

# An Entropic Topology Reconfiguration to Improve the Robustness of Complex Networks under Failures and Targeted Attacks

Farshad Safaei<sup>1</sup>

Hossein Yeganloo<sup>2</sup>

<sup>1</sup>Faculty of Computer Science and Engineering, Shahid Beheshti University, Tehran, Iran

<sup>2</sup>School of Computer Science, Institute for Research in Fundamental Sciences (IPM), Tehran, Iran

## ABSTRACT

One of the defensive strategies to increase the resilience of the networks is the rewiring mechanism in which the affected nodes are disintegrated from the faulty nodes and connect to a profitable node with a given probability. In this article, based on the concept of Shannon's entropy, a rewiring method is proposed to modify the configuration of the complex networks and improve their resilience. We measure the network robustness based on a spectrum of degree distribution, heterogeneity, and in addition, the average size of the largest connected cluster during removing the nodes as the consequence of systematic attacks to the centralities (i.e. degree, betweenness, and dangalchev's closeness). We apply the proposed rewiring strategy to six artificial data sets and six real data sets. The experimental results showed that a significant improvement of general resilience can be obtained through swapping about 30% of communication links.

**Keywords:** Complex Networks, Network Robustness, Shannon's Entropy, Edge Rewiring, Network Optimization, Onion-Like Network.