

REAVR

Real-Time Earthquake Prediction using Spectrograms

Hatay, southern Turkey (2023). Source: BBC News

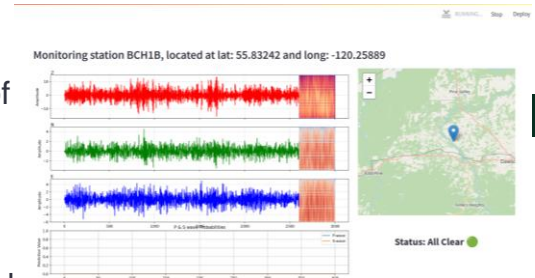
PROBLEM STATEMENT:

Earthquake early warning systems (EEWS) face challenges in providing accurate and timely warnings due to their inability to detect subtle, real-time frequency changes indicative of seismic activity. Despite advances in deep learning, these systems still struggle to accurately predict P-waves—the first wave during an earthquake—and S-waves, which are slower but more destructive. This hinders their effectiveness in EEWS for issuing immediate warnings.



SOLUTION:

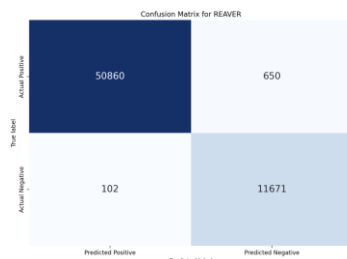
- A system that uses attention-based sliding-window spectrograms for the real-time prediction of P- and S-waves of earthquakes, leveraging a multi-stage encoder to process seismic data, and two dedicated decoders for P- and S-wave onsets
- User-friendly web-based implementation that provides a services for monitoring seismic activity and analyzing historical earthquake waveforms.



RESULTS:

- **Fast Earthquake Detection:** Detects earthquakes in just 0.08 seconds from the P wave's onset, enabling rapid alerts and response preparations.
- **Accurate Earthquake Detection:** Achieves 98.8% accuracy on differentiating between earthquakes and noise signals.

Method	Δt_{mean} (s)	$\sigma_{\Delta t}$ (s)	Median (s)	Q1 (s)	Q3 (s)
Phasenet	1.67	2.01	0.83	0.59	1.93
Eqtransformer	3.73	4.48	1.62	1.20	4.00
STA/LTA	0.27	0.31	0.15	0.04	0.40
REAVR	0.08	0.16	0.04	0.03	0.12



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