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COMPARING MAMDANI AND SUGENO HIERARCHICAL FUZZY SYSTEMS FOR ENVIRONMENTAL IMPACT ASSESSMENT: A PIPELINE PROJECT CASE STUDY

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Abstract

Several studies have been conducted in various fields comparing Mamdani and Sugeno fuzzy inference systems (FISs). This study contributes to the literature by comparing the performance of Mamdani and Sugeno hierarchical fuzzy systems (HFSs) in terms of their technical performance within the context of environmental impact assessment (EIA), a multi-criteria decision analysis (MCDA) method, with the aim of illuminating practical issues that need to be taken into account during application. The context is a non-commercial, research-oriented EIA of a pipeline project in southern Iran. Mamdani and Sugeno HFSs were developed with data collected for and expertise gained via a previous formal EIA of the same project. The two developed HFSs were of binary structure, reducing complexity while also facilitating sensitivity analysis. A sensitivity analysis was carried out with the full range of possible HFS input values. Excluding the final FISs, the FIS outputs did not differ significantly between the two examined HFSs. However, the behavior of the Sugeno HFS was found to be more linear than that of its Mamdani counterpart with a higher degree of sensitivity to input value changes. This study indicates that the Mamdami HFS is unreliable in some areas due to fluctuations in the output surface, which necessitates smoothing before it can be applied.

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