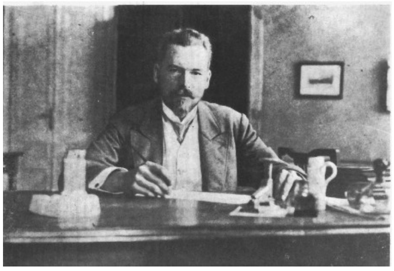

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q-Neighbor Majority-Vote Model on Complex Networks

Friday, 20 September 2019 12:40 (20 minutes)

A q-neighbor majority-vote model for the opinion formation is introduced in which agents represented by two-state spins update their opinions on the basis of the opinions of randomly chosen subsets of q their neighbors (q-lobbies). The agents with probability $(1-2p)$, $0 \leq p \leq 1/2$, obey the majority-vote rule in which the probability of the opinion flip depends only on the sign of the resultant opinion of the q-lobby, and with probability $2p$ act independently and change opinion or remain in the actual state with equal probabilities. Thus, the parameter p controls the degree of stochasticity in the model. In the model under study the agents are located in the nodes of complex networks, e.g., Erd\"os-R\'enyi graphs or scale-free networks, and the neighborhood of each agent consists of all agents connected with him/her by edges, out of which the q-lobby is chosen randomly at each step of the Monte Carlo simulation. This model is related to a recently introduced q-neighbor Ising model [A.\ J\c{e}drzejewski et al., Phys.\ Rev.\ E 92, 052105 (2015); A.\ Chmiel et al., Int.\ J.\ Modern Phys.\ C 29, 1850041 (2018)], with agents obeying Metropolis opinion update rule, in which, in particular, first-order ferromagnetic transition was reported, with the width of the hysteresis loop oscillating with q. In contrast, in the q-neighbor majority vote model only second-order ferromagnetic transition is observed. Theory for this transition is presented both in the mean-field approximation, valid for large mean degrees of nodes and large q, and in a more elaborate pair approximation. In the latter case the predicted location of the critical point p_c agrees quantitatively with that obtained from Monte Carlo simulations for various complex networks with broad range of mean degrees of nodes and sizes of the q-lobby. Finite size scaling analysis shows that in the vicinity of the critical point the magnetization shows scalin typical for the mean-field Ising model, with the critical exponent $\beta = 1/2$, but other critical exponents depend on the topology of the underlying complex network.

Summary

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