Causal effect metrics are not equal when facing population's shifts

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Abstract

There are currently several practices to report so-called treatment or causal effect in applied work, an in particular its magnitude: absolute difference, ratio, odds ratio, number needed to treat, and so on. The choice of such measures have several impacts as: (i) providing different appreciation of the same phenomenon, and (ii) leading to different heterogeneity of treatment effect patterns. In addition, not all metrics are collapsible. In this work, we review usual causal measures present in the literature, and recall typical arguments found about their pros and cons. Doing so, we enrich the existing formal framework and definitions of collapsibility and treatment effect heterogeneity, unifying different existing definitions. But the main contribution is our proposal to reverse the thinking. Rather than starting from the metric, we propose to start from a non-parametric generative model of the outcome. We show that depending on the nature of the outcome, each metric expresses something different. A by-product of our analysis is another way of understanding what heterogeneity and homogeneity of treatment effect means, not through the lens of the metric, but through the lens of the generative model. Finally, we also show how some metrics are easier to generalize to other populations, in the sense that they require less covariates for standardization. Our results are general as the proposed models are all non-parametric

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