Summer Solstice 2018 Conference on Discrete Models of Complex Systems

Gdańsk, June 25-27, 2018

Majority vote model with independence on complex networks

Andrzej Krawiecki, *Faculty of Physics, Warsaw University of Technology*, Poland

One of the most popular models for the opinion formation is the majority vote model with agents represented by two-state spins located in the nodes and interacting via edges of a possibly complex network of social contacts. In the simplest version of this model the agents assume, with probability governed by a parameter q $(0 < q < 1/2)$, the opinion in agreement with that of the majority of their neighbors. In a variant called the majority vote model with independence the agents obey the above-mentioned ferromagnetic update rule with certain probability $1 - p$ $(0 < p < 1)$ while with probability p they make decision randomly. In this contribution the majority vote model with independence is investigated on complex networks, including random graphs and scale-free networks. It is shown that the parameters q and $p/2$ are equivalent and as one of them is decreased, with the other fixed, the model can exhibit transition to the ferromagnetic state at a critical value qc or pc which depends on the mean degree $< k >$ and on the moment $< k^{3/2} >$ of the distribution of the degrees of nodes $p(k)$. The critical behavior of the magnetization M is determined in the mean-field approximation. The model on random regular or Erdos-Renyi graphs belongs to the universality class of the mean-field Ising model, with M scaling as $(qc-q)^{\beta}$ or $(2pc-2p)^{\beta}$ with $\beta = 1/2$. In the case of the model on scale-free networks with the degree distribution $p(k) \sim k^{-\gamma}$ for $5/2 < \gamma < 7/2$ the scaling behavior is non-universal, with $\beta = 1/2(\gamma - 5/2)$, while for $\gamma > 7/2$ the mean-field scaling with $\beta = 1/2$ occurs. These results are confirmed by Monte Carlo simulations.