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Application of Machine Learning to SAR Image for Persistent Scatterers Pixel Selection

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The Persistent Scatterers InSAR (PSInSAR) technology, utilizing pixels with stable phases to extract ground deformation, is an effective tool for large-scale, long-time surface monitoring applications. PSInSAR has been widely used for surface deformation applications, such as earthquake event research, risk management of infrastructure, and land subsidence monitoring. With the improvement of instruments and satellite orbit design, the resolution of SAR images has increased both in spatial and temporal domains, resulting in a large volume of data for analysis. However, for such datasets, the efficiency of data processing is an important issue. PSInSAR results obtained from these data usually take serval weeks, which made the near-time data analysis and early warning application impractical. In this study, the supervised deep learning model, U-Net, which is based on a convolutional neural network, is applied to the differential InSAR dataset acquired from Sentinel-1 for persistent scatterers selection. Labels obtained from traditional PSInSAR results are used for dataset training. As a result, the time cost of machine learning is less than the traditional PSInSAR procedure. Moreover, the model could be reused for different image coverage and monitoring periods, which means it is unnecessary to retrain the model for another dataset. Also, the PSInSAR product with different spatial coverages obtained from the training model is compared to the result from the standard PSInSAR procedure to verify the reliability of the model, which indicates that machine learning has the potential to become a more efficient method for persistent scatterers pixel selection.

Keywords: SAR, Persistent Scatterers, Machine Learning