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Data Driven, multi-scale dynamics for complex social systems

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Social systems are known to display rich, dynamical patterns owing in large part to the hierarchical graph structure of such systems. Recent work by our group has shown that online collective behavior follows generalized Burgers-like equations. Our goal is to use PINNs to infer the best equation form for these online dynamics which underpin many current societal problems. In this talk, we propose an end-to-end, encoder-pooling-decoder framework for inferring the dynamics of complex social systems based on graph- and operator-learning approaches. In particular, we encode the dynamical history of a system using hyperbolic embeddings (HGCN) and differentiable coarse graining (DiffPool), enabling downstream forecasting and operator learning of multi-scale Burgers equations.