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Investigation of "Tiebreak" of Majority Discussion System in Chess

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Computer programs are considered stronger than the human because Deep Blue®won Garry Kasparov who is the grand champion in Chess game.

In Shogi, many people are studying to create the agent which is stronger than the human, but so far there is no computer program that is stronger than the human. However, "Monju" gained outstanding results by obtaining the 3rd place in the 19th world Shogi championship. Besides that, "Akara2010" won Shimizu who is a professional Shogi player in 2010. These programs are implemented by using the council system, and it is said that the council system is useful in computer games. Therefore, many scholars are studying about the council system.

Hanawa et al. performed a consultation experiment in mini-Shogi as the first step in their research. In their experiment, four kinds of player were created by transforming the mini-Shogi program. The four players were different because their search method and evaluation function was somewhat transformed for three players, preferably resulting in an optimistic and pessimistic player as well as in an aggressive and a defensive player. A move was chosen from the moves that the four players generated by using simple majority. If the opinions were divided 2: 2 or 1: 1: 1: 1, the move for the original program was chosen. The results in the table indicate that the consultation algorithm has outscored all of the four players. This experiment hints at the possibility that consultation by majority

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is more effective than consultation by human players. The consultation algorithm presented hereis quite simple, and does not need communication between the programs on the reason of their move. Therefore, two or more participating programs can be executed completely independently.

Sugiyama et al. successfully designed a new strategy of move selection by a set of computer players in Shogi. Moreover, the strength of the strongest Shogi programs was improved. The constructed ensemble system selects the player that yields the highest evaluation value, and the selection rule is simple enough to build an interconnected network of computer players. The performance of the optimistic selection rule was confirmed by using the open software, BONANZA and GPS SHOGI. The method increased the winning rate from 50% to 60% or even higher. In addition, the underlying mechanism of the optimistic selection rule was clarified in terms of search instability caused by move re-ordering and LMR.

Althöfer carried out studies since 1985 on chess. He proposed a method called a 3-Hirn system. They demonstrated that it became proficient at about 200 rating points rather than using original program, when moves were chosen by a 3-Hirn system (two computers and an adequate weak human coordinator). The results mean that better moves were made than when they were chosen by one computer alone. A good move was chosen in the 3-Hirn system from two or more moves when a human player who was sufficiently skilled intervened.

Spoerer et al. tests 3-member council system in Chess. Games were played against the strongest program. His statistics were gathered about the situations where the group outvoted the group leader. He found out that group members should be almost equal in strength whilst still showing significant strength difference, and denial percentage of leader's candidate depends on the strength of the members. Spoerer et al. also performed experiments on groups of Chess programs to test the effect of group size on performance. They studied copies of the same Chess program, as opposed to different Chess programs. Simple Majority Voting was used to mechanically combine the individual Chess program's decisions into a group decision. Games of Chess were played between groups of increasing size, and individual Stockfish was used as an opponent. Results show that winning rate increases with group size.

The purpose of this study is to analyze group performance in chess game. The group plays chess with multi-players on one side and a computer player on the other side. In the game, the group decides the next move using majority voting. In most cases, it is easy to decide the next move with the majority opinions. However, there are cases such that it may not have majority opinion when deciding the next move. For example, in a group that is comprised of three programs, all the three programs have different opinion from each other for the next move. In others words, there is no majority voting in this case. This situation is called "Tiebreak", which will be analyzed in this research. In "Tiebreak"case, the group always decides the next move by the leader's opinion. However, we proposed that the group always randomly decides the next move. In each opinion, we can see that the higher the number of group members, the higher the winning rate. However, we can also see that the winning rate of the group drops in certain cases and may not be always constantly increasing. The randomly decided next move may be the correct move but we cannot assure that. Besides, the preliminary results show that the winning rate of the group is higher when the rate of "Tiebreak" is lower. Thus, this scenario should be analyzed. From the results alone, we cannot conclude that "Tiebreak" influence the group performance. In winning game, the frequency of "Tiebreak" is the highest when the group's evaluation is more than 0. However, "Tiebreak" rarely occurs when the group's evaluation is less than 0. In drawing game, the frequency of "Tiebreak" is the highest when the group's evaluation is around the value between 100 and 200. In losing game, the frequency of "Tiebreak" is the highest when the group's evaluation is near to 0 and also when it is near to -1000. This situation shows that the group has an advantage when the group's evaluation is towards the value of 0, and the group is at its disadvantage when the group's evaluation is towards the negative values. With these information, we may be able to find out whether "Tiebreak" is the tuning point that determines the group's situation.