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Rapid unsupervised economic assessment of urban flood damage using SAR images

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Climate change projections for 2030 indicate a concerning increase in the frequency of floods, which is expected to result in significant economic damages and losses on a global scale. The growth of urbanization has indeed increased flood risk, highlighting the need for a prompt evaluation of economic losses to facilitate rapid response and effective reconstruction. However, providing timely and accurate economic damage assessment immediately after a flood event is difficult and associated with high uncertainty. Remote sensing data can support this task, but challenges such as cloud cover, infrequent return times from satellites, and the lack of ground truth data make supervised approaches challenging. To address these challenges, we propose a new economic damage assessment approach based on the analysis of multi-temporal and multi-source, Synthetic Aperture Radar (SAR) images before and after the flood peak with an unsupervised change detection method. This method utilizes computer vision techniques, specifically a pixel-based approach with SAR data (Sentinel-1 and TerraSAR-X/TanDEM-X) to monitor changes in buildings and the flood extension. It employs various threshold techniques and parameters to determine the optimal threshold values for highlighting changes and the presence of water. By using this method, our aim is to obtain an economic model based on pixels, which represents the volume of water surrounding or on each building and the flood extension. The purpose of this study is to support governments in decision-making processes and enable insurers to efficiently assess and compensate for damages caused by flood events.