Silvio Paolo Sabatini

Associate professor

silvio.sabatini@unige.it
+39 010 3532092
+39 320 4330884

Education and training

1996
PhD in Electronic Engineering and Computer Science
The physical structure of perception - models and architectures of perceptual microsystems
University of Genoa - Genoa - IT

1992
M.Sc. (laurea) in Electronical Engineering
Microelectronic neural systems - receptive field models for texture analysis - summa cum laude
University of Genoa - Genoa - IT

Academic experience

2011 - ONGOING
Associate professor of Bioengineering
University of Genoa - Genoa - IT

1999 - 2011
Assistant professor of Computer Science
University of Genoa - Genoa - IT

Research interests

As an electronic engineering and computer scientist by training, he addressed the research of natural and artificial vision systems, with particular reference to modeling and implementation issues that concern the problem of representation and processing of visual information. The evolution of the research activities has encompassed different phases: starting from the investigation of **visual operators for data-driven static and dynamic image analysis** (1992-1998), to the investigation of the problem of **dynamic scene understanding for visually-guided behavior** (1999-2007). The major achievements in those periods were: **analog integrated "perceptual engines"**, models for the origins of Gabor-like receptive fields, **early-vision feature representation in the full harmonic space**, and the development of **"large-scale" neuromorphic architectures for distributed representation of depth and motion** visual features for guiding actions. More recently (2008-today), the motor/active perspective becomes more

decisive, not only with reference to the task to be accomplished, but as a key component for understanding perception itself.
Currently, the research is following two specific tracks: (1) *Systems, tools, and models for assessing and conditioning perception-action experience*, with the goal of developing systems and assessing technologies for conditioning sensory and sensorimotor integration, with potential applications in diagnosis, therapy, and rehabilitation of disorders of the developmental age, in the elderly, and in association with neurologic diseases; (2) *Neuromorphic cognitive systems*, with the goal of designing neuromorphic computing systems for active efficient encoding of sensory information and multidimensional sensory signal representation.

Grants

2008 - 2011

Heterogeneous 3-D Perception Across Visual Fragments (EYESHOTS) (http//www.eyeshots.it/)

European Commission

652200 Euro - Pricipal investigator

The research aimed to investigate the interplay existing between vision and motion control, and to study how to exploit this interaction to achieve a *knowledge* of the surrounding environment that allows a robot to act properly. Robot perception can be flexibly integrated with its own actions and the understanding of planned actions of humans in a shared workspace. The research relied upon the assumption that a complete and operative cognition of visual space can be achieved only through active exploration of it: the natural effectors of this cognition are the eyes and the arms.
Crucial but yet unsolved issues we addressed are: object recognition, dynamic shifts of attention, 3D space perception including eye and arm movements including action selection in unstructured environments. We propose a flexible solution based on the concept of *visual fragments*, which avoids a central representation of the environment and rather uses specialized components that interact with each other and tune themselves on the task at hand.
In addition to a high standard in engineering solutions the development and application of novel learning rules enabled our system to acquire the necessary information directly from the environment.
The study and models of human/primate behaviour, based on specific experiments, guided many of our envisaged solutions.
Three main objectives were addressed: (1) A robotic system for interactive visual stereopsis [composed of: an anthropomorphic mechatronic binocular system; and software vision modules based on cortical-like population, to be used as an experimental platform]; (2) A model of a multisensory egocentric representation of the 3D space [constructed on binocular visual cues, signals from the oculomotor systems, signals about reaching movements performed by the arm]; (3) A model of human-robot cooperative actions in a shared workspace [relaying on the concept of shared attention

to understand the intention or goal of the communicating partner].