Title: Data-driven models of ecological systems

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Short description: Many ecological systems show striking patterns of self-organization -- such as synchrony of flocking birds and schooling fish or patterns of vegetation in arid ecosystems. Over the past two decades, mathematical and computational models are widely employed to describe such patterns. A large part of research has focussed on 'static patterns' and comparison to data is qualitative. In this project, we aim to develop data-inspired and data-driven models of stochastic dynamics of self-organised systems. We may use employ data from high-resolution videos of schooling dynamics or satellite images of ecosystems. The mathematical and computational aspects will involve techniques such as stochastic processes, nonlinear dynamics, agent-based models, image processing tools, and machine learning applied on real data sets - as appropriate -- to gain new insights on the dynamics of patterns.

Some related references:

Jitesh Jhawar, Richard G. Morris, U. R. Amith-Kumar, M. Danny Raj, R. Harikrishnan, Tim Rogers and Vishwesha Guttal, 2020, Noise-Induced Schooling of Fish, ***Nature Physics,*** **16: 488–493** doi: https://doi.org/10.1038/s41567-020-0787-y

Gokul Nair, Athmanathan Senthilnathan, Srikanth Iyer, and Vishwesha Guttal, 2019**,** Fission-fusion dynamics and group-size dependent composition in heterogeneous populations, ***Physical Review E***, **99**, 032412, doi: https://doi.org/10.1103/PhysRevE.99.032412

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