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Time-dependent discret, Ising-like model for SIS epidemic systems

Standard SIS (Susceptible-Infected-Susceptible), SIR and other similar epidemic systems are commonly modeled as mean field dynamic systems or simulated as different kinds of cellular automata. We model a SIS system as an asymmetric Ising model. In its simplest version, each individual is considered fixed to the nodes of a square lattice of linear size L and they interact with their nearest neighbors only. Then each individual is represented by a vector which may assume the values 1 (susceptible) or -1 (infected) and the probabilities of a susceptible to become infected and an infected to recover depend respectively on the number of infected neighbors and a constant field H. Here we show that the SIS model is consistent with time dependent probabilities in a Glauber fashion, derive the classic mean-field equations and through extensive Monte Carlo simulations, we show how spatial heterogeneities arise naturally from the model.