**Brief version of INFO algorithm for easy use of researchers:  
INFO: An Efficient Optimization Algorithm based on Weighted Mean of Vectors**

<https://doi.org/10.1016/j.eswa.2022.116516>

**1. Weighted mean of vectors algorithm (INFO)**

(INFO is a population-based optimizationalgorithm that calculates the weighted mean for a set of vectors in the search space.The INFO uses three operators to update the vectors' positions in each generation:

* Stage 1: Updating rule
* Stage 2: Vector combining
* Stage 3: Local search

**1.1. Updating rule stage**

INFO uses the mean-based rule (MeanRule) to update the position of vectors, which is extracted from the weighted mean for a set of random vectors. In addition, the convergence acceleration part (*CA*) is also added to the updating rule operator to promote global search ability. The main formulation of the updating rule is defined as,

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

whereandare the new vectors in the *g*th generation; andis the scaling rate of a vector, as defined in Eq. (9). are different integers randomly selected from the range [1, *NP*];is a constant number and has a very small value; *randn* is a normally distributed random value. It should be noted that in Eq. (1),can be changed based on an exponential function defined in Eq. (2.1):

(2)

(2.1)

In Eq. (1), the MeanRule is formulated as,

(3)

Where *r* is a random number within the range [0, 0.5].

and are defined in Appendix A.

In Eq. (1), the *CA* can be defined as,

or or (4)

**1.2. Vector combining stage**

INFO combines the two vectors calculated in the previous section (and) with vector­ regarding the condition to generate the new vector , according to Eq. (5). In fact, this operator is used to promote the local search ability to provide a new and promising vector:

|  |  |
| --- | --- |
|  |  |
|  |  |
|  | (5.1) |
|  |  |
|  | (5.2) |
|  |  |
|  |  |
|  | (5.3) |
|  |  |

whereis the obtained vector using the vector combining in *g*th generation; and is equal to .

**1.3. Local search stage**

INFO uses the local search stage to prevent from deception and dropping into locally optimal solutions. According to this operator, a novel vector can be produced around , if *r* < 0.5, where *rand* is a random value in [0, 1]:

|  |  |
| --- | --- |
|  |  |
|  |  |
|  | (6.1) |
|  |  |
|  | (6.2) |
|  |  |
|  |  |

in which

(6.3)

 (6.4)

wheredenotes a random number in the range of (0, 1); and­is a new solution, which combines the components of the solutions, , , and , randomly. This increases the randomness nature of the proposed algorithm to better search in the solution space. and are two random numbers defined as:

(6.5)

(6.6)

where *p* denotes a random number in the range of (0, 1). The random numbersand can increase the impact of the best position on the vector. Finally, the proposed INFO algorithm is presented in Algorithm 1, and Fig. 4 depicts the flowchart of the proposed algorithm.

|  |
| --- |
| **Algorithm 1.** Pseudo-code of the INFO algorithm. |
| **STEP 1. Initialization** |
| Set parameters *Np* and *Maxg* |
| Produce an initial population |
| Calculate the objective function value of each vector |
| Determine the best vector |
| **STEP 2. for** *g* = 1 to *Maxg* **do** |
| **for** *i* = 1 to *Np* **do** |
| Select randomlywithin the range [1, *Np*] |
| ►**Updating rule stage** |
| Calculate the vectorsand using Eq. (1) |
| ►**Vector combining stage** |
| Calculate the vectorusing Eq. (5) |
| ► **Local search stage** |
| Calculate the local search operator using Eq. (6) |
| Calculate the objective function value |
| **if** **then** |
| **Otherwise** |
| **end for** |
| Update the best vector (( |
| **end for** |
| **STEP 3. Return** Vectoras the final solution |

**Appendix A.**

(1.1)

where

 (1.2)

 (1.3)

 (1.4)

 (1.5)

|  |  |
| --- | --- |
|  | (1.6) |

where

 (1.7)

 (1.8)

 (1.9)

 (1.10)

(1.11)

(1.12)

where , , and are three weighted functions to calculate the weighted mean of vectors that help the proposed INFO algorithm to search in the solution space globally. ,, andare the best, better, and worst solutions among all vectors in the population for the *gth* generation, respectively. In fact, these solutions are determined after sorting the solution at each iteration.