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Talk Title:
Computational Comparative Approaches for Understanding Why Auditory Neurophysiological and Psychophysical Properties Have Emerged in the Auditory System

Abstract:
The auditory system takes a sound waveform as an input and processes it through ears and a series of brain regions to recognize the information of the sound source (e.g. the identity of the source object, location of the source, and speech content and speaker properties when the sound is speech) and the surrounding environment (e.g. the ambient noise and the size of the space). Neurophysiology and psychophysics have revealed how the auditory system realizes sound recognition functions by relating physical dimensions of the stimulus (e.g. frequency, intensity, and temporal modulation) with neural activities and perception, respectively. On the other hand, computational approaches are effective in tackling the question of why the auditory system exhibits such neurophysiological and psychophysical properties. In this talk, I will introduce studies that try to answer the “why” in the auditory system through computational modeling. This approach consists of two steps: training a machine learning model for behaviorally relevant objectives and comparing the neurophysiological and psychophysical properties in the model with those in the auditory system. By observing convergent and divergent properties, as in the convergent/divergent evolution, between the model and the auditory system, we can discuss what kinds of constraints have shaped the auditory system during its evolution and/or development, as is often done in comparative biology.

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