Abstract

Computer artificial intelligence (AI), which aims to benefit human daily life, consists of several subfields due to difficulties of creating artificial general intelligence that can perform any human intellectual task perfectly. Among the subfields, AI techniques for playing games have attracted researchers' attention from a very early stage of AI research. Thanks to much amount of study, AI players can now beat human pro players in many games such as Chess, Shogi and Go.

On the other hand, there are games in which AI players are still not competitive enough due to the lack of efficient methods for these games. We believe that this situation needs to be improved to enhance the game experience of human players. General methods that can be applied to AI players in more games should be developed. Even if game creators can develop relatively competitive AI players in many games with rule-based programs, there is a high developing cost for providing AI players for each new game title. Besides competitive AI players, AI players focusing on purpose on something other than competitiveness are also important, for example, AI players adjusting their competitiveness to make equally matched games, AI players coaching beginner players, or AI players manipulating game characters in a human-like way. These types of AI players are essential to entertain human players in various game situations of various genres of games.

Therefore, we aimed at enabling AI players to cope with various game genres and situations. There can be quite a large number of combinations of "game genre" and "purpose that AI players focus on", so we divided the combinations into four large classes, namely, "turn based game player focusing on competitiveness," "turn based game player focusing on purpose other than competitiveness," "real time game player focusing on competitiveness," and "real time game player focusing on purpose other than competitiveness." After that, we picked one AI problem per each class considering the popularity of the game genre and the difficulty of addressing the problem.

At first, we addressed a problem of making a competitive AI player in turn based strategy game. We proposed three types of forward pruning methods to enable AI players to look ahead further during the game tree search. This method resulted in a 74% win-rate in average during matches against existing champion AI programs.

Next, we handled a problem of making a less-dissatisfactory team mate AI player in Computer Role Playing Games.

Our method estimates human player's preference on game states in RPG, then, it cooperates well as a team mate with the human player. The proposed player gained 3.85 score in average in a subject experiment where each human subject rates the degree of satisfaction from 1 to 5 points.

After that, we coped with a problem of making a competitive AI player in fighting games, where the game progress is based on pseudo real time, leaving AI players with a very short time for their calculation. Our method combines existing AI players of rule-based architecture and switches the control among them. This strategy succeeded in enhancing the competitiveness of existing rule based AI players, and gained +888 game scores through matches against them.

Finally, we addressed a problem of making an AI player with human-like behavior in shoot' tem up video games. We adopted a tree search with an influence map technique, which results in 4.2 score by 5-star rating during an human subject experiment to evaluate the human likeness of the AI player.

Keywords: Artificial Intelligence, Game, Machine learning, Tree search, Monte Carlo Simulation