

## **AN INNOVATIVE FUZZY LOGIC FOR DECISION-MAKING THAT EMPLOYS THE RANDOMIZED RESPONSE TECHNIQUE**

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### **ABSTRACT**

This paper introduces an innovative optimization model employing fuzzy logic to address the challenge of minimizing variance while considering costs in the context of a two-stage stratified random sampling model with a randomized response approach. The proposed model leverages the alpha-cut technique to establish an optimal allocation strategy, making it possible to effectively manage the trade-off between cost constraints and variance reduction objectives. To illustrate the practical application of the model, we provide numerical examples, demonstrating its efficacy in real-world scenarios. This research contributes to the field by offering a comprehensive framework for decision-makers to enhance the quality of data collection processes, particularly in situations where preserving respondent privacy is crucial. The integration of fuzzy logic and randomized response techniques presents a novel approach to addressing the inherent challenges of collecting sensitive information while maintaining data integrity and cost-efficiency.

### **KEYWORDS**

Stratified random sample, Optimal allocation, Sensitive attribute, and Unrelated randomized response approach.

### **1. INTRODUCTION**

In the realm of statistical inference, various methodologies can be employed to draw conclusions, depending on the context and goals of the analysis. One commonly used approach involves integrating the inference process within a probabilistic framework, utilizing models tailored for analytical and enumeration-based inference. This method is a staple in the toolkit of statisticians across the board and serves as a foundational basis for making informed decisions based on observed data. However, it is essential to recognize that enumeration inference demands a distinct probability structure, diverging from the