

Application of Sequentially Discounting AR Learning (SDAR) Algorithm to Real-time Event Detection

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Microseismic monitoring is one of the most variable monitoring techniques at the CO₂ injection site to demonstrate safe CO₂ injection operation to stakeholders. Microseismic monitoring has been conducted at major CO₂ injection sites. Real-time and accurate detection of seismic events from huge recorded data enables reliable event locations. The seismic events include microseismicity induced by CO₂ injection and natural earthquakes.

Real-time signal detection methods have been studied with the development of the seismic monitoring. For example, the detection method using thresholds of amplitudes, STA/LTA method (Coppens, 1985), the detection method by combination use of AR model and Akaike Information Criterion (Yokota et al., 1981) have commonly used to detect seismic events. These methods are very effective for seismic events with good S/N ratios and are used to detect natural earthquakes. On the other hand, microseismic events induced by CO₂ injection usually have small magnitudes around M0 or less than M0. At offshore CO₂ injection sites, the data recorded by the seismometers deployed on the seabed usually have high noise levels, therefore the event detection method which are robust to noise are highly required.

Recently, we have been developing a new event detection method using Sequentially Discounting AR Learning (SDAR) algorithm, which can eliminate unwanted noise properly and can detect seismic events with small magnitudes in a real-time basis. The SDAR algorithm expresses non-stationary time-series data with AR model in a short period of time. The algorithm renews the short-term AR model corresponding to the new data over discounting the old data. Therefore, this method can detect rapid changes of time-series data in a real-time basis without giving information in advance. The algorithm was originally developed in information and communication fields and have been used to detect unauthorized or break-in access (Takeuchi and Yamagishi, 2006).

At the meeting, we will introduce our real-time seismic event detection method using SDAR algorithm.

[References]

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