BMC Neuroscience

Poster presentation

Open Access

Learning in spatially extended dendrites

Carl-Magnus Svensson*[1], Stephen Coombes[1] and Yulia Timofeeva[2]

Address: [1]School of Mathematical Sciences, University of Nottingham, Nottingham, NG7 2RD, UK and [2]Department of Computer Science, University of Warwick, Coventry, CV4 7AL, UK

Email: Carl-Magnus Svensson* - pmxcms1@nottingham.ac.uk

* Corresponding author

from Sixteenth Annual Computational Neuroscience Meeting: CNS*2007
Toronto, Canada. 7–12 July 2007

Published: 6 July 2007

BMC Neuroscience 2007, **8**(Suppl 2):P200 doi:10.1186/1471-2202-8-S2-P200

Dendrites are not static structures, new synaptic connections are established and old ones disappear. Moreover, it is now known that plasticity can vary with distance from the soma [1]. Consequently it is of great interest to combine learning algorithms with spatially extended neuron models. In particular this may shed further light on the computational advantages of plastic dendrites, say for direction selectivity or coincidence detection. Direction selective neurons fire for one spatio-temporal input sequence on their dendritic tree but stay silent if the temporal order is reversed [2], whilst "coincidence-detectors" such as those in the auditory brainstem are known to make use of dendrites to detect temporal differences in sound arrival times between ears to an astounding accuracy [3]. Here we develop one such combination of learning and dendritic dynamics by extending the "Spike-Diffuse-Spike" [4] framework of an active dendritic tree to incorporate both artificial (tempotron style [5]) and biological learning rules (STDP style [2]).

References

1. Froemke RC, Poo MM, Dan Y: **Spike-timing-dependent synaptic plasticity depends on dendritic location.** *Nature* 2005, **434(7030):**221-225.
2. Mo C-H, Gu M, Koch C: **A learning rule for local synaptic synaptic interactions between excitation and shunting inhibition.** *Neural Computation* 2004, **16:**2507-2532.
3. Agmon-Snir H, Carr CE, Rinzel J: **The role of dendrites in auditory coincidence detection.** *Nature* 1998, **393:**268-272.
4. Timofeeva Y, Lord GJ, Coombes S: **Spatio-temporal filtering properties of a dendritic cable with active spines: a modeling study in the spike-diffuse-spike framework.** *J Comput Neurosci* 2006, **21(3):**293-306.
5. Gutig R, Somplinsky H: **The tempotron: a neuron that learns spike timing-based decisions.** *Nat Neurosci* 2006, **9(3):**420-428.