

“Variations in Error Strategies of Foraging Ant”

Hiraku Nishimori

Meiji Institute for Advanced Study of Mathematical Sciences, Meiji University

(nishimor2@meiji.ac.jp)

The foraging efficiency of ant colonies is studied along with the idea of the strategy of errors. The strategy of errors is a seemingly paradoxical group-tactics proposed by Deneubourg, meaning that failure of individual ants in precisely following pheromone trail, rather, increases the efficiency of pheromone-mediated group foraging.

Here, we extended Deneubourg’s original idea to entrain more realistic processes observed in the foraging experiments of a species of garden ant, *Lasius Japonicus*.

Through numerical calculations of the present model, we obtained two results: i) In a certain range of environmental conditions, non-uniform distribution of the degree of errors among workers in a colony leads the colony to make optimal foraging, ii) According to the variation of food-supplying environment, specifically the variation of the distance between nearby food sources, a transition of the optimal distribution of the degree of errors from the non-uniform distribution to the uniform distribution takes place[2]. In addition, we proposed a mathematically tractable model to describe the above numerical outcomes [3]. These results indicate that the idea of the strategy of errors has more scalability than what has originally been considered.

References

- [1] J. L. Deneubourg, J. M. Pasteels, and J.C.Verhaeghe, Probabilistic Behaviour in Ants: A Strategy of Error, *J. Theo. Bio.* Vol.3,259(1983)
- [2] M.Shiraishi, R.Takeuchi, H.Nakagawa, S.I.Nishimura, A.Awazu, H.Nishimori, Diverse stochasticity leads a colony of ants to optimal foraging, *J. Theo. Bio.*, 465, 7(2019)
- [3] H.Nishimori and M.Shiraishi, in preparation