

The Power of Optical and SAR Imaging for Remote Monitoring of Land and Infrastructure

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ABSTRACT:

The growing availability of high-resolution multi-frequency imagery from satellite, aerial, and ground-based platforms is revolutionizing the monitoring of geohazards, land deformation, and the structural health of critical infrastructure.

State-of-the-art image processing techniques—including Synthetic Aperture Radar Interferometry (InSAR), Digital Image Correlation (DIC), Speckle Tracking, Change Detection, and Structure-from-Motion (SfM) photogrammetry—enable the extraction of surface displacements and structural changes with unprecedented spatial density, precision, and temporal resolution. These fully remote and non-invasive methodologies support the systematic observation of large-scale areas, offering significant benefits for continuous and pervasive monitoring. Their integration into operational workflows enhances the ability to assess risks, improve infrastructure resilience, and inform data-driven decision-making processes in both natural and built environments.

