

Optimization using Dragonfly Algorithm: Review and Applications

Jaswinder Singh¹, Mikanshu Rani²

Department of Computer Science and Engineering
Guru Jambheshwar University of Science and Technology, Hisar, Haryana, India
jaswinder_singh_2k@rediffmail.com, mikanshu6406@gmail.com

Abstract: The Dragonfly Algorithm (DA) is the most recent heuristic optimization algorithm based on Swarm Intelligence. This review paper will give brief introduction, previous research conducted on DA and applications of dragonfly algorithm in various domains. Some of the advantages and disadvantages of Dragonfly Algorithm (DA) is also discussed in this paper. This work will help other researchers to understand and use the dragonfly algorithm to optimize engineering problems and to perform feature selection by selecting only the relevant features.

Keywords: *Optimization, Swarm Intelligence, Dragonfly.*

I INTRODUCTION

We are in the Big Data era. As the quantity of data, we acquire grows, grows exponentially, extracting the essential data becomes increasingly essential. Data of high dimensions increases the search area and takes longer to process when implementing model-based machine learning approaches. There is a need to decrease the number of features by selecting only important features and removing the duplicate ones. One of the recently developed feature selection algorithm on the basis of Swarm Intelligence is Dragonfly Algorithm which gives optimize solution to problems and selects only relevant or important features and eliminates the irrelevant features; thus, helps in feature selection.

Dragonfly Algorithm (DA) perform optimization in two phases. These two phases are represented by static and dynamic swarming behaviours. These are [1]:

- 1) Exploration/hunting
- 2) Exploitation/migration

A flowchart displaying the flow of Dragonfly Algorithm is shown in figure 1 below, and steps of Dragonfly Algorithm are defined as follows:

- Start.
- Initialize the population's position.
- Find objective function.
- If there is neighbour dragonfly then calculate separation, alignment, cohesion, food attraction and enemy distraction motions.
- Update the dragonfly position.
- If there is no neighbouring dragonfly then find Levy Flight motion
- Give a new position to dragonfly on the basis of random walk.
- Repeat above steps until stopping criterion reached.
- Note the best solution.
- Finish.

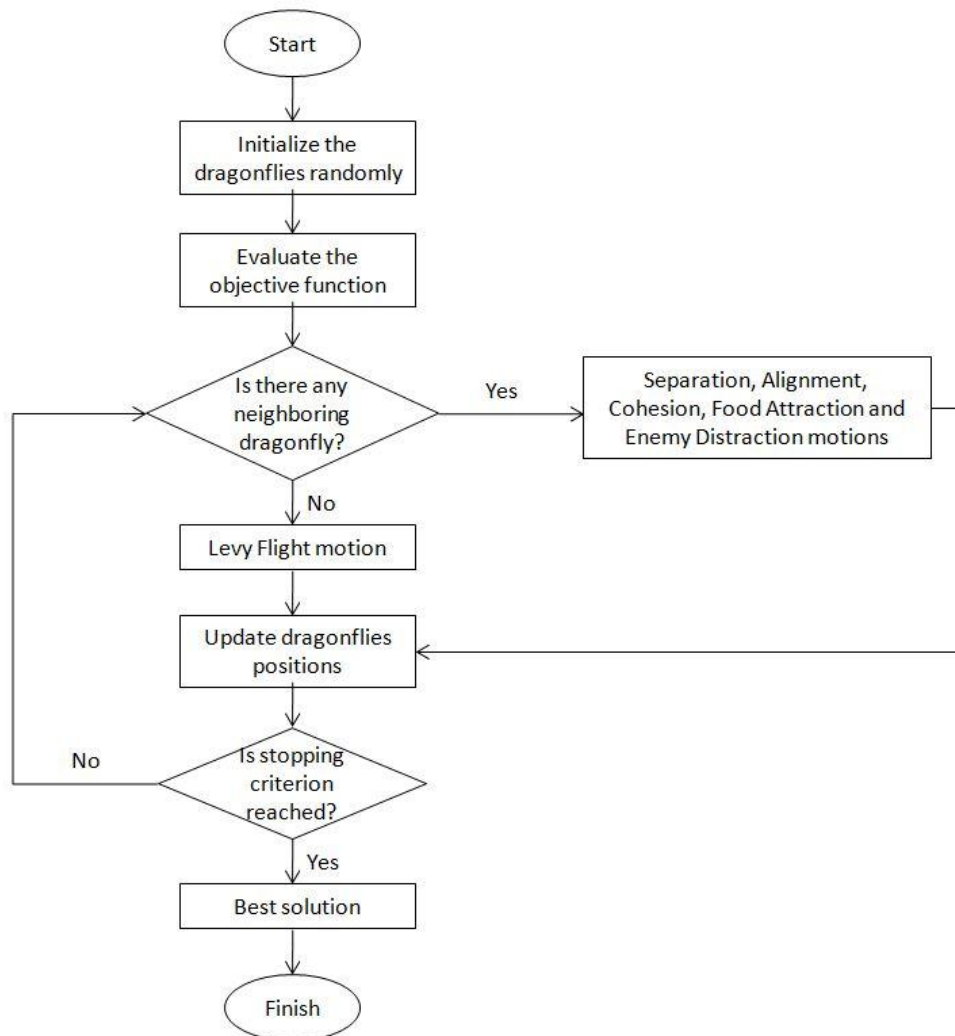


Fig 1: Flowchart of Dragonfly Algorithm

II LITRATURE REVIEW

Mirjalili[1] designed phases of optimization i.e., exploration and exploitation in his research work. His work also proposed the variants of DA- Binary DA and Multi objective DA. The results of DA and BDA showed that dragonfly algorithms perform better as compared to other algorithms.

Rahman and Rashid [2] discussed the dragonfly algorithm and investigate in engineering domain, and also examined hybrid or merged form of DA. Some applications of DA were also discussed in the engineering domain; and their work and experiments suggest that dragonfly algorithm performs excellently for small to medium optimization in different applications.

Rahman and Rashid [3] presented dragonfly algorithm, its variants and its hybridization versions. Merits and demerits of dragonfly algorithm were also discussed in their work; and some future recommendations were also given.

Alshinwan *et al.* [4] presented a review on Dragonfly algorithm and discussed its important characteristics. In this review they described the previous work done by other researchers on dragonfly algorithm and its variants. They also highlighted advantages and disadvantages of dragonfly algorithm in their research work to help other researches in future work.

Hendardi *et al.* [5] reviewed Dragonfly Algorithm by collected research work done in 2020, from their understanding they found that dragonfly algorithm performs optimization excellently in networks or electricals problems.

Emambocus *et al.* [6] presented a survey on DA and its hybrids, discussed their performance and applications in different areas. They also compared the performance of Dragonfly Algorithm with other swarm intelligence algos. They also gave some challenges and future directions for DA.

III APPLICATIONS OF DRAGONFLY ALGORITHM

Dragonfly Algorithm has its applications in many fields like Software Design and development, Modernisation Solution, Web Applications, Platform Information, Business Information, Mobile Applications, and Android Operating System etc. In the table 1 below, applications of the DA in different domains given by different authors are presented:

Table 1: Applications of DA

Research work	Applications of DA
[2]	<ul style="list-style-type: none"> * Mechanical Engineering * Electrical Engineering * Optical Parameters * Economic Load Dispatch * Loss Reduction
[3]	<ul style="list-style-type: none"> * Image Processing * Machine Learning * Wireless and Network
[4]	<ul style="list-style-type: none"> * Benchmark Functions * Machine Learning Applications * Optimal Parameters Application * Engineering Applications * Image Processing * Software Engineering * Network Applications
[6]	<ul style="list-style-type: none"> * Optimal Design * Electrical Engineering * Networking * Mechanical Engineering * Machine Learning * Resource Allocation * Digital Image Processing * Numerical Optimization
[7]	<ul style="list-style-type: none"> * Combinatorial Optimization * Constrained Optimization * Continuous Optimization

IV ADVANTAGES & DISADVANTAGES

The table 2 below shows some of the advantages and disadvantages of dragonfly algorithm [3, 4]:

Table 2: Advantages and Disadvantages of DA

Advantages	Disadvantages
<ul style="list-style-type: none"> ✓ Mixing with other algorithms is strangely satisfying. ✓ Powerful neighbourhood search characteristic. ✓ Reasonable execution time. ✓ A few parameters tuning. ✓ Suitable for many kinds of optimization problems. ✓ An efficient global scheme to seek. ✓ Fitting for wide search space. ✓ Very simple and easy to implement. ✓ It suits applications in different areas. 	<ul style="list-style-type: none"> ✓ Suffer from premature convergence. ✓ No theoretical converging frame. ✓ Probability distribution changes by generations.

V CONCLUSION

Dragonfly Algorithm is the most recent algorithm to optimize a problem in many areas. In this paper we have discussed dragonfly algorithms and steps involved to implement this algorithm. This paper briefly describes different applications of dragonfly algorithm in many domains. This algorithm has many advantages and disadvantages, but it has so many benefits that it can be used to optimize a problem or to perform feature selection. More work on the hybridization of different variants of dragonfly algorithm can be done in the future.

References

[1] Mirjalili, S. (2015). Dragonfly algorithm: a new meta-heuristic optimization technique for solving single-objective, discrete, and multi-objective problems. *Neural Computing and Applications*, 27(4), 1053–1073. doi:10.1007/s00521-015-1920-1

[2] Rahman, C. M., Rashid, T. A., Alsadoon, A., Bacanin, N., Fattah, P., & Mirjalili, S. (2021). A survey on dragonfly algorithm and its applications in engineering. *Evolutionary Intelligence*. doi:10.1007/s12065-021-00659-x

[3] Rahman, C. M., & Rashid, T. A. (2019). Dragonfly Algorithm and Its Applications in Applied Science Survey. *Computational Intelligence and Neuroscience*, 2019, 1–21. doi:10.1155/2019/9293617

[4] Alshinwan, M., Abualigah, L., Shehab, M., Elaziz, M. A., Khasawneh, A. M., Alabool, H., & Hamad, H. A. (2021). Dragonfly algorithm: a comprehensive survey of its results,

variants, and applications. *Multimedia Tools and Applications*, 80(10), 14979–15016. doi:10.1007/s11042-020-10255-3

[5] Hendaridi, D., Josephen, W. F., Warnars, Abdurrachman, E., Assiroj, P., Kistijantoro, A. I., & Doucet, A. (2021). Dragonfly Algorithm in 2020: Review. *Commun. Math. Biol. Neurosci.* 2021, ISSN: 2052-2541. Doi: 10.28919/cmbn/5767

[6] Emambocus, B.A.S., Jasser, M.B., Mustapha, A., & Amphawan, A. (2021). Dragonfly Algorithm and Its Hybrids: A Survey on Performance, Objectives and Applications. *Sensors* 2021, 21, 7542. doi: 10.3390/s21227542

[7] Meraihi, Y., Ramdane-Cherif, A., Acheli, D., & Mahseur, M. (2020). Dragonfly algorithm: a comprehensive review and applications. *Neural Computing and Applications*, 32(21), 16625–16646. doi:10.1007/s00521-020-04866-y

[8] Mafarja, M., Heidari, A. A., Faris, H., Mirjalili, S., & Aljarah, I. (2019). Dragonfly Algorithm: Theory, Literature Review, and Application in Feature Selection. *Springer Series on Fluorescence*, 47–67. doi:10.1007/978-3-030-12127-3_4

[9] Chantar, H., Tubishat, M., Essgaer, M., & Mirjalili, S. (2021). Hybrid Binary Dragonfly Algorithm with Simulated Annealing for Feature Selection. *SN Computer Science*, 2(4). doi:10.1007/s42979-021-00687-5