Development of 3D point cloud feature extraction methods with drone aerial images for quantitative analysis of topographic and geological structures; an example of Fujikawa-kako fault zone

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In this study, we show the new quantitative analytical method for topographic and geological structures, owing to the development of UAV(Unmanned Aerial Vehicle: drone) and surveying technique such as Network-RTK.
Firstly, we explain the method to construct the 3D-model from aerial images taken by drone. Then, we explain the method to extract characteristics related to topographic and geological structure from 3D-model. We take an example of riverbed outcrop in Fujikawa-kako fault zone.

The Suizin lava layer is exposed in the riverbed outcrop of Iriyamase fault in Fujikawa-kako fault zone. However, there are various theories about its origin. AIST(2016) identifies a lava about 10 km upstream of the Fuji River as Suizin lava and suggests that Suizin Lava may have flowed down the Fuji River from there.

On the other hand, Yamamoto(2014) questions this hypotheisis from the discrepancy between the chemical compositions of the two lava.
We controled the automatic shooting by drone above the both banks of the riverbed, and sampled the pictures of the outcrops. The pictures are taken not only right under but also diagonally(45-60 degrees) from the four points of the compass , thus it is possible to obtain upright wall of outcrop with hight resolution. The location information is recored in an each picture, which is positioned by the RTK mounted on the drone. From these pictures of outcrops, dense 3D point cloud is calculated by using the software metashape(version 6.1). The point cloud is the set of points, whose dimension is six (locationl: latitude, longtitude, altitude, color: red, green, blue). For the region including outcrops (50m x 50m x 10m), the 30 million point clouds (its average distance is 3cm) and 50 million triangle mesh are generated.

In this study, we developed a method to automatically extract the boundary between the lava layer and the underlying gravel layer in the estimated 3D point cloud using computer vision technology. Unsupervised clustering DBSCAN (Ester, Martin, 1996) was performed after performing appropriate pre-processing such as color reduction processing on the point cloud. Its result is almost matched with the result of manual trace.

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