Identifying and Tracking Turbulence Structures

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Abstract: In atmospheric science the detection and tracking of turbulence structures observed in nature has been the focus of many studies. In this talk we present a statistical approach to object tracking which allows for paths to merge together or split apart. Paths are also allowed to be born, die, and go undetected for several frames. The splitting and merging of paths is a novel addition for a statistically-based tracking algorithm. This addition is essential for storm tracking, which is the motivation for this work. The utility of this tracker extends well beyond the tracking of storms however. It can be valuable in other tracking applications that have splitting or merging, such as vortices, radar/sonar signals, or groups of people. The method assumes that the location of an object behaves like a Gaussian Process when it is observable. Objects are required to be born, die, split, or merge according to a Markov State Model. Path correspondence is achieved by an algorithm that finds the paths that maximize the likelihood of the assumed model.