Heteroclinic chains in a model of associative memory

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Abstract

We consider a Hopfield network designed to model so called prime-target relations in associative memory. In this model stable equilibrium states correspond to learned patterns, representing concepts stored in the memory. Passage through a sequence of concepts from one to the next has been called *latching dynamics* (see Lerner I. and Shriki O., Internally and externally driven network transitions as a basis for automatic and strategic processes in semantic priming: theory and experimental validation. *Front.Psychol* **5:314**, 2014). It has been conjectured that synaptic depression, that is weakening of synaptic connections due to the depletion of neuro-transmitter, is the biological mechanism of the transitions between the concepts. In our recent work we show that in the Hopfield network, extended to include a model of synaptic depression, latching dynamics can be approximated by heteroclinic chains (see Aguilar C., Chossat P., Krupa M., Lavigne F., Latching dynamics in neural networks with synaptic depression. *PLoS ONE* **12** (8), 2017). In this talk we discuss the conditions for the existence of heteroclinic chains using singular perturbation theory: we define a singular limit and determine necessary and sufficient conditions for the existence of heteroclinic chains. Subsequently we discuss the passage times in the presence of noise.

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