SYNCHRONY GENERATION IN NETWORKS OF SPIKING NEURONS WITH DYNAMIC SYNAPSES AND A DYNAMIC LEARNING RULE.

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In biological neural networks, synaptic connections and their modification by Hebbian forms of associative learning have been shown in recent years to have quite complex dynamic characteristics, both short-term and long-term. It is clear that in building artificial neural networks of "spiking" neurons for spatio-temporal pattern learning and recognition, such dynamic characteristics may play an important role. In this paper we first review the neuroscientific evidence for the dynamic characteristics of learning and memory, and propose a novel computational associative learning rule that takes account of this evidence. We show that the application of this learning rule allows us to mimic in a computationally simple way certain characteristics of the biological learning process. In particular we show that the learning rule displays similar temporal asymmetry effects which result in either long-term potentiation or depression in the biological synapse. We then show that the action of dynamic synapses, both depression and facilitation, and the application of the LTP/LTD learning rule, in networks of "spiking" neurons can lead to stimulus-induced synchronisation of the firing of neurons in the network.