Non-elitist evolutionary algorithms excel in fitness landscapes with sparse deceptive regions and dense valleys

Dang, Duc-Cuong; Eremeev, Anton; Lehre, Per Kristian

DOI:
10.1145/3449639.3459398

Citation for published version (Harvard):
Dang, D-C, Eremeev, A & Lehre, PK 2021, Non-elitist evolutionary algorithms excel in fitness landscapes with sparse deceptive regions and dense valleys. in F Chicano (ed.), *GECCO '21: Proceedings of the Genetic and Evolutionary Computation Conference.* Genetic and Evolutionary Computation Conference (GECCO), Association for Computing Machinery (ACM), New York, pp. 1133–1141, 2021 Genetic and Evolutionary Computation Conference, GECCO 2021, Virtual, Online, France, 10/07/21. https://doi.org/10.1145/3449639.3459398

Corrigendum to “Non-elitist Evolutionary Algorithms excel in Fitness Landscapes with Sparse Deceptive Regions and Dense Valleys” (GECCO 2021)

Duc-Cuong Dang, Anton Eremeev and Per Kristian Lehre

January 31, 2022

Abstract

We describe three minor corrections required for (Dang, Eremeev, and Lehre, GECCO2021). All the theorems remain unchanged, except that Theorem 11 requires an additional assumption that the selection mechanism is f-monotone.

Required Correction 1

The following small correction is required in Definition 2: Replace

$$\forall r \in [n]$$

with

$$\forall r \in [n-1]$$

in conditions (SP1) and (SP2).

Explanation

To see why $r = n$ needs to be excluded from the definition, assume that $x \in B$. If the complement bitstring $\overline{x}$ is member of B, then for $r = n$

$$|S_r(x) \cap B| = 1 > \varepsilon \binom{n}{r}.$$

which violates condition (SP1) for any $\varepsilon < 1$. If $\overline{x}$ is not member of B, then for $r = n$

$$|S_r(\overline{x}) \cap B| = 1 = \omega\left(\frac{1}{n}\binom{n}{r}\right),$$

which violates condition (SP2).

Required Correction 2

The following property must be assumed for the selection mechanism used in Theorem 11: It has to be f-*monotone*. This is a natural property of common selection mechanisms which says: for two individuals x and y with $f(x) \geq f(y)$, the probability of selecting x must be at least that of selecting y.

The following misprints also should be corrected:

(i) in the formulation of Lemma 4, the right-hand side of the inequality $\Pr(p_{\mathrm{mut}}(x) \in B \mid x \in B) \leq \rho$ should read $\rho + O(n^{-n})$

(ii) in the proof of Theorem 11 in the first block of equations, $\beta(0, \gamma)\varepsilon$ should be changed to $\beta(0, \gamma)\rho$.

Explanation

The monotonicity implies that $\beta(\psi_1, \psi_1 + \gamma) \geq \beta(\psi_2, \psi_2 + \gamma)$ for any $\psi_1 < \psi_2$, and this is used when applying conditions (SM0) and (SM2b) in the proof of Theorem 11. Except for the above mentioned misprints, no change in the proof is required. Note that with the added assumption, it is possible to relax (SM2b) to only hold for $\psi = \psi_0$ (instead of the whole interval $\psi \in [0, \psi_0]$).

Required correction 3

In the proof of Lemma 14,

$$\delta := \frac{1}{3000}$$

should read

$$\delta := \frac{1}{30000}.$$