Short-term Synaptic Depression Enhances the Resolution of Population Codes

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In some brain regions processing continuous information, e.g. position or moving direction of objects, the resolution of two stimuli may be affected by the finite tuning widths of neurons, if their separation is less than the tuning width. The overall neuronal activity profile will be single peaked and very similar to that of a single stimulus. If the brain uses the peak position of the neuronal activity profile to extract information of the net stimulus, one may find it difficult for the brain to perceive two narrowly separated stimuli. In this talk, I will present a network model in which short-term depression is present in synapses between neurons. Short-term depression causes the system to generate periodic excitement of neuronal activity, namely population spikes, enabling each individual stimulus to be represented almost simultaneously, thus enhancing the resolution of the population code. We will compare our results with transparent motion experiments on monkeys and human.

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