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Reading and writing the neural code: initial steps towards enhancing perception and cognition using brain-machine interfaces

Abstract

Brain-machine interfaces (BCIs) hold the promise to restore or enhance sensory functions lost to disease or injury. Sensory processing in the brain is heavily dependent upon both the external stimulus statistics and internal brain state. Therefore, to restore and enhance brain sensory functions using BCIs, we will need to not only understand how the information is dynamically encoded by populations of neurons, but also how to devise strategies to optimize brain state. My talk will first use sensory adaptation as an example to demonstrate that the sensory pathway adaptively changes the neural code based on the properties of sensory stimuli. Moreover, I will discuss how the activation of the locus coeruleus – norepinephrine (LC-NE) system, a major neuromodulatory system that controls brain state, enhances sensory processing. LC activation increased the perceptual sensitivity of animals performing tactile discrimination tasks, and this improvement was blocked when NE effects in the thalamus were pharmacologically precluded.

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ESPCI ParisTech

10 Rue Vauquelin, 75005 Paris / Nobelium room (bat. C, 3rd floor)

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