Thesis Project Form

Title (tentative):   Segregation of object and background motion in the retina

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Description

Motivation and application domain

The human visual system can distinguish objects moving in the scene whilst doing eye movements to scan the surrounding, effectively separating local and global motion.
A robot can take advantage of the same mechanism to detect items to interact with while observing the environment or moving.
We propose a bioinspired model for iCub, the humanoid robot, to detect local motion with suppression of global image motion based on specific connections among Receptive Fields in the retina.

General objectives and main activities

The student should be able to implement the first proof of concept of the model characterising the system. The model will distinguish ego-motion from the motion of single objects in the scene.

1. Formalisation of the model, architecture, models of spiking neurons, connectivity to implement the model proposed in [1]
2. Implementation of the model on Loihi (or DYNAPs) (python-based) and integration with event-driven cameras (from YARP and C++)
3. Validation and characterisation of the implemented model with simulated and then real stimuli

Training Objectives (technical/analytical tools, experimental methodologies)

The model will exploit the inherent capabilities of the Event-Driven cameras such as low latency and precise temporal information and will be based on the use of spiking neural networks implemented on the latest INTEL platform for neuromorphic computing (Loihi). Loihi is a digital platform able to emulate spiking neurons. The implementation will create a population of neurons segregating egomotion based on their activity. The model could also be implemented on the neuromorphic analog DYNAPs circuit physically emulating neurons.

Place(s) where the thesis work will be carried out:

Additional information

Maximum number of students: 1