Implementation of attentional bistability of the dragonfly visual neurons in an intelligent biomimetic agent
— Report One —

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1 Introduction

Motion detection in computer vision has been very significantly influenced by the mechanisms of biological insect vision. In this project, we will attempt to reproduce the target selection mechanism used in a dragonfly by modeling and implementing it in a biomimetic agent. Dragonflies are notoriously effective at capturing prey The centrifugal small target motion detector neuron 1 (CSTMD1) is a higher order visual neuron in the brain of the dragonfly. This neuron reacts to the presentation of multiple visual stimuli by firing as if only one of the stimuli was present; this is presumably an attentional selection mechanism [1]. At Professor Shanahans lab, they have simulated the large contralateral dendritic field of the CSTMD1 neuron with a biophysical multicompartmental Hodgkin and Huxley model. Along with Klaus Stiefel (Neuromorphic Engineering Workshop, 2013 Telluride, USA), they found that with certain numbers of inhibitory synapses and potassium conductance densities, two mutually coupled CSTMD1 neurons are capable of a bistable switching process between two input patterns. This bistability can serve as a mechanism for the observed attentional selection.

The high level idea of the project is to employ the principle used by the CSTMD1 neuron in a biomimetic agent that behaves like a dragonfly showing attention-like target selection when performing a simple foraging task.

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References

[1] Steven Wiederman and David O'Carroll. Selective attention in an insect visual neuron. *Current Biology*, 2013.