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T3.3-P33. Seismic event discrimination using diffusion maps

Discrimination between earthquakes and explosions is an important component of the CTBT verification regime. Currently used seismic discrimination methods give a partial solution to the problem. In this work, we apply advanced machine learning methods and in particular diffusion maps for automatic earthquake-explosion discrimination. Diffusion maps is a nonlinear kernel method, which learns local similarities between data points to create a global parameterization of the observed data set. The kernel is based on a Markov diffusion process and spectral analysis of this kernel provides a compact representation of the data in Euclidean space. We apply diffusion maps for constructing a geometric representation of the seismograms that capture the intrinsic structure of the signal. In the obtained low-dimensional representation, seismic events with similar source mechanism from the same region have a similar representation. This enables to discriminate earthquakes from explosions. We demonstrate our approach on several seismic data sets.

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