Implicit hierarchy through autonomous neural dynamics

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The dense homogeneous associative network (dHAN) is based on an undirected weighted graph, where every edge represents a weak excitatory link between neurons. Neurons without excitatory connection are suppressing each other via strong inhibition. This results in a dynamical system, where every clique defines a stable attractor. To every node of this WTA network a 'reservoir' variable is introduced; the efferent strength of every neuron is modulated by this reservoir. By depleting the reservoir, when the node is active, and regenerating it, when inactive, the former stable attractors turn into transient attractors of the system.

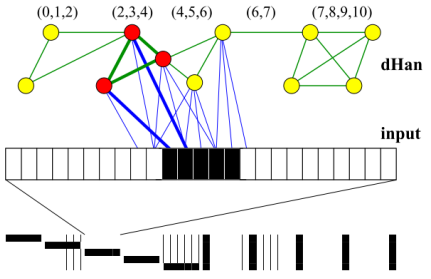

Fig. 6 A dHan layer (top) with neural activities $\{x_i\}$ and cliques (0,1,2), ... receives sensory signals via the input layer (middle) in the form of certain input patterns (bottom).

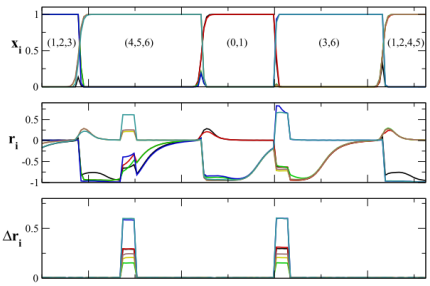

Fig. 7 The activity levels x_i of a dHan layer containing seven neurons, compare Fig. 6, the growth rates r_i and the contributions from the input-layer Δr_i, see Eq. (11). The first input stimulus does not lead to a deviation of the transient state dynamics of the dHan layer. The second stimulus modulates the ongoing transient state dynamics, influencing the neural competition during the sensitive phase.

References