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Producing High Quality Digitizations from Historical Analog Seismograms of Nuclear Explosions

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The recovery and digitization of legacy seismogram waveforms is critical for research of historical events in nuclear monitoring. We are improving the digitization process by applying an interpolation algorithm and examining the frequency recovery of the potential records. The implementation of a Piecewise Cubic Hermite Interpolating Polynomial (PCHIP) interpolation algorithm improves the quality of the digitization and minimizes the amount of distortion. We quantify the effectiveness of scan density by the ease of digitization and waveform accuracy. Low scan resolutions adversely affect waveform accuracy and ultimately the frequency recovery. This is demonstrated in a synthetic 'white noise' seismogram that emulates an analog record. The synthetic signal is converted to numerous scan resolutions then digitized. After digitization, the digital seismograms are compared back to the original synthetic seismogram. Preliminary results indicate that a 200 DPI image can recover signals up to about 2.5 Hz whereas a 600 DPI image can recover up to about 8 Hz, assuming an original recording speed of 60 mm/s and a short period sensor. Additional analog seismogram parameters such as line width, signal contrast, and signal amplitude all factor into the overall quality and waveform accuracy of digitized data.

Promotional text

We have improved the digitization process for analog seismograms representing historical nuclear explosions and quantified the effects of variables such as scan resolution, contrast, and line thickness and how they impact waveform accuracy, and ultimately frequency recovery.

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