

Deformation Pattern Detection in Mining Areas based on Unsupervised Machine Learning and InSAR Data

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Underground exploitation of mineral resources influences the ground surface in the form of deformation. The Synthetic Aperture Radar Interferometry (InSAR) method is a technique used to remotely measure ground surface displacements, including deformations in mining areas, using satellite SAR imagery. InSAR time series methods in combination with Sentinel-1 open imagery provide extensive collections of data about land surface phenomena. Optimising and automating the extraction of information from the expanding inventory of Earth Observation data is a major challenge for the scientific community. This paper presents a method for unsupervised pattern detection from InSAR displacement time series data.

The study was carried out for the Legnica-Głogów Copper Belt area in south-western Poland. The SBInSAR (Small Baseline InSAR) method was used to measure ground surface displacements (Berardino et al., 2002). Vertical displacements were calculated by fusion of multi-geometry data from ascending and descending satellite orbits. Vertical displacements of the ground surface from May 2016 to October 2020 were determined.

An unsupervised machine learning method, Self Organising Maps (also called Kohonen's Network), has been used to aggregate time series with similar characteristics and patterns into 10 separate clusters. The research confirmed that the use of unsupervised machine learning methods in displacement time series analysis allows the detection of patterns in unstructured data, facilitating the analysis of the observed phenomena.

References:

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