Machine Learning; Reports Outline Machine Learning Study Results from Rice University (Near-surface Monitoring of Plugged and Abandoned Wells for Real-time Leakage Detection In Geologic Carbon Storage)

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2025 NOV 17 (VerticalNews) -- By a News Reporter-Staff News Editor at Journal of Robotics & Machine Learning -- Data detailed on Machine Learning have been presented. According to news reporting from Houston, Texas, by VerticalNews journalists, research stated, "The risk of CO2 and brine leakage to environmental receptors is one of the main concerns in geologic CO2 storage. Legacy wells from past oil and gas activities may be located within the area of review, necessitating continuous monitoring to ensure they are properly sealed to prevent fluid migration."

Financial supporters for this research include Energy Institute at The University of Texas at Austin, United States Department of Energy (DOE), **Bureau of Economic Geology**'s External Support Leveraging Program.

The news correspondents obtained a quote from the research from Rice University, "Deployment of an efficient monitoring system for early detection of leakage from failed wells is imperative to mitigate environmental and financial risks. This study proposes a cost-effective near-surface monitoring package capable of real-time surveillance of plugged and abandoned (P&A) wells. Controlled pilot-scale CO2 and water release experiments were conducted to identify soil properties that are most sensitive to leakage in the near-surface vadose zone above P&A well stubs. Multiple release scenarios with different rates and durations were implemented, and machine learning techniques were applied to identify anomalous data patterns caused by leakage. Among measured parameters, soil electrical conductivity (EC) was the most sensitive indicator of leakage. Several machine learning models, including Logistic Regression, K-Nearest Neighbors, Support Vector Machine, Random Forest, XGBoost, and LightGBM, were evaluated for anomaly detection in EC data. Tree-based models outperformed traditional classifiers, with Random Forest achieving the lowest false alarm rate and XGBoost yielding the highest detection rate. Uncertainty quantification using Conformal Prediction showed that LightGBM had the highest confidence in anomaly prediction."

According to the news reporters, the research concluded: "Although the experiments were performed under controlled conditions, the approach demonstrates a relatively promising, low-cost monitoring technique for leakage detection for near-surface monitoring of legacy wells."

This research has been peer-reviewed.

For more information on this research see: Near-surface Monitoring of Plugged and Abandoned Wells for Real-time Leakage Detection In Geologic Carbon Storage. International Journal of Greenhouse Gas Control, 2025;147. International Journal of Greenhouse Gas Control can be contacted at: Elsevier Sci Ltd, 125 London Wall, London, England. (Elsevier - www.elsevier.com; International Journal of Greenhouse Gas Control - www.journals.elsevier.com/international-journal-of-greenhouse-gas-control/)

Our news journalists report that additional information may be obtained by contacting Sahar Bakhshian, Rice University, Dept. of Earth Environmental & Planetary Science, Houston, TX 77005, United States. Additional authors for this research include Hassan Dashtian, Arya Chavoshi, Mahdi Haddad, Susan D. Hovorka, Michael H. Young, Katherine D. Romanak and Mohsen Ahmadian.

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