

Design and Implementation of Set Theory-Based Models for Efficient Data Representation in Computing Systems

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Abstract: The rapid growth of data-intensive applications in modern computing systems has created a strong need for efficient, structured, and mathematically sound data representation techniques. Set theory, as a fundamental branch of discrete mathematics, provides a powerful conceptual framework for modeling relationships, organizing data, and performing logical operations in computing environments. This paper focuses on the design and implementation of set theory-based models for efficient data representation in computing systems. The proposed approach leverages core set-theoretic concepts such as unions, intersections, complements, relations, and mappings to structure data in a clear, compact, and logically consistent manner. By applying these principles, complex data structures can be simplified, redundancy can be reduced, and computational efficiency can be improved. The study highlights how set theory supports database design, data classification, information retrieval, and algorithm development. The results demonstrate that set theory-based models enhance clarity, scalability, and reliability in data handling, making them highly suitable for modern computing applications.

Keywords: Energy Set Theory, Data Representation, Computing Systems, Mathematical Modeling, Discrete Mathematics, Data Structures, Algorithm Design