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"Sensor Adaptation and Development in Robots by Entropy Maximization of Sensory Data"

Abstract

A method is presented for adapting the sensors of a robot to the statistical structure of its current environment. This enables the robot to compress incoming sensory information and to nd informational relationships betweensensors. The method is applied to creating sensoritopic maps of the informational relationships of the sensors of a developing robot, where the informational distance between sensors is computed using information theory and adaptive binning. The adaptive binning method constantly estimates the probability distribution of the latest inputs to maximize the entropy in each individual sensor, while conserving the correlations between different sensors. Results from simulations and robotic experiments with visual sensors show how adaptive binning of the sensory data helps the system to discover structure not found by ordinary binning. This enables the developing perceptual system of the robot to be more adapted to the particular embodiment of the robot and the environment.