

APPLICATION OF CO-EVOLUTIONARY SYSTEM FOR STRATEGY DEVELOPMENTS OF TEAMS IN THE SAME GENERATION TO TEAM MATCH-UP GAMES

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ABSTRACT. *In coevolution, two competing species reciprocally drive one another increasing the levels of complexity of tactics and strategies. However, this phenomenon is not only guaranteed, but also the co-evolutionary process may fall into a limit cycle when the same solutions are adopted over and over again by both species. The authors proposed a new co-evolutionary system using a classifier system for strategy developments in match-up games by players in the same generations and applied it to poker games. Consequently, the coevolutionary process of the four players were confirmed and discussed the validity of the system. In this paper, the authors apply the co-evolutionary system to a simplified soccer type game, which had been originally designed by authors, for two teams composed of three agents. First, the co-evolutionary system proposed in our former works is overviewed briefly. Next, an application method of the co-evolutionary system to the simplified soccer type game is described after explanations of the circumstance and rules of the game. Finally, coevolutionary process and developments of strategies of the two teams are confirmed through the results of the simplified soccer type game as well as the case of the poker games.*

Keywords: Coevolution, Soccer game, Classifier system, Coevolutionary system and Team match-up games

1. Introduction. Coevolution is a situation in which two different species co-evolve with each other. This mechanism has shown successful results in developments of GA and GP [1]-[12]. In coevolution, a continuous increase in complexity of individual strategies is required. But each individual tends to find the simpler strategies that can win against current opponents [13]. Therefore, the individuals may incite over-specialization [14, 15], and the relation of individuals may fall into a limited cycle that rediscovers the same class of strategies over and over or the mastery of some individual may be fixed by an arrested evolution of other individuals [14, 16, 17]. To avoid this problem, a "Hall of Fame (HOF)" that extended elitism in time for purposes of testing was proposed by Rosin [18] and was applied to a predator-prey interaction [21], the robot duel [13], etc. In this method, good opponent individuals collected from every past generation HOF were used as an evaluator. The current individuals were able to generate better individuals in the following generation by testing against the HOF. In consequence, this method achieved