

Abstract for the NIPS 2003 Demonstration Session

Title: From visual attention through to motor control

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Abstract

Visual attention, working memory, reinforcement learning and motor control subsystems are integrated to form a platform for future investigations of the planning and control of complex movements within autonomous robots. The elements of the demonstration are as follows. The ventral pathway, prefrontal areas and frontal eye fields provide an object search, selection and recognition system. A feed-forward motor controller maps desired hand positions in visual coordinates to the pressure ratios required to control a two joint arm powered by two pairs of McKibben air muscles. The combined system is demonstrated on an object recognition and reaching task. Adding a simple basal ganglia model generates sequences of reaching movements to perform a block-copying task. A cerebellum generates sequences of motor commands and the sensory consequences of actions to perform more sophisticated movements as demonstrated in learned throwing and tracking tasks and to facilitate planning at a future stage. Real-time performance of the cerebellar subsystem is achieved through the use of efficient event driven algorithms in software and FPGA-based implementations in hardware of simple conductance-based spiking neurons. The demonstration represents the work of a large and diverse group of researchers with an equally diverse range of research objectives. The different elements have been integrated using the Network Model Interface, a component wrapper which abstracts the interaction between a generic component and a generic framework, and which enables the different components to be investigated and combined within different frameworks and contexts.

Key Words

Attention, cortex, control, large-scale computing, silicon neuron