An investigation on image processing techniques for substrate classification based on dominant grain size on RGB images from UAV

M. Shafi*

Laboratory of Photogrammetry and Remote Sensing -Fakultät Vermessung, Informatik und Mathematik, Hochschule für Technik Stuttgart, Germany
*Corresponding author: 42momo1mpj@hft-stuttgart.de

Abstract

Water management, especially considering the ecological health and function of rivers are receiving considerable attention due to their   economic and social impacts. The study of ecological and abiotic processes is the main focus of the field of ecohydraulics, which investigates the river dynamics especially focusing on the changes in river habitats, where the river bed substrate composition is a major abiotic input parameter. The classification of bed substrates is commonly based on the dominant grain size, and is important in a wide variety of contexts; biodiversity and ecological integrity, provision of information for flood defense and flood hazard management, maintenance of stream navigation and sediment transportation, and studies on ecosystem services.

This thesis applies remote sensing technology and advanced image processing techniques for the study of river habitats. The texture parameters are examined using image processing techniques to determine the dominant grain classes of substrate, providing a new method to classify and map the river bed, considering the different regions of submerged, dry exposed and vegetated regions. The study was conducted using high-resolution RGB orthomosaic with 1 cm/px resolution, acquired via a UAV and compared with ground truth mapping data using the dominant substrate to classify each spatial region.

The image cover was classified via application and examination of a variety of pixel-based image classification methods. The highest classification accuracy for pixel based analysis was achieved using the thresholding and masking algorithm which achieved an overall 97% correct classification. For measurement of substrate classes, object-based image classification was applied, where the texture parameter was applied by using different gray level co-occurrence matrix (GLCM) in all directions. The classification accuracy for segmentation-based-classification obtained, was found to be lower, at 61%.