Active Efficient Coding: Linking the Development of Perception and Behavior

(Talk #9)

***Bertram E. Shi**

[1]Professor, Department of Electronic and Computer Engineering, The Hong Kong University of Science and Technology, Hong Kong

***Email of Presenting Author:** eebert@ust.hk

The efficient coding hypothesis is a powerful guiding principle for studying sensory coding and models derived from it have had impressive successes in explaining early visual representations based on the statistical properties of natural images. However, most models to date have not accounted for the fact that organisms actively shape these input statistics through their behavior, and that these statistics change dynamically as this behavior develops and changes in part due to changes in the sensory coding. In the context of binocular vision, eye movements such as vergence and drift actively shape the statistics of the binocular correlations between the retinal inputs from the two eyes. Here we describe the theoretical framework of "active efficient encoding." The central tenet of this framework is that animals and humans have evolved and/or learned to utilize their motor systems to facilitate the efficient encoding of relevant sensory signals. While it is clear that behavior affects the statistics of sensory inputs, the active efficient encoding hypothesis posits that it actually optimizes these statistics. For example, we show that under this hypothesis vergence eye movement behavior emerges naturally as it contributes to efficient coding of binocular information. Another consequence of this model is that binocularly correlated drift movements may be critical in the development of the neural encoding of binocular disparity.