Artificial Bee Colony Algorithm

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Outline

1. Introduce ABC algorithm

- Basic idea
- System flow
- Parameters

2. Experimental Result

- Visualisation
- Benchmark

Introduce ABC Algorithm

Basic Idea

Introduce ABC algorithm

- Proposed by Derives Karaboga in 2005
- Inspired by the foraging behavior of honey bee when seeking a quality food source.
- The honey bees can be categorized into employed bees(1), onlooker bees(2), and scout bees(3).

Focus on behaviors:

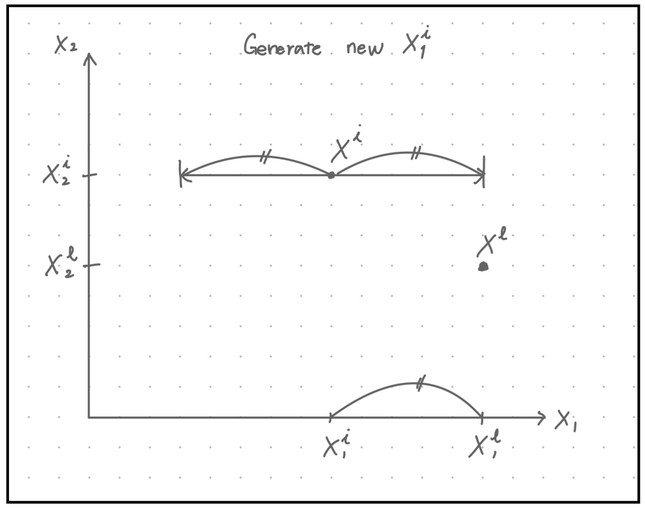
- Exploit the food (1)
- Seek new food around current food(2) → Exploitation
- Find new food randomly(3) → Exploration

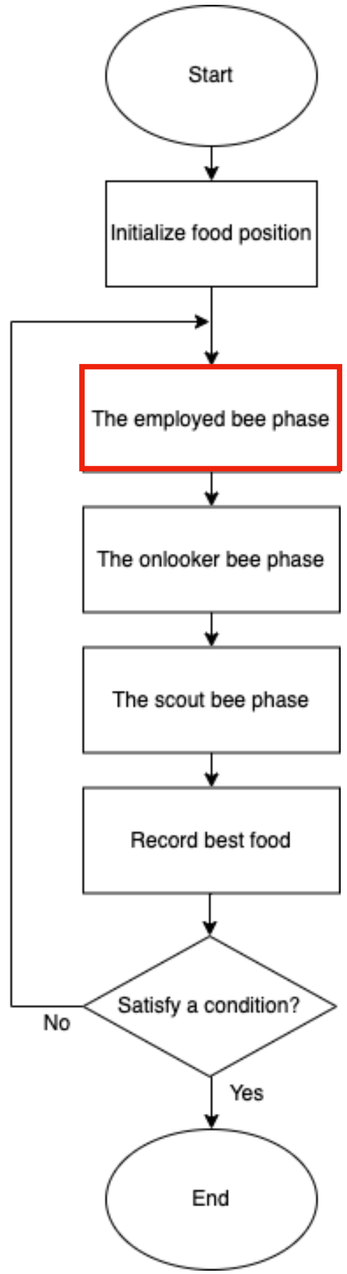
System Flow

Introduce ABC algorithm

1. Compare current food position with new food position around current one.
2. Select food position based on step 1 and visit the food position.

$$x_{j(new)}^{i} = x_{j}^{i} + rand[-1,1] \times (x_{j}^{i} - x_{j}^{l})$$



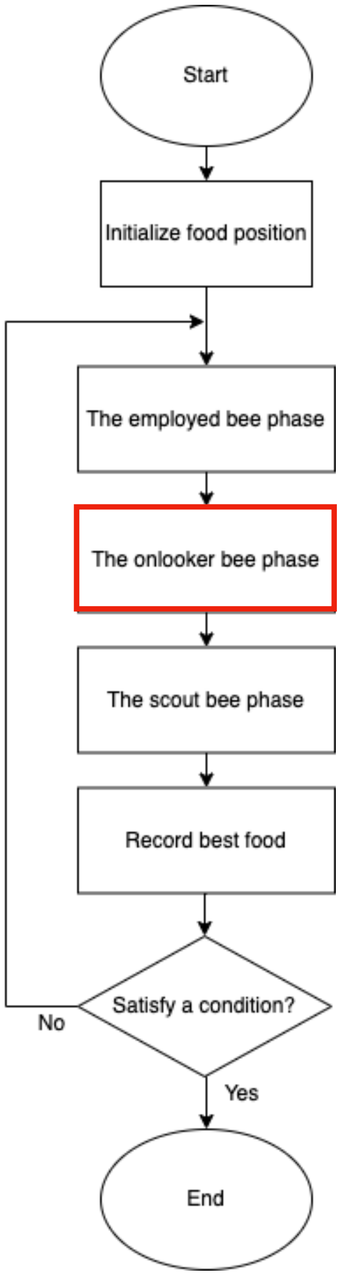


System Flow

Introduce ABC algorithm

1. Select food position which the employed bee has based on the fitness of food position. (Roulette wheel)
2. Do what the employed bee phase do.

But bad food position wouldn’t be rejected by this selection.
It still can do exploitation until limit(number of visits).
→ Guarantee of diversity

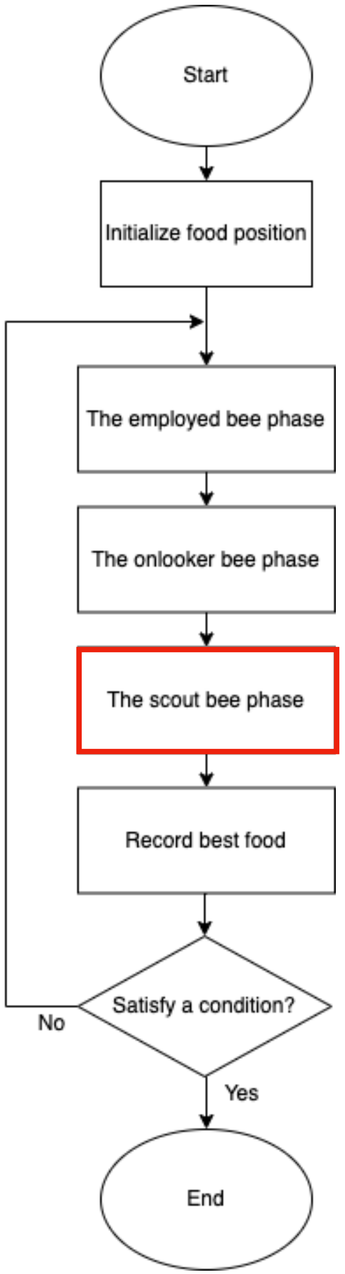


System Flow

Introduce ABC algorithm

1. Check whether each food position reaches the limit(number of visits).
2. If so, renew a food position randomly.

If the number of visits is larger, each food position can do exploitation much times



Parameters

Introduce ABC algorithm

ABC algorithm	GA
Food position	Chromosome(Individual)
Food set	Population

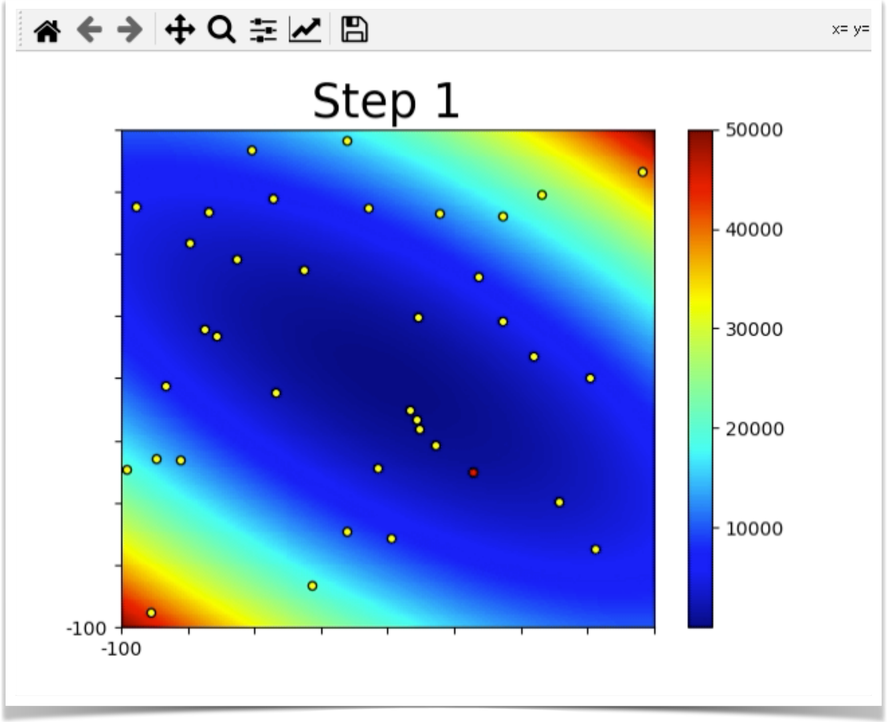
- Number of employed bees: number of food positions
- Max number of visits
- Number of onlooker bees
- Number of repeats

Experimental Result

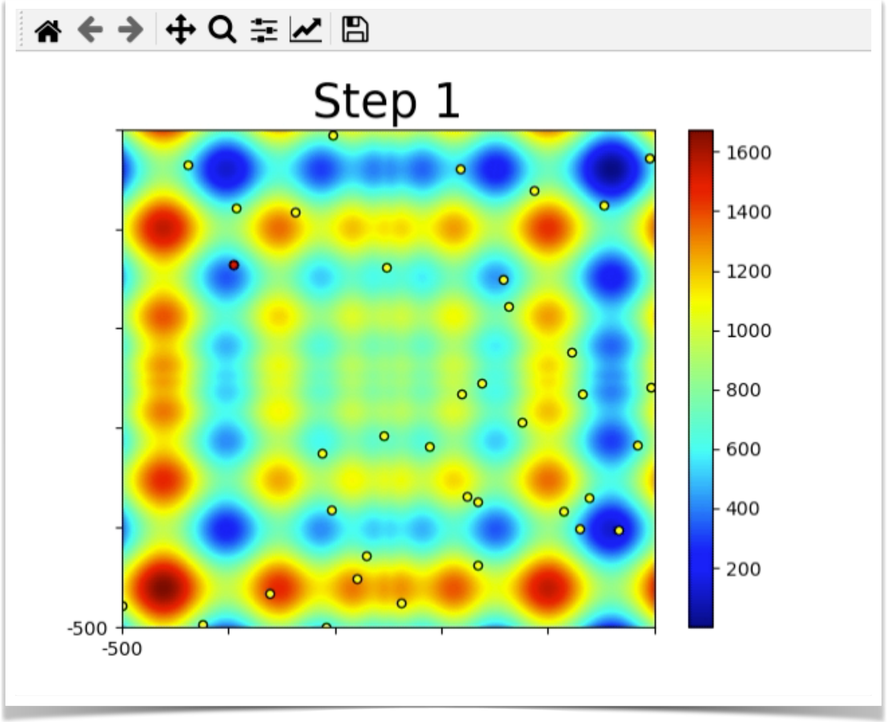
Visualisation

Experimental Result

Unimodal (Quadric)



Multimodal (Schwefel)



Benchmark: Average Number of Repeats

Experimental Result

- Dimension: 30
- Magnification: 0.6
- EBEE = Dimension * 31 * Magnification
- OBEE = Dimension * 4 * Magnification
- VISIT = Dimension * 92 * Magnification

- About magnification, recommend between 0.05(unimodal) and 0.7(multimodal) .

Function	Average number of repeats
Shwefel	535
Ackley	274.2
Sphere	166.8
Quadric	1178.9
Rosenbrock	77.8
Griewank	1997.3

Benchmark: 10,000 Repeats

Experimental Result

- Dimension: 30
- Magnification: 0.6
- EBEE = Dimension * 31 * Magnification
- OBEE = Dimension * 4 * Magnification
- VISIT = Dimension * 92 * Magnification

- In my GA assignment, there is a 90% chance to get good result(Acceptance range) with griewank.

Function	Average final best fitness
Shwefel	0.000381826986
Ackley	3.05E-14
Sphere	2.10E-162
Quadric	9.12E-09
Rosenbrock	2.963613915
Griewank	0 or less than 1E-308

Thank you