Causal and counterfactual dependence on probabilistic causal teams

Gabriel Sandu
University of Helsinki

In recent interventionist theories of causation (e.g.[6], [3]), one defines causal relationships in roughly the following way: the variable X is a (total) cause of the variable Y if there is an intervention on X which changes the probability of $Y = y$ for some value y of Y. Thus, in order to give an account of causation, one needs to (i) be able talk about the probability of the values of the relevant variables; and (ii) to give an account of interventions. It is generally acknowledged (Woodward, Pearl) that if, in addition, one wants the causal relationship to be a robust one, that is, to sustain counterfactuals (*if* $X = x$ *had been the case, then* $Y = y$ *would have been the case*), then one also needs (iii) to specify explicitly a deterministic mechanism or a law (*structural equation*) which connects X and Y. In a joint work with Fausto Barbero, we introduced a probabilistic language interpreted over causal multiteams, an extension of the team semantics which was originally introduced by Hodges ([2]) to give an interpretation of Hintikka and Sandu's Independence-friendly (IF) languages, and afterwards extensively used by Väänänen ([4]) and others as a semantical framework for Dependence Logic. The transition from teams to multiteams ([1]; [5]) is needed in order to capture step (i). To implement steps (ii) and (iii) we still need to extend multiteams with mechanisms representing interventions and structural equations. The result is a logical language which is more general than the ones existing in the standard literature on causation, being able to express various notions of causal, counterfactual, and probabilistic (in)dependence and which works for both *recursive* and *non-recursive* systems.

References

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