Classification and Imitation of In-Games Non-intent of Main-goal achievement Human-like Action

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The progress of research in computer player field has significantly improved especially in " Classical board game " such as Chess Shogi and Game of Go. The performance of computer players in this domain is now sufficient to surpass professional level of human players. The skill of computer player in modern video game is also rapidly improving. Recently, DeepMind Technologies Co., LTD presented Deep Q-Network (DQN) technique to handle 49 types of arcade-games (e.g. Pong, Breakout, Space Invaders, Seaquest). Among that, in 43 types, DQN player shows better performance than the conventional techniques and in 29 types DQN player is able to reach or beat Human professional players ' records. It is said we became closer to the first goal of the research in this area which is player 's performance. Thus, entertainment computer player especially human-like computer player is focused by researchers in very recently year.

" Human-like computer player " is a player whose behavior is likely to human-player behavior. There are many factors which adjust Human-likeness, have been mentioned. For example, play style in classical board games which able to notice by feeling of human, or the intention to play consistent. Another example in fighting game, to avoid very high speed reaction (attack or evasion) which is beyond human speed should be concerned.

In order to produce human-like behavior, this research focus at " the action in game which unrelated to main-goal of the game ". Such as, " the repetition of punch when staying out of attack range in order to provoke opponent " in Action Fighting game or " to inform alliance about item location by repeating jump " in multiplayer action game which text or voice communication is forbidden. Such Actions are often behaving by human player. However, it is difficult to be produce by computer players whose were design for clear main objective. This kind of actions are still less considered in previous research. In order to produce human-like behavior, it is significant to consider well in every action even with or without intention of human player.

In this article, the action in game which not directly related to the game 's main objective is defined as " In-game non-primary objective action ". Moreover, case example of actions which appears in various gene of game were recorded and analyzed. The recorded are including 45 type of action from 30 titles of games and these actions were categorized by the purpose of action into 7 types such as " reminder ", " provoke " and

“ greeting ”. In addition, condition of occurrence, method of reproduction, a guideline to implement human-like computer player have been discussed.

In this research, the collection classification and discussion of “ In-game non-primary objective action ” have been showed. Moreover, a human-like computer player approach has been proposed and implemented. Previous literature proposed many ways to produce human-like behaviors. Direct learning from human action by supervised learning approach or using reinforcement learning approach fight against human player are promising and often introduced. However, the action such as “ reminder ” or “ warning ”, the co-operate actions which indirect related to main objective has not been implemented.

In order to confirm mentioned problem, the experiment of information transition by using reinforcement learning in co-operative tracking game has been conducted. Two computer player were informed just only their own position and their alliance in a start point. No information of enemy location has been informed. The goal of game is to catch the enemy by 2 agent have to be surrounding the enemy. The result show that the agent who found enemy first, behave the unnecessary for searching action such as repeating move and the another agent is possible to learn a policy of information transition.