

# Large Scale Survey and Benchmarking of Causal Discovery Algorithms

Praxis der Forschung WS 2021/22

Causal inference from observational data “demands a good deal of humility.”

--- Cochran

## Scope

1 – 4 students. The content can be extended if more participants.

## Background

**Causal discovery** is a branch of *causal inference*, a subfield shared by many areas, such as medicine, epidemiology, social science, economics. Its goal is to derive causal relationships between observed variables in a form of causal graph, when experiment is infeasible.

There exists several causal discovery methods and algorithms and several newer ones are being published, each claiming to be more accurate or suitable for some scenarios than the others. However, unlike supervised learning, we can only “crawl towards the truth” in causal inference. Practitioners must rely on the authors’ claim when selecting methods, because it is difficult to verify algorithm performance with the real world data. Unfortunately, the many published methods and algorithms are not tested on the same data sets nor evaluated using the same metrics. There exists only a few review papers on methods [1][2] and evaluation frameworks [3], but none to date attempts to benchmark them under equal grounds.

## Goals

The ultimate goals of this projects are to update the taxonomy of causal discovery methods, provide evidences of method performance and guideline to method selection.

## Tasks

1. Research and unify evaluation frameworks for causal discovery
2. Curate real world data sets suitable for causal discovery
3. Review literature on causal discovery methods, sort them according to known classification system and update it if necessary.
4. Design experiment settings and criteria to evaluate the researched causal discovery methods
5. Evaluate causal discovery methods with the developed / unified framework.

## Contact

Ployplearn Ravivanpong, [ployplearn.ravivanpong@kit.edu](mailto:ployplearn.ravivanpong@kit.edu)

## References

- [1] Review of Causal Discovery Methods Based on Graphical Models. Glymour, C., Zhang, K., & Spirtes, P. *Frontiers in genetics*, 10, 524. (2019). <https://doi.org/10.3389/fgene.2019.00524>
- [2] D'ya like DAGs? A Survey on Structure Learning and Causal Discovery  
MJ Vowels, NC Camgoz, R Bowden - arXiv preprint arXiv:2103.02582, 2021
- [3] The Case for Evaluating Causal Models Using Interventional Measures and Empirical Data. Gentzel, Amanda & Garant, Dan & Jensen, David. *33rd Conference on Neural Information Processing Systems (NeurIPS 2019)*, Vancouver, Canada.
- [4] CauseMe: An online system for benchmarking causal discovery methods. J. Muñoz-Marí, G. Mateo, J. Runge, and G. Camps-Valls. In preparation (2020).