ACM Transactions on Evolutionary Learning and Optimization Inaugural Issue Editorial

Natural evolution has led to the emergence of amazing life forms that are adapted to and can thrive in the most hostile environments, from deep seas to high mountains, from hot springs to arctic cold. And as Darwin discovered, the underlying principles are very simple: genetic variation combined with survival of the fittest. With the rise of computers, it became possible to simulate evolution on a much faster pace, and to use its principles to solve all kinds of optimization problems by having candidate solutions adapt to a problem instance rather than individuals to an environment. This idea that has been independently developed by Schwefel and Rechenberg (Evolution Strategies), Holland and DeJong (Genetic Algorithms), and Fogel (Evolutionary Programming). This area of research has since evolved into a large and successful discipline called *Evolutionary Computation* (EC), with thousands of active researchers and two large professional organisations: The IEEE Computational Intelligence Society and the ACM Special Interest Group on Evolutionary Computation (to which this journal is linked). Because of the simplicity of the underlying principles, but more so because of its very broad applicability to problems where more traditional methods fail, EC is used today to solve many of the most challenging optimization problems in almost every industry sector. From its early beginnings, the field has grown in various directions, developing algorithmic variants for new application areas such as multi-objective optimization, dynamically changing problems, or problems under uncertainty, to name just a few. The frontier of what problems can be solved has been pushed in terms of number of decision variables or number of objectives, in some cases by exploiting problem-specific knowledge. Other nature-inspired optimization algorithms have been developed, such as particle swarm optimization or ant colony optimization, and although these are not strictly based on the principles of natural evolution, they have found their place in the broadening umbrella of the EC community. The field has also matured, developing theory, making available public domain libraries and agreeing on proper statistical techniques for algorithmic comparisons. Still, the field remains vibrant, flexible and open to embrace new developments.

One of the big trends in recent times has been the rise of machine learning, and we believe that EC and machine learning are closely linked in many different ways. To give a few examples:

- Machine learning usually involves solving difficult optimization problems, including the infamous hyperparameter tuning problem, and EC is a powerful technique for such problems.
- For problems with computationally expensive fitness evaluations, the EC community has turned to using surrogate models. These are essentially machine learning tools to predict the quality of some candidate solutions, with the goal to replace some of the expensive fitness evaluations.

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- Most applications of EC are essentially a combined learning and optimization problem: one needs to learn about the search space (exploration) while simultaneously using the gained knowledge to search for better solutions (exploitation). This trade-off is made very explicit in another increasingly popular global search algorithm, Bayesian Optimization.
- Most EC algorithms have parameters, and predicting what parameters work best depending on problem characteristics is a challenging machine learning problem.
- Genetic Programming, an open-ended evolutionary algorithm, has been successfully applied to many typical machine learning problems and is not bounded by pre-specified complexity limits.

So we believe the EC community sits at the heart between optimization and machine learning, and has a great deal to offer to both of these communities.

ACM Transactions on Evolutionary Learning and Optimization (ACM TELO) aims to be home to the whole EC community, including related areas such as population-based methods, Bayesian optimization and swarm intelligence. We welcome papers that make solid contributions to theory, method and applications. And because we expect EC to play an important role at the interface between optimization and machine learning, we are particularly interested in papers at this interface, such as the use of evolutionary optimization for tuning and configuring machine learning algorithms, the use of machine learning to support and configure evolutionary optimization, and hybrids of evolutionary algorithms with other optimization and machine learning techniques.

The journal aims for very high quality standards, which is reflected in a rigorous double-blind reviewing process where an associate editor is providing one of the reviews. Furthermore, it is our hope to contribute to the sustainability of the field by encouraging authors to make their code publicly available, and offer to award ACM Reproducibility Badges to papers in the three categories of “Artifacts Available” (source code available in public archival repository), “Artifacts Evaluated” (documented, complete and exercisable) and “Results Reproduced” (results can be obtained from provided code). If authors apply for one or more of these badges at the time of submission, the journal’s reproducibility board will determine whether the requested badges can be awarded or, if not, what would need to be changed.

It is an exciting time in artificial intelligence and the larger field of computer science. Computational intelligence is now a part of daily life for almost everyone, even if they do not always see the computation that is taking place just behind their screen. This also means that researchers and developers constantly face new and more complex optimization and learning problems. We are confident that EC and this journal will make fundamental contributions to this field.

We thank ACM and ACM SIGEvo for their support in setting up this journal.

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