Contribution ID: **453** Type: **Poster Presentation**

Induced Seismicity Event Detection using Multi-station Time-frequency-Based Machine Learning Models at a geologic carbon storage site

Tuesday, 20 May 2025 10:05 (1h 30m)

Early detection and monitoring of induced seismic events resulting from geologic CO2 injection is crucial for ensuring the safety and stability of geologic carbon storage (GCS) operations. At many GCS sites, passive microseismicity detection and analysis is tedious and proper design of autonomous detection systems is labor-intensive. In this study we use multi-head convolutional neural networks (CNNs) to detect microseismic activity induced during GCS from continuous recordings at the Illinois Basin Decatur Basin (IBDP). Multi-channel spectrograms (i.e., time-frequency images) from deep borehole and surface sensors are used as inputs to multi-head CNN models. Conventional pickers are also used to make a labeled data for both p- and s-arrival times, which are used as a reference case to evaluate the performance of machine learning models. In addition, we utilized energy-related features of waveforms such as Mel-frequency Cepstral Coefficients and/or multi-level output from wavelet decompositions. These features were selected based on feature identification through decision-tree based analysis. Preliminary analysis shows the addition of these features enhances the accuracy of event detection, but more waveform data from different sensors such as geophones within the reservoir, above reservoir, and surface array is a primary factor to improve coverage and enhance detection. We will demonstrate how the usage of spectrogram and proper data normalization for pre-processing enables us to improve event detection even with limited data availability. SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

Country

United States

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

I would like to submit this presentation into the student poster award.

Water & Porous Media Focused Abstracts

References

Primary authors: LIZAMA, Daniel (Sandia National Laboratories); YOON, Hongkyu (Sandia National Laboratories)

Presenter: LIZAMA, Daniel (Sandia National Laboratories)

Session Classification: Poster

Track Classification: (MS15) Machine Learning and Big Data in Porous Media