Guidelines for Student Reports

PERFORMANCE ANALYSIS OF SURROGATE ASSISTED DIFFERENTIAL EVOLUTION (SADE) OPTIMIZER WITH ADDITIONAL INDIVIDUALS UPDATE POSSIBILITY WHEN DEALING WITH ACKLEY'S BENCHMARK FUNCTION IN 5D-10D

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Abstract

Surrogate model assisted evolutionary algorithms have recently attracted much attention due to the growing need for computationally expensive optimization in many real-world applications.
Within this framework, a Gaussian process surrogate model assisted evolutionary algorithm for computationally expensive optimization problems (Surrogate Assisted Differential Evolution, SADE) has been implemented. Its major components are a surrogate model-aware search mechanism for expensive optimization problems when a high-quality surrogate model is difficult to build. A new framework is developed and used in SADE, which carefully coordinates the surrogate modeling and the evolutionary search, so that the search can focus on a small promising area and is supported by the constructed surrogate model. Compared to other state-of-the-art EAs, similar solutions can be obtained with a significant reduction of exact function evaluations.
The aim of this project is to test the performances of SADE algorithm when dealing with the ACKLEY's benchmark function, both in 5D and in 10D, considering different configurations of the optimizer (introduction of additional update of individuals), as well as compare its performances with classic DE.

Reference Bibliography: Evolutionary Optimization [1]-[9].

[1] P. Rocca, M. Benedetti, M. Donelli, D. Franceschini, and A. Massa, "Evolutionary optimization as applied to inverse problems," Inverse Problems - 25 th Year Special Issue of Inverse Problems, Invited Topical Review, vol. 25, pp. 1-41, Dec. 2009.

[2] P. Rocca, G. Oliveri, and A. Massa, "Differential Evolution as applied to electromagnetics," IEEE Antennas Propag. Mag., vol. 53, no. 1, pp. 38-49, Feb. 2011.

[3] M. Benedetti, G. Franceschini, R. Azaro, and A. Massa, "A numerical assessment of the reconstruction effectiveness of the integrated GA-based multicrack strategy," IEEE Antennas Wireless Propag. Lett., vol. 6, pp. 271-274, 2007.

[4] P. Rocca, R. J. Mailloux, and G. Toso, "GA-Based optimization of irregular sub-array layouts for wideband phased arrays design," IEEE Antennas and Wireless Propag. Lett., vol. 14, pp. 131-134, 2015.

[5] P. Rocca, L. Manica, and A. Massa, "An improved excitation matching method based on an ant colony optimization for suboptimal-free clustering in sum-difference compromise synthesis," IEEE Trans. Antennas Propag., vol. 57, no. 8, pp. 2297-2306, Aug. 2009.

[6] P. Rocca, L. Manica, and A. Massa, "Ant colony based hybrid approach for optimal compromise sum-difference patterns synthesis," Microwave Opt. Technol. Lett., vol. 52, no. 1, pp. 128-132, Jan. 2010.
[7] P. Rocca, L. Manica, F. Stringari, and A. Massa, "Ant colony optimization for tree-searching based synthesis of monopulse array antenna," Electronics Letters, vol. 44, no. 13, pp. 783-785, Jun. 19, 2008.
[8] L. Poli, P. Rocca, L. Manica, and A. Massa, "Handling sideband radiations in time-modulated arrays through particle swarm optimization," IEEE Trans. Antennas Propag., vol. 58, no. 4, pp. 1408-1411, Apr. 2010.
[9] M. Donelli, D. Franceschini, P. Rocca, and A. Massa, "Three-dimensional microwave imaging problems solved through an efficient multi-scaling particle swarm optimization," IEEE Trans. Geosci. Remote Sensing, vol. 47, no. 5, pp. 1467-1481, May 2009.

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