A philosophical essay on life and its connections with genetic algorithms

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Abstract. This paper makes a number of connections between life and various facets of genetic and evolutionary algorithms research. Specifically, it addresses the topics of adaptation, multiobjective optimization, decision making, deception, and search operators. It argues that human life, from birth to death, is an adaptive or dynamic optimization problem where people are continuously searching for happiness.

This paper speculates that a person's life has many similarities with the way genetic algorithms (GAs) work, and argues that many problems encountered in day-to-day life have a direct counterpart in some aspect of GA research. In particular, the following topics are explored:

- Life has a large search space
- Happiness is life's best objective
- Happiness involves multiple objectives
- Life occurs in a non-stationary environment
- Life can have traps
- GA operators in real life

In the rest of the paper each of the above topics is briefly addressed (a longer version of this essay is available elsewhere [1]).

Human beings make decisions and take actions continuously. There are many different ways in which we can live our lives. The number is so large that one could say that the search space of life is unlimited. When we are born we are faced with a whole world to explore, just like an artificial individual at generation zero of a randomly initialized population.

Most people would agree that happiness is the main ingredient that drives our lives. We all want to maximize happiness, but happiness means different things to different people. In some sense, happiness is something that involves multiple objectives. People have different objectives or goals that wish to be fulfilled in life. The same thing holds for many real world optimization problems, and genetic algorithms have shown to be useful for that purpose.

What makes us happy today might not make us happy tomorrow. Our goal is to continuously seek happiness, day after day, year after year. In order to do that, global convergence should be avoided by all means. Life has no optimal

solution. The important thing is to seek happiness and be prepared to react to changes in a timely manner. The same thing happens in many real world problems where the objective function changes through time.

Deception is one of the things that cause difficulties to GAs. An example of a deceptive problem is the so-called trap function. The problem is misleading because small incremental changes on a solution are rewarded, leading the search to a deceptive attractor. I firmly believe that deception occurs in life as well. It typically happens in those situations when one is not capable of looking far ahead enough, and simply follows the easy path. Herein I argue that the important thing is that one is able to recognize a trap, and once that happens, avoid by all means continuing doing small incremental changes. Instead, use GAs as a source of inspiration, and try escaping traps in more efficient ways. For example, by enlarging the population of our past decisions and finding the necessary linkages to allow escaping the trap in a quick way.

In genetic algorithms, selection is the operator that distinguishes good from bad solutions. Humans seem to have a natural way of applying selection in real life. A quotation from the Dalai Lama reveals the similarities.

> Generally speaking, one begin by identifying those factors which lead to happiness and those which lead to suffering. Having done this, one then sets about gradually eliminating those factors which lead to suffering and cultivating those which lead to happiness. (Dalai Lama)

If one observes the way most people live, one has to conclude that, with some exceptions once in a while, what people usually do in life is mostly small variations of what they have done in the past. In many ways, what we do today is not much different from what we did yesterday, and that sounds a lot like a mutation kind of exploration way of life. Likewise, one could speculate that crossover corresponds to the big decisions than one makes in life. Tracing back my own life, I can clearly recognize some landmarks that were very important for my development. In many ways, those were decisions that required a bit more thought, were more unusual, more challenging, more risky, but were also the ones that yielded the highest payoff on the long run.

As a final remark, it is interesting to observe that the pioneers of the field of genetic and evolutionary algorithms have used nature and life as an inspiration for designing computer algorithms. This paper speculates that the reverse is also true; that genetic algorithms can be used as a source of inspiration for life itself.

References

1. Lobo, F.G.: A philosophical essay on life and its connections with genetic algorithms. arXiv Report cs.NE/0402050 (2004) (Available at http://arxiv.org/abs/cs.NE/0402050).