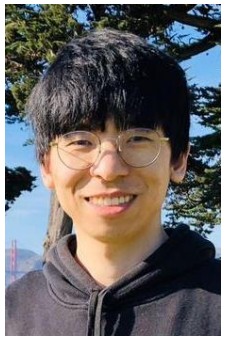
A Generative Adversarial Framework for Bounding Confounded Causal Effects

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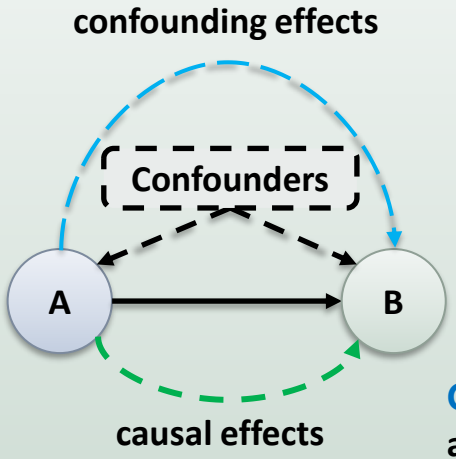
Unidentifiable Problem

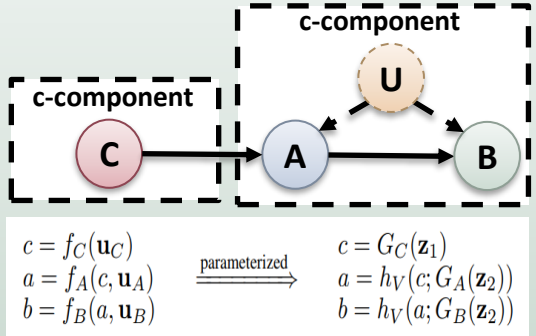


When hidden confounders exist, the ACE may not be uniquely calculated from the observational data without further assumptions, known as the ***unidentifiable problem***.

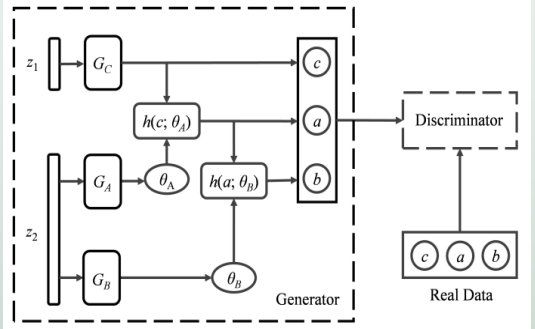
Goal: How to bound ACEs to continuous and possibly high dimensional variables when hidden confounders exist.

Example

- Causal graph and equations



- Architecture of neural networks



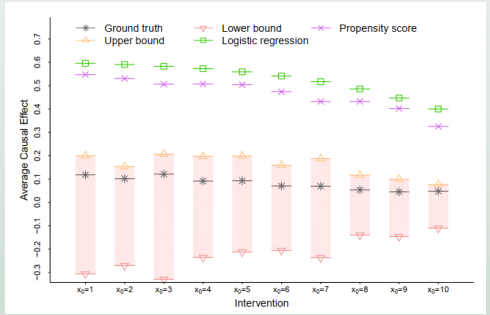
Proposed Framework

Framework: We propose to parameterize the unknown exogenous random variables and structural equations of a causal model using neural networks and implicit generative models.

- Estimate response functions from $\mathbf{PA}_V$ to V by neural networks with a certain network structure.
- Use the implicit generative model to generate the distribution for the response-function variable.
- Parameterize the causal model by expressing it with response-function variables.
- Formulate an adversarial learning problem for computing the bounds of the ACE.

Experiments

- Results of synthetic dataset



- Results of adult dataset