Complexity

Special Issue on
Computational Intelligence in Modeling Complex Systems and Solving Complex Problems

CALL FOR PAPERS

Models and procedures based on nature inspired approaches are called Computational Intelligence (CI). CI includes three major areas: fuzzy systems, artificial neural networks, and evolutionary (and population based) algorithms, including their hybrid combinations. It is often advantageous to combine them with traditional approaches, such as gradient type optimization or bounded exhaustive search. Such methods often successfully cope with complexity.

Computer Science (CS) defines complex systems as being intractable (usually NP-hard) and showing nondeterministic and uncertain behavior. Problems with complex systems are common in engineering, in natural sciences, in biomedical systems, and even in social systems. Modeling, control, decision support, search, and optimization here often lead to a dead end when classic mathematics and traditional CS are applied. From the application aspect, however, it is often sufficient to deploy approaches which offer good suboptimal solutions. Where no general algorithm exists, a "satisfactory solution" might be achieved by a proper metaheuristic, suitable for finding the exact optimum for a limited class of problems (with bounded dimensionality or bounded uncertainty) and delivering close to the optimum solution for a wider (still bounded) class of the same problem. The "goodness" of such a solution is measured by the "overall cost."

It is possible to quantify the overall cost of a combined model and associated algorithm by adding the costs of time and space complexity to the cost of model errors. A "solution" (model or data structure and algorithm) is "efficient" if the overall cost is possibly low or is less than a predefined threshold. Often in search and optimization problems there are metaheuristics, which certainly find the exact solution for a limited size and may find the solution in a wider range, while in other cases (depending on structure and size) they will not find any solution at all. The need of resources is often unpredictable; thus it is never sure if a solution will be delivered at all. We expect "efficacious" solutions, which are efficient and predictable at the same time—and possibly generally applicable.

This special issue will focus on most recent research results on new models, structures, and algorithmic, mainly metaheuristic approaches to complex problems with reasonably good modeling accuracy and with reasonably low and predictable resources needed.

As CI approaches are often suitable for delivering such efficacious solutions, authors are invited to present theories, algorithms, and frameworks aimed at bringing about advanced techniques of Computational Intelligence for the modeling of complex systems and the solution of complex problems.

Potential topics include but are not limited to the following:

- Interpolative and hierarchical fuzzy systems
- Fuzzy signatures and signature sets
- Fuzzy cognitive maps, artificial neural networks, and learning systems
- Genetic, bacterial, and other evolutionary algorithms (Big Bang Big Crunch Algorithm, Particle Swarm Optimization, Imperialist Competitive Optimization, etc.)
- Hybrid models consisting of fuzzy/neural/evolutionary algorithms
- All in the context of complex systems and problems

Authors can submit their manuscripts through the Manuscript Tracking System at https://mts.hindawi.com/submit/journals/complexity/cimcs/.

Papers are published upon acceptance, regardless of the Special Issue publication date.

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