

Applications of UAVs in Mining Geology and Mineral Exploration

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Unmanned aerial vehicles (UAVs) have recently gained popularity in the geosciences because they can be used for the systematic acquisition of georeferenced, high-resolution (mm-scale) aerial photographs at relatively low cost over large surface areas (hundreds of meters to kilometers). UAVs are capable of flying autonomously along predefined routes in order to capture aerial images that can be used for digital photogrammetry. Such a workflow permits the extraction of spatial information from a series of overlapping photographs based on computer vision algorithms. The resulting computed 3-D photorealistic models can provide digital elevation data and be used to accurately measure large amounts of spatial data (i.e., fracture orientations and densities) in a fraction of time compared to traditional geological workflows.

In the near future, UAVs will be equipped with sensors that will collect airborne geophysical and electrooptical data at high resolution. For example, UAV-assisted hyperspectral imaging will accelerate geological mapping and rock classification in open pits without disrupting mining operations. Further advances lie in the realm of automatic to semiautomatic mapping and data extraction. We present results from UAV surveys at various Australian test sites, where detailed spatial information on geological structures was extracted from 3-D photogrammetric models. Additionally, we discuss recent technical and legislative limitations regarding the use of UAVs and give an outlook on future developments with a focus on the application of UAVs in mining geology, exploration, and environmental remediation.