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UAV Data Analysis in the Cloud - A Case Study

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The mapping of fracture networks from aerial photographs, tracing of fault scarps in digital elevation models, and digitisation of boundaries from potential field data is fundamental to many geological applications (e.g. resource management, natural hazard assessment, geotechnical stability etc.). However, conventional approaches to digitising geological features are labour intensive and do not scale.

We describe how we designed an automated fracture detection workflow and implemented it in a cloud environment, using free and open-source software, as part of The Australian Scalable Drone Cloud (ASDC, https://asdc.io) national initiative. The ASDC aims to standardise and scale drone data, then analyse and translate it for users in academia, government, and industry.

In this use case, we applied automatic ridge/edge detection techniques to generate trace maps of discontinuities (e.g. fractures or lineaments). The approach allows for internal classification based on statistical description and/or geometry and enhances the understanding of the internal structure of such networks. Further, photogrammetry and image analysis at scale can be limited by the available computing resources, but this issue was overcome through implementation in the cloud. The simple methods l serve as a basis for emerging techniques that utilise machine learning to fully automate the discontinuity identification and represents an important step in the cultural adoption of such tools in the Earth Science community.

We deployed Open Drone Map (ODM) onto a cloud infrastructure to produce orthophoto mosaics from aerial images taken by UAV to implement this case study. We ported a fracture detection and mapping algorithm from Matlab to Python for the image analysis. The image analysis workflow is orchestrated through a Jupyter Notebook on a Jupyter Hub. The resulting prototype workflow will be used to better scope the services needed to manage the ASDC platform, like user management and data logistics.