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有界模型检测同步多智体系统的时态认知逻辑

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Abstract

This paper presents an approach to the verification of temporal epistemic logic in synchronous multi-Agent systems via bounded model checking (BMC). By incorporating epistemic modalities into temporal logic CTL*, a temporal epistemic logic ECKLn is introduced, and it is interpreted under the semantics of synchronous interpreted system. The temporal epistemic expressive power of ECKLn is greater than that of Penczek and Lomuscio's logic CTLK. Agents' knowledge interpreted under synchronous semantics can be skillfully attained by the state position function, which avoids extending the encoding of the states and the transition relation of plain temporal epistemic model for time domain. The technical details and the correctness of the BMC method for logic AECKLn/EECKLn (the universal or existential fragment of ECKLn) are given. A case study of train controller system is presented to illustrate the processing of the BMC method.

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摘要

提出在同步的多智体系统中验证时态认知逻辑的有界模型检测(bounded model checking,简称BMC)算法.基于同步解释系统语义,在时态逻辑CTL*的语言中引入认知模态词,从而得到一个新的时态认知逻辑ECKLn.通过引入状态位置函数的方法获得同步系统的智能体知识,避免了为时间域而扩展通常的时态认知模型的状态及迁移关系编码.ECKLn的时态认知表达能力强于另一个逻辑CTLK.给出该算法的技术细节及正确性证明,并用火车控制系统实例解释算法的执行过程.

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