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Lab 5 – Neural networks

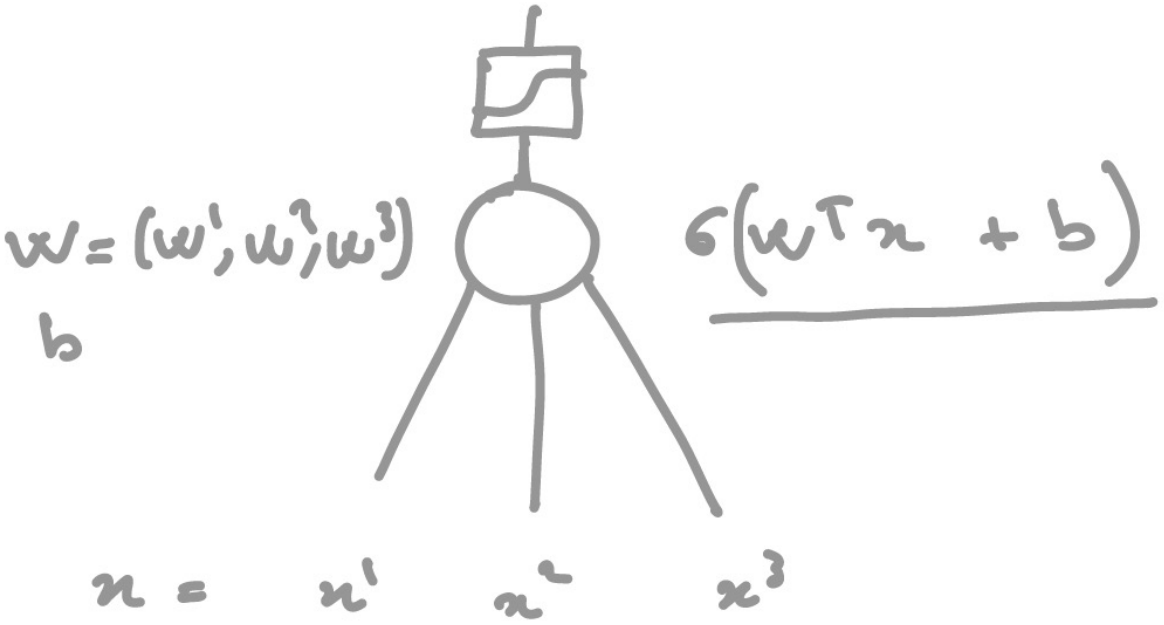
A path to non-linearity

$$f_w(x) = w^T x = \sum_{j=1}^{d} w^j x^j$$

$$f_w(x) = w^T \Phi(x) = \sum_{j=1}^{p} w^j \phi^j(x)$$

$$f_w(x) = \sum_{i=1}^{n} w^i K(x, x_i)$$

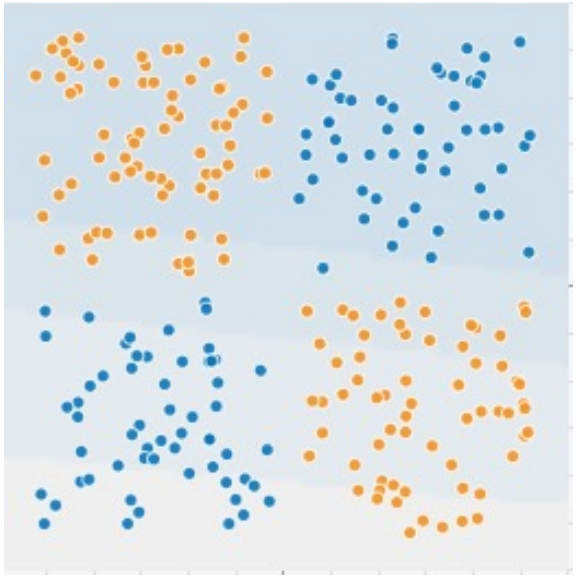
Neural networks

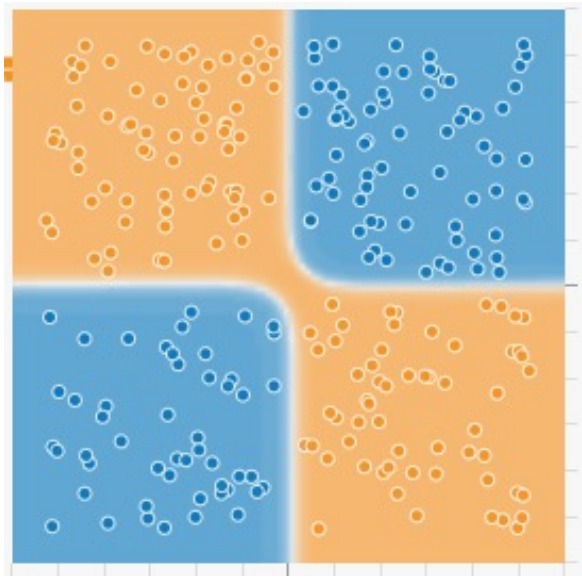


Non-linear activation functions

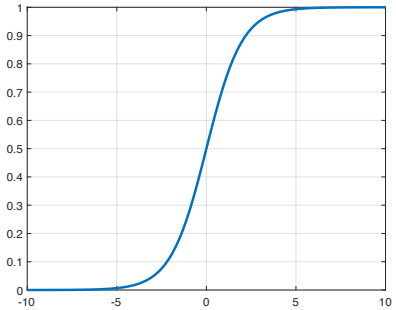
They introduce non-linearities into the network

https://playground.tensorflow.org

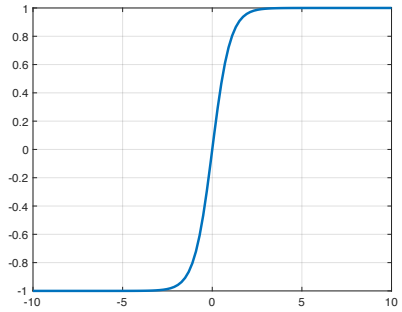




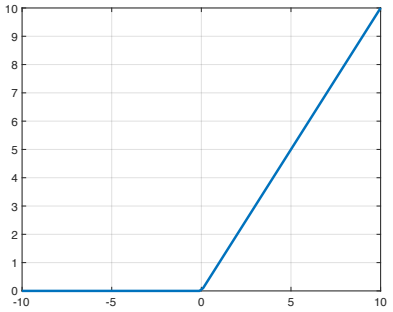
Non-linear activation functions



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

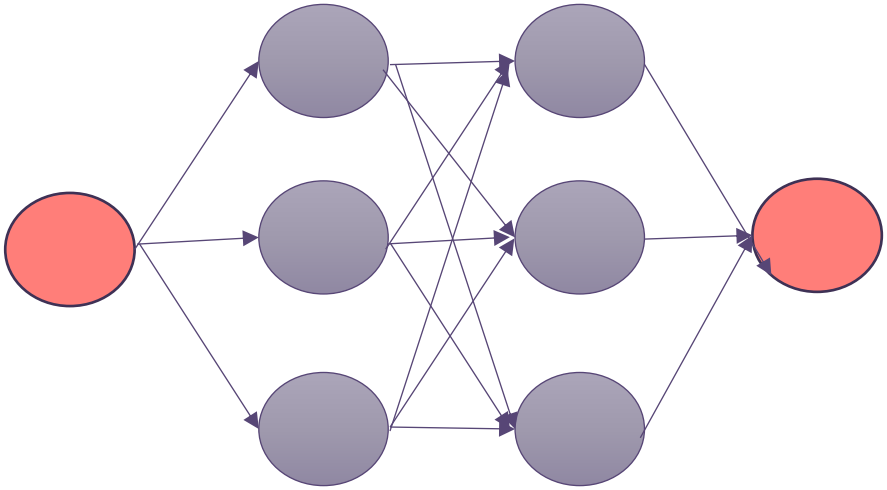


$$tanh(x) = \frac{e^{x} - e^{-x}}{e^{x} + e^{-x}}$$



$$f(x) = max(0, x)$$

Let’s stack neurons



Your objectives today

Play with neural networks, their structure and training choices

- Investigate what happens as you increase the number of neurons in a layer or the number of layers
  - Shallow network with very few neurons (e.g. 2)
  - Shallow network with more neurons
  - Deeper network with many neurons
- Consider a more complicated input data

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