

Discrimination between earthquakes and explosions using diffusion maps

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Discrimination between earthquakes and explosions is not only an essential component of nuclear test monitoring but it is also important for the maintaining the quality of earthquake catalogs. For example, wrong classification of explosions as earthquakes may cause the erroneous estimation of seismicity hazard.

Currently used discrimination methods provide a partial solution to the problem. In this work, we apply advanced machine learning methods and, in particular, the diffusion maps for automatic earthquake-explosion discrimination. Diffusion maps enable us to construct a geometric representation of the seismograms that capture the intrinsic structure of the signal. As a pre-processing step, the seismograms are converted to the normalized sonograms.

We demonstrate our approach on a data set comprising seismic events from the Dead Sea area that were taken from the seismic catalog of the Geophysical Institute of Israel for years 2004-2014 with duration magnitudes $M_d \geq 2.5$. The diffusion-based algorithm provides correct discrimination rate that is more than 90%.