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Spatial unmixing for environmental impact monitoring of mining using UAS and WV-2

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The three principal activities of the mineral resources mining industry – mining, mineral processing and metallurgical extraction – all produce waste. The environmental impact of these activities depends on many factors, in particular, the type of mining and the size of the operation. The effects of the mining (extraction) stage tend to be mainly local, associated with surface disturbance, the production of large amounts of solid waste material, and the spread of chemically reactive particulate matter to the atmosphere and hydrosphere. Many studies have shown the potential of remote sensing for environmental impact monitoring, e.g., [1]. However, its applicability has been limited due to the inherent spatial-spectral and temporal trade-off of most sensors.
More recently, miniaturization of sensors makes it possible to capture color images from unmanned aerial systems (UAS) with a very high spatial resolution. In addition, the UAS can be deployed in a very flexible manner, allowing high temporal resolution imaging. More detailed spectral information is available from multispectral images, albeit at lower spatial resolution. Combining both types of images using image fusion can help to overcome the spatial-spectral trade-off and provide a new tool for more detailed monitoring of environmental impacts.
Within the framework of the ImpactMin project, funded by the Framework Programme 7 of the European Commission, the objective of this study is to implement and apply the spatial unmixing algorithm, as proposed by [2], on images of the 'Vihovici Coal Mine' area, located in the Mostar Valley, Bosnia and Herzegovina. A WorldView2 (WV2) satellite image will be employed, which provides 8-band multispectral data at a spatial resolution of 2m. High spatial resolution images, obtained by a SmartPlanes UAS, will provide RGB data with 0.05m spatial resolution. The spatial unmixing technique is based on the idea that a linear mixing model can be used to perform the downscaling of the spectral information of the first image to the spatial resolution of the second image. The spatial unmixing technique has shown potential as a fusion approach [2], but has never been tested on real settings at a very high detail, i.e. cm level spatial resolution.

The aim is to demonstrate suitability of the spatial unmixing method on this type of imagery, and to investigate how this can contribute to increase the detail of environmental impact monitoring in the region under study. The results will be presented at the conference.

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