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A Fuzzy Set-Theoretic Approach to Decision Making

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In many complex decision situations the data available may not be sufficient to define a decision-making problem in an exact and objective form. The processing of such data involves approximating and subjectively assessing the information necessary to describe the decision situation. The ability to capture the vague nature of the information may be the key to solving an ill-defined problem.

This paper presents quantitative models that accommodate the imprecision resulting from the vagueness and the subjectivity in the assessment of decision situations. The tools of quantification used to represent this imprecision are fuzzy set theory and operations. A new interpretation of the decision-making process in a fuzzy environment is motivated. Guidelines by which the "best" decision alternative can be determined are presented.

Integrating Expert Systems Using Fuzzy Numbers

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Real-time processing constraints of operational expert avionics systems are driving a trend to concurrent processing of several systems. This paper demonstrates an algorithmic technique to integrate expert systems where the systems are allowed to use fuzzy numbers as output. One approach to solving the integration problem is examined; each alternative is considered as a possible target, each judge as one of four expert planners, and each criterion as a consideration that is examined by at least one expert. The experts are allowed to use fuzzy numbers to quantify each target's suitability within each criterion. Four on-board experts are allowed to use fuzzy numbers because there is difficulty assigning specific real numbers to alternatives. The expert opinions are integrated in a manner that also considers the mission. Separate sets of criteria weights are used, where each set provides a "mission context" under which the analyst operates. The result is a ranking of subsets of targets, starting with the most desirable. Other analysts operating in parallel provide support for other aircrew knowledge needs. This approach minimizes the information pipeline to the pilot and exploits the power of concurrent processing. Given sufficient computing power, the design is one possible method for providing real-time data analysis.

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