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

Thesis Project Form

Title (tentative): A neuromorphic system for learning stereopsis in active settings

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Description

Motivation and application domain

Stereopsis requires precise vergence control and balanced retinocortical convergence of visual signals coming from the two eyes. Absence of sensorimotor disorders during active vision experience in a critical period is crucial for a correct development.

General objectives and main activities

The thesis aims at training a well-established model of early representation of information in the human visual cortex, to (1) investigate the necessary and sufficient conditions that lead to typical development, (2) advance hypotheses on conditions leading to atypical development, (3) predict the effects of corrective counteractions.
The starting point is (1) a â€œpre-trainedâ€• front-end â€œconvolutionalâ€• neural network (working with monocular spatiotemporal receptive fields on the signal provided by the two retinas), (2) a cortical circuitry that governs redundant binocular convergence, and (3) a kinematic model of the binocular oculomotor system. Learning should not require any supervision from outside but rely on some form of self-calibration.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn to employ an array of methodologies and instrumentation, including:
â€¢ Stereoscopic rendering and binocular image formation
â€¢ Firing rate neuromorphic models
â€¢ Python/MATLAB programming language
â€¢ Unsupervised learning

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