Geothermal Energy Group
Göttingen

Geoscience Centre
University of Göttingen

Close-range sensing workflows in Structural Geology based on open-source/open access solutions

Bianca Wagner & Bernd Leiss

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Data acquistion

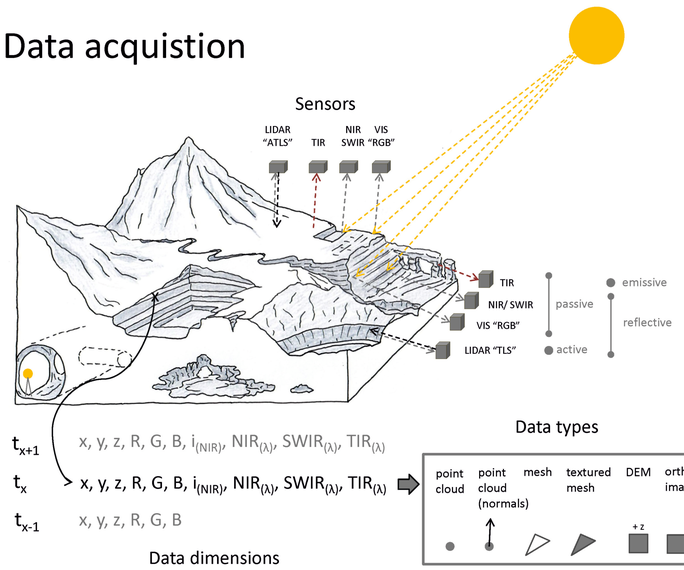
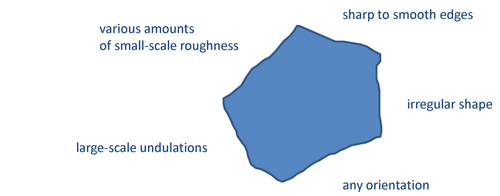
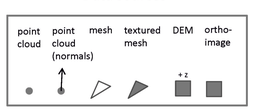


Figure 1: Schematic sketch illustrating typical geological outcrops (horizontal, vertical or mixed) and applicable aerial and terrestrial sensor types as well as resulting data dimensions and data types of digital outcrop models (DOMs)

Fracture network extraction



Data sources



Starting points

on the plane
or
at the edges

Preprocessing

smoothing
noise removal
decimating
or nothing

Figure 2: Schematic sketch illustrating initial conditions, challenges, data sources and analysing strategies of fracture network extraction.

Background

In Structural Geology, many projects start with intensive field-based data acquisition campaigns, which might be performed in quite different types of natural or artificial outcrops. For some years, this field work has been substantially influenced and transformed by various close-range sensing techniques that allow the field geologist to create a digital outcrop model (DOM) and to take along plenty of geometrical and spectral information about the outcropping rocks.
In general, DOMs can be utilized for outcrop visualisation, documentation, manual outcrop analysis ("point-picking"), extraction of spectral data and/or semi-automatic extraction of geometric data. Within a structural investigation DOMs might be deployed for fold analysis, fault analysis, extraction of fracture networks, fracture roughness estimation, detection of neotectonic activities or digitisation of geological features for 3D-models of various scales resulting in a large number of analysing techniques.
Latter might be carried out on point clouds or meshes (with or without spectral information) and may differ in pre-processing and processing steps as well as in software solution. Therefore, the analysing structural geologist faces various tools, data formats, file types, operations and outcomes. Our investigation focus on the compilation of useful, transparent, sustainable and comparable workflows or "pipelines", which can be executed by open-source/open-access solutions.

Thematic workflows

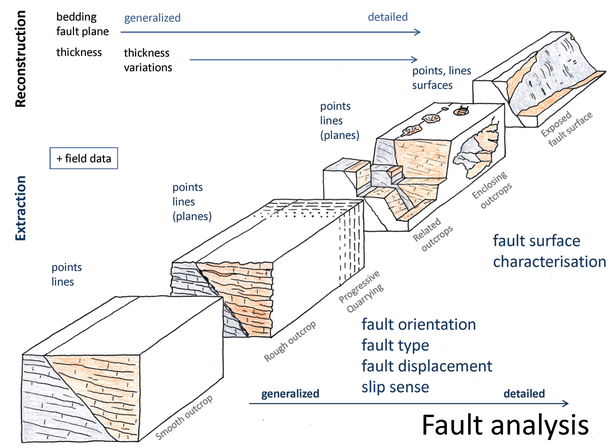


Figure 3: Schematic sketch illustrating common geological outcrop types exposing extensional faults and extractable 2D and 3D objects.

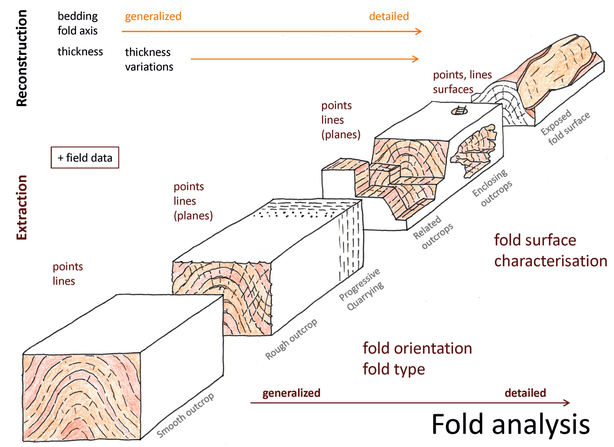


Figure 4: Schematic sketch illustrating common geological outcrops exposing fold structures and extractable 2D and 3D objects

Geoscience Centre, University of Göttingen, D-37077 Göttingen, Germany, bwagner1@gwdg.de