Technische Hochschule Nürnberg

MA-Thesis

Neuronal Sensor Fusion for a Robot Dog Self-motion Perception

ACCENTURE LABS

Short description

The Sensorimotor Processing, Intelligence, and Control Embedded Neural Network or SPICEnet is a novel neural network used for control. It is a lightweight, biologically inspired network based on three canonic and versatile neural computation mechanisms. Using competition, cooperation and learning in 1D populations of neurons, SPICEnet is able to do learning, inference, de-noising, sensor fusion and decision making in the same substrate without changing the architecture. The goal of this project is to use SPICEnet to learn self-motion sensory and motor signals for the Unitree Go Edu robot dog from recorded sensory-motor data streams. The purpose is to have a sensor fusion module to robustly estimate self-motion and be robust to sensory perturbations and uncertainty. The approach should be bottom-up, from learning correlations within-modality (i.e., vision – optic flow, disparity) and up to between modality (i.e., inertial, vision, and copies of motor signals). The project implies working with ROS, acquire data from the sensor subsystem and building custom code that integrates SPICEnet with the existing infrastructure on the robot.

Tasks

- Introduction to the SPICEnet: modeling, evaluation, and existing implementation on synthetic sensor data.
- Introduction to ROS and pub-sub paradigm.
- Sensor and motor control data acquisition (sensors, motor signals, motion ground truth).
- Evaluate the use of SPICEnet on the acquired robot data.
- Porting the SPICEnet sensor fusion implementation to ROS.
- Understanding the sensory environmental perception and evaluate self-motion perception of the robot.

Prerequisites

- Very good math and programming skills.
- Experience with embedded systems programming.
- Familiar with robot programming and ROS.

Supervisors

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