University Côte d'Azur
LEAT Research Lab
UMR CNRS 7248

Research Internship

Digital electronic design of a neuromorphic controller for robotic systems

Context

The biological brain is able to perform high performance calculations with a much higher efficiency than our most powerful computers with very low energy consumption.
The aim of this work is to study the performance and the power consumption of models of artificial neural networks inspired from the behavior of the cortical areas in the brain. These models inherit from the theory of the Dynamic Neural Field Theory (DNFT) but exhibits high computational complexity [1]. The goal will be then to explore different implementations of this particular neural network onto embedded devices and hardware programmable devices (FPGA) [2] in order to reach efficient implementation onto autonomous systems. We will specifically focus on the realization of a robotic system to deploy the neural network into the sensory-motor loop of the robot [3].

Internship mission

The internship mission will be organized in several periods:

- Theoretical study of spike-based neural networks and scientific bibliography,
- Design of the hardware architecture supporting discrete formalization of the DNF equations,
- Experiment and analysis of the complexity of the digital architecture onto a FPGA device target,
- Validation of the architecture with spiking stimuli coming from an asynchronous camera onto a robotic system.

References

[1] *Dynamic neural field theory for motion perception, Giese, M. A., volume 469. Springer Science & Business Media, 2012.*
[2] *Hardware design of a neural processing unit for bio-inspired computing, L Fiack, L Rodriguez, B Miramond - New Circuits and Systems Conference (NEWCAS), 2015*
[3] *A neuromorphic controller for a robotic vehicle equipped with a dynamic vision sensor, Hermann Blum et al.,* International Robotics Science and Systems Conference, *2017.*

Practical information

Location : LEAT Lab, Sophia Antipolis
Duration : 6 months from March 2018
Grant : 546 € / month
Profile : Digital electronics, embedded systems, neural networks, sensors/actuators, robotics

Contact

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