Deep Learning Applications in Exploration Geophysics: A Review

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In exploration geophysics, deep learning (DL) has become a game-changing technique, providing innovative solutions to challenging problems in resource estimation, subsurface imaging, and the interpretation of geophysical data. Recent developments in DL methods for processing, inverting, and interpreting seismic data are highlighted in this study, along with how they are integrated into geophysical processes. The use of generative adversarial networks (GANs) for the creation of synthetic data, recurrent neural networks (RNNs) for temporal analysis in geophysical time series, and convolutional neural networks (CNNs) for the extraction of seismic features are important advancements. DL has greatly improved resolution, accuracy, and computational efficiency in geophysical activities by utilizing big datasets and high-performance computers. Nevertheless, issues including interpretability, the lack of labeled data, and the requirement for domain-specific modifications still exist. By increasing exploration efficiency and lowering environmental impact, DL can help ensure the sustainable use of natural resources and open the door for creative geophysical solutions, as this paper highlights.

Keywords: Deep Learning; Geophysics; CNN; GAN; Exploration Geophysics