UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Thesis Project Form

Title (tentative): Synthesis and characterization of receptive fields of an event-based artificial retina

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Description

Motivation and application domain

Computational models of early processing typically rely on simple linear contrast-encoding assumptions, which do not account for many second-order mechanisms. Accordingly, many details remain underrated, and their implications on functional vision not fully understood. By example, letâ€™s think about asymmetries in the responses to brightness and darkness observed in the cells of ON and OFF pathways, which extend to neuronal spatial receptive fields and temporal properties.

General objectives and main activities

The thesis aims to implement neuromorphic multi-layer networks of leaky integrate and fire (LIF) neurons in cascade to a motorized event-based camera, as artificial replicas of the early stages of an active vision system for explaining and predicting visual performance in arbitrary natural and laboratory visual tasks. At a functional level, the system will (1) consider the neural resources required to account for a range of linear/nonlinear early visual processes, and (2) provide the inference engines for relating the resulting visual representations to performance on psychophysical tasks. The visual performance of the resulting silicon model will be comparatively assessed with that of a typical human observer. Specifically, the project will focus on the design of a network to reproduce the human contrast sensitivity function.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn to employ an array of methodologies and instrumentation, including:
â€¢ LIF neurons
â€¢ SNN simulators (e.g., LAVA)
â€¢ Psychophysics methodologies
â€¢ Task design and data collection

Place(s) where the thesis work will be carried out: Bioiengineering Lab (PSPC), via Opera Pia 13

Additional information

Pre-requisite abilities/skills: Neuromorphic computing

Maximum number of students: 2

Financial support/scholarship: None