Master project (MP, 5 ECTS)

Working title	Automated determination of geometric block parameters from coloured photographs with Matlab

Description

In Block-in-Matrix (BIM) structures the geometric block parameters can have a significant influence on the overall strength and deformational behaviour. Besides the spatial distribution of blocks, these parameters are:

- Shape of block (e.g. elongated, cubic, platy, spherical, elliptical)
- Ratio between largest and smallest dimension of the block
- Block volume
- Block orientation

For each geometric parameter the frequency distribution in the investigated ground volume is of interest. With the distributions the effect the rock blocks on the mechanical properties of the matrix material can be investigated qualitatively using empirical relationships.

During the excavation of an underground structure, several possibilities exist to measure and/or to calculate the geometric block parameters (e.g. examination of rock cores, analysis of excavated material). However, these possibilities are very laborious. As the face is documented in detail after each excavated round, the documentation itself as well as all photographs taken from the exposed rock mass could provide enough data for post processing.

With Matlab the geometric block parameters shall be extracted from coloured images. A code has to be written, which allows the user to analyse the geometric block parameters in a semi-automatic way (interference by the user if necessary only, most of calculations shall run automatically). As photographs are two-dimensional only, the parameters to be determined are:

- Block area
- Spatial distribution of blocks in 2D
- Shape of blocks in 2D
- Ratio between largest and smallest dimension of blocks in 2D
- Orientation of blocks in 2D

Figures below (from [1]) show exemplarily how the results of image processing can look like.
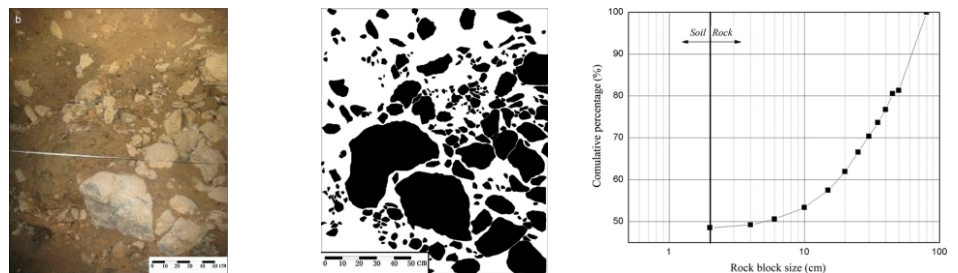
Existing Matlab packages (e.g. Image Processing Toolbox, Statistics and Machine Learning Toolbox) should be used. The Matlab code has to be evaluated with several photographs and potential limitations of the code have to be highlighted.

Requirements	Good skills in Matlab
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Start / Duration	Immediately / max. 120 hours
Literature	[1] Wen-Jie, X., Qiang, X. and Rui-Lin, H. 2011. Study on the shear strength of soil-rock mixtures by large scale direct shear test. International Journal of Rock Mechanics & Sciences 48(8), pp. 1235 – 1247.