Robotics and Embedded Systems

Human Brain Project

## Master Thesis - Semester Project

# Advanced Autonomous Driving Control Based on Bio-inspired Vision Sensor and Spiking Neural Network.

## Background

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 advanced autonomous driving or robot locomotion control.

## Your Tasks

In this thesis, your task will be building the neuromorphic mapping SNN network from DVS to autonomous vehicle locomotion control based on our simulated results [1]. 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 autonomous driving, like wall following, lane 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)
- Good knowledge of data fusing

Figure 1 DVS

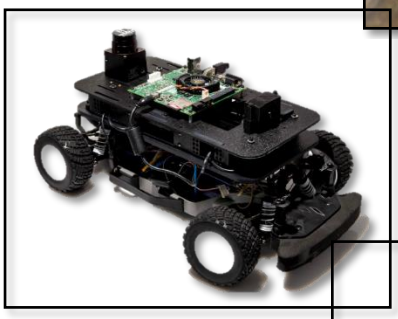
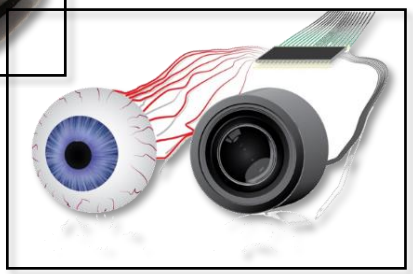


Figure 2 Vehicle



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[1] *End to End Learning of Spiking Neural Network based on R-STDP for a Lane Keeping Vehicle,* ICRA 2019