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Innovative Methods for Deriving Geotechnical Features from Drill Core Scanning

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Accurate geotechnical data is fundamental to the mining industry, directly impacting operational safety and economic feasibility in both surface and underground mining environments. Understanding subsurface conditions enables safe extraction of ore while maximizing value and minimizing execution risk. Knowledge of these conditions is largely derived from drill core data (supplemented by surface observations, historical records, and geophysical surveys).

At GeologicAI, our focus is the extraction of geotechnical parameters from scanned drill core using advanced sensor technologies and integrated analytics platforms. Our system integrates multiple scanning instruments, including LiDAR, RGB imaging, wet photography, Short-Wave Infrared (SWIR), Visible-Near Infrared (VNIR), X-Ray Fluorescence (XRF), and magnetic susceptibility ("mag sus"). GeologicAI has anchored its geotechnical pipeline on LiDAR-based segmentation, which enables consistent classification of core segments as competent or rubble and automatically detects presence and positions of discontinuities. Using dense point cloud data, an algorithm detects changes in surface geometry to infer fractures and discontinuities, which are then verified through human quality control. Once segmented, parameters of interest such as Total Core Recovery (TCR), Rock Quality Designation (RQD), Solid Core Recovery (SCR), joint properties (including roughness and infilling), alteration, and structural measurements of discontinuities can be estimated with the aid of complementary RGB, SWIR, VNIR, XRF, and mag sus sensors. Validation against traditional methods (manual logging and televiewer data) by several major clients has shown strong agreement with this novel system.

By developing and deploying unified tools for auto-segmentation, lithology classification, mineral mapping, and geotechnical interpretation, complete rock mass characterization can be achieved with few other inputs (e.g. compressive strength, groundwater conditions). Through its modular, sensor-integrated approach, GeologicAI aims to transform geotechnical workflows into a high-throughput, standardized, scalable and reproducible process, thereby advancing safety, interpretability, and efficiency across the mining value chain.