A Self-Play Experiment in Computer Shogi

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Abstract

This paper discusses the relationship between a performance level and average game length in the game of shogi. There are many reports about relations between depth of search and performance level. Our approach of this research enabled prediction of the development of computer chess enables one to predict the theory-of-game's nature.

1. Introduction

In recent years, computer shogi has accomplished a rapid development [Iida et al, 2002]. The strongest computer shogi programs are equivalent to four or more dan of amateur players. The level of the marketed shogi softwares is also improving. Therefore, playing on various levels, starting from a beginner is possible. Self-play experiments of shogi or chess have been executed for examining a relation between depth and strength [2]. And generally says, the deeper programs search the stronger they become.

This paper focuses on how game length changes with change in the strength of players. Especially, we investigate how the average game length changes by self-play among players of the same skill level.

2. Experiment Design

Two computer shogi softwares of the same level, "Gekisashi 2" and "Todai Shogi 5" self-played each other and we investigated how the average game length changed according to strength.

We used following levels.

- "Gekisashi 2" (used 10 different classes) : the 12th kyu, the 10th kyu, the 8th kyu, the 6th kyu, the 4th kyu, the 2nd kyu, the 1st dan, 2nd dan, 3rd dan, and 4th dan.
- "Todai Shogi 5" (used 5 different classes) : the beginner, the beginners' kyu, the middle kyu, the upper kyu, and the master.

Details are following.

- The number of self-play was made into 500 in each level.
- Each side was to be played within 30 seconds, with no match time limit.
- We used a 3.0GHz Pentium4 computer running WindowsXP.
- We used the opening book.
- After self-play, the average game length and standard deviation, except for the duplicated games, were calculated.
- The winning percentage of the black was calculated from the matches except those ended in draw.

3. Hypothesis

The following hypotheses were formed as the

result of the preliminary experiment prior to this research [Iida, 2004].

Hypothesis 1 "With increase in the performance level, monotonous reduction of the average game length occurs before monotonous increase takes place."

On low levels, since there are many moves that serve no purpose, game length tends to increase significantly. However, as the level increases, players will be able to win faster. As a result, game lengths decrease gradually. After the game length reaches the bottom it then begins to increase with improvement of the player's level. Furthermore, when the player's level increases further, they tend to select their moves conservatively, resulting in continuous equilibrium state that causes the average game length to increase.

Hypothesis2 "Introducing resign system, the average game length becomes monotonously shorter after a certain point."

When resigning is a part of the rules the game basically ends when a player recognizes his inevitable loss, making the game length shorter. In case of beginners games do not come to end before checkmate because they cannot recognize complicated checkmates. However, when players' levels are high they are able to recognize the outcome of the match earlier than beginners can. As the result, game length will be shorter.

4. Experiment Results

The following are the results of experiment. Table 1 and Table 2 show the percentages of victories for black with average game length and standard deviation of each shogi software. Figure 1 and Figure 2 illustrate Table 1 and Table 2 graphically.

Table1: The experiment results of self-play of "Gekisashi".

Gekisashi	12kyu	10kyu	8kyu	6kyu	4kyu	2kyu	1dan	2dan	3dan	4dan
game length	143.55	156.42	203.77	120.87	141.99	145.03	142.25	145.04	152.56	150.26
standard deviation	79.42	82.48	149.14	36.82	62.54	57.94	53.08	52.88	83.20	59.69
black win	0.611	0.525	0.468	0.529	0.527	0.501	0.473	0.507	0.493	0.505

Table2: The experiment results of self-play of "Todai Shogi".

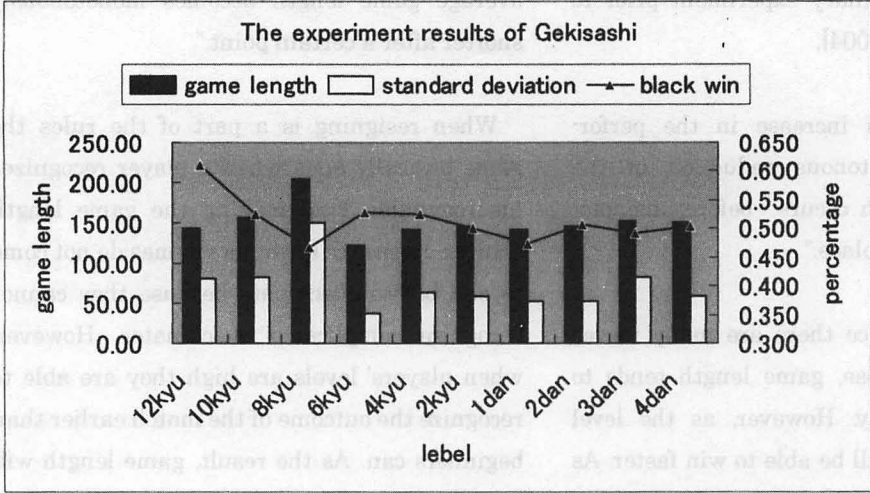| Todai Shogi	beginner	beginner's kyu	middle kyu	upper kyu	master
game length	141.52	130.95	132.95	136.02	138.74
standard deviation	86.45	41.70	40.58	41.04	34.60
black win	0.535	0.507	0.465	0.463	0.522

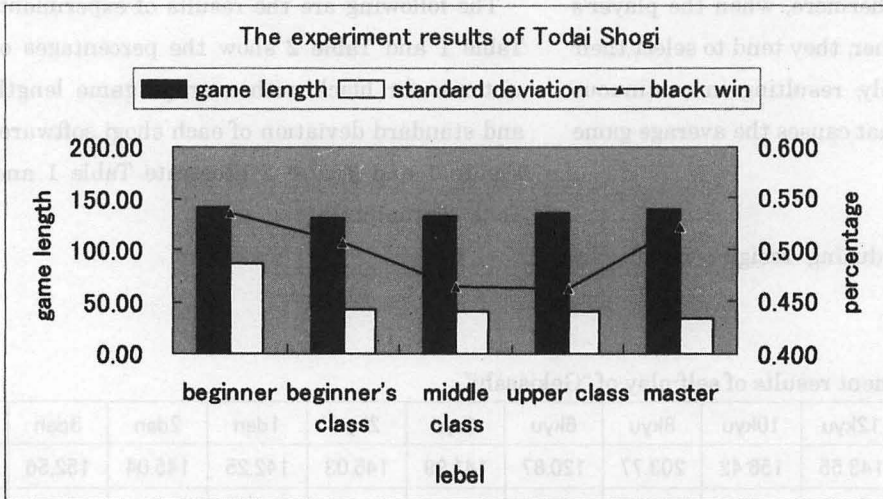Figure1: The experiment results of self-play of "Gekisashi".

Figure2: The experiment results of self-play of "Todai Shogi".

5. Consideration

In the matches between low level players, there were some matches that had long game lengths. This is thought that the increase of the moves in the deadlock of the opening game led to the increase of the average game length. Moreover, since sometimes the fighting begins from the draw by repetition of moves pattern, it

had affected the average game length of a self-play at the low level. Although the self-play at the low level had consumed much time in the opening game, many matches finished quickly. The average game length did not increase in the moves of low level players.

Moreover, if we use not only average game length but the concept of opening game, middle

game and end game can be simulated accurately, taking statistics of each average will notably show the differences between different levels. It is expected that at the low level that opening games will be longer and the latter game will be shorter.

From the figures, both shogi softwares' average game length increase slowly and steadily from a certain level.

When computer shogi becomes stronger, the average game length may be stabilized and the chance of draw may increase.

Moreover, it brought an interesting result that the percentage of victories of the black in a low level was high.

In this experiment, since both of each software were designed to resign, the second hypothesis of " Introducing resign system, the average game length becomes monotonously shorter after a certain point." seemed logical. Neither of the shogi software can be referred to as this hypothesis holds true.

In Gekisashi, the game length did not increase as it was first predicted at the low level. Moreover, the game length did not decrease at the high level, either. Todai Shogi was also similar in the average game length increasing as the level became higher. The question of "How much difference is enough for a player to resign?" must be considered. It is necessary to verify by continuous experiments and by using the records of the matches played by human players of various abilities.

6. Future Work

In this paper, we experimented in self-play by using available marketed computer shogi softwares. The level of computer shogi was changed and 500 matches were played at each level. In self-play, it was shown how average game length changes by change in abilities.

In the game in the case of a low level, average game length became long. And if a certain level is exceeded, players do not waste their moves by carrying out useless moves early in the match, stabilizing the game length. Moreover, it is quite possible that the average game length stabilizes as players become stronger is partially due to their tendency to resign when they recognize that they have no chance to win or draw.

In the future, average game length will have to be found from other computer shogi softwares along with the records from human shogi matches of various levels and determine what the average game length really means.

References

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