



Institut de Recherche
en Informatique de Toulouse
CNRS - INP - UT3 - UT1 - UT2J

Internship – Master thesis

Model checker for multi-agent systems with natural strategies

Extension of MCMAS-SLK

Overall goal

The purpose is to provide a tool for automated verification of multi-agent systems. The Master thesis will focus on implementing an extension of an existing tool, named MCMAS-SLK, to handle natural strategies (*i.e.*, strategies that are machine-processable with bounded memory while being “human-friendly”). MCMAS-SLK is a model checker for the verification of systems against specifications given in epistemic strategy logic (SLK).

Description

The aim of this work is to go further in the automated verification of sophisticated game concepts such as Nash equilibria over natural strategies with bounded complexity while considering specifications concerning individual and group knowledge.

- The overall context of the Master thesis is the software « MCMAS ». It is a symbolic model checker tailored to the verification of Multi-Agent Systems (MAS). MAS descriptions are given by means of ISPL (Interpreted Systems Programming Language) programs. ISPL is an agent-based, modular language inspired by interpreted systems, a popular semantics in MAS. MCMAS-SLK is an extension for considering specifications given in epistemic strategy logic.
- Natural strategies are conditional plans, represented through an ordered list of expressions-action rules. In a memoryless strategy, the expression is an epistemic Boolean condition. In a strategy with recall (memory), the condition is a regular expression over epistemic conditions.
- Strategic reasoning consists of reasoning about the existence of a winning strategy (an action or a sequence of actions) while considering other players actions. Strategic logic (SL) is a highly expressive language for strategic reasoning that handles strategies as first-order objects. SLK is an extension for handling imperfect information and NatSLK is a variant that considers natural strategies.
- The aim is to verify the system specification (defined in NatSLK formulas) in relation to properties (e.g., efficiency, strategyproofness) and solution concepts (e.g., Nash and dominant strategy equilibrium).

In a first step the student will learn the syntax and semantics of the specification language (NatSLK) and the software MCMAS-SLK. In a second step, the student will implement an extension of MCMAS-SLK to handle natural strategies. In a third step, the student will evaluate the performance of the implementation in comparison to MCMAS-SLK (e.g., execution time).

Organisation and contact

This internship is part of a new project aiming at mixing Strategic Reasoning, Auctions and General Game Playing and aiming at building a General Auction Player. The proposal may lead to a PhD.

Starting date: February 2022 / 5-6 months.

Stipends: 500-600€ per month

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