Robotics and Embedded Systems

Human Brain Project

Master Thesis - Semester Project

Develop Learning Algorithm for Event Based Autonomous Systems Based on Dynamic Vision Sensor

Background

Event based autonomous systems based on Dynamic Vision Sensor 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.

Recent research shows that an end-to-end approach trained by deep learning / reinforcement learning proved powerful in robotics and autonomous driving. On the other hand, Spiking Neural Network (SNN) as a brain-inspired approach, is more energy efficient, generalization and better suitable for parallelization. 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 sensorimotor mapping could be established and used for achieving autonomous control of the systems.

Link to DVS sensor: https://www.youtube.com/watch?v=LauQ6LWTkxM

Topics

- Develop an Event based Vision System for Intelligent Vehicle and Driver Interaction
- Develop an RGBD camera based Vision System for Intelligent Vehicle and Driver Interaction
- Event based SLAM with Bio-inspired Vision Sensor and RGBD camera
- Target Tracking based on Bio-inspired Vision Sensor
- Human Motion/Action/Gesture Recognition Based on Bio-inspired Vision Sensor
- Develop an Event based vision System for Driver Drowsiness Detection
- Learning Sensorimotor Mapping for Autonomous Drving based on Bio-inspired Vision Sensor
- Learning Robot Grasping based on Event based Vision Sensor
- Lane Detection based on Event based Vision Sensor
- Autonomous Locomotion of Snake-like Robot based on Event based Vision Sensor

Your Tasks

Based on different topic, your task will be:

- designing a bio-inspired vision based system
- building a high-quality dataset based on bio-inspired vision sensor
- developing machine learning algorithms
- conducting prototype experiments to evaluate your algorithms on the vision systems

Requirement

- Six month working time
- Interested in computer vision, robotics, autonomous driving
- Interested in machine learning (deep learning/spiking neural network)

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