BMC Neuroscience

BioMed Central

Poster presentation

Open Access

Spike to spike MT model and applications

Maria-Jose Escobar*, Pierre Kornprobst and Thierry Vieville

Address: Odyssee Lab, INRIA Sophia-Antipolis, France

Email: Maria-Jose Escobar* - Maria-Jose.Escobar@sophia.inria.fr

* 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):P150 doi:10.1186/1471-2202-8-S2-P150

Our contribution

We propose a bio-inspired MT model working in a fully spiking mode: our MT layer receives spiking inputs coming from a previous spiking V1 layer. The MT layer integrates this information to produce spikes as output. Interestingly, this spike to spike model allows us to study and model some of the dynamics existing in V1 and MT, and due to the causality of our cell representations it is also possible to integrate some top-down feedback. This model differs from existing ones such as e.g. [1] and [2], that generally have analogue entry and consider motion stimuli in a continuous regime (as plaids or gratings) discarding dynamic behaviours. In this model we also propose an implementation for the inhibition done between cells in V1 and MT. The interaction between V1 cells is done both for neighbouring cells with the same velocity and for cells with the same receptive field but different velocity orientations. On the other hand, the inhibition between MT cells is done to help the model in the detection of the pattern motion direction. The architecture and details of our model are shown in Figure 1.

Interest of a spike to spike model

We are interested in validating the behaviour of our model with:

Grating and plaids.We will compare our results with e.g. [1] and [2].

Dynamic. The activation of MT cells is not constant in time, it suddenly increases when the motion direction is

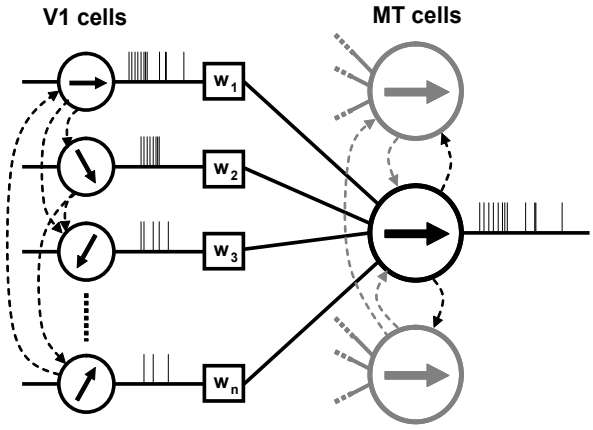

Figure 1
Architecture of model here presented. The first layer is formed as an array of direction-selective V1 complex cells tuned for different speeds and directions of motion. Each V1 complex cell is modelled with a motion energy detector following [5]. The second layer of the model corresponds to a spiking MT cell array. Each MT cell has as input the spike trains of the V1 complex cells inside its receptive field; all the V1 cells considered inside the MT receptive field have the same orientation, the model data being based on biological findings [2]. The dashed lines represent the interactions between V1 and MT cells. The values of the weights w_i are adjusted (they could also be found through learning as STDP) to tune the MT neuron for a certain motion pattern direction.

changed. We study the dynamical effects as described in [3].

Motion recognition. We will show how the spiking output of MT can be successfully used to recognize biological motion starting from real video sequences [4].

Acknowledgements

This work was partially supported by the EC IP project FP6-015879, FACETS and CONICYT Chile.

References

1. Sejnowski T, Nowlan S: **A selection model for motion processing in area MT of primates.** *Journal of Neuroscience* 1995:1195-1214.
2. Simoncelli E, Heeger D: **A model of neuronal responses in visual area MT.** *Vision Res* 1998, **38:**743-761.
3. Perge J, Borghuis B, Bours R, Lankheet M, van Wezel R: **Temporal dynamics of direction tuning in motion-sensitive macaque area MT.** *Journal of Neurophysiology* 2005, **93:**2104-2116.
4. Escobar MJ, Wohrer A, Kornprobst P, Vieville T: **Biological motion recognition using an MT-like model.** *Neurocomp* 2006.
5. Adelson EH, Bergen JR: **Spatiotemporal energy models for the perception of motion.** *J Opt Soc Am A* 1985, **2:**284-299.