Supplementary materials for "On the Pathological Behavior of Adaptive Differential Evolution on Hybrid Objective Functions"

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Results of CoDE on Hybrid functions with heterogeneous components

This supplement shows the results for CoDE (a *non-adaptive DE*) on the Hybrid heterogeneous functions described in Section 5.1 of the paper. The experimental setup and conditions are identical to the experiments with the adaptive DEs (SHADE, JADE, jDE) described in Section 5.

Figure 1 shows the success rates of CoDE [2] on the hybrid functions, $H_{\mathrm{Sph,Ras}}$, $H_{\mathrm{Sph,Ack}}$, $H_{\mathrm{Sch,Ras}}$, $H_{\mathrm{Sch,Ack}}$, $H_{\mathrm{Ros,Ras}}$, $H_{\mathrm{Ros,Ack}}$ (30, 50 dimensions) for various allocation of variables among the two components r. The source code for CoDE was downloaded from [3] and we minimally modified this program so that this would work with the our hybrid functions.

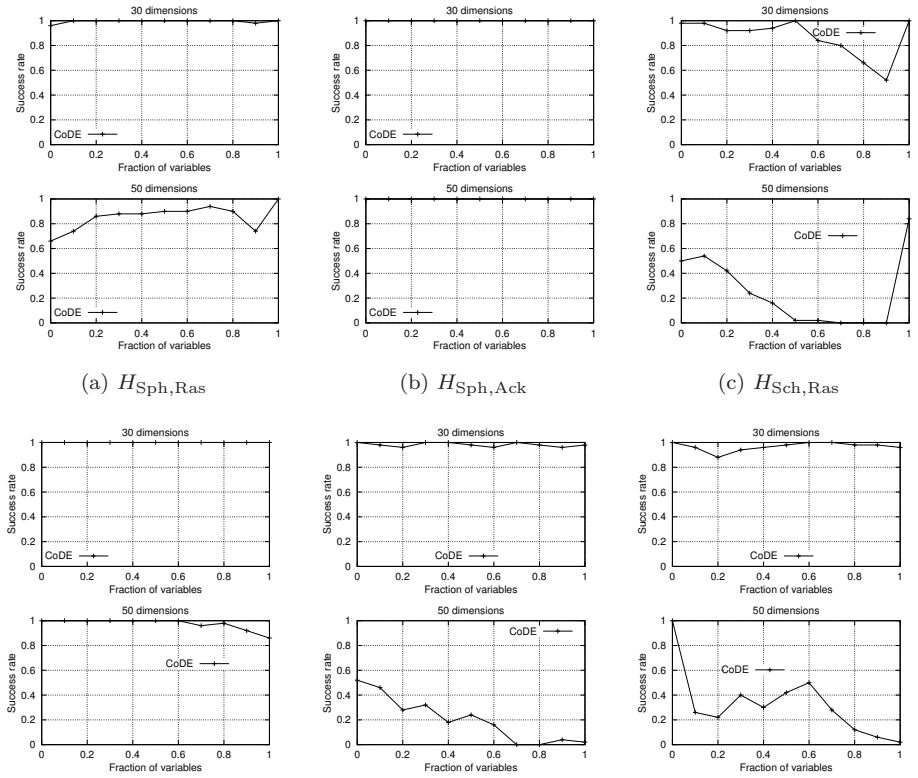
Clear performance degradations can be seen as r varies Figure 1. Unlike the adaptive DEs, in 50 dimensions, performance does not recover when $r = 1$. This is because CoDE does not perform well on these particular pure functions corresponding to $r = 1$ (Rastrigin and Rosenbrock on 50 dimensions). This observation is consistent with a previous empirical comparison of SHADE, JADE, dyNP-jDE (a variant of jDE), and CoDE on standard benchmarks in [1].

References

[1] R. Tanabe and A. Fukunaga. Success-history based parameter adaptation for differential evolution. In *IEEE CEC*, pages 71–78, 2013.

[2] Y. Wang, Z. Cai, and Q. Zhang. Differential evolution with composite trial vector generation strategies and control parameters. *IEEE Tran. Evol. Comput.*, 15(1):55–66, 2011.

[3] Zhang's-website. http://dces.essex.ac.uk/staff/qzhang. 2013.



(a) $H_{\mathrm{Sph,Ras}}$ (b) $H_{\mathrm{Sph,Ack}}$ (c) $H_{\mathrm{Sch,Ras}}$

(d) $H_{\mathrm{Sch,Ack}}$ (e) $H_{\mathrm{Ros,Ras}}$ (f) $H_{\mathrm{Ros,Ack}}$

Figure 1: Performance of CoDE on heterogeneous hybrid functions ($H_{\mathrm{Sph,Ras}}$, $H_{\mathrm{Sph,Ack}}$, $H_{\mathrm{Sch,Ras}}$, $H_{\mathrm{Sch,Ack}}$, $H_{\mathrm{Ros,Ras}}$, $H_{\mathrm{Ros,Ack}}$). Success rate (out of 50 runs) is shown as a function of r^F, the fraction of variables allocated to component function F_i. Results for 30 and 50 dimensions are shown.