Institut für Photogrammetrie
und GeoInformation

Leibniz
Universität
Hannover

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

Fresh concrete characterization based on image sequences of the concrete mixing process using Deep Learning

Proposal for a Master thesis topic (DE/EN)

Nienburger Straße 1, 30167 Hannover
Fakultät für Bauingenieurwesen und Geodäsie

Institut für Photogrammetrie
und GeoInformation

Prof. Dr.-habil. Christian Heipke

M.Sc. Maximilian Meyer

Tel. +49 511 762-3931
Fax +49 511 762-2483
E-Mail: meyer@ipi.uni-hannover.de

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Concrete is one of the most widely used building materials in the construction industry - in Germany alone, several million tons of concrete are mixed and used every year. The quality of the fresh concrete is decisive for the quality of the building. However, today's quality assurance measurements only take place on the construction site, which means that if there are deviations from the target properties, the concrete must be discharged and a new one produced. If the properties of concrete could already be determined during its production, it would be possible to control the concrete to the desired properties with suitable additives.

The properties of the concrete influence its flow behaviour around obstacles. An obstacle can also be an object that moves through the concrete and thus sets it in motion like the paddle in the mixer. To predict the properties, one possibility is to observe the flow behaviour of the concrete and to derive the properties of the concrete based on the observations. As part of the thesis, a neural network (e.g., Recurrent Neural Network (RNN), long short-term memory (LSTM) or transformer-based models) should be trained to predict the fresh concrete properties. A data set consisting of image sequences taken of the concrete during the mixing process is available for training. The image sequences contain orthophotos and depth elevation maps (DEM) of the mixing process.

Good programming skills are a prerequisite. Experience with the deep learning packages such as pytorch is a great advantage, as is prior knowledge of image analysis. The thesis can be written in German or English and will be supervised by Maximilian Meyer M.Sc.

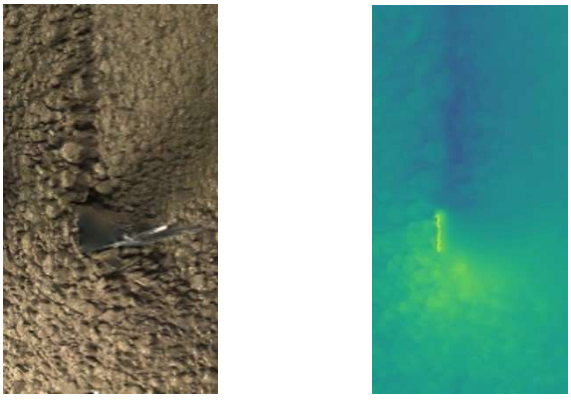

Figure 1: Orthophoto (left) and depth elevation map (right) of the mixing process.

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