Qualitative visual presentation of evolution algorithms

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Abstract

Heart-like visualization as a substitute and supplement to canonical visualization contains more information than a canonical one, while at the same time being acceptable and recognizable to the observer. Heart-like visualization makes a quick and simple qualitative assessment of the condition of the evolution algorithm possible, and it is appropriate for a dynamic observance of algorithm flow.

1. INTRODUCTION

Basic characteristic of evolution algorithms is simultaneous existence of a number of individuals, e.g. potential solutions for the task. It is customary to represent a limited number of the characteristics of an evolution algorithm, for example the fitness of the best individual in a population and average fitness of a population. The other values are not represented, as the representation would be too complex to survey. The above values are customarily represented in a rectangular co-ordinate system, with the fitness values on the ordinate and the index (ordinal number) of the generation on the abscissa. This is practically the only way evolution algorithms are visualized in literature.

2. HEART-LIKE VISUALIZATION OF AN EVOLUTION ALGORITHM

A heart-like visualization of an evolutionary algorithm represents individual fitness values as lengths starting in the center of the presentation, i.e. in the polar co-ordinate system. The algorithms for a heart-like visualization is as follows:

a) individuals of a population are sorted in accordance to their fitness (from highest to lower) and are indexed with letter i,
b) individual fitness are normalized: $f_n(x_i)=f(x_i)/f(x_{max})$,
c) the points of the heart-like representation are drawn according to the following expressions:

$$\vec{r}_i = f_n(x_i)\angle(i-1)\cdot\frac{\pi}{n}+\frac{\pi}{2}\ ,\ i=1(2)n \qquad (1)$$

$$\vec{r}_i = f_n(x_i)\angle(-i)\cdot\frac{\pi}{n}+\frac{\pi}{2}\ ,\ i=2(2)n\ , \qquad (2)$$

where $\angle$ means angle of vector. Length of vector is $f_n(x_i)$ and i is the index of vector (index of sorted individual).
d) the points obtained in this way are connected so that a closed shape is drawn and the shape is filled in.

The representation obtained in the above manner is a hear-like visualization of an evolutionary algorithm. Due to the algorithm described above (sorting the individuals and alternating arrangement i.e. angle of the vectors), the shape mentioned will, in most practical instances, have a heart-like form, similar to that seen in Fig. 1.

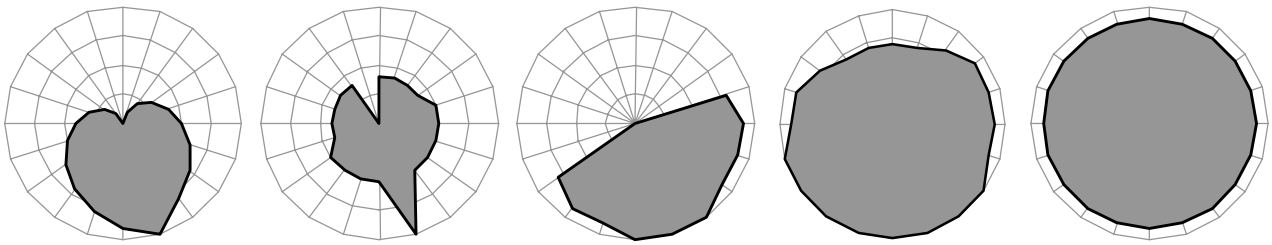

Fig. 1. Representation of various populations