CRETE CENTER FOR
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CCQCN SEMINAR

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3rd Floor Seminar Room

Associative memory: Lessons from engineering and neuroscience

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FORTH-IMBB

Abstract

Associative memory is one of the oldest artificial neural network (ANN) paradigms. The concept of the associative memory was first introduced by the formalism of a correlation matrix. In the correlation matrix, memory patterns are encoded as the activity patterns across a network of computing units. Patterns are stored in memory by Hebbian modification of the connections between the computing units. A memory is recalled when an activity pattern that is a partial or noisy version of a stored pattern is instantiated in the network. Network activity then evolves to the complete stored pattern as appropriate units are recruited to the activity pattern, and noisy units are removed, by threshold-setting of unit activity. Memory capacity for accurate recall is strongly dependent on the form of patterns to be stored and the learning rule employed. Associative memory networks can be found everywhere in the brain. Hippocampus is a brain region where episodic and spatial memories are stored. Much is known about the anatomical, physiological and molecular characteristics as well as the connectivity and synaptic properties of various cell types in the hippocampal circuits, but how these detailed properties of individual neurons give rise to the encoding and retrieval of memories remains unclear. Computational models play an instrumental role in providing clues on how these processes may take place. In this talk, I will present computational models of associative memories in the hippocampus. Issues such as retrieval of memories as a function of cue loading, presentation frequency and learning paradigm, memory capacity, recall performance will be discussed. I hope to convey the message that computational models can lead to a number of experimentally testable predictions that may lead to a better understanding of the biophysical computations in the brain.

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