

Swarm Intelligence

Project seed

Keld Helsgaun, computer science



Social insects, such as ants and bees, give us a powerful metaphor for developing problem solving systems consisting of simple, cooperating agents. The collective intelligence of social insects, “swarm intelligence”, is not based on complex abilities but on the interaction between quite simple individuals.

By simulating swarm intelligence on a computer, it is possible to solve numerous computer science problems. For instance, a lot of combinatorial optimization problems have been solved by simulating the instinctive abilities of ants for finding their way in an unknown terrain. The method is inspired of ethological research in the collective behavior of ants. Ethologists have attempted to understand how almost blind ants can find the shortest path from the anthill to a place with food. One hypothesis is that the ants “communicate” by means of their excrements. Each ant deposits excrements to its trail and when another ant later meets the trail it chooses to follow the trail with a high probability. In this way, the “desire” to follow the trail is reinforced.

In other words, the ants collectively learn an appropriate behavior. In computer science terms, we have *distributed computations done by cooperating, but not centrally controlled, processes*. This method is of course especially relevant in relation to problem solving on parallel computers. However, the method has also proven its worth on traditional computers.

There are many possibilities for doing a project in this area. One possibility is to implement and test an algorithm inspired by the behavior of ant colonies for solving a classical optimization problem, namely “The traveling salesman problem”. This problem is, in short, to find the shortest tour for a person that must visit a set of cities.

References:

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“Swarm intelligence: from natural to artificial systems”,
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http://dlia.ir/Scientific/e_book/Science/Cybernetics/006285.pdf

E. Bonabeau and G. Théraulaz,
“Swarm smarts”,
Scientific American, pp. 72-79, March 2000.
http://staff.washington.edu/paymana/swarm/sciam_0300.pdf

A good start page is
http://en.wikipedia.org/wiki/Swarm_intelligence

Other project proposals

Ten project proposals in artificial intelligence:
http://www.akira.ruc.dk/~keld/teaching/Projektforslag/AI_Projects.pdf