Internship proposal

Optimal adjustability of direct effects from summary causal graphs

Context: The Pierre Louis Institute of Epidemiology and Public Health (IPLESP), co-accredited by Inserm and Sorbonne University, brings together research strengths in epidemiology and public health within Sorbonne University. IPLESP's main objective is to produce original knowledge on pressing public health issues and related intervention effectiveness, focusing on emerging infectious diseases, chronic diseases, environmental health, and mental health. To tackle these challenges, causal inference [Pearl, 2000, Hernan and Robins, 2023] emerges as an indispensable tool. Therefore, at IPLESP, we are establishing a new team dedicated to developing advanced methodologies rooted in causal inference. One objective of this team is to address the problem of direct effect identification and estimation using abstract graphs, in particular using summary causal graphs [Assaad et al., 2022] and temporal data.

Recently, a complete identifiability result has been presented for summary causal graphs [Ferreira and Assaad, 2024]. In case where identifiability is established, two adjustment sets are suggested to estimate the direct effect from temporal data. Nevertheless, multiple valid adjustment sets could potentially exist. While an estimator based on any of these sets is unbiased, the estimation variance may differ across various sets. Consequently, we are interested in identifying as many valid adjustment sets as possible to optimize the estimation of direct effects.

Proposal: This internship primarily focuses on exploring the feasibility of identifying an optimal adjustment set for estimating the direct effect through a summary causal graph. The intern will initially devise a criterion and establish a completeness result detailing all potential adjustment sets. Subsequently, among these adjustment sets, the intern will explore the feasibility of identifying the optimal one using the graph. Furthermore, the intern is expected to apply this new finding to estimate direct effects utilizing epidemiological data.

Candidate: Highly motivated candidate with an M2 degree and strong background in probability, machine learning, and causal inference, along with a keen interest in epidemiology. Proficiency in programming is also required. The candidate will have the opportunity to persue with a PhD in causal inference.

Location: The intern will work at IPLESP (`https://iplesp.fr/`), located in Paris. She/he will be supervised by Charles Assaad.

Dates: Starting date: April 2023, for a duration of 5-6 months.

Contact: To apply, please send a CV and a cover letter to Charles Assaad charles.assaad@ens-lyon.fr

References

C. K. Assaad, E. Devijver, and E. Gaussier. Survey and evaluation of causal discovery methods for time series. *J. Artif. Int. Res.*, 73, apr 2022. doi: 10.1613/jair.1.13428.

S. Ferreira and C. K. Assaad. Identifiability of direct effects from summary causal graphs. *Proceedings of the AAAI Conference on Artificial Intelligence*, 2024. forthcoming.

M. Hernan and J. Robins. *Causal Inference: What If*. Chapman & Hall/CRC Monographs on Statistics & Applied Probab. CRC Press, 2023. ISBN 9781420076165.

J. Pearl. *Causality: Models, Reasoning, and Inference*. Cambridge University Press, New York, NY, USA, 2000. ISBN 0-521-77362-8.