ABSTRACT

Land subsidence, the gradual descent of the earth's surface, poses a considerable risk to infrastructure, ecological stability, and human safety. Precise subsidence forecasting is crucial for prompt mitigation and adaptation strategies. This research analyzes the utilization of deep learning, particularly transformer-based models, to forecast subsidence trends and suggests a regulatory framework grounded in the developed models. This method enhances the precision of subsidence predictions to improve the accuracy of our model, we incorporated rainfall datasets as an additional parameter, considering its significant role in influencing subsidence through soil saturation, erosion, and groundwater depletion. By integrating rainfall data, the model effectively captures the interplay between precipitation patterns and land movement, enhancing the predictive capabilities of the transformer architecture. We assessed the efficacy of our model via a series of experiments utilizing subsidence data gathered from diverse geographical regions. The Transformer architecture, recognized for its exceptional efficacy in natural language processing, has demonstrated significant potential in geographical data analysis. The transformer adeptly simulates the complex phenomena of land subsidence by utilizing its capacity to capture remote dependencies and discern intricate spatial linkages.The experimental findings validate the efficacy of the suggested model, with the highest evaluation values observed at different locations: CLBG recorded the highest MAE (0.068142), CBTL had the highest RMSE (0.089456), and CPTS exhibited the highest Mean Squared Error (MSE) (0.003389). In terms of model accuracy, the R-squared (R^2) values confirm the model's reliability, with the lowest R^2 value of 0.972851 observed at CLBG, indicating strong predictive performance across all stations. The consistently high R^2 values suggest that the model effectively explains the variance in subsidence trends while capturing temporal dependencies. Additionally, we propose a regulatory framework for subsidence management that utilizes predictive model outputs, including rainfall-based subsidence projections, to guide risk assessment and decision-making. This approach facilitates proactive mitigation and adaptation strategies, ensuring a more comprehensive response to subsidence-related risks.

Keywords: Land subsidence, Transformer, Rainfall datasets, Regulatory