

# Neural Networks seminar - summer term 2024

- Hopfield model:

- Ising model with multiple coupling constants:  $H = \sum_{i \neq j} J_{ij} S_i S_j$
- Usability as associative memory
- Analogous to spin glasses, Replica theory

- Perceptron

- Linear separability, XOR-problem

- Learning and minimization

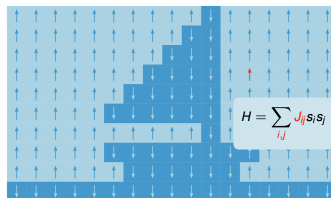
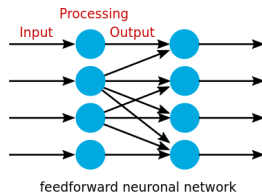
- Model complexity
- High dimensional statistics
- Minimization algorithms

- Supervised learning

- Deep NNs, convolutional NNs
- MNIST data set

- Unsupervised learning

- Generative networks
- Max-Ent models



Review article for physicists: [arXiv:1803.08823](https://arxiv.org/abs/1803.08823)

# Formalities

## Time and Requirements

Organisational meeting: Thursday 11.04.2024, 15:15, P912

Times: to be discussed

- seminar talk, programming / written report
- depending on number of participants in teams of two
- language depending on participants English or German
- questions: niklas.grimm ; philipp.stengele ; matthias.fuchs

## Prerequisites

- Hamiltonian mechanics
- Gibbs-Boltzmann distribution
- Gibbs entropy
- Ising model

## Concepts

- Probability distributions
- Monte-Carlo
- Bayesian inference
- High dimensional statistics