Course G: Basic neurosciences 2
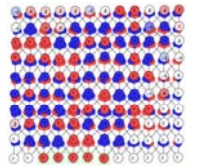
Computational neuroscience
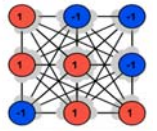
Tutorial
Emil Ratko-Dehnert
Summer term 2011

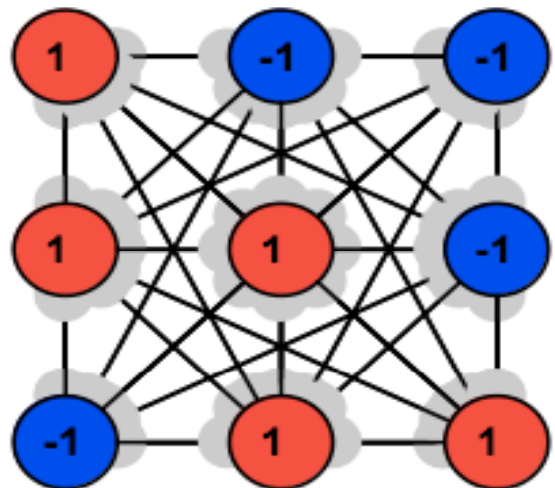# Last time

- **Introduction to** simbrain

- **Labs on**

    1. Propagation of activation

    2. Vectors in NN; OR vs XOR

    3. Node rules and weights

Outlook

- Short review of pattern association

  – Auto- vs. Hetero-associative networks

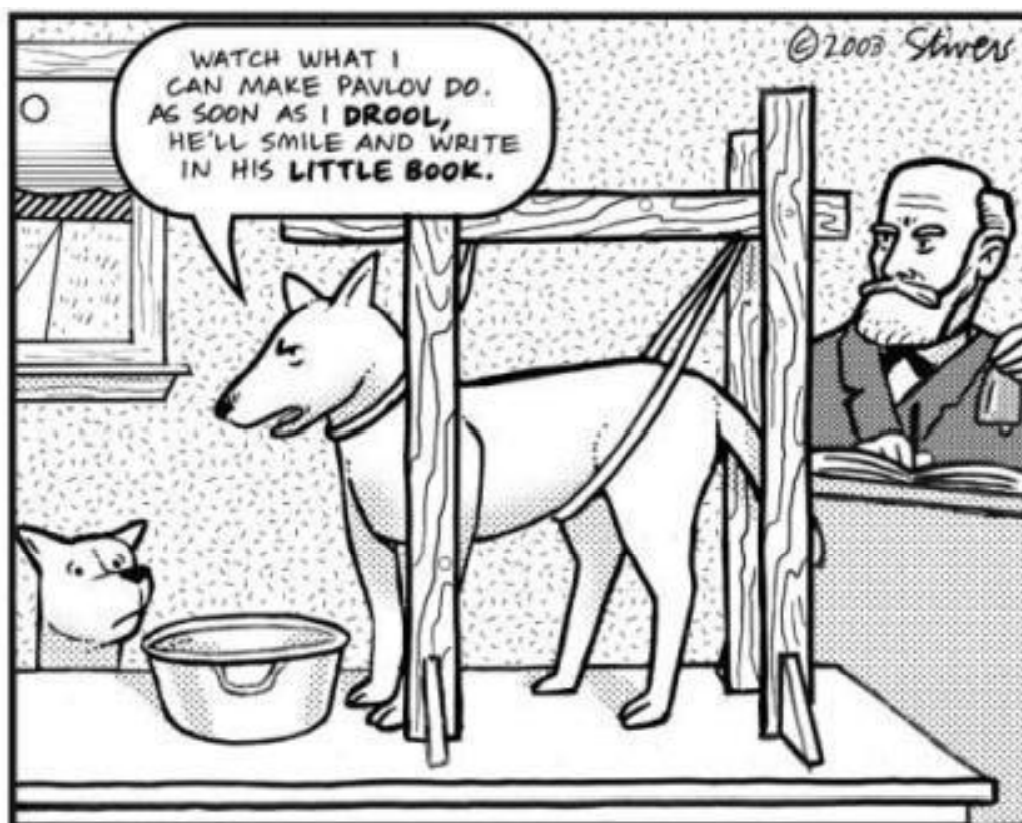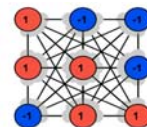 – Feedforward vs. Recurrent networks

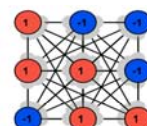- Time to fill out Evaluation

---

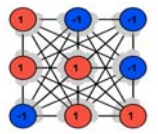Session 3

PATTERN ASSOCIATION

Patterns in the world

- Central aspect of cognition is forming associations between stimuli, concepts and other patterns in the world

  – E.g. Pawlowian Dog

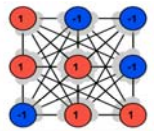 – Seeing a photo, recalling details of a vacation

Pattern association

- Pattern association is a traditional app-lication in neural networks

- Widely used to model human memory, conditioning work and also in engineering, to study effective ways of storing infor-mation
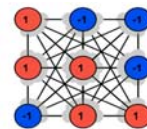
Basic Concepts

- A pattern associator (or associative memory) is one which associates an input pattern with an output pattern.

- PA are usually trained by showing them input patterns and in some sense telling them what target pattern they should produce in response
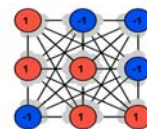
Auto- vs. Heteroassociative networks

- Heteroassociative networks are trained to associate each input vector with a specific output vector

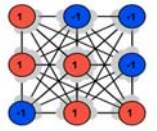- Auto-associative networks is trained to associate each input with itself.
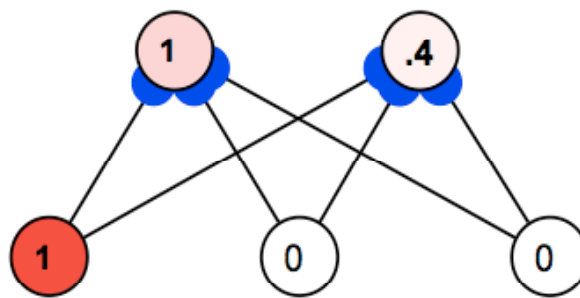
Why do this?

- Pattern completion, i.e. Associate from a fragment of a pattern with the whole pattern

- Psychological analgoy:

  - Seeing part of a picture and imagining/ completing the whole
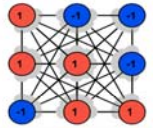
Feed-forward networks

- Feed-forward networks can implement both auto- and hetero-associative networks.

- The hetero-ass. network below couples 3D vectors in a 2D space.
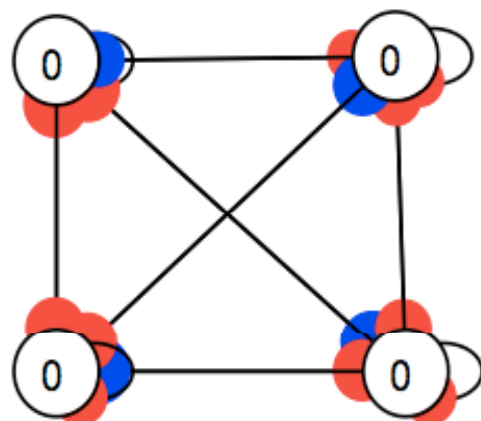
Recurrent networks

- Recurrent networks tend to be used to implement auto-associative networks

- The input pattern is an initial state, supplied to the network, the target pattern is the pattern it settles into (the so-called nearest attractor)

And now to the labs!