

Graph-based nonlocal gradient flows and their local limits

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In this talk I will discuss systems of multiple nonlocally interacting species on a large class of graphs ranging from finite graphs to continuous graphs or graphons. The proposed analytical model is based on the theory of metric gradient flows and provides a unified upwind-based framework, including concave mobilities and non-1-homogeneous kinetic relations. Exploiting the systems gradient flow nature, we prove existence of weak solutions by establishing a rigorous link to a variational formulation in a quasi-metric setting. In addition, the behaviour of the arising dynamics is explored in numerical and analytical case studies, showcasing phenomena such as the formation of patterns, the aggregation of one species or the separation of different species. Finally, we will see for linear mobility and 1-homogeneous kinetic relation that solutions of nonlocal systems, defined on a suitable family of graphons, converge to solutions of a system of nonlocal interaction equations in Euclidean space.