9x9 GO AS BLACK WITH KOMI 7.5: AT LAST SOME GAMES WON AGAINST TOP PLAYERS IN THE DISADVANTAGEOUS SITUATION

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ABSTRACT

9x9 Go is by far easier than 19x19 Go for computers. However, until a recent date, and with the usual 7.5 komi in computer-Go, computers could only win games against professional players as white; playing as black is considered as much more difficult. This paper reports the two first and only wins as black against professional players, including one game against a top-ranked player, winner of a recent major tournament and therefore clearly accepted as a top pro.

1. INTRODUCTION

Go is a territory-based two-players board game: the player with biggest territory at the end of the game has won. As black starts, a compensation, termed *komi*, is given to white. Go can be played on any board size; 9x9, 13x13 and 19x19 are the most usual formats.

It is usually considered that 9x9 Go, with the 7.5 komi usual in computer-Go, is easier for white than for black. In particular, white often plays peacefully, just stabilizing two groups, and wins. It is therefore a striking success that MoGo and MoGoTW won (i) the first ever win as black against a pro and (ii) the first ever win as black against a top pro. These two games, and some related technical elements, are presented below. Both MoGo and MoGoTW are based on Monte-Carlo Tree Search (Chaslot *et al.* (2006), Coulom (2006), Kocsis and Szepesvari (2006)), RAVE (Gelly and Silver (2007)), a mixed of self-built and handcrafted opening book (Audouard *et al.* (2009)), patterns (Chaslot *et al.* (2007), Coulom (2007), Lee *et al.* (2009)).

2. TWO SUCCESSES IN 9X9 COMPUTER-GO AS BLACK

The first success against a pro as black is presented in section 2.1; however, as will be pointed out, the opponent (Catalin Taranu, 5p) played somehow for fun this game, preferring an opening which makes the game interesting and complicated rather than an efficient opening - at that time, MoGo was equipped with a moderately good opening book and pros, when playing in a concentrated manner, usually won games against computers, in particular when humans play as white. The game played by MoGoTW (a variant of MoGo, modified by the Taiwanese partners of the project) against Chun-Hsun Chou (9p) is much better and presented in section 2.2.

2.1 The game won as black against Catalin Taranu 5p

Catalin Taranu is a romanian player, born in 1973. He learnt Go at the age of 16, and went in 1995 to Japan where he became a professional player (5p) after two years of study in the Nagoya branch of the Nihon Kiin. He now works in Bucharest where he teaches Go; he is the only professional player born in Europe. The game played against Catalin Taranu (Rennes, France, 2008) is presented in Fig. 1.

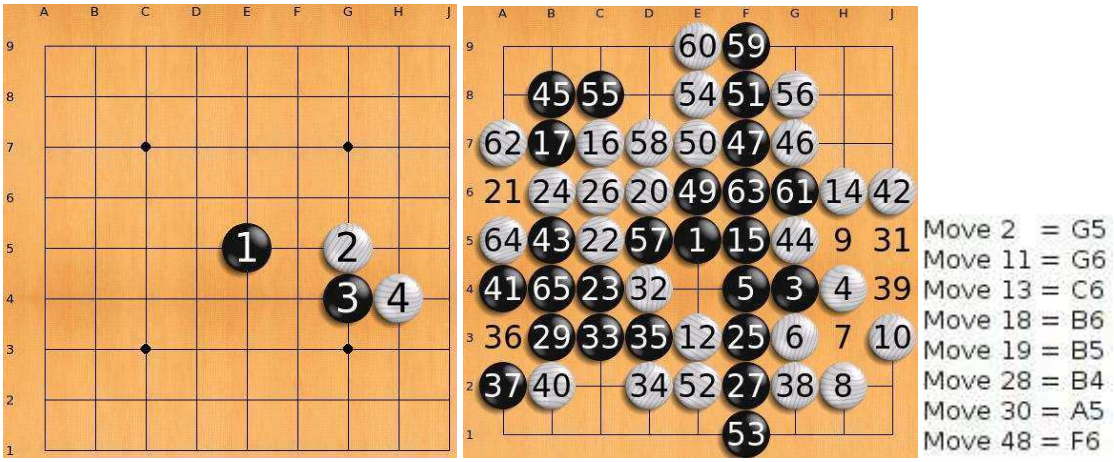

Figure 1: The first ever win by a computer (MoGo) against a professional player as black. Catalin had played the beginning of the game in order to make it fun and interesting; the second white move H4 (left) is suboptimal. Right: the final position.

The move 4 (second white move), H4, is weaker than the move C5 played by Chun-Hsun Chou in the same situation; Catalin, who had won the previous games, was trying to make this game complicated and interesting. The move 13 is quite defensive : Mogo is ahead enough (even with the komi of 7.5 points) to play like this. Then Catalin is trying to create a huge fight by playing *tsuke* (*i.e.* an agressive move at the contact of an opponent's stone) in C7. Then begins a lot of *ko* fights (*i.e.* fights involving threats as usually seen when the rule forbidding returns to already seen situations applies) during which Mogo shows his reading skills - the sequence from move 27 to the end is quite impressive and shows that computers now play ko fights correctly. This matters as the game of Go with ko is known as EXPTIME-complete(Robson (1983)), whereas the game of Go without ko is only shown to be PSPACE-hard (Lichtenstein and Sipser (1980)); unless a proof of EXPTIME-hardness of go without ko is found, we can conjecture that ko fights involve a higher complexity level than other parts of the game and this example shows that computers are strong for this kind of situations.

2.2 The game won as black against Chun-Hsun Chou 9p

Chun-Hsun Chou (9p) has won the LG Cup 2007 and is therefore considered as a top professional player. The game (played in Taipei, Taiwan, in November 2009) is presented in Fig. 2. Comments in the caption have been given by the human professional player himself. White is trying with move 22 to create a second group alive, which normally leads to a victory as white in a 9x9 game with komi of 7.5 points. But with the *tesuji* (a *tesuji* is a good unexpected move, out of the naive line of play) 29, black is creating a *ko* for the life of the white group. White cannot win this *ko* because of a lack of threats. However, White still can try to play move 32 at 55(c8), which would make the game more difficult for black. That is because the komi 7.5 is too large.

3. SOME EXPERIMENTS AGAINST MOGO

We analyze experimentally below (i) the komi (ii) the main variation in the opening book at its current state in the automatic building of the opening book (as explained in Audouard *et al.* (2009), the opening book of MoGo is in constant automatic building on Grid5000).

3.1 The right komi

As well known, the komi 7.5 is too large, at least for many high-level players; this leads to a better winning rate as white against MoGo than as black. MoGo with 10 minutes per side played several games against S. Billouet (4Dan in France), on a 16-cores machines (the short time setting seemingly makes things easier for humans; nonetheless, some explicit numbers around this supposed superiority of humans in blitz games,

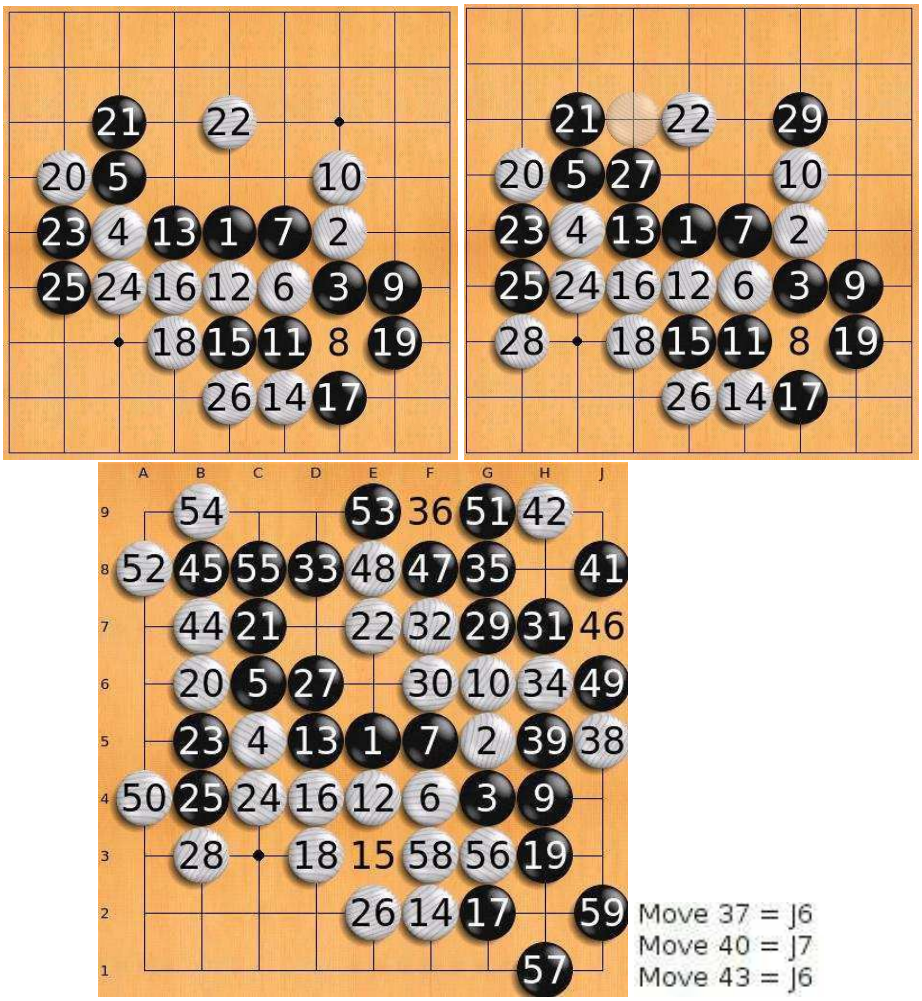

Figure 2: The game won by MoGoTW as black against Chun-Hsun Chou 9p. Top, left: a bad move played by M. Chou (move 26). Top, right: the very good 29^{th} move played by MoGoTW, but the situation is still undecided. Bottom: MoGo played very well the rest of the game and wins.

which is not usual for games in which alpha-beta is the main approach, has to be fully documented in the future). The results are as follows:

- MoGo won one out of five games as black;
- MoGo won 21 games out of 24 as white.

The three games won by the human player as black are presented in Fig. 3 (a,b,c).

3.2 Main variations in the opening book of MoGo

We experimented a quite long opening with MoGo playing both black and white. This opening is E5-G5-G4-C5-C6-B6-D6-F4-F5-G3-H4-H3, which is played automatically by MoGo.

It leads to a white victory very often : white is eating the two black stones G4-H4, making a lot of points, and then is trying to use the potential of the two stones B6-C5 (they're probably dead but can still create some nuisances; this phenomenon is termed in japanese by the word *aji*) to do a good endgame and finally win. We experimented a lot of moves with black but found none that leads to a black victory. Furthermore, it appears that all the black moves in the proposed sequence are almost forced. We strongly think that these first white moves are an excellent sequence if black opens with the *tengen* E5, but we need more games with strong black players to see if this opening can be beaten by black.

Importantly, the new version of MoGo as black plays C7 instead of D6: E5-G5-G4-C5-C6-B6-C7: this leads to a much better winning rate for black; the resulting situation is (within rotation) as in Fig. 3 (d), and

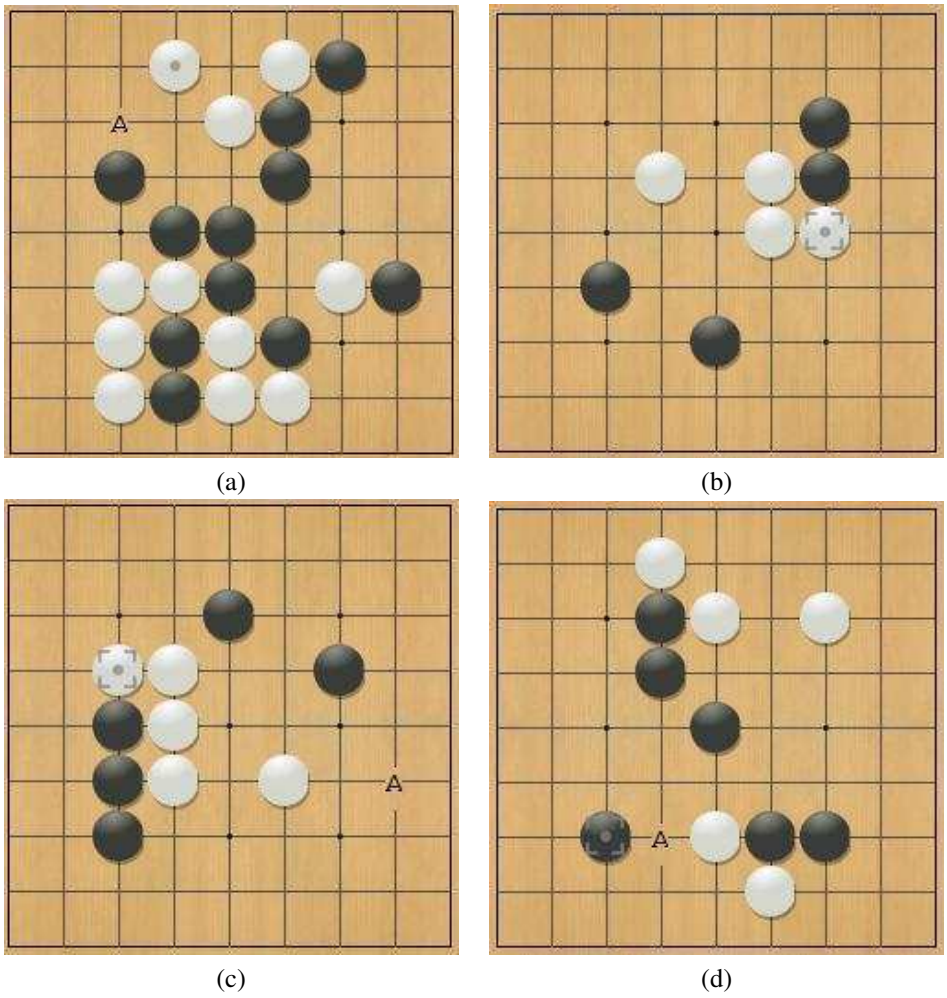

Figure 3: In the three first situations (a), (b) and (c) which are good for Black (confirmed by Pro.), from blitz games with 10 minutes per side, the human (black) wins in spite of the 7.5 komi. The estimated winning rate by MoGo for white in cases (a), (b) and (c) are 55%, 62%, and 64% respectively, showing that MoGo misreads some openings. The fourth opening is particularly interesting as it appears that MoGo considers it as a win for white; we show a sequence (Fig. 4), later in the game, in which MoGo is very optimistic for white whereas it is a win for black.

is seemingly much better for black. But Black cannot obtain this situation. In the sequence E5-G5-G4-C5-C6-B6, White will not play B6, but F4, just like the game of Chou 9p vs. MogoTW. After the white move F4, it is hard for Black to win. So C6 is a bad move; Black should play F5 instead. Now, E5-G5-G4-C5-F5 may be the best sequence for Black if Black plays E5 first. With komi 7.5, maybe the best first move is not E5. We are studying for F5 as first move, now.

4. DISCUSSION

Computers are now nearly at the best human level in 9x9 Go. They have already several wins as white (MoGo won several games as white against pro players, and Fuego won as white against a 9p player in Jeju island, Korea, in 2009). MoGo realized the two first wins as black against professional players, including a 9p player, winner of the LG Cup 2007.

The main weakness of MoGo in 9x9 was the opening book; this opening book was much improved by the use of automatic building on a cluster (Audouard *et al.* (2009)), but severe weaknesses could be found by P. Audouard (strong amateur player), and MoGo became much stronger after some work by human experts. It is usually considered that the 7.5 komi is too large, so that with a sufficiently big handcrafted opening book maybe computers can become unbeatable as white; nonetheless, the automatic building of opening book, often studies new variations for which black performs not so bad as shown in section 3.2.

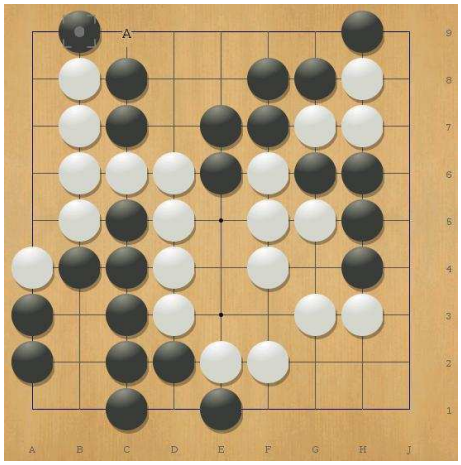

Figure 4: A situation in which MoGo is very optimistic as white, whereas it is going to loose. A detailed analysis of the simulations suggests that MoGo does not clearly see that H8 is dead and believes that H6 can be killed (semeai).

As shown by Fig. 3, besides the opening which is in progress, semeais are the main weakness for computers even in 9x9 Go.

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