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Developing an open source-based spatial data infrastructure for integrated monitoring of mining areas

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In all phases of mining campaigns, comprehensive spatial information is an essential requirement in order to ensure economically efficient but also safe mining activities as well as to reduce environmental impacts. Earth observation data acquired from various sources like remote sensing or ground measurements is important e.g. for the exploration of mineral deposits, the monitoring of mining induced impacts on vegetation or the detection of ground subsidence. The GMES4Mining project aims at exploring new remote sensing techniques and developing analysis methods on various types of sensor data to provide comprehensive spatial information during mining campaigns (BENECKE et al. 2013).
One important task in this project is the integration of the data gathered (e.g. hyperspectral images, spaceborne radar data and ground measurements) as well as results of the developed analysis methods within a web-accessible data source based on open source software. The main challenges here are to provide various types and formats of data from different sensors and to enable access to analysis and processing techniques without particular software or licensing requirements for users. Furthermore the high volume of the involved data (especially hyperspectral remote sensing images) makes data transfer a major issue in this use case.
To engage these problems a spatial data infrastructure (SDI) including a web portal as user frontend is being developed which allows users to access not only the data but also several analysis methods. The Geoserver software is used for publishing the data, which is then accessed and visualized in a JavaScript-based web portal. In order to perform descriptive statistics and some straightforward image processing techniques on the raster data (e.g. band arithmetic or principal component analysis) the statistics software R is implemented on a server and connected via Rserve. The analysis is controlled and executed directly by the user through the web portal and allows an easy exploration of the data to assess its quality and suitability for a specific task. More complex remote sensing image analysis is performed through 3rd party software, which is dynamically integrated into a Web Processing Service (WPS). With an increasing data volume the transmission becomes a key problem for a WPS processing this raster data. Here the Moving Code principle embedded in the 52North WPS implementation (MÜLLER et al. 2013) is applied to engage this problem by flexibly sending processes to the WPS which is directly coupled with the data on a server. The required parameters to control the processing are entered via an interface within the web portal. The Moving Code approach not only contributes to improving web processing for big data sets but it also makes it easier to integrate external executable programs into a WPS.
As a result the proposed framework of web services and a web portal successfully combines various open source technologies to integrate all of the gathered vector and raster data as well as the analysis methods developed during the GMES4Mining project into a spatial data infrastructure and to enable access to them through a web browser.

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