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Escher-like Tiling Design Using Estimation of distribution algorithm

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Abstract

This paper proposes a method that generates a tileable shape similar to a given image [1]. Tiling is an act of continuously covering the plane with finite types of figures, or tiles, so that there are no gaps and overlaps. A figure, which can be covered in the plane with no gaps and overlaps, is called a tileable figure. An analytical method for generating tileable figures has been proposed [2]. However, the method requires trial-and-error repetitions of manual modification of an input figure shape and application of the analytical method. A hierarchical optimization method that reduces the user's fatigue required by the analytical method has also been proposed [3]. This method uses the analytical method as the lower layer optimization solver, and a genetic algorithm (GA) [4] as the upper layer optimizer. Although this method can generate tileable shapes that do not include self-intersection, it requires high computational cost since the upper solver is based on simple GA.

Therefore, this paper improves the hierarchical optimization method by replacing a simple GA used in the upper layer with Estimation of distribution algorithm (EDA) [5]. The EDA builds a probability distribution and samples solution candidates according to the distribution. The proposed method allows flexible design of an objective function and constraints, which avoids, as with the previous hierarchical method, and converges more quickly than the previous method. Experimental results showed that the proposed method could produce tileable shapes for various input figures within a practical computational time.

References

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