Mathematical modeling for shortest path formation by ants between nest and food source

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Social insects are an important example of complex collective behavior. In particular, ant colonies develop different tasks as foraging, building and allocation. Several models have been proposed to describe the behavior of ants when moving from nest to food sources based on numerical simulations with no mathematical justification.

In this talk, we propose a mechanism for the formation of paths of minimal length between two points by a collection of individuals undergoing reinforced random walks taking into account not only the lengths of the paths but also the angles (connected to the preference of ants to move along straight lines). Our model involves reinforcement (pheromone accumulation), persistence (tendency to preferably follow straight directions in absence of any external effect) and takes into account the bifurcation angles of each edge (represented by a probability of willingness of choosing the path with the smallest angle). We describe analytically the results for 2 ants and different path lengths and numerical simulations for several ants based on the results appeared in [1] and [2].

References

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