

# Verifying Strategic Abilities of Neural-symbolic Multi-agent Systems

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## Abstract

We investigate the problem of verifying the strategic properties of multi-agent systems equipped with machine learning-based perception units. We introduce a novel model of agents comprising both a perception system implemented via feed-forward neural networks and an action selection mechanism implemented via traditional control logic. We define the verification problem for these systems against a bounded fragment of alternating-time temporal logic. We translate the verification problem on bounded traces into the feasibility problem of mixed integer linear programs and show the soundness and completeness of the translation. We show that the lower bound of the verification problem is PSPACE and the upper bound is coNEXPTIME. We present a tool implementing the compilation and evaluate the experimental results obtained on a complex scenario of multiple aircraft operating a recently proposed prototype for air-traffic collision avoidance.

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## Keywords

Neuro-symbolic agents, Verification

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