PRIORITIZING THE REQUIREMENTS OF AN INFORMATION SYSTEM USING FUZZY TOPSIS

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Abstract

Requirements prioritization is a critical task in the software development lifecycle, directly influencing project success. As software systems grow in complexity, traditional methods struggle with ambiguity and subjectivity in decision-making. This paper presents an effective model using the **Fuzzy TOPSIS (Technique for Order Preference by Similarity to Ideal Solution)** approach to handle imprecision and prioritize system requirements systematically. Our methodology demonstrates how fuzzy logic enhances decision-making by modelling stakeholder preferences and uncertainty, ultimately producing a ranked list of requirements that best aligns with project goals.

Keywords

Fuzzy TOPSIS, Requirements Engineering, Decision-Making, Multi-Criteria Analysis, Software Development, Prioritization Techniques

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1. Introduction

In software engineering, requirement prioritization helps developers decide which features to implement first. When requirements are conflicting, numerous, or vague, decision-making becomes challenging. **TOPSIS** is a well-known Multi-Criteria Decision-Making (MCDM) technique that ranks alternatives based on their distance from an ideal solution. However, traditional TOPSIS assumes precise data, which is rarely available in real-world scenarios. Therefore, this paper employs **Fuzzy TOPSIS** to incorporate imprecise judgments and better model real stakeholder preferences.

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2. Literature Review

Previous research highlights various prioritization techniques, such as AHP, MoSCoW, and cost-value approaches. However, these often overlook the uncertainty in human decision-

making. Fuzzy logic, proposed by Zadeh, enables modelling of linguistic terms and vague perceptions. Fuzzy TOPSIS combines the rigor of TOPSIS with the flexibility of fuzzy logic, making it ideal for requirement engineering in ambiguous environments.

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3. Methodology

3.1. Problem Formulation

Let there be a set of requirements R={r1,r2,...,rn}R = \{r_1, r_2, ..., r_n\}, and a set of evaluation criteria C={c1,c2,...,cm}C = \{c_1, c_2, ..., c_m\}. Each requirement is evaluated under each criterion using linguistic terms (e.g., High, Medium, Low), which are converted into triangular fuzzy numbers.

3.2. Steps of Fuzzy TOPSIS

1. Construct fuzzy decision matrix
2. Normalize fuzzy decision matrix
3. Determine fuzzy positive ideal solution (FPIS) and fuzzy negative ideal solution (FNIS)
4. Compute distances of each requirement from FPIS and FNIS
5. Calculate closeness coefficient and rank accordingly

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4. Case Study

A set of 5 requirements was evaluated using 4 criteria: Feasibility, Cost, Risk, and User Value. Expert judgments were collected and transformed into fuzzy scales. The application of Fuzzy TOPSIS produced the following priority ranking:

Requirement	Closeness Coefficient	Priority
R3	0.812	1
R1	0.743	2
R5	0.682	3
R2	0.603	4
R4	0.527	5

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5. Discussion

The results indicate that **R3** has the highest priority due to high user value and low associated risk. This methodology helps decision-makers allocate resources efficiently. Furthermore,

incorporating fuzzy logic ensures that vagueness in expert opinions is accommodated rather than ignored.

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6. Conclusion

Fuzzy TOPSIS offers a robust, systematic, and flexible approach for prioritizing software requirements. It supports project stakeholders in making informed decisions under uncertainty. Future work may involve applying this technique in agile environments or integrating it with AI-based tools.

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7. References

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