Optimization of the time series surface deformation analysis using machine learning algorithms on the interferogram simulation data

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Time-series InSAR techniques, such as Stanford Method for Persistent Scatterers (StaMPS) are commonly used to measure time-series surface deformation. This study presents a novel approach of optimized time series deformation analysis based on a support vector regression (SVR) algorithm and optimization Hot-Spot Analysis on persistent scatterers (PS). To examine the performances of the optimized process in time-series, we generated a synthetic interferogram using a Mogi model equation to construct a simulated surface deformation phase. Topography errors simulated orbital error and atmospheric error phases have been added to synthetic interferogram construction. All the synthetic interferogram based on Sentinel-1 SAR Image acquisition dates over Seoul, Korea. An SVR algorithm was used to find an optimum measurement point and reduce error points in time-series analysis. Then, the OHSA approach was implemented on the optimum measurement point through the analysis of Getis-Ord Gi* statistics. As the result, the optimization measurement point indicates refined results in the mean velocity deformation map and time-series graph. In addition, the detection accuracy can be improved by more than 10% with synthetic data. Then, the correlation coefficient between the optimization result and the deformation model shows a good correlation (> 0.8). Also, the standard deviation of time-series results can be reduced by more than 7% after optimizing the process. The proposed method is useful to detect a low deformation rate and can be implemented for several deformation cases.