Bees behaviors algorithm and probably technological replacement in the future.

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1.   Introduction:

As we all probably know climate change has been affecting us and our environment for the last seventy (70) years, according to the NASA for the last four thousands (4000) centuries the atmospheric carbon dioxide level had been above three hundred (300) parts per million but after 1950's the level have risen considerably over the normal level already established. This demonstrate that atmospheric CO2 has increased since the Industrial Revolution. All this caused by the greenhouse gases, emitted by the every day of humans, that are making the earth warmer "ten times faster than the average rate of ice-age-recovery warming"[1], affecting not just us, but more important our ecosystems and animals.

The best example for that are bees best known for their their role in pollination, has one of the most important species that makes this duty, bees are flying insects very related to wasps or even ants and we all know for their most common specie the "honey bee" for the honey that we consume and beeswax. The bees that we often see are the workers which are female bees that are not fertile, they are in charge of recollenting the pollen, build the nest, protect the nest and clean all the mess, when a queen dies the workers create a new queen by given her nutrients in a special diet until she transforms into a fertil queen. On the other hand we have the drones which are the male picture of the bees and his work is to reproduce with the queen, in the winter they often get expulse from the nest, while the other bees live inside the nest thanks to all the nectar they have been recollecting.[2]

Bees are legitimately important for humans, we depend on them for pollination, this means that without bees it would be impossible to crop any kind of food or there would not be any kind of vegetation. Global warming is affecting them too, the increase in temperature lead to a change in flower morphology, phenology, flower sex ratios and nectar chemistry, and this can "altered attractiveness of flowers or nutritional rewards to pollinators could dramatically alter pollinator fitness and plant-pollinator mutualisms."[3]

On the other hand, according Marla Spivak "bees in fact have been in decline since World War II. We have half the number of managed hives in the United States now compared to 1945" and mainly this is because of multiple and interactive causes, for example, flowerless landscapes, after that period of time the organization of how the farms harvested the lands change making thousands of kilometers with only one specie of plant making harder for bees to found real food for them, that cause a disfuncional food system; pesticides, that produce intoxication and afterwards death; diseases parasites and monoculture. All this together can lead to a colossal disaster, called Colony Collapse Disorder (CCD).[4]

Thanks to all these problems 10 years ago a group of investigator along with the Harvard University and the Northeastern University, started to think how difficult it would to create a robot bee colony, the task seems impossible due to the physiology of bees and the amount of tasks they can perform thanks to it a tiny can fly for hours with an incredible stability while they search for flowers and avoid predators, making us see how millions of years of evolution have became into outstanding flying machines.

Now let's imagine the whole picture, they had to create a hive, which contains thousands of bees that rarely do not have an specific authority to tell them what to do, even so they all accomplish singular tasks for the health of the hives and in cases such as the dead of the queen the bees adapt rapidly through these changes without causing "without taking forever or causing havoc through miscommunication"[5] The invention of something as the robobees is in a perspective something very difficult, but it would make a lot of things better, because of the multiple things it may do, it would not be the same exact bees, they would be a better bee, the problem of it is that the construction, the materials and other programming are still evolving to get there.
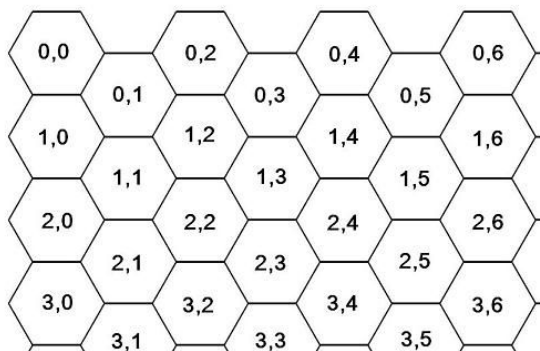
2. Problem:

The global warming and agriculture actions such as using pesticides and monoculture have cause a dramatic decrease in bees population and their colonie. This loss generate a meaningful environmental problem, because bees are fundamental to a natural development of the ecosystem. It is very important to solve this problem due to this can lead to a food shortages, because bees are responsible of most pollination and variety of vegetation in the world.

3. Related work:

3.1. How to distribute the hives.

It is very important for scientist to study correctly the hives, to answer any question, that is why you can visualize a hive as a rectangular matrix of size NxM. assigning coordinates to each cell which contains honey. You can ask to the program to sum the honey for over all cells from one specific cell to another.[6]

3.2. Waggle dance

How do the bees found their way to their food previously found, variations of this algorithm has been us to solve engineering problems and so on."Without loss of generality, it will be hereafter assumed that the optimisation problem entails the minimisation of a specified cost measure. A candidate solution to the problem is defined by a given number of parameters, and its cost is measured via an objective function (*fitness function*) of these parameters."
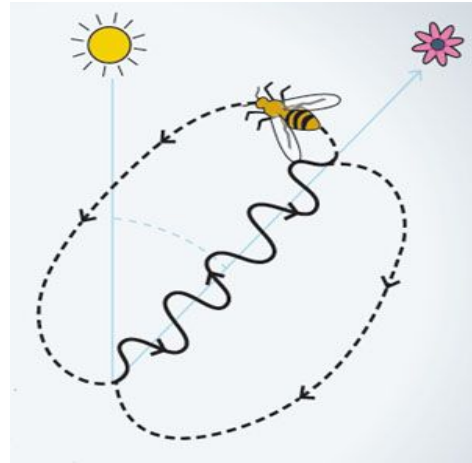
photo[1]

"Given a minimisation problem defined over the n-dimensional continuous solution space $U = \{x \in Rn;$ $\min i < xi < \max i, i = 1, \dots, n\}$, each candidate solution is represented as an n-dimensional vector of decision variables $x = \{x1, \dots, xn\}$. The goal of the optimisation task is to find the solution that minimises the set cost function $f(x):U \rightarrow R$."[7]

3.3 Artificial Bee Colony

The idea of the ABC comes from the inspiration in the biological behavior of the bee colonies in search for food "ABC consists of three essential components: positions of food sources, amounts of nectar and different kinds of bees. In the algorithm, each food source position represents a plausible solution of the problem under consideration and the amount of nectar represents the quality of said solution. Each kind of bee represents a particular operation to generate new positions of food sources (new solutions)" [8]

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[1] Retrieved from [9]

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