Chapter 6

RESEARCH COMMENTARY
Survival of the Fittest Algorithm or the Novelest Algorithm?
The Existence Reason of the Harmony Search Algorithm

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ABSTRACT

Recently a paper was published which claims "harmony search is equivalent to evolution strategies and because the latter is not popular currently, the former has no future. Also, research community was misguided by the former's disguised novelty." This paper is written to rebut the original paper's claims by saying 1) harmony search is different from evolution strategies because each has its own uniqueness, 2) performance, rather than novelty, is an algorithm's survival factor, and 3) the original paper was biased to mislead into a predefined conclusion. Also, the shortcomings of current review system, citation system, and funding system are briefly mentioned.

INTRODUCTION

Recently I happened to read a paper (Weyland, 2010) with shocking title "how the research community can be misled by a 'novel' methodology." The paper claimed that the harmony search (HS) algorithm is similar to the evolution strategies (ES) algorithm (the author in the paper even said HS is "completely equivalent" to ES), and that the research community was misguided by the "fake" novelty of the HS algorithm. Did the (original paper's) author really intend to write a

good paper or a *veto-ergo-sum* (I protest, therefore I exist) paper?

As the original developer of the HS algorithm, I feel like writing a rebuttal because the research community will be "really" misguided otherwise.

Is HS Equivalent to ES?

Although I do not know much about ES (this algorithm is not very popular in my research area), based on my literature review when I wrote the original HS paper (Geem et al., 2001), ES was developed to solve continuous-valued problem such as parameter calibration (Schwefel, 1994) using standard deviation (Fogel, 1995) while HS was originally developed to solve discrete-valued problem such as traveling salesperson problem without using any statistical information. I cannot imagine how the author concluded that HS equals ES with these different problem set and algorithm structure.

The author claims that because both HS and ES use solution population and produce one solution per iteration, HS is equivalent to ES if the latter is tweaked.

I'd like to rebut this musically. People may easily tell Schöberg's from Haydn's. However, sometimes people may not be able to tell Haydn's from Mozart's because they share similarity (e.g., Sonata structure). Or, religiously speaking, people may hardly tell the difference between two denominations under Christianity. If we tweak the liturgy of Denomination A, it may become that of Denomination B. In this case, can we say A equals B? (If someone is ecumenical, (s)he may say so though).

Likewise, every meta-heuristic algorithm possesses similarity as well as uniqueness, and there exists the possibility that the discrepancy between HS and ES is greater than that between ES and another nature-inspired algorithm. Also, there is a chance for HS to become a general form of another algorithm.

More fundamentally, every meta-heuristic algorithm contains only two basic features: global search and local search. The key factor to an algorithm's success is how efficiently two features are handled using certain number of operation categories (sometimes different algorithms share the identical operation). As an "evolutionary" algorithm which is a similar term to meta-heuristic algorithm, any algorithm can be survived as long as it is the fittest or at least fitter than others instead of being novel.

Most importantly, when I searched Wikipedia, I could not find the structure $(\mu+1)$-ES which, the author claimed, equals that of HS. Instead, Wikipedia says: $(1+\lambda)$-ES is a general form which has the opposite structure (multiple children from one parent) of HS; $(1+1)$-ES is the simplest form; and $(\mu+\lambda)$-ES is the contemporary form. Maybe $(\mu+1)$-ES is possible, but appears not popular.

Thus, HS and ES normally have opposite structures and they were originally developed for opposite variable-type (discrete and continuous) problems. I cannot compare more details because Wikipedia does not provide any details of ES.

When I further investigate ES by reading a comprehensive introduction paper written by one of the original ES developers (Beyer & Schwefel, 2002), I found only a brief description of $(\mu+1)$-ES. But it still selects parents (two of μ are chosen at random and recombined to give life to an offspring) while HS never does this. In other words, I never found any exact match between ES and HS with respect to the algorithm structure, not to mention details.

Is Novelty Everything?

If the author still wants to focus on similarity between HS and ES rather than their own uniqueness, I'd like to ask this question: Why is ES not popular in one of my research areas (more specifically, hydraulic and hydrologic optimization field)?

For the optimal design of hydraulic networks as an example, ES was not utilized in major literature

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