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Using drone images to create Digital Surface Models for coastal monitoring

An automated Unmanned Aerial Vehicle – Structure from Motion pipeline to create analysis-ready Digital Surface Models for coastal monitoring

As human population continues to increase near coasts, coastal erosion events have become more severe. It is therefore important to monitor the coastline to prevent human loss and minimize economic and environmental consequences. To do this, a model of the study area needs to be created detailing the elevation as accurately as possible, a digital surface model. Individual digital surface models from different times can then be compared to identify the effect coastal erosion has upon a study area if an identical workflow is used.

Drones provide a both flexible and cost-efficient method to capture a study area. These individual images can then be 'stitched together' using photogrammetry to derive the elevation of the study area. By fully automating this workflow, repeatability can be ensured making the digital surface models comparable. Besides writing a python script, it was required to mask out water and identify ground control points to fully automate the workflow. Ground control points describe points on the ground with known coordinates that are visible on the images. This allows to transform image, pixel, coordinates to real-world coordinates. Water moves constantly, making it difficult to calculate elevation accurately using photogrammetry. Artificial Intelligence was therefore used to train a model capable of identifying water in a drone image. Lastly, a multitude of settings within the photogrammetry software were analysed to optimize the accuracy of the digital surface models created.

The final digital surface models achieved a root mean square error of 3 – 4 cm, proving a very high accuracy and confirming high accuracies achieved in other studies using similar approaches. It was further shown that it is very important to use appropriate settings within the photogrammetry software Agisoft Metashape. When using the fully automated approach described in this paper, the automatic identification of ground control points remains a difficulty. The results showed that the approach is promising, but the points could not be identified as accurate as when identifying them manually.

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