

Popular science abstract

The scientific objective of the project is to propose new operators and optimizers that use the *Dark Gray-box* optimization idea. Recent research shows that in the field of *Evolutionary Computation* (EC), such methods have the potential to propose results that are of significantly higher quality than those of nowadays state-of-the-art optimizers.

EC is devoted to proposing optimization methods. Interestingly, the first evolutionary algorithms implementations (so-called *genetic algorithms*) aimed to simulate the evolutionary process so we could better understand it. The base of this process was the genetic recombination that takes place for any offspring (the genotype of any offspring is a composite of the genotypes of its parents and a random factor). However, it was soon noticed that if the genotype represents an encoded solution to some optimization problem, then the evolution simulator becomes an excellent optimization tool.

Evolutionary algorithms turned out to be effective in solving hard computational problems for which the classical algorithms can not find high-quality solutions. Such problems are common for any branch of science, technology, and the problems that come up in the world around us. The examples of such problems may be production scheduling in a factory, proposing the best travelling route, engineering the best shape of an antenna, generating the programs that drive the autonomous robots, but also creating the better public transport, and solving the land-sharing problems to increase the quality of life and safe the natural environment at the same time.

In this project, we propose developing a new class of evolutionary optimizers based on the idea of Dark Gray-box optimization. Such methods discover and appropriately use the knowledge considering inter-dependencies of problem variables. Thus, they can propose solutions of quality that is significantly higher than the solutions of nowadays state-of-the-art optimizers.

Evolutionary computation delivers highly-effective optimizers for other branches of science and technology. Thus, improving the effectiveness of evolutionary algorithms is essential and influences the state of all science branches that use such tools. This is the objective of the proposed project. Proposing more effective optimizers will improve (although indirectly) the quality of life of any man on the planet.

This project aims to propose more effective optimizers by better understanding the structure and features of the solved problem. The research performed in such a manner is highly promising because it assumes the conscious and intended work based on understanding the problem's nature.