PURDUE UNIVERSITY

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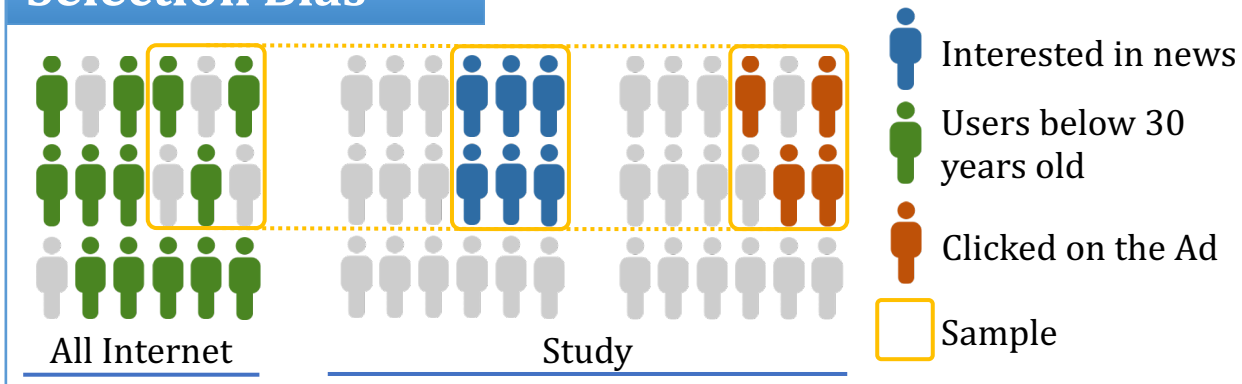
Causal Effect Identification by Adjustment under Confounding and Selection Biases

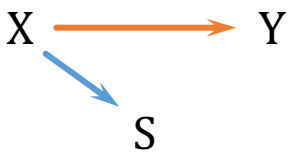
Causal Inference

Answer questions about change, i.e. *How will the click through rate (Y)change, if an agent picks the topic (X) of the ad displayed to the users*?

Selection Bias



Proportions in the sample do not match those in the whole population!
Will our conclusions hold for the general advertisement business?

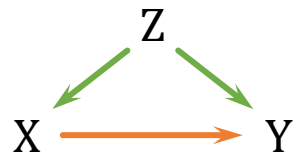


Selection Bias represented in a Causal Diagram

Confounding Bias

- Age (Z) of the user influences what topics are likely to be shown.
- Age (Z) affects the likelihood of the user clicking the ads.

How much is the topic (X) affecting the click through rate (Y)?



Confounding Bias represented in a Causal Diagram

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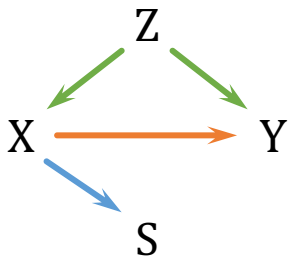
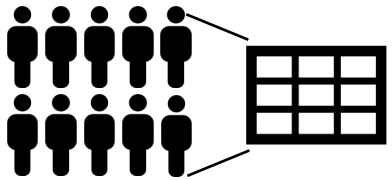
Our Task

- Consider both Selection Bias and Confounding bias simultaneously



- Use external data without selection bias to enhance the robustness of the inference process



Applications

- Robotics
- Statistics
- Economy
- Medicine
- Biology
- Experimental Design
- Epidemiology
- Marketing

Contributions

- Complete criterion to decide valid covariate adjustment sets without external data.
- Complete criterion when measures on the covariates are available from external data.
- Efficient (polynomial delay) algorithm to find such sets systematically.