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INTERVENTIONAL MARKOV EQUIVALENCE FOR MIXED GRAPH MODELS

Abstract: Oftentimes researchers and practitioners may be interested in learning not only a representative of a Markov equivalence class (MEC) of graphs, but a specific member of the class. In the case of DAGs, the classic approach to this problem is to sample data from an interventional setting and use this data to refine MECs of DAGs into smaller sets. This process naturally relies on combinatorial interpretations of invariance properties of distributions Markov to DAGs that can be used to define these refined interventional MECs of DAGs. Recently, Yang et al. (2018) gave a graphical characterization of this interventional Markov equivalence for DAG models that relates to the global Markov properties of DAGs. Using this idea, we will extend the notion of interventional Markov equivalence using global Markov properties of loopless mixed graphs and generalize their graphical characterization to ancestral graphs. On the other hand, we will also extend the notion of interventional Markov equivalence via invariance properties of distributions Markov to acyclic directed mixed graphs. Finally, we will see that these two generalizations coincide at their intersection; i.e., for directed ancestral graphs, thereby completely generalizing the theory of Yang et al. (2018) to this setting.

References:

- [1] Yang, K. D., Katcoff, A., Uhler, C. (2018) Characterizing and learning equivalence classes of causal DAGs under interventions. *Proceedings for the 35-th International Conference on Machine Learning*.
- [2] Solus, L. (2019). *Interventional Markov equivalence for mixed graph models*. In preparation.