Seminar Hora Informaticae   Institute of Computer Science, Prague

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Evolutionary Algorithms for Expansive Optimization.

Evolutionary algorithms are powerful optimizers with applications in many areas. However, their use is complicated by the large number of objective function evaluations that they require. This is especially problematic in cases where the evaluation is slow or expensive. There are generally two ways, how to deal with this problem - one is to parallelize the algorithm, the other is to use so-called surrogate models (cheap approximations of the real expensive objective function). In the talk, we will explore both of these areas. In the first part, we will discuss two types of parallelization - one of them is usable in cases when the evaluation is not only slow, but also the evaluation time is variable, i.e. in cases where standard parallelization techniques often cannot fully utilize the available computational resources. Then we will discuss recent libraries for implementing evolutionary algorithms on GPUs. In the second part, we will briefly talk about surrogate-based optimization. Surrogate models are mostly used in areas, where the individual encoding is rather simple. We will talk about the potential to apply them also in areas with complex individual structure, such as in genetic programming, automated machine learning and neural architecture search.

References:

(1) Martin Pilát, Roman Neruda. "Parallel evolutionary algorithm with interleaving generations." In Proceedings of the Genetic and Evolutionary Computation Conference, pp. 865-872. ACM, 2017. doi: 10.1145/3071178.3071309

(2) B. Huang, R. Cheng, Z. Li, Y. Jin and K. C. Tan, "EvoX: A Distributed GPU-Accelerated Framework for Scalable Evolutionary Computation," In IEEE Transactions on Evolutionary Computation, IEEE, 2024. doi: 10.1109/TEVC.2024.3388550

(3) Yaochu Jin. "Surrogate-assisted evolutionary computation: Recent advances and future challenges." Swarm and Evolutionary Computation 1, no. 2 (2011): 61-70. Elsevier. 2011. doi: 10.1016/j.swevo.2011.05.001

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Martin Pilát (https://www.mff.cuni.cz/cs/fakulta/organizacni-struktura/lide?hdl=4171) received his Ph.D. in 2013 at Charles University, Faculty of Mathematics and Physics. He currently works as an assistant professor at the same place. He teaches courses on nature inspired computation and computational intelligence, but also courses on logic and multi-agent systems. His research interests include evolutionary algorithms for expensive optimization, machine learning, deep learning and their applications. He mainly focuses on evolutionary algorithms for problems with complex individual encoding or with expensive objective functions and their application in machine learning, automated machine learning, and neural architecture search.

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HORA INFORMATICAE (meaning: TIME FOR INFORMATICS) is a broad-spectrum scientific seminar devoted to all core areas of computer science and its interdisciplinary interfaces with other sciences and applied domains. Original contributions addressing classical and emerging topics are welcome. Founded by Jiří Wiedermann, the seminar is running since 1994 at the Institute of Computer Science of the Czech Academy of Sciences in Prague.

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