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The Formula Synthesis Problem - Focus on Propositional Dynamic Logic

Logic in Computer Science plays important roles ranging from formal methods to Human-Computer Interaction, including Software and Hardware Engineering, etc. Regarding the former broad application domain of formal methods, a tremendous amount of work concern verification, namely satisfiability checking (for model synthesis) and model checking (for counterexample/witness synthesis). I want to discuss a fairly novel question, called Formula Synthesis Problem, that I believe is extremely natural to address, and yet has not received enough attention in logic. In its most general form, the Formula Synthesis Problem consists in deciding whether some formula in a given set is satisfied by a given model (and output one if any). Obviously, if the input set of formulas is finite, this amounts to model checking. On the contrary, if this set is infinite, say obtained by some term-grammar for formulas, then the answer becomes extraordinary challenging.

I will focus on recent results for the case of Propositional Dynamic Logic extended with shuffle, as originally investigated by myself, S. Rubin and F. Schwarzentruber at AAAI 2022. Some of the results have been presented at my invited talk at ICLA 2025.

This is joint work with Alan Le Brech.