Applying causal inference in Ecology: Motivation, assumptions and methods

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Résumé

Observational data is being produced and made available at unprecedented scales in Ecology. Machine learning has already enabled significant successes based on this data surge, including species identification, climate prediction and conservation optimisation, among others. Interpretability methods increase confidence in how models behave by making the information on which models rely explicit. However, to achieve a causal understanding of ecological processes, it is necessary to investigate the assumed links between drivers. Randomized control trials are considered the gold standard for balancing out the influence of any confounder on a precise causal effect estimation. Yet it would be impossible and highly unethical to apply treatments and controls to populations and ecosystems every time a particular effect is studied. This is where causal inference intervenes. Methods enable the estimation of causal effects from observational data only, provided that there is additional knowledge or clear hypotheses on the data-generating processes. To attribute drivers of biodiversity change and drive conservation policies in the Anthropocene, it appears necessary to apply causal discovery and effect estimation techniques. This presentation will examine assumptions that guide the choice between available methods and will take a closer look at time series. From the path method to causal machine learning, the range of techniques available in this rapidly expanding field can indeed seem overwhelming.

Mots-Clés: causal inference, key assumptions, time series, attribution

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