GNN-based Skyline Query Processing for Large-Scale and Incomplete Graphs

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Abstract

Skyline queries are crucial in database management, selecting optimal points from multi-dimensional datasets based on dominance relationships. They are widely used in decision-making, recommendation systems, and data filtering. However, traditional skyline algorithms struggle with large volumes and missing data, leading to high computational costs and inefficiencies. This research proposes a hybrid approach that integrates the ISkyline dominance graph technique with Graph Neural Networks (GNNs) to improve skyline query performance under such conditions. The GNN component is utilized to predict skyline tuples in the presence of missing or incomplete data. Evaluation on both synthetic and real-world datasets demonstrates improved accuracy and efficiency compared with established methods such as ISkyline, SIDS, and OIS. This research demonstrates the potential to improve query processing efficiency and to support applications in e-commerce, finance, and smart data systems. Copyright (c) 2026 IIUM Press. This work is licensed

Author keywords

Graph Neural Networks (GNNs); Incomplete data; Machine learning; Pareto optimality; Skyline query processing

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