Strategic Instrumental Variable Regression:
Recovering Causal Relationships from Strategic Responses

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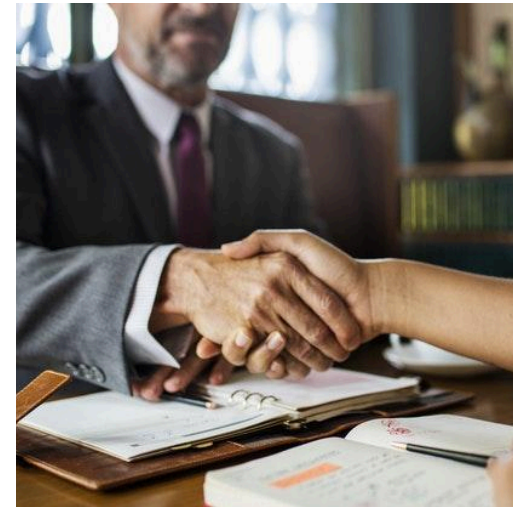*ICML 2022*

Motivation

- ML models increasingly used to assess individuals' qualifications

Lending

Education

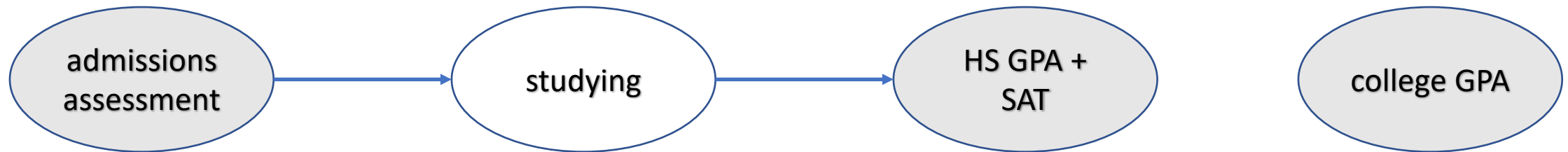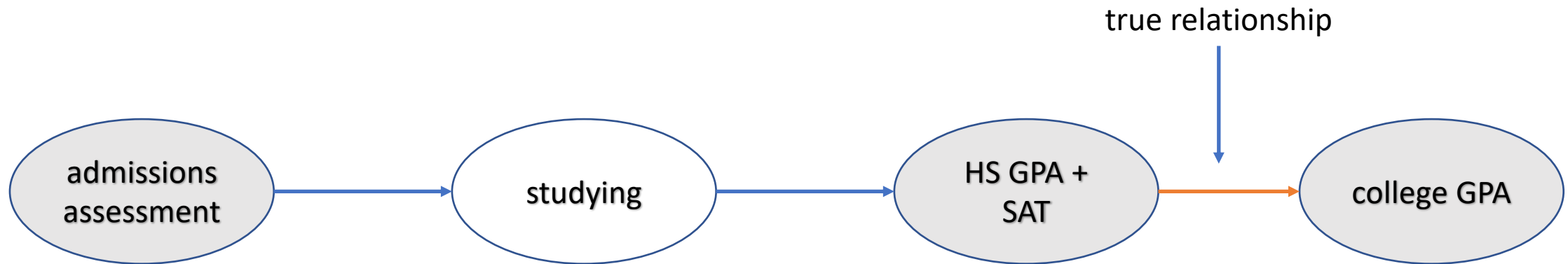Employment

Example

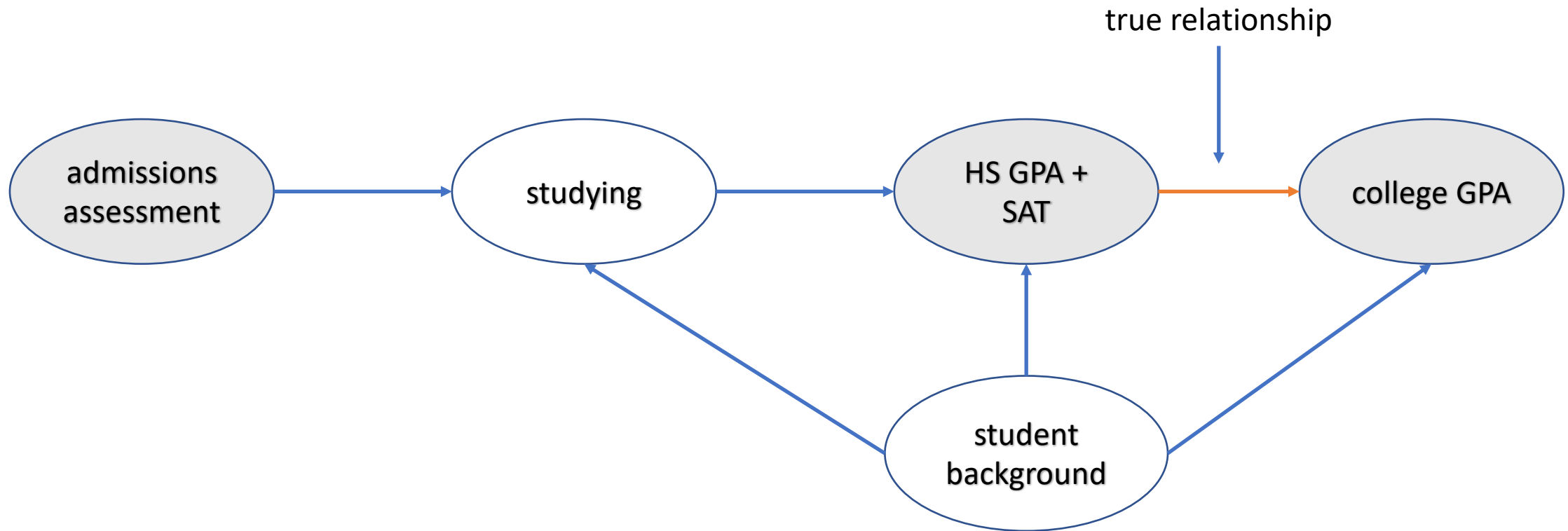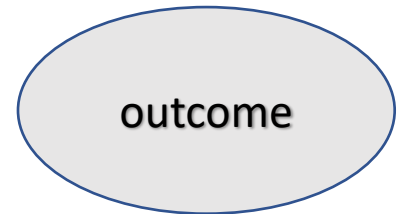admissions assessment

college GPA

Example

Example

Example

Example

Our Model

assessment rule

outcome

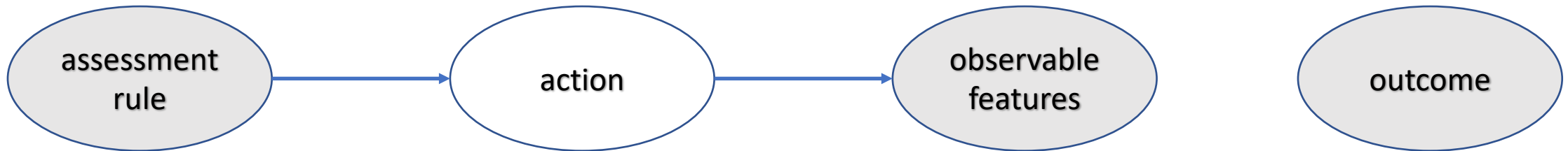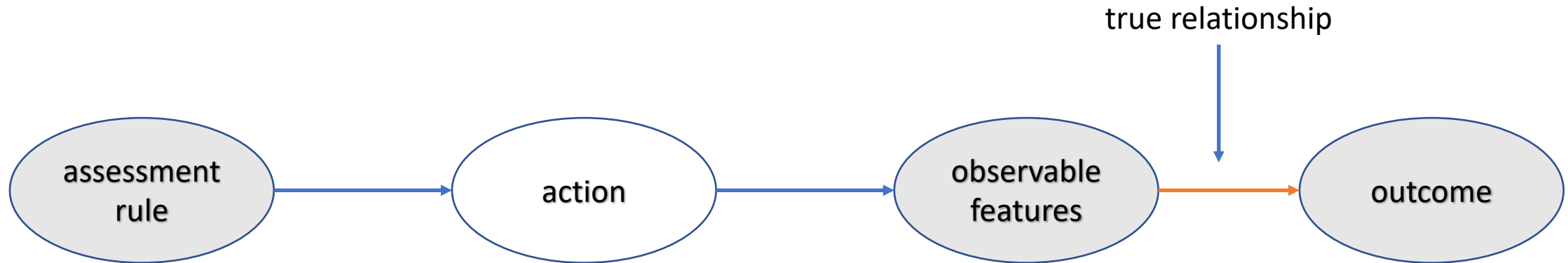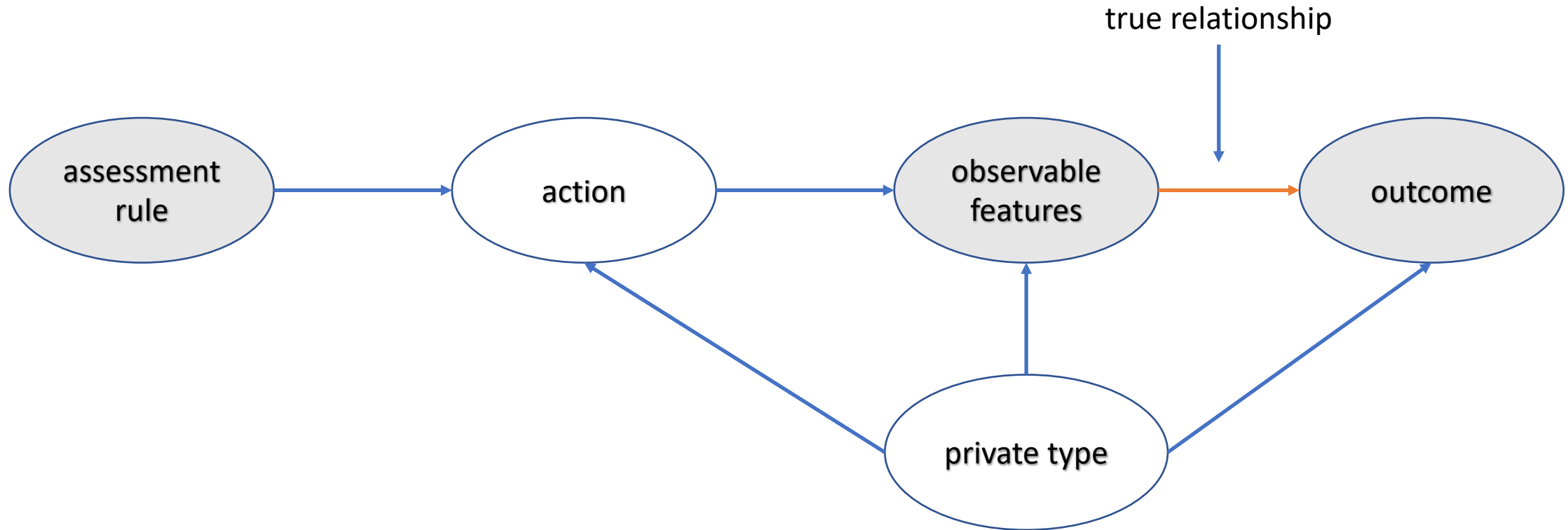# Our Model

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Key observation: Assessment rule is a valid instrument!

Main Result

- Can apply 2SLS to recover unbiased estimate of true relationship
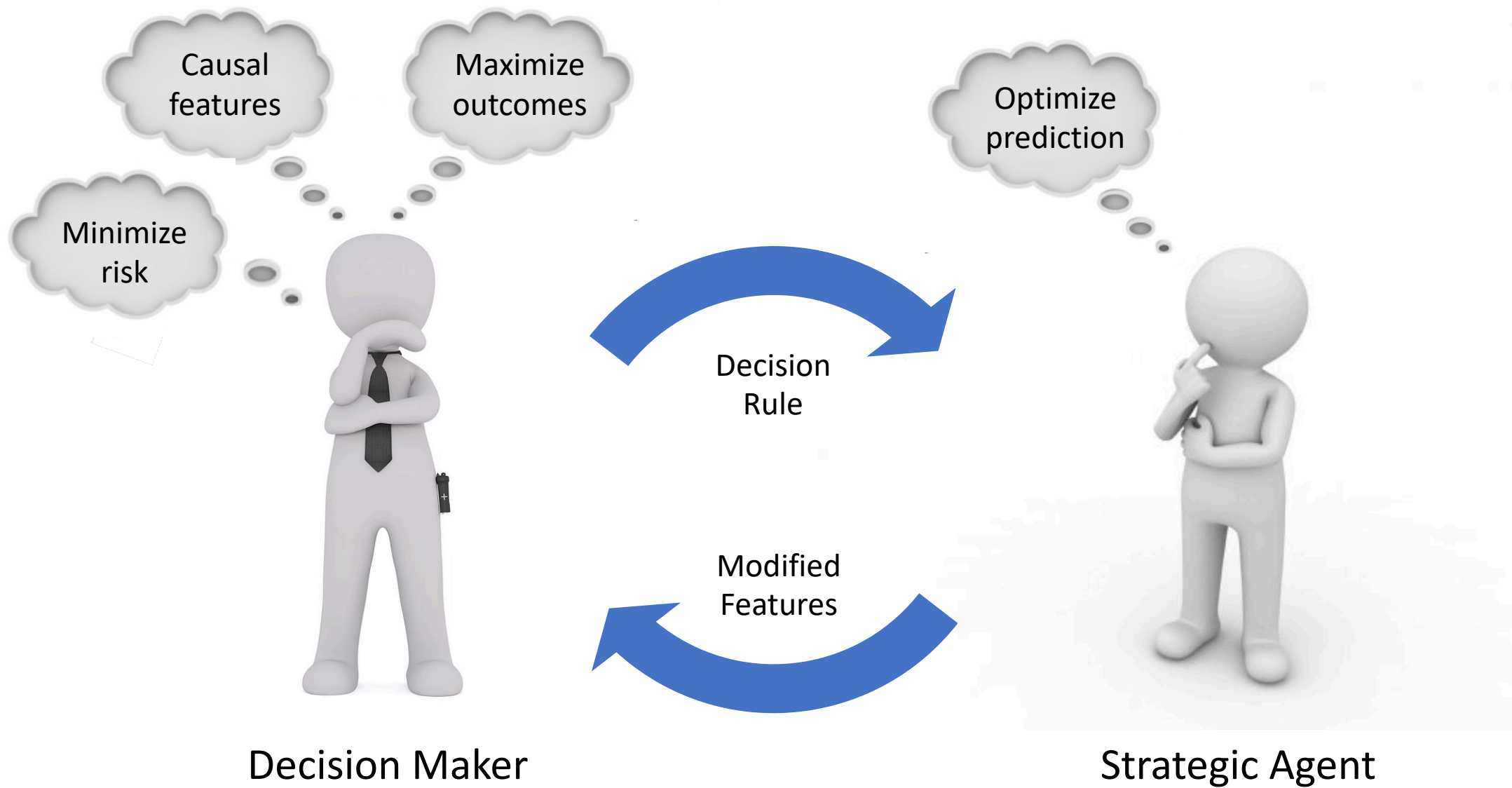
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- Sufficient conditions on sequence of assessments for convergence

Why Learn Causal Relationships?

- Secondary result: making predictions using causal relationship satisfies individual fairness

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- Secondary result: making predictions using causal relationship satisfies individual fairness
- Useful for other decision maker objectives

Causal features

Maximize outcomes

Minimize risk

Optimize prediction

Decision Rule

Modified Features

Decision Maker

Strategic Agent

Agent Outcome Maximization

- Goal: maximize $\mathbb{E}[y]$
- Can use parameters recovered during 2SLS to solve LP

Predictive Risk Minimization

- Goal: minimize $\mathbb{E}[(y - \hat{y})^2]$
- Can use parameters recovered during 2SLS to do SGD

Experiments

- Semi-synthetic college admissions dataset