Optimal Network Modularity For Information Diffusion

INDIANA UNIVERSITY BLOOMINGTON

Azadeh Nematzadeh, Emilio Ferrara, Alessandro Flammini, and Yong-Yeol Ahn

Center for Complex Networks and Systems Research

CNetS

Linear Threshold Model

Information can diffuse more quickly in Large Network due to easier multiple exposure.

$s_i : 0, 1$

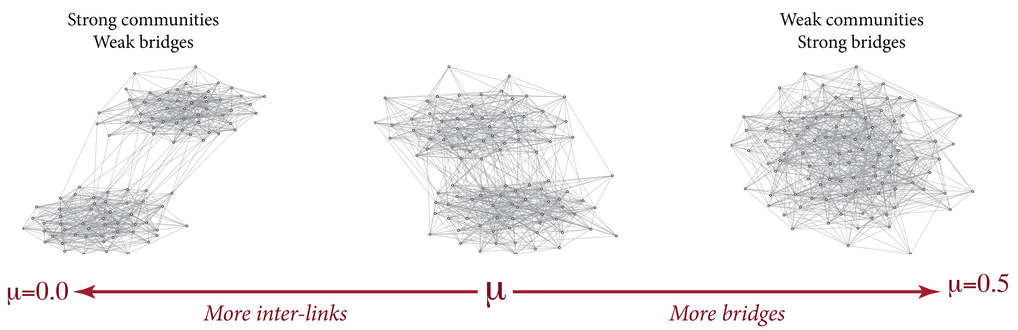
k_i : Degree of node i

θ : Adoption threshold

$N(i)$: The set of node i neighbors

$$s_i(t+1) = \begin{cases} 1 & \text{if} \quad \theta k_i < \sum_{j \in \mathcal{N}(i)} s_j(t), \\ 0 & \text{otherwise,} \end{cases}$$

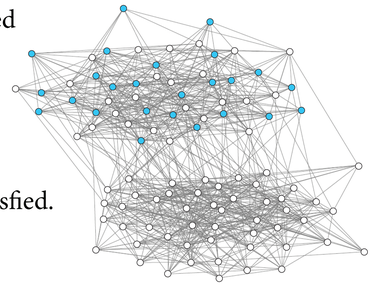
Which network does facilitate the information diffuse the best?



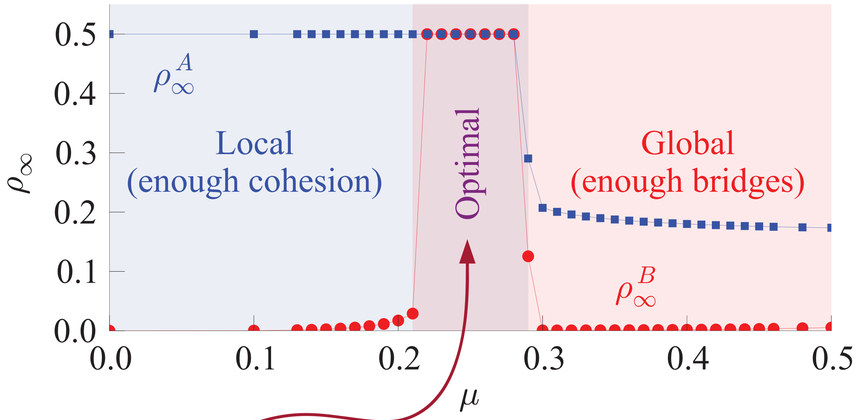
Dynamics

A fraction ρ_0 of randomly selected agents, is initialized in the active state.

A synchronous update of each node if the adoption threshold condition is satisfied.

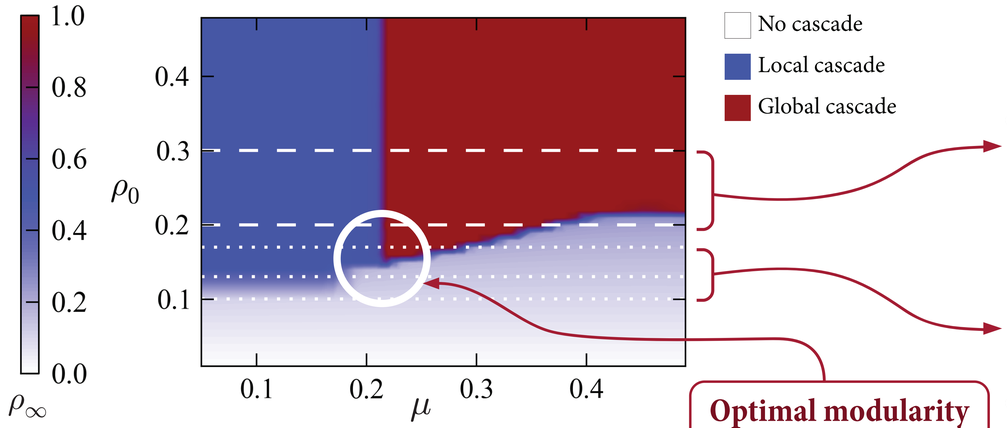


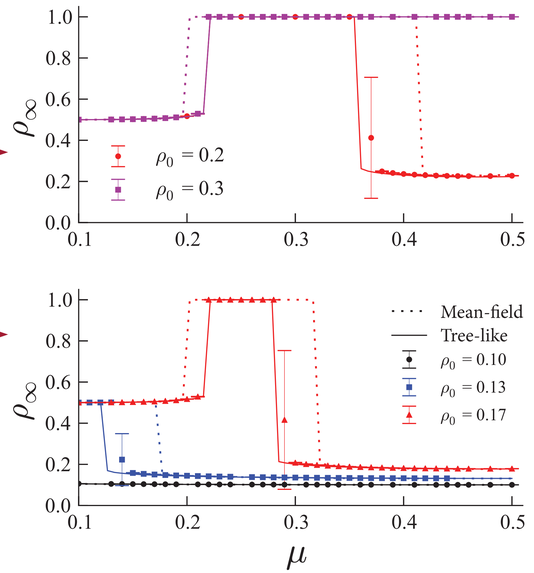
Intra-Community vs. Inter-Community



In the optimal regime:
Modularity is strong enough to initiate the local spreading and weak enough to induce inter-community spreading.

Phase Diagram





We demonstrate the existence of optimal modularity, where global cascades require the minimal number of early adopters.