

Integrating dominance relations in decision-making problems

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Abstract: This study proposes a novel decision-making framework that integrates dominance relations to enhance the robustness and interpretability of multi-criteria analysis. Traditional decision models often rely on compensatory aggregation methods, which may obscure the inherent superiority of one alternative over another across all criteria. By incorporating the concept of dominance—where an alternative is considered superior if it performs at least as well as another on all criteria and strictly better on at least one—the proposed approach systematically identifies non-dominated solutions and reduces the decision space. The framework further combines dominance rules with outranking methods to handle conflicting criteria and incomplete preference information. Through theoretical analysis and illustrative examples, we demonstrate that the integration of dominance relations not only improves the transparency of the decision process but also mitigates the influence of arbitrary weighting. The findings offer a practical tool for decision-makers in fields such as resource allocation, project selection, and policy evaluation, where clear and justifiable choices are essential.

Keywords: Dominance relations, Decision making, Integration, Multi-criteria