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## Presentation Abstract

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Title: Roles of feedforward, recurrent and feedback connections in reliable visual processing

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Abstract: The primate visual cortex has a complex organization of connectivity both between visual areas and within the areas. Feedforward connections from lower visual areas to higher ones are accompanied by recurrent lateral connections within each area. There are also top-down feedback connections from higher visual areas back to lower ones, which considerably outnumber feedforward projections. We modeled a multilayer spiking neural network to explore conditions under which stable processing of stimuli is possible. It takes few hundred msec for the visual system to perceive a complex visual stimulus. We found, however, that a purely feedforward multilayer network model can process only first 10-20 msec period of sustained stimuli because the initial transient caused by the stimulus onset quickly became decorrelated with short time constant. In contrast to a purely feedforward multilayer neural network, feedback and recurrent connections generated more prolonged activity that was processed during the entire stimulation time. Processing in a multilayer feedforward network is sensitive to synchrony among neurons in each layer; neurons in the next layer can be activated when they receive coordinated input from the neurons in the previous layer. The feedback and recurrent connections enhance synchronous firing among the neurons within each layer. Our study, therefore, predicts that both the recurrent and feedback connections are required for reliable processing and that some degree of spike synchrony is essential.

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