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Talk title

Mathematical methods to understand the role of the dynamics of neural responses for perceptual decision-making

Abstract

Perceptual decision-making is an essential cognitive process. Its key computation is that of transforming information about sensory stimuli into an appropriate behavioral output. A fundamental gap in our knowledge is understanding how this key computation is implemented by populations of neurons. New experimental tools for both recording and perturbing activity of neural populations, in rodents performing cognitive tasks, are becoming available. However, progress addressing fundamental questions about the population code for perceptual decisions is still limited by the lack of appropriate quantitative mathematical methods that ideally exploit and combine these new experimental tools. We developed a comprehensive mathematical framework - Intersection Information - to analyze these data and combine observation and perturbation of neural activity, and eventually crack the neural code. I will present this mathematical framework and illustrate its significance with investigations of to key aspects regarding the role of neural response dynamics in perceptual decision making: the role of millisecond scale action potential timing, and the role of time lagged functional coupling between different neurons.

Biography

Stefano Panzeri is a computational neuroscientist who works at the interface between theory and experiments and investigates how circuits of neurons in the brain encode sensory information and generate behaviour. He graduated in

Theoretical Physics at Turin University and then did a PhD in Computational Neuroscience at SISSA, Trieste, Italy. In previous years, he took Fellowships and/or Faculty jobs at the Universities of Oxford, Newcastle, Manchester and Glasgow in the UK, and Harvard Medical School in the US. He currently works as Senior Scientist with Tenure at the Istituto Italiano di Tecnologia in Rovereto, Italy.