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of ENGINEERING

# Active Learning for Decision-Making from Imbalanced Observational Data

11.06.2019

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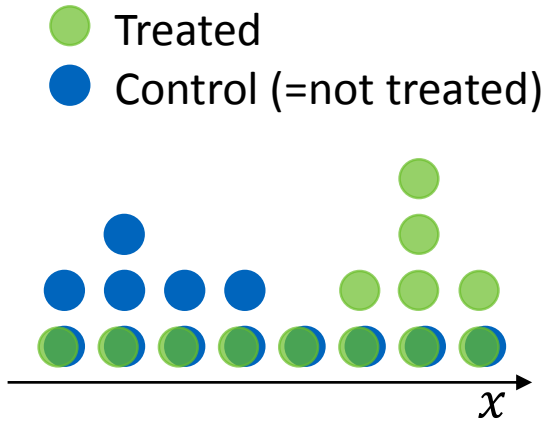
# Problem and setup

- Decision-making task: Choose treatment to a new, previously unseen unit $\tilde{x}$

- Learn individual treatment effect

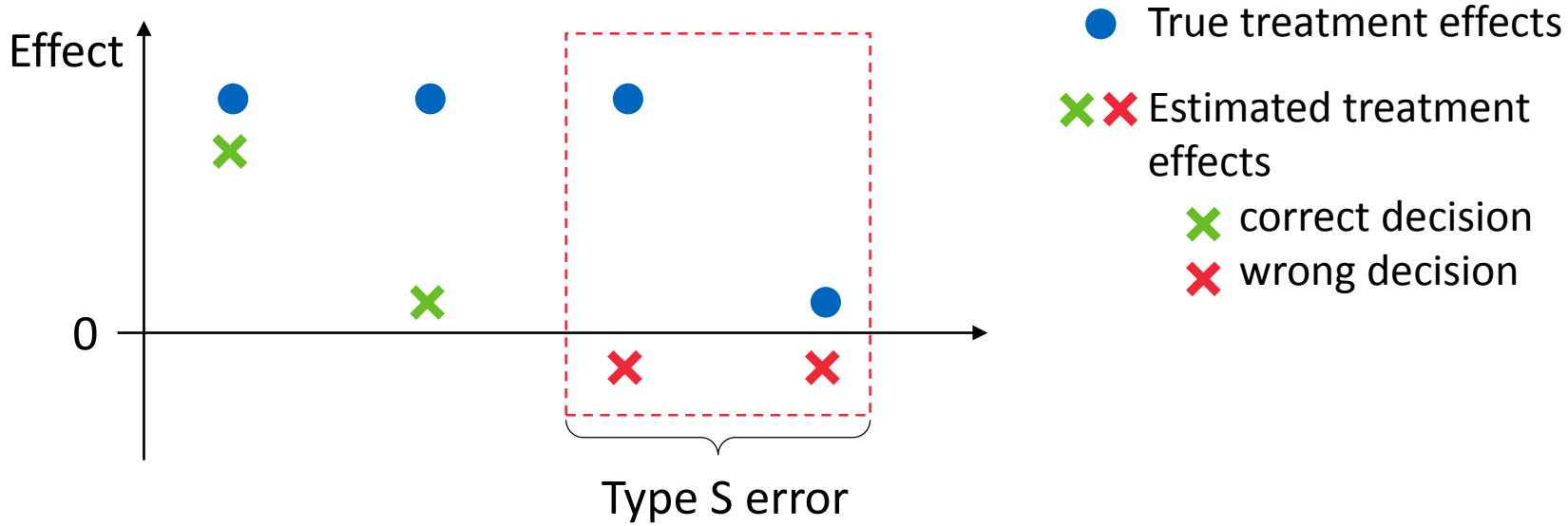
$$\tau = \mathbb{E}[y[1] - y[0] \mid x]$$

- Imbalance
  - Different covariate distributions in treated and control groups
  - Causes uncertainty to $\hat{p}(\tau \mid x, D)$



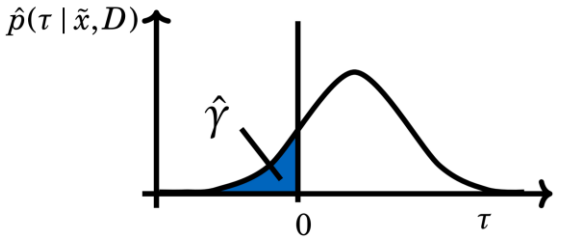
# Decision-making performance

- Type S error rate
  - Probability that the model infers the sign of the treatment effect wrong

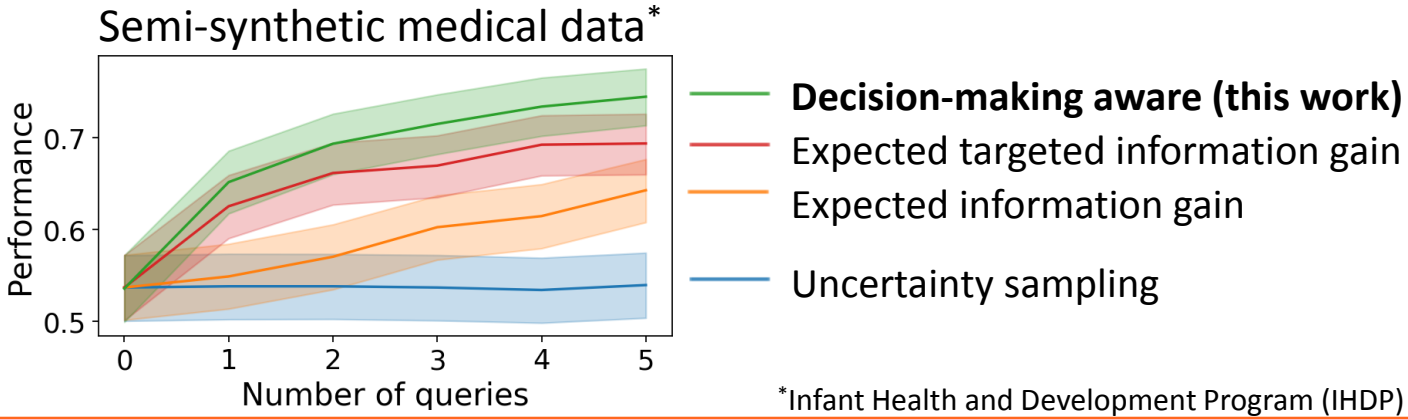


# Contributions

- Conditions when imbalance increases Type S error rate
- Estimate for Type S error rate




- Active learning to minimize estimated Type S error rate




*Infant Health and Development Program (IHDP) data (Hill 2011).

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# Summary

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- Imbalance impairs decision-making performance
- Type S error rate
  - A natural measure for decision-making performance
- Bayesian estimate of Type S error rate
- Active learning that targets the Type S error rate the most effective in improving decisions
- Code available at https://github.com/IirisSundin/active-learning-for-decision-making

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