Institut für Photogrammetrie
und GeoInformation

Leibniz Universität Hannover

Institut für Photogrammetrie und GeoInformation,
Nienburger Straße 1, 30167 Hannover

CNN-based Uncertainty Estimation for Dense Stereo Matching

Proposal for a Master thesis topic (DE/EN)

In recent years, various deep learning-based approaches have been presented in the literature to assess the uncertainty associated to depth in the context of dense stereo matching. One of the most promising directions is the estimation of uncertainty based on features from three-dimensional cost volumes. Such a cost volume is created as part of most dense stereo matching procedures and contains the pixel dissimilarity of all potential correspondences. This information allows to assess the uniqueness and localisation accuracy of a potential match and thus to draw conclusions regarding the uncertainty of a disparity / depth estimate resulting from the matching process. However, prior to the introduction of deep learning-based approaches, various methods were presented combining different types of features, for example, via linear aggregation or based on a random forest. Such combinations have regularly shown to significantly improve the accuracy of the estimated uncertainty compared to the use of a single feature type.

The objective of this master thesis is to investigate whether such a combination of different feature types is also advantageous in the context of Convolutional Neural Networks (CNNs). The basis for this investigation is given by a CNN used to predict uncertainty via cost volume-based features. In a first step, additional types of features are to be identified and assessed with respect to their potential for adding valuable information. Afterwards, a concept is to be developed to consider all selected features within one CNN architecture, allowing to learn the task of uncertainty prediction in a consistent and reasonable way. The developed approach is to be evaluated with respect to the quality of the predicted uncertainties using different datasets to investigate the suitability of the employed feature types as well as the approach's general validity.

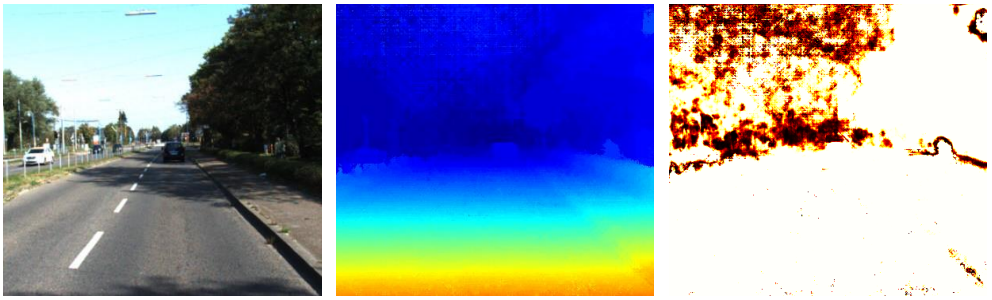

Figure 1: Example from the KITTI 2015 stereo dataset. From left to right: Left RGB image, depth map (close objects in orange to far away ones in blue) and uncertainty map (small uncertainties in white to high ones in black).

This thesis will be supervised by Max Mehltretter.

Nienburger Straße 1, 30167 Hannover
Fakultät für Bauingenieurwesen und Geodäsie

Institut für Photogrammetrie
und GeoInformation

Prof. Dr.-habil. Christian Heipke

Max Mehltretter, M.Sc.

Tel.+49 511 762-2981
Fax +49 511 762-2483
E-Mail:
mehltretter@ipi.uni-hannover.de

Besucheradresse:
Nienburger Straße 1
30167 Hannover
www.ipi.uni-hannover.de