

Where best to intervene?

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Abstract

One common motivation for mediation analysis is to help identify promising avenues for future interventions with the goal of improving the efficacy of an exposure or mitigating a harmful effect or disparity. In other words, mediation analysis is thought to help address the question, "Where best to intervene?" In this article, we formalize this notion, which naturally leads to causal estimands that can inform about the effects of certain future (generally stochastic) interventions on unobserved variables along causal pathways. These interventions correspond to so-called randomized interventional analogs of natural direct and indirect effects and path-specific effects. Unlike so-called natural mediation effects, these effects are manipulable in the sense that they comport with the target trial principle; that is, they are estimable in a hypothetical future randomized trial. Furthermore, their identification does not rely on any cross-world counterfactual independence assumptions. Lastly, we show that these effects contain so-called separable effects as a special case when the relationship between the exposure and the unobserved variable is constrained to be a deterministic equivalence. Thus, the class of estimands we discuss can be viewed as a kind of generalization of separable effects where the relationship between the exposure and a separable component is permitted to be nondeterministic.