

Three research directions of interactive evolutionary computation

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<https://hdl.handle.net/2324/2230937>

出版情報 : 2018-09-19. Springer Verlag
バージョン :
権利関係 :



Three Research Directions of Interactive Evolutionary Computation

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Abstract. We overview three research directions of interactive evolutionary computation (IEC). They are (1) extending IEC applications, (2) reducing IEC user fatigue by improving/developing interface, algorithms, operators, frameworks, and others, and (3) using IEC as a tool for analyzing human characteristics.

Keywords: interactive evolutionary computation, application-oriented research, reducing human fatigue, fastening evolutionary computation, analysis of user characteristics

1 Introduction

Interactive evolutionary computation (IEC) is a framework that evolutionary computation (EC) optimizes a target system based on human subjective evaluations to the outputs from the target system. There are many tasks which performances are hard to be measured but can be evaluated by humans. IEC shown in Fig. 1 (a) can optimize such tasks by involving a human user in an optimization loop.

2 IEC Application-oriented Research

The first direction of IEC research is to expand IEC application areas. IEC has been applied to wide variety of areas. They are roughly categorized into three: (1) artistic applications such as creating computer graphics (CG), music, editorial design, and industrial design, (2) engineering applications such as acoustic or image processing, robotics control, data mining, generating programming code, and media database retrieval, and (3) others such as educations, games, and geological simulation. See these perspectives in the reference [1].

3 Research for Reducing IEC User Fatigue and Making IEC Practical

The second direction of IEC research is to reduce IEC user fatigue and make IEC practical. IEC users must repeat evaluations many times and feedback them

to a tireless computer. This nature causes IEC user fatigue, and especially, it becomes a serious problem for practical use when end-users use IEC.

Several trials have been proposed. Some of them are: improving IEC user interface, developing new EC algorithms and EC operations that make EC converge faster and are effective under the restricted IEC conditions, developing new IEC framework with less human fatigue is other solution, introducing an IEC user's evaluation model made by machine learning, allowing an IEC user to intervene in an EC search, and others. See these works in the reference [1].

4 IEC as a Tool for Analyzing Human Characteristics

The third direction of IEC research is to use the IEC as a tool for analyzing human characteristics; see Fig. 1(b). This is a new and unique approach, and there are few related works so far.

Since an IEC target system is optimized based on a human psychological evaluation scale, we may know the scale indirectly by analyzing the optimized target system. It somehow has similarity to *reverse engineering* in software engineering. Other explanation of this approach is that IEC is a tool for visualizing impressions or images in mind. Artists have skills for expressing them by drawing pictures, playing musical instruments, programming CG and writing in poems, for example. However, it is hard for many ordinary people who have no such skills to express the impressions or mental images. IEC helps those who have less skill to express the mental images using IEC-based systems.

Thanks to this kind of IEC use, we may be able to analyze human characteristics by analyzing obtained optimized systems and their system outputs. Through the analysis, we are looking forward to finding out new psychological or physiological unknown facts.

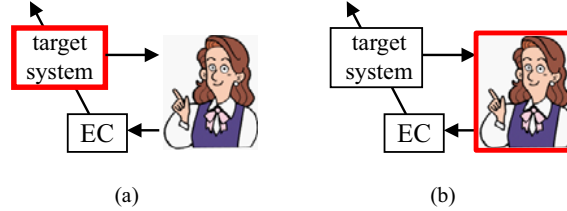


Fig. 1. IEC frameworks (a) for optimization and (b) for human science.

References

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