Estimating the volumes of correlations sets in causal networks

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Causal networks beyond that in the paradigmatic Bell's theorem can lead to new kinds and applications of non-classical behavior. Their study, however, has been hindered by the fact that they define a non-convex set of correlations and only very incomplete or approximated descriptions have been obtained so far, even for the simplest scenarios. Here, we take a different stance on the problem and consider the relative volume of classical or non-classical correlations a given network gives rise to, considering distances to sets of interest and how they distribute too. Among other results, we show instances where the inflation technique, arguably the most disseminated tool in the community, is unable to detect a significant portion of the non-classical behaviors, up to three copies of each source, and that a concentration phenomenon of distances happens in one of them. Interestingly, we also show that the use of interventions, a central tool in causal inference, can enhance substantially our ability to witness non-classicality.

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