

Bio-inspired vision

Monday, 26 September 2011 16:30 (45 minutes)

Despite all the impressive progress made during the last decades in the fields of information technology, microelectronics and computer science, artificial sensory and information processing systems are still much less effective in dealing with real-world tasks than their biological counterparts. Even small insects still outperform the most powerful computers in routine functions involving e.g. real-time sensory data processing, perception tasks and motor control and are, most strikingly, orders of magnitude more energy-efficient in completing these tasks. The reasons for the superior performance of biological systems are still only partly understood, but it is apparent that the hardware architecture and the style of neural computation are fundamentally different from what is state-of-the-art in artificial synchronous information processing. Very generally speaking, biological neural systems rely on a large number of relatively simple, slow and unreliable processing elements and obtain performance and robustness from a massively parallel principle of operation and a high level of redundancy where the failure of single elements usually does not induce any observable system performance degradation.

In the late 1980's, C. Mead at CalTech demonstrated that silicon VLSI technology can be employed in implementing "neuromorphic" circuits that mimic neural functions and fabricating building blocks that work like their biological role models i.e. neurons, axons, ganglions, photoreceptors etc. Neuromorphic systems, as the biological systems they model, are adaptive, fault-tolerant and scalable, and process information using energy-efficient, asynchronous, event-driven methods. The greatest success of neuromorphic systems to date has been in the emulation of sensory signal acquisition and transduction, most notably in vision.

This talk discusses the motivation for looking at nature as a source of inspiration for constructing the next generation of information processing systems and argues that the application of biological computational principles has the potential to overcome technological and architectural limitations faced by modern VLSI-based digital computers. Recent developments in biomimetic vision, one of the most successful fields of neuromorphic engineering, are presented and possible future directions for computer vision are suggested.

Presenter: Dr POSCH, Christoph (Austrian Institute of Technology GmbH)

Session Classification: Opening 2

Track Classification: Systems