ICTS Thesis Defense Seminar

Title : A study of dynamical instabilities and filter stability using ensemble Kalman filters

Speaker : Shashank Kumar Roy (ICTS-TIFR, Bengaluru)

Date : Monday, 20 January 2025

Time : 11:00 AM (IST)

Abstract : Data assimilation, or filtering, comprises mathematical theory and algorithms for online state estimation of chaotic dynamical systems, where sparse and noisy observations are combined with numerical models. In this talk, we address two key problems related to reliable estimation of the uncertainty in the state and the instability directions of these systems. The first problem examines nonlinear filter stability, an important property that ensures the long-term posterior distribution of the state remains robust to errors in the initial distribution. We propose a method utilizing the Wasserstein distance to numerically evaluate the stability of general Bayesian filtering algorithms for deterministic dynamical systems. The second problem focuses on the computation of local instability directions, such as Lyapunov vectors, from approximate trajectories. This is particularly important when the true underlying trajectory is unknown but only partially accessible through noisy data. Using trajectories obtained from a filtering algorithm, we estimate Lyapunov vectors and their associated subspaces. We further analyze the sensitivity of these vectors and subspaces to perturbations in the trajectory. Our study highlights the limitations in their accuracy when estimated from approximate trajectories.

Venue : Online
Zoom Link:
https://icts-res-in.zoom.us/j/97029371967?pwd=H954SYSkxuKkilMMwhmSBcg9jirZ5H.1
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