# Neural Networks
- Homework 1 -

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1   Mind map

Neural network (NN) is a parallel distributed system consisted of computing cells ("neurons") that is capable of storing and using experimental knowledge to model a brain in processes of certain tasks performance.

Figure 1: S. Haykin, Neural Networks, chapter 1. Mind map (a zoomed version of the map is attached as NN.png file).
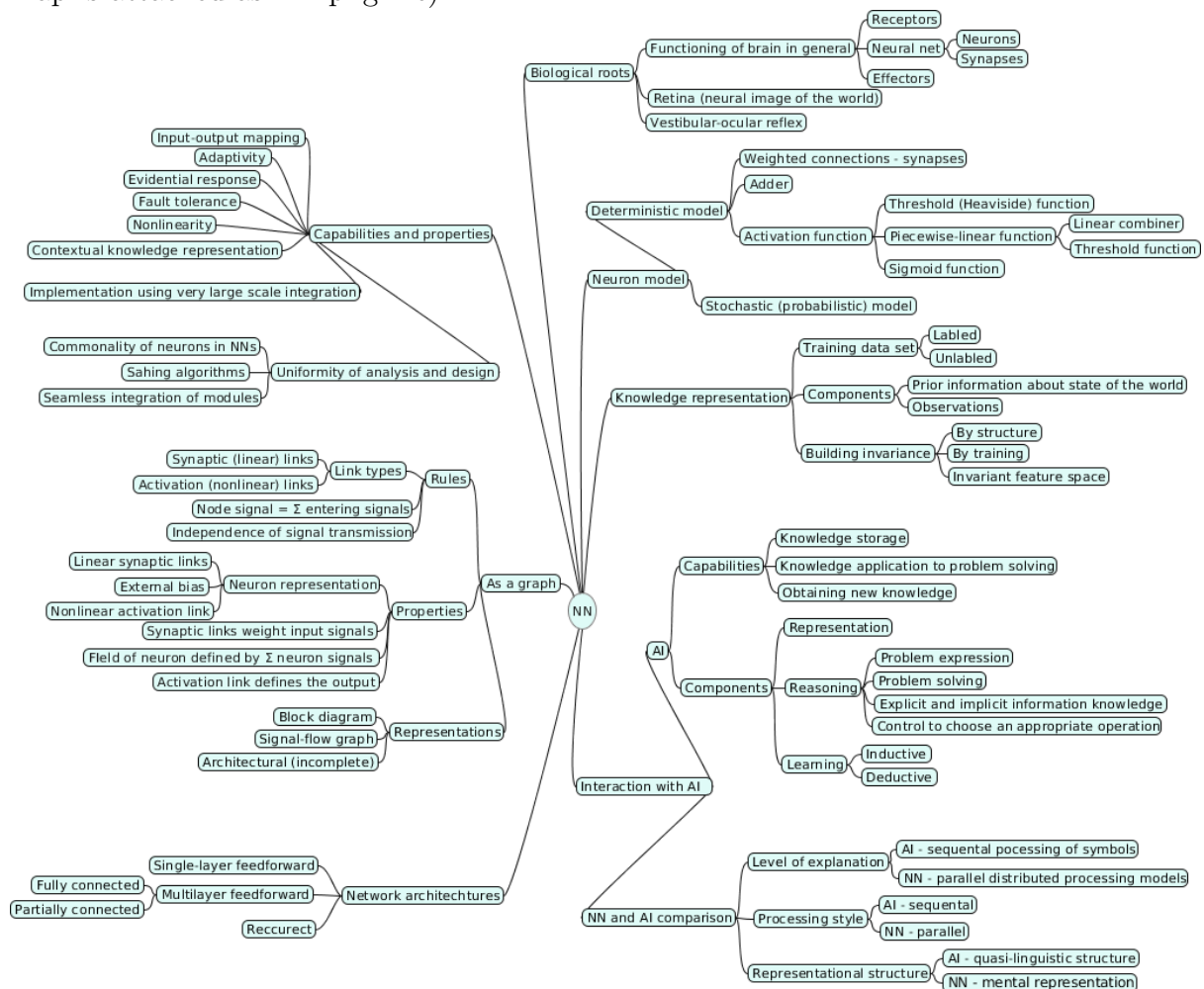
2 Exercises

2.1 Exercise 1.1

$\phi(v) = \frac{1}{1+exp(-av)}$

Show that $\frac{d\phi(v)}{dv} = a\phi(v)[1 - \phi(v)]$. What is the value of this derivative at the origin?

Solution:

$\frac{d\phi(v)}{dv} = \frac{d((1+exp(-av))^{-1})}{dv} = -\frac{-a \cdot exp(-av)}{(1+exp(-av))^2} = \frac{a(exp(-av)+1-1)}{(1+exp(-av))^2} = \frac{a}{(1+exp(-av))}\left(1 - \frac{1}{(1+exp(-av))}\right) = a\phi(v)[1 - \phi(v)]$

$\frac{a}{(1+exp(-a \cdot 0))}\left(1 - \frac{1}{(1+exp(-a \cdot 0))}\right) = \frac{a}{(1+1)}\left(1 - \frac{1}{(1+1)}\right) = \frac{1}{4}$