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Towards master-level play of Shogi

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Abstract

This paper presents our research that aims at defeating the human champion by computer Shogi TACOS we develop. The challenges to make a computer play games have been attempted since computers were invented. After the computer Chess machine defeated the human World Chess Champion in 1997, the interest of researches changed to more complex games such as Amazons, Shogi and Go. We have chosen Shogi for our subject because of the complexity. Moreover, we can expect big impact if a computer defeats the human champion since Shogi is the most popular board game in Japan.

In this study, we especially focus on the drawbacks of computer Shogi in the opening. Although the long-term view is required for planning a strategy in opening game, it is hard to implement such an idea on a computer. In complex games, a computer prepares an opening database (so-called *opening book*) that contains thousands moves often played by masters, and using that database a computer can play the master-level opening.

Although we can also use opening book in Shogi, it is not exhaustive. Therefore, to improve the opening play of computer Shogi, we tackle the following challenges:

- Using an opening book effectively in in-book positions.
- Playing the stable opening game even in out-of-book positions.

As the former challenge, we prepare a large opening book automatically made from thousands of master games and tune the book that a computer would select a prepared opening strategy. We propose a tuning method that tunes an opening book through lots of self-playing games. Using the opening book tuned by proposed method, TACOS has played a reasonable opening game in all tournaments and has obtained good results.

As the later challenge, we improve position evaluation in opening game by evaluating the formation that one would make in the opening stage. We enhance the piece square tables that are commonly used in computer Shogi to make and evaluate formations. We also introduce some methods to evaluate formations more correctly. By implementing those methods on TACOS, we can improve its opening play remarkably in the out-of-book positions.

In addition to improve the playing level in opening, we also tackle other two problems that have to be improved in this paper. One is an enhancement of the use of transposition tables. To search effectively with valuable information stored during the previous search, we propose a method that uses two different transposition tables alternatively. Another one is the opportune time recognition of attacking. The first fights that start after constructing a formation are one of the weak points of computer Shogi. To tackle this problem, we deal with the edge attack, one of the attacking that a computer is poor at, while examining the possibility of attacks in a position and searching attack lines deeply when a position is regarded as an opportune timing for the attacking.

Implementing those measures and other enhancements, the playing strength of TACOS was improved awfully. These improvements lead some fruits in several tournaments such as 1st prize on the 10th Computer Olympiad and 4th place on the 16th World Computer Shogi Championship. In addition, TACOS could drive a professional Shogi player into a corner in a public game played on September 2005.

Key Words: computer Shogi, opening book, piece development, book tuning, evaluation function, game-tree search