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Asynchronous Opinion Dynamics in Social Networks

Opinion spreading in a society decides the fate of elections, the success of products, and the impact of political or social movements.
The model by Hegselmann and Krause is a well-known theoretical model to study such opinion formation processes in social networks.
In contrast to many other theoretical models, it does not converge towards a situation where all agents agree on the same opinion, but towards a stable situation where agents sharing the same opinion form a cluster, and agents in different clusters do not influence each other.%}

We focus on the social variant of the Hegselmann-Krause model where agents are connected by a social network and their opinions evolve in an iterative process. Agents are activated one after each other at random. When activated, an agent adopts the average of the opinions of its neighbors having a similar opinion. Thus, the set of influencing neighbors of an agent may change over time. To the best of our knowledge, social Hegselmann-Krause systems with asynchronous opinion updates have only been studied with the complete graph as social network.%}

We show that such opinion dynamics are guaranteed to converge for any social network. We provide an upper bound of $\mathcal{O}(n|E|^2(\varepsilon/\delta)^2)$ on the expected number of opinion updates until convergence, where $|E|$ is the number of edges of the social network. For the complete social network we show a bound of $\mathcal{O}(n^3(n^2 + (\varepsilon/\delta)^2))$ that represents a major improvement over the previously best upper bound of $\mathcal{O}(n^9(\varepsilon/\delta)^2)$.

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