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Analyzing Deep Learning Performance for Seismic Waveform Discrimination at Global Distances

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Deep Learning has shown a lot of promise in analyzing seismic waveforms for a number of tasks. However, most studies have focused on detections made at nearby stations that are roughly within 100km. These methods are not readily applicable for global-scale networks such as those maintained by the International Monitoring System (IMS). We look at the task of discriminating between earthquakes and explosions and attempt to apply a number of recent approaches for this task. In particular, we focus on events with magnitude between 3-4 mb that have been unambiguously classified by the International Seismological Center (ISC). We analyze the performance of methods that have been developed using a mix of Convolutional Neural Nets (CNNs) and Recursive Neural Nets (RNNs) as well as methods that use the so called GAN (Generative Adversarial Net)-"critic" approach of building features on seismic waveforms. We provide the guidance for the applicability of these methods for treaty monitoring purposes as well as building earthquake hazard maps using the IMS data.