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Demystifying Machine Learning in Geoscience – A Pragmatic Approach to Modern Geoscience

Geoscience is experiencing the machine learning (ML) and artificial intelligence (AI) revolution, similar to every facet of society. However, geoscience has many different data types (geochemical compositions, geophysical values, rock descriptions, structural measurements). Some measurements are interpreted by the human eye (abundance of minerals) and others are measured down to the parts per billion by analytical equipment. When we compile all these measurements together, we often use them to risk thousands to millions of dollars. Because of this, there is some resistance in the adoption of AI methods in favour of spending more time looking at rocks and less time listening to computers. This talk will hopefully bring the geoscience community together by demystifying machine learning, understanding its limitations, and discussing how we might move forward as geoscientists in a world where AI is at the forefront of society. To demystify machine learning, we'll break down its fundamental tasks into three types of problems: regression, classification, clustering, and see how various algorithms may treat the same problem and what that means to understanding the underlying geology. To understand its limitations, we'll look at how we test and score the output of these algorithms. And finally, to see how we move forward, we'll talk about the needs of the exploration industry and how we can leverage these methods to help us achieve our goals. Importantly, all with no math! Machine learning offers new ways to speed up exploration workflows and derive new insights into previous data, but ultimately needs accurate and insightful geological data to analyze. Most importantly, time needs to be spend analyzing the inputs and output of these models to ask ourselves, why the algorithm did what it did, and if that makes sense with the geology. This moves our use of these techniques from artificial intelligence to “collective intelligence”.