
Innovative Technologies Inspired by Biosonar
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Fundamental to health human function is the transformation of sensory information to motor commands for adaptive behaviors such as reaching, grasping, tracking, and steering in the environment. A more complete understanding of the mechanisms that support these vital functions of the nervous system will facilitate treatment and rehabilitation when they fail to develop normally or break down through disease. Our CRCNS project takes an innovative, multidisciplinary approach to advance technology and theory on this central problem in neurobiology and medicine, drawing on the coordinated efforts in engineering, systems neuroscience and computational modeling. Specifically, we propose to integrate miniaturized radio telemetry recordings, advanced signal processing, control systems theory, adaptive motor studies and spatial behaviors. Empirical studies will employ an animal model that has evolved a highly successful adaptive sonar-guidance system, the echolocating bat. This mammal actively controls a complex of motor behaviors, guided by dynamic, 3-D spatial information extracted from acoustic signals. We will collect, analyze, and interpret behavioral and neural recordings from a free-flying echolocating bat, and this data will be used in computational models of sensorimotor feedback control and spatial navigation through complex environments. This work will direct the development of new algorithms for adaptive control in robotics and applications in neuromorphic engineering. It will also lay the foundation for a wide range of biomedical applications, such as implantable neural prostheses, ultra-lightweight low power sensors, controllers, medical tool design, and sonar-based assistive medical devices.

Project Website

http://www.isr.umd.edu/crcns_batsonar/