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TOPIC: Drone images and Structure from Motion (SfM) as future tools for large-scale determination of grain size compositions

Advisor

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Keywords

Drone images, grain size distribution, machine learning, gravel bed rivers, Structure from Motion (SfM)

Introduction and background

The grain size distribution of gravel bars is an essential parameter for assessing the morphological conditions of rivers. Also, as an input parameter for numerical investigations, this insight is of high importance. However, obtaining of grain size distributions, especially along river stretches, is time-consuming and labour-intensive. Therefore, this study investigates whether it is possible to obtain grain size distributions for an entire river section by using drone images and SfM technology. By using a machine learning approach, it will be investigated how many sediment samples are necessary as a training data set to obtain reliable grain size distribution for a gravel bar and if these training data sets may be used for an entire river stretch.

Research goals and Methods to be used

First, the PhD candidate shall review key and state-of-the-art literature on Structure from Motion (SfM) to become familiar with this research area. Simultaneously, a literature review on drones (e.g., flight height and or speed) and the resolution of the implemented GPS systems shall be conducted. Based on the findings an artificial test bed will be elaborated at the



hydraulic laboratory, and a commercially available DJI drone will be used for the first investigations. Comparisons with data obtained by a laser scanner will be made to quantify the accuracy. Here a special focus is set on the influence of the flight altitude on the accuracy of the results, also depending on the grain size distribution. Based on these findings field investigations will be performed to test the newly gained knowledge and for obtaining data for further post-processing. Data sets include drone images from different gravel bars and different rivers, as well as manually obtained grain size distributions. Based on a machine learning approach the number of necessary training data sets will be investigated in order to achieve good results. In a final step, the transferability will be investigated and an answer should be given on the question if these training data sets can be used for other gravel bars in the same water body, or whether they can even be transferred to other water bodies.

Research environment

The PhD candidate will conduct experiments in the hydraulic laboratory at IWS as well as in the field. Besides, the student will become part of an interdisciplinary working group consisting of post-docs and doctoral students that conduct research on morphological processes in rivers.

Prerequisites

Good knowledge in statistics, sediment transport and programming is required.

Contact for questions

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