Indicators and precursors of transitions in complex systems

Henrik Jeldtoft Jensen, Complexity & Networks Group and Department of Mathematics, Imperial College London

Abstract:

We use the Tangled Nature model of co-evolving agents in a high dimensional abstract type space to develop mathematical methods that allow us to monitor and to some extend see warnings of approaching systemic level transitions. The fundamentally stochastic dynamics is approximated by deterministic mean field equations. Because of the very high dimensionality fixed points cannot be identified by analytic means, but an eigenvalue stability analysis can be performed numerically about the quasi stable configurations generated by the stochastic dynamics. The appearance of positive eigenvalues associated with directions with an overlap with the instantaneous state vector of the system is found to be a good indicator/precursor of transitions or tipping points.