Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Seminar

Biological Data Science From the Perspective of Dynamical Systems Theory

Tosif Ahamed

Lunenfeld-Tanenbaum Research Institute, Toronto

Biology is undergoing a data revolution exhibited by high-resolution measurements of 4D spatiotemporal dynamics in complex biological systems. Of particular interest are simultaneous neural and behavioural recordings now possible in several important model systems. We can now hope to fully tackle one of the most fundamental questions in biology: how do animals control and adapt their behaviour? However, due to their complexity, 4D spatiotemporal datasets bring unique challenges in how to analyse and extract meaning from them; stretching the limits of existing analysis methods. In this talk, I will share my thesis that the mathematical theory of dynamical systems combined with modern machine learning and topological data analysis methods provide a powerful avenue to build interpretable, data-driven models of complex biological phenomena. I will demonstrate this thesis with the help of examples from my past and current research on building a purely data driven theory of C. elegans locomotor behaviour.

References:

1. Ahamed, Tosif, Antonio C. Costa and Greg J. Stephens. "Capturing the continuous complexity of behaviour in Caenorhabditis elegans." Nature Physics 17.2 (2021): 275-283.
2. Loveless, Jane, and Barbara Webb. "Chaotic worms" Nature Physics 17.2 (2021): 170-171.
3. Costa Antonio Carlos, and Ahamed, Tosif, et al. "Maximally predictive ensemble dynamics from data" arXiv preprint arXiv:2105.12811 (2021).

Monday, Oct 17th 2022

4:00 PM (Tea/Coffee at 3:45 PM)

Seminar Hall, TIFR-H