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A Generative Adversarial Framework for Bounding Confounded Causal Effects

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Abstract : Causal inference from observational data is receiving wide applications in many fields. However, unidentifiable situations, where causal effects cannot be uniquely computed from observational data, pose critical barriers to applying causal inference to complicated real applications. In this paper, we develop a bounding method for estimating the average causal effect (ACE) under unidentifiable situations due to hidden confounders. We propose to parameterize the unknown exogenous random variables and structural equations of a causal model using neural networks and implicit generative models. Then, with an adversarial learning framework, we search the parameter space to explicitly traverse causal models that agree with the given observational distribution and find those that minimize or maximize the ACE to obtain its lower and upper bounds. The proposed method does not make any assumption about the data generating process and the type of the variables. Experiments using both synthetic and real-world datasets show the effectiveness of the method.

Keywords : average causal effect, hidden confounding, bound estimation, generative adversarial learning
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