AHMED SID-ALI, Carleton University

Large-Scale and Large-Time Behaviour of Finite-State Mean-Field Interacting Particle Systems on Block-structured Networks

Since *Kac*'s and *McKean*'s seminal works, the *mean-field theory* has been widely exploited to study the time evolution of large stochastic interacting particle systems. In the classical homogeneous setting with complete interaction graphs, the big picture is well understood, and various asymptotic results have been established. Though such assumptions are reasonable in statistical physics, it might no longer be the case when considering other applications. Therefore, it is of interest to study systems where the homogeneity and/or the complete interaction assumption are no more relevant. In this talk, we take one direction towards heterogeneity by considering systems in a multi-population paradigm. Namely, we present a model for block-structured networks with dynamically changing multi-colors nodes where the interactions are described through *local empirical measures*. Two levels of heterogeneity are considered: between and within the blocks. We then look at the large-scale and large-time asymptotics of the system. We first present, under original regularity conditions, a bunch of limiting results in the $N \to \infty$ asymptotics: *Propagation of chaos, laws of large numbers*, and *large deviation principles* for the vectors of empirical measures and the empirical processes together with the LDP of the corresponding unique invariant measure. We will then see how to exploit the latter results to investigate the large-time behavior of the empirical process vector by relying on the *Freidlin-Wentzell theory* and the work of Hwang and Sheu. In particular, we present some *metastable phenomena* arising at large N and large t when the limiting *McKean-Vlasov system* contains multiple ω-*limit sets*.