Automated Drillhole Target Generation for In-mine Grade Control and Out-of-Sample Resource Definition Using Site Models and Economic Constraints

Farzi Yusufali, Ilia Sucholutsky
Stratum, Toronto, ON, Canada

Producing optimally-placed drilling targets for in-mine and out-of sample exploration automatically can be valuable for reserves expansion and testing potential areas of mineralization quickly, especially when mine topography changes daily. In this paper, we propose a protocol that accepts a block model, topography map, depletion model, infrastructure files, and constraints to produce a predetermined number of drill targets that are compatible with the existing infrastructure (including underground mines) and optimized for Measured confidence with statistical safeguards included. We demonstrate this on an orogenic lode gold mine where the nugget effect is extremely high; the protocol applied to this mine resulted in over 40,000 oz of gold verified across five clusters with Measured confidence with a 2500m drilling program. Roughly 80% of drillholes hit economic mineralization and extended over 2 blocks with an average grade of almost 4g/T. Given the 60% hitrate baseline for only in-mine exploration performed by the site, this method demonstrated resilience against high grade variance in adjacent blocks and applicability to in-mine grade control and resource definition in Inferred regions of the asset.
The constraints accepted were tuned to the high grade variability within adjacent blocks, limited number of short-range drillholes, existing underground infrastructure, and physical constraints of the drill itself. Cut-off grade, maximum drillhole length, maximum angle for drill deviation, minimum spacing between drillholes, and minimum angle between the strike and drillhole, and stopes locations are also accepted as inputs. Alongside the drillhole pad location and orientation outputs, a rank is also assigned to each drillhole that quantifies the amount of verified oz per meter (in total and Measured confidence) using the reference resource model fed into the protocol.