Co-Creative Decision Making in Artifactual Systems in Consideration of Bounded Rationality

Tomomi KITO*, Nobutada FUJII*, Kanji UEDA*

Abstract

This study purposes a co-creative decision making method of artifactual systems for creating effective solutions under incomplete conditions by introducing bounded rationality as a characteristic of agents.

A “perfectly rational” model or a “perfectly optimal” model has been addressed classically as an agent model in the field of economics and engineering. Nevertheless, limitations or drawbacks of such models have been indicated under imperfect conditions. “Bounded rationality” or “bounded optimality” is becoming well established as the alternative. These terms indicate limitations of agents’ knowledge or cognitive ability, and are used to resolve agents’ inherent deficits.

In contrast, this study proposes that bounded rationality has positive aspects to its use. Bounded rationality can be used for generating effective solutions to decision-making problems under incomplete conditions. The key concept of our method is “co-creation” that is based on a multi-agent approach. The effectiveness of a multi-agent approach for situational complexity has been demonstrated in some studies.

In this paper, specifications of our target systems are clarified by classifying multi-agent systems. Classification items by which specifications of the target systems are revealed are: (1) Presence of the system’s purpose and (2) An agent’s rationality. Our target is systems which has the purpose and include several bounded-rational agents. In other words, we address the system of which the purpose cannot be attained if all agents behave rationally. In such a case, the possibility exists of attaining the system’s purpose by introducing some bounded-rational agents.

We also present a specific description of bounded rationality for application to artifactual systems. Each agent outputs action through decision-making function while input is state of environment. Information of state is incomplete and it is not always possible for the agent to act as planned. Hence, decision-making function must have flexibility to absorb such fluctuation of state and action. We regard this flexibility as bounded rationality. One of principal property is random action selection. The effectiveness of introducing this property to several agents was tested in the computer simulation. The simulation is modeled based on the Ant System. The simulation was executed by changing ratio of bounded-rational agents and the random probability. The simulation results allow derivation of the argument that both introducing high level of randomness into several agents and introducing a certain level of randomness into all agents would improve the overall system performance.