Computational neuroscience.

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Editorial

Computational Neuroscience (also known as theoretical neuroscience or mathematical neuroscience) is a branch of neuroscience that studies the principles that govern the development, structure, physiology, and cognitive abilities of the nervous system using mathematical models, theoretical analysis, and abstractions of the brain. Computational neuroscience is a subfield of theoretical neuroscience that uses computational simulations to test and solve mathematical models; yet, the two subjects are frequently confused. The phrase mathematical neuroscience is sometimes used to emphasise the field's quantitative aspect. Connectionism, control theory, cybernetics, quantitative psychology, machine learning, artificial neural networks, artificial intelligence, and computational learning theory all use biologically unrealistic models. Computational neuroscience, on the other hand, focuses on the description of biologically plausible neurons (and neural systems) and their physiology and dynamics. Theoretical neuroscience models aim to capture the essential features of the biological system at multiple spatial-temporal scales, ranging from membrane currents and chemical coupling to network oscillations, columnar and topographic architecture, nuclei, and psychological faculties such as memory, learning, and behaviour. These computational models help to frame ideas that may be evaluated directly in biological or psychological research. Computational neuroscience's ultimate goal is to explain how electrical and chemical signals in the brain are used to represent and interpret information. It covers biophysical computation mechanisms in neurons, computer simulations of neural circuits, and learning models.

Eric L. Schwartz coined the term "computational neuroscience" when he organised a conference in Carmel, California, in 1985, at the request of the Systems Development Foundation, to provide a summary of the current status of a field that had previously been known by a variety of names, including neural modelling, brain theory, and neural networks. The book Computational Neuroscience was released in 1990 as the result of this definitional workshop. James M. Bower and John Miller convened the first of the yearly free international conference focused on Computational Neuroscience in San Francisco, California in 1989. In 1985, the California Institute of Technology established the Computational and Neural Systems Ph. D. programme, which was the first graduate educational programme in computational neuroscience.

The challenge of understanding the brain is drawing a rising number of scientists from all fields. Although there has been an explosion of discoveries about the structure of the brain at the cellular and molecular levels over the last several decades, we still don't know how the nervous system allows us to see, hear, learn, remember, and plan particular activities. Computational neuroscience is used in a variety of domains. Some are:

- Deep Learning, Artificial Intelligence and Machine Learning
- Human psychology
- Medical sciences
- Mental models
- Computational anatomy
- Information theory

Computational Neuroscience, a relatively new area within the larger study of neuroscience, has emerged as critical for improving our understanding of brain function and turning that knowledge into technology applications.

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