Séminaire ETIS : Stephen Grossberg

26 Juin 2019, 14:00

Titre du séminaire et orateur

The Resonant Brain: Laminar cortical dynamics of conscious awareness, invariant object category learning, recognition, and Where's Waldo search.

Stephen Grossberg (Boston University)

Date et lieu

Mercredi 26 juin 2019, 14h.

Université de Cergy Pontoise, Amphi Lwoff, St Martin.

Abstract

This talk will describe key design principles and processes whereby our brains make our minds. Neural models of these processes clarify how autonomous adaptive intelligence works, and have been converted into algorithms for multiple large-scale applications. In particular, the talk will describe recent progress towards understanding how brains autonomously learn to attend, see, recognize, predict, and act upon valued objects and events in a changing world. These results build upon revolutionary computational paradigms whereby the brain computes: Complementary Computing clarifies the nature of brain specialization, Laminar Computing clarifies why all neocortical circuits are organized into characteristic layers of cells, and Adaptive Resonance clarifies how self-stabilizing unsupervised and supervised learning can occur in a rapidly changing world. The talk will review how our brains autonomously learn invariant object categories as a scene is freely scanned with eye movements, and how these invariant object representations enable Where's Waldo searches for valued objects in scenes. Multiple brain processes are coordinated to achieve this competence, including 3D vision and figure-ground separation, spatial and object attention, invariant category learning, and predictive remapping. These results clarify how our eyes can autonomously scan salient features of an interesting object even before we know what it is, and how perceptual stability is achieved across eye movements. Also explained is how our brains solve the stability-plasticity dilemma whereby we can rapidly learn to recognize huge numbers of objects and events quickly without experiencing catastrophic forgetting; how attention and learned expectations are related to learning; what brain states support conscious seeing of objects; how conscious seeing and knowing regulate task-appropriate actions; and how social cognitive capabilities such as joint attention and imitation learning grow out of these abilities.

Bio

Stephen Grossberg is one of the pionneers of neural networks. He is a cognitive scientist, theoretical and computational psychologist, neuroscientist, mathematician, biomedical engineer, and neuromorphic technologist. He is the Wang Professor of Cognitive and Neural Systems and a Professor of Mathematics, Psychology, and Biomedical Engineering at Boston University. He develops brain models of vision and visual object recognition; audition, speech, and language; development; attentive learning and memory; cognitive information processing and social cognition; reinforcement learning and motivation; cognitive-emotional interactions; navigation; sensory-motor control and robotics; and mental disorders. These models involve many parts of the brain, ranging from perception to action, and multiple levels of brain organization, ranging from individual spikes and their synchronization to cognition. Many of these projects are done in collaborations with PhD students, postdoctoral fellows, and faculty. He also collaborates with experimentalist colleagues to design experiments to test theoretical predictions and fill conceptually important gaps in the experimental literature, carry out analyses of the mathematical dynamics of neural systems, and transfer biological neural models to applications in neuromorphic engineering and technology.


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