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GNN-Based Data Fusion for Precipitation Estimation Using Opportunistic Sensors

Wednesday, June 25, 2025 3:15 PM (45 minutes)

Accurate precipitation estimation is essential for hydrology, meteorology, and climate studies. Traditional methods rely on rain gauges, weather radars, and satellite observations, each with inherent limitations. Opportunistic sensing through Commercial Microwave Links (CML) offers a promising complementary data source, especially in regions with sparse conventional observations. This work explores the use of Graph Neural Networks (GNNs) for fusing precipitation data from radars, rain gauges, and CML to improve rainfall estimation.

We propose a novel GNN-based approach that models the spatial and temporal dependencies among different sensing sources. By representing the measurement network as a graph, GNNs can effectively learn relationships between nodes and edges. The model is trained and evaluated using real-world precipitation datasets. Its performance is compared with other deep learning techniques, including Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), in terms of accuracy and robustness to missing or noisy data. Initial results suggest that GNNs outperform conventional deep learning models by better capturing spatial correlations and leveraging the irregular distribution of sensing nodes. This study highlights the potential of GNNs for multi-source data fusion in precipitation estimation, paving the way for improved rainfall monitoring using opportunistic sensing.

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No

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