Learning Causal Relationships from Conditional Moment Conditions by Importance Weighting

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May 21, 2021

Abstract

We consider learning causal relationships under conditional moment conditions. Under conditional moment conditions, in contrast to unconditional moment conditions, standard causal methods are often inadequate and can lead to faulty inferences. To address this issue, we propose a novel method that approximates unconditional moment conditions with conditional moment conditions through importance weighting using the conditional density ratio. Our proposed approach successfully approximates unconditional moment conditions, allowing us to employ methods for estimating causal parameters from unconditional moment conditions, such as generalized method of moments, adequately in a straightforward manner. We also discuss how several existing methodologies proposed in the machine learning literature do not adequately address issues when using conditional moment conditions, raising serious concerns about their performance. The problem is partly related to the datasets used in existing studies that obfuscate these concerns, and we discuss appropriate experimental settings. Our proposed method performs well compared to existing methods, and we provide theoretical justification for its use.