# Quality control of 3D Geological Models using an Attention Model based on Gaze

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The Geological Survey of the Netherlands (GSN) produces 3D stochastic geological models of the upper 50 meters of the Dutch subsurface. The voxel models are regarded essential in answering subsurface questions on, for example, aggregate resources, groundwater flow, land subsidence studies and the planning of large-scale infrastructural works such as tunnels. GeoTOP is the most recent and detailed generation of 3D voxel models. This model describes 3D lithological variability up to a depth of 50 m using voxels of 100*100*0.5m.

Due to the expected increase in data-flow, model output and user demands, the development of (semi-)automated quality control systems is getting more important in the near future. Besides numerical control systems, capturing model errors as seen from the expert geologist viewpoint is of increasing interest. We envision the use of eye gaze to support and speed up detection of errors in the geological voxel models. As a first step in this direction we explore gaze behavior of 12 geological experts from the GSN during quality control of part of the GeoTOP 3D geological model using an eye-tracker. Gaze is used as input of an attention model that results in 'attended areas' for each individual examined image of the GeoTOP model and each individual expert. We compared these attended areas to errors as marked by the experts using a mouse.

Results show that: 1) attended areas as determined from experts' gaze data largely match with GeoTOP errors as indicated by the experts using a mouse, and 2) a substantial part of the match can be reached using only gaze data from the first few seconds of the time geologists spend to search for errors.

These results open up the possibility of faster GeoTOP model control using gaze if geologists accept a small decrease of error detection accuracy. Attention data may also be used to make independent comparisons between different geologists varying in focus and expertise. This would facilitate a more effective use of experts in specific different projects or areas. Part of such a procedure could be to confront geological experts with their own results, allowing possible training steps in order to improve their geological expertise and eventually improve the GeoTop model. Besides the directions as indicated above, future research should focus on concrete implementation of facilitating and optimizing error detection in present and future 3D voxel models that are commonly characterized by very large amounts of data.