Multiscale Condition Assessment Of Post-Earthquake Buildings

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Abstract Damage assessment of post-earthquake buildings in urban areas is critical for emergency responses and rescue decisions after an earthquake. In this study, multiscale images from multiple sources are utilized to achieve damage detection and condition assessment of post-earthquake buildings using convolutional neural networks (CNNs), including large-scale images from satellites, median-scale images from unmanned aerial vehicles (UAVs), and small-scale images from digital cameras collected onsite. Firstly, rapid building localization and binary classification of collapse or not for small dense buildings in broad areas are achieved by a modified YOLOv4 model using roof-only images from satellites. Subsequently, a modified U-Net for the semantic segmenation of post-earthquake buildings in three levels of no damage/light damage/moderate damage, severe damage, and destroyed is established using facade-plus-roof images from UAVs. Then, images from hand-held cameras are used to train a fine-grained object detection model to obtain detailed information of quantities, locations, and severities for multiple categories of seismic damages, including concrete crack, wall spalling, wall damage, rebar exposure, and buckling. Finally, a comprehensive condition assessment method is implemented using the multiscale results of damage recognition mentioned above. A case study on the old Beichuan town is performed to demonstrate the effectiveness of the proposed method for condition assessment of post-earthquake buildings integrating multiscale information. Keywords: Multiscale Condition Assessment, Computer Vision, Deep Learning, Information Fusion, Post-earthquake Buildings