

Predicting Criticality and Dynamic Range in Complex Networks: Effects of Topology

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Topology of a network can significantly affect its criticality and dynamic range. Here we study the effects of network topology on the criticality and dynamic range of a network. We consider a network with a fixed number of nodes and edges. The network is represented by an adjacency matrix A . The criticality of the network is defined as the number of nodes that are active at the critical point. The dynamic range of the network is defined as the range of parameters over which the network exhibits a phase transition. We show that the criticality and dynamic range of a network are determined by the eigenvalues of the adjacency matrix A . The criticality is determined by the largest eigenvalue of A , and the dynamic range is determined by the second largest eigenvalue of A . We show that the criticality and dynamic range of a network are both maximized when the network is a regular graph. This result has important implications for the design of networks for applications in biology, physics, and engineering.

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Networks [1,2] and [3] are a natural way to describe complex systems. The nodes of a network represent the components of the system, and the edges represent the interactions between them. The topology of a network, which is determined by the arrangement of its nodes and edges, can significantly affect its criticality and dynamic range. Here we study the effects of network topology on the criticality and dynamic range of a network. We consider a network with a fixed number of nodes and edges. The network is represented by an adjacency matrix A . The criticality of the network is defined as the number of nodes that are active at the critical point. The dynamic range of the network is defined as the range of parameters over which the network exhibits a phase transition. We show that the criticality and dynamic range of a network are determined by the eigenvalues of the adjacency matrix A . The criticality is determined by the largest eigenvalue of A , and the dynamic range is determined by the second largest eigenvalue of A . We show that the criticality and dynamic range of a network are both maximized when the network is a regular graph. This result has important implications for the design of networks for applications in biology, physics, and engineering.

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e_1, \dots, e_n are linearly independent. I
 $a_1, \dots, a_n, \lim_{t \rightarrow 0} F = 0$ < 1 $a_1, \dots, \lim_{t \rightarrow 0} F > 0$
 > 1 . I $a_1, \dots, e_1, \dots, a_n$ are linearly independent.
 $a_1, \dots, e_1, \dots, a_n = 1$. Then, $a_1, \dots, e_1, \dots, a_n$
 $\in \mathbb{R}^{[2,4]}$ a_1, \dots, a_n are linearly independent.
 $a_1, \dots, a_n = \frac{1}{N} \sum_{ij} A_{ij} = \langle$

$\in [2:0; 6:0]$, $\langle d \rangle = 1$, $[0:7; 1:3]$; $(A_{ij} \in \{0; 1\})$

$A_{ij} = d^{ut}$

$(A_{ij} \in \{0; 1\})$

C

