

Characterizations of the Logarithmic Least Squares Method

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Abstract

Derivation of priority vectors from pairwise comparisons is a fundamental step in the solution of a number of decision-making problems. We offer some insight into the choice of estimation methods by providing characterizations for the Logarithmic Least Squares Method (*LLSM*, sometimes called geometric mean) and the ranking induced by this procedure.

First, *LLSM* is proved to be the unique method satisfying correctness in the consistent case and invariance to a transformation called consistency reconstruction. After that, it is shown that ranking according to the geometric mean is the unique ranking of alternatives, which satisfies the following properties:

- *Anonymity*: the ranking of alternatives does not depend on their labels;
- *Aggregation invariance*: if an alternative is not worse than another according to some decision-makers, this relation should be preserved when their preferences are aggregated;
- *Responsiveness*: a weak form of monotonicity requiring that if alternative i is ranked as high as alternative j , then it should be ranked strictly higher when the pairwise comparison of i and j is improved for i .

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