Abstract

The thesis links learning theory with logics of knowledge and belief.

Following the introduction and mathematical preliminaries, Chapter 3 contains a methodological analysis of both frameworks, in particular it analyzes the basic learning-theoretic setting in terms of dynamic epistemic logic.

In Chapter 4 we use learning theory to evaluate dynamic epistemic logic-based belief-revision policies. We investigate them with respect to their ability to converge to the true belief for sound and complete streams of positive data, streams of positive and negative data, and erroneous fair information. We show that some belief-revision methods are universal on certain types of data, i.e., they have full learning power.

Chapter 5 is concerned with expressing identification in the limit and finite identifiability in the languages of modal and temporal logics of epistemic and doxastic change. We characterize learnability by formulas of various logics of knowledge and belief.

In Chapter 6 we investigate the notion of definite finite tell-tale set in finite identifiability of languages, in particular the computational complexity of finding various kinds of minimal DFTTs. Assuming the computability of learning functions we show that there are classes of languages that are finitely identifiable, but no computable agent can always conclude it as soon as it is objectively possible.

In Chapter 7 we analyze different levels of cooperativeness between the learner and the teacher in a game of perfect information based on sabotage games. We give formulas of sabotage modal logic that characterize the existence of winning strategies in such games. We show that non-cooperative case is PSPACE-complete, and that relaxing the strict alternation of the moves of the two players does not influence the winning conditions.

In Chapter 8 we generalize the Muddy Children puzzle, to account for arbitrary quantifier announcements. We characterize the solvability of the generalized version of the Muddy Children puzzle and we propose a new representation of the epistemic situation of Muddy Children scenarios. Our modeling is linear with

respect to the number of agents, and is more concise than the one used in the classical dynamic epistemic approach.

Overall, we focus on building a connection between formal learning theory and dynamic epistemic logic. We provide dynamic epistemic logic with a uniform framework for considering iterated actions. On the other hand, this leads to a logical view on inductive inference and to syntactic characterizations of learnability in modal and temporal logics. Further topics of the thesis, taken from the domains of computability, games, and multi-agency, strengthen the connection by providing additional computational, logical and philosophical insights into the process of epistemic and doxastic change.