SEG 2022 Conference: Minerals For Our Future

---

# 3D Locally Varying Anisotropy Fields Produced Automatically From Sparse, Continuous Numeric Point Data

Alexander M. Wilson, Ali Mohammad Mehr, Samuel F. Cantor
Minerva Intelligence, Vancouver, BC, Canada

Geological phenomena often do not conveniently fit into a stationary random function model. Structural deposit influences such as folding, faulting, and non-linear fluid interactions may result in deposit complexity that is challenging to model accurately, particularly when using statistical interpolation techniques that rely on distance-organized points as input (e.g., kriging).

We present a novel machine learning method that can automatically quantify three-dimensional, locally varying anisotropy (LVA) fields directly from unprocessed (sparse) continuous numeric point data. The method utilizes an overlapping, moving window to repeatedly sample input data subsets and applies a directional continuity mapping algorithm that can determine the optimal anisotropy ellipsoid configuration (i.e., orientation, shape, and size) for each subset area. The algorithm can manage the presence of discrete, sub-parallel features of interest and adjust for missing data and data boundaries by trending towards a conservative isotropic case. The generated LVA fields may be used to i) guide structural and geometric exploratory data analysis of complex systems, and ii) inform more realistic 3D block model estimations that can dynamically adjust the sample search neighbourhoods and predictive weightings to account for the local changes in anisotropy.

Ultimately, our method represents an important step towards a reliable and accurate semi-autonomous geologic modelling system that is capable of seamlessly capturing the nuances and complexity inherent to many geologic systems.