

Course description:

Evolutionary algorithms are part of the computational intelligence dealing with heuristic solving optimization problems.

Evolutionary algorithms are used to solve optimization problems for which you can not use traditional algorithms (eg when such algorithms do not exist or are too computationally expensive when optimization problem can not be defined mathematically, when the approximate solutions are sufficient or sufficiently good with practical point of view).

Examples of optimization problems are considered, on the one hand, well-known problems NPzupelne (evolutionary algorithms which try to provide a solution sufficiently good in view of practical applications) and, on the other hand, various practical problems are difficult to define mathematically (including those in which it is unknown analytical pattern of the objective function, but it is known the count value, for example, perform some simulation).

Practical problems solved optimization with evolutionary algorithms apply to expert systems, systems of classification and object recognition and decision support systems. Popular is the use of evolutionary algorithms for image analysis, including satellite images and medical images, to analyze economic and financial data, especially data of high and ultra-high frequency, the construction of air traffic control systems, the construction of artificial intelligence in games, etc.

The first part of the lecture will cover basic evolutionary algorithms to solve the classic problem of optimization of their design and adaptation to specific practical problems and theoretical and implementation. The second part of the lecture will focus on modern evolutionary algorithms for solving difficult problems, such as optimization of multi-modal, multi-criteria optimization and dynamic optimization.

Lectures will require a basic knowledge of probability and statistics (for example, credit lecture RPIS). During the workshop you will be required programming skills in classical programming languages (C / C ++, Java, Python), and useful may also ability to program in popular tools used to analyze the data, such as Matlab or Octave (these tools will be able to learn yourself in the first weeks of classes or attend a course at the same time modern language processing).

Program of the lecture:

1. Introduction to evolutionary algorithms.
2. Basic evolutionary algorithms: genetic algorithms, evolutionary strategies, genetic programming, evolutionary programming.
3. Advanced evolutionary algorithms discovering knowledge about the problem of optimization.
4. Parallel and distributed evolutionary algorithms.
5. multimodal optimization algorithms.
6. multi-criteria optimization algorithms.
7. dynamic optimization algorithms.
8. Selected applications of evolutionary algorithms.