

論文 / 著書情報
Article / Book Information

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Type(English)	Summary

(博士課程)
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論文要旨

THESIS SUMMARY

専攻 : Department of	Computational Intelligence and Systems Science	専攻	申請学位 (専攻分野) : Academic Degree Requested	博士 () Doctor of Engineering
学籍番号 : Student ID Number			指導教員 (主) : Academic Advisor(main)	Hiroshi Deguchi
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要旨 (英文 800 語程度)
Thesis Summary (approx.800 English Words)

Aspiration-Based Learning Shaped by Sharing Mechanism and Its Applications

Chapter 1: Learning process and the availability of information on how decision makers behave in environments that exhibit strategic interdependence is a crucial factor in the theory of interdependent decision-making. The overall aim of this thesis is to advance the investigation of the impact of the above crucial factor. To fulfill this aim, firstly, we list the limitation of aspiration-based reinforcement learning from previous researches as follows:

1. Social dilemma: the solution depends on model parameters, e.g., initial aspiration level, learning rate, and habituation.
2. Homogeneity assumption: use the same parameters and the same model of learning.
3. Individual learning: no interaction.

According to our motivation, we want to solve a research question as follows: If agents follow the aspiration-based learning, and the information about agents' aspiration level are shared through interaction, what kind of behavior would be emerged in the macro level?

To answer the research question we proposed research objectives as follows:

1. To build aspiration-based learning that handles the effect of learning rate and habituation parameters.
2. To build a mechanism of sharing information (aspiration level) that handles heterogeneity.
3. To apply the learning model and the mechanism in different fields, i.e., social dilemma, organizational learning and economic (duopoly market).

The specific contributions of this thesis are to build a new aspiration-based learning model that uses the dynamic learning rate. Within this method, the heterogeneity aspects, i.e., different habituation parameters, different learning models, and different initial aspiration levels can be handled. Besides, we also propose a new model of sharing information to change individual learning to social learning through interaction. This method can make the agents coordinate their action and also coordinate their aspiration level. We also implement the proposed models to different area of investigation, i.e., social dilemmas, learning organizational, and duopoly markets. This investigation is important to generalize the proposed models.

Chapter 2: We build a model of aspiration-based learning by using dynamic learning rate. We use this model to investigate cooperative behavior in the social dilemmas. The purpose of the model is

to handle some problems that arose in previous aspiration-based models, i.e., initial aspiration level, learning rate parameter, and habituation. The proposed model promotes cooperative behavior compare with Bush-Mosteller, improves the convergence time compare with Bush-Mosteller and Q-learning model, overcomes the heterogeneous issue, i.e., differences in parameter setting (aspiration levels and habituation). The more agents involve in the game, the harder cooperative behavior can be achieved.

Chapter 3: We build a sharing mechanism to investigate cooperative behavior in social dilemmas. The purpose of the model is to introduce interaction among the agents. Through the interaction the agents share their aspiration levels. We use three learning models, i.e., Roth-Erev model, Borgers-Sarin model, and Satisfying model to accommodate heterogeneous agents with respect to the learning model. With interaction and sharing aspiration level all players can improve their cooperative behaviour in a group. However, as the number of players increases, the level of cooperative behaviour decreases and needs more time to converge.

Chapter 4: We apply the aspiration-based learning model and the sharing mechanism to the problems of organizational learning. We modify the mutual learning model by introducing three phases in the learning processes. The first phase is the experimental phase, i.e., the members of the organization try to find other alternative depending on their probability of experimentation. The second phase is the learning phases, i.e., the members learn form the code and learn by the code. The third phase is the interaction phases, i.e., the members interact to share their aspiration level. Through these learning processes, the model improves the knowledge achieved by the members and the organization compared with the March's model. Moreover, the model is robust against environmental changing, i.e., turnover and environmental turbulence.

Chapter 5: We use the aspiration-based learning model and the sharing mechanism to investigate the firms' behavior in duopoly markets. Some research state that if the firms perceive the industries average profitability as aspiration levels, then the markets will converge to the collusive behavior. However, those researches assume that all firms have the same aspiration level, which is represented by the overall average profit as a reference point. Another assumption is that the information on the overall average profit is provided. To handle this disadvantage, we propose the aspiration-based learning in which each firm has its own aspiration level and using the sharing mechanism to search the information about other aspiration levels. Simulation results show that the learning model and the information searching mechanism lead the market to competitive outcome, i.e., Nash equilibrium, if the firms have many strategies even if their initial aspiration level is low. However, if the firms have fewer strategies and start with high initial aspiration level, then collusive behavior will occur.

Chapter 6: The proposed model has proved the importance of aspiration-based learning and sharing mechanism on investigating the behavior of agents by playing specific game. However, we only justify the model through simulation. In future we would like to justify our model by using analytical approach and experimental approach. In analytical approach, we need to simplify our model, i.e., only consider two-players case to investigate precisely the dynamics of aspiration-based learning shaped by sharing mechanism. In experimental approach, we need to design experimental procedure that can be used to explore the dependence of aspiration level and sharing mechanism among subjects.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 2 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 2 copies of 800 Words (English).