

Department of Electrical and Computer Engineering

Title: « *Sand-Scorpion Inspired Spiking Neural Network: from Biology to Theoretical Model to Real-Time Application* »

Guillaume Garreau

PhD student at the University of Cyprus

Wednesday, 25th September 2013, 17:00 – 18:30
Room ΠΤΕΡ E113, Old Campus
University of Cyprus

Abstract:

Acoustic scene analysis is a vast field that traditionally focuses on sound recognition in the audible range and on how the brain segregates and classifies the different sound sources into meaningful objects. A lot of information however is also contained in frequencies below and above our auditory frequency range. For example, bats and dolphins are well known for their ability to locate and catch food through ultrasonic vocalisation and reception. Similarly, several bird species, mice, fish and insects also hunt for prey, find a mate, or communicate through ultrasonic sounds. Low-frequency vibrations are used by sand scorpions to find worms in total darkness. They can detect variations in sand as small as 0.1 nm and pinpoint the direction of their prey [Stürzl et al, 2000].

As part of my Ph.D. research I have designed and built hardware, and accompanying software, which uses ultrasonic waves in air to recognise people and their actions. Furthermore I have developed a system that uses low frequency vibrations in the ground to track the trajectory of a person by using a method inspired from the sand scorpion. In this presentation I will focus on the low frequency end of the sound spectrum.

Firstly I will introduce the biological aspects of how sand scorpions detect their prey in nature. Next, I will present a neural software simulator that was used to simulate the localization system of the scorpion's neural network. Furthermore, I will give the details of a custom built data collection system for collecting information required to feed the artificial scorpion's sensory system, along with the challenges met and the solutions. Finally I will present the results obtained during the data collection and future directions that will lead to even better results.

Biography:

Guillaume Garreau (IEEE M'10) is currently a PhD student at the University of Cyprus. He received his Masters degree in Engineering of Cognition, Creation and Learnings majoring in Cognitive Sciences in 2009 from the Institut National Polytechnique de Grenoble (INPG) and received his Masters degree in Micro and Nano-technologies for Integrated Systems in 2008 from the Institut National Polytechnique de Grenoble (INPG), the Politecnico di Torino and the Ecole Polytechnique Federale de Lausanne. In 2009 Mr Garreau joined the University of Cyprus as a researcher/PhD candidate and has been working on a EU FP7 project, "SCANDLE", in the area of acoustic scene analysis, towards his doctorate degree. Mr Garreau is a member of the IEEE Circuits and Systems Society. He regularly reviews papers for the IEEE Biomedical Circuits and Systems Conference, the IEEE International Symposium on Circuits and Systems and the Frontiers in Neuromorphic Engineering Journal. His research interests include embedded system design, bioinspired acoustic signal processing, biomedical circuits and systems and neuromorphic engineering.