Artificial Bee colony Project – Notes

Since 2005, some members of the intelligent systems research group, the head of the group isD.Karaboga, have studied on ABC algorithm and its applications to real world-problems. Karabogaand Basturk have studied on the version of ABC algorithm for unconstrained numerical optimization problems and its extended version for the constrained optimization problems.

ABC as an optimization tool, provides a population-based search procedure in which individuals called foods positions are modified by the artificial bees with time and the bee's aim is to discover the places of food sources with high nectar amount and finally the one with the highest nectar. In ABC system, artificial bees fly around in a multidimensional search space and some (employed and onlooker bees) choose food sources depending on the experience of themselves and their nest mates, and adjust their positions. Some (scouts) fly and choose the food sources randomly without using experience. If the nectar amount of a new source is higher than that of the previous one in their memory, they memorize the new position and forget the previous one. Thus, ABC system combines local search methods, carried out by employed and onlooker bees, with global search methods, managed by onlookers and scouts, attempting to balance exploration   and   exploitation   process.

The model consists of three essential components: employed and unemployed foraging bees, and food sources. The first two components, employed and unemployed foraging bees, search for rich food sources, which is the third component, close to their hive. The model also defines two leading modes of behaviour which are necessary forself-organizing and collective intelligence: recruitment of foragers to rich food sources resulting in positive feedback and abandonment of poor sources by foragers causing negative feedback.

1. Food Sources: In order to select a food source, a forager bee evaluates several properties related with the food source such as its closeness to the hive, richness of the energy, taste of its nectar, and the ease or difficulty of extracting this energy.
For the simplicity, the quality of a food source can be represented by only one quantity although it depends on various parameters.
2. Employed foragers: An employed forager is employed at a specific food source which she is currently exploiting. She carries information about this specific source and shares it with other bees waiting in the hive. The information includes the distance, the direction and the profitability of the food source.
3. Unemployed foragers: A forager bee that looks for a food source to exploit is called unemployed.It can be either a scout who searches the environment randomly or an onlooker who tries to find a food source by means of the information given by the employed bee. The mean number of scouts is about 5–10%.

In ABC, a colony of artificial forager bees (agents) search for rich artificial food sources (good solutions for a given problem). To apply ABC, the considered <u>optimization</u> problem is first converted to the problem of finding the best parameter vector which minimizes an objective function. Then, the artificial bees randomly discover a population of initial solution vectors and then iteratively improve them by employing the strategies: moving towards better solutions by means of a neighbour search mechanism while abandoning poor solutions.

Initialization Phase

REPEAT

 1. Employed Bees Phase→ Place the employed bees on their food sources

 2. Onlooker Bees Phase → Place the onlooker bees on the food sources depending on their nectar amounts

 3. Scout Bees Phase → Send the scouts to the search area for discovering new food sources

 4. Memorize the best solution achieved so far

UNTIL(Cycle=Maximum Cycle Number or a Maximum CPU time)