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Topologically robust network nonlocality

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In recent years, the study of Bell-type nonlocality on networks has led to an array of intriguing foundational results. Nonetheless the field still faces difficulties in finding a justified application. One of the key barriers for this is the assumption of independent sources in network nonlocality, which is difficult to enforce. In our work we examine a possible operational interpretation for such independent sources. In particular, in networks without inputs, parties connected with a common classical source can be interpreted as malicious parties working together. We explore the first steps in this framework and show that there exist nonlocal distributions which are robust against the topology of the network, i.e. in the spirit of decentralized protocols, the overall distributions are nonlocal even if one is unsure which parties are collaborating. In fact, we show that in large random networks this is quite typical. We further examine the relation to randomness generation and highlight some remaining challenges in developing protocols based on network nonlocality.

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