**Brief description of hunger games search (HGS) optimization**

### 1 Approach food

To express its approaching behavior in mathematical formulas, the following formulas are proposed to imitate the contraction mode:

|  |  |
| --- | --- |
|  | (1) |

where is in the range of ; and respectively represent random numbers, which are in the range of is a random number satisfying normal distribution; indicates that the current iterations; and represent the weights of hunger; represents the location information of a random individual in all the optimal individuals; represents each individual's location; and the value of *l* has been discussed in the parameter setting experiment.

The formula of is as follows:

|  |  |
| --- | --- |
|  | (2) |

where , represents the fitness value of each individual; and is the best fitness obtained in the current iteration process. is a hyperbolic function .

The formula of is as follows:

|  |  |
| --- | --- |
|  | (3) |
|  | (4) |

where is a random number in the range of ; and stands for the largest number of iterations.

### 2 Hunger role

The starvation characteristics of individuals in search are simulated mathematically.

The formula of in **Eq. (5)** is as follows:

|  |  |
| --- | --- |
|  | (5) |

The formula of in **Eq. (6)** is shown as follows:

|  |  |
| --- | --- |
|  | (6) |

where represents the hunger of each individual; represents the number of individuals; and is the sum of hungry feelings of all individuals, that is . , and are random numbers in the range of .

The formula for is provided below:

|  |  |
| --- | --- |
|  | (7) |

where preserves the fitness of each individual in the current iteration.

The formula for can be seen as follows:

|  |  |
| --- | --- |
|  | (8) |
|  | (9) |

where is a random number in the range of ; represents the fitness value of each individual; is the best fitness obtained in the current iteration process; *WF* stands for the worst fitness obtained in the current iteration process; and and indicate the upper and lower bounds of the search space, respectively. The hunger sensation is limited to a lower bound, .

|  |
| --- |
| **Algorithm 1** Pseudo-code of HGS |
| Initialize the parameters *, ,,,*  Initialize the positions of Individuals  **While (**  Calculate the fitness of all Individuals  Calculate the by **Eq.** (7)  Calculate the by **Eq.** (5)  Calculate the by **Eq.** (6)  **For**  Calculate by **Eq.** (2)  by **Eq.** (3)    **End**    **End While**  **Return** |

**Reference**

Yutao Yang, Huiling Chen, Ali Asghar Heidari, Amir H Gandomi, **Hunger Games Search: Visions, Conception, Implementation, Deep Analysis, Perspectives, and Towards Performance Shifts**, Expert Systems with Applications,2021,114864, <https://doi.org/10.1016/j.eswa.2021.114864> (<https://www.sciencedirect.com/science/article/pii/S0957417421003055>)