Perceptions prédictives et prédictions perceptuelles : architectures des circuits cérébraux et mécanismes dynamiques

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Résumé

A difficult research question in systems neuroscience concerns the mechanistic elucidation of information integration in brain networks: How do sensory inputs modify the ongoing activity of the brain? What is the nature of competitive signaling between bottom-up inputs vs. top-down modulations in perception and behavior? How are these mechanisms altered in disease? We recently proposed a model of systems dynamics in hierarchical brain networks based on polyrhythmic oscillatory brain activity. This mechanistic framework implements a generic form of contextual predictive inference of input signals into brain networks. In essence, this vision is aligned with the principles of perceptual inference, which predict that spontaneous brain activity during resting wakefulness constantly implements the self's representation of its environment.
Inspired by this framework, I will review a series of neurophysiological data that account for this hypothesis in a diversity of brain functions. In particular, we recently proposed to train artificial neural networks on naturalistic stimuli to produce encoding models of neural activity that account for contextual uncertainty and prediction errors in perception. I will show how we used this approach to reveal the corresponding brain signaling pathways for natural speech processing.

Mots-Clés: caribou

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