L'inférence causale en présence de dépendance et de structure de réseau
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# Using propensity score to adjust for residual confounding in small area studies

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Small area studies, where data has been aggregated by geographical areas, are a common used design in environmental epidemiology to assess the impact of area level risk factors on health outcomes. However the resulting estimates are often biased and difficult to interpret due to unmeasured confounders, which typically are not available from the standard administrative registries used for these studies. Information on relevant confounders can be often gained through other data sources, in particular datasets such as surveys or cohorts. In this case the data are available at the individual level rather than at the area level; however such data typically lack the systematic geographical coverage of administrative registries. We develop a framework of analysis which combines ecological and individual level data from different sources to provide an adjusted estimate of area level risk factors which is less biased. Our method (i) summarises all available individual level confounders into an area level scalar variable, which we call ecological propensity score (EPS), (ii) implements a hierarchical structured approach to impute the values of EPS whenever they are missing, under different missingness assumptions (iii) includes the estimated or imputed EPS into the ecological regression linking the risk factors of interest to the health outcome, thus delivering area level risk estimates which allow a fuller adjustment for confounding than traditional small area studies. Through a range of simulations, we show that such a way of building and using EPS is a promising method to reduce the bias intrinsic in ecological studies due to unmeasured confounders and we demonstrate its benefits for both dichotomous and continuous exposure. We apply the method to case studies in environmental epidemiology investigating the impact of air quality on health outcomes (coronary heart disease and lung cancer) in England (UK).

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