

GSA Connects 2023 Meeting in Pittsburgh, Pennsylvania

Paper No. 221-5

Presentation Time: 9:15 AM

USING DEEP NEURAL NETWORKS AND DATA FUSION TO ASSESS RELATIVE DEGREES OF CHEMICAL AND PHYSICAL WEATHERING OF ALLUVIAL FANS: AN EXAMPLE FROM SOUTHEASTERN CALIFORNIA

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Alluvial fans are a commonly used landform in arid regions for assessing the climatic and tectonic history of a region. Physical and chemical processes shape the evolution of these surfaces, with distinct properties visible in various remote sensing datasets, specifically surface roughness and spectral reflectance. These properties are widely used to delineate individual relative age units, but this is labor-intensive and requires a trained interpreter and can be highly subjective. Efforts to integrate relative age into a framework that integrates sensed surface properties with directly measured surface ages should ideally minimize any subjectivity. Machine learning processes offer enhanced methods to solve classification related tasks on imaged properties. Specifically, deep neural networks (artificial neural networks with multiple layers) have seen wide application for the interpretation of remote sensing data for classification, segmentation, identification, and regression tasks. These processes offer new opportunities to analyze landforms in a systematic manner that takes full advantage of numerous datasets that characterize different processes.

In southeastern California, we have ongoing efforts to characterize the age of inaccessible faulted landforms along portions of the Garlock and associated faults. While ultimately, we expect to link remote sensing properties with absolute age measurements, an intermediate task is producing a classifier that can consistently classify segments of alluvial fans and slopes. Using a training dataset produced by a trained interpreter, we built a classifier to segment areas of different relative age using NAIP 4 band VNIR (Visual-Near Infrared) imagery, ASTER, Landsat 8/9, and Sentinel 2 multispectral VNIR-SWIR (SWIR: Shortwave Infrared) imagery, L-band (~23 cm wavelength) PALSAR and C-band (~5.6 cm wavelength) Sentinel-1 backscatter intensity, and surface roughness metrics calculated from ~5 pt/m² aerial LiDAR. For this, we assessed the accuracy of multiple commonly applied published deep learning networks, such as ResNet, DenseNet, Vision Transformer, and InceptionNet. This methodology will be incorporated into a model linking the surface absolute age with the same remote sensing data.

Session No. 221

[T103. Sedimentary Archives of Mountain Building from the Fault-Scarp to the Range-Front: Interpreting Colluvial Wedge and Alluvial Fan Systems](#)

Wednesday, 18 October 2023: 8:00 AM-12:00 PM

321 (David L Lawrence Convention Center)

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