TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA

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Macroarea di Ingegneria

Seminar

Scaling laws in living social systems

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Scaling laws are ubiquitous in mechanics, from material strength to turbulence. These laws describe system behavior via power-laws, connecting specific properties to size. While foundational in physics, recent studies have identified scaling laws in living social systems that currently lack rigorous mechanistic understanding. Toward a methodology for unveiling the underpinnings of these complex systems, we tackle two distinct problems. First, we examine the scaling of metabolic rate in insect colonies, measured in the laboratory. Grounded in a "reverse social contagion" hypothesis, we establish an experimentally validated compartmental model for colony energy savings. Second, we analyze firearm prevalence across U.S. cities—a much less structured scenario where only ecological data are available. Using multidimensional data, we demonstrate the possibility of informing plausible modeling hypotheses through causal discovery and, consequently, formulating network-theoretic models.

Maurizio Porfiri is an Institute Professor at New York University Tandon School of Engineering (Departments of Mechanical and Aerospace Engineering, Biomedical Engineering, Center for Urban Science and Progress, CUSP, and Civil and Urban Engineering, CUE). He is presently the Director of CUSP, Interim Chair of CUE, and the founding Director of the Urban Institute. He received M.Sc. and Ph.D. degrees in Engineering Mechanics from Virginia Tech; a "Laurea" in Electrical Engineering and a Ph.D. in Theoretical and Applied Mechanics from Sapienza University of Rome and the University of Toulon. He conducts and supervises research on complex systems, with applications ranging from mechanics and robotics to urban science and behavioral biology.