Seminar

MAX PLANCK INSTITUTE
FOR DYNAMICS AND
SELF-ORGANIZATION

Towards a computational approach to emergent phenomena

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Emergence is one of the most fascinating and challenging aspects of complex systems, which let them feature unique properties at different spatio-temporal scales. Recent work has introduced various mathematical approaches to emergence, which let us to formalise precise conjectures about emergent phenomena that can be then verify on empirical data. The talk will provide an overview of various formalisations of emergence that focus on dynamical features between microscopic and macroscopic levels. The discussion will be illustrated on the frameworks introduced in [1] using information decomposition, and the one in [2] based on computational mechanics. By doing this, the talk will argue towards a pluralistic understanding of emergence, which discriminates between sub-types and identify specific tools to best address them.

References:
[1] Rosas, F. E., Mediano, P. A., Jensen, H. J., Seth, A. K., Barrett, A. B., Carhart-Harris, R. L., & Bor, D. (2020). Reconciling emergences: An information-theoretic approach to identify causal emergence in multivariate data. PLoS computational biology, 16(12), e1008289.
[2] Rosas, F. E., Geiger, B. C., Luppi, A. I., Seth, A. K., Polani, D., Gastpar, M., & Mediano, P. A. (2024). Software in the natural world: A computational approach to emergence in complex multi-level systems. arXiv preprint arXiv:2402.09090.

Monday, May 13th, 2024 at 2:00 pm

MPI-DS, Maria Goeppert seminar room (0.79)

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