
Graph Coloring Framework to Mitigating Cascading Failure in Complex Networks

Poster

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Cascading failures pose a significant threat to the stability of complex systems, often leading to widespread collapse across various infrastructures and financial networks. This study presents a robust and practical methodology aimed at reducing the risk of such failures within complex networks, with a particular focus on the importance of local network topology. Central to our approach is an advanced algorithm designed to identify a critical subset of nodes within the network, with this subset being notably substantial relative to the network's overall size. To refine this algorithm, we incorporate a graph coloring heuristic to precisely target the most crucial nodes, thereby minimizing the subset size while maximizing its strategic impact. By securing these key nodes, the network's resilience to cascading failures is significantly enhanced. Our method for identifying critical nodes, supported by experimental results, demonstrates superior performance compared to conventional techniques. We validate the effectiveness of our approach through comparative analysis with existing strategies and assess its performance across various network configurations and failure scenarios. Empirical validation is achieved by applying our method to real-world networks, affirming its effectiveness as a strategic tool for improving network robustness. Full paper published in Singh, Karan, V. K. Chandrasekar, and D. V. Senthilkumar. "Streamlined approach to mitigation of cascading failure in complex networks." arXiv preprint arXiv:2406.18949 (2024).

References

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