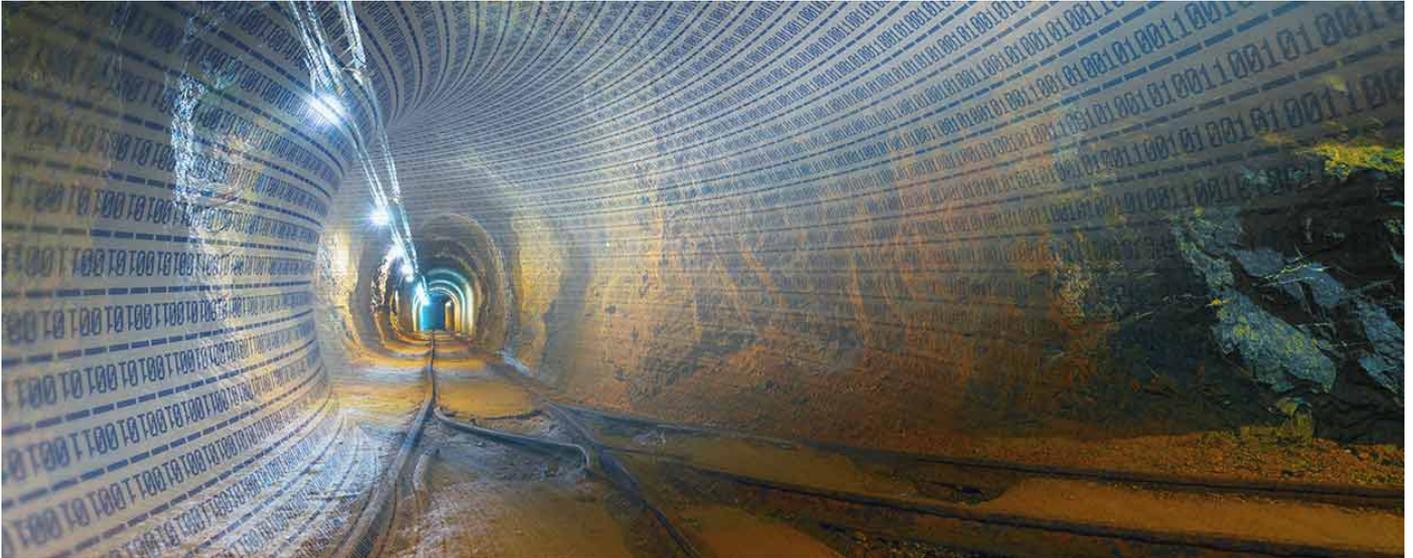


# How Golder Used Machine Learning to Help a Gold Mine Optimize Operations



## Project Info

Client

Confidential Mining Client.

Location

US

## Description

As a subset of Artificial intelligence (AI), the capabilities of Machine Learning (ML) have improved significantly, allowing companies to optimize and improve a wide range of business operations. Mining companies are no exception and are taking advantage of ML to improve their operations and production — from predictive maintenance to achieving interoperability within different operational teams. Successful ML programs most commonly result in huge efficiencies in both time and resources. Ultimately, this produces financial savings, so it's little wonder why ML is so desirable for the mining industry.

## The project challenges

For the past 12 months, Golder has been working on an innovative ML project to assist a client in their gold-mining operations. In fact, the project was the first of its kind to be awarded Golder Innovation Project funding. (Golder's Innovation Program is aimed at supporting innovation in all its forms, from breakthrough technologies to incremental improvements to existing services we provide to our clients.)

The project focused on solving a common problem in mines — the sorting of materials into appropriate categories for processing and waste. A client who was commencing operations at a mine in the US approached Golder for assistance. The client and Golder personnel had common connections in academia, and when the client realized that Golder had integrated ML into other mining clients' operations, they reached out.

The client wanted assistance developing a more efficient and accurate method for grade control using hyperspectral mineralogy – a form of spectral imaging that senses the electromagnetic spectrum and detects minerals. Specifically, the client wanted to know whether Golder could build an automated workflow for the classification of scanned core based on the images produced from hyperspectral scanning. They were interested in three classifications:

- Heap leach material for gold extraction
- Materials for further mill processing
- Waste materials
- A collaborative effort

The Golder team was confident in their ability to create successful ML solutions to help the client improve efficiency with the use of image processing and computer vision. In order to access the top expertise and achieve the best cutting-edge solutions for the client, Golder worked alongside other innovative companies as well.

Software stacks and teams of people worked closely to support the project:

- Golder deployed their machine learning team with programming expertise and made available subject matter experts (SMEs) in geochemistry, geomechanics, mineralogy, and others.
- Microsoft brought support and knowledge from their AI teams, as well as access to the Microsoft Azure cloud platform, combined with Databricks distributed cluster computing and Custom Vision Service.
- TerraCore supported with in-depth geospectral-imaging expertise

With this collaborative approach, Golder was able to deliver the best possible solution to the client.

## The ultimate solution

A common challenge, well-known across the industry, stems from depth registration issues in core boxes. Although field engineers and technicians follow standardized procedures to meet the relevant quality requirements, inconsistencies often arise. These inconsistencies often come from the variable lengths of rock column samples, drilling cores getting washed out or lost, or inconsistent spaces within the core boxes. With a strong collaborative team across respective industries, however, Golder and their collaborators were able to come up with novel processes to resolve these registration issues. The resulting data was much more consistent.

In the end, the project team led by Golder subject-matter experts were able to:

- Upload hyperspectral images of material samples to Azure Cloud
- Merge the images with other metadata such as elemental assay, mineralogy, and lithology for classification
- Train neural network algorithms to analyze all data for classification
- Build a cloud-based workflow for the ingestion, processing, and analysis of hyperspectral core scanned images leading to predictive grade control

Through these learnings, new core logging procedures have been developed for Golder's ongoing and future drilling programs where use of digital core scanning and image processing is foreseen for automation process. This helps to avoid significant efforts required to fix the depth registration and other associated issues for further data analysis.

## A positive outcome

Images and data were divided into training and testing sets, and the team was able to successfully use machine learning to classify materials. As a result, the client will save time and resources on their material classification process, resulting in significant financial savings. In addition, the ML classification process is consistent and more accurate than a similar process done by hand, resulting in a more valuable product with far less wasteful labor. Ultimately the solution is a true win-win scenario.

