Faster Algorithms for Markov Equivalence

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Abstract

Maximal ancestral graphs (MAGs) have many desirable properties; in particular they can fully describe conditional independences from directed acyclic graphs (DAGs) in the presence of latent and selection variables. However, different MAGs may encode the same conditional independences, and are said to be *Markov equivalent*. Thus identifying necessary and sufficient conditions for equivalence is useful when we learn the structure of variables or parametrize them. Several criteria for this already exist, but in this paper we give a new non-parametric characterization in terms of the heads and tails that arise in the parameterization for discrete models.

We also provide polynomial time algorithms ($O(ne^2)$, where n and e are the number of vertices and edges respectively) to verify equivalence. Moreover, we extend our criterion to ADMGs and summary graphs and propose an algorithm that converts a summary graph to an equivalent MAG in polynomial time ($O(n^2e)$). Hence by combining both algorithms, we can also verify equivalence between two summary graphs or ADMGs.

If there is time, we will also give some initial results on characteristic and standard imsets for MAGs.

Reference.

Hu, Z. and Evans, R. J. Faster algorithms for Markov equivalence. In *Proceedings of the 36th Conference on Uncertainty in Artificial Intelligence (UAI-20)*, 2020.