

# ALGORITHM

## CHAOTIC CAUCHY HC2RCEDUMDA (CC\_HC2RCEDUMDA)

### Developed by:

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**CC\_HC2RCEDUMDA :** It is the modified version of the HC2RCEDUMDA using Chaotic Cauchy distribution. This algorithm uses a cellular estimation of distribution algorithm similar to CUMDANCauchy. The search space is reduced by transforming continuous variables to categorical variables and then inverting the process, basically using an encoding-decoding method. This algorithm also estimates an univariate marginal distribution from the neighborhoods' best individuals. More information about the HC2RCEDUMDA is given in [1].

## Cauchy DISTRIBUTION

It is a random walk, the length of which is derived from the Cauchy distribution as described in following equation. Where, 'u' and 'v' obtain from the normal distribution. The most species (e.g. swordfish and Silky sharks) and insects use Cauchy distribution to hunt for food. In CC\_HC2RCEDUMDA algorithm, the function of Cauchy step is to efficiently exploit and explore the search space by generating the new population using the Cauchy STEP to obtain the global solution. The behavior of Cauchy flights in 50 successive steps beginning at origin (0,0) is illustrated in Figure 1.

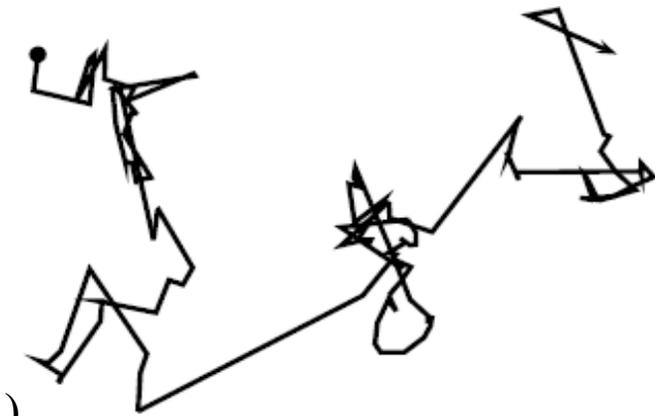
$$Step\_Length = \frac{u}{|v|^{1/\beta}}, \text{ Where, } u = rand(0,1) * Sigma, v = rand(0,1)$$

$$Sigma = \left\{ \frac{\Gamma(1 + 2\beta) * \sin(\Pi * \beta)}{\Gamma[(1 + \beta) / 2] * \beta * 2^{(\beta-3)}} \right\}^{1/\beta} \text{ Where } \beta=1, \text{ Cauchy co-efficient.}$$

$$ccrand = rand(1, I\_D)$$

$$ccpos = ((1./ccrand) - floor(1./ccrand)) / 2$$

$$CHAOTIC\_Cauchy\_DISTRIBUTION = unifrnd(0.1, 0.1, 1) .* Step\_Length * (ccpos)$$



**FIGURE 1 . Illustration of Cauchy flight .**

**CHAOTIC Cauchy DISTRIBUTION** is the enhance version of the Cauchy distribution. In this, the randomly generated number using GAUSS map CHAOTIC equation is used in the Cauchy distribution for improving the diversity and quality of new population and it finally improves the global search ability of the algorithm.

# References

- 1). J. Almeida, J. Soares, F. Lezama, B. Canizes and Z. Vale, "Evolutionary Algorithms applied to the Intraday Energy Resource Scheduling in the Context of Multiple Aggregators," *2021 IEEE Symposium Series on Computational Intelligence (SSCI)*, 2021, pp. 01-08, doi: 10.1109/SSCI50451.2021.9660005.
- 2). Ansel Yoan Rodríguez González, Samantha Barajas, Ramón Aranda, Yoan Martínez López, Julio Madera, Competition on Evolutionary Computation in the Energy Domain: Smart Grid Applications 2021, <http://www.gecad.isep.ipp.pt/ERM-competitions/wp-content/uploads/2021/08/Hc2RCEDUMDA.pdf>
- 3). C. Brown Liebovitch and L. S. Glendon, "Lévy flights in dove *Juhoansi* foraging patterns," *Hum Ecol.*, vol. 35, no. 1, pp. 129-138, Feb. 2007, doi: 10.1007/s10745-006-9083-4.
- 4). Rodríguez-González, A. Y., Barajas, S., Aranda, R., Martínez-López, Y., Quintana, J. M., (2021, July). Ring Cellular Encode-Decode UMDA: Simple is effective. In *Proceedings of the 2021 Genetic and Evolutionary Computation Conference Companion*. doi: 10.1145/3449726.3463278
- 5). Martínez-López, Y., Rodríguez-González, A. Y., Madera, J., Mayedo, M. B., & Lezama, F. (2021). Cellular estimation of distribution algorithm designed to solve the energy resource management problem under uncertainty. *Engineering Applications of Artificial Intelligence*, 101, 104231.
- 6). Dharmesh Dabhi and Kartik Pandya, "CHAOTIC LEVY HC2RCEDUMDA" <http://www.gecad.isep.ipp.pt/ERM-competitions/2022-2/>.
- 7). Martínez-López, Y., Rodríguez-González, A. Y., Quintana, J. M., Moya, A., Morgado, B., & Mayedo, M. B. (2019, July). CUMDANCauchy-C1: a cellular EDA designed to solve the energy resource management problem under uncertainty. In *Proceedings of the Genetic and Evolutionary Computation Conference Companion* (pp. 13-14)
- 8). Martínez-López, Y., Madera, J., Rodríguez-González, A. Y., & Barigye, S. (2019). Cellular Estimation Gaussian Algorithm for Continuous Domain. *Journal of Intelligent & Fuzzy Systems*, 36(5), 4957-4967.