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A theory of adaptive sensory coding in dynamic environments

Wednesday, July 5, 2023 12:00 PM (50 minutes)

Our thinking about sensory systems has been shaped by two dominant theoretical frameworks: probabilistic inference and efficient coding. Probabilistic inference specifies optimal strategies for learning about relevant properties of the environment from local and ambiguous sensory signals. Efficient coding provides a normative approach to study encoding of natural stimuli in resource-constrained sensory systems. By emphasising different aspects of information processing they provide complementary approaches to study sensory computations. In this talk, I will discuss our attempts to bring them together by identifying general principles that underlie the resource-efficient sensory coding for accurate perceptual inferences in changing environments. This synthesis enables us to build theories of neural coding in dynamic scenarios, where sensory systems have to continuously infer the changes of the relevant properties of the world. I'll demonstrate how our theory can account for attentional dynamics in the visual cortex and identify fundamental trade-offs in efficient sensory adaptation. Towards the end, I'll take a step back and discuss briefly how can we rigorously compare predictions of normative theories to complex experimental data.

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Session Classification: Invited talk