Special issue on GECCO competitions

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Every year the Genetic and Evolutionary Computation Conference (GECCO) offers a diverse program of competitions that represents a wonderful opportunity to address challenging problems while competing with other members of the evolutionary computation (EC) community. These competitions also showcase riveting applications of EC in the top conference of the field.

In 2013 GECCO offered six different competitions, which received a total of 31 submissions:

- The **Visualizing Evolution** competition was organized by David Walker, Richard Everson, and Jonathan Fieldsend. Participants were asked to exhibit cutting edge visualizations of an evolutionary process. The competition was also connected with the Visualization Methods workshop, wherein participants were afforded the opportunity to present their work. Submissions were evaluated by the organizers based on originality, quality, and relevance.
- The **Evolutionary Art, Design, and Creativity** competition, organized by Christian Gagné, Amy K. Hoover, Eduardo R. Miranda, and Craig Reynolds, aimed at showcasing human-quality artistic works or creativity-enhancing experiences generated by or with the assistance of evolution. Submitted works could be music, images, sculptures, videos, interactive online experiences, or any form of expression. The goal was to exhibit some form of independent creativity through genetic and evolutionary computation. A selected jury of researchers, from both the EC and technological art communities, evaluated the

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entries with respect to several criteria, including artistic or design merit, innovation, creativity, technical quality, and relevance.

- The **GPUs for Genetic and Evolutionary Computation** competition, organized by Daniele Loiacono and Antonino Tumeo, focused on the application of genetic and evolutionary computation that can maximally exploit the parallelism provided by low-cost consumer graphic cards. The entries submitted were evaluated by a panel of experts in terms of degree of parallelism obtained, overall speed-up, and programming style.
- The **EvoRobocode** competition, organized by Daniele Loiacono and Moshe Sipper, challenged the participants to apply EC techniques to design a competitive robotic tank controller for the Robocode platform. Robocode is an open source Java programming game, where the goal is to develop a tank to fight against others in the official tournaments organized online. The entries of this competition were evaluated by a panel of judges, primarily based on their performance (assessed through a tournament of one-on-one fights), the relevance of EC in the development process, and the novelty of the approach.
- The **Simulated Car Racing** competition was organized by Daniele Loiacono and Pier Luca Lanzi. The goal of this competition was to design and submit a controller for a racing car that competed on three unknown tracks. Submitted entries were allowed to learn tracks during a warm-up stage; then their performance was tested in a qualifying stage and, finally, they all raced together in the final stage. Entries were scored according to damage received, fastest lap, and final position achieved in the races during the final stage of the competition.
- The **Industrial Challenge** was organized by Martina Friese, Oliver Flasch, Olaf Mersmann, and Thomas Bartz-Beielstein, with GreenPocket as an industrial partner. The goal of this competition was to develop accurate and efficient forecasting methods and to apply them to real-world smart home time series data. Entries were evaluated by the organizers based both on quality and prediction accuracy.

This special issue includes a selection of four top works submitted to the competitions of GECCO 2013.

The paper by Fernàndez de Vega et al. describes a study on human creativity involving five artists who created 50 paintings following the typical steps of a genetic algorithm: selection, crossover, and mutation. This study sheds a new light on the human creative process from an EC perspective and also leads to *XY*, a collective artwork awarded first place at the Evolutionary Art, Design, and Creativity competition.

The paper by Harper describes the winning entry of the EvoRobocode competition, developed through genetic programming and coevolution. In particular, he designed a *Backus Naur Form* (BNF) grammar suitable for representing a robot tank for Robocode, and applied Grammatical Evolution—a form of genetic programming devised to evolve programs based on a given BNF grammar—to search for an effective controller. Harper exploited spatial coevolution to evolve competitive tanks without requiring domain knowledge or a baseline to evaluate the evolving players.

The paper by Quadflieg et al. describes *Mr. Racer*, the winning entry of the Simulated Car Racing competition. The authors designed Mr. Racer as a modular controller, and applied evolutionary strategies—namely, CMA-ES—to optimize the parameters. During the warm-up stage of the competition their controller is able to learn a model of the unknown tracks, which is used in later stages to drive as fast as possible.

Finally, the paper by Sanchez and Cussat-Blanc describes their entry for the Simulated Car Racing competition, which is based on an artificial gene regulatory network. The authors discuss how they developed a controller with a very limited amount of domain knowledge and how they trained it to deal effectively with opponents.

The guest editors thank all the authors who submitted an entry to the GECCO competitions and all the organizers who put a lot of effort to run six great competitions. We thank all the reviewers for their precious expertise in evaluating either the entries of the competition or the works included in this special issue. A sincere thanks goes also to our sponsors, NVIDIA, GreenPocket, and the GECCO organization for providing us with nice prizes for winners and runners-up. Finally, we thank Lee Spector for his encouragement and support of this special issue.