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Machine Learning in Earthquake Seismology

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Abstract

Machine learning (ML) is a collection of methods used to develop understanding and predictive capability by learning relationships embedded in data. ML methods are becoming the dominant approaches for many tasks in seismology. ML and data mining techniques can significantly improve our capability for seismic data processing. In this review we provide a comprehensive overview of ML applications in earthquake seismology, discuss progress and challenges, and offer suggestions for future work. Conceptual, algorithmic, and computational advances have enabled rapid progress in the development of machine learning approaches to earthquake seismology.The impact of that progress is most clearly evident in earthquake monitoring and is leading to a new generation of much more comprehensive earthquake catalogs.Application of unsupervised approaches for exploratory analysis of these high-dimensional catalogs may reveal new understanding of seismicity.Machine learning methods are proving to be effective across a broad range of other seismological tasks, but systematic benchmarking through open source frameworks and benchmark data sets are important to ensure continuing progress.

Keywords: machine learning, earthquake seismology, seismic monitoring, earthquake catalog, seismicity, unsuper

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