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Editorial

Inaugural editorial for Swarm and Evolutionary Computation

For years, nature has remained a source of inspiration for computer-scientists, who dare to face the nearly intractable search and optimization problems, arising from diverse fields of knowledge, in a non-conventional way. Optimization is at the core of many natural processes like Darwinian Evolution, social group behavior, and foraging. Through millions of years, every species had to evolve their physical structures to adapt to the environments they were in. This process of adaptation leads to a kind of morphological optimization and it is so perfect that nowadays, the similarity between a shark, a dolphin or a submarine is striking.

A keen observation of the underlying relation between optimization and biological evolution has led to the development of a new paradigm of computational intelligence – the Evolutionary Computing (EC) techniques – for performing very complex search and optimization. Evolution, as of now, extends beyond the study of life and appears as an optimization process that can be simulated using a computer or other devices and used for efficient problem solving in all disciplines of science and engineering. The paradigm of evolutionary computing techniques dates back to the early 1950s, when the idea to use Darwinian principles for automated problem solving originated. It was not until the sixties that three distinct interpretations of this idea started to be developed in three different places. *Evolutionary Programming* (EP) was introduced by Lawrence J. Fogel in USA, while the researchers led by John Henry Holland devised a new way to simulate the Darwinian evolution to solve computational problems and called his method the *Genetic Algorithm* (GA). In Germany, Ingo Rechenberg and Hans-Paul Schwefel introduced the *Evolution Strategies* (ESs). These areas developed separately for about 15 years. From the early nineties onwards, they started to be unified as different representatives ("dialects") of one technology, called EC. Also in the early nineties, a fourth stream following the general ideas had emerged — the *Genetic Programming* (GP).

Swarm Intelligence (SI) refers to a recently developed group of nature-inspired algorithms for multi-agent search and optimization. The behavior of a single ant, bee, termite or wasp often is too simple, but their collective and social behavior is of paramount significance. A look at National Geographic TV Channel reveals that advanced mammals including lions also enjoy social lives, perhaps for their self-existence at old age and in particular when they are wounded. The collective and social behavior of living creatures motivated researchers to undertake the study of what is today known as *Swarm Intelligence*. Historically, the phrase Swarm Intelligence (SI) was coined by Beni and Wang in the late 1980s in the context of cellular robotics. A group of researchers in different parts of the world started working almost at the same time to study the versatile behavior of different living creatures and especially the social insects. The efforts to mimic such behaviors through computer simulation finally resulted into the fascinating field of SI. SI systems are typically made up of a population of simple agents (an entity capable of performing/executing certain operations) interacting locally with one another and with their environment. Although there is normally no centralized control structure dictating how individual agents should behave, local interactions between such agents often lead to the emergence of global behavior.

It is not always proper to see SI as a sub-discipline of evolutionary computing family. The algorithms belonging to these two families are certainly not equivalent, and very often are not a special case of the other. Each has its own distinguishing features. SI mainly depends on the dynamics of the virtual agents while evolutionary computing involves the change in distribution of the trial solutions over the fitness landscape following mutation, recombination, and natural selection principles from Darwinian Theory. Very recently, SI started to encompass problems not directly linked with numerical optimization, e.g. shape formation and control for a robot-swarm. However, the two families can very well complement each other and already there has been a good trend of hybridizing the algorithms from both.

We believe that the research with swarm intelligence and evolutionary computing algorithms will continue to receive an increasing attention of researchers from diverse domains. Applications of these algorithms will multiply over the years to come in several disciplines ranging from engineering (e.g., mechanical engineering design, civil, chemical, instrumentation, and electrical engineering), computer sciences (e.g., pattern recognition, data mining, different kinds of scheduling problems, and image segmentation), and life and medical sciences (e.g., genetics, biology, microbiology, paleontology, psychiatry, and pathology) to earth sciences (e.g., geography, geology, and remote sensing), social sciences (e.g., sociology, psychology, archeology, and education), and economics (e.g., financial predictions, portfolio optimization, business intelligence etc.).

Swarm and Evolutionary Computation is the first peer-reviewed publication of its kind that aims at reporting the most recent research and developments in the area of nature-inspired intelligent computation based on the principles of swarm and evolutionary algorithms. It will serve as an archival repository of advanced, innovative, and interdisciplinary research involving the theoretical, experimental, and practical aspects of the two paradigms and their hybridizations. Survey papers reviewing the state-of-the-art of current topics will also be welcomed as well as novel and interesting applications. The journal will try to attain the best trade-off between the review period and the quality of review. In addition, the journal will foster an industrial uptake by publishing interesting and novel applications in fields and industries dealing with challenging problems.

We take this opportunity to thank the respected Editorial board members for their advice, assistance, and personal encouragement to start this journal. Special thanks are also owed to the Elsevier

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Staff including Sweitze Roffel, Jason Awerdick, Ann Gabriel, and Senthil Ammaiyan Subbaiah. Finally, we would like to express our appreciation to all the authors and reviewers, who are volunteering a great amount of their time and effort in support of this new publication. We fervently hope that our efforts together will contribute to the related research communities in years to come.

P.N. Suganthan, *Co Editor-in-Chief*
School of Electrical and Electronic Engineering,
Nanyang Technological University, 639798, Singapore

Swagatam Das, *Co Editor-in-Chief*
Department of Electronics and Telecommunication Engineering,
Jadavpur University, Kolkata – 700 032, India

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