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UAV image classification of a riverine landscape by using machine learning with image processing techniques

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This presentation examined a machine learning with image processing techniques for classifying land cover conditions in UAV (Unmanned Aerial Vehicle) images of a riverine landscape. The UAV images were taken in a river course of Kurobe River, Japan in both November 2017 and 2018, where it had a braided channel with well-vegetated gravel beds. The UAV image analyzed was composed of a RGB, NDVI (Normalized Difference Vegetation Index), and a DSM (Digital Surface Model) of the river geomorphology made from an SfM (Structure from Motion) image processing of the UAV images. In addition, as a preprocessing of a machine learning, the DSM was decomposed into the low/high wavenumber components by a wavelet transform, and further its edges were extracted by a Laplacian filter for effectively utilizing the height difference information in DSM. These characteristic values from UAV images were all used in combination to examine their effectiveness in machine learning for the riverine land cover classification. The machine learning techniques examined in this presentation was RF (Random Forest), and the true values of trees, grasses, bare gravel/sand bed, and water surface in part of the river course were given as a training dataset. The result of the machine learning with the image preprocessing treatment showed that the F-measure, which is consist of precision and recall rates, had high enough above 0.91 in the dataset including all the characteristic values from RGB, DMS, and NDVI into the machine learning algorithm. As for the comparison of effectiveness in each characteristic value in riverine land cover classification, the combination of DSM high wavenumber and DSM edge values made the F-measure higher in trees/grasses classification. Furthermore, the applicability of the machine learning with the image processing techniques examined here were discussed in detail in terms of the calculation time and the quality of input images for accurate classification.