The Fruit Fly Optimization Algorithm (FOA) is inspired by nature, based on the foraging behavior of fruit fly. This algorithm is a widely recognized optimization method, used by many researchers around the world for research purposes. The characteristic of fruit flies is their ability to quickly detect food sources due to their superior sense of smell and vision compared to other species. First, they use their sense of smell to gather scents from the air to determine the direction of the food source. Once the direction is established, they move towards the food source, and as they get closer, they use their vision to accurately approach the food source and begin to exploit it.

*Node deployment in wireless sensor network based on FOA*

Steps are as follows:

Step 1: Initialize the parameters including population size (nPop), the maximum iteration number (MaxIt), the initial position of the fruit fly group (X\_axis, Y\_axis).

Step 2: Each fruit fly is assigned a random distance and direction allowing them to use scent to find food.

(1)

(2)

rand is a random number from 0 to 1, step is a search jump and the range of values of RandomDistance is [-step, step].

Step 3: Calculate the distance from the food source to the root (), then calculate the value of the concentration dispersion of the scent ().

(3)

(4)

Step 4: Calculate the smell value of each individual fruit fly into the fitness function to evaluate the quality.

(5)

Step 5: Identify the individual fruit fly with the highest smell value.

(6)

Step 6: Store the highest smell value and the coordinates of the food source so that the following flies can use their vision to exploit it.

(7)

Step 7: For each iteration, repeat steps (2) to (5) above and determine whether the smell value is better than the previous one. If it is better, proceed with the replacement. [1]

Applying FOA in the deployment of nodes in a Wireless Sensor Network (WSN) to achieve maximum coverage and ensure connectivity. Coverage here refers to the area that sensor nodes can monitor or track. The nodes must be placed so that they can communicate with each other within the communication range. In this approach, we create the initial population with node positions that have been checked for connectivity, rather than generating the initial population with random positions. The fitness function here is the maximum coverage.

A large step size allows the algorithm to cover a broader search space quickly, converging fast and exploring potential areas. However, its local search capability is weak. A small step size allows the algorithm to explore the area around a solution, enabling more precise adjustments and potentially leading to better solutions. However, its global search capability is weak, the convergence speed decreases, and it may get stuck in local optima. It is necessary to choose the appropriate step that fits the problem. [2]

# Tài liệu tham khảo

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