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Identification of individual coherent sets associated with flow trajectories using Coherent Structure Coloring[1] KRISTY SCHLUETER-KUCK, JOHN DABIRI, Stanford University — In recent years, there has been a proliferation of techniques that aim to characterize fluid flow kinematics on the basis of Lagrangian trajectories of collections of tracer particles. Most of these techniques depend on presence of tracer particles that are initially closely-spaced, in order to compute local gradients of their trajectories. In many applications, the requirement of close tracer spacing cannot be satisfied, especially when the tracers are naturally occurring and their distribution is dictated by the underlying flow. Moreover, current methods often focus on determination of the boundaries of coherent sets, whereas in practice it is often valuable to identify the complete set of trajectories that are coherent with an individual trajectory of interest. We extend the concept of Coherent Structure Coloring to achieve identification of the coherent set associated with individual Lagrangian trajectories. This algorithm is proven successful in identifying coherent structures of varying complexities in canonical unsteady flows. Importantly, although the method is demonstrated here in the context of fluid flow kinematics, the generality of the approach allows for its potential application to other unsupervised clustering problems in dynamical systems.

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Kristy Schlueter
Stanford University

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