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Spatiotemporal discrimination in neural networks with short-term synaptic plasticity BENJAMIN SHLAER, PAUL MILLER, Brandeis Univ — Cells in recurrently connected neural networks exhibit bistability, which allows for stimulus information to persist in a circuit even after stimulus offset, i.e. short-term memory. However, such a system does not have enough hysteresis to encode temporal information about the stimuli. The biophysically described phenomenon of synaptic depression decreases synaptic transmission strengths due to increased presynaptic activity. This short-term reduction in synaptic strengths can destabilize attractor states in excitatory recurrent neural networks, causing the network to move along stimulus dependent dynamical trajectories. Such a network can successfully separate amplitudes and durations of stimuli from the number of successive stimuli[1], and so provides a strong candidate network for the encoding of spatiotemporal information. Here we explicitly demonstrate the capability of a recurrent neural network with short-term synaptic depression to discriminate between the temporal sequences in which spatial stimuli are presented.

[1]Miller, P. (2013). Stimulus number, duration and intensity encoding in randomly connected attractor networks with synaptic depression. *Front. Comput. Neurosci.* 7:59.

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