Special Issue

SAR Image Change Detection: From Hand-Crafted to Deep Learning

Message from the Guest Editors

Synthetic Aperture Radar image change detection has emerged as a pivotal technology in modern remote sensing. Traditional approaches, predominantly relying on hand-crafted algorithms such as ratio operators, and statistical models, frequently struggle with SAR's inherent challenges—speckle noise, geometric distortions, and intricate backscattering mechanisms. These limitations often result in reduced accuracy, particularly in heterogeneous environments, and necessitate labor-intensive parameter tuning. The paradigm shift toward deep learning has revolutionized SAR change detection by automating hierarchical feature extraction and enhancing model robustness. Convolutional Neural Networks and advanced architectures like U-Net and Transformer-based models excel at capturing multi-scale spatiotemporal patterns, effectively suppressing noise while preserving subtle change signatures. Innovations such as Siamese networks, attention mechanisms, and unsupervised learning frameworks further address critical bottlenecks like labeled data scarcity and cross-domain adaptation, enabling scalable deployment across diverse geographical regions.

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