

Towards model-based quaternary geomorphological mapping in Norway: one thematic map at the time

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The mounting costs of geohazard-induced damage and the rising demand for mineral resources increase the need for reliable geological maps in Norway. However, due to the time-consuming mapping process, the wide diversity in landscapes and the large areas to cover, nationwide coverage of detailed maps remains out of sight. Especially geomorphological mapping relies heavily on manual interpretation of digital terrain models (DTMs), a step that can be subdivided and enhanced by machine learning. Ideally, this approach results in various model-based nationwide thematic maps, with examples being general sediment distribution, sediment thickness, and landforms.

In this study, sediment distribution and alluvially dominated fan-landforms are modeled using a UNet-based semantic segmentation approach with training data from both legacy databases and newly labeled samples. Sediment thickness was modeled using a pixel-based regression random forest trained on legacy point observations from various databases, coupled with the sediment distribution map and several DTM derivatives as covariates. While the models are rooted in conventional methods, this contribution aims for an honest, data-centric discussion on recurring issues in the development of such thematic maps. This includes, among others, the effect of incomplete training data, label ambiguities, spatial resolution, and the use of legacy versus newly sampled data on model training and their outcomes. By addressing these methodological issues with their potential solution, we share a practical perspective on ongoing model development for geological mapping in general and geomorphological mapping in particular.