Measures of contextuality and non-contextuality

Ehtibar N. Dzhafarov[1] and Janne V. Kujala[2]

[1]*Purdue University, 703 Third Street, West Lafayette 47907, USA*
[2]*University of Turku, FI-20014 Turun yliopisto, Finland*

(Non)contextuality is a basic property of any system of random variables labeled by their contents (that which they measure) and contexts (under what conditions they measure it). A system is consistently connected (obeys the "no-disturbance" or "no-signaling" requirement) if any two random variables with the same content are identically distributed. Empirical systems of random variables are usually inconsistently connected. The Contextuality-by-Default (CbD) theory provides a principled way of determining if a system, generally inconsistently connected, is contextual. We discuss different ways of constructing measures of (the degree of) contextuality for arbitrary systems of random variables. Two of them are developed within the framework of the CbD. We propose a third such measure, whose distinguishing feature is that it can be naturally extended to a measure of (the degree of) noncontextuality for systems found to be noncontextual.

[1] Kujala, J.V., Dzhafarov, E.N. (2019). Measures of contextuality and noncontextuality arXiv:1903.07170.

[2] Dzhafarov, E.N. (2019). On joint distributions, counterfactual values, and hidden variables in understanding contextuality. arXiv:1809.04528.