Some computational aspects of attractor memory

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Abstract

In this thesis I present novel mechanisms for certain computational capabilities of the cerebral cortex, building on the established notion of attractor memory. A sparse binary coding network for generating efficient representation of sensory input is presented. It is demonstrated that this network model well reproduces receptive field shapes seen in primary visual cortex and that its representations are efficient with respect to storage in associative memory. I show how an autoassociative memory, augmented with dynamical synapses, can function as a general sequence learning network. I demonstrate how an abstract attractor memory system may be realized on the microcircuit level -- and how it may be analyzed using similar tools as used experimentally. I demonstrate some predictions from the hypothesis that the macroscopic connectivity of the cortex is optimized for attractor memory function. I also discuss methodological aspects of modelling in computational neuroscience.

Key Words
Datalogi, attractor memory, cerebral cortex, neural networks