

Pengembangan Model Hybrid CNN dan SVM untuk Deteksi Anomali pada Data Time Series di Industri Minyak dan Gas

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Abstract

In order to avoid possible equipment damage, leaks, or other operational disruptions, anomaly detection in time series data is essential in the oil and gas sector. Traditional methods are less successful in accurately detecting anomalies due to the complexity of time series data, which includes large volumes, high noise, and irregular anomaly patterns. As a result, this study suggests creating a hybrid model that combines a Support Vector Machine (SVM) for classifying anomalous data with a Convolutional Neural Network (CNN) for extracting spatial-temporal features.

Interquartile range (IQR) data cleaning, Isolation Forest data labeling, MinMaxScaler normalization, and long-time window data sequence generation are the first steps in the study. While SVM is used in conjunction with SMOTE and GridSearch to classify unbalanced data, CNN is utilized to extract features from temperature and pressure data. The results show that the best configuration is achieved by combining Isolation Forest, a window length of 10, and SVM as a classifier. The evaluation results show an F1-Score of 0.95505, ROC-AUC of 0.97827, PR-AUC of 0.99048, and there are 431 anomalies with a computation time of 695.90. This model can detect anomalies accurately and adaptively and can be used as a replacement solution for real-time monitoring of mining and gas industry conditions.

Keywords: anomaly detection, time series, CNN, SVM, oil and gas industry
