Checkers Strategy Evolution with Speciated Neural Networks*

Kyung-Joong Kim and Sung-Bae Cho

Dept. of Computer Science, Yonsei University
134 Shinchon-dong, Sudaemoon-ku, Seoul 120-749, Korea
uribyul@candy.yonsei.ac.kr, sbcho@cs.yonsei.ac.kr

Checkers is a very simple game and easy to learn. Unlike chess, it is simple to move and needs a few rules. With respect to checkers, the evolutionary algorithm can discover a neural network that can be used to play at a near-expert level without injecting expert knowledge about how to play the game. Evolutionary approach does not need any prior knowledge to develop machine player but can develop high-level player. However, conventional evolutionary algorithms have a property of genetic drift that only one solution often dominates at the last generation. Because of genetic drift, it is difficult to discover diverse checkers players that have different properties in search space with simple evolutionary algorithm. Combining diverse solutions can make better performance than single dominating solution by complementing each other.

Game tree is used to find optimal move in checkers with min-max search strategy. Simple evolutionary algorithm with speciation technique is used to find optimal neural network structure that evaluates leaf nodes of game tree (Fig. 1.). In this research, crowding algorithm is adopted to speciated population. In first step, population of neural networks is initialized with random manner and genetic operations change chromosomes that represent weights and biases of neural network. In second step, each of the two children competes with one of the two parents, according to similarity. The similarity between two neural networks is based on the Euclidean distance of weights and biases of them. Fitness level is determined relatively by the information of competition result with parents. In third step, representative individuals are extracted from each species that is identified by clustering the last generation population and combined. Representative player is the winner of tournament competition among all individuals in a cluster. Combination of representative player is based on the mixture of evaluation values about leaf nodes in a game tree with the method of average, maximum, and minimum.

Simple EA and speciated EA have a population of 100 individuals and are evolved in 50 generations. There are 68 games in 1:1 match because the number of speciated players is 68. In this match, simple EA is a bit better than speciated EA (defeat rate of speciated EA: 47%). Meanwhile, average, max, and min combining of speciated players can defeat simple EA player with the rate 63.6%, 50% and 40% respectively. In this experiments, average combination method performs better than other methods.

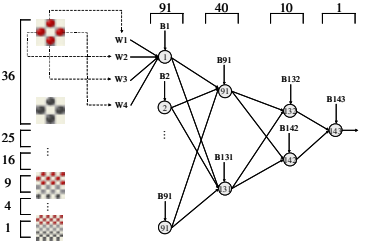

Fig. 1. Neural network architecture for evaluating leaf node of a game tree.

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