Institut für Photogrammetrie
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Integrating Geometric Knowledge into Deep Learning for Dense Stereo Matching

Proposal for a Master thesis topic (DE/EN)

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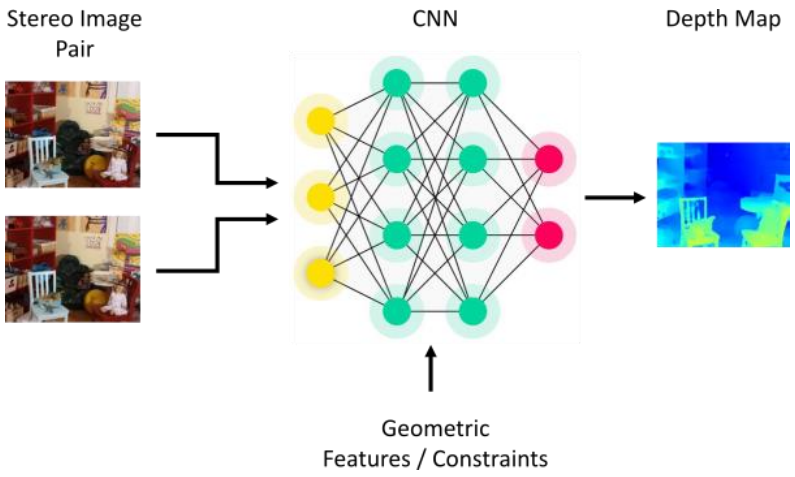
The reconstruction of depth information from one image pair is a classical task in photogrammetry as well as in computer vision and the minimal case of the well-known structure from motion problem. It refers to the concept that 3D structures can be recovered from the projected 2D motion field of a scene acquired with a moving sensor. A special case of this task is dense stereo matching, which determines depth for every or at least a large majority of pixels within a stereo image pair. In recent years, especially deep learning-based approaches have shown convincing results accomplishing this task. However, this kind of methods are often mainly data driven. In consequence, such methods tend to generalise badly to different sets of data and, in addition, they often learn geometrical principles from scratch, which are basically well-known.

The objective of this master thesis is to develop a methodology, which allows to integrate geometric knowledge on the task of dense stereo matching into a Convolutional Neural Network (CNN) trained end-to-end. In more detail, it is to be investigated if the ideas of existing hand-crafted approaches can be used to improve the performance of a CNN-based method. For this purpose, a concept has to be developed to apply these ideas to the architecture or training procedure of an existing CNN. The developed approach is to be examined with respect to its effects on the characteristics of the CNN, such as changes in accuracy, in the amount of necessary training data or in the ability to generalise to data not seen during training.



This thesis will be supervised by Max Mehltretter.

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