UNIVERSITY OF SOUTH FLORIDA

Defense of a Doctoral Dissertation

Interactive Fitness Domains in Competitive Coevolutionary Algorithms

by

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For the Ph.D. degree in Computer Science and Engineering

Evolutionary Algorithms (EA) have been successfully applied to a wide range of optimization and search problems where no mathematical model of the quality of a candidate solution is available. Interactive Evolutionary Algorithms (IEA) and Competitive Coevolutionary Algorithms (CCoEA) go one step further by being able to tackle problems where the only means to evaluate the quality of a candidate solution is via interactions. In a typical IEA, interactions take place between the solution being evolved and human evaluators. In a CCoEA, interactions take place between solutions themselves, without need for human interaction. This dissertation first identifies Computer-Aided Learning as an application domain which exemplifies the overlap of both fields. In particular, this work develops ``EvoParsons", a novel interactive and competitive (co)evolutionary approach to evolve practice problems for students in introductory computer programming course. The second work studies Pareto dominance relations of coevolutionary interactions by looking at both coevolutionary benchmarks and EvoParsons. It builds a unique approach to understand both structural and relational dominance of coevolutionary interaction function. This method can be applied in open ended problems like EvoParsons where interactions between practice problems and students can't be defined mathematically. It reveals the applicability of Coevolutionary dimension extraction, its sensitivity to dominance relations, and its robustness to noisy outcomes.

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Publications

1) **ATM Golam Bari**, Alessio Gaspar, P.R. Wiegand, Anthony Bucci, Jenifer Albert, and Amruth N. Kumar, Evolutionary Parsons Puzzles: Design, Implementation & Preliminary Evaluation", Genetic Programming and Evolvable Machines (2019)
2) **ATM Golam Bari,** Alessio Gaspar, "Challenges and Opportunities of Candidate Solutions Evaluation in Competitive Coevolutionary Algorithm and Interactive Evolutionary Algorithm, submission of ACM Computing Survey (2019).
3) **ATM Golam Bari**, Alessio Gaspar, R. Paul. Wiegand, Dymtro Vitel, Kock Cheng Tong, Stephen Kozakolf, On the Potential of Evolved Parsons Puzzles to Contribute to Concept Inventories in Computer Programming, 126th ASEE Annual Conference and Exposition, Tampa, Florida, June 15-19, 2019.
4) **ATM Golam Bari,** Alessio Gaspar, R.Paul Wiegand, Anthony Bucci, Selection Methods to Relax Strict Acceptance Condition in test-based Coevolution, IEEE WCCI 2018, July, Rio de Janeiro, Brazil
5) **ATM Golam Bari**, Alessio Gaspar, R.Paul Wiegand, Anthony Bucci, "Does Relaxing Strict Acceptance Condition Improve Test Based Pareto Coevolution?, IEEE Symposium Series on Computational Intelligence 2017, Nov 27 - Dec 1, Hawaii, USA
6) Alessio Gaspar, **ATM Golam Bari**, Amruth N.Kumar, R. Paul Wiegand, Anthony Bucci, Jennifer L. Albert. "Evolutionary Practice Problem Generations: More Design Guidelines". In Proceedings of the 30th International Conference of the Florida Artificial Intelligence Research Society, FLAIRS 17, 2017.
7) Alessio Gaspar, **ATM Golam Bari**, Amruth N. Kumar, R. Paul Wiegand, Anthony Bucci, Jennifer L. Albert. " Evolutionary Practice Problem Generations: Design Guidelines ". In the proceedings of International Conference on Tools in Artificial Intelligence, 2016, Nov 6-9, San Jose, California, USA.
8) **ATM Golam Bari,** P.R. Wiegand, Alessio Gaspar, Anthony Bucci, Dominance Relations of Pareto Coevolution from Artificial to EvoParsons's Interaction, in preparation.

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