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# Computational Principles of Dynamic Sensory Representations

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Sensory systems need to achieve a delicate balance between external and internal influences in order to accurately represent relevant information. Dynamic adjustments of the sensory code to these influences have been traditionally categorized depending on their origin and studied separately. Sensory adaptation is a response of a neuron to exogenous changes in stimulus statistics, while internal modulation adjusts sensory representations to changes in the endogenous states of the brain such as behavioral goals, attention or uncertainty. In this talk I will present a theoretical framework which provides a unifying perspective on how sensory codes adapt to such changes regardless of their origin. Starting from the same set of basic principles grounded in information theory and Bayesian inference, our framework generates candidate normative explanations of the diversity of adaptive responses in the early visual system as well as the attentional modulation of neural populations in the primary visual cortex. I will conclude by presenting an experimental finding of spatio-temporal patterns of neural activity which dominate sensory responses in a brain region that has been thought to be predominantly a sensory relay - the superficial superior colliculus. These findings emphasize the need for new theories which will be required to understand the computational principles of dynamic sensory processing.

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