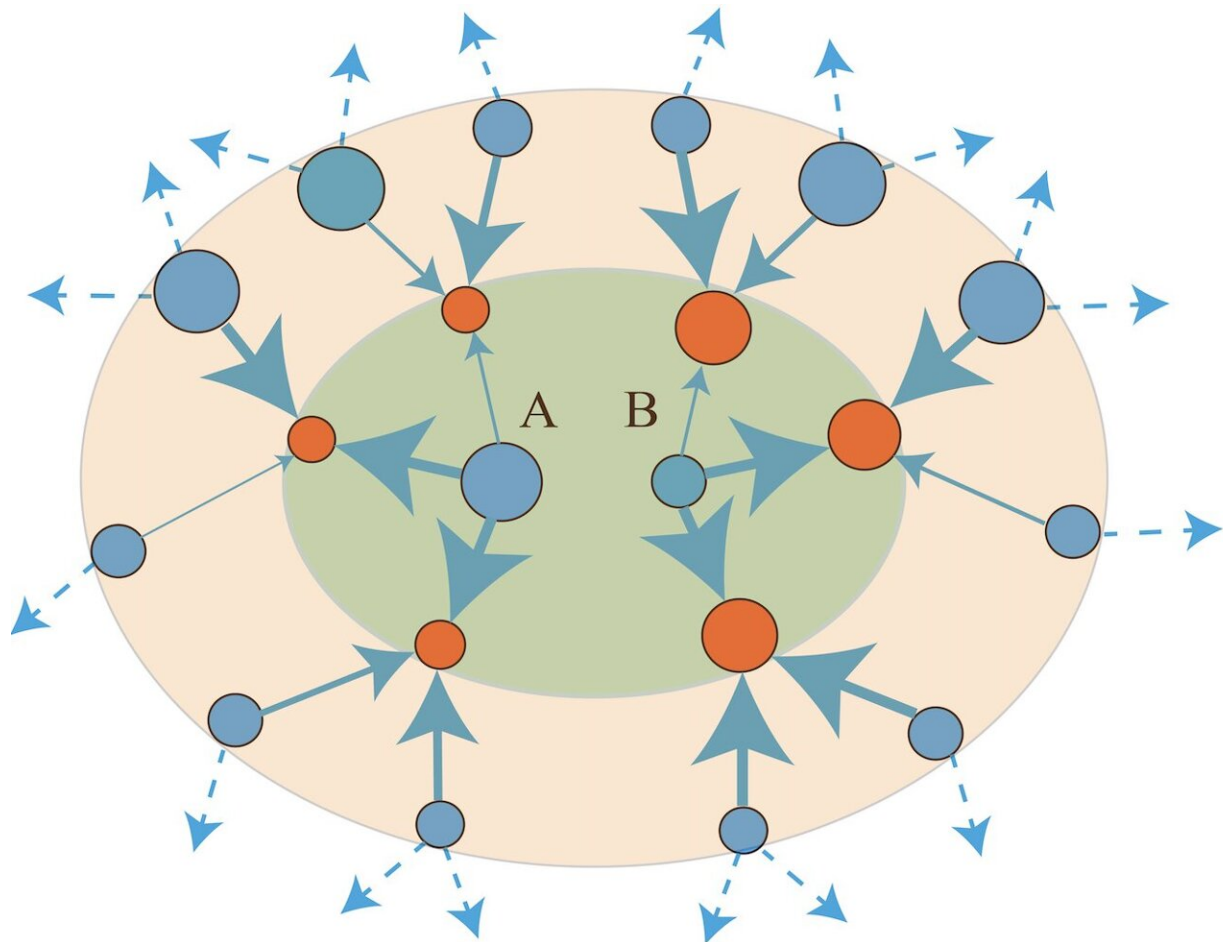# A new algorithm to predict information superspreaders in social media

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high-influence node A and low-influence node B

Nodes A and B look the same when only considering their closest network connections (directed arrows in the green region). The two users A and B

influence three users each (orange nodes), and they exhibit the same number of information propagation events (arrows' thickness). Yet by analyzing the information propagation patterns to the six nodes influenced by A and B (including arrows in the orange region), the influence-susceptibility algorithm determines that the nodes influenced by B are more susceptible to influence than those influenced by A and, therefore, A is more influential. Credit: Science China Press

Understanding how information flows in social networks is critical to counteracting dangerous misinformation, promoting the spreading of news, and designing healthy online social environments. Scholars have long realized the role of information superspreaders—namely, users with the capability to spread messages and ideas to many others rapidly.

A long-standing research tradition identifies the superspreaders through their position in the social network. Recent research, published in the journal *National Science Review* and led by Prof. Linyuan Lü (University of Electronic Science and Technology of China) and Dr. Manuel S. Mariani (University of Zurich), challenges this long-standing paradigm. It shows that users' behavioral traits (i.e., how they tend to behave) provide more accurate early indicators of their spreading ability than where they sit in the social network.

The authors departed from traditional network approaches by starting with a model for how information flows from individual to individual. Motivated by previous empirical findings, the model assumes that the probability that a message is transmitted from a source to a target user is determined by both the source's influence (namely, a parameter that captures her likelihood to transmit information to others) and the target's susceptibility to influence.

The users' influence and susceptibility parameters are not known a

priori. However, the authors derived a pair of coupled equations that connect the users' influence and susceptibility with the structure of the underlying propagation network, which enables their computation on massive behavioral datasets.

Through these equations, the authors could measure the influence and susceptibility scores of millions of users in Weibo and Twitter, which improves our understanding of information superspreaders in two ways. First, the results by the authors challenge the paradigm that the network hubs—i.e., the users with many followers—are the most effective information spreaders.

They show that, instead, the influence and susceptibility scores of the users provide more accurate predictors of being a superspreader than the users' number of followers. Second, superspreaders are characterized by more high-contagion links (i.e., the product between their influence and their audiences' susceptibilities tends to be large), and they tend to influence more influential users.

This suggests that explaining the superspreaders requires the integration of network structures and individual-level behavioral characteristics.

These findings could open new directions in social network research. Within the realm of information spreading, the simplifying assumptions of the propagation model might be gradually relaxed. More refined models may include topic diversity, algorithmic influences, memory effects, all of which could lead to different equations for the users' influence and susceptibility scores.

The influence and susceptibility scores may also vary by topic, which could eventually lead to a multidimensional characterization of the users and their spreading capabilities.

On a more general note, the paradigm proposed by this study could also have implications for interventions aimed at large-scale behavioral change. Traditionally, these activities focus on persuading the social hubs to adopt a new product or behavior early. The authors' findings suggest that a more effective approach might rely on identifying high-contagion links that connect highly influential and highly susceptible potential adopters.

To this end, additional research is needed to adapt the algorithm to the spreading of behaviors, which will likely require different sets of equations compared to those obtained for information spreading. Field experiments will be needed to validate the resulting insights. Eventually, these efforts could reveal how to best integrate individuals' positions in their social networks with how they typically behave to design interventions for behavioral change, which is key for organizations and policymakers.

More information: Fang Zhou et al, Beyond network centrality: Individual-level behavioral traits for predicting information superspreaders in social media, *National Science Review* (2024). DOI: 10.1093/nsr/nwae073

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