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Interpretation and mapping of geological features using mobile devices for 3D outcrop modelling

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Advances in 3D digital geometric characterisation have resulted in widespread adoption in recent years, with photorealistic models utilised for interpretation, quantitative and qualitative analysis, as well as education, in an increasingly diverse range of geoscience applications. Topographic models created using lidar and photogrammetry, optionally combined with imagery from sensors such as hyperspectral and thermal cameras, are now becoming commonplace in geoscientific research. Mobile devices (tablets and smartphones) are maturing rapidly to become powerful field computers capable of displaying and interpreting 3D models directly in the field. With increasingly high-quality digital image capture, combined with on-board sensor pose estimation, mobile devices are, in addition, a source of primary data, which can be employed to enhance existing geological models. Adding supplementary image textures and 2D annotations to photorealistic models is therefore a desirable next step to complement conventional field geoscience.

This contribution reports on research into field-based interpretation and conceptual sketching on images and photorealistic models on mobile devices, motivated by the desire to utilise digital outcrop models to generate high quality training images (TIs) for multipoint statistics (MPS) property modelling. Representative training images define sedimentological concepts and spatial relationships between elements in the system, which are subsequently modelled using artificial learning to populate geocellular models. Photorealistic outcrop models are underused sources of quantitative and qualitative information for generating TIs, explored further in this research by linking field and office workflows through the mobile device.

Existing textured models are loaded to the mobile device, allowing rendering in a 3D environment. Because interpretation in 2D is more familiar and comfortable for users, the developed application allows new images to be captured with the device's digital camera, and an interface is available for annotating (interpreting) the image using lines and polygons. Image-to-geometry registration is then performed using a developed algorithm, initialised using the coarse pose from the on-board orientation and positioning sensors. The annotations made on the captured images are then available in the 3D model coordinate system for overlay and export. This workflow allows geologists to make interpretations and conceptual models in the field, which can then be linked to and refined in office workflows for later MPS property modelling.