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APPLICATION ARTICLE

Using genetic algorithm to improve consistency and retain authenticity in the analytic hierarchy process

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Abstract
The quality of decision using the analytic hierarchy process (AHP) depends upon the consistency of the pairwise comparison matrices (PCM) in the AHP hierarchy. While several studies describe methods to improve consistency, the related issue of retaining authenticity of the judgements has received far less attention. In this paper, a multi-objective genetic algorithm is presented for the purpose of reducing the inconsistency of a PCM while ensuring a high degree of authenticity with respect to the original input. A number of Pareto-optimal solutions are generated as a result of the optimization. Heuristics for choosing one of these PCMs based on a trade-off between consistency and authenticity is also presented. To demonstrate the effectiveness of the proposed method two inconsistent PCMs are selected for rectification. Rectified PCMs from the proposed method as well as from other established methods are compared. It is seen that the proposed method results in consistency that compares favorably with existing methods while retaining a greater degree of authenticity. Though the proposed method is slow and computationally intensive, we believe that this is a cost worth incurring in the interest of reliability and authenticity of judgements.

Keywords Multi objective optimization · Analytic hierarchy process · Consistency · Authenticity · Pairwise comparison matrix · Genetic algorithm · Pareto frontier

1 Introduction

A large class of decision making problems involves comparison of alternatives for their suitability to meet a stated objective. In many cases the objective and the alternatives can be structured in a tree-like hierarchy. Analytic Hierarchy Process (AHP) [1–3] uses this intuitive framework to make the problem of decision-making

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