SORS/WomenInBSC: Understanding feedback control in biological systems

AI4S registration link

Abstract

Feedback control is a fundamental principle of life, essential for maintaining homeostasis across biological scales. To better understand and design feedback mechanisms in cellular systems, we developed CoRa (Control Ratio)—a general computational framework that quantifies the contribution of feedback by comparing a system with feedback to an otherwise identical one without it. This controlled comparison isolates feedback effects while accounting for biomolecular constraints. CoRa provides an intuitive metric that can be applied broadly, regardless of network complexity, and evaluates both steady-state and dynamic responses to perturbations. Its simplicity and interpretability enable systematic, high-throughput analysis of diverse control architectures, revealing unexpected trade-offs and unifying principles across strategies. Applied to synthetic biology designs, CoRa helps identify key structural features underlying robust control. Overall, CoRa offers a powerful, scalable approach for dissecting and engineering biomolecular feedback systems.

Short Bio

Mariana Gómez-Schiavon completed her B.Sc. in Genome Sciences at the National Autonomous University of Mexico (UNAM), her M.Sc. in Biomedical Engineering and Physics at the Center for Research and Advanced Studies (CINVESTAV), and her Ph.D. in Computational Biology and Bioinformatics at Duke University. She also conducted her postdoctoral research at the University of California San Francisco (UCSF). In 2021, Dr. Gómez-Schiavon established her research group, which focuses on Evolutionary Systems Biology, as part of the International Laboratory for Human Genome Research (LIIGH, UNAM). Combining tools from population genetics and systems biology, her group investigates how the dynamic properties of gene regulatory circuits emerge, propagate and persist through natural selection. The long-term goal of Dr. Gómez-Schiavon's group is to develop a quantitative theoretical framework that connects molecular-scale dynamic regulation with evolutionary patterns, elucidating the fundamental principles underlying the structure of gene regulatory circuits.

Speakers

Speaker: Mariana Gómez-Schiavon, Junior Faculty, LIIGH-UNAM; Adjunct Investigator, iBio-Chile
Barcelona Supercomputing Center - Centro Nacional de Supercomputación

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