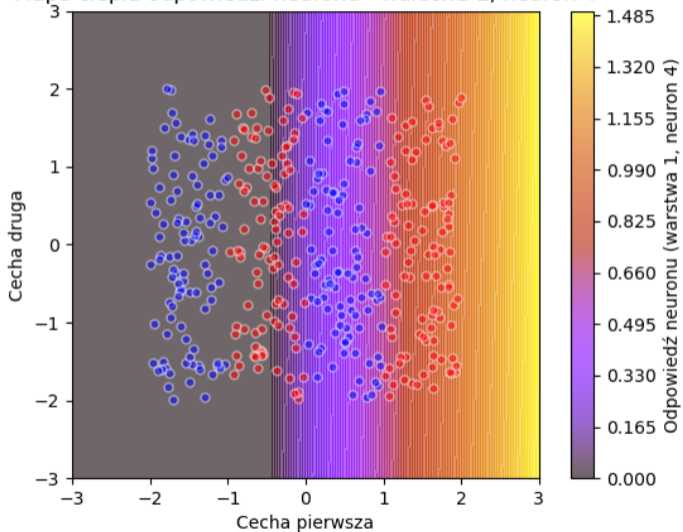
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 2

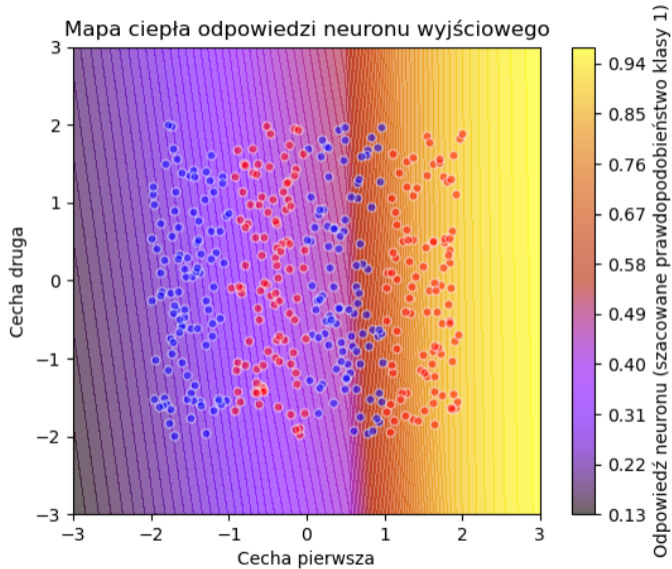


Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 3



Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 4

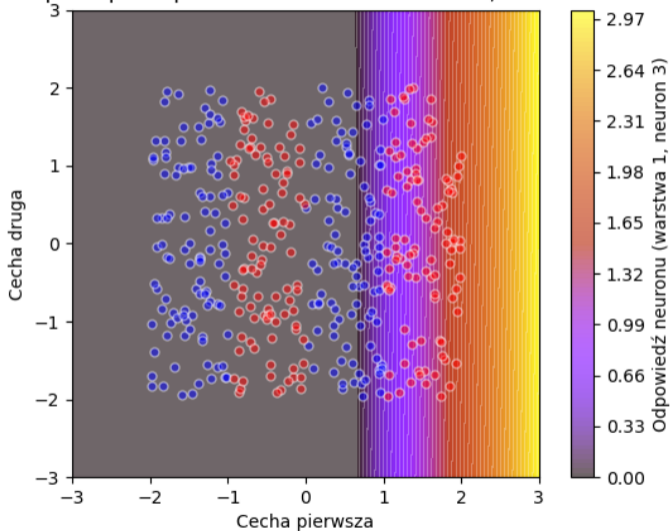




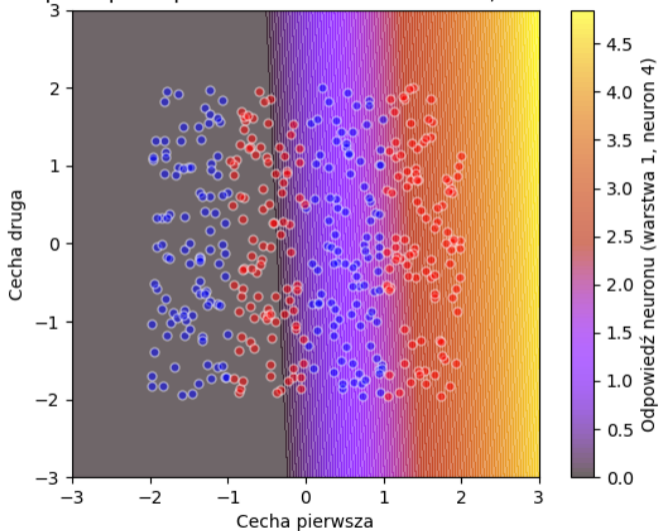
2 warstwy ukryte (5, 5), $\otimes \otimes \rightarrow \ominus \ominus \ominus \ominus \ominus \rightarrow \ominus \ominus \ominus \ominus \ominus \rightarrow \odot$



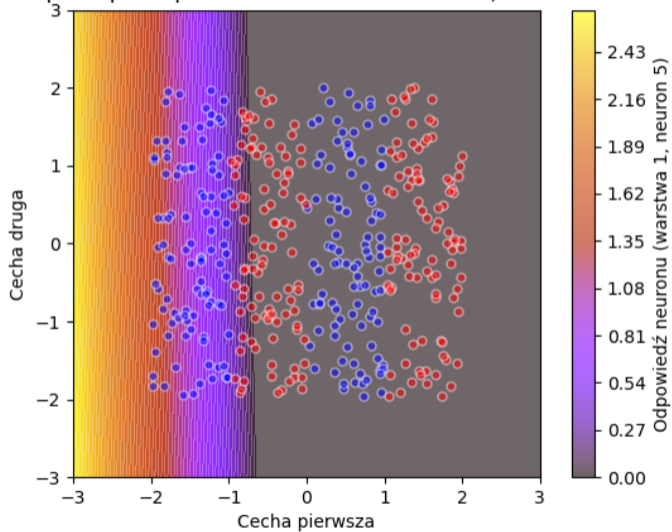
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 3



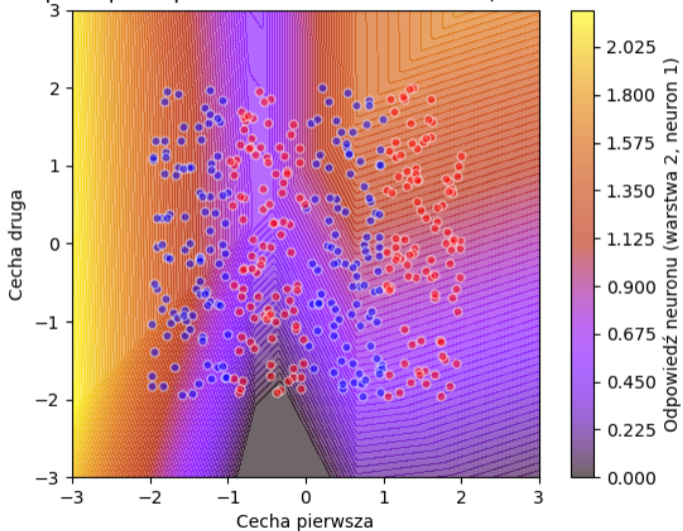
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 4



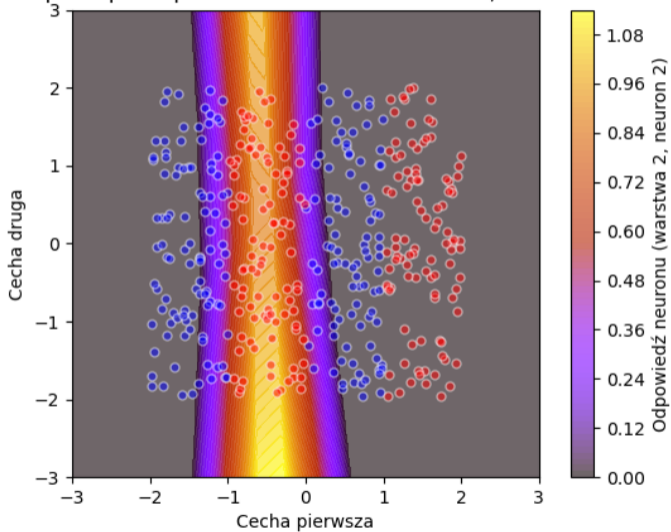
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 5



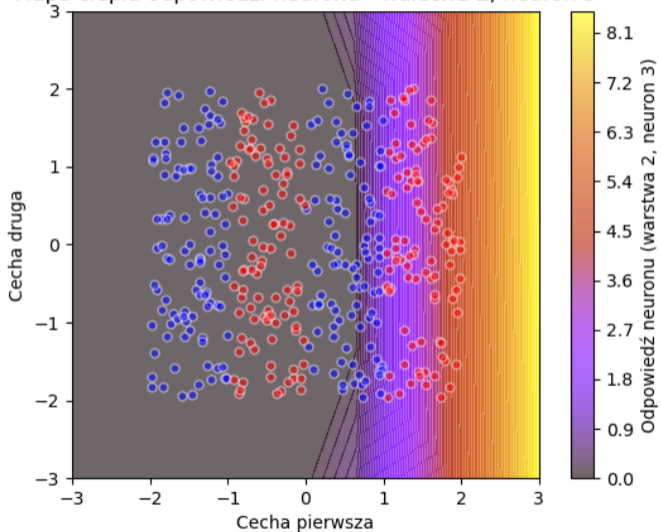
Mapa ciepła odpowiedzi neuronu - warstwa 2, neuron 1



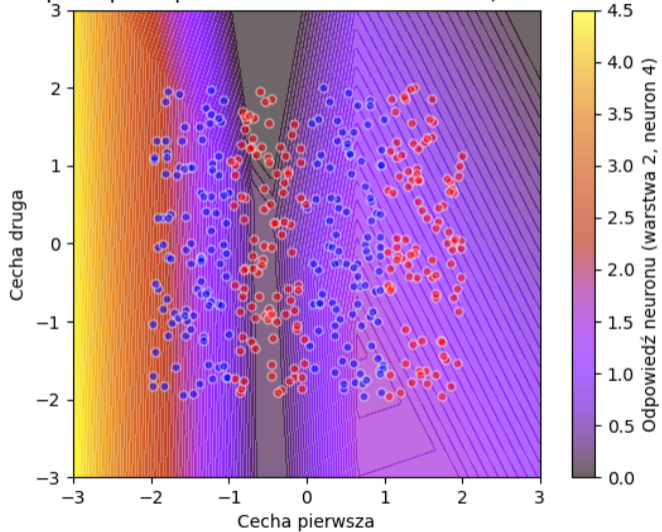
Mapa ciepła odpowiedzi neuronu - warstwa 2, neuron 2



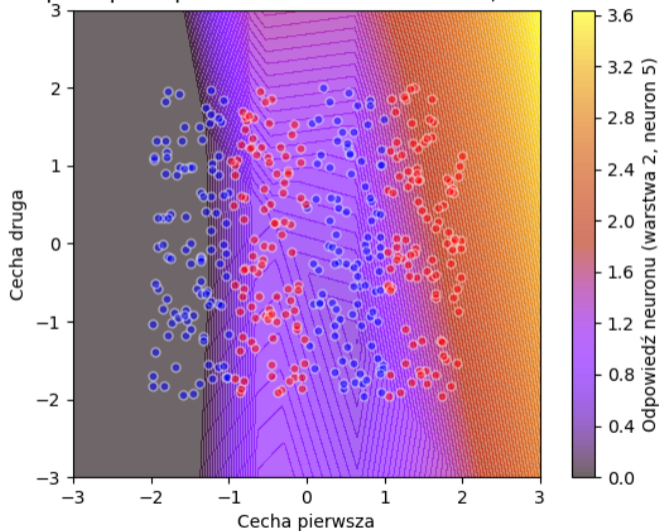
Mapa ciepła odpowiedzi neuronu - warstwa 2, neuron 3

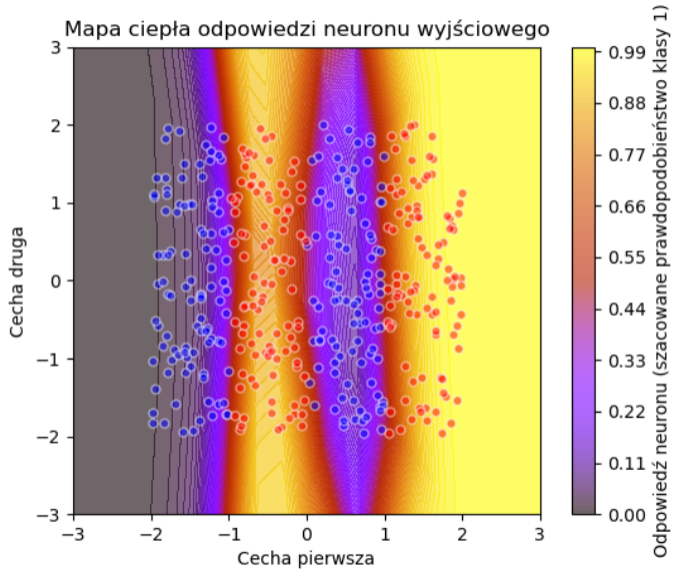


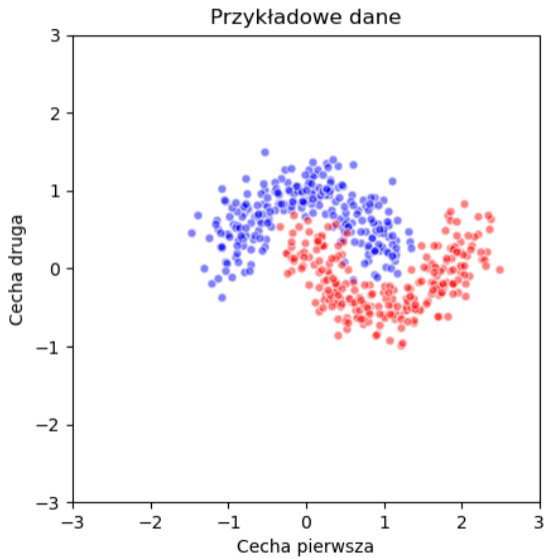
Mapa ciepła odpowiedzi neuronu - warstwa 2, neuron 4



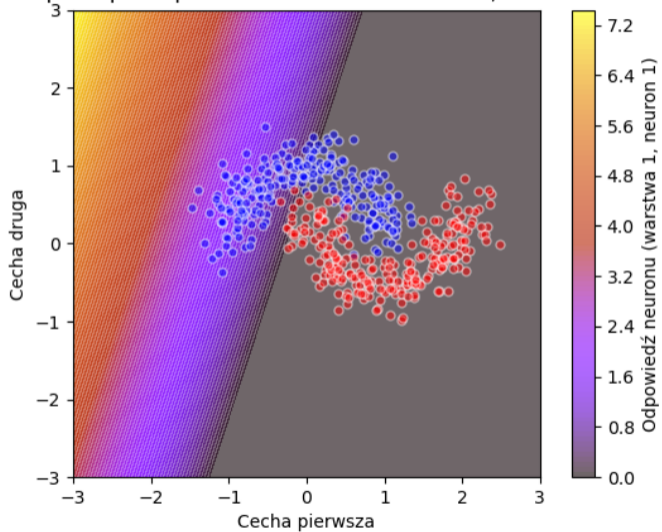
Mapa ciepła odpowiedzi neuronu - warstwa 2, neuron 5



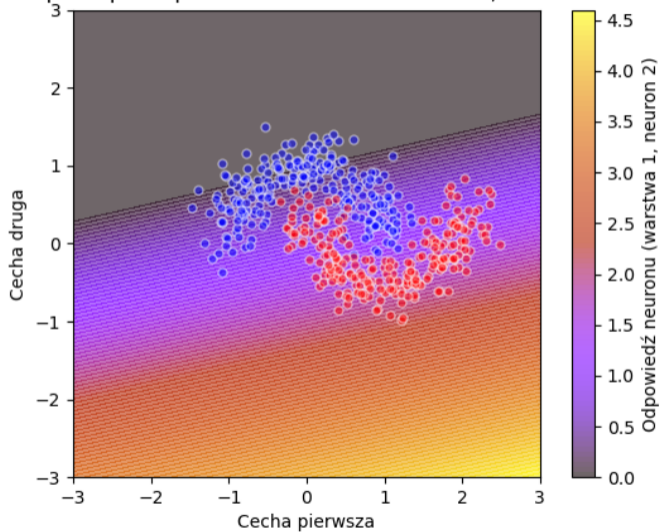




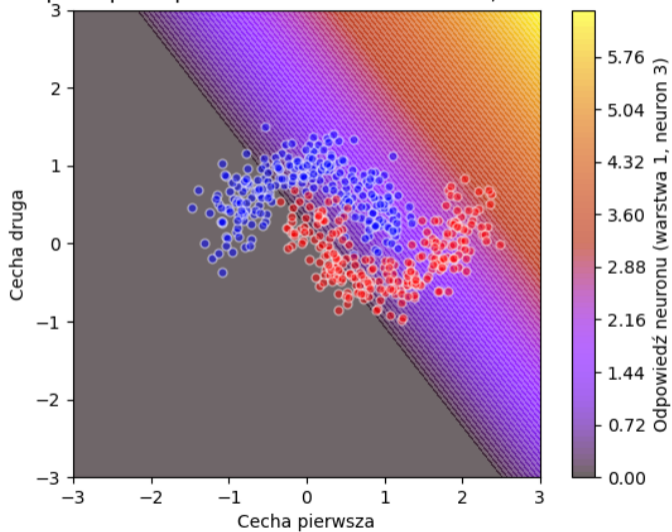
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 1



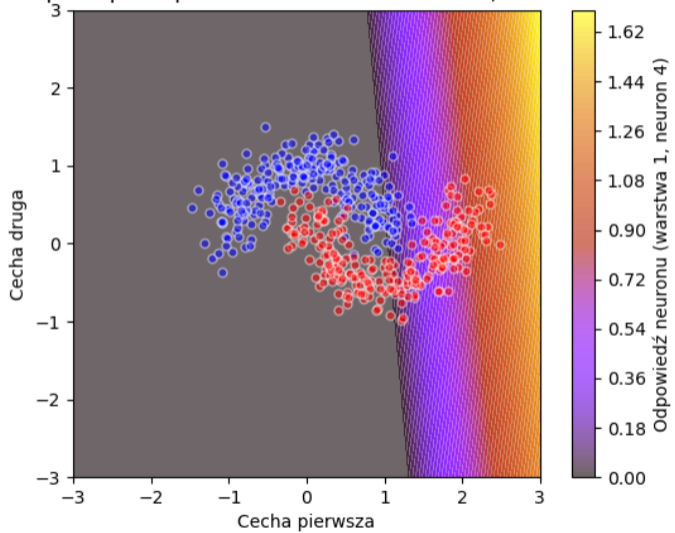
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 2



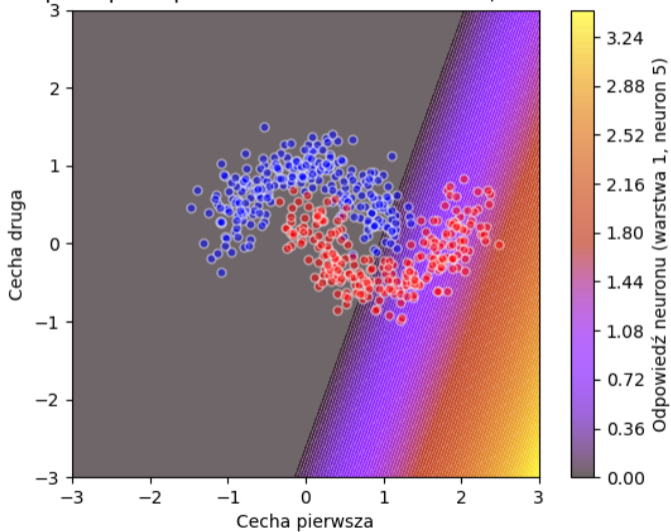
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 3



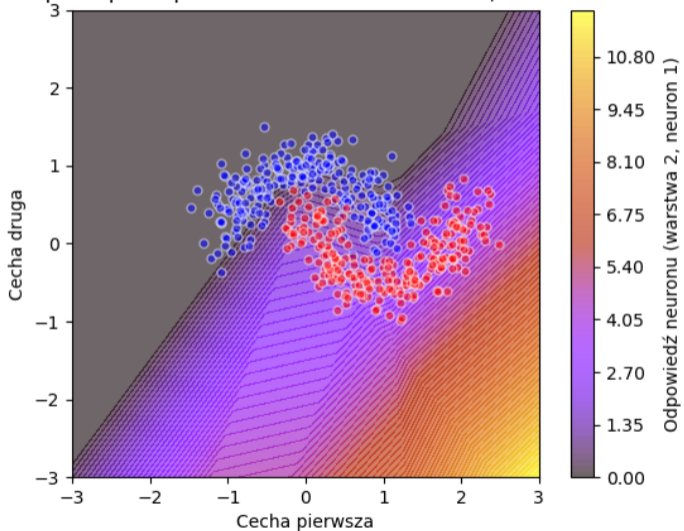
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 4



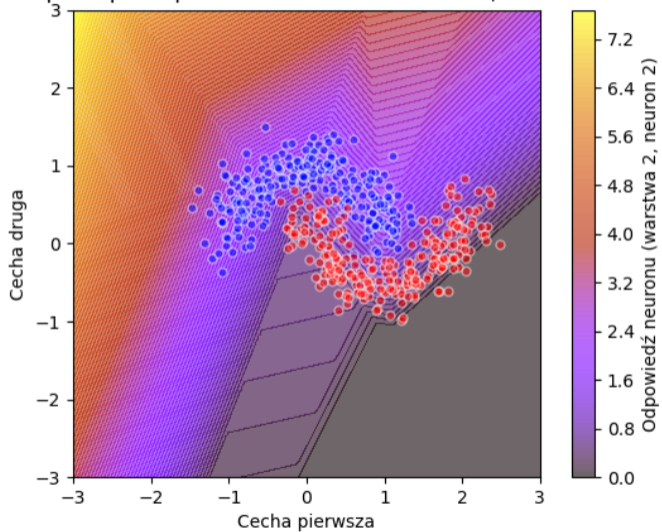
Mapa ciepła odpowiedzi neuronu - warstwa 1, neuron 5



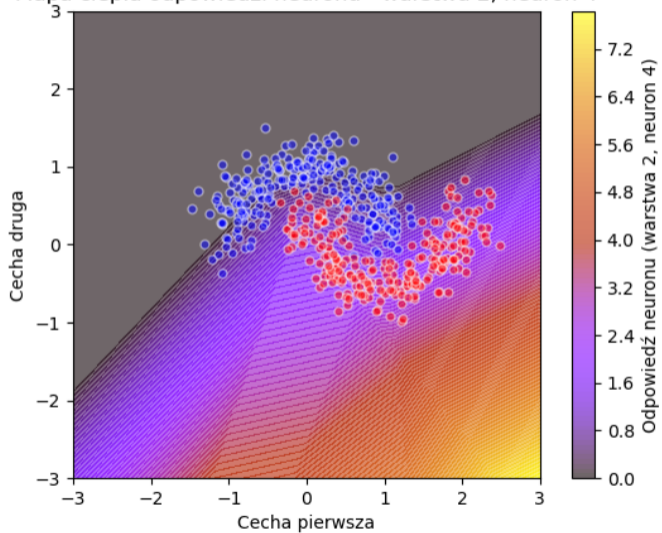
Mapa ciepła odpowiedzi neuronu - warstwa 2, neuron 1

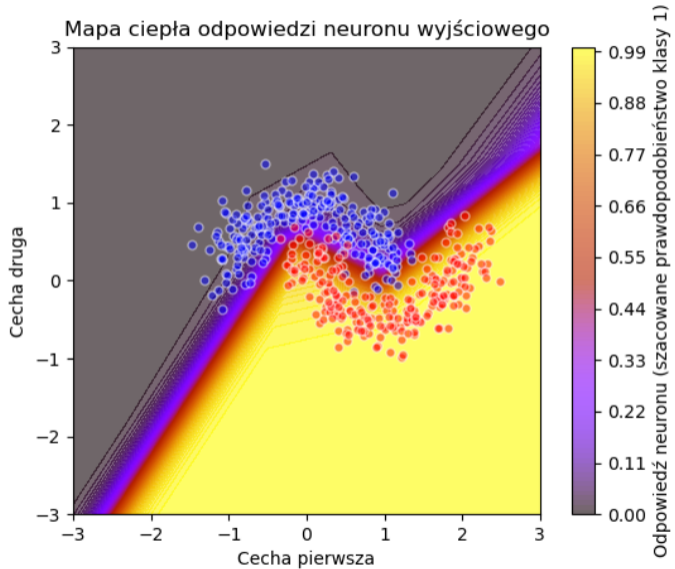


Mapa ciepła odpowiedzi neuronu - warstwa 2, neuron 2



Mapa ciepła odpowiedzi neuronu - warstwa 2, neuron 4





2 warstwy ukryte (10, 10), $\otimes \otimes \rightarrow 10 \times \ominus \rightarrow 10 \times \ominus \rightarrow \odot$



