

**Category: Basic research**

**Title:** Study of nature-inspired optimization methods with machine learning in network communication.

**Názov výsledku:** Štúdium optimalizačných metód inšpirovaných prírodou s využitím strojového učenia v sieťovej komunikácii.

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**Projekts:** VEGA 2/0125/20, APVV-17-0619

**Annotation:**

The research in [1] aimed to robust global optimization influenced by simplicity and efficiency principles introduced in two optimization algorithms of the latest generation. Galactic Swarm Optimization (GSO) is inspired by the motion of stars, galaxies and super-clusters of galaxies under the influence of gravity. It acts as a global controller of the entire optimization process by using several flexible two-phase cycles (exploration and exploitation) to find new and better solutions. The optimization process in the original version of GSO suffers from a shortcoming in the discovery phase, which in our work is enhanced by hybridization with our evolutionary version of the Whale Optimization Algorithm (EWOA). Concretely, the discovery phase in GSO is replaced by EWOA to avoid early convergence. Furthermore, EWOA is improved in comparison with WOA in ensuring global optimization even at higher dimensions of the search space using Levy-Flight trajectory (LFT). The achieved effect in the research is a faster local search with adaptive steps. Evolution approach is also improved by employing a two-point crossing operator. The overall results through extensive experiments have shown that our hybridization and evolution approach delivers excellent performance with the accuracy, speed of convergence, and stability of the optimization process. In the context of nature-inspired optimization methods, the research in [2] is focused on the applicability of optimization approaches with machine learning (neural network) in the domain of network communication. Specifically, it is a scientific solution to improve Quality of Service (QoS) with Extreme Learning Machine (ELM neural network) and an improved version of Tug of War optimization (TWO) in the core.

**Scientific results:**

[1] NGUYEN, Minh - TRAN, Trung - NGUYEN, Thieu - NGUYEN, Giang. Hybridization of galactic swarm and evolution whale optimization for global search problem. In IEEE Access, 2020, vol. 8, no. 1, art. no. 9072130, p. 74991-75010. (2019: 3.745 - IF, Q1 - JCR, 0.775 - SJR, Q1 - SJR). ISSN 2169-3536. Open Access. Typ: ADCA

**Citácie:**

[1.1] MIGALLON, Hector - BELAZI, Akram - SANCHEZ-ROMERO, Jose-Luis - RICO, Hector - JIMENO-MORENILLA, Antonio. Settings-Free Hybrid Metaheuristic General Optimization Methods. In MATHEMATICS, 2020, vol. 8, no. 7, pp., Registrované v: WOS

[1.2] SREENIVAS, Velagapudi - NAMDEO, Varsha - KUMAR, E. Vijay. Group based emotion recognition from video sequence with hybrid optimization based recurrent fuzzy neural network. In Journal of Big Data, 2020-12-01, 7, 1, pp., Registrované v: SCOPUS

[2] NGUYEN, Thieu - HOANG, Bao - NGUYEN, Giang - NGUYEN, Minh. A new workload prediction model using extreme learning machine and enhanced tug of war optimization. In Procedia Computer Science, 2020, vol. 170, p. 362-369. (2019: 0.342 - SJR, Scopus-Q2). ISSN 1877-0509. Open Access. Typ: ADMB