Learning to Act: Qualitative Learning of Deterministic Action Models

In this article we study learnability of fully observable, universally applicable action models of dynamic epistemic logic. We introduce a framework for actions seen as sets of transitions between propositional states and we relate them to their dynamic epistemic logic representations as action models. We introduce and discuss a wide range of properties of actions and action models and relate them via correspondence results. We check two basic learnability criteria for action models: finite identifiability (conclusively inferring the appropriate action model in finite time) and identifiability in the limit (inconclusive convergence to the right action model). We show that deterministic actions are finitely identifiable, while arbitrary (non-deterministic) actions require more learning power—they are identifiable in the limit. We then move on to a particular learning method, i.e. learning via update, which proceeds via restriction of a space of events within a learning-specific action model. We show how this method can be adapted to learn conditional and unconditional deterministic action models. We propose update learning mechanisms for the afore mentioned classes of actions and analyse their computational complexity. Finally, we study a parametrized learning method which makes use of the upper bound on the number of propositions relevant for a given learning scenario. We conclude with describing related work and numerous directions of further work.