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Particle systems and kinetic equations modelling interacting agents in high dimension

We explore how concepts of high-dimensional data compression via random projections onto lower-dimensional spaces can be applied for tractable simulation of certain dynamical systems modeling complex interactions. In such systems, one has to deal with a large number of agents (typically millions) in spaces of parameters describing each agent of high-dimension (thousands or more). Even with todays powerful computers, numerical simulations of such systems are prohibitively expensive. We propose an approach for the simulation of dynamical systems governed by functions of adjacency matrices in high-dimension, by random projections via Johnson-Lindenstrauss embeddings, and recovery by compressed sensing techniques.