A Trust Model in Bootstrap Percolation

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Bootstrap percolation, which originated from the field of statistical mechanics, is a class of monotone cellular automata describing an activation process which follows certain activation rules. In particular, in the classical r-neighbor bootstrap process on a graph G, a set A of initially infected vertices spreads by infecting vertices with at least r already-infected neighbors. Motivated by the study of social networks and biological interactions through graphs, where vertices represent people and edges represent the relations among them, this paper introduces a novel model which is named T-Bootstrap percolation (T -BP). In this new model, vertices of the graph G are assigned random labels, and the set of initially infected vertices spreads by infecting (at each time step) vertices with at least a fixed number of already-infected neighbors of each label. The Trust Model for Bootstrap Percolation allows one to impose a preset level of skepticism towards a rumor, as it requires a rumor to be validated by numerous groups in order for it to spread, hence imposing a predetermined level of trust needed for the rumor to spread. Various properties of this new model (e.g. the critical probability of infection and the confidence threshold) are described by considering different random and non-random networks. The model is also compared to other types of bootstrap percolation from the literature, such as U-bootstrap percolation. Ultimately, many applications for the model are found in the field of communications: particularly in investigating rumor spread, combating fake news, and developing marketing strategies, along with potential future applications in modeling the spread of genetic diseases.

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