Using Alternating-Time Logic for Modeling of Artificial Agents in Wireless Nets

Extended abtract

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Introduction

My thesis concerns the modeling of artificial agents in wireless sensor nets. A Belief Desire Intention (BDI) model or other Branching-time logic based systems are used for modeling of mental state of an agent in multiagent systems. In the context of multiagent systems a Branching-time logic deals with sets of formulas as possible worlds. Branching-time logic is based on predicate logic, but it introduces modality operators (necessity operator $\Box$ and possibility operator $\Diamond$) and additional quantificators. An agent solves its problem by traveling through possible worlds. Theese worlds are modeled by Kripke structure - a nondeterministic finite state machine defined as $KS = (S, S_0, R, L)$, where S is the set of states, $S_0 \subseteq S$ is the set of initial states, R is subset of cartesian product $S \times S$ and L is projection of states on subsets of set of atomic formulas. A graphical representation of Kripke structure is usualy an n-ary tree and all quantificators in Branching-time logic are defined over an n-ary computational tree. For example formula Ap defines that formula p is true in all branches from current junction.

Benefits of Alternating-time logic

Branching-time logic (specificaly CTL* logic) allows explicit specification of an existential or an universal qualificator over over all paths in computation tree. Alternating-time logic (ATL) offers more general specification. It allows a selective quantification over chosen paths. While CTL* logic is natural specification language for modeling a closed systems, Alternating-time logic offeres the possibility of specification of an opened systems.

My work

Firstly, I will be dealing with the Implementation of ATL System. Secondly, I will investigate the affect of my system on the decission process of an agent. Then I will study the problems of receptivness, realizability and controlability of ATL formulas. All these problems can be formulated as model-checking problems. Finally, I will measure and discuss the time and space complexity of my system in game-like environment and compare the results of my system with CTL* based system.