ETH zürich

Automatic object detection to analyze the geometry of gravel grains – a free stand-alone tool

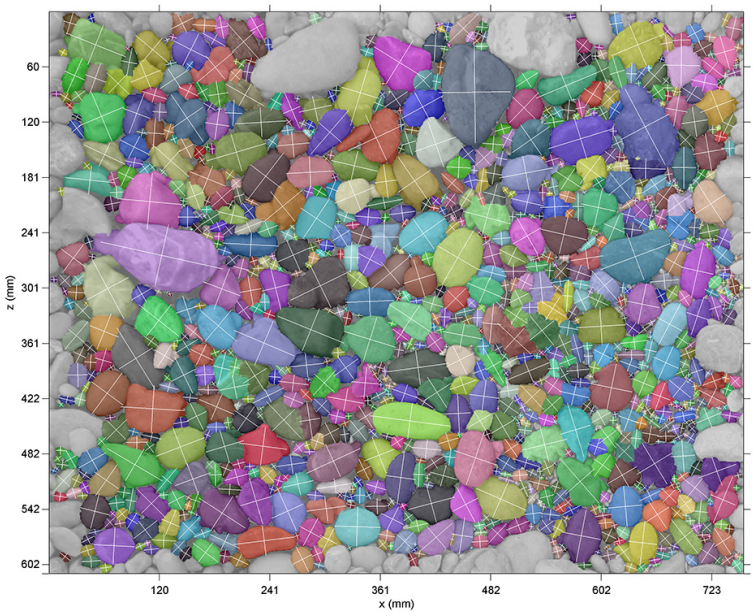

Figure 1: Automatically detected grain areas

Within this project, an automated procedure is developed to estimate the grain size distribution of a gravel bed by analyzing a digital top-view photograph of it. The MATLAB based methodology is inspired by an approach originally developed at Loughborough University, but optimized to obtain a more precise separation in different area elements referring to top view areas of single grains. Moreover, a graphical user interface will enable semi-automatic control and optional correction of the detected elements.

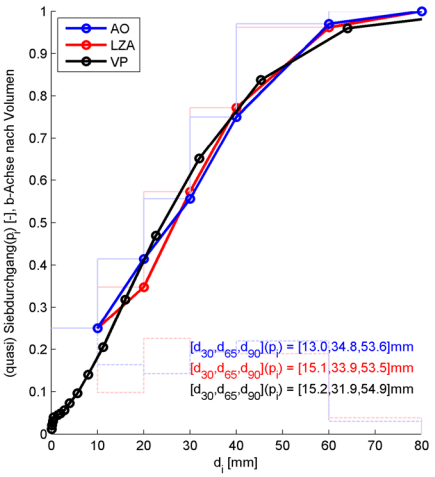

Figure 2: Derived grain size distribution

The surface area of each grain is replaced with an ellipse of the same normalized second central moments. Fig. 1 shows an exemplary result of the acutal test version of the optimized VAW-intern MATLAB-Code. Here, each area detected as a single grain-element is color-coded differently. The main axes are highlighted in white. The grain-by-number statistic of the minor axes lengths is transformed by Fehr's (1987) method to obtain a quasi-grain size distribution in volume percent – a depiction as typically given by a classical laboratory sieve analysis - in opposite to a grain-by-number statistic as gained originally from the object detection. The grain size distribution of the subsurface layer is determined by using an empirical estimation of the percentage of non-detected finer grains. As shown in fig. 2, the grain size distributions obtained by automatic object detection ('AO', in blue), in-situ line sampling analysis ('LZA', in red) and laboratory sieving of a volume sampling ('VP', in black) are in a good agreement concerning the essential geometric parameters.

The time effort for a grain size analysis by automatic object detection is only at a fraction of the time needed for classical methods. A further benefit is that additional parameters can be provided for each grain such as: ratio of minor axis/major axis, area, perimeter, center coordinates, and the grain orientation in a horizontal plane. Factors which may decrease the quality of the results are: cast shadowing, high percentage of fine material, partly wetted or partly covered stones, and intra-granular textures.

Free access to the newly developed stand-alone tool named BASEGRAIN 1.0 including a graphical user interface (GUI) is given since 2012/08/10.

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