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OPTIMIZATION ALGORITHMS FOR SOLVING SCIENTIFIC AND ENGINEERING PROBLEMS

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In recent decades, new computational methods have been proposed to solve complex practical problems. The development of various computational algorithms inspired by wildlife is one of the most important achievements of science and engineering. Such algorithms provide an improved basis for problem solving and decision-making.

Examples of life activity, taken from biology and observed in nature, served as a prerequisite for the development of many complex algorithms for solving various optimization problems in the real world. Such algorithms are subdivided into evolutionary computing (EC) and swarm intelligence (SI) algorithms. The first category includes algorithms inspired by the law of "survival of the fittest" or the principles of "natural selection", while the second is based on algorithms inspired by the collective intelligence of a swarm or the behavior of insect colonies and other animal communities.

Evolutionary algorithms (EA) are based on the process and mechanisms of biological evolution. According to Darwin's theory of natural selection, competition among individuals for limited food resources in nature leads to the dominance of the strongest individuals over the weak (survival of the fittest). The process of evolution through natural selection helps to maintain the diversity of species and their adaptability to the environment. EAs distribute adaptation characteristics through an iterative process that accumulates and improves through trial and error. Variants of solving the problem are members of a virtual population striving to survive in the environment specified by the objective function of a particular problem. In each case, the evolutionary process improves the population of individuals, usually using models of evolutionary mechanisms such as genetic recombination and mutation.

EAs provide a solution to many intractable optimization problems of the real world, to which traditional methods may not apply due to the continuity of the search space, undefined variables. These algorithms can be combined with existing methods (for example, local search and other exact methods) and successfully solve problems with any combination of problems, such as local optimum, constraints, dynamic components, etc. The main paradigms of evolutionary computations inspired by nature are:

• genetic algorithms (GA);
• genetic programming (GP);
• evolutionary programming (EP);
• differential evolution (DE), etc.

The term "swarm" is used to refer to communities, colonies of insects (such as ants, termites, or bees) that act collectively. Individual members of the swarm act without control, and each of them has a stochastic nature of behavior. Simple local rules with no connection with the global pattern and interactions between systematic or autonomous representatives have led to the formation of a collective intelligence called "swarm intelligence" (SI), through which the environment and resources are used most efficiently by the swarm. Self-organization is the main feature of swarm systems.

For a swarm algorithm to be considered intelligent, it must meet the following requirements:

1. The swarm must be able to perform simple spatial and temporal calculations (approximation principle).
2. It must respond to various environmental quality factors, such as food quality, or location safety (quality principle).
3. The swarm must not place all its resources in too narrow passages, but distribute them in many places (the principle of diversity);
4. The swarm must not deviate from its line of behavior after each change in the environment (the principle of stability);
5. The swarm must be able to change its behavior when necessary (principle of adaptability).

The main paradigms of wildlife-inspired swarm algorithms are:

• Ant algorithm (AA);
• Particle swarm method (PSM);
• Algorithm of artificial swarm of bees (ASB) and others.

To conclude, the research may result in developing a universal library of bionic algorithms. It will help in implementation of metaheuristic algorithms based on bionic models for solving optimization problems in various fields of application.

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THE INFLUENCE OF URBANISM ON HUMAN LIFE

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In the modern world, urbanization is a global socio-cultural process, and an urbanist is a person who equips the urban environment so that everyone is comfortable in it, become one of the most demanded professions. Today, as it is known, megalopolises are developing quite actively, but the progress of each city, in our opinion, should keep pace with the convenience of its inhabitants.

Such scientists as Barabanov A, Jacobs D., Clark T., Lloyd R., Pautova L., Petrovskaya O., Ugryumova A., Landry C., Wirt L. and others dealt with problems of urban studies.

If an ordinary person looks at the city, then he sees many parks, roads, monuments, buildings and so on. The architect, in turn, can only look at the place and imagine what can be built there. And the urbanist is the one who analyses, mentally projects and decides: "Is this really needed here?" It relies on the wishes, habits of residents, and also takes into account the relevance of any object for the townspeople. An urbanist must be able to imagine how all systems of the city will interact so that it is as practical, aesthetically pleasing and useful as possible for residents. Ugryumova A. notes in her work that the main strategy for creating a comfortable urban environment, in accordance with the principles of creating city architecture, is the ability to competently and logically equip a space for a resident and a tourist [3].

How often do we enjoy the landscape and atmosphere of the city? On the example of Kharkiv, we can say that the city is quite well thought out and well equipped. But there are certain shortcomings in the accessibility of places for leisure activities. In some districts of the city, there are no places for active recreation, except for school basketball and football grounds, which are constantly overcrowded, which negatively affects on emotional state of residents. In addition, insufficient illumination interferes with comfortable living and recreation for the townspeople, and also leads to a worsening of the crime situation in some areas of the city. Petrovskaya O. investigated this problem in her article "Modern theories of the development of urbanism", noting that