Title: Solving problems using MCTS

Author: Dominik Malý

Department: Department of theoretical informatics and mathematical logic

Supervisor: RNDr. Jan Hric

Supervisor's e-mail address: Jan.Hric@mff.cuni.cz

Abstract: MCTS (Monte Carlo Tree Search) methods are a state-of-the-art approach to the computer solution of strategic board game Go. Because of their versatility and successfulness, these techniques show great potential for all kinds of problems. This paper aims to explore the suitability of MCTS for solving different kind of problems, specifically games of one player, like Sudoku or SameGame. I've created a computer player based on MCTS, who can solve not only Sudoku and SameGame, but also other tasks of similar kind. I've experimentally examined many MCTS extensions and their eligibility for solving these games and through extensive testing I've also compared the suitability of various kinds of UCT selection functions and used heuristics. In case of SameGame I've compared my algorithm to another existing one undertaking the same problem. In the end I've described what kind of problems has a MCTS-based computer player to overcome, if it is to successfully solve games of this type, and what characteristics should these problems posses to be suitable for MCTS solution.

Keywords: MCTS, Go, Sudoku, SameGame, UCT