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The influence of DEM characteristics on SAR interferometry for traffic infrastructure monitoring (DE/EN)

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Geodetic monitoring of traffic infrastructures such as roads and railways is crucial to ensure traffic flow and reduce maintainance costs. In recent years, Interferometric Synthetic Aperture Radar (InSAR) has emerged as a remote sensing method to monitor traffic infrastructure stability. During the InSAR analysis, an external Digital Elevation Model (DEM) is used for different purposes. First, SAR images are coregistered to a common reference image with the aid of a DEM. Precise coregistration enables an analysis of the phase of a pixel over time. Second, a topographic phase is removed from the interferograms using the DEM. Therefore, any errors in the DEM contribute systematically to the observed interferometric phase and can be correlated with the parameter of interest: the phase due to surface deformation. Finally, the interferograms are geocoded using the DEM. Accurate geolocation of pixels is only possible when the DEM is up to date and accurate enough.

One reason for errors in the DEM is the spatial resolution and its averaging effect. For instance, highways merely cover a few pixels in a Sentinel-1 SAR image and hence, its size is comparable to medium-resolution DEMs like the widely used SRTM DEM with 30m resolution. In the context of traffic infrastructure monitoring, the impact of the DEM resolution and the resulting error in InSAR time series analysis is barely investigated. In this thesis, the impact of DEM on InSAR monitoring of traffic infrastructure will be studied. In this context, InSAR time series analysis will be performed using different DEMs with a resolution lower, almost similar, and higher than the SAR resolution. Adequate methods and analysis strategies shall be developed to assess the effect of the DEM resolution for the application of traffic infrastructure monitoring.

Experience with InSAR processing, programming skills in e.g. python or Matlab and basic Linux/Unix knowledge will be beneficial for this thesis.

This thesis will be supervised by Andreas Piter, M.Sc., and Dr.-Ing. Mahmud Haghshenas Haghighi.

Image source:
Police Stralsund

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