Robotics and Embedded Systems

Human Brain Project

Master Thesis - Semester Project

Autonomous Locomotion Control for Snake Robot Based on Bio-inspired Vision Sensor and Spiking Neural Network

Background

The advantage of a snake-like robot imitating the locomotion of real snakes is that it can move well in unstructured environments, like narrow pipes, rough or soft ground, and even in water. Hence, it is significant to make the snake robots move autonomously. This autonomous locomotion ability relies on the sensory perceptual system and decision-making system.

Bio-inspired vision systems target at exploring the way that human retina works. As one of the best promising solution for bio-inspired vision, the Dynamic Vision Sensor (DVS) can see the world like your own retina by detecting the dynamic contrast changes of each pixel, which completely overthrows the traditional machine vision architectures by recording the entire image. On the other hand, Spiking Neural Network (SNN) can provide a biologically inspired way of manipulating data for different sensory modalities and computations, like the human brain. By considering the DVS output as the spiking neurons input for SNN, a neuromorphic mapping could be established and used for achieving autonomous locomotion control for snake robots.

Your Tasks

In this thesis, your task will be building the neuromorphic mapping SNN network from DVS to autonomous vehicle locomotion control. To be specific:

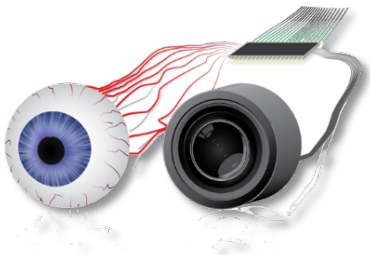
1. You will analyze and process the DVS output data so as to be used as input for SNN.
2. You will build up a SNN network to control the forward locomotion of snake-like robots, like wall following, target tracking, and obstacle avoiding.
3. You will conduct a serious of simulations and prototype experiments to evaluate your SNN controller.

Requirement

- Six month working time
- Interested in autonomous driving and robotics locomotion control
- Interested in machine learning (spiking neural network)

Figure 1 DVS

Figure 2 Snake Robot



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